Keysight X-Series Signal Analyzer

This documentation is for the following X-Series Instruments, with the N9062C or N9062EM0E applications installed:

- EMI Receivers (PXE, MXE)
- Multi-Touch Signal Analyzers (UXA, PXA, MXA, EXA, CXA)

SCPI Language Compatibility Mode User's & Programmer's Reference

KEYSIGHT TECHNOLOGIES

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1 Documentation Roadmap

This section describes the Keysight products covered by this document, and provides links to related documentation.

KEYSIGHT TECHNOLOGIES

1.1 Products Covered by this Document

Product Family	Full Product Name	Model Numbers
EMI Receivers	PXE EMI Receiver	N9048B
	MXE EMI Receiver	N9038B
Multi-Touch Signal Analyzers	UXA Signal Analyzer	N9042B
		N9041B
		N9040B
	PXA Signal Analyzer	N9030B
	MXA Signal Analyzer	N9021B
		N9020B
	EXA Signal Analyzer	N9010B
	CXA Signal Analyzer	N9000B

1.2 Additional Documentation

If your instrument or computer has an internet connection, then you can access the latest editions of all X-Series Signal Analyzer documentation via the links below.

This document is available in 2 formats:

– **Embedded Help**, in the instrument

– **Users & Programmers Reference**, in downloadable PDF format

The following documents are in downloadable PDF format:

Getting Started Guides, Instrument Messages & Security

– N90x0B Getting Started & Troubleshooting Guide

– N9041B Getting Started & Troubleshooting Guide

– X-Series Signal Analyzers Instrument Messages

– Security Features & Statement of Volatility

Specifications Guides

– N9000B CXA Specifications Guide

– N9010B EXA Specifications Guide

– N9020B MXA Specifications Guide

– N9030B PXA Specifications Guide

– N9040B UXA Specifications Guide

– N9041B UXA Specifications Guide

Measurement Guides

– Spectrum Analyzer Mode Measurement Guide

– Real-Time Spectrum Analyzer Measurement Guide

– Noise Figure Measurement Guide

– Analog Demod Measurement Application Measurement Guide

– Phase Noise Measurement Application Measurement Guide

- EMI Measurement Application Measurement Guide

Service Guides

- N9010B EXA Service Guide
- N9020B MXA Service Guide
- N9030B PXA Service Guide
- N9040B UXA Service Guide

2 Special Information for the SCPI LC Mode

This chapter provides information that is specific to the SCPI Language Compatibility Mode (hereinafter referred to as the "SCPI LC Mode").

It includes the following topics:

2.1 SCPI LC Mode Description

The Keysight SCPI LC Mode is designed to allow X-Series signal analyzers to be controlled using the SCPI programming commands from the following Rohde & Schwarz (R&S) instruments:

- R&S FSE
- R&S FSP
- R&S FSU
- R&S ESU
- R&S FSL
- R&S FSV
- R&S FSW

An X-Series analyzer with SCPI LC Mode installed is able to emulate the FSE/FSP/FSU/ESU/FSL/FSV/FSW measurement functions as closely as possible in many automated systems, with minimal or no modification to the currently used measurement software.

- SCPI LC Mode supports over 300 SCPI commands from the FSE/FSP/FSU/ESU/FSL/FSV/FSW instruments, and 16 of the IEEE 488.2 standard SCPI commands
- SCPI LC Mode supports commands from the Spectrum Analyzer (default) mode. Commands from other options or modes are not supported
- SCPI LC Mode does not support the same front panel operations, user interface and measurement screen display as the FSE/FSP/FSU/ESU/FSL/FSV/FSW instruments
- SCPI LC Mode does not support the Split Screen feature
- SCPI LC Mode partly supports Channel Power measurements, OBW measurements, ACP measurements and IQ traces

2.2 General Rules and Limitations

SCPI LC Mode has been designed to emulate the remote operation of the R&S FSE/FSP/FSU/ESU/FSL/FSV/FSW instruments for the most commonly used commands needed for basic spectrum analyzer functions. It is not a fully-compatible direct replacement for these instruments in all cases, and does not support instrument modes beyond the core spectrum analyzer. It also does not emulate the local front-panel interface (buttons) and display, as used for manual operation.

This section highlights the following specific emulation differences and limitations:

– "Couplings" on page 39

– "Data Formats" on page 39

– "Markers" on page 40

– "Numeric Ranges" on page 40

– "Remote Control" on page 40

– "Returning Data" on page 40

– "Units" on page 40

– "Status System & SRQ" on page 40

– "Supported Commands and Queries" on page 41

– "Unsupported Commands and Queries" on page 42

2.2.1 Couplings

SCPI LC Mode uses the auto coupling features of the X-Series analyzers, and may be slightly different from the FSE/FSP/FSU/ESU/FSL/FSV/FSW. To eliminate the possibility of "Meas Uncal" errors between auto and manual values, values default to the X-Series auto settings where applicable (for example, resolution bandwidth).

The parameter’s default value is adjusted to match that of the FSE/FSP/FSU/ESU/FSL/FSV/FSW unless otherwise stated.

2.2.2 Data Formats

SCPI LC Mode supports data formats defined for the X-Series analyzers.

2.2.3 Markers

SCPI LC Mode emulates the behavior of FSE/FSP/FSU/ESU/FSL/FSV/FSW instruments.

2.2.4 Numeric Ranges

Numeric ranges are limited to that of the X-Series analyzers unless otherwise stated.

2.2.5 Remote Control

SCPI LC Mode supports remote operation through the following interfaces: GPIB, LAN, USB or Telnet.

2.2.6 Returning Data

Data returned in response to a command or query is defined in the topics listed in "Supported SCPI Command Descriptions" on page 622, unless otherwise stated.

The data returned from queries, especially from a trace query, match the FSE/FSP/FSU/ESU/FSL/FSV/FSW for the most common data formats (ASCII, Binary 32).

2.2.7 Units

SCPI LC Mode supports the following standard units. Any units supported by FSE/FSP/FSU/ESU/FSL/FSV/FSW commands that are not supported by the application are noted in the table and details found in the topics listed in "Supported SCPI Command Descriptions" on page 622.

– Frequency Units: HZ, KHZ, MHZ, GHZ

– Amplitude Units: DB, DBM, DBUV, DBMV, DBUA, V, A, W

– Time Units: KS, S, MS, US, NS

2.2.8 Status System & SRQ

The STATus subsystem is a remote-only command structure that allows a controller to determine the operating status of the instrument. The system can also allow the instrument to request service from the controller on an interrupt basis. The system is a complex hierarchy, where specific details of an instrument’s condition are summarized upward to higher level registers. The use of this system is optional, and your programs may vary widely in the depth to which you use it.

The topmost Status Byte Register, Standard Event Status Register, and their SRQ behavior, are specified by IEEE 488.2 standard. SCPI LC Mode adopts the Status system of the Keysight X-Series analyzers, which conforms to the IEEE 488.2 standard and behaves like that of any IEEE488.2-compliant instrument. These status conditions, events, or commands should emulate any compliant instrument, for example:

– operation complete, *OPC and *OPC?
– Status Byte bits, including Error/Event reporting, plus *CLS, *STB
– Standard Event Status Register bits, plus *ESE, *ESR, *PSC
– SRQ behavior and *SRE mask
– most error conditions (top level), plus STATus:QUEue? and SYSTem:ERRor?
– queries
– use of STATus:OPERation and STATus:QUEStionable commands, although specific bits may be mapped differently

At lower levels of detail, different vendors have implemented their status systems differently. Therefore, if a program (written for one of the emulated instruments) makes deep or sophisticated use of the status subsystem, it may not run correctly with SCPI LC Mode and so require modification. The major differences include (but are not limited to) the following:

– RF & IF Overload condition
– parallel polling, IST-flag (Individual Status), and PPE (Parallel Poll Enable) mask
– limit or limit margin mask failure reporting
– sweep break feature (of a multi-sweep measurement)
– specific error message numbers, specific error message text
– status conditions associated with Screen B (specifically)

2.2.9 Supported Commands and Queries

Only a subset of the FSE/FSP/FSU/ESU/FSL/FSV/FSW series commands is supported in SCPI LC Mode. The list of supported commands was determined by feedback from our customers combined with technical considerations and constraints.

The supported FSE/FSP/FSU/ESU/FSL/FSV/FSW commands are summarized with short notes in "Supported SCPI Command Descriptions" on page 622. In some cases, a command is accepted without error, but no action taken, for example, a display line.

2.2.10 Unsupported Commands and Queries

If a command or query is valid for FSE/FSP/FSU/ESU/FSL/FSV/FSW products but not supported by SCPI LC Mode, the X-Series analyzer may handle it in the following way:

- Generate an error message. This type of SCPI command is not covered in this manual.

If your use case is not fully supported, contact your local Keysight Technologies Sales and Service Office, or if in the United States, call 1-800-829-4444.

2.3 Hardware and Firmware Requirements for SCPI LC Mode

For maximum compatibility, you should select an X-Series analyzer that equals or exceeds the frequency range of the FSE/FSP/FSU/ESU/FSL/FSV/FSW analyzer you are replacing.

2.4 Service & Calibration

SCPI LC Mode does *not* support the SCPI commands required for calibration or service of the Keysight instruments.

Therefore, prior to calibration or service of the Keysight X-Series instrument, you must exit SCPI LC Mode and switch to the instrument's **Spectrum Analyzer Mode** application (the instrument's default mode).

You can use the front-panel "Mode/Meas/View Dialog" on page 47 to switch modes. Alternatively, you can switch to Spectrum Analyzer Mode programmatically by sending *either* of the SCPI commands:

- `:INST:SEL SA`
- `:INST:NSEL 1`

3 User Interface

Here are the basic elements of the Multitouch User Interface. For more information, tap a topic.

Included in this section are also topics for several front panel keys not described in other topics. Tap one of these topics for more information.

"Cancel key" on page 121

"Onscreen Keyboard key" on page 122

"Touch On/Off Key" on page 123

"Tab key" on page 124

3.1 Screen Tabs

In the X-Series Multitouch User Interface (or Multitouch UI), you can run many different Measurement Applications, or “Modes”. Examples are Spectrum Analyzer Mode, LTE-A FDD Mode, IQ Analyzer Mode, and Real Time Spectrum Analyzer Mode. Each Mode has its own set of controls, windows and SCPI commands.

Each Mode runs within a “Screen”. The Multitouch UI supports multiple “Screens” (see "Multiscreen" on page 106 for more information). Each screen displays one Measurement in one Mode. The set of configured screens is shown across the top of the display as a set of Screen Tabs, with a + tab at the right for adding new Screens:

You can see up to six tabs at a time on the UXA, and 4 at a time on the CXA, EXA, MXA and PXA. If there are more Screens configured than this, arrows appear to the left and right of the Screen Tabs; pressing the arrows scrolls the Screen Tabs to the left or right. A scroll bar also appears at the bottom of the Screen Tabs, indicating that you can scroll the tabs by dragging them with your finger; you can also scroll them by dragging the scroll bar.

Pressing a Screen Tab selects that screen for operation. Pressing the blue (selected) Screen Tab is the same as pressing the Mode/Meas front panel key.

Both actions open the "Mode/Meas/View Dialog" on page 47. In addition, if you have a PC keyboard plugged in, the sequence CTL-SHIFT-M will open up this dialog.

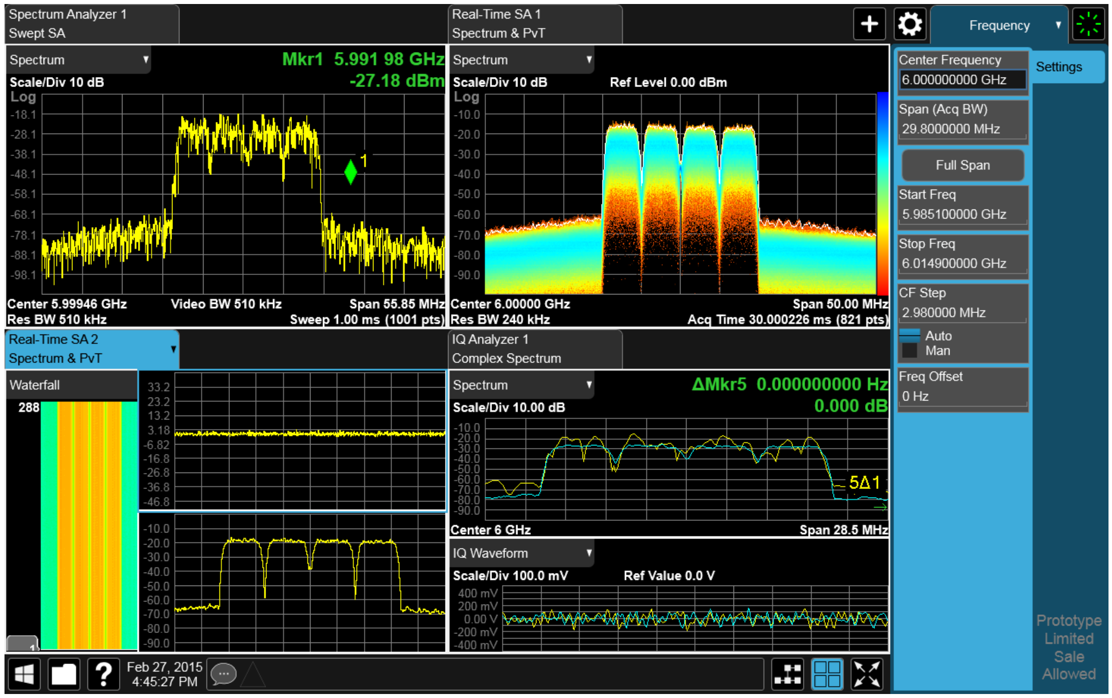
The + tab at the right of the Screen Tabs bar adds a new Screen by cloning the current screen. The new Screen has the identical setup and settings as the current Screen. You can then change the Mode, Measurement and/or settings of the new Screen.

You can define up to 16 screens at once.

Example Multiscreen View

The example below shows a four-screen display in Multiscreen view.

The Screen called “Real-Time SA 2” is selected, as indicated by its blue tab. Touching any other screen or tab selects the screen for that tab and brings it to the foreground.



The following topics provide more information:

– "Mode/Meas/View Dialog" on page 47

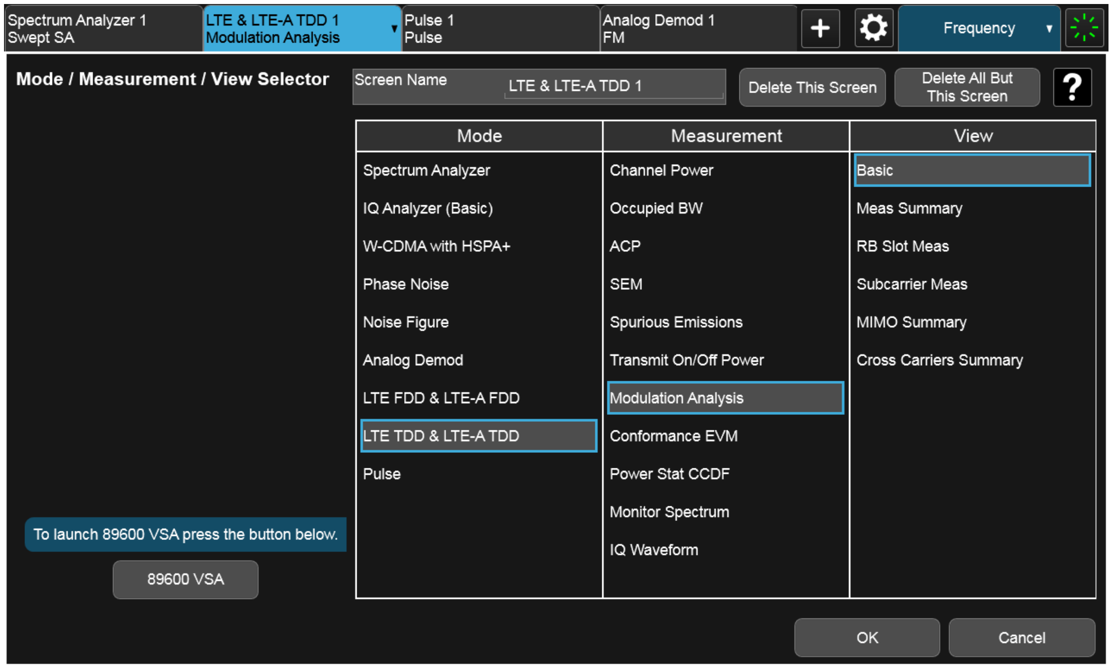
– "Add Screen" on page 63

– "Multiscreen" on page 106

3.1.1 Mode/Meas/View Dialog

The Mode/Meas/View dialog opens when you press the selected (blue) Screen tab (see "Screen Tabs" on page 46) or the **Mode/Meas** front panel key.

This dialog displays lists of available Modes, Measurements and Views, as well as the "Sequencer" on page 57 control for configuring Screens.



3.1.1.1 Mode

The first column in the Mode/Meas/View dialog allows you to select the desired Mode from those currently licensed in your instrument.

Modes, also known as “measurement applications”, are collections of measurement capabilities packaged together to provide you with an instrument personality specific to your measurement needs. Each Mode is ordered separately by Model Number and must be licensed in order for it to be available in the instrument.

You select the Mode you want to run using the Mode/Meas/View dialog. Once a Mode is selected, only the commands that are valid for that mode can be executed

For more information on Modes, preloading Modes, and memory requirements for Modes, see "More Information" on page 50

The `:INSTrument[:SELect]` command is used to remotely select a Mode by sending the instrument a parameter which represents the name of the desired Mode. The Mode Names may be found in the table under "Index to Modes" on page 50.

The `:INSTrument:NSELect` command is used to remotely select a Mode by sending the Mode Number of the desired Mode. See "Instrument Number Select" on page 49. The Mode Numbers may be found in the table under "Index to Modes" on page 50.

The `:INSTrument:CONFigure` command causes a Mode and Measurement switch at the same time. This generally results in faster overall switching than sending the `:INSTrument:SELect` and `CONFigure` commands separately. See "Mode and Measurement Select" on page 49.

Remote Command	`:INSTrument[:SELect] <mode_id>`
	where <mode_id> is one of the values listed in Index to Modes below.
	`:INSTrument[:SELect]?`

Example	`:INST SA`
Notes	A list of the valid mode choices is returned by the `:INST:CAT?` query
Preset	The default Mode is set to SA on a "Restore System Defaults->All", unless noted below: For N8973B, N8974B, N8975B, or N8976B: NFIG For E7760: BASIC
State Saved	Saved in instrument state
Annunciation	Application Title is in the Screen Tab

Instrument Number Select

Remote Command	`:INSTrument:NSELect <integer>` `:INSTrument:NSELect?`
Example	`:INST:NSEL 1`
Notes	The Mode Numbers may be found in the table under "Index to Modes" on page 50 SA mode is number 1 The command is sequential: i.e. continued parsing of commands cannot proceed until the instrument select is complete and the resultant SCPI trees are available
Preset	The default Mode is set to `1` on a "Restore System Defaults->All", unless noted in the table above
State Saved	Saved in instrument state

Mode and Measurement Select

Remote Command	`:INSTrument:CONFigure:<mode>:<meas>` where <mode> is a valid parameter for the :INST:SEL command and <meas> is a valid parameter for the :CONF command in the Mode specified by <mode>

Example	`:INST:CONF:SA:SAN`
	selects the Spectrum Analyzer mode and the Swept SA measurement
	`:INST:CONF:WCDMA:RHO`
	selects the WCDMA mode and the Mod Accuracy measurement

Notes	The available parameters for <mode> are dependent upon installed and licensed applications resident in the instrument. The available parameters for <meas> are dependent on the <mode> parameter and the valid measurements available for that mode, which can depend on model numbers and installed options In general this command will execute more quickly than sending the equivalent separate INST:SEL and :CONF commands

Index to Modes

The Mode Number in the table below is the parameter for use with the `:INSTrument:NSELect` command. The Mode Parameter is the parameter for use with the `:INSTrument[:SELect]` command. Your actual choices will depend upon which applications are installed in your instrument.

Mode	Mode Number	Mode Parameter <mode_id>
5G NR	109	NR5G
89601 VSA	101	VSA89601
Analog Demod	234	ADEMOD
Avionics	232	AVIONIC
Bluetooth	228	BTooth
EMI Receiver	141	EMI
GSM/EDGE/EDGE Evo	13	EDGEGSM
I/Q Analyzer (Basic)	8	BASIC
LTE FDD & LTE-A FDD	107	LTEAFDD
LTE TDD & LTE-A TDD	108	LTEATDD
Measuring Receiver	233	MRECEIVE
MSR	106	MSR
Noise Figure	219	NFIGure
Phase Noise	14	PNOISE
Power Amplifier	81	PA
Pulse	151	PULSEX
Radio Test	300	RTS
Real Time Spectrum Analyzer	2	RTSA
Remote Language Compatibility	266	RLC
SCPI Language Compatibility	270	SCPILC
Sequence Analyzer	123	SEQAN
Short Range Comms	218	SRCOMMS
Spectrum Analyzer	1	SA
Vector Modulation Analyzer	200	VMA
WCDMA with HSPA+	9	WCDMA
WLAN	217	WLAN

More Information

The Mode name appears on the Screen Tab, followed by a number identifying which instance of the mode appears on that screen. Each Screen contains one Mode. For example, in the image below there is one Real-Time Spectrum Analyzer and two Spectrum Analyzer screens. The current Screen contains Real-Time SA 1.

It is possible to specify the order in which the Modes appear in the Mode menu, using the Configure Applications utility on the Desktop. It is also possible, using the same utility, to specify a subset of the available applications to load into memory at startup time, which can decrease the startup time of the instrument and the amount of memory consumed.

Each application (Mode) that runs in an X-Series instrument consumes virtual memory. The various applications consume varying amounts of virtual memory, and as more applications run, the memory consumption increases. Keysight characterizes each Mode and assigns a memory usage quantity based on a conservative estimate. The Configure Applications utility shows an estimate for how much memory each Mode will consume.

You can still run a Mode even if it is not preloaded into memory - during runtime, the first time an application that is not loaded into memory is selected (by either pressing that applications Mode key or sending that application’s :INST:SEL command over SCPI), the Application will be loaded, but this takes a few seconds. The instrument will pause while loading the application while displaying a message box that says “Loading application, please wait...” Preloading the application eliminates this wait time but consumes additional memory.

3.1.1.2 Application Mode Remote Commands

This section contains a number of remote commands that are provided for programming convenience and remote compatibility.

Application Mode Catalog Query (Remote Command Only)

Returns a string containing a comma separated list of names of all the installed and licensed measurement modes (applications). These names can only be used with the :INSTrument[:SELect] command.

Remote Command	`:INSTrument:CATalog?`
Example	`:INST:CAT?`
Notes	Query returns a quoted string of the installed and licensed modes separated with a comma. Example: "SA,PNOISE,WCDMA"
Backwards Compatibility Notes	VSA (E4406A) :INSTrument:CATalog? returned a list of installed INSTrument:SELECT items as a comma separated list of string values, for example: "BASIC","GSM","EDGEGSM","CDMA","SERVICE" X-Series uses the ESA/PSA compatible query of a string contain comma separated values: "SA,PNOISE,NFIG,BASIC"

Current Application Model (Remote Command Only)

Returns a string that is the Model Number of the currently selected application (mode). This information is also displayed in the **Show System** screen.

Remote Command	`:SYSTem:APPLication[:CURRent][:NAME]?`
Example	`:SYST:APPL?`
Notes	Query returns a quoted string that is the Model Number of the currently selected application (Mode). Example: "N9060A" String length between 6 to 9 characters.
Preset	Not affected by Preset
State Saved	Not saved in state, the value will be the selected application when a Save is done.

Current Application Revision (Remote Command Only)

Returns a string that is the Revision of the currently selected application (mode). This information is also displayed in the Show System screen

Remote Command	`:SYSTem:APPLication[:CURRent]:REVision?`
Example	`:SYST:APPL:REV?`
Notes	Query returns a quoted string that is the Revision of the currently selected application (Mode). Example: "1.0.0.0" String length is a maximum of 23 characters. (each numeral can be an integer + 3 decimal points) The format is Major.Minor.Build.Compile, where Major must correspond to the Integer portion of the Version in the license file for the application.
Preset	Not affected by a Preset
State Saved	Not saved in state, the value will be the selected application when a Save is done.

Current Application Options (Remote Command Only)

Returns a string that is the Options list of the currently selected application (Mode). This information is also displayed in the Show System screen

Remote Command	`:SYSTem:APPLication[:CURRent]:OPTion?`
Example	`:SYST:APPL:OPT?`
Notes	Query returns a quoted string that is the Option list of the currently selected application (Mode). The format is the name as the *OPT? or SYSTem:OPTion command: a comma separated list of option identifiers. Example: "1FP,2FP"

	String length is a maximum of 255 characters.
Preset	Not affected by a Preset
State Saved	Not saved in state per se, the value will be the selected application when a Save is invoked.

Application Catalog Number of Entries (Remote Command Only)

Returns the number of installed and licensed applications (Modes).

Remote Command	`:SYSTem:APPLication:CATalog[:NAME]:COUNt?`
Example	`:SYST:APPL:CAT:COUN?`
Preset	Not affected by Preset
State Saved	Not saved in instrument state.

Application Catalog Model Numbers (Remote Command Only)

Returns a list of Model Numbers for the installed and licensed applications (Modes).

Remote Command	`:SYSTem:APPLication:CATalog[:NAME]?`
Example	`:SYST:APPL:CAT?`
Notes	Returned value is a quoted string of a comma separated list of Model Numbers. Example, if SAMS and Phase Noise are installed and licensed: "N9060A,N9068A" String length varies based on licenses. Licenses are between 6 and 9 characters. So the string length will be between COUNt * 7 – 1 and COUNt * 10 – 1. (7 & 10 = Model Number length + 1 for comma. -1 = no comma for the 1st entry.)
Preset	Not affected by a Preset
State Saved	Not saved in instrument state.

Application Catalog Revision (Remote Command Only)

Returns the Revision of the provided Model Number.

Remote Command	`:SYSTem:APPLication:CATalog:REVision? <model>`
Example	`:SYST:APPL:CAT:REV? 'N9060A'`
Notes	Returned value is a quoted string of revision for the provided Model Number. The revision will be a null-string ("") if the provided Model Number is not installed, licensed, and loaded. Example, if SAMS is installed and licensed: "1.0.0.0" String length is a maximum of 23 characters. (each numeral can be an integer + 3 decimal points)

Preset	Not affected by a Preset.
State Saved	Not saved in instrument state.

Application Catalog Options (Remote Command Only)

Returns a list of Options for the provided Model Number

Remote Command	`:SYSTem:APPLication:CATalog:OPTion? <model>`
Example	`:SYST:APPL:CAT:OPT? 'N9060A'`
Notes	Returned value is a quoted string of a comma separated list of Options, in the same format as *OPT? or :SYSTem:OPTion?. If the provided Model Number is not installed and licensed a null-string ("") will be returned. Example, if SAMS is installed and licensed: "2FP" String length is a maximum of 255 characters.
Preset	Not affected by a Preset
State Saved	Not saved in instrument state.

ESA SA compatibility command (Remote Command only)

Provided for backwards compatibility with ESA. When this command is received, the analyzer aliases it to the appropriate Mode.

Remote Command	`:INSTrument[:SELect] 'SA' | 'PNOISE' | 'EDGE' | 'GSM' | 'BASIC'`
Example	`:INST 'SA'`
Notes	The query is not a quoted string. It is an enumeration as indicated in the Instrument Select table above

GSM Mode compatibility command (Remote Command only)

Provided for backwards compatibility. When this command is received, the analyzer aliases it to the following:

```
:INST:SEL EDGEGSM
```

Remote Command	`:INSTrument[:SELect] GSM`
Example	`:INST GSM`

SA compatibility command for EMC (Remote Command only)

Provided for ESU compatibility. When this command is received, the analyzer aliases it to the following:

```
:INST:SEL SCPILC
```

This results in the analyzer being placed in SCPI Language Compatibility Mode, in order to emulate the ESU Spectrum Analyzer Mode.

Remote Command	`:INSTrument[:SELect] SANalyzer`
Example	`:INST SAN`

APD compatibility command for EMC(Remote Command only)

Provided for ESU compatibility. When this command is received, the analyzer aliases it to the following:

`:INST:SEL EMI`

`:CONF APD`

This results in the analyzer being placed in the EMI Receiver Mode, running the APD measurement, in order to emulate the ESU APD Mode.

Remote Command	`:INSTrument[:SELect] APDistribution`
Example	`:INST APD`

IF Mode compatibility command for EMC (Remote Command only)

Provided for ESU compatibility. When this command is received, the analyzer aliases it to the following:

`:INST:SEL EMI`

`:CONF MON`

This results in the analyzer being placed in the EMI Receiver Mode, running the Monitor Spectrum measurement, in order to emulate the ESU IF Mode.

Remote Command	`:INSTrument[:SELect] IFANalyzer`
Example	`:INST IFAN`

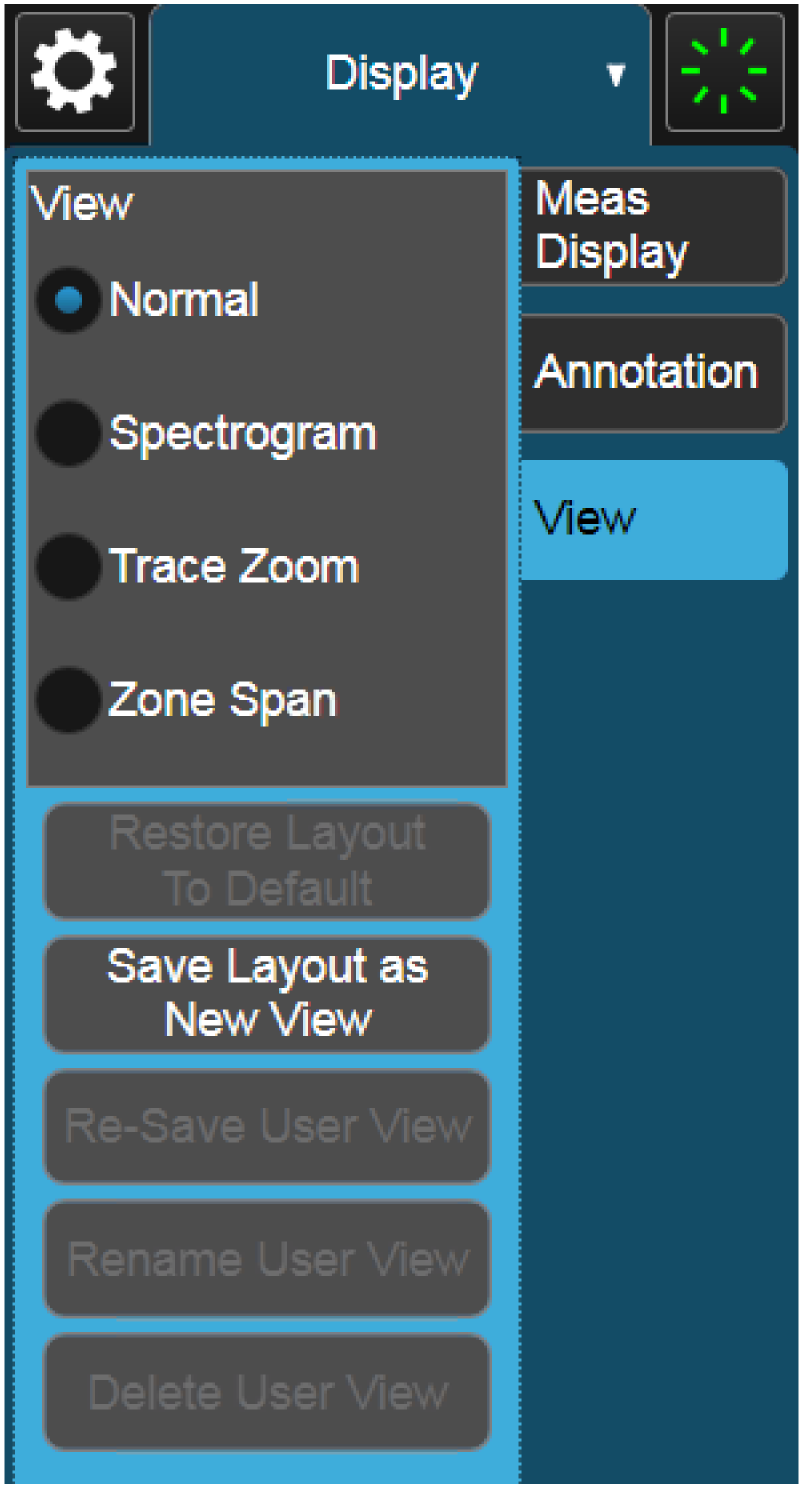
3.1.1.3 Measurement

The Measurement column of the Mode/Meas/View dialog shows all the Measurements available for the Mode which is selected in the first column. Select a Measurement in the second column and the View column will show all the Views available for that measurement. Once you have the Mode, Measurement and View selected, press OK to change the current Screen to that Mode, Measurement and View.

3.1.1.4 View

A View is a collection of Result Windows. The View column of the "Mode/Meas/View Dialog" on page 47 shows all the Views available for the Measurement which is selected in the second column. Once you have the Mode, Measurement and View selected, press OK to change the current Screen to that Mode, Measurement and View.

The View may also be set by using the View tab on the Display menu. The View tab is the last tab on the Display menu for every measurement. The Views are the same as those listed in the "Mode/Meas/View Dialog" on page 47.



3.1.1.5 Sequencer

The Screen Sequencer allows multiple Screens to update sequentially while in "Multiscreen" on page 106 display mode. Each Screen will update in sequence, and when all have updated, the sequence will start again.

To start the Sequencer, you must have more than one Screen defined and you must have Multiscreen selected (see "Screen Tabs" on page 46

).

If you want each Screen to use a different input, you must turn off **All Screens Use Same Input** under **Input/Output**, **Input**. Be aware that this could cause mechanical switches to cycle as you go from Screen to Screen, potentially reducing the life of these switches.

NOTE: Differences in hardware settings between the Screens may cause switches and/or attenuators to cycle as you go from one Screen to another. This could potentially reduce the life of these components. To avoid this, make sure Attenuation, **µW Path Control** and other switch settings are the same in each Screen.

NOTE: When the Sequencer is running, the destination of any SCPI commands that are sent is unpredictable, so you should stop the Sequencer before sending any measurement related SCPI commands. Once the Sequencer is stopped, select a specific Screen by using the `:INSTrument:SCReen:SELect` command before sending any further commands. See "Select Screen" on page 108

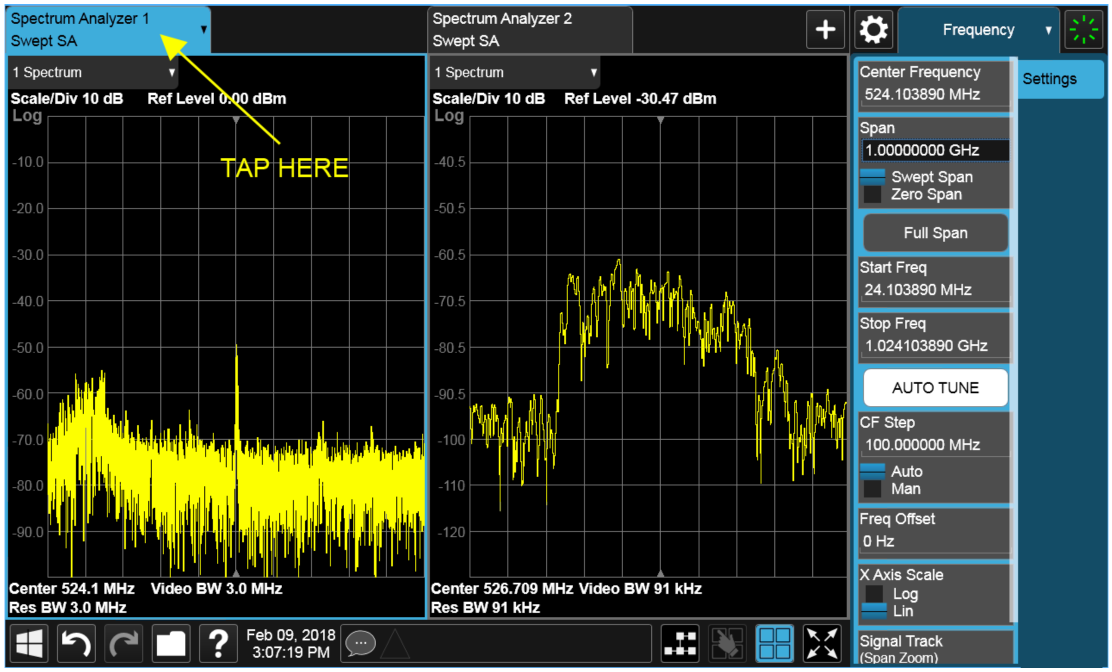
NOTE: When the Sequencer is running, Auto alignment is temporarily disabled. A pending auto alignment might be executed when the sequencer is stopped.

See "More Information" on page 58

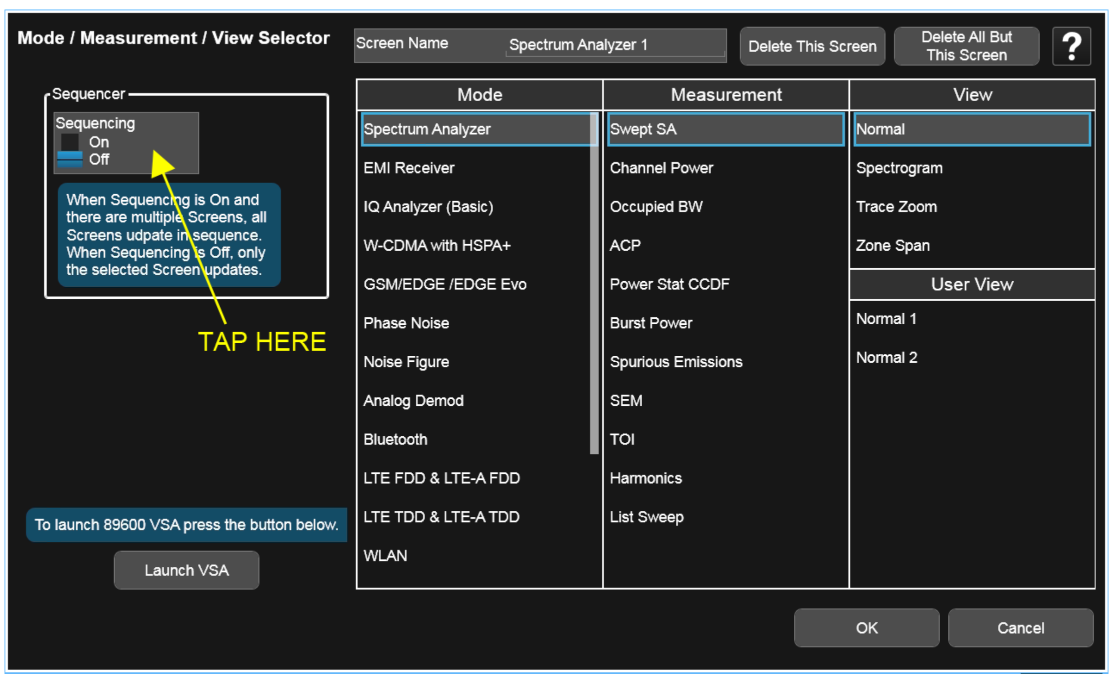
Remote Command	`:SYSTem:SEQuencer ON | OFF | 1 | 0` `:SYSTem:SEQuencer?`
Example	`:SYST:SEQ ON`
Notes	If the display is disabled (via `:DISP:ENAB OFF`) then the error message "-221, Settings conflict; Screen SCPI cannot be used when Display is disabled" is generated
Dependencies	To start the Sequencer, you must have more than one Screen defined and you must have Multiscreen selected
Preset	`OFF`

More Information

To start the Sequencer, tap the current (blue) Screen tab to go into the Mode/Meas/View Dialog:

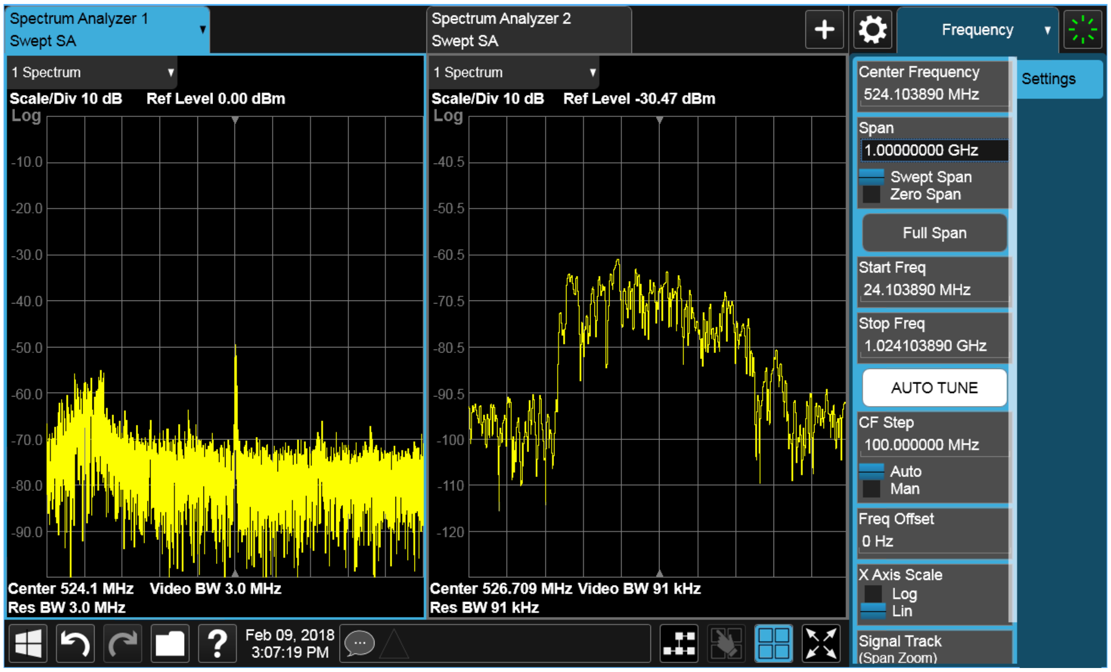


In the Sequencer block in the upper left hand corner, tap the Sequencing switch to turn it On:

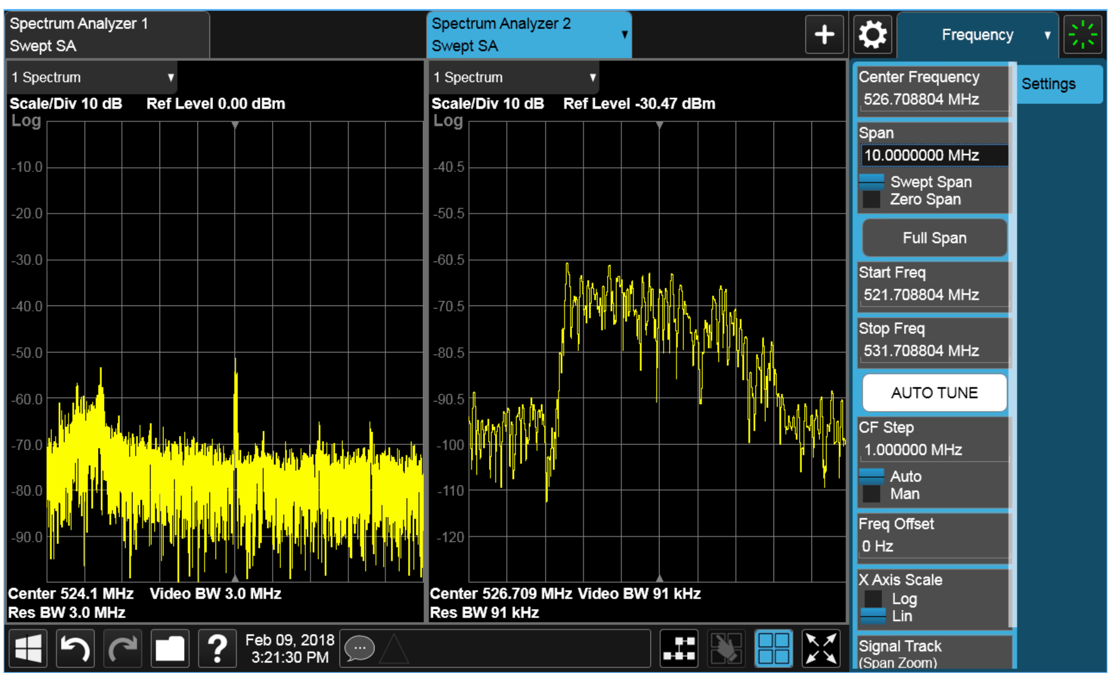


The instrument will immediately exit the Mode/Meas/View Dialog and begin making measurements in each of the screens, one after the other. When a measurement is being made in a particular Screen, that Screen's tab will be blue.

Measurement being made in Screen 1:



Measurement being made in Screen 2:



Touching any hardkey or control on the display will cause the Sequencer to stop, so that you can make desired changes. When this happens, the message “Sequencer stopped” is displayed.

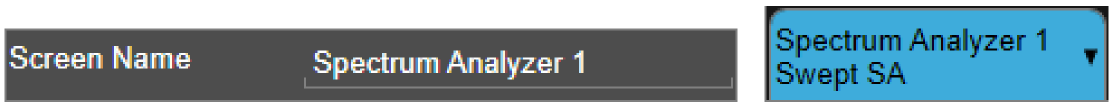
When the Sequencer is running, the screens update in the order in which they were created.

Each Screen takes one measurement then passes control to the next Screen. Each Screen updates as though it were in Single Sweep or Single Measurement mode. Thus, if Averaging is turned on, a Screen may take multiple sweeps before moving on to the next Screen.

3.1.1.6 Screen Name

By default, the screen name is the Mode (Application) name followed by a number indicating the instance of the application.

You may change the name displayed on the Screen Tab of any screen. The control to do this appears in the "Mode/Meas/View Dialog" on page 47:



When you touch this control an onscreen keyboard appears, allowing you to change the name. Whatever you change it to appears on the Tab, even if you subsequently change the screen to a different Mode.

To reset the name, delete the screen name entirely.

Each Screen Name must be unique; you cannot give the same name to more than one screen.

Remote Command	`:INSTrument:SCReen:REName <alphanumeric>`
Example	`:INST:SCR:REN "Baseband"`
Notes	The currently active screen is renamed. If the `<alphanumeric>` specifying the new name is already present in the list of screen names, the error message "-224, Illegal parameter value; New name <name> already exists" appears If the display is disabled (via `:DISP:ENAB OFF`) then the error message "-221, Settings conflict; Screen SCPI cannot be used when Display is disabled" appears

3.1.1.7 Delete This Screen

Pressing this button deletes the current Screen (the one with the blue tab). Deleting a screen removes it from view and selects the next lower screen in the list of screens. If only one screen is configured, it cannot be deleted.

If you press the **Delete This Screen** button, a prompt appears:

"This function will delete the current screen and its settings. This action cannot be undone. Do you want to proceed?"

Pressing **OK** or Enter deletes the screen, pressing **Cancel** or **ESC** does not.

Remote Command	`:INSTrument:SCReen:DELete`
Example	`:INST:SCR:DEL`
Notes	The currently active screen is deleted If the screen you are attempting to delete is the only configured screen, the error message "-221, Settings conflict; Last screen cannot be deleted" is displayed If the display is disabled (via `:DISP:ENAB OFF`) then the error message "-221, Settings conflict; Screen SCPI cannot be used when Display is disabled" is generated

3.1.1.8 Delete All But This Screen

Pressing this control deletes all the Screens except the current Screen (the one with the blue tab).

If you press the **Delete All But This Screen** button, a prompt appears:

"This function will delete all defined screens and their settings, except for the current screen. This action cannot be undone. Do you want to proceed?"

Pressing **OK** or Enter deletes the screen, pressing **Cancel** or ESC does not.

Remote Command	`:INSTrument:SCReen:DELete:ALL`
Example	`:INST:SCR:DEL:ALL`
Notes	You can reset the instrument to the power-on configuration by invoking `:INST:SCR:DEL:ALL` followed by `:SYSTem:DEFault ALL` If the display is disabled (via `:DISP:ENAB OFF`) then the error message "-221, Settings conflict; Screen SCPI cannot be used when Display is disabled" appears

3.1.1.9 89600 VSA

Pressing this button launches the 89600 VSA software. The 89600 VSA software is powerful, PC-based software, offering the industry's most sophisticated general purpose and standards specific signal evaluation and troubleshooting tools for R&D engineers. Even for proprietary and non-standard signals in SATCOM or MILCOM applications, you can make signal quality measurements with customized IQ constellation.

The 89600 VSA software offers the following features:

– Over 35 general-purpose analog and digital demodulators ranging from 2FSK to 4096QAM

– Flexible and custom IQ and OFDM signal analysis for single carrier

– Standards specific modulation analysis including:

– Cellular: GSM/EDGE, cdma2000, W-CDMA, TD-SCDMA, LTE(FDD/TDD),

– LTE-Advanced and more

– Wireless networking: 802.11a/b/g, 802.11n, 802.ac, 802.16 WiMAX (fixed/mobile), WiSUN (MR-FSK PHY)

– RFID

– Digital satellite video and other satellite signals, radar, LMDS

– Up to 400K bin FFT, for the highest resolution spectrum analysis

– A full suite of time domain analysis tools, including signal capture and playback, time gating, and CCDF measurements

– 20 simultaneous trace displays and the industry's most complete set of marker functions

– Easy-to-use Microsoft Windows graphical user interface

For more information see the Keysight 89600 Series VSA web site at www.keysight.com/find/89600vsa

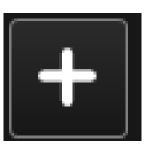
To learn more about how to use the 89600 VSA in the instrument, start the 89600 VSA software, then open the 89600 VSA Help and navigate to the topic "About Keysight X-Series Signal Analyzer with 89600 VSA Software".

Example	`:INST:SEL VSA89601` `:INST:NSEL 101`

3.1.2 Add Screen

On X-Series analyzers you can configure up to 16 different Screens at one time. Each Screen contains one Mode, each Mode contains one Measurement, and each Measurement contains a number of Windows.

You can add screens by pressing the “+” icon in the "Screen Tabs" on page 46 panel. The icon is shown below:



Every time you add a Screen, the instrument “clones” or “copies” the current Screen into the new Screen. If desired, you can then use the "Mode/Meas/View Dialog" on page 47 to change the Mode, Measurement and/or View of the new Screen, or simply operate a second copy of your previous Screen, thus preserving the settings of your previous Screen.

When you have defined the maximum number of Screens (16), the “+” icon disappears.

For more information about operating the instrument with multiple screens configured, see "Multiscreen" on page 106.

Remote Command	`:INSTrument:SCReen:CREate`
Example	`:INST:SCR:CRE`
Notes	The maximum number of screens is 16. If an attempt to add a screen occurs when the maximum have been defined, the error message “-221, Settings conflict; Screen limit reached” appears When you create a new screen the Screen Name is the current Mode name followed by a number indicating the instance of the Mode. If the display is disabled (via `:DISP:ENAB OFF`) then the error message “-221, Settings conflict; Screen SCPI cannot be used when Display is disabled” appears

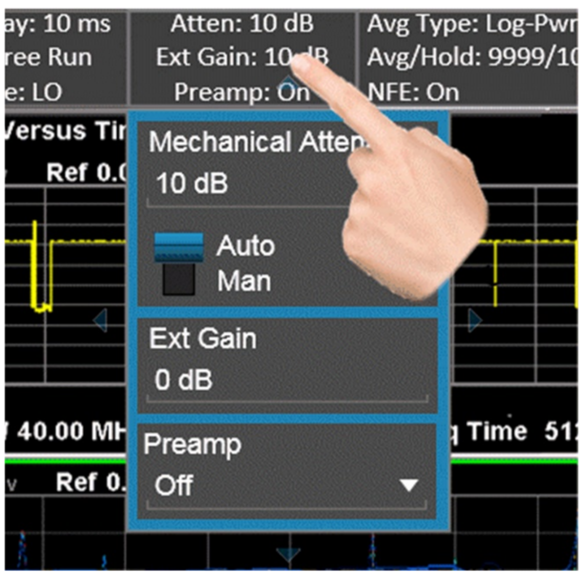
3.2 Meas Bar

The Meas Bar is used to display annotation for the current measurement. There are three primary uses for the Meas Bar:

1. To show annotation for the most important parameters in the measurement so you can see them at a glance
2. To show the annotation that you will most want to have recorded in a screen dump
3. To give you quick access to settings.

The Meas Bar is made up of a number of annotation panels, each of which, when pressed, opens up a dialog below it which contains controls for those settings.

For example, here is what the display looks like when you touch one of the regions of the Meas Bar:



Touching anywhere off the hotspot panel or pressing any hardkey except **Save** or **Quick Save** closes the hotspot panel.

In a hotspot panel, the control in black with the blue border is the active function. Each panel may have its own default active function.

Settings that are colored amber are those that you need to be particularly aware of; for example, if Alignments are off, this is shown in amber, so you will know that you may not be meeting spec. Similarly, if DC coupling is on, this is shown amber, to alert you to be careful what voltage you put on the input.

You can turn the Meas Bar on and off with a switch on the Annotation tab of the Display menu.

System Control Panel

The leftmost panel holds the GPIB/Remote annunciators, the Single/Continuous symbol/control, the LXI indicator and the PASS/FAIL indicator. Tapping this panel drops down controls for Single/Continuous, Pause/Resume and restart.

GPIB/Remote annunciators

The GPIB/Remote annunciators are shown as the letters `KRLTS`. Each letter is shown if the state is true and is not shown if the state is false, as follows:

K	Keylock indicator	This is shown when the instrument is in the Keylock state (turned on and off by the `SYST:KLOCk` command)
R	Remote annunciator	Shown when the instrument is in the remote state, as when being controlled via the IEEE-488 bus (GPIB) or TCP/IP connections
L	GPIB Listen annunciator	Shown when addressed to listen via GPIB orTCP/IP
T	GPIB Talk annunciator	Shown when addressed to talk via GPIB or TCP/IP
S	GPIB SRQ annunciator	Shown when the instrument is asserting SRQ on GPIB. This annunciator is an amber color

Single/Continuous symbol/control

This annunciator shows as an arrow on an oval line when in Continuous, or an arrow on a straight line when in Single.

LXI indicator

This indicator displays in green when LAN is connected, in white when LAN is not connected, and in red when LAN is connected but has a connection problem.

PASS/FAIL indicator

This annunciator displays when Limits are turned on. It is green if all Limits are passing, and a red FAIL if any limit is not passing.

The following command queries the status of the current measurement limit testing. It returns a 0 if the measured results pass when compared with the current limits. It returns a 1 if the measured results fail any limit tests.

Remote Command	`:CALCulate:CLIMits:FAIL?`
Example	`:CALC:CLIM:FAIL?` queries the current measurement to see if it fails the defined limits Returns a 0 or 1: 0 it passes, 1 it fails

Trace Detector Settings Panel

In the Swept SA and some other measurements, there is a special panel summarizing the settings for the traces in the measurement:

There is one column for each trace. The rows are as follows:

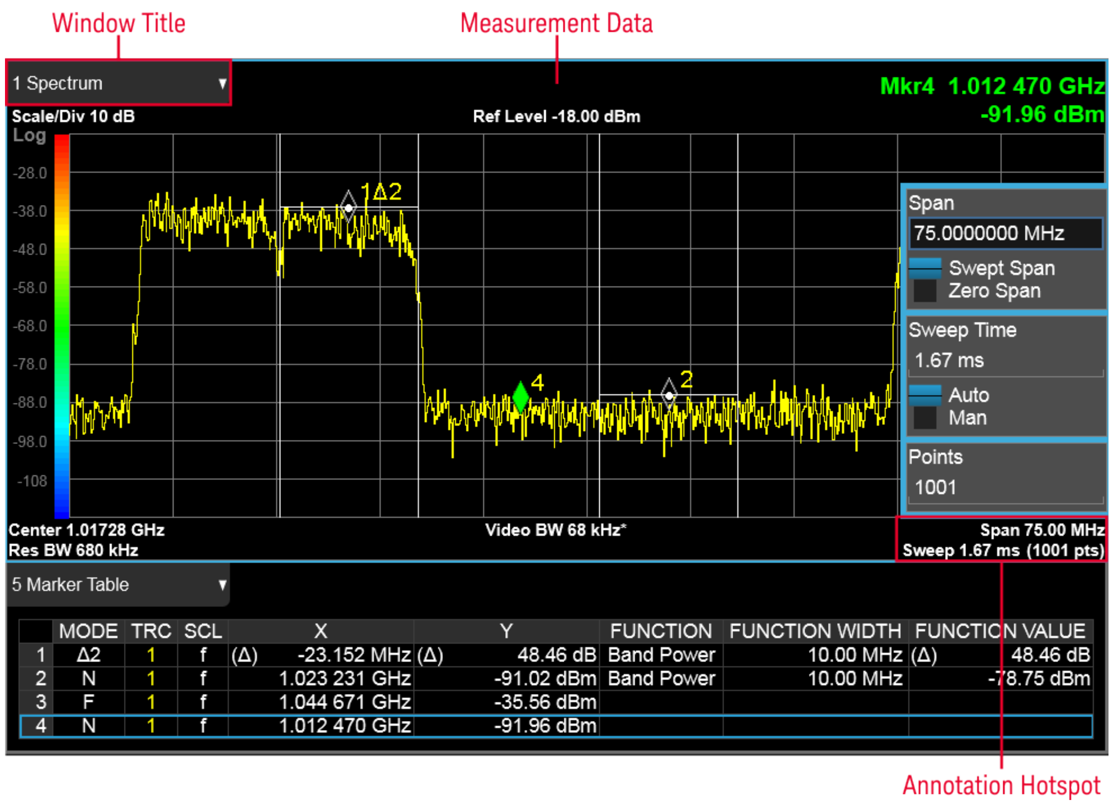
- The top row shows the Trace Number, in the trace color.
- The second row shows the Trace Type for each trace (W=Clear/Write, A=Trace Average, M=Max Hold, m=Min Hold); this letter is in white if the trace is Active, in gray if the trace is inactive; there is a bar through the letter if the trace is not being displayed
- The third row shows the detector for each trace (N=Normal, S=Sample, A=Average, P=peak, p=negative peak, Q=Quasi Peak, E=EMI Average, R=RMS Average, f=math function)

In the example above, trace 1 is active, visible, and in Average using the Sample detector, the other traces are inactive, blanked and in Clear/Write using the Normal detector.

Tapping this panel drops down controls for the Traces.

3.3 Measurement Display

The Measurement Display contains one or more data windows displaying the result of the current measurement. These may be graphical or textual windows.



Each window in the Measurement display contains a "Window Title" on page 68, "Measurement Data" on page 72, and graphical windows also may contain "Annotation Hotspot" on page 75s.

The selected window in the Measurement Display is indicated by a blue border. Window-dependent controls in the menu panel always refer to the selected window.

3.3.1 Window Title

The Window Title appears in the upper left hand corner of the window, and includes a title describing the measurement data currently being displayed in the window. The title may also contain additional information about the data in the window, for example in the LTE measurement supplication, the component carrier being displayed in the window will be indicated (e.g., “CC0”).

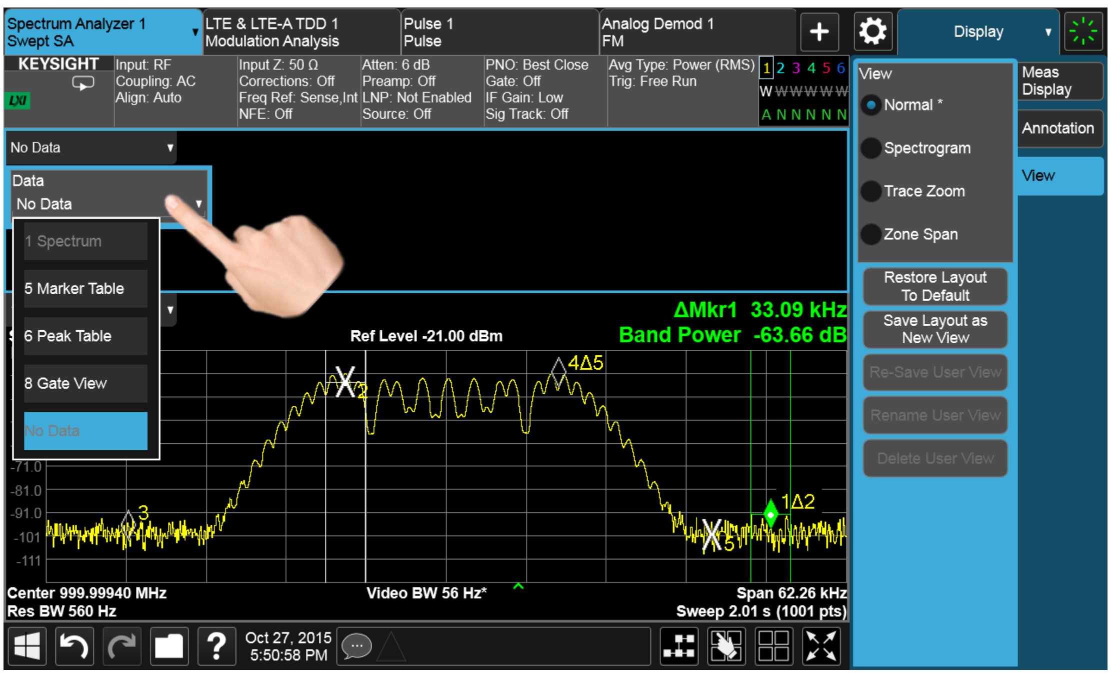
Measurements that support User Views (see "View Editor" on page 84) also display the Window Number in the Window Title, to enable window addressing from SCPI. The number is the number that will be used in the SCPI command to address that window, for example, in the WCDMA Mod Accuracy measurement, Code Domain

Power is assigned window number 6, so you address it with the following SCPI command:

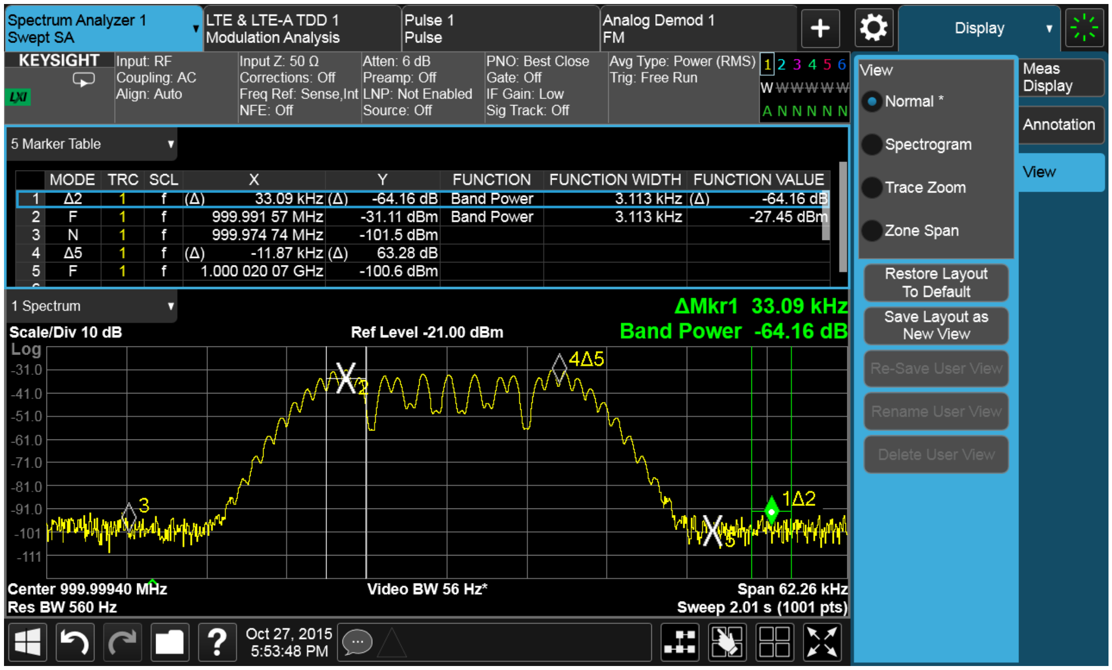
```
:DISP:RHO:WIND6:TRAC:Y:RLEV 0.0
```

Note the arrow pointing down on the right side of the Window Title. This indicates that touching the Window Title will display a dropdown, which enables you to select the Measurement Data to be displayed in the window.

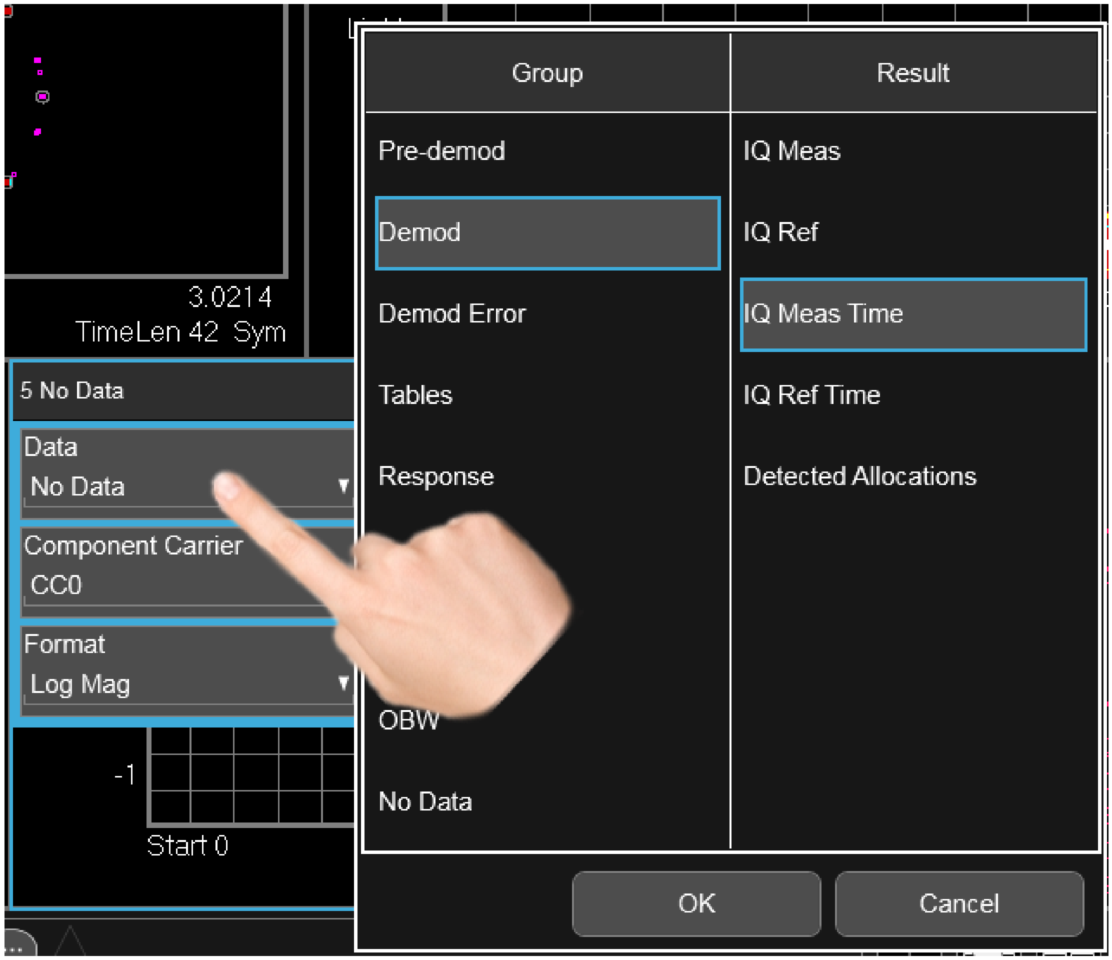
For example, if we wish to assign the results of the upper window in the display below to the Marker Table, we would touch the window title and then the "Data" control that is revealed, as shown:



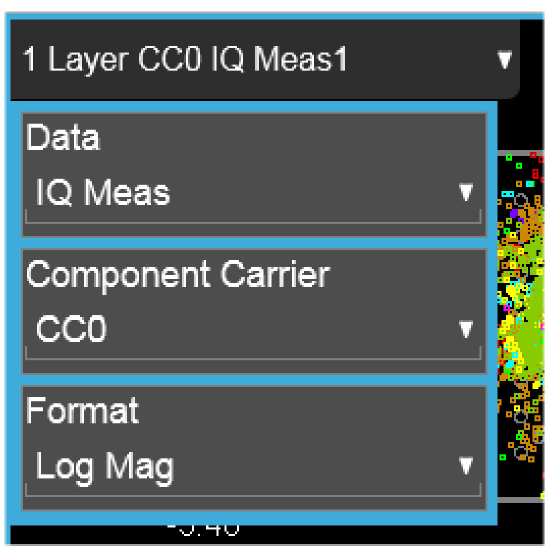
And then select Marker Table, yielding the result below:



Note also that the Window Data dropdown can be a cascaded list, if the number of available results requires categorization to hold them all:



Note also that the Window Data dropdown sometimes includes controls for further configuring the window, for example, in LTE choosing the desired Component Carrier and Data format.



Touching a window's title dropdown also selects the window.

3.3.2 Measurement Data

The Measurement Data region shows graphical or textual data for the Data selected in the Window Title Data control. Below you can see examples of both graphical and textual windows in a four-window display.

There are many gestures which you can use to interact with a measurement display window. They are detailed below.

Swipe

There are several swipe actions, as listed below. One of the most important actions is swiping a spectrum window to the left or right, or up or down, to adjust the frequency and level of the spectrum, as shown below.

Swipe actions are summarized in the table below. Not all of these may be available, depending on the measurement.

Object	Action
Spectrum Trace Left/Right	Drag trace (change Center Frequency)
Spectrum Trace up/down	Drag trace (change Ref Level)
Marker Left/Right	Drag marker along trace
Fixed Marker Left/Right/Up/Down	Drag marker in space
Scrollable area	Scroll vertically or horizontally. Scrollable areas include the Menu Panel (if overfull), tables and lists. A scrollable area is indicated by a vertical or horizontal translucent white bar which can also be dragged by a mouse When scrolling a table: – Row headers remain in place when the table is scrolled horizontally, and scroll with the table when the table is scrolled vertically – Column headers remain in place when the table is scrolled vertically, and scroll with the table when the table is scrolled horizontally
Toggle control	Toggle in that direction

Pinch

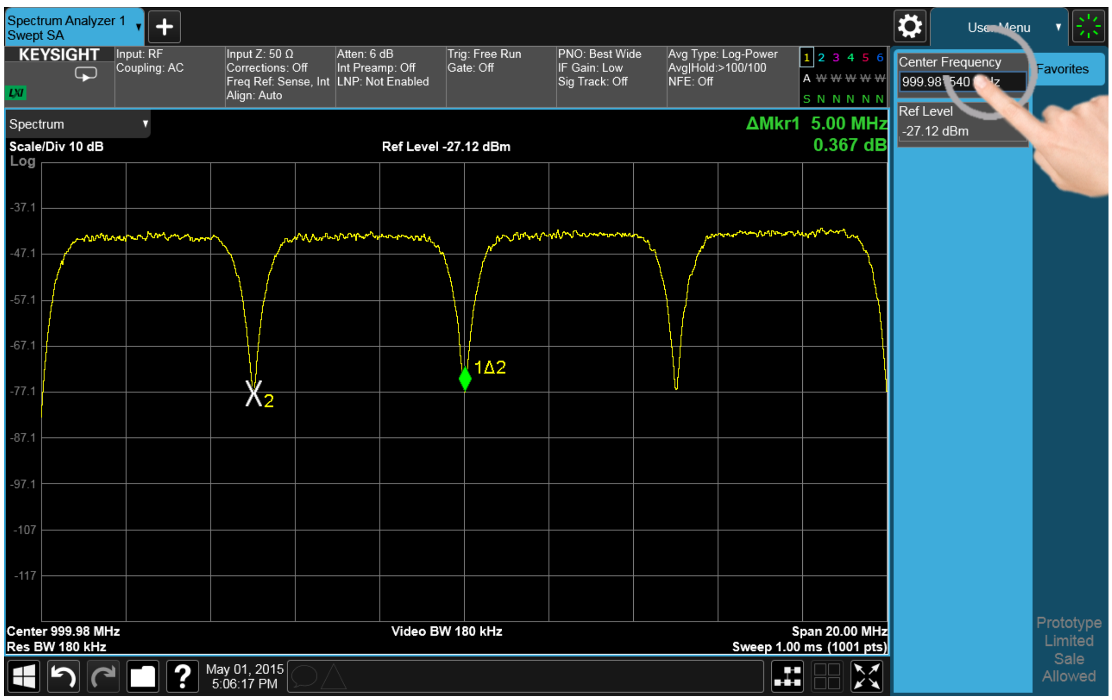
You can also pinch in or out either horizontally or vertically to zoom in the x-axis or y-axis dimension. For example, a pinch horizontally lets you adjust the Span of the

Spectrum window. Also, pinching on the wings of a Band Power or other Band Function allows you to widen or narrow that Band Function.

Pinching may sometimes be easier if you use the index finger of each hand, rather than pinching with one hand.

Touch-and-Hold

You can also touch-and-hold the display, that is, touch it and hold your finger on the display. A circle is drawn, and when the drawing completes, a right-click gesture is performed that depends on the screen feature touched, as listed in the table below.



Right Click on a Trace	Peak Search, Trace Type (Clear/Write, Trace Average, Max Hold, Min Hold), Trace View/Blank (Active, View, Blank, Background). Not all of these may be available, depending on the measurement
Right Click on a Marker	Marker Mode (Normal. Delta, Fixed, Off), Peak Search, Next Peak, Next Pk Right, Next Pk Left). Not all of these may be available, depending on the measurement
Right Click on the Background	Lets you select Help
Right Click on a Menu Panel control	Lets you add or remove that control from the User Menu or get Help on that control

Tap

Tapping an object causes the actions defined in the table below:

Object	Action
Marker	Select
Marker (repeated taps on stacked)	Cycle through stacked markers
Trace	Select. In addition if Marker is the active function, move the selected marker to the point where you tapped
Trace (repeated taps on stacked)	Cycle through stacked traces
Window	Select if unselected
Screen	Select if unselected

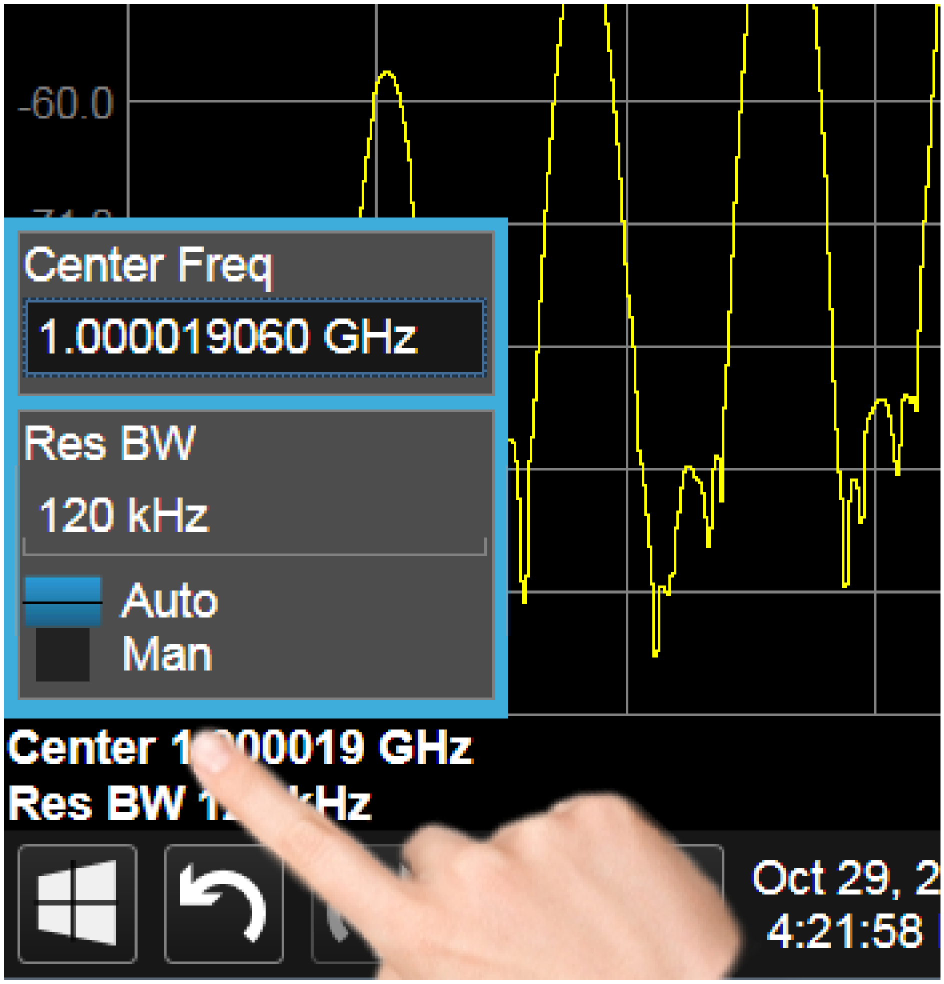
Double Tap

Double-tapping an object causes the actions defined in the table below:

Object	Action
Window	Zoom/Unzoom

3.3.3 Annotation Hotspot

You can tap on a graticule annotation to modify one of the fields in that annotation. For example if you tap on the region with Center Freq and Res BW in it, a menu panel pops up with just those settings on it.



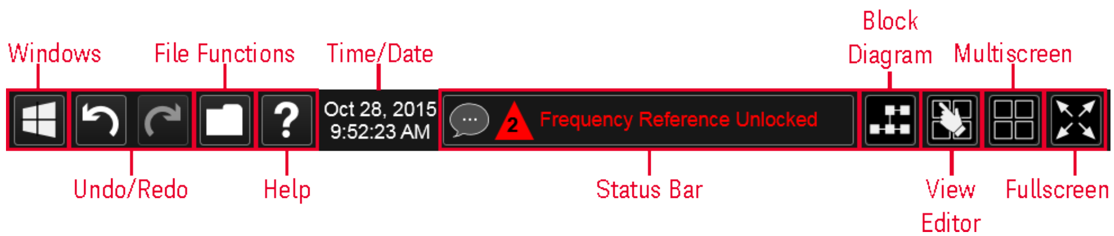
Touching anywhere off the hotspot panel or pressing any hardkey except **Save** or **Quick Save** closes the hotspot panel.

Annotation which is not currently able to be adjusted is not grayed out on the display, but the control in the hotspot that drops down or pops up is grayed out.

In a hotspot panel, the control in black with the blue border is the active function. Each panel may have its own default active function

3.4 Control Bar

The Control Bar contains controls and readouts that let you control instrument functions independent of the current measurement.



3.4.1 Windows

Pressing the Windows icon on the "Control Bar" on page 77 has the same effect as pressing the Windows icon on the Windows taskbar. It displays the Windows taskbar and Start Menu, which allows you to launch Windows programs and access features such as the Control Panel.

3.4.2 Undo/Redo

The Undo button in the "Control Bar" on page 77,

and the Undo front panel key,

are used to undo the most recently executed function.

If you Undo a function, and then decide you should not have done so, you can use the **Redo** button in the "Control Bar" on page 77 to put it back the way it was. The Redo function may also be executed by pressing **Ctrl+Undo** (holding the **Ctrl** key down while pressing the **Undo** font panel key).

Undo allows you to restore a setting, which you had previously set, back to its value before you changed it. When you press the Undo button or front panel key, the last setting you changed is "undone", that is, its previous setting is restored. You are notified of this fact with an advisory pop up message; for example, if the Center

Frequency had been 300 MHz, and you changed it to 1 GHz and then pressed **Undo**, the message would show:

```
UNDO: Center Freq 1 GHz -> 300 MHz
```

The instrument can store 5 levels of action for Undo.

To truly understand Undo and Redo, it helps to think of two “stacks”, an Undo stack and a Redo stack,

UNDO stack	REDO stack

Whenever you perform an action, it is placed on the Undo stack. So for example, if you set the Center Frequency to 1 GHz, then set the RBW to 1 MHz, then set the Detector to Peak, each of these actions gets “pushed” onto the Undo stack:

UNDO stack	REDO stack
Det = Peak	
RBW = 1MHz	
CF = 1 GHz	

When you press **Undo**, the top item on the Undo stack is removed, the action represented by that item is undone, and the item is placed on the Redo stack. So pressing **Undo** once in the above case would undo the setting of the peak detector, and the stacks would look like this:

UNDO stack	REDO stack
RBW = 1MHz	Det = Peak
CF = 1 GHz	

Now pressing **Undo** again would undo the RBW = 1 MHz action, and the stacks would look like this:

UNDO stack	REDO stack
CF = 1 GHz	RBW = 1MHz
	Det = Peak

Now pressing Redo would Redo the RBW = 1 MHz action, and the stacks would again look like this:

UNDO stack	REDO stack
RBW = 1MHz	Det = Peak
CF = 1 GHz	

Also, whenever you set a value, the Redo stack is cleared; you can't redo an action once you have interrupted the original flow of actions. Think of the Undo stack as the past, and the Redo stack as the future; if you have items in both stacks it means you have gone back to a time in the past; if you then *do* something you have changed the future, so the old future (the Redo stack) gets cleared.

For example, in the example above, if you now were to change another setting, such as VBW = 1 kHz, the Redo stack gets cleared, and the stacks would look like this:

UNDO stack	REDO stack
VBW = 1 kHz	
RBW = 1MHz	
CF = 1 GHz	

Undo can undo changes you make with the knob or step keys, however all contiguous events that affect the same parameter are aggregated into one event for the sake of Undo. For example, if CF is the active function and is 1 GHz, and you turn the knob back and forth, then enter a value, then use the step keys, when you press Undo, the instrument returns to CF = 1 GHz.

Actions that Cannot be Undone

There are some actions that cannot be undone, because these clear the Undo/Redo stack:

– Restore Mode Defaults clears the stack for that Mode in that Screen

– Sending SCPI commands clears the stack for that Mode in that Screen

– Loading a state file (including User Preset) clears the stack for that Mode in that Screen

– Deleting a Screen clears all the stacks in that screen

– Changing Views

Undo/Redo works within the context of a Mode. Each Mode in each Screen keeps its own record. Settings in the Control Panel or System Settings menus are not undoable.

There are several actions that may change many parameters. Among these are Auto Tune, and Adjust Atten for Min Clipping. After executing such a function, Undo sets all parameters back to their value before the function was selected. Auto Tune appears to be a single action, even though the instrument executes it in several steps.

Redo reverses the effect of the last Undo action, assuming that no other settings have been changed since the last Undo. Changing a setting after an Undo clears memory of all settings after that Undo, that is, it clears the Redo stack, as explained above.

When you press the **Redo** icon or **Ctl** and the **Undo** hardkey, you are notified with an advisory popup message; for example, if the Center Frequency had been 300 MHz, and you changed it to 1 GHz and then pressed **Undo**, the message would say:

```
UNDO: Center Freq 1 GHz -> 300 MHz
```

If you then press **Redo**, the message will say:

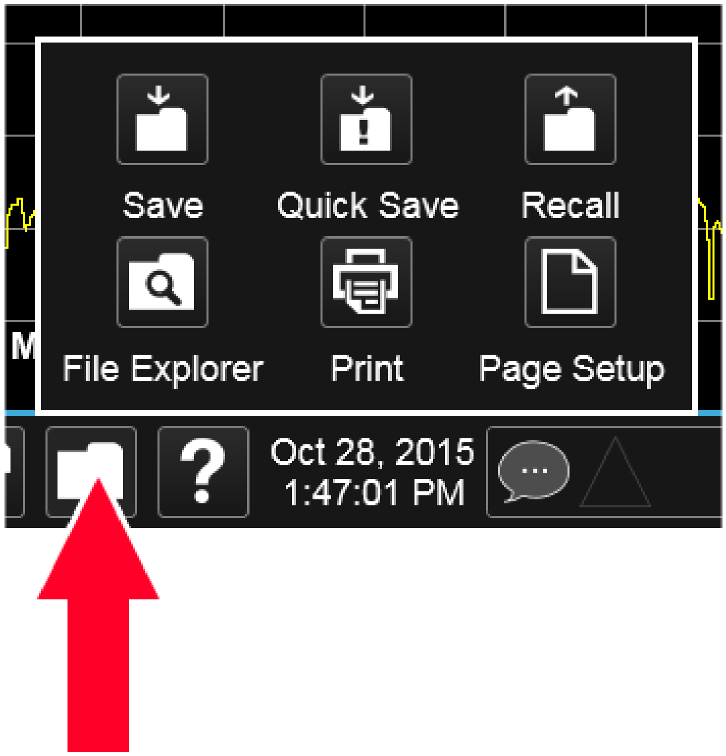
```
REDO: Center Freq 300 MHz -> 1 GHz
```

Neither **Undo** nor **Redo** perform any navigation, and have no effect on which menu panel is displayed nor which function is active.

3.4.3 File Functions

The File Functions popup contains controls for executing Save, Recall, File and Print operations. You display the File Functions popup by tapping the File Functions icon in the "Control Bar" on page 77.

For more information on a control, tap an icon in the image below.



Tapping this folder icon displays the File Functions popup

3.4.3.1 File Explorer

Pressing the File Explorer button in the "File Functions" on page 80 dialog opens the Windows File Explorer, which allows you to perform operating system file functions such as Move, Copy and Delete.

File Explorer also allows you to map network drives to drive letters on your PC or intranet, in order to more easily save screen images, states and other data, and load them back into the instrument.

3.4.4 Help

Pressing the Help button in the "Control Bar" on page 77, the **Help** front panel key, or **F1** if you have a PC keyboard connected, opens the context-sensitive Help system and allows you to get Help on the current menu panel. The Help button appears in the "Control Bar" on page 77 and also in the banner of full-screen dialogs.

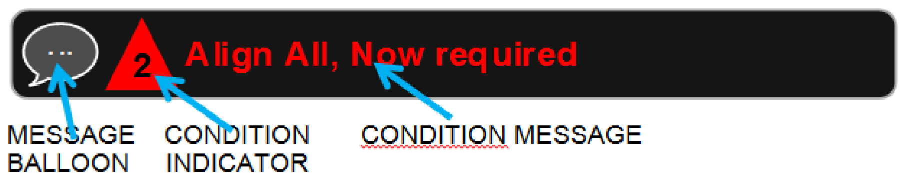
You can also use the Help window's Contents pane to navigate to Help for any function in the instrument.

In addition, if you touch and hold a specific control, one of the choices is **Help on this setting**.

The Help window appears in full screen mode, with the Contents pane on the left and the User Documentation pane on the right. The small pullout tab between the Contents pane and the User Documentation pane enables you to hide or view the Contents pane.

3.4.5 Status Bar

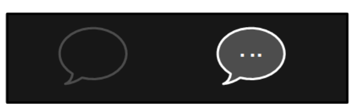
The Status Panel (or Status Bar) appears at the bottom of the display and contains three fields:



The message balloon appears on the left side of the Status Panel and lets you know when there is an unread message in the queue as shown above. Pressing the Message Balloon opens up the Show Status dialog with the Messages tab selected.

The message balloon has a gray outline and no fill if there are no unread messages; it has a gray fill and a white outline and displays a white ellipsis in the middle if there are unread messages.

Touching the Message Balloon opens up the Show Status dialog with the History tab selected. Touching anywhere else on the Status Bar opens up the Show Status dialog with the Current Conditions tab selected.

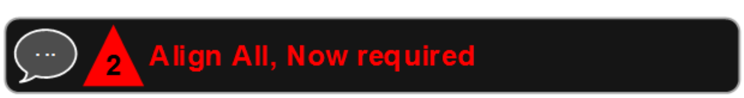


The Condition Indicator appears to the right of the Message Balloon and shows the current number of open conditions, as below:

The triangle is unfilled if no there are no open conditions, yellow if all open conditions are warnings, and red if at least one open condition is an error. The number displayed is the total number of open conditions.

Pressing the Condition Indicator opens up the Show Status dialog with the Current Conditions tab selected.

The Condition Message appears to the right of the Condition Indicator:



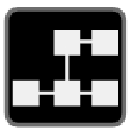
Warning condition messages display in yellow, error condition messages display in red.

If there is more than 1 open condition, the Condition Message cycles through the display of all of the open conditions, one at a time. Each message is displayed for 2 seconds, then the next for 2 seconds, and so on.

Pressing the Condition Message opens up the Show Status dialog with the Current Conditions tab selected.

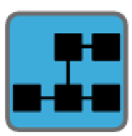
3.4.6 Block Diagram

When you press the Block Diagram button in the "Control Bar" on page 77, the display changes to a stylized pictorial representation of the current internal hardware setup and signal processing path. When you touch one of the blocks on the Block Diagram, the corresponding menu panel opens.



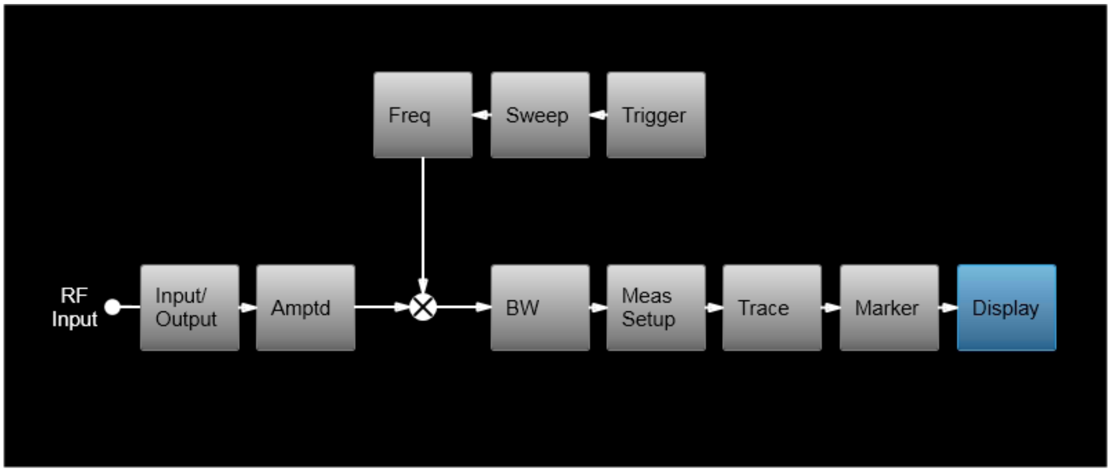
When you press the Block Diagram button, the display changes to a stylized pictorial representation of the current internal hardware setup and signal processing path. When you touch one of the blocks on the Block Diagram, the corresponding menu panel opens.

While in the Block Diagram display, the button is blue colored, as:

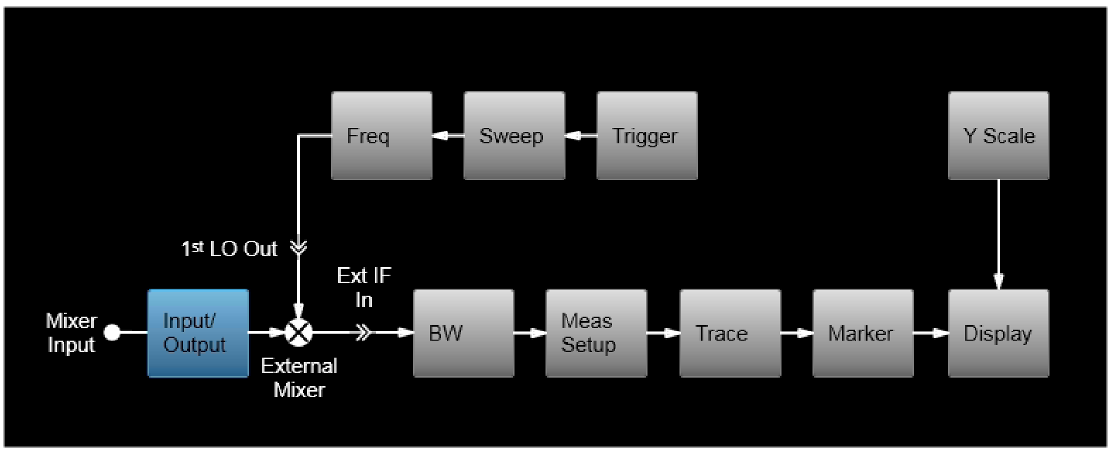


To exit the Block Diagram display, tap the button again.

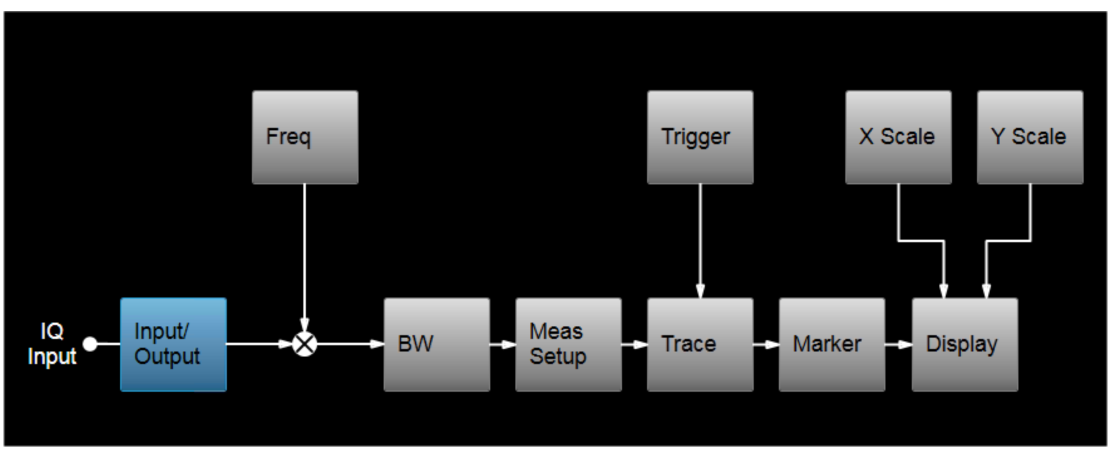
The Block Diagram display is not meant to be a completely accurate representation, but one which can show differences as you change the hardware setup. For example, here is the basic RF Block Diagram:



And here is the Block Diagram when External Mixing is selected:



And here is the Block Diagram when the I/Q inputs are selected:



3.4.7 View Editor

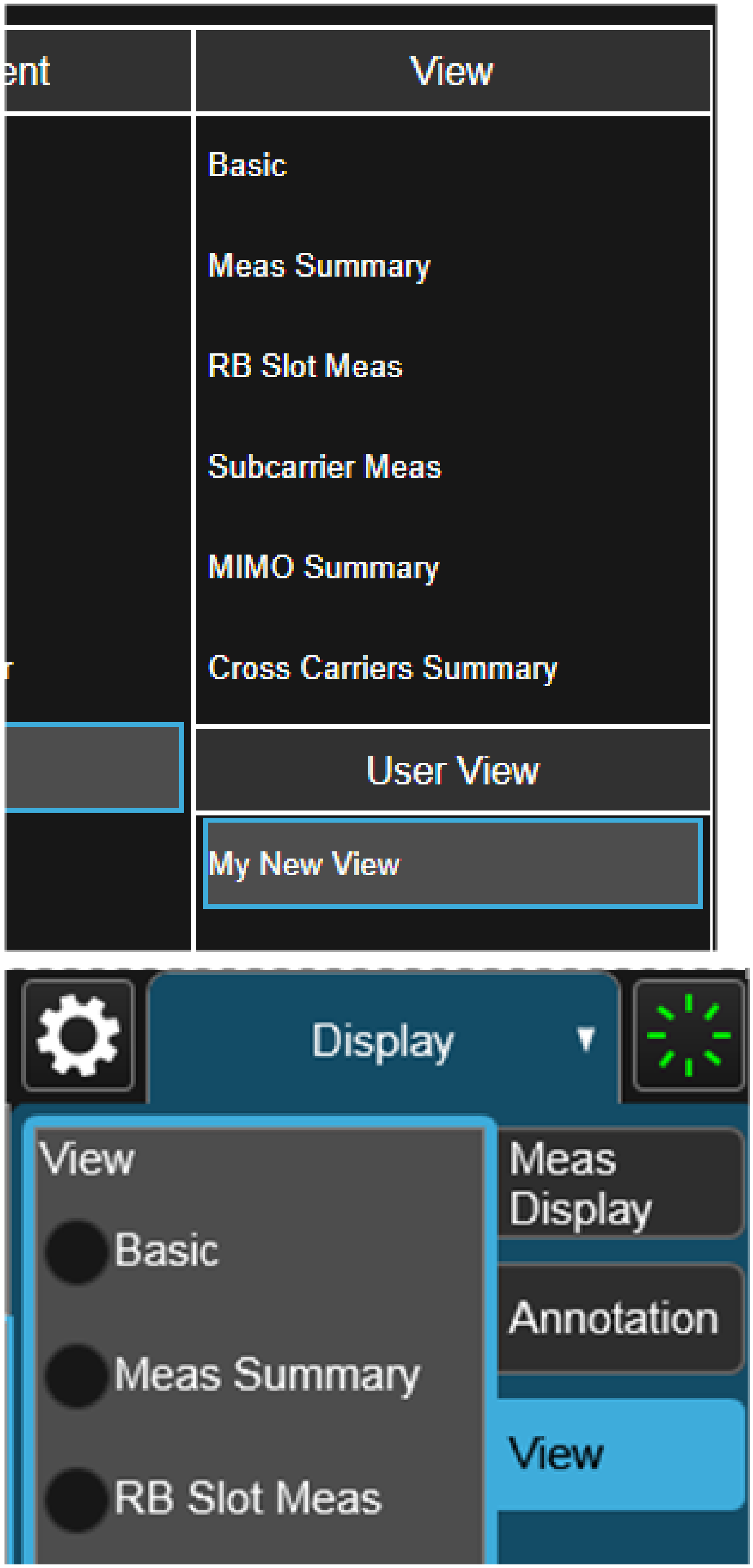
This section describes the use of the View Editor, which allows you to:

– Add windows to and delete windows from the current measurement

– Resize and rearrange windows

– Create User Views

User Views are custom Views that you create by adding, deleting, rearranging, resizing, or changing the contents of the windows in an existing View, and then saving the edited View as a new View. The instrument lists the current User Views for a measurement after the Predefined Views, in the Mode/Meas dialog and on the View menu panel under Display:

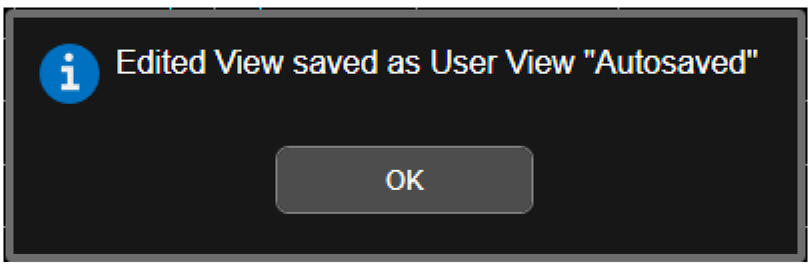

View
Basic
Meas Summary
RB Slot Meas
Subcarrier Meas
MIMO Summary
Cross Carriers Summary
User View
My New View
Display
View
Basic
Meas Summary
RB Slot Meas
Meas Display
Annotation
View

You can save an edited View using the **Save Layout as New View** control in the View menu (see "To Save a User View" on page 100).

On occasion, the instrument may automatically save an edited View for you. If you have edited a View, so that the * is displaying next to the View name, you must save that View as a User View before you save State or switch measurements. If you forget that you have made changes to a View, then to keep from losing your edited View when you switch measurements, the instrument will save it for you. If you have an edited View that has not been saved and you try to do any of the following:

- Enter the “Save” menu
- Switch Measurements
- Switch Modes
- Switch Screens

the edited view will be saved for you with the name “Autosaved”. When this happens, you will receive the following message:



If an Autosaved User View already exists, the User View called “Autosaved” will be overwritten with the currently edited view. If you have multiple edited views, the selected edited view will be Autosaved. If there is not an edited view selected the last selected edited view will be Autosaved.

To Open the View Editor

Pressing the View Editor button (shown above) in the "Control Bar" on page 77, at the bottom right of the screen, opens the View Editor.

While in the View Editor, the icon is blue colored, as:

Pressing the View Editor button again exits the View Editor.

To Close the View Editor

Tap the View Editor button again.

The user chooses the desired View through the use of the Mode/Meas/View dialog (see "Mode/Meas/View Dialog" on page 47) or the View menu (a tab under the **Display** key). The View menu allows the user to browse the views in the current measurement. The View menu contains a list of Predefined Views for you to use. If you wish to modify a Predefined View or create your own, new View, you use the View Editor.

User Views & Predefined Views

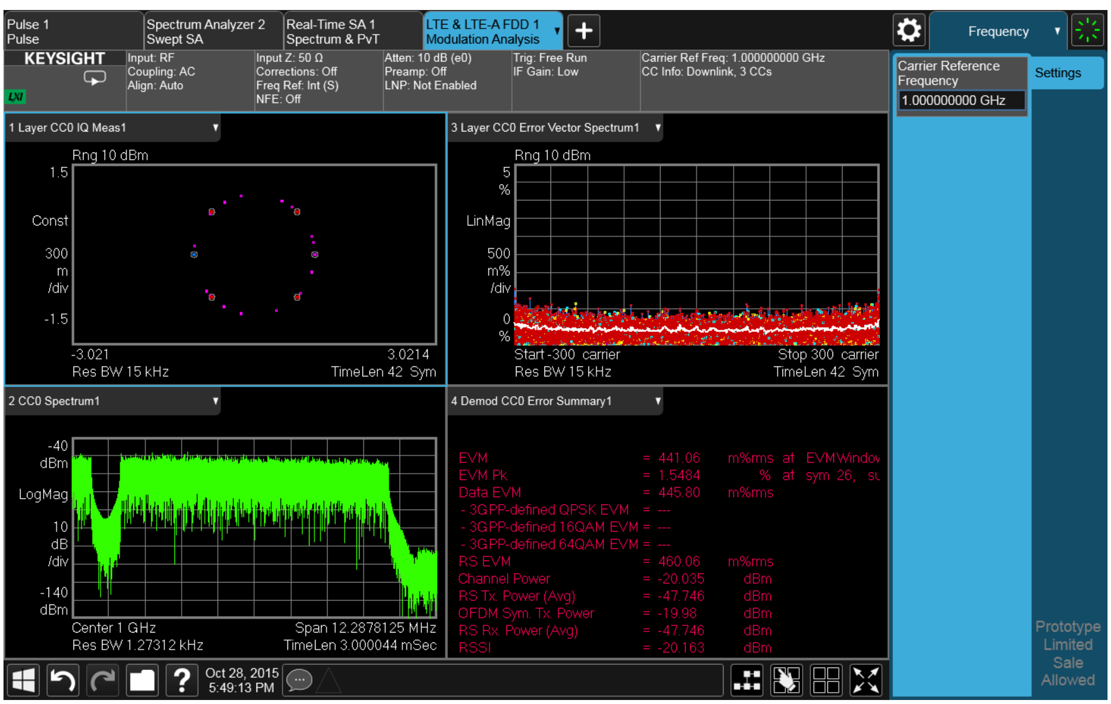
A User View is any View that is not in the list of predefined Views for the current measurement. For example, the Swept SA measurement has four predefined Views: Normal, Spectrogram, Zone Span, and Trace Zoom.

User Views allow you to add, delete, change and rearrange the windows of a predefined View, creating a new custom view.

3.4.7.1 To Create a User View

Whenever you add or delete a window to/from a predefined View, or change what is being displayed in a Predefined View's window, the Predefined View is marked with an asterisk (*), to show that it has been modified.

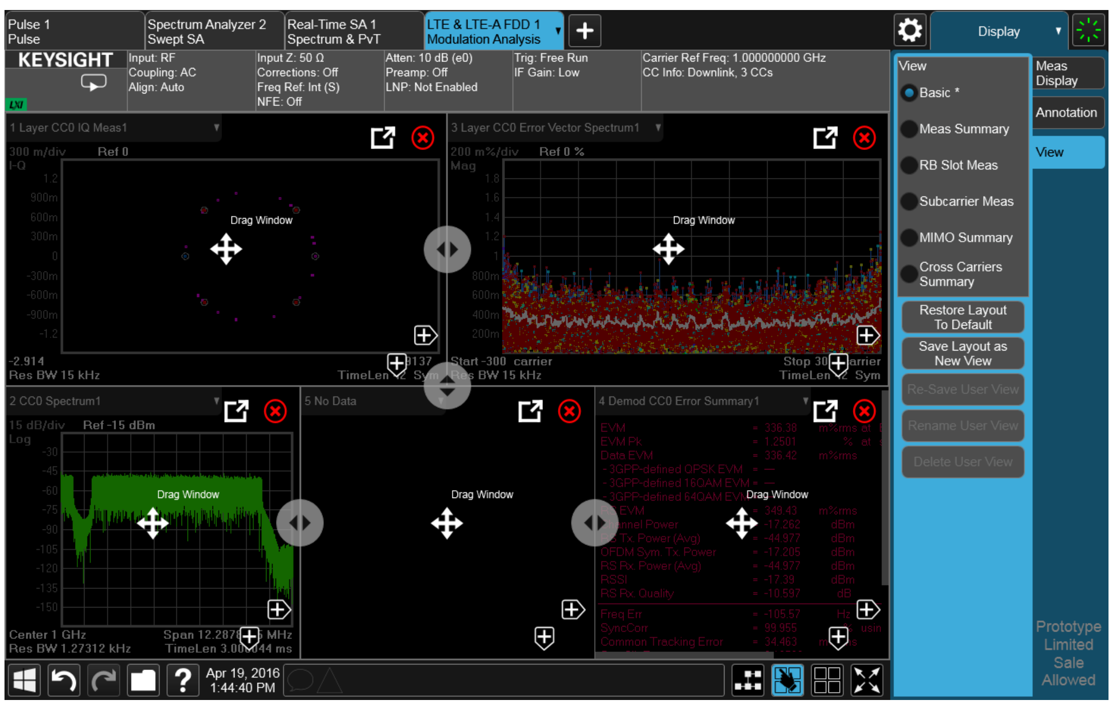
For example, to edit the View shown below, you press the Edit View icon.



When you do this, you get the View Editor screen, which appears as below. The menu panel switches to the View menu. Here we see that we are in the Predefined View called “Basic”.

Each window has two arrows containing + signs. Pressing either of the "+" symbols adds a new window on that side. For example, let's say you press the + symbol on the right of the lower left window:

You would then see this:



A fifth window has been added, and is automatically assigned the number 5. (The window number, which is displayed in the Window Title region, is used when sending SCPI commands to that window).

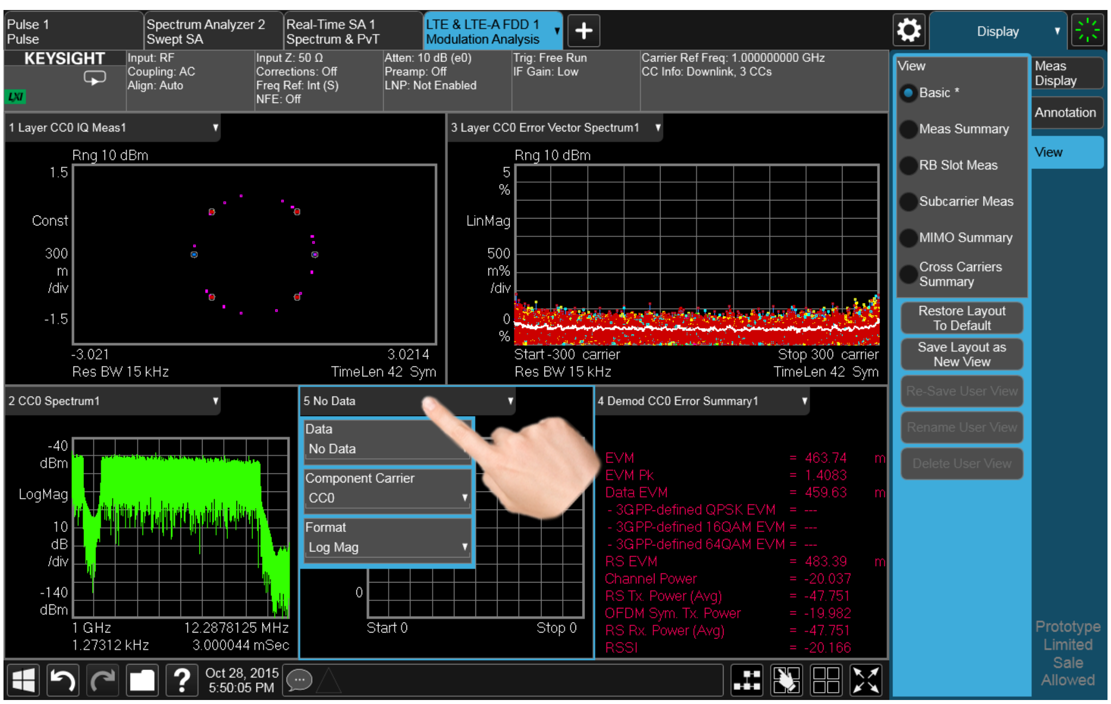
Note the * that now appears next to Basic in the View menu, indicating that you are now in the **modified** Basic View. You see the * if you add, delete or rearrange windows, but simply resizing windows does not display the *. The * means you are in a modified View, which must be saved as a User View before you leave the measurement (if you don't save it, the instrument will save it for you).

Note also that the Restore Layout to Default control is no longer grayed out. If you press this control it restores the Basic View to its default state. Restore Layout to Default becomes available when you add, delete or rearrange windows **and** when you resize them; otherwise it is grayed out.

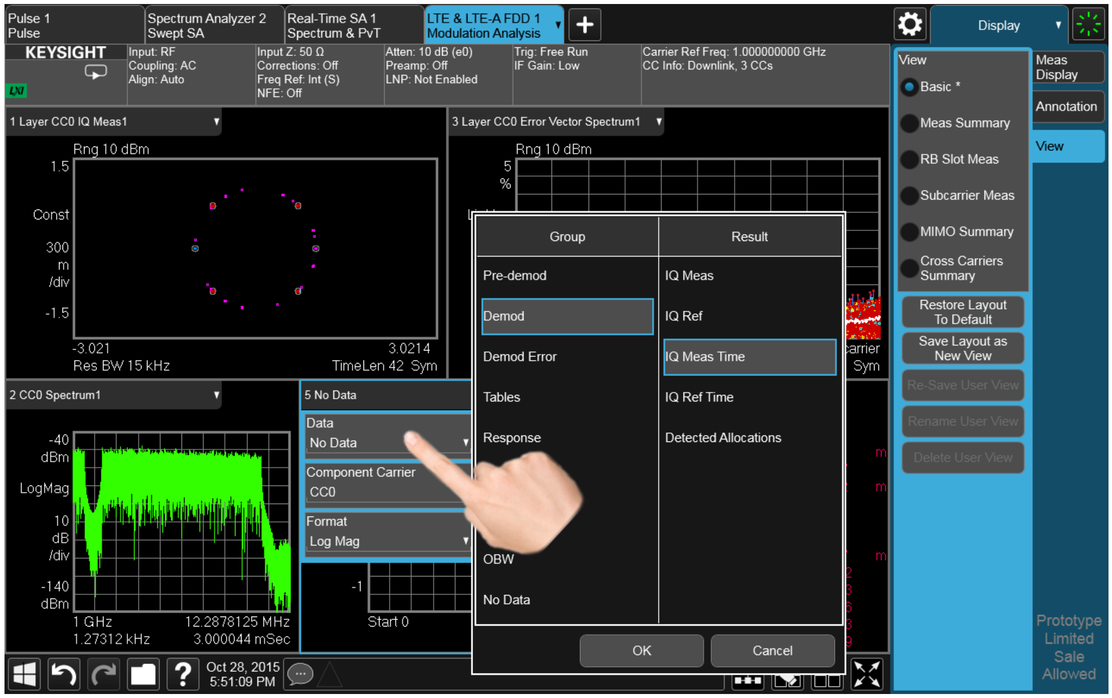
You can add more windows with the "+" arrow symbols. Note that the "+" arrow symbols only appear if the current measurement has more windows available to display. If you are already displaying all the measurement's windows, the "+" symbols disappear.

You can exit the View Editor by again tapping the Edit View icon.

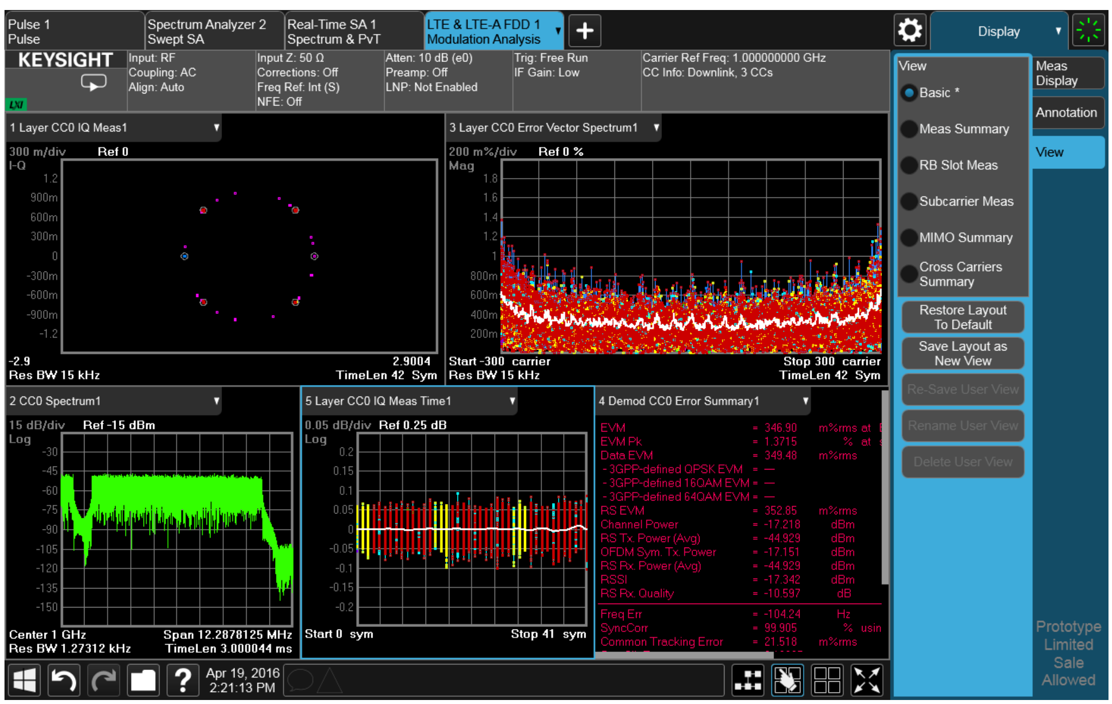
You can specify which result you want to see in the new window by tapping its title region.



A panel drops down, containing a Data control for specifying window results. Some measurements, such as LTE-A in this example, also provide controls on this dropdown for specifying other window parameters, such as the Component Carrier and Data Format, Tap the Data control and you will see a list of available results for the window. In some cases, as in LTE-A, this will be a cascading list, due to the number of results available:



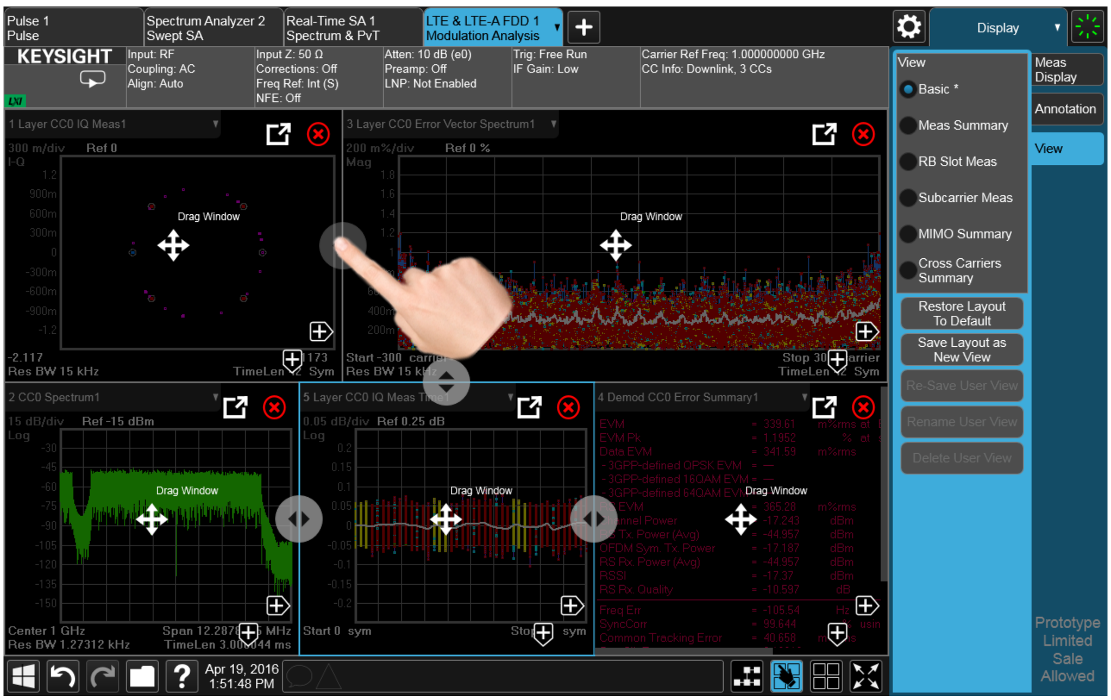
Choose the result you want and tap OK. Here we have chosen IQ Meas Time from the Demod group:



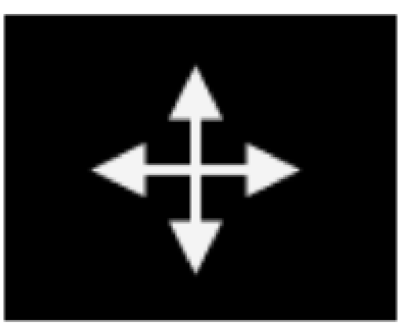
Your new, edited User View is now ready to use.

3.4.7.2 To Resize or Rearrange Windows in a View

Sometimes you may wish to resize a window. To do this go back into the View Editor and note the large, translucent white circles along the edges of the draggable borders. These are the “resize handles”. You can resize the windows by dragging these handles. Note that in their quiescent state they are slightly translucent; when you touch one it turns solid white, indicating that it is draggable. If you touch and drag one of them it moves the axis to which it is attached.

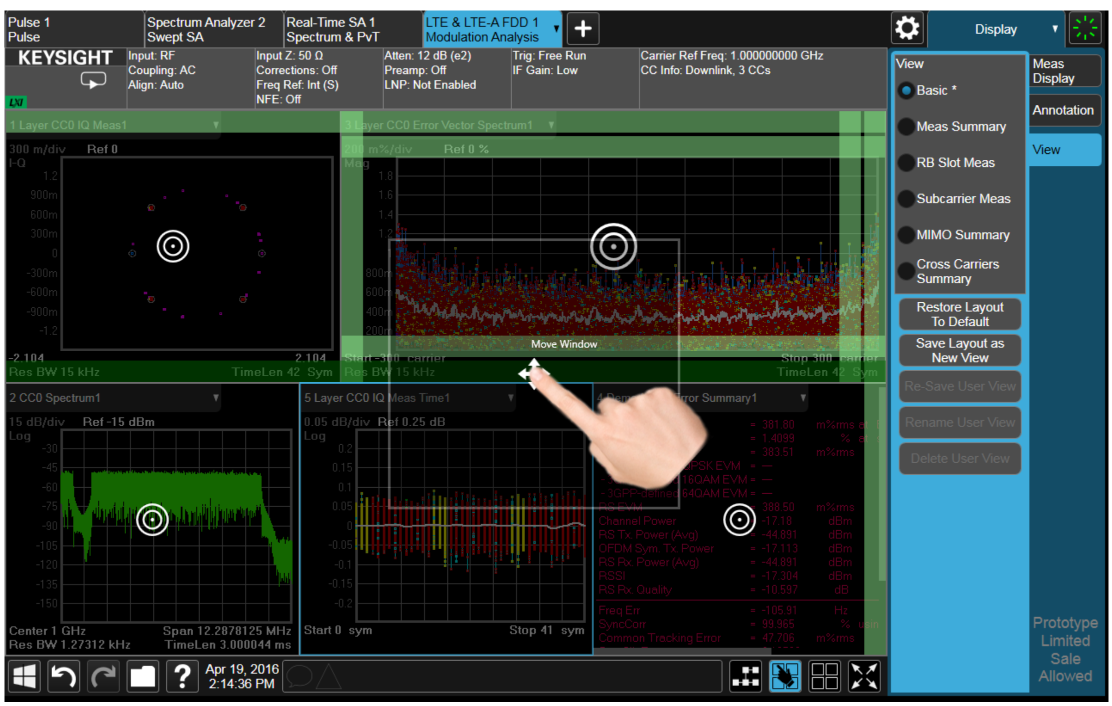


Another feature that comes with the View Editor is the ability to move windows around. You do this by dragging the four-arrow objects in the center of the window; the whole window goes along. Actually you can touch and drag anywhere in the window (except on one of the arrows or the delete circle) and it will drag, but the four-arrow objects give you an indication and a convenient finger target.

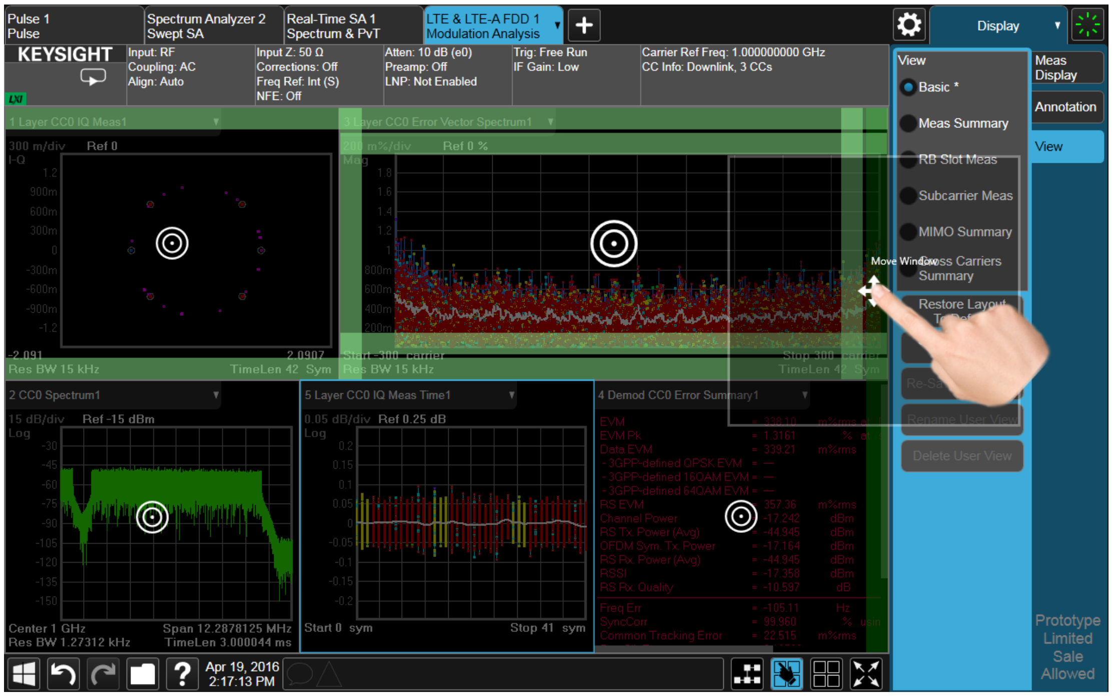


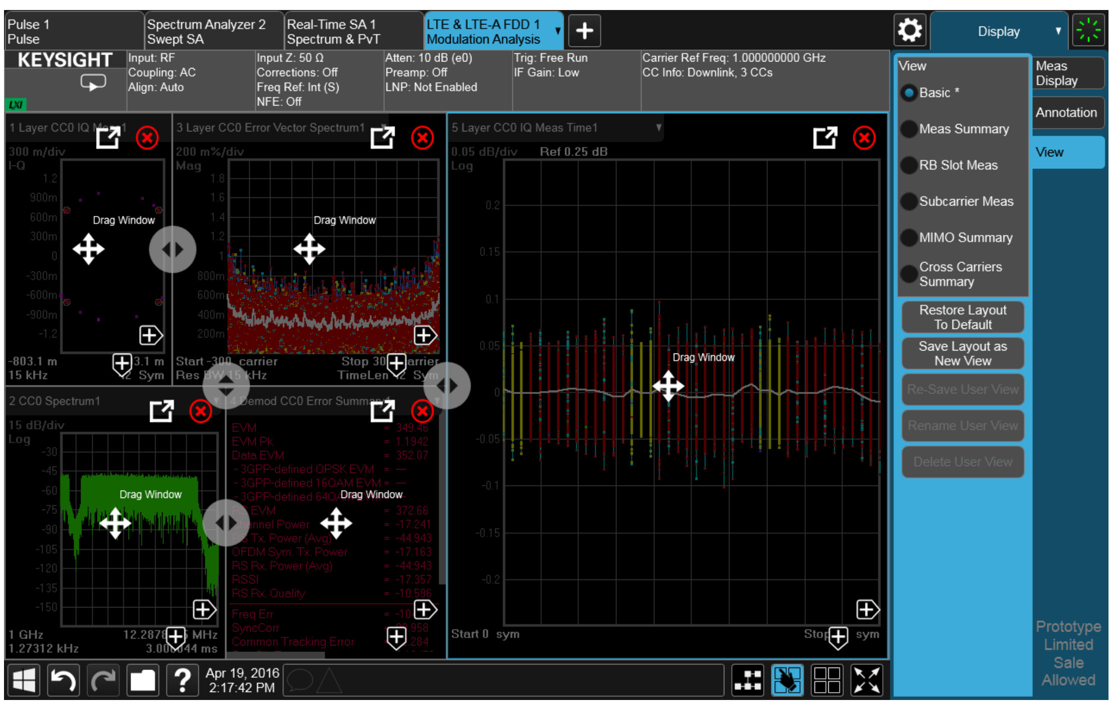
The outline of the window appears as it is being dragged. When you start to drag a window, target symbols appear in the other windows:

If you drop a window on one of the targets, it swaps positions with the target window. If you drag a window's center into another window, green stripes appear on the edges to show you where the window will go when you release it:



When you hover over one of the stripes it gets dimmer, to show the position the window being dragged will take on. If you release a window over an inner stripe, the window you are dragging and the window over which you were hovering resize to share the space the target window originally occupied. If you release a window over an outer stripe, as shown below, the window you are dragging takes on a new position outside the array of other windows:





In either case, one or more of the remaining windows resize to occupy the space formerly occupied by the window you were dragging.

3.4.7.3 To Undock and Redock Windows

You can undock a window from the analyzer's display frame so that it becomes a separate, floating window with its own Windows banner and title. There are two different ways to do this:

1. Drag the window to a spot on the display where its center is not on top of any targets or green stripes. When you do this the note on the window will change to "Undock Window":

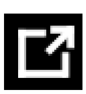
Now release the window and it will undock in place without changing size:

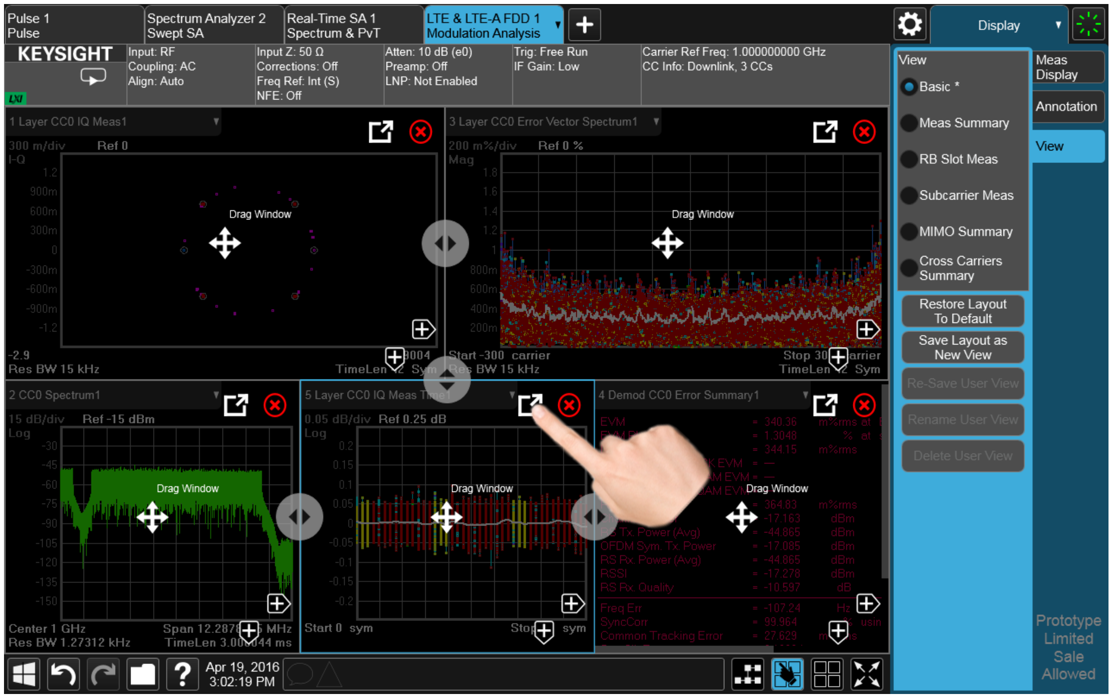
Notice that it now has a banner and a title of its own. The first line of the banner is the Mode name and the second is the Measurement name. If the window is too small, these will be shortened with an ellipsis. The window name and number themselves appear in the upper left corner of the window, as usual.

Note that we are still in Edit View mode so the main window stills display the shaded overlay and, if there is more than one window left on the main display, the “move” arrows and delete and undock controls.

There are no “add” arrows or “drag cross” or “delete X” on the undocked window, because now it is a normal Windows window; so you can minimize it, maximize it, delete it, and resize it in the normal Windows way, whether the main window is in Edit View or not. You can also drag it around or to any monitor, and it will snap to full screen when dragged to an edge like any other Windows window.

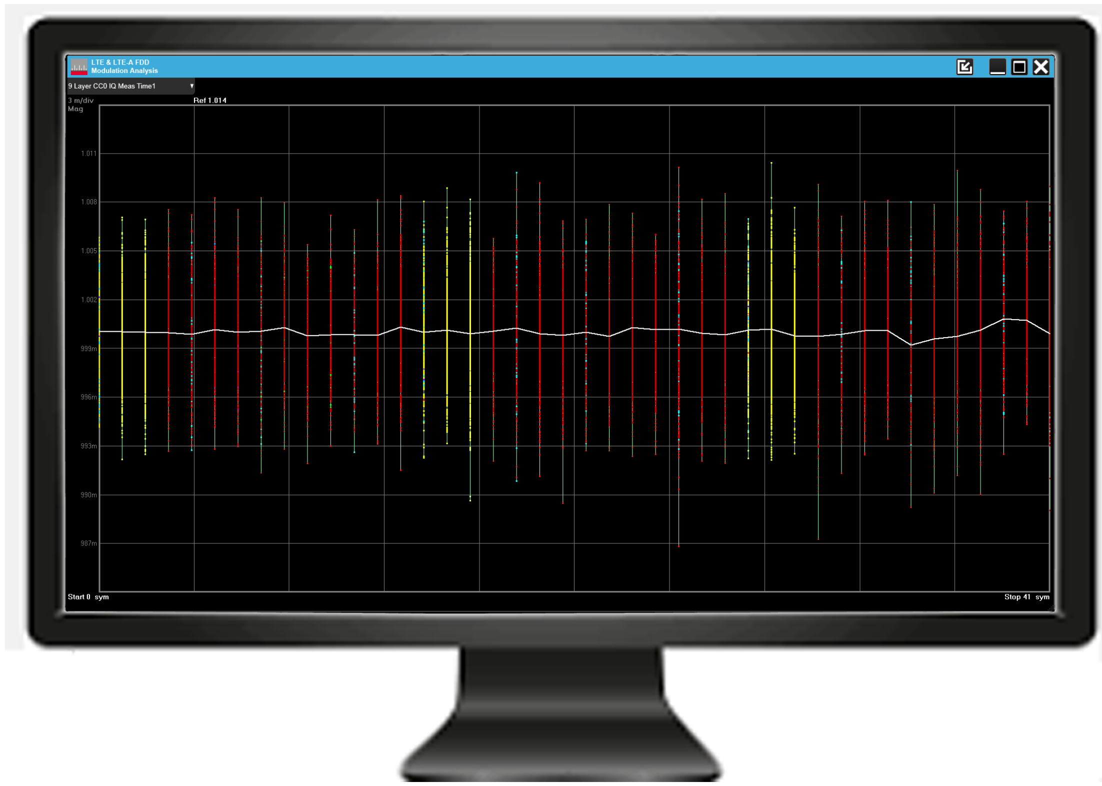
2. Tap the “undock” icon in the corner of the window:





A prompt will appear with a picture which allows you to specify which monitor to which you wish to undock the window:

Tap one of the monitors and you will see the window undock to that monitor, which may be a different monitor than the analyzer:



You can now treat this window like any other in Windows; you can resize it, drag it around and/or to a different monitor, etc.

The undocked windows represent a modified (starred) View and can be saved to a User View. They disappear if you change measurements or Views and return if you change back. If the external monitor is unplugged, the undocked windows land back on the main analyzer window and remain there, undocked, even if the monitor is plugged back in. The same is true if a User View is selected which had windows on a monitor that is not connected.

Note that even with a window undocked, there is still only one selected window in xSA, indicated by a blue window border (for a docked window) or a blue window banner (for an undocked window). Also, all popup messages still appear only on the main analyzer screen.

In multiscreen display mode, all windows for each Screen's current View (docked and undocked) are displayed. In single screen display mode, only the windows associated with the current Screen's current View (docked and undocked) are displayed.

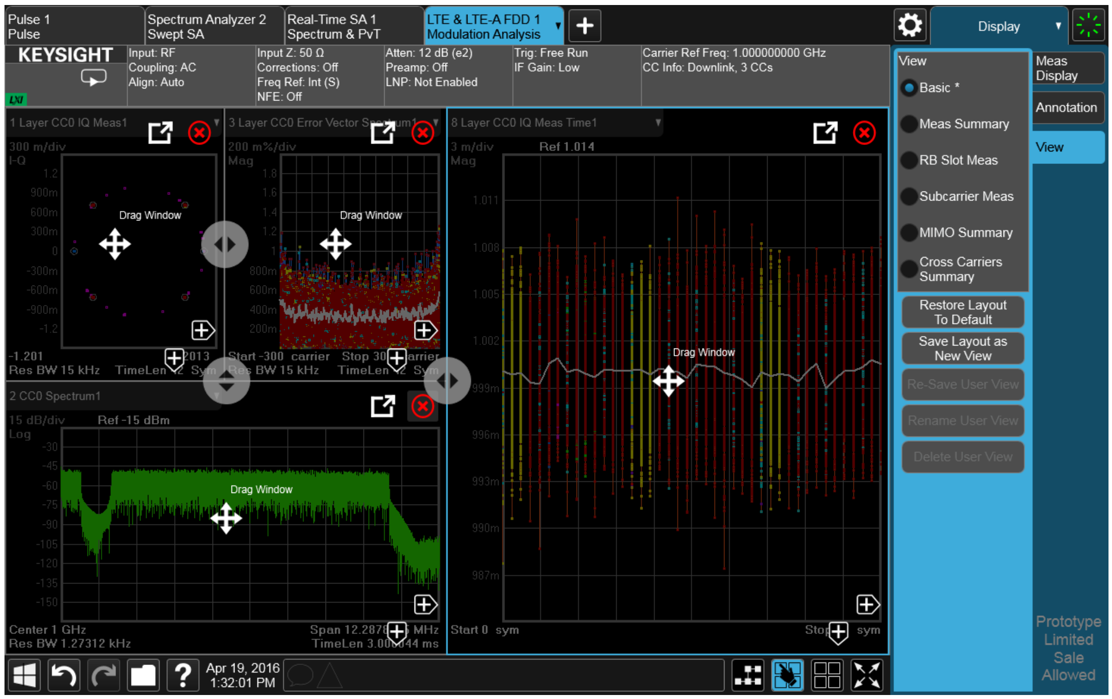
With undocked windows, when you save a Screen Image, the undocked windows are not included in the png.

To redock an undocked window to its original location, tap the "redock" icon in the window's banner:  The window will return to its original location.

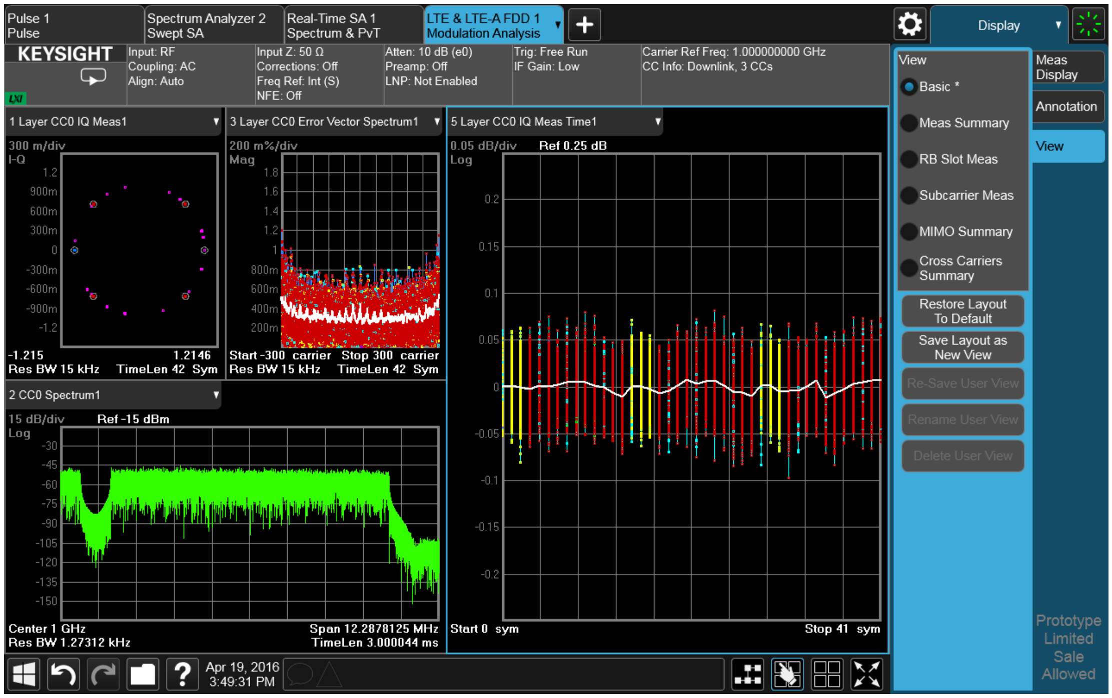
3.4.7.4 To Delete a Window from a View

The View Editor also lets you delete a window. To do this, tap one of the circled red X's, as shown below.

There has to be more than one window for you to see the circled red Xs.



Now press the View Editor button (the blue hand) to exit the View Editor. At this point, you have an edited Predefined View, as shown by the * next to Basic:



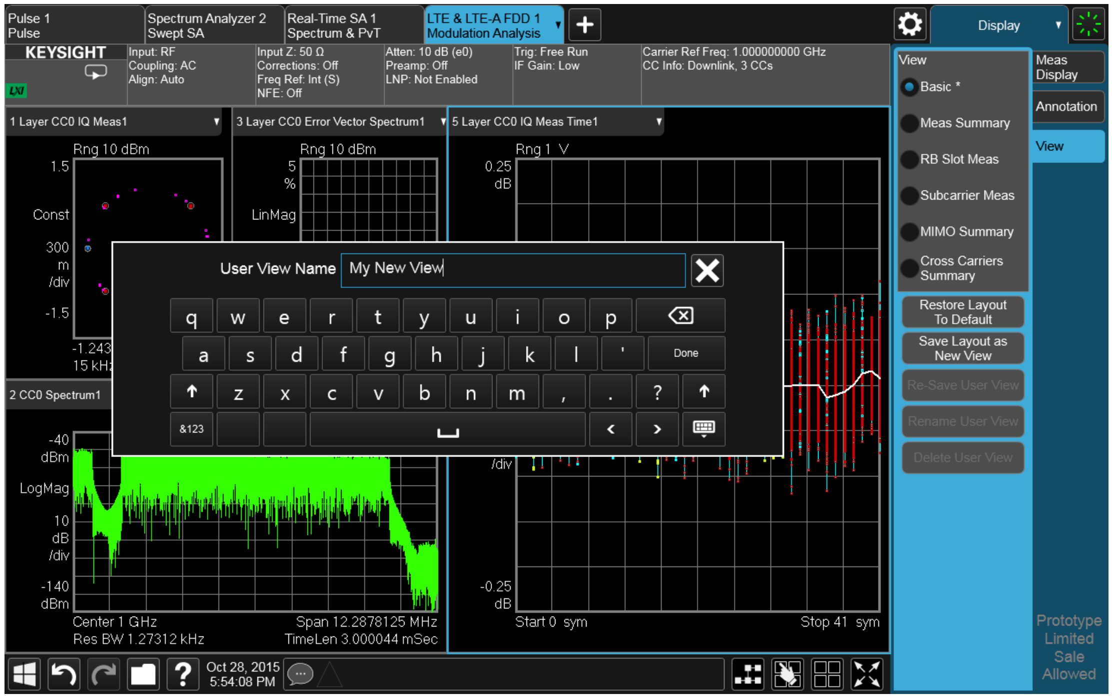
When you are finished with it, you can restore the Layout to the default for Basic by pressing “Restore Layout to Default”. Or you can save your edited View as a “User View” (if you exit the measurement without saving the edited View, the instrument will save it for you as a User View called “Autosaved”).

If you clone the current Screen by pressing the “+” tab, the modified Predefined View will be saved as a User View called “Autosaved”, and it will be available in the new Screen.

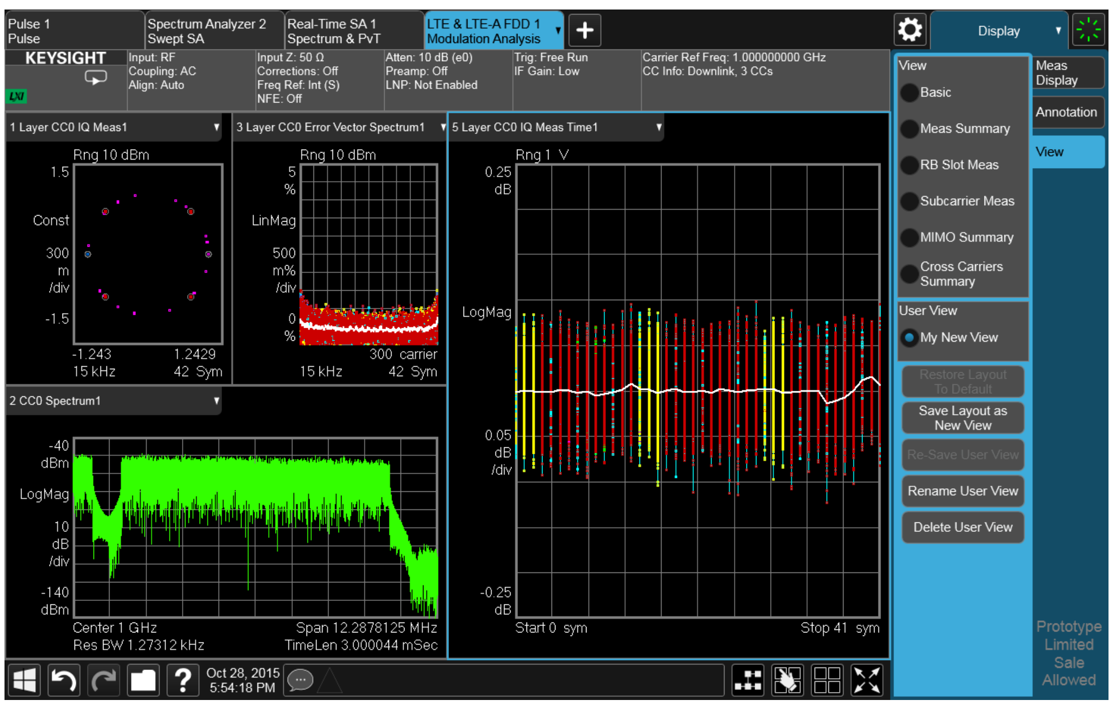
3.4.7.5 To Save a User View

See also "Transferring User Views Between Instruments" on page 102

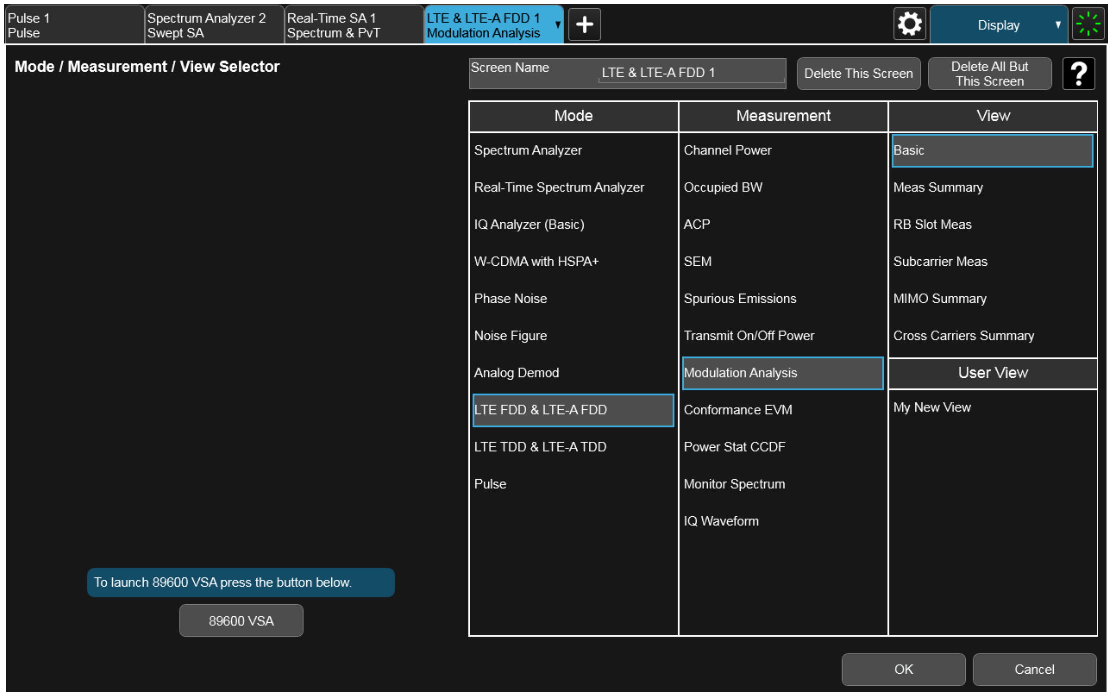
To save your new View as a User View, tap the “Save Layout as New View” control. You will get an alpha keyboard that lets you name your new View; the default is the old View name with a number. Below, we have typed in “My New View”:



When you tap "Done", the View is saved:



Notice the User View region which has appeared on the menu panel above, with the new User View called "My New View. Notice also that "Basic" has returned to its original, unedited state and the * is gone from its name. Note also that "Restore Layout to Default" is grayed out. Note also that if you go to the Mode/Meas dialog, you will see the User View there as well:



When naming a new View, you must choose a name that is not already in use for any User View in any measurement; this is because User Views get written to permanent memory and are available to all instances of the Measurement in any screen. They survive a Mode Preset and also survive shutdown and restart of the application.

Transferring User Views Between Instruments

To transfer a User View to another instrument, you must copy the desired file to a portable drive or to your network and then copy it to the target instrument.

When you save a User View, a file is created (or updated if it already exists) containing all the User Views for the current measurement. All of these files are saved on the D: drive in the instrument, in the folder:

`D:\Users\Instrument\My Documents\UserViews`

(assuming you are logged in as Instrument, which is the default).

Look for the file for your measurement. The file naming convention is:

`ModeName.MeasName.layout`

Where `ModeName` is the long-form SCPI parameter for the `:INST:SEL` command for your Mode, and `MeasName` is the long-form SCPI parameter for the `:CONF` command for your Measurement.

For a full list of all `ModeName` parameters, see **Index to Modes** in "Mode" on page 48.

The following is a full list of all `MeasName` parameters.

Measurement Name	SCPI ID
ACP, Adjacent Channel Power	`ACPower`

Measurement Name	SCPI ID
AM	AM
APD	APD
Burst Power	BPOWer
Channel Power	CHPower
Code Domain	CDPower
Combined GSM	CGSM
Combined WCDMA	CWCDma
Complex Spectrum	SPECtrum
Conformance EVM	CEVM
Digital Demod	DDEMod
Disturbance Analyzer	DANalyzer
EDR In-band Spurious Emissions	IBSPurious
EVM	EEVM
FM	FM
FM Stereo	FMStereo
Frequency Scan	FSCan
GMSK Phase & Freq Error	PFERror
Harmonics	HARMonics
IQ Waveform	WAVeform
LE In-band Emissions	IBEMissions
List Power Step	LPSTep
List Sweep	LIST
Log Plot	LPLot
Mod Accuracy	RHO
Modulation Analysis	EVM
Monitor Spectrum	MONitor
Noise Figure	NFIGure
Occupied BW	OBWidth
Output RF Spectrum	EORFspectr
Output Spectrum BW	OBWidth
PM	PM
Power Amplifier	PAMPlifier
Power Control	PCONtrol
Power Stat CCDF	PSTatistic
Power vs Time	EPVTime
Pulse	PULSe
QPSK EVM	EVMQpsk

Measurement Name	SCPI ID
SEM	SEMask
Spectral Flatness	FLATness
Spectrum & PvT	RTSA
Spot Frequency	SFRequency
Spurious Emission	SPURious
Strip Chart	SCHart
Swept SA	SANalyzer
TOI	TOI
Transmit Analysis	TX
Transmit On/Off Power	PVTime
Transmit Power	TXPower
Tx Band Spur	ETSPur

Examples:

- The User View file for the Swept SA measurement is `SA.SANalyzer.layout`.
- The User View file for the ACP measurement in the WCDMA mode is `WCDMA.ACPower.layout`.

Copy the desired file to a thumb drive or to your network. Then go to the target instrument and copy the file into the D:\Users\Instrument\My Documents\UserViews directory on that instrument (again, assuming you are logged in as Instrument).

NOTE: copying this file to another instrument will overwrite the file already in that instrument, if any, and will destroy any User Views that might have been created on that instrument.

NOTE: When you delete the last User View for a measurement, the file is removed.

3.4.7.6 To Rename a User View

You can rename a User View by selecting that View and tapping "Rename User View." You can also re-edit a User View; if you do this, an asterisk will appear next to the User View's name. You can then tap "Re-Save User View to save it back to its existing name, or "Save Layout as New View" to add another, new User View.

3.4.7.7 To Delete a User View

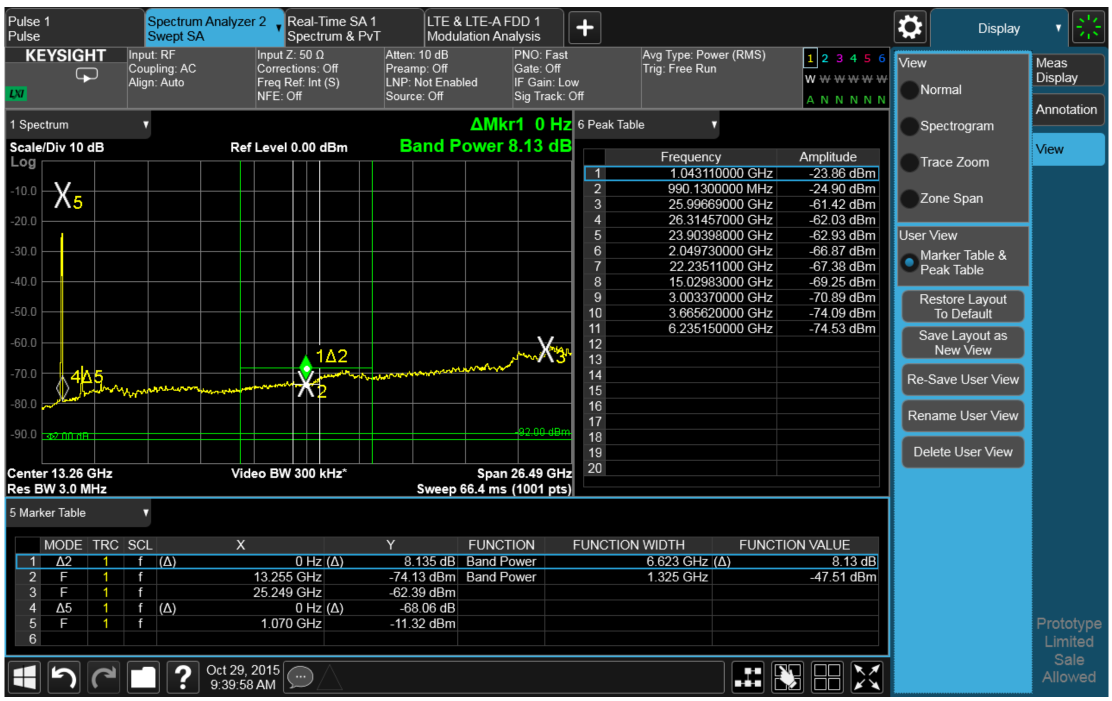
You can delete a User View by doing the following:

1. From the "Mode/Meas/View Dialog" on page 47, *or* from the **View** menu, select the User View that you want to delete

2. Switch to the **Display** menu
3. Select the **View** tab
4. Tap **Delete User View**

3.4.7.8 Use Case: Displaying Marker and Peak Tables

One common application for User Views is to create a View that allows the Spectrum Analyzer to display both a Marker Table and a Peak Table at the same time. To do this, simply add a Marker Table Window and a Peak Table window to the Spectrum window of the Swept SA measurement. The result is shown below; note that the new View has been named "Marker Table & Peak Table":



NOTE: There are legacy displays like Marker Table, Peak Table, Measure at Marker and Gate View, which are not Views but special display modes. These are retained for backwards compatibility, however they are turned on and off with switches and do not use the View system. Turning on one of these switches does not create a modified View, it merely adds the specified window to the current View; turning the switch back off removes the window. While the switch is on, NO View shows as selected in the View menu. These switches are grayed out if you are in a modified View or a User View. Since only one of these switches can be on at a time, and because these switches turn off on a Preset, User Views offer a superior way of adding windows than using the switches.

Some measurements do not support User Views; these do not allow adding, deleting or rearranging windows, however they do allow resizing windows. In these measurements you can get into the View Editor but the Add icons, Delete icons and Move icons will not appear. You can still resize the windows and in some cases (e.g. Noise Figure) you can still change window contents.

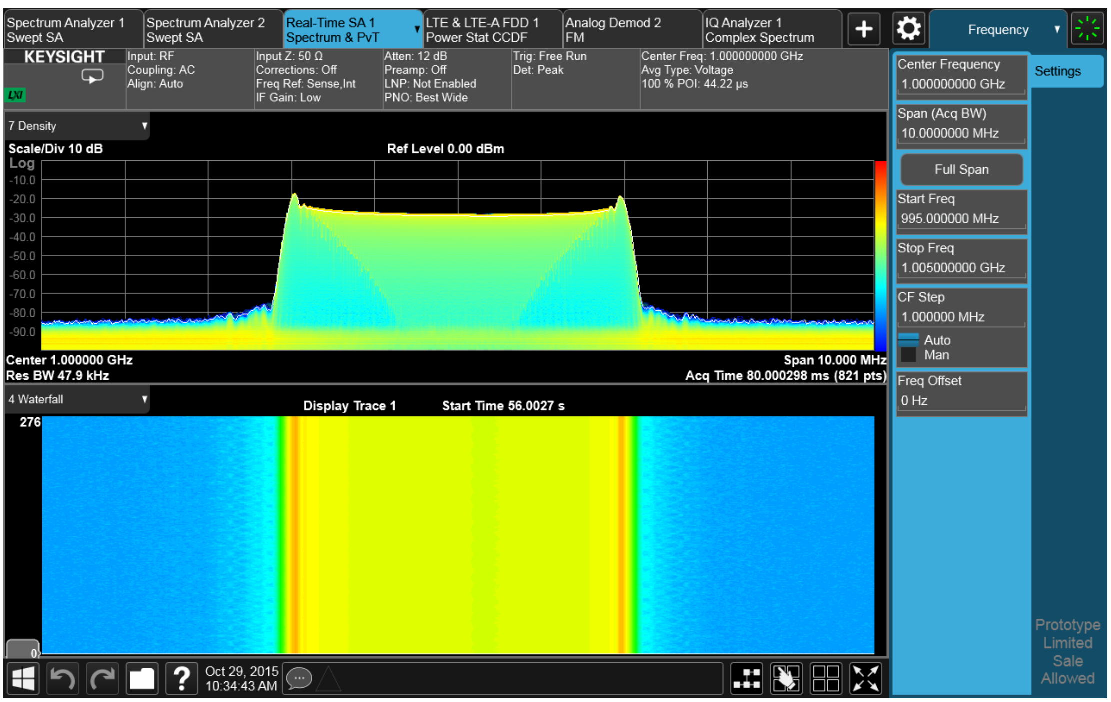
3.4.7.9 View Editor Remote Commands

Remote Commands for User Views can be found in the documentation for the **Display, View** tab.

See "View" on page 158.

3.4.8 Multiscreen

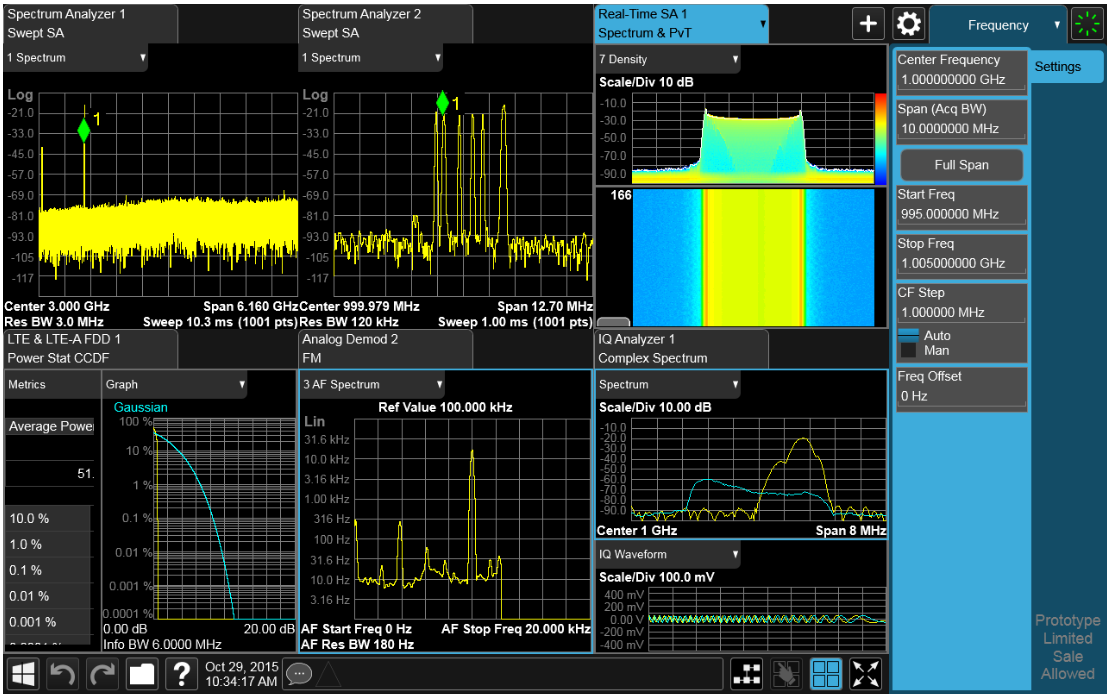
You can configure up to 16 different Screens at a time. Normally, you only see one Screen, and the set of configured screens is shown across the top of the display in a series of "Screen Tabs" on page 46. Touching any screen’s tab brings it to the foreground, makes it the current Screen and starts it updating.



Multiscreen view lets you display all of the configured Screens at once.

You can switch to Multiscreen View by pressing this button in the "Control Bar" on page 77 at the bottom right of the screen:

Multiscreen View looks like this:



While in Multiscreen View, the button changes from a black background to a blue background:

To exit Multiscreen view, tap the button again.

Multiscreen View cannot be activated if only one screen is configured.

Each Screen contains one Mode, each Mode contains one Measurement, and each Measurement contains a number of Windows arranged in Views. You can configure multiple instances of the same Mode along with any combination of other Modes.

In Multiscreen View, just as in Single Screen View, only one screen is active.

You switch Screens by tapping the Screen Tab you want, or when in Multiscreen View, you can tap the Screen itself. When you switch Screens, the current Screen's state and measurement results are preserved, the new Screen's previous state and data are loaded, and the new Screen starts running its Mode.

In Multiscreen View:

– The Meas Bar does not display

– The Screens are presented in an array of equal size boxes, except where the number of Screens means some have to be different sizes (as when you have 3 Screens, 5 Screens, etc.).

– Each Screen has a tab that contains the name of the Mode and Measurement in the box and a number associated with the instance of that Mode. You can enter a custom Screen name that replaces the Mode name, by going into the Mode/Meas dialog

- There is always one and only one selected Screen. It is indicated by a blue tab. Only the selected Screen is actually running a measurement and updating its display
- The selected window in the selected screen is the context for the current menus. It is the only window on the display with a blue border
- As you go from screen to screen, each screen remembers the last menu that was active in that screen and restores it as the active menu

In Multiscreen View, as in Single Screen View, tapping the blue tab or pressing the Mode/Meas front panel key opens the "Mode/Meas/View Dialog" on page 47 which allows you to change the Mode (or Measurement or View) being displayed in that Screen.

Remote Command	`:INSTrument:SCReen:MULTiple[:STATe] OFF | ON | 0 | 1` `:INSTrument:SCReen:MULTiple?`
Example	`:INST:SCR:MULT ON`
Notes	If only one screen is configured, attempting to set Multi-Screen ON generates the error "-221, Settings conflict; Multi-Screen requires >1 screen"
Preset	OFF

For more information, see the following:

- "Select Screen" on page 108
- "Screen List (Remote only command)" on page 109

3.4.8.1 Select Screen

You can select a screen by touching its tab or, in "Multiscreen" on page 106 mode, touching the screen itself. Selecting the Screen activates the screen and suspends the previously selected screen (if any).

Remote Command	`:INSTrument:SCReen:SELect <screen name>` `:INSTrument:SCReen:SELect?`
Example	`:INST:SCR:SEL "Baseband"`
Notes	If the <screen name> is specified but not found in the list of Screens, the error message "-224, Illegal parameter value; Screen Name not found" is generated If the display is disabled (via `:DISP:ENAB OFF`) then the error message "-221, Settings conflict; Screen SCPI cannot be used when Display is disabled" is generated
Preset	Returns the name of the active screen

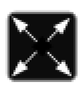
3.4.8.2 Screen List (Remote only command)

You can obtain a list of currently configured Screens. This permits your remote program to manage screens for selection, renaming, or deletion.

Remote Command	`:INSTrument:SCReen:CATalog?`
Example	`:INST:SCR:CAT?`
Notes	The query response is a comma separated list of Screen Names. If only 1 Screen is configured, there is no trailing comma For R&S compatibility, the following query is also available: `:INSTrument:SCReen:LIST?`
Preset	Returns list of currently configured Screens

3.4.8.3 Fullscreen

The Fullscreen button is in the "Control Bar" on page 77, at the lower right corner of the display.



When **Full Screen** is pressed the measurement window expands horizontally over the entire instrument display. The screen graticule area expands to fill the available display area.

It turns off the display of the menu panel, however the controls that drop down from the Meas Bar and on-screen annotation are still available, and you can still drag the trace and markers and perform a pinch zoom, so you can still operate the instrument.

Pressing **Full Screen** again while Full Screen is in effect cancels Full Screen.

You can get even more screen area for your data display by turning off the Meas Bar using the Annotation tab of the Display menu)

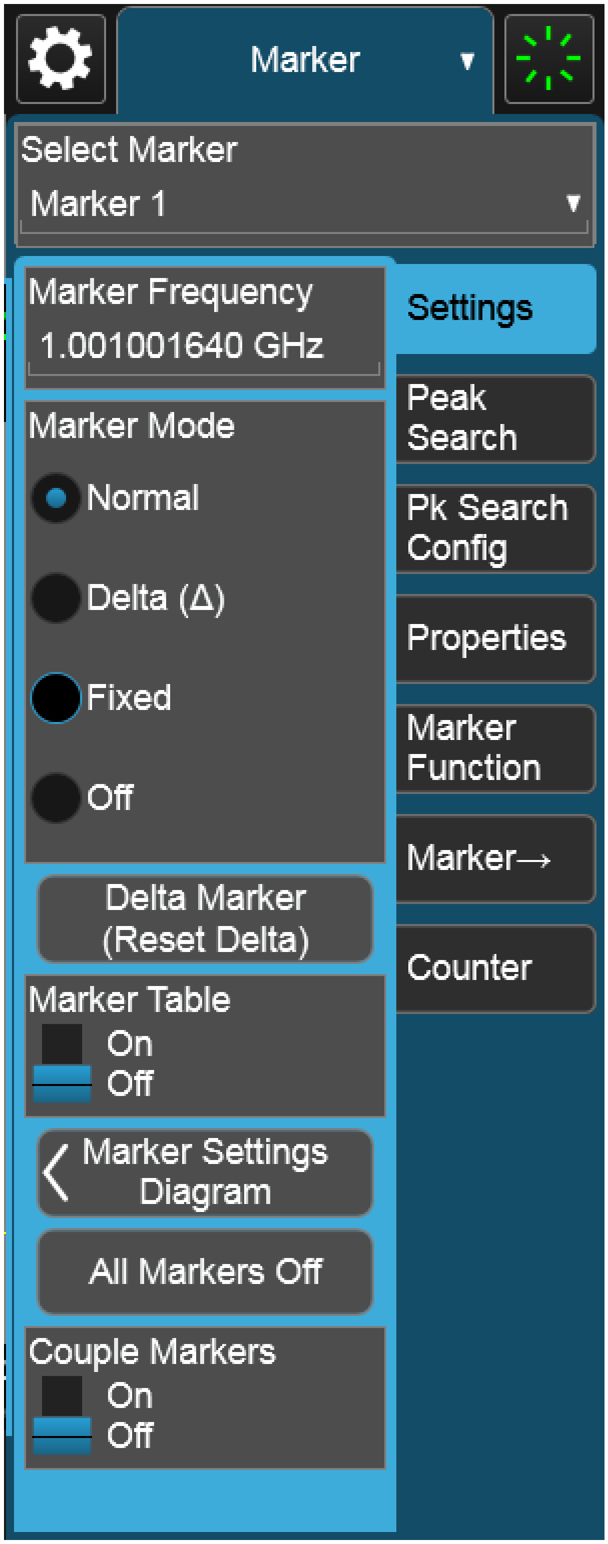
Full Screen is canceled by the **Preset** key.

Remote Command	`:DISPlay:FSCReen[:STATe] OFF | ON | 0 | 1` `:DISPlay:FSCReen[:STATe]?`
Notes	This was set to Off by :SYST:DEF MISC in MXA1, but not by Preset. It is no longer set Off by :SYST:DEF MISC, since it is now meas global instead of mode global
Preset	Unaffected by Preset but set to Off by Restore Misc Defaults or shutdown and restart
State Saved	Not saved in instrument state
Backwards Compatibility	`:DISPlay:MENU[:STATe] OFF | ON | 0 | 1`

SCPI	This emulates ESA full screen functionality, which is the same as the FSCReen command in PSA except that the sense of on/off is reversed (that is, OFF means the menus are OFF, so Fullscreen is ON) and the default is ON (meaning Fullscreen is OFF)
Backwards Compatibility Notes	In ESA/PSA, Full Screen was turned on with a softkey, so pressing any other key turned Full Screen off. In the X-Series, because a hardkey is provided to turn this function on and off, pressing any other key no longer turns off Full Screen

3.5 Menu Panel

The menu panel is the main focus of the X-Series Multitouch user interface. The controls include active functions, dropdowns, action buttons, radio buttons and toggles.

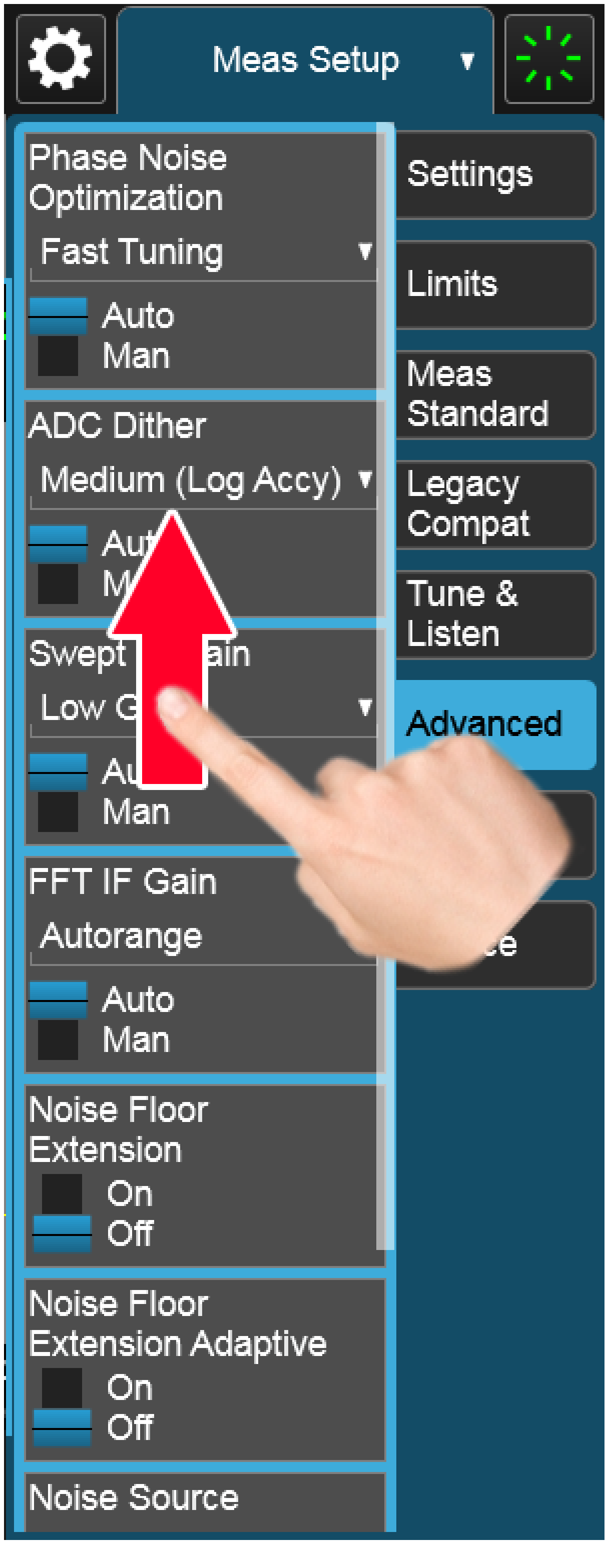


The menu panel normally appears on the right side of the display and consists of a rectangular panel with multiple "sub-panels" lying on top of each other, each sub-panel being accessed by a tab on the right.

You press a front panel key (or “hardkey”) to access a particular menu. On the front panel there are twelve “measurement hardkeys” (the ones in the shaded region in the figures below) – these are the hardkeys that open up menus in the menu panel.

With a menu open, tap a tab to access the controls on its sub-panel. Whenever you press the front panel key associated with a menu, the default (top) tab is selected.

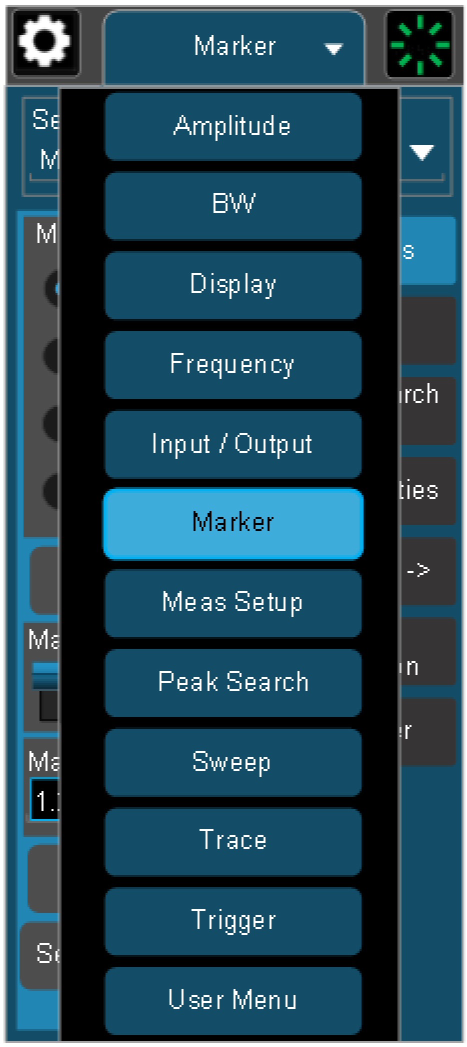
If the number of controls on a panel exceeds the height of the panel, scrolling is enabled, which is indicated by a white bar on the left that fades away after a few seconds. You swipe up or down with your finger to scroll the panel, or you can grab the white bar with a mouse.



If you move to a different menu panel or sub-panel and then come back to a previous panel, the previous panel is always reset to be scrolled all the way back to the top.

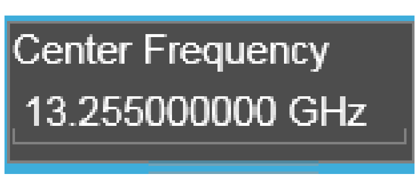
Accessing Menus Without Using Front-Panel Keys

You can access the menu panels without using the front panel keys, as you would need to do if you were operating the instrument using Remote Desktop. Touch or click on the menu title, as shown below. A dropdown containing the twelve measurement hardkeys appears. Selecting a hardkey from the dropdown displays the corresponding menu, and the dropdown disappears.

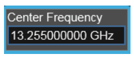


Entering Numeric Values

Many controls on the menu panel allow you to enter numeric values. These are called “active functions.” An active function control displays a number and a suffix, for example 13.255 GHz, as in the example below:



An active function is "active" if the numeric value is surrounded by a black background with a blue border, as below. In this state, it is ready to receive numeric input from the number pad on the front panel, the knob, or the step keys.



When an active function is in the active state, you can start typing or pressing the number keys on the front panel, which causes the Numeric Entry Panel to appear, as shown below. The Numeric Entry Panel displays the typed value, and the terminators to complete the entry.

Here we see a UXA with an active function control in the active state. Although no Numeric Entry Panel is displayed, you can just touch the "2" key:

This causes the Numeric Entry Panel to pop up to receive the numbers you are typing:

Type in as many digits as required, then touch one of the unit terminator buttons in the Numeric Entry Panel to complete the entry. In this case, 2 GHz was the desired entry, so you just touch the “GHz” terminator:

The Numeric Entry Panel disappears and, in the example, the active function value becomes 2 GHz.

It is important to note that you can always pop up the Numeric Entry Panel by touching an active function control while it is active; for example, if you were to touch it in the figure above, the Numeric Entry Panel would pop up right next to the control:

You can display the Numeric Entry Panel by touching any active function control while it is active, but you don't have to pop up the Numeric Entry Panel first, you can just start typing and it will pop up on its own, thus saving you a keystroke.

You can also adjust a value without displaying the Numeric Entry panel by turning the knob or using the step keys while an active function is active. If you turn the knob or use the step keys while the Numeric Entry Panel is displayed, it disappears, allowing you to see the entire screen while you are making the adjustment.

You can also drag the Numeric Entry Panel to another part of the display if it is covering something that you wish to see while it is on the screen.

3.6 Cancel key

This front-panel key has the same functions as the Windows **Esc** (Escape) key. It does the following:

- Cancels dialogs
- Cancels active functions (unless there is an entry in progress, in which case it cancels that, and reverts to the previous value)
- Resets input overloads
- Aborts print operations
- Cancels certain other operations (such as alignments)
- Returns you to Local Control (if in Remote)
- If the backlight is off, turns on the backlight, and does nothing else

Most of this functionality is the same as earlier X-Series models and similar to ESA and PSA operation.

When the instrument is in Remote, any hardkey that is pressed on the front panel displays this message:

`Analyzer is in Remote. Press ESC to return to Local`

The exception is the **Cancel (ESC)** key, which takes the instrument out of Remote.

When the instrument is also in the LLO (local lockout state), the **Local** key is locked out as well. When this is the case, and the **Local** key is pressed, this message is displayed:

`Local key is locked out by remote computer. Cancel Local Lockout on computer or release remote control`

When you see this message, you should disconnect the remote computer, or use it to take the instrument out of the Local Lockout state.

3.7 Onscreen Keyboard key

This key turns the onscreen alpha keyboard (OSK) on and off.

There are two onscreen keyboards:

- The Multitouch OSK, which pops up automatically if, while using the analyzer application, a text field becomes the active function
- The Windows OSK, which you must open manually when a text field must be entered while interacting with Windows or other apps

3.8 Touch On/Off Key

This front-panel key turns the display touch functionality on and off. If off, you can turn it back on using the front panel **Touch On/Off** key. When the touch functionality is off, you can still use a mouse as a pointer.

When toggled, a dialog box appears midscreen that confirms “Touchscreen On” or “Touchscreen Off”.

This function remains in effect until it is turned off or until the app shuts down. The app always starts up with Touch enabled.

3.9 Tab key

This key has the same function as the **Tab** key on a PC keyboard.

You can use this key to display the Windows Taskbar, as follows.

- Alt-Tab to the Desktop
- Touch the desktop
- Touch **TAB**
- The Taskbar appears

4 SCPI LC Mode & Swept SA Measurement

To select SCPI LC Mode and its only measurement (SCPILC Swept SA) using the instrument's front-panel interface, use the "Mode/Meas/View Dialog" on page 47.

To select SCPI LC Mode, and its measurement, programmatically, use either of the following SCPI commands:

– `:INSTrument[:SELect] SCPILC`

  For more details of this command, see "INSTrument[:SELect]" on page 706.

– `:INSTrument:NSELect 270`

  For more details of this command, see "INSTrument:NSELect" on page 707.

SCPI LC Mode has only one measurement, so, when you send either of the above commands, the SCPILC Swept SA Measurement will automatically be selected.

4.1 SCPI Support

SCPI LC Mode supports only a limited subset of SCPI commands. The full set of supported commands is provided in "List of Supported SCPI Commands" on page 600.

The topics included in this chapter may apply to multiple instrument modes and measurements. For this reason, the topic content may include SCPI command definitions that are **not** supported by SCPI LC Mode.

4.2 Functions in this Chapter

This chapter provides complete details of the instrument's front-panel measurement functions.

– "SCPI LC Swept SA Views & Windows" on page 128

– Amplitude

– BW

– Display

– Frequency

– Marker

– Meas Setup

– Sweep

– Trace

4.3 SCPI LC Swept SA Views & Windows

SCPI LC Mode has only one view (Normal View), and the view has only one window (Spectrum Window).

Some views are multiple-window views. When in a multiple window view, you select a window by touching it. The menu controls may sometimes change depending on which window is selected.

Whenever the view changes, the default menu is Frequency, unless otherwise specified in the view description.

For details of the User View-related controls in this menu, see the descriptions under the "View Editor" on page 84.

4.3.0.1 Reference level

The Reference Level specifies the amplitude represented by the topmost graticule line.

Changing the reference level does not restart a measurement, because it is a display function only; instead it vertically 'pans' all displayed traces and markers to the new value. If a change to the reference level changes the attenuation value (e.g., through an auto coupling), then the measurement will be restarted.

For the corresponding SCPI command and parameter details, see "DISPlay [:WINDow]:TRACe:Y[:SCALe]:RLEVel" on page 692

Couplings

If you reduce the attenuation, the analyzer may have to lower the reference level to keep it below its allowed maximum. This allowed maximum level is specified in the "Max" row, along with other variables that affect it.

When you increase attenuation, the reference level does not change.

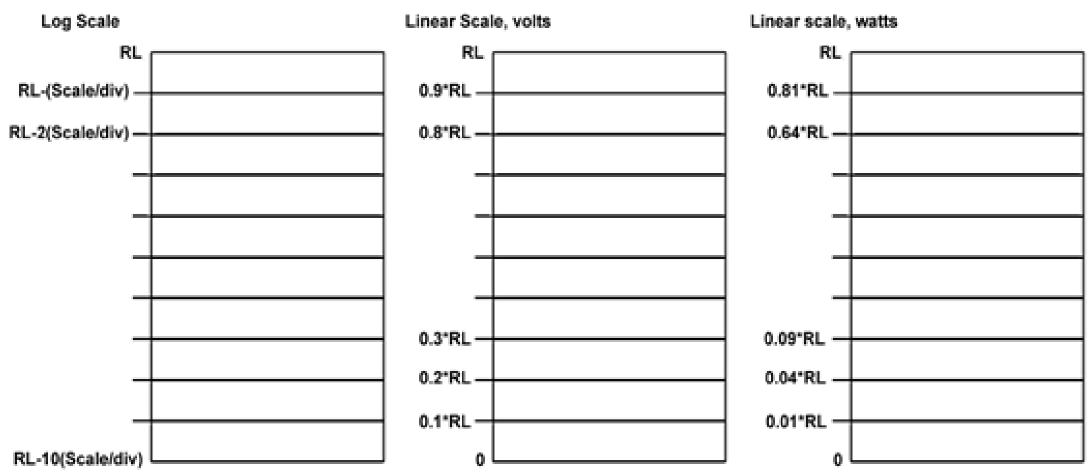
Backwards Compatibility Notes

1. In PSA, there was a restriction on Ref Level Max which was that it could not exceed 0 dBm when the preamp was on. This restriction does not apply to X-Series

2. Ref Level – Ref Level is a display function, not a measurement control function, so a change in the setting does not start a new sweep (unless attenuation changes). This behavior differs from that of legacy analyzers

Amplitude Representations

The following is an illustration of the reference level and Y Axis scales under various conditions:



4.3.0.2 Display Scale

Chooses a linear or logarithmic vertical scale for the display and for remote data readout.

When Display Scale (Log) is selected, the vertical graticule divisions are scaled in logarithmic units. The top line of the graticule is the Reference Level and uses the scaling per division Scale/Div to assign values to the other locations on the graticule.

When Display Scale (Lin) is selected, the vertical graticule divisions are linearly scaled with the reference level value at the top of the display and zero volts at the bottom. Each vertical division of the graticule represents one-tenth of the Reference Level.

The Y Axis Unit used for each type of display is set by pressing Y Axis Unit. The analyzer remembers separate Y Axis Unit settings for both Log and Lin.

For the corresponding SCPI command and parameter details, see "DISPlay [:WINDow]:TRACe:Y:SPACing" on page 694

Dependencies

If Normalize is on, Display Scale is forced to Log and is grayed out.

Couplings

Changing the Display Scale always sets the Y Axis unit to the last unit specified for the current amplitude scale.

4.3.0.3 Reference Level Offset

Adds an offset value to the displayed reference level. The reference level is the absolute amplitude represented by the top graticule line on the display.

For the corresponding SCPI command and parameter details, see "DISPlay [:WINDow]:TRACe:Y[:SCALe]:RLEVel:OFFSet" on page 693

Backwards Compatibility Notes

1. In pre-X-Series instruments, Ref Level Offset could not be adjusted by the knob or step keys. That is no longer the case
2. In ESA and PSA, Ref Level Offset was applied to the data as it was acquired; thus if the Offset changed the new offset was not applied until new trace data was taken. In X-Series, the offset is applied as the data is displayed/queried, so if you change the offset, it will change the data immediately

More Information

Offsets are used when gain or loss occurs between a device under test and the analyzer input. Thus, the signal level measured by the analyzer may be thought of as the level at the input of an external amplitude conversion device. Entering an offset does not affect the trace position or attenuation value, just the value of the top line of the display and the values represented by the trace data. Thus, the values of exported trace data, queried trace data, marker amplitudes, trace data used in calculations such as N dB points, trace math, peak threshold, and so forth, are all affected by Ref Level Offset.

Changing the offset causes the analyzer to immediately stop the current sweep and prepare to begin a new sweep, but the data will not change until the trace data updates, because the offset is applied to the data as it is taken. If a trace is exported with a nonzero Ref Level Offset, the exported data will contain the trace data with the offset applied.

The maximum reference level available is dependent on the reference level offset. That is, Ref Level - Ref Level Offset must be in the range -170 to +30 dBm. For example, the reference level value range can be initially set to values from -170 dBm to 30 dBm with no reference level offset. If the reference level is first set to -20 dBm, then the reference level offset can be set to values of -150 to +50 dB.

If the reference level offset is first set to -30 dB, then the reference level can be set to values of -200 dBm to 0 dBm. In this case, the reference level is “clamped” at 0 dBm because the maximum limit of +30 dBm is reached with a reference level setting of 0 dBm with an offset of -30 dB. If instead, the reference level offset is first set to 30 dB, then the reference level can be set to values of -140 to +60 dBm.

4.3.0.4 Number of Divisions

Allow you to set the number of divisions vertically in the graticule. For example, set this to 12 to allow 120 dB of dynamic range with a scale of 10 dB/division.

Preset	10
State Saved	Saved in instrument state

4.3.1 Attenuation

This menu controls the attenuator functions and interactions between the attenuation system components.

There are two attenuator configurations in the X-Series. One is a dual attenuator configuration consisting of a mechanical attenuator and an optional electronic attenuator. The other configuration uses a single attenuator with combined mechanical and electronic sections thatcontrols all the attenuation functions. Different models in the X-Series come with different configurations.

See "Dual Attenuator Configurations" on page 132

See "Single Attenuator Configuration" on page 132

Most attenuation settings are the same for all measurements – they do not change as you change measurements. Settings like these are called “Meas Global” and are unaffected by Meas Preset.

This tab is only available when the hardware set includes an input attenuator, which is typically only the case when using Keysight’s box analyzers. For example, this tab does not appear in:

– VXT models M9420A/21A/10A/11A

– E7760

– M9391A

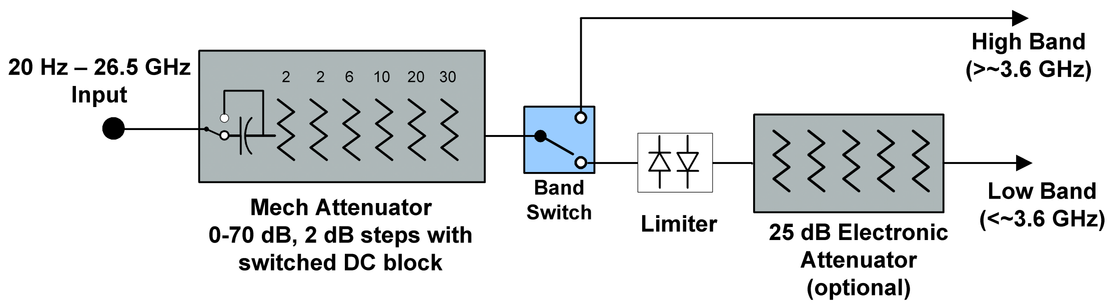
– M9393A

This tab also does not appear in UXM. In UXM all Attenuation and Range settings are disabled, as the expected input power level is handled by the Call Processing App that drives the DUT power control.

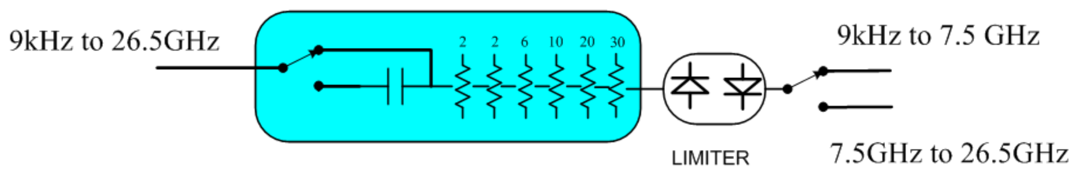
Dependencies	In measurements that support the I/Q inputs, this tab is unavailable when I/Q is the selected input, and is replaced by the Range tab in that case.

Dual Attenuator Configurations

Configuration 1: Mechanical attenuator + optional electronic attenuator

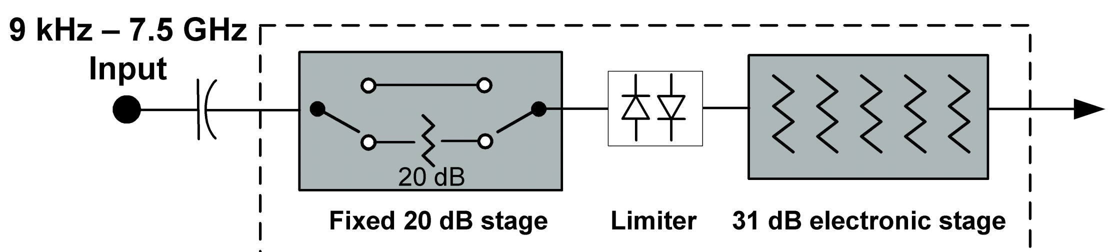


Configuration 2: Mechanical attenuator, no optional electronic attenuator



(note that Configuration 2 is not strictly speaking a dual-section attenuator, since there is no electronic section available. However, it behaves exactly like Configuration 1 without the Electronic Attenuator option EA3, therefore for the sake of this document it is grouped into the "Dual Attenuator" configuration)

Single Attenuator Configuration



You can tell which attenuator configuration you have by pressing the Attenuation tab, which (in most Modes) opensthe Attenuation menu. If the first control in the Attenuation menu says Mech Atten you have the dual attenuator configuration. If the first control says Atten you have the single attenuator configuration.

Dual Attenuator **Single Attenuator**

(Note that depending on the measurement, there may be no Auto/Man functionality on the Mech Atten control).

In the single attenuator configuration, youcontrol the attenuation with a single control, as the fixed stage has only two states. In the dual attenuator configuration, both stages have significant range so you are given separate control of the mechanical and electronic attenuator stages.

When you have the dual attenuator configuration, you may still have only a single attenuator, because unless option EA3 (the Electronic Attenuator option) is available, and you purchase it, you will have only the mechanical attenuator.

4.3.1.1 Mech Atten

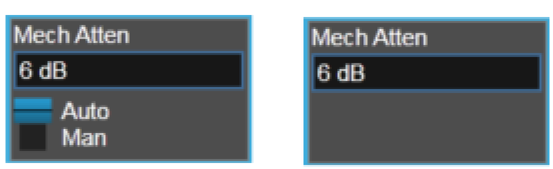
This control is labeled Mech Atten in dual attenuator models and Atten in single attenuator models. In the dual attenuator configuration, this control only affects the mechanical attenuator.

This control lets you modify the attenuation applied to the RF input signal path. This value is normally auto coupled to the Ref Level, the Internal Preamp Gain, any External Gain that is entered, and the Max Mixer Level, as described in the table below.

Attenuator Configurations and Auto/Man

There are two distinct attenuator configurations available in the X-Series, the single attenuator and dual attenuator configurations. In dual attenuator configurations, we have the mechanical attenuation and the electronic attenuation, and the current total attenuation is the sum of the electronic + mechanical attenuation. In single attenuator configurations, we refer to the attenuation set using the Mech Atten control (or POW:ATT SCPI) as the “main” attenuation; and the attenuation that is set by the SCPI command POW:EATT as the “soft” attenuation (the POW:EATT command is honored even in the single attenuator configuration, for compatibility purposes). Then the current total attenuation is the sum of the main + soft attenuation. See the "Elec Atten" on page 135 control description for more on “soft” attenuation.

In the dual attenuator configuration, when the electronic attenuator is enabled, there is no Auto/Man functionality for the mechanical attenuator, and the Auto/Man toggle function disappears:



Mech Atten when Elec Atten is disabled

Mech Atten when Elec Atten is enabled

SCPI Command not available in SCPI LC Mode

Preset	The preset for Mech Attenuation is “Auto”
Min/Max	Min:0 dB The attenuation set by this control cannot be decreased below 6 dB with the knob or step keys. To get to a value below 6 dB it has to be directly entered from the keypad or via SCPI. This protects from adjusting the attenuation to a dangerously small value which can put the instrument at risk of damage to input circuitry. However, if the current mechanical attenuation is below 6 dB it can be increased with the knob and step keys, but not decreased Max:70 dB In the single attenuator configuration, the total of ATT and EATT cannot exceed 50 dB, so if the EATT is set to 24 dB first, the main attenuation cannot be greater than 26 dB and will be reduced accordingly; if the main attenuator is set to 40 dB first, EATT cannot be greater than 10 dB
State Saved	Saved in instrument state

Dependencies

Some measurements do not support the Auto setting of Mech Atten. In these measurements, the Auto/Man selection is not available, and the Auto/Man toggle function is not available.

In dual attenuator configurations, when the electronic attenuator is enabled, the mechanical attenuator has no auto setting and the Auto/Man toggle function is not available. The state of Auto/Man is remembered and restored when the electronic attenuator is once again disabled.

Couplings

When Mech Atten is in Auto, it uses the following algorithm to determine a value:

If the USB Preamp is connected to USB, use 0 dB.

Otherwise, Atten = ReferenceLevel + PreAmpGain + ExternalGain – RefLevelOffset - MaxMixerLevel + IF Gain.

Limit this value to be between 6 dB and the Max value (see Max row, below). No value below 6 dB can ever be chosen by Auto.

The resulting value is rounded up to the largest value possible given the attenuation step setting. That is, 50.01 dB would change to 60 dB (for a 10 dB attenuation step).

The “IF Gain” term in the equation above is either 0 dB or +10 dB, depending on the settings of FFT IF Gain, Swept IF Gain, max Ref Level and the Auto/Man setting of Mech Atten. See Error! Reference source not found.

In External Mixing,where the Attenuator is not in the signal path, the Attenuator setting changes as described above when Mech Atten is in Auto, but no changes are made to the actual attenuator hardware setting until the input is changed back to the RF Input.

4.3.1.2 Elec Atten

Controls the Electronic Attenuator in dual attenuator configurations. This control does not appear in single attenuator configurations, as the control of both the mechanical and electronic stages of the single attenuator is integrated into the single Atten control.

This control includes an Enable/Disable toggle switch. It is only possible to enter a value for the Electronic Attenuator when this switch is in the “Enable” position.

Using the Electronic Attenuator: Pros and Cons

The electronic attenuator offers finer steps than the mechanical attenuator, has no acoustical noise, is faster, and is less subject to wear.

The “finer steps” advantage of the electronic attenuator is beneficial in optimizing the alignment of the analyzer dynamic range to the signal power in the front panel as well as remote use. Thus, you can achieve improved relative signal measurement accuracy. Compared to a mechanical attenuator with 2 dB steps, the 1 dB resolution of the electronic attenuator only gives better resolution when the odd-decibel steps are used. Those odd-decibel steps are less accurately calibrated than the even-decibel steps, though, so one tradeoff for this superior relative accuracy is reduced absolute amplitude accuracy.

Another disadvantage of the electronic attenuator is that the spectrum analyzer loses its “Auto” setting, making operation less convenient.

Also, the relationship between the dynamic range specifications (TOI, SHI, compression and noise) and instrument performance are less well-known with the electrical attenuator. With the mechanical attenuator, TOI, SHI and compression threshold levels increase dB-for-dB with increasing attenuation, and the noise floor does as well. With the electronic attenuator, there is an excess attenuation of about 1 to 3 dB between 0 and 3.6 GHz, making the effective TOI, SHI, and so forth, less well known. Excess attenuation is the actual attenuation relative to stated attenuation. Excess attenuation is accounted for in the analyzer calibration.

SCPI Command not available in SCPI LC Mode

Preset	0 dB OFF for Swept SA measurement
Min/Max	Min:0 dB Max:Dual attenuator configuration: 24 dB Single attenuator configuration: the total of ATT and EATT cannot exceed 50 dB, so if the EATT is set to 24 dB first, the main attenuation cannot be greater than 26 dB and will be reduced accordingly; if the main attenuator is set to 40 dB first, EATT cannot be greater than 10 dB
State Saved	Saved in instrument state

Notes

Electronic Attenuation's specification is defined only when Mechanical Attenuation is 6 dB.

Dependencies

This control only appears in Dual Attenuator models with an Electronic Attenuator installed. It does not appear in models with the Single Attenuator configuration, as in the single attenuator configuration there is no "electronic attenuator" there is only a single integrated attenuator (which has both a mechanical and electronic stage). However, in the single attenuator configuration, EATT SCPI commands are accepted for compatibility with other X-series instruments and set a "soft" attenuation as described in Attenuator Configurations and Auto/Man. The "soft" attenuation is treated as an addition to the "main" attenuation value set by the Atten control or the `:POW:ATT` SCPI command and affects the total attenuation displayed on the Atten control and the Meas Bar.

When Enable Elec Atten is off or grayed out, the Elec Atten control is grayed out.

This control only appears in Dual Attenuator models with an Electronic Attenuator installed. It does not appear in models with the Single Attenuator configuration, as in the single attenuator configuration there is no "electronic attenuator" there is only a single integrated attenuator (which has both a mechanical and electronic stage). However, in the single attenuator configuration, EATT SCPI commands are accepted for compatibility with other X-series instruments and set a "soft" attenuation as described in Attenuator Configurations and Auto/Man.

The electronic attenuator (and the "soft" attenuation function provided in single attenuator configurations) is unavailable above 3.6 GHz. Therefore, if the Stop Frequency of the analyzer is > 3.6 GHz then the Enable Elec Atten control will be OFF and grayed out.

If the Internal Preamp is on, meaning it is set to Low Band or Full, the electronic attenuator (and the "soft" attenuation function provided in single attenuator configurations) is unavailable. In this case the Enable Elec Atten control will be OFF and grayed out.

If either of the above is true, if the SCPI command is sent, an error indicating that the electronic attenuator is unavailable will be sent.

If the electronic/soft Attenuator is enabled, then the Stop Freq of the analyzer is limited to 3.6 GHz and the Internal Preamp is unavailable.

The SCPI-only "soft" electronic attenuation for the single-attenuator configuration is not available in all measurements. It is not available in the Swept SA measurement.

Couplings

Enabling and disabling the Electronic Attenuator affects the setting of the Mechanical Attenuator (in dual attenuator configurations). This is described in more detail below this table.

More Information

The electronic attenuator offers finer steps than the mechanical attenuator, has no acoustical noise, is faster, and is less subject to wear. These advantages primarily aid in remote operation and are negligible for front panel use. See Using the Electronic Attenuator: Pros and Cons for a detailed discussion of the pros and cons of using the electronic attenuator.

For the single attenuator configuration, for SCPI backwards compatibility, the “soft” attenuation feature replaces the dual attenuator configuration’s electronic attenuator. All the same couplings and limitations apply. See Attenuator Configurations and Auto/Man.

Mechanical Attenuator Transition Rules

When the Electronic Attenuator is enabled, the Mechanical Attenuator transitions to a state that has no Auto function. Below are the rules for transitioning the Mechanical Attenuator. Note that the information below ONLY applies to the dual attenuator configurations, and ONLY when the Electronic Attenuator is installed:

When the Electronic Attenuation is enabled from a disabled state

- The Mechanical Attenuator is initialized to 10 dB (this is its optimal performance setting). You can then set it as desired with SCPI, numeric keypad, step keys, or knob, and it behaves as it normally would in manual mode
- The Auto/Man state of (Mech) Atten is saved
- The Auto/Man line on the (Mech) Atten softkey disappears and the auto rules are disabled
- The Electronic Attenuator is set to 10 dB less than the previous value of the Mechanical Attenuator, within the limitation that it must stay within the range of 0 to 24 dB of attenuation

Examples in the dual attenuator configuration

- Mech Atten at 20 dB. Elec Atten enabled, Mech Atten set to 10 dB, and Elec Atten set to 10 dB. New total attenuation equals the value before Elec Atten enabled
- Mech Atten at 0 dB. Elec Atten enabled, Mech Atten set to 10 dB, and Elec Atten set to 0 dB. New total attenuation does not equal the value before Elec Atten enabled
- Mech Atten at 40 dB. Elec Atten enabled, Mech Atten set to 10 dB, and Elec Atten set to 24 dB. New total attenuation does not equal the value before Elec Atten enabled

When the Electronic Attenuation is disabled from an enabled state

– The Elec Atten key is grayed out

– The Auto/Man state of (Mech) Atten is restored

– If now in Auto, (Mech) Atten recouples

– If now in Man, (Mech) Atten is set to the value of total attenuation that existed before the Elec Atten was disabled. The resulting value is rounded up to the smallest value possible given the (Mech) Atten Step setting – (That is, 57 dB changes to 58 dB when (Mech) Atten Step is 2 dB)

4.3.1.3 Mech Atten Step

This controls the step size used when making adjustments to the input attenuation.

This control is labeled Mech Atten Step in dual attenuator models and Atten Step in single attenuator models. In the dual attenuator configuration, this control only affects the step size of the mechanical attenuator.

This feature has a toggle choice from the front panel, but it takes a specific value (in dB) when used remotely. The only valid values are 2 and 10.

SCPI Command not available in SCPI LC Mode

Preset	2 dB unless noted below EXA and CXA: 10 dB (2 dB with option FSA)
State Saved	Saved in instrument state

Couplings

When the attenuation step size changes, the current mechanical attenuation value is adjusted (if necessary) to be quantized to the new step size. That is, if the step is set to 10 dB, the mechanical attenuation is increased if necessary so it is a multiple of 10 dB.

Dependencies

Blanked in CXA and EXA if option FSA (2 dB steps) is not present. If blanked, attempts to set it via SCPI will yield an error.

4.3.1.4 Max Mixer Level

Controls the limitation on the Ref Level for a given attenuation setting, and therefore also interacts with the Auto rules for selecting the attenuation as a coupling from the reference level.

SCPI Command not available in SCPI LC Mode

Preset	-10 dBm
Min/Max	-50 dBm/0 dBm
State Saved	Saved in instrument state

4.3.1.5 Max Mixer Lvl Rules

Max Mixer Level Rules allows you to optimize the Max Mixer Level setting for certain kinds of measurements.

- Normal – historical, and backwards compatible. The instrument has been designed so that, at the default setting, any signal below the reference level is extremely unlikely to give ADC overloads. At this mixer level the scale fidelity will be within specifications, thus compression with be negligible
- TOI – allows a range of settings of the Max Mixer Level that can be optimum for measurements limited by the instrument third-order dynamic range. The default setting is commonly appropriate but RBW affects this. A good setting for Max Mixer Level would be higher than the optimum mixer level by half of the attenuator step size
- Compression – allows a range of settings of the Max Mixer Level that can be optimum for measurements limited by the tradeoffs between instrument accuracy due to compression, and dynamic range due to the noise floor. The default setting is commonly appropriate, representing mixer drive levels that cause 1 dB or less compression at most carrier frequencies. Typical measurements that would be optimized by this setting are the measurement of low sideband levels, including nulls, in angle-modulated signals (FM and PM). Also pulsed-RF measurements, including finding nulls to estimate pulse width, which are often best done with significant overdrive (compression) of the front end

Setting Name (readback)	Setting Name (verbose)	Max Mixer Level Preset Value, dBm	Max Mixer Level minimum value, dBm	Max Mixer Level maximum value, dBm
Normal	Normal – balance TOI, noise and compression	–10	–50	0
TOI	TOI-limited dynamic range	–25	–50	–10
Compression	Compression-limited dynamic range	–3	–10	+30

Preset	NORM

4.3.2 Signal Path

The Signal Path Tab contains controls that pertain to the routing of the signal through the frontend of the instrument.

In general, this tab only appears in analyzers whose hardware supports this signal routing. For example, this tab does not appear in many of the modular analyzer products, including VXT Models M9420/21A. It also does not appear in the UXM.

This tab DOES appear in VXT Models M9410A/11A, because the Software Preselection control is in this tab, and VXT Models M9410A/11A implement a version of Software Preselection.

4.3.2.1 Presel Center

When this control is pressed, the centering of the preselector filter is adjusted to optimize the amplitude accuracy at the frequency of the selected marker. If the selected marker is not on when Presel Center is pressed, the analyzer will turn on the selected marker, perform a peak search, and then perform centering on the marker's center frequency. If the selected marker is already on and between the start and stop frequencies of the analyzer, the analyzer performs the preselector calibration on that marker's frequency. If the selected marker is already on, but outside the frequency range between Start Freq and Stop Freq, the analyzer will first perform a peak search, and then perform centering on the marker's center frequency.

SCPI Command not available in SCPI LC Mode

The value displayed on the Presel Adjust control will change to reflect the new preselector tuning.

A number of considerations should be observed to ensure proper operation.

Proper Preselector Operations

A number of considerations should be observed to ensure proper operation:

1. If the selected marker is off, the analyzer will turn on a marker, perform a peak search, and adjust the preselector using the selected marker's frequency. It uses the "highest peak" peak search method unqualified by threshold or excursion, so that there is no chance of a 'no peak found' error. It continues with that peak, even if it is the peak of just noise. Therefore, for this operation to work properly, there should be a signal on screen in a preselected range for the peak search to find

2. If the selected marker is already on, the analyzer will attempt the centering at that marker's frequency. There is no preselector for signals below about 3.6 GHz,

therefore if the marker is on a signal below 3.6 GHz, no centering will be attempted and an advisory message generated

3. In some models, the preselector can be bypassed. If it is bypassed, no centering will be attempted in that range and a message will be generated

Notes

Note that the rules outlined above under the control description apply for the remote command as well as the control.The result of the command is dependent on marker position, and so forth. Any message shown by pressing the control is also shown in response to the remote command.

Dependencies

Grayed out if the microwave preselector is off.

If the selected marker's frequency is below Band 1, an advisory message is generated and no action is taken.

Grayed out if entirely in Band 0.

Blank in models that do not include a preselector, such as option 503. If the SCPI is sent in these instruments, it is accepted without error, and the query always returns 0.

Grayed out in the Spectrogram View.

Couplings

The active marker position determines where the centering will be attempted.

If the analyzer is in a measurement such as averaging when centering is initiated, the act of centering the preselector will restart averaging but the first average trace will not be taken until the centering is completed.

Status Bits/OPC dependencies

When centering the preselector, *OPC will not return true until the process is complete and a subsequent measurement has completed, nor will results be returned to a READ or MEASure command.

The Measuring bit should remain set while this command is operating and should not go false until the subsequent sweep/measurement has completed.

4.3.2.2 Preselector Adjust

Allows you to manually adjust the preselector filter frequency to optimize its response to the signal of interest.

For general purpose signal analysis, using Presel Center is recommended. Centering the filter minimizes the impact of long-term preselector drift. Presel Adjust can be used instead to manually optimize the preselector. One application of manual optimization would be to peak the preselector response, which both optimizes the signal-to-noise ratio and minimizes amplitude variations due to small (short-term) preselector drifting.

SCPI Command not available in SCPI LC Mode

Preset	0 MHz
Min/Max	–500 MHz/500 MHz
State Saved	The Presel Adjust value set by Presel Center, or by manually adjusting Presel Adjust, is not saved in instrument state, and does not survive a Preset or power cycle

Notes

The value on the control reads out to 0.1 MHz resolution.

Dependencies

Grayed out if microwave preselector is off.

Grayed out if entirely in Band 0.

Blank in models that do not include a preselector, such as option 503. If the SCPI is sent in these instruments, it is accepted without error, and the query always returns 0.

Grayed out in the Spectrogram View.

4.3.2.3 Internal Preamp

Accesses a menu of controls for the internal preamplifier. Turning on the preamplifier gives a better noise figure, but a poorer TOI to noise floor dynamic range. You can optimize this setting for your particular measurement.

The instrument takes the preamp gain into account as it sweeps. If you sweep outside of the range of the preamp the instrument will also account for that. The displayed result will always reflect the correct gain.

For some measurements, when the preamp is on and any part of the displayed frequency range is below the lowest frequency for which the preamp has specifications, a warning condition message appears in the status line. For example ,for a preamp with a 9 kHz lowest specified frequency: "Preamp: Accy unspec'd below 9 kHz".

SCPI Command not available in SCPI LC Mode

Preset	OFF LOW
State Saved	Saved in instrument state

Examples

Selection	Example	Note
Off	:POW:GAIN OFF	
Low Band	:POW:GAIN ON :POW:GAIN:BAND LOW	Sets the internal preamp to use only the low band. The frequency range of the installed (optional) low-band preamp is displayed in square brackets on the Low Band selection in the dropdown
Full Range	:POW:GAIN ON :POW:GAIN:BAND FULL	Sets the internal preamp to use its full range. The low band (0-3.6 GHz or 0-3GHz, depending on the model) is supplied by the low band preamp and the frequencies above low band are supplied by the high band preamp The frequency range of the installed (optional) low-band preamp is displayed in square brackets on the Full Range selection in the dropdown. If the high band option is not installed the Full Range selection does not appear

Dependencies

Preamp is not available on all hardware platforms. If the preamp is not present or is unlicensed, the key is not shown.

The preamp is not available when the electronic/soft attenuator is enabled.

If a `:POW:GAIN:BAND FULL` command is sent when a low band preamp is available, the preamp band parameter is to LOW instead of FULL, and an "Option not installed" message is generated.

Couplings

The act of connecting the U7227A USB Preamplifier to one of the analyzer’s USB ports will cause the Internal Preamp to be switched on. When this happens an informational message will be generated: “Internal Preamp turned on for optimal operation with USB Preamp.” Note that if the Internal Preamp was already on, there will be no change to the setting, but if it was Off it will be switched On, to Full Range.

Note that this same action occurs when the SA mode is selected while the USB Preamp is connected to one of the analyzer’s USB ports, if it is the first time that the SA mode has run since powerup, or if the last time the SA mode was running the USB Preamp was NOT connected.

Subsequently disconnecting the USB Preamp from USB does not change the Internal Preamp setting nor restore the previous setting.

4.3.2.4 µW Path Control

The **µW Path Control** functions include the **µW Preselector Bypass** (Option MPB), **Low Noise Path** (Option LNP) and **Full Bypass Enable** controls in the High Band path circuits.

When the µW Preselector is bypassed, the user has better flatness, but will be subject to spurs from out of band interfering signals. When the Low Noise Path is enabled, the analyzer automatically bypasses certain circuitry in the high frequency bands which can contribute to noise, when it is appropriate based on other analyzer settings.

For most applications, the preset state is Standard Path, which gives the best remote-control throughput, minimizes acoustic noise from switching and minimizes the risk of wear in the hardware switches, particularly in remote test scenarios where both low band and high band setups will follow in rapid succession. In this path, the bypass of the low band/high band switch and microwave preamp is never activated, which can cause some noise degradation but preserves the life of the bypass switch.

For applications that utilize the wideband IF paths, the preset state is the µW Preselector Bypass path, if option MPB is present. This is because, when using a wideband IF such as the 140 MHz IF, the µW Preselector's bandwidth can be narrower than the available IF bandwidth, causing degraded amplitude flatness and phase linearity, so it is desirable to bypass the preselector in the default case.

You may choose Low Noise Path Enable for a lower noise floor, especially in the 21-26.5 GHz region, though without improving many measures of dynamic range, and without giving the best possible noise floor. The preamp, if purchased and used, gives better noise floor than does the Low Noise Path. But the preamp's compression threshold and third-order intercept are much poorer than that of the Low Noise Path.

A fourth choice is Full Bypass Enable, which combines µW Preselector Bypass and Low Noise Path Enable. Because this can bypass most of the circuitry between the input and the first mixer, care should be taken when using this setting to avoid damaging the mixer. Full Bypass Enable is only available if both options LNP and MPB are present, as well as option FBP.

Path	Note
Standard Path	Normal setting for most measurements. µW Preselector in circuit, Low Noise Path disabled
Low Noise Path Enable	See "Low Noise Path Enable" on page 145
µW Preselector Bypass	See "µW Preselector Bypass" on page 147
Full Bypass Enable	See "Full Bypass Enable" on page 148

Notes	If a Presel Center is performed, the analyzer will momentarily switch to the Standard Path, regardless of the setting of **µW Path Control** The DC Block will always be switched in when the low noise path is switched in, to protect succeeding circuitry from DC. Note that this does not mean "when the low noise path is enabled" but when, based on the Low Noise Path rules, the path is actually switched in. This can happen when the selection is

	Low Noise Path Enable or **Full Bypass Enable**. In the case where the DC Block is switched in the analyzer is now AC coupled. However, if the user has selected DC coupling, the UI will still behave as though it were DC coupled, including all annunciation, warnings, status bits, and responses to SCPI queries. This is because, based on other settings, the analyzer could switch out the low noise path at any time and hence go back to being DC coupled Alignment switching ignores the settings in this menu, and restores them when finished
Dependencies	Does not appear in CXA-m Does not appear in VXT Models M9410/11A Does not appear in BBIQ and External Mixing The Low Noise Path selection does not appear unless Option LNP is present and licensed. The µW Preselector Bypass selection does not appear unless Option MPB is present and licensed. The Full Bypass Enable selection does not appear unless options LNP and MPB are both present as well as option FBP. In any of these cases, if the required options are not present and the SCPI command is sent, error -241, "Hardware missing; Option not installed" is generated The Low Noise Path and Full Bypass Enable selections are grayed out if the current measurement does not support them
Preset	All except modes specified below: `STD` IQ Analyzer, VXA, Pulse and Avionics mode: MPB option present and licensed: `MPB` MPB option not present and licensed: `STD`
State Saved	Save in instrument state
Range	Standard Path|LNP Enable|µW Presel Bypass|Full Bypass Enable
Annotation	In the Meas Bar, if the Standard path is chosen, it says: µW Path: Standard If Low Noise Path is enabled but the LNP switch is not thrown, it shows: µW Path: LNP,Off If the Low Noise Path is enabled and the LNP switch IS thrown, it shows: µW Path: LNP,On If the preselctor is bypassed, it says: µW Path: Bypass If Full Bypass Enable is selected but the LNP switch is not thrown, it shows: µW Path: FByp,Off If Full Bypass Enable is selected and the LNP switch IS thrown, it shows: µW Path: FByp,On

Low Noise Path Enable

You may choose Low Noise Path Enable, which gives a lower noise floor under some circumstances, particularly when operating in the 21–26.5 GHz region. With the Low Noise Path enabled, the low band/high band switch and microwave preamp are bypassed whenever all of the following are true:

- The analyzer is not in the Low Band, meaning:

   – the start frequency is above 3.5 GHz and
   – the stop frequency is above 3.6 GHz.
- the internal preamp is not installed or (if installed) is set to **Off** or **Low Band**

Note that this means that, when any part of a sweep is done in Low Band, the Low Noise Path is not used, whether or not the **Low Noise Path Enable** is selected in the user interface. Also, if the preamp is turned on, the Low Noise Path is not used, whether or not the **Low Noise Path Enable** is selected in the user interface. The only time the Low Noise Path is used is when **Low Noise Path Enable** is selected, the sweep is completely in High Band (> 3.6 GHz) and no preamp is in use.

For measurements that use IQ acquisition, the low noise path is used when the Center Frequency is in High Band (> 3.6 GHz) and no preamp is in use. In other words, the rules above are modified to use only the center frequency to qualify which path to switch in. This is not the case for FFT's in the Swept SA measurement; they use the same rules as swept measurements.

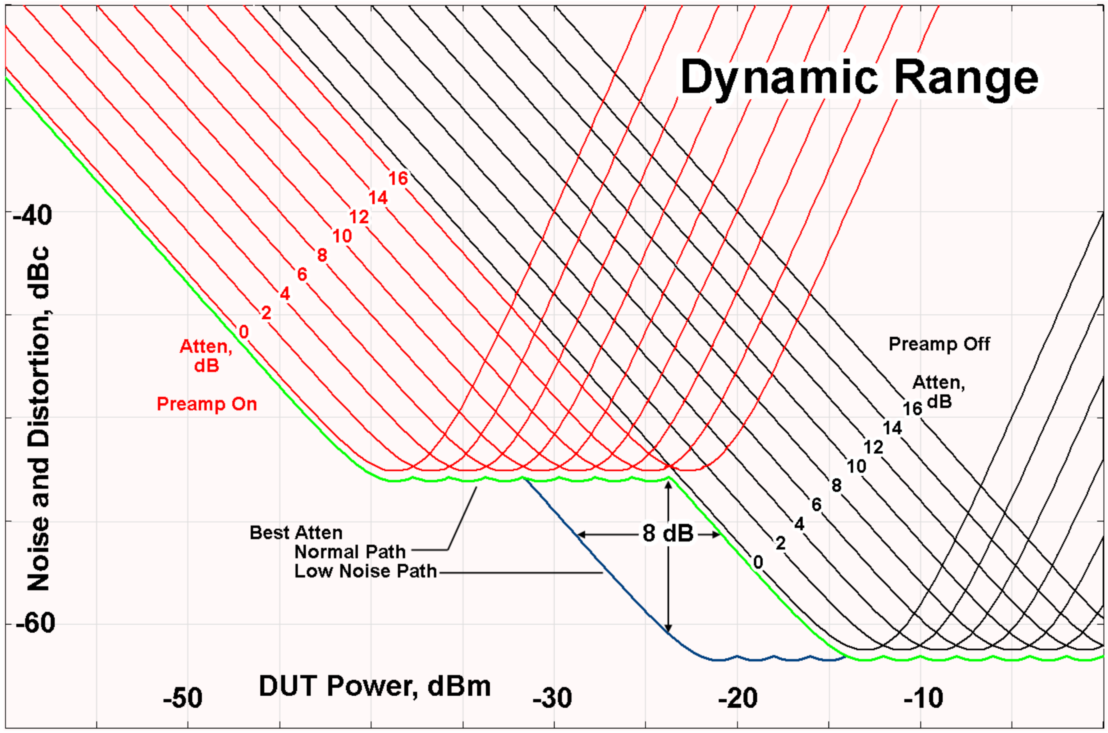
The user should understand that the Low Noise Path, while giving improved DANL, has the disadvantage of decreased TOI performance and decreased gain compression performance relative to the standard path.

The user should also understand that the bypass switch is a mechanical switch and has finite life, so if the **Low Noise Path** is enabled, it is possible to cause frequent cycling of this switch by frequently changing analyzer settings such that the above conditions hold true only some of the time. A user making tests of this nature should consider opting for the **Standard Path**, which will never throw the bypass switch, at the expense of some degraded noise performance.

The low noise path is useful for situations where the signal level is so low that the analyzer performance is dominated by noise even with 0 dB attenuation, but still high enough that the preamp option would have excessive third-order intermodulation or compression. The preamp, if purchased and used, gives better noise floor than does the "Low Noise Path." However, its compression threshold and third-order intercept are much poorer than that of the non-preamp path.

There are some applications, typically for signals around –30 dBm, for which the third-order dynamic range of the standard path is good enough, but the noise floor is not low enough even with 0 dB input attenuation. When the third-order dynamic range of the preamp path is too little and the noise floor of the standard path is too high, the Low Noise Path can provide the best dynamic range

The graph below illustrates the concept. It shows, in red, the performance of an analyzer at different attenuation settings, both with the preamp on and off, in a measurement that is affected by both analyzer noise and analyzer TOI. The green shows the best available dynamic range, offset by 0.5 dB for clarity. The blue shows how the best available dynamic range improves for moderate signal levels with the low noise path switched in. In this illustration, the preamp improves the noise floor by 15 dB while degrading the third-order intercept by 30 dB, and the low noise path reduces loss by 8 dB. The attenuator step size is 2 dB.



There are other times where selecting the low noise path improves performance, too. Compression-limited measurements such as finding the nulls in a pulsed-RF spectrum can profit from the low noise path in a way similar to the TOI-limited measurement illustrated. Accuracy can be improved when the low noise path allows the optimum attenuation to increase from a small amount like 0, 2 or 4 dB to a larger amount, giving better return loss at the analyzer input. Harmonic measurements, such as second and third harmonic levels, are much improved using the low noise path because of the superiority of that path for harmonic (though not intermodulation) distortion performance.

µW Preselector Bypass

This control toggles the preselector bypass switch for band 1 and higher. When the microwave presel is on, the signal path is preselected. When the microwave preselector is off, the signal path is not preselected. The preselected path is the normal path for the analyzer.

The preselector is a tunable bandpass filter which prevents signals away from the frequency of interest from combining in the mixer to generate in-band spurious signals (images). The consequences of using a preselector filter are its limited bandwidth, the amplitude and phase ripple in its passband, and any amplitude and phase instability due to center frequency drift.

Option MPB or pre-selector bypass provides an unpreselected input mixer path for certain X-Series signal analyzers with frequency ranges above 3.6 GHz. This signal path allows a wider bandwidth and less amplitude variability, which is an advantage when doing modulation analysis and broadband signal analysis. The disadvantage is that, without the preselector, image signals will be displayed. Another disadvantage of bypassing the preselector is increased LO emission levels at the front panel input port.

Image responses are separated from the real signal by twice the 1st IF. For IF Paths of 10 MHz and 25 MHz, the 1st IF is 322.5 MHz, so the image response and the real signal will be separated by 645 MHz. The 1st IF will be different for other IF Path settings. When viewing a real signal and its corresponding image response in internal mixing, the image response will be to the left of the real signal.

Also, the image response and the real signal typically have the same amplitude and exhibit the same shape factor.

However, if Option FS1, Fast Sweep Capability, is enabled, the image response in the Swept SA measurement will appear lower in amplitude and have a much wider shape factor compared to the real signal.

Full Bypass Enable

With Full Bypass enabled, the microwave preselector is bypassed. In addition, the low band/high band switch and microwave preamp are bypassed whenever all of the following are true:

- The analyzer is not in the Low Band, meaning:
  - the start frequency is above 3.5 GHz and
  - the stop frequency is above 3.6 GHz.
- the internal preamp is not installed or (if installed) is set to **Off** or **Low Band**

Note that this means that, when any part of a sweep is done in Low Band, the Low Noise Path is not used, whether or not the **Full Bypass Enable** is selected in the user interface. Also, if the preamp is turned on, the Low Noise Path is not used, whether or not the **Full Bypass Enable** is selected in the user interface. The only time the Low Noise Path is used is when **Full Bypass Enable** is selected, the sweep is completely in High Band (> 3.6 GHz) and no preamp is in use.

NOTE

When Full Bypass Enable is selected, and Attenuation is set to 0 dB, there will be a direct AC connection between the input and the first converter when the Low Noise Path switches in (when Start Freq >3.6 GHz and the Preamp is either not licensed, set to Low Band or Off). This puts the first converter at high risk to be damaged by high AC power. Consequently, whenever Full Bypass is enabled, a warning message appears in the status bar:

`Full Bypass Enabled, maximum safe input power reduced`

4.3.2.5 Res BW

Activates the resolution bandwidth active function, which allows you to manually set the resolution bandwidth (RBW) of the analyzer. Normally, Res BW (Auto) selects automatic coupling of the Res BW to Span using the ratio set by the Span:3 dB RBW key. To decouple the resolution bandwidth, press the Auto/Man toggle on the Res BW control, or simply enter a different value for Res BW.

When the Res BW is manually selected, it may be returned to the coupled state by pressing the Auto/Man toggle on the Res BW control. This may also be done by pressing Auto Couple or by performing a Preset.

For SCPI command and parameter details, see "[SENSe]:BANDwidth|BWIDth [:RESolution] " on page 717 and "[SENSe]:BANDwidth|BWIDth[:RESolution]:AUTO " on page 718

Preset	Auto
Min/Max	Min:1 Hz Max:8 MHz is the max equivalent −3 dB RBW, which means that the named RBW can actually exceed 8 MHz if using a filter other than −3 dB Gaussian
State Saved	Saved in instrument state

Notes

For numeric entries, all RBW Types choose the nearest (arithmetically, on a linear scale, rounding up) available RBW to the value entered.

The setting and querying of values depends on the current bandwidth type.

Dependencies

When in Zero Span with no EMI Standard selected, there is no Auto setting for Res BW. The Auto/Man toggle disappears in this case, and if the SCPI command [:SENSe]:BWID[:RESolution]:AUTO ON is sent, it generates a message.

While using the Tracking Generator, you must make sure the Start Frequency is high enough to avoid capturing LO feedthrough in the trace. How high you must make the Start Frequency to avoid this will depend on the RBW you have set. The analyzer displays a condition warning message if the Start Frequency falls below roughly 2.5 times the current RBW. The warning is, “Source Uncal;adj Start Freq|RBW|Points”. When you see this warning, you should increase the Start Freq, narrow the RBW, or increase the number of Sweep Points.

Couplings

Res BW is normally coupled to Span; if Res BW is set to Auto, as the Span decreases, so will the Res BW, to maintain the ratio set by the Span:3 dB RBW control (or 106:1 for measurements that do not have a Span:3 dB RBW control). In

Zero Span, this coupling is normally turned off and Res BW has no Auto setting.

When a CISPR or MIL EMI Standard is in use, the Res BW is coupled to Center Frequency and not to Span, and this is true even in Zero Span

More Information

When Res BW is set to Auto, the bandwidth selected depends on the Filter Type.

Only certain discrete resolution bandwidths are available. The available bandwidths are dependent on the Filter Type or the EMC Standard. If an unavailable bandwidth is entered with the numeric keypad, the closest available bandwidth is selected.

The zero-span case in the Swept SA measurement deserves some mention, because RBW is coupled to Span when in a swept (non-zero) span and in zero span there is normally no meaningful RBW coupling in Zero Span. However, when a MIL or CISPR EMC Standard is selected, there IS a meaningful coupling for RBW in Zero Span – in fact, it is coupled to Center Frequency, in order to make measurements according to the EMI specifications.

4.3.2.6 Video BW

Lets you change the analyzer post-detection filter (VBW or "video bandwidth") from 1 Hz to 8 MHz in approximately 10% steps. In addition, a wide-open video filter bandwidth may be chosen by selecting 50 MHz. The VBW is annotated at the bottom of the display, in the center.

An * is displayed next to the VBW annotation when certain detector types (Average, EMI Average, Quasi Peak, and RMS Average) are in use. This is because the VBW filter is out of the circuit for these detectors and does not affect any traces which use them. If there is any active trace using one of these detectors the * is displayed. See Annotation Examples.

Normally, Video BW (Auto) selects automatic coupling of the Video BW to RBW using the ratio set by the VBW:3 dB RBW key. To decouple the resolution bandwidth, press the Auto/Man toggle on the Video BW control, or simply enter a different value for Video BW.

When the Video BW is manually selected, it may be returned to the coupled state by pressing the Auto/Man toggle on the Video BW control. This may also be done by pressing Auto Couple or by performing a Preset.

For SCPI command and parameter details, see "[SENSe]:BANDwidth|BWIDth:VIDeo" on page 720

Preset	Auto ON
Min/Max	Min:1 Hz Max:50 MHz
State Saved	Saved in instrument state.

Notes

For numeric entries, the analyzer chooses the nearest (arithmetically, on a linear scale, rounding up) available VBW to the value entered. The 50 MHz VBW is defined to mean “wide open”.

The values shown in this table reflect the conditions after a Mode Preset.

Dependencies

Some times the displayed Video BW is not actually used to process the trace data:

- When the Average Detector is selected and Sweep Type is set to Swept, the video bandwidth filter cannot be used, because it uses the same hardware as the Average Detector
- When the Quasi-Peak, EMI Average or RMS Average detector is selected the VBW is implemented by the digital IF as part of the detector

When this is the case, the VBW still acts to change the Sweep Time, if Sweep Time is in Auto, and still affects the data on other traces for which this is not the case.

Couplings

Video bandwidth (VBW) is normally coupled to RBW. If VBW is set to Auto, then the VBW is changed as the RBW changes, to maintain the ratio set by the VBW:3 dB RBW control (or 10:1 for measurements that do not have a VBW:3 dB RBW control).

Backwards Compatibility Notes

For backwards compatibility this command obeys both the `BANDwidth` and `BWIDth` forms.

4.3.2.7 VBW:3dB RBW

Selects the ratio between the video bandwidth and the equivalent 3 dB resolution bandwidth to be used for setting VBW when VBW is in Auto.

VBW:3dB RBW (Auto) selects automatic coupling of the VBW:3 dB RBW ratio to Detector using the rules described below in "Auto Rules" on page 152. To decouple the ratio, press Auto/Man until the toggle switch selects Man, or simply enter a new value.

When the VBW:3dB RBW is manually selected, it may be returned to the coupled state by pressing the VBW:3 dB RBW Auto/Man toggle switch until Auto is selected. This may also be done by pressing Auto Couple on the Meas Setup menu or by performing a Preset.

For SCPI command and parameter details, see "[SENSe]:BANDwidth|BWIDth:VIDeo" on page 720

Preset	1 ON
Min/Max	0.00001/3000000
State Saved	Saved in instrument state.

Notes

The values shown in this table reflect the conditions after a Mode Preset.

Auto Rules

The Auto Rules for the VBW:3dB RBW function are as follows:

If Source Mode is set to “Tracking”: Use 1.0

Otherwise, we go through the following list of detector numbers and find the lowest numbered detector being used on any active traces (traces for which Update is On):

1. Peak
2. Normal
3. Average
4. Sample
5. Negative Peak
6. EMI Average
7. Quasi Peak
8. RMS Average

Use that detector to pick the ratio based on the following criteria:

1. If the detector is Peak and the EMC Standard is set to either CISPR or MIL, use 10.0 (we use wide VBWs to capture peak levels accurately)
2. Otherwise, if the detector is Negative Peak, use 1.0 (in the Negative Peak case, there are no known significant use models so we use a medium ratio)
3. Otherwise, if the detector is Normal, use 1.0 (historical precedent)
4. Otherwise, if the detector is Average, and the span is nonzero, use 0.1. The use of a small ratio in Average detection is desirable because of its effect on the sweep time equations. The VBW filter is not actually in-circuit when the average detector is on. If the detector is Average, and the span is zero, use 10.0, which

gives optimal behavior for Interval Markers in zero span. Note that only the Swept SA measurement supports Zero Span

5. Otherwise, if the detector is EMI Average, Quasi Peak or RMS Average, use 10.0. In fact this is a "don't care" since no VBW is used for these detectors, as noted under "Dependencies" for the VBW key

6. Otherwise, the detector is simply Peak or Sample. These two detectors, surprisingly, can use the same rules. In these cases, if any active trace is in max hold or min hold, use 10.0, because Max and Min Hold operations will usually be intended to capture peaks and pits without smoothing from the VBW filter; otherwise, use 1.0 as a compromise, because you have not set the analyzer in a way that implies that you are measuring noise, pulsed-RF or CW signals, and for backward compatibility with earlier analyzers

Note that because the above couplings depend on which traces are active, they are re-examined whenever any trace goes active or inactive, except when this leaves no traces active. Transitioning to the state where no traces are active should not affect the couplings. The annotation will always reflect the state of the last trace which was active.

4.3.2.8 Span:3 dB RBW

Selects the ratio between span and resolution bandwidth.

Normally, Span:3dB RBW (Auto) selects a Span:3 dB RBW ratio of 106:1 . If you manually enter the ratio, the Auto/Man toggle switch will move to Man, which enables you to manually select ratios more suitable for certain measurements.

When the Span:3dB RBW is manually selected, it may be returned to the coupled state by pressing the Span:3dB RBW Auto/Man toggle switch until Auto is selected. This may also be done by pressing Auto Couple under Meas Setup or by performing a Preset.

SCPI Command not available in SCPI LC Mode

Preset	106 ON
Min/Max	2/10000
State Saved	Saved in instrument state

Notes

The values shown in this table reflect the conditions after a Mode Preset.

Dependencies

Grayed out when the EMC Standard is set to CISPR or MIL, since RBW is coupled to Center Frequency rather than Span in this case.

4.3.2.9 RBW Filter

Selects the type for the resolution bandwidth filters. Historically, the Res BW filters in HP/Agilent/Keysight spectrum analyzers were Gaussian filters, specified using the –3 dB bandwidth of the filter. That is, a 10 MHz Res BW filter was a Gaussian shape with its –3 dB points 10 MHz apart. In the X-Series, the RBW Filter BW menu lets you choose between a Gaussian and Flat Top filter shape, for varying measurement conditions.

SCPI Command not available in SCPI LC Mode

Preset	Auto Couple chooses the preset value
State Saved	Saved in instrument state

Notes

`GAUSsian` = Gaussian

`FLATtop` = Flattop

Dependencies

The RBW Filter Type control is grayed out if the EMC Standard is set to CISPR or MIL. In this case the Filter Type is always Gaussian. The Filter BW is chosen as appropriate for the filter and the standard. Any attempt to set it to Flattop will give an error.

4.3.2.10 RBW Filter BW

Selects the type of filter bandwidth used to specify the width of the Gaussian RBW filters. Historically, the Gaussian Res BW filters in HP/Agilent/Keysight spectrum analyzers were specified using the –3 dB bandwidth of the filter. That is, a 10 MHz Res BW filter was a Gaussian shape with its –3 dB points 10 MHz apart. For certain types of applications it can be useful to specify the filter width using points other than the –3 dB points. In the X-Series, the RBW Filter BW function allows you to pick the filter based on its –3 dB (Normal) bandwidth, its –6 dB bandwidth, its Noise bandwidth, or its Impulse bandwidth. Note that in all four cases the –3 dB bandwidth is the same. The filter does not change, but the way you specify it changes.

For example, set the RBW to 1.0 kHz with the RBW Filter BW set to Normal. Now set the RBW Filter BW to –6 dB. The bandwidth displayed for RBW changes to 1.41 kHz. The shape and bandwidth of the filter have not changed, only the way the filter is annotated and the value that appears in the RBW active function area have.

See "More Information" on page 155

SCPI Command not available in SCPI LC Mode

Preset	Auto Couple chooses the preset value
State Saved	Saved in instrument state

Notes

DB3 = –3 dB (Normal)

DB6 = –6 dB

IMPulse = Impulse

NOISe = Noise

Dependencies

Grayed out and displays --- if the Flattop filter type is selected.

When EMC Standard is set to CISPR or MIL, the RBW Filter BW Control is greyed out and the readback annotation on the key is blanked. This is because the RBW Filter BW is chosen as appropriate for the filter and the standard and not selected by thiscontrol. Any attempt to set it otherwise will give an error.

Examples

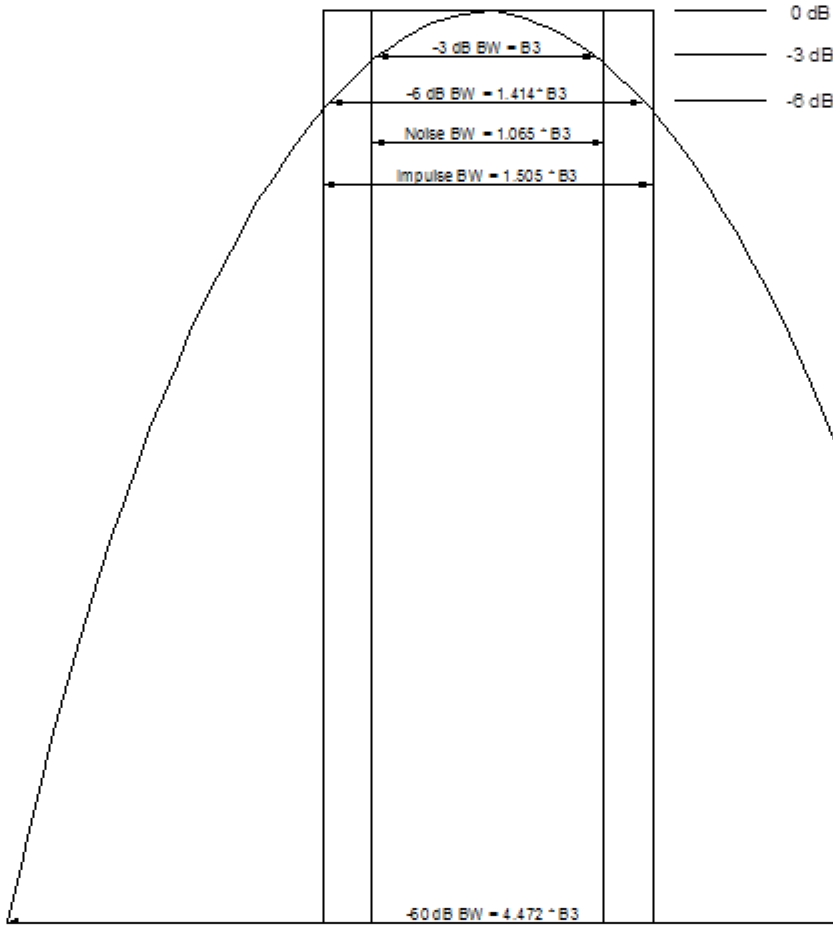
Filter BW	SCPI Example	Displayed bandwidth of a filter with 1 kHz -3 dB bandwidth
-3 dB (Normal)	BAND:TYPE DB3	1.0 kHz
–6 dB	BAND:TYPE DB6	1.41 kHz
Noise	BAND:TYPE NOIS	1.06 kHz
Impulse	BAND:TYPE IMP	1.48 kHz

More Information

The analyzer provides four ways of specifying the bandwidth of a Gaussian filter:

1. The –3 dB bandwidth of the filter
2. The –6 dB bandwidth of the filter
3. The equivalent Noise bandwidth of the filter, which is defined as the bandwidth of a rectangular filter with the same peak gain that would pass the same power for noise signals
4. The equivalent Impulse bandwidth of the filter, which is defined as the bandwidth of a rectangular filter with the same peak gain that would pass the same power for impulsive (narrow pulsed) signals

The following figure shows the relationships of the various filter bandwidths for filters with the X-Series' shape factor (shape factor is defined as the ratio of the –60 dB bandwidth to the – 3 dB bandwidth):



Gaussian Filter BW

The Filter Type menu lets you choose the filter bandwidth (–3 dB, –6 dB, Noise or Impulse) that will be used when specifying the width of the filter. Note that for a given Gaussian filter, changing the filter bandwidth specification does not affect the filter width at all but only the means of specifying it. For example, the filter whose –3 dB bandwidth is 1.0 kHz is the same as the filter whose –6 dB bandwidth is 1.41 kHz, whose Noise bandwidth is 1.06 kHz, and whose Impulse bandwidth is 1.48 kHz. As you cycle through these various filter bandwidths the filter does not change, but the way the filter is annotated and the value which appears in the active function area and on the softkey does.

4.3.2.11 Wide Bandwidths

The Wide Bandwidths control enables you to access a set of Resolution Bandwidths that are wider than the standard RBWs. These wide bandwidths only appear in the

Swept SA measurement. The Wide Bandwidths control is only available when Span is set to Zero Span, otherwise the control is grayed out.

When Wide Bandwidths are On:

- The minimum RBW is 10 MHz. The Wide Bandwidths selection must be Off to select RBWs 8 MHz or narrower
- A channel filter shape is used that is nearly square (shape factor 1.2:1), rather than Gaussian or Flattop, and the RBW Filter Type is grayed out and displays “Channel”
- RBW Filter BW is grayed out and shows “–3 dB”
- No VBW filter is used, so VBW averaging is not available. Since VBW averaging is not available, the VBW annotation has the * symbol added (meaning no video averaging). When no VBW averaging is available, this is equivalent to having a VBW setting that is greater than RBW
- Only the Peak detector is available, all other detectors are grayed out

The instrument independently remembers the RBW settings for when Wide bandwidths are set to off and when Wide bandwidths are set to on. For example, if an RBW of 300 kHz was set before Wide bandwidths was turned on, then the instrument will go back to an RBW of 300 kHz when Wide bandwidths is turned off.

SCPI Command not available in SCPI LC Mode

Dependencies	Only appears if at least one of the the following options is installed: B85, B1A, B1X, B1Y, B2X, B5X Requires HW Option RBE
Preset	OFF
State Saved	Saved in instrument state

Specific sets of RBWs are available when Wide Bandwidths is set to On, as follows:

IF BW	RBW
< 160 MHz	10 MHz, 15 MHz, 20 MHz, 25 MHz, 30 MHz, 40 MHz, 50 MHz, 60 MHz, 70 MHz
= 160 MHz	10 MHz, 15 MHz, 20 MHz, 25 MHz, 30 MHz, 40 MHz, 50 MHz, 60 MHz, 70 MHz, 80 MHz, 100 MHz and 133 MHz
255 MHz or 510 MHz	10 MHz, 15 MHz, 20 MHz, 25 MHz, 30 MHz, 40 MHz, 50 MHz, 60 MHz, 70 MHz, 80 MHz, 100 MHz, 133 MHz, 150 MHz, 200 MHz and 212 MHz

4.3.2.12 Display Line

Activates an adjustable horizontal line in the Spectrum window that is used as a visual reference line. The line’s vertical position corresponds to its amplitude value.

The display line can be adjusted using the step keys, knob, or numeric keypad. The unit of the Display Line is determined by the Y axis unit setting under Amplitude. If more than one window has a display line, the display line of the selected window is controlled.

If the display line is off the screen, it shows as a line at the top or bottom of the screen with an arrow pointing up or down.

The display line is unaffected by Auto Couple.

SCPI Command not available in SCPI LC Mode

Preset	Sets the Display Line to Off and -25 dBm on Preset OFF
Couplings	When a value is set for the display line, turn it On When the Display Line goes from Off to On, if it is off screen, set it to either the top or bottom of screen, depending on which direction off screen it was. The Display Line's value does not change when it is turned off
State Saved	Saved in instrument state

4.3.2.13 Freq Line

This control affects whichever Freq Line has been selected by the Select Freq Line control. It activates an adjustable vertical visual reference line on the selected window. The Freq Line can be adjusted using the step keys, knob, or numeric keypad.

If the Freq Line is off the screen, it shows as a line at the left or right of the screen with an arrow pointing left or right.

The Freq Line only displays in Swept Spans and is unaffected by Auto Couple.

SCPI Command not available in SCPI LC Mode

Preset	Freq Line 1 selected, Off, and set to 1 GHz
State Saved	Saved in instrument state

4.3.3 View

The View tab contains controls for selecting the current View and for editing User Views.

4.3.3.1 Restore Layout to Default

The Restore Layout to Default control becomes available when you add, delete or rearrange windows and when you resize them. Otherwise it is grayed out.

If you press this control, it will restore the Basic View to its default state.

4.3.3.2 Save Layout as New View

To save your new View as a User View, tap the **Save Layout as New View** control in the View menu. An alpha keyboard appears to let you name the new View. The default is the old View name with a numeric suffix.

When naming a new View, you must choose a name that is not already in use for any User View in any measurement. User Views get written to permanent memory and are available to all instances of the Measurement in any screen. They survive a Mode Preset and also survive shutdown and an application restart.

Tap **Done** to save the View.

After saving the new User View, the following menu changes occur:

- A User View region appears on the View menu panel, with the new User View
- The “Basic” view returns to its original, unedited state and its name no longer has an asterisk suffix
- The Rename User View and Delete User View controls are no longer grayed out
- The new User View also appears in the "Mode/Meas/View Dialog" on page 47

4.3.3.3 Re-Save User View

This control lets you edit a User View and save it to its original name.

4.3.3.4 Rename User View

You can rename the current View by giving it a new unique name. Only User Views can be renamed, if the current View is a Predefined View, you will get an error.

Remote Command	`:DISPlay:VIEW:ADVanced:REName <alphanumeric>`
Example	`:DISP:VIEW:ADV:REN “Baseband”`
Notes	<alphanumeric> is case insensitive; you can specify mixed case, however the name will be evaluated on a single case. If the <alphanumeric> specifying the new name is already present in the list of View names, the error message “-224.XXXX,Illegal parameter value; View <alphanumeric> already exists” is generated. If the current View is a Predefined View, the error message “-224,Illegal parameter value; Cannot rename a Predefined View” is generated. If the display is disabled (via DISP:ENAB OFF) then the error message “-221,Settings conflict;View SCPI cannot be used while Display is disabled” is generated.

4.3.3.5 Delete User View

You can delete the current View if it is a User View. The default view become the current view for the Measurement.

Remote Command	`:DISPlay:VIEW:ADVanced:DELete`
Example	`:DISP:VIEW:ADV:DEL`
Notes	<alphanumeric> is case insensitive; you can specify mixed case, however the name will be evaluated on a single case. If the <alphanumeric> is not present in the list of View names, the error message "-224,Illegal parameter value;View <alphanumeric> does not exist" is generated. If the current View is a Predefined View, the error message "-224,Illegal parameter value; Cannot delete a Predefined View" is generated. If the display is disabled (via DISP:ENAB OFF) then the error message "-221,Settings conflict;View SCPI cannot be used while Display is disabled" is generated.

4.3.4 Annotation

The Annotation tab contains controls for setting up the annotation for the current Mode or Measurement.

4.3.4.1 Graticule

Pressing Graticule turns the display graticule On or Off for all windows with graticules in all measurements in the current Mode. It also turns the graticule y-axis annotation on and off.

SCPI Command not available in SCPI LC Mode

Preset	On
State Saved	Saved in instrument state

Notes

The graticule is the set of horizontal and vertical lines that make up the grid/divisions for the x-axis and y-axis.

4.3.4.2 Screen Annotation

This controls the display of the annunciation and annotation around the graticule, including any annotation on lines (such as the display line, the threshold line, etc.) and the y-axis annotation, for all windows with screen annotation in all measurements in the current Mode.

This does *not* include marker annotation (or the N dB result). When off, the graticule expands to fill the entire graticule area, leaving only the 1.5% gap above the graticule as described in the Trace/Detector chapter.

SCPI Command not available in SCPI LC Mode

Preset	On This should remain Off through a Preset when **System Settings**, **User Infterface**, **Annotation** is set to **All Off**
State Saved	Saved in instrument state

Notes

Grayed-out and forced to OFF when **System Settings**, **User Interface**, **Annotation** is set to **All Off**.

4.3.4.3 Trace Annotation

Turns on and off the labels on the traces, showing their detector (or their math mode) as described in the Trace/Detector section, for all windows in all measurements in the current Mode for which Trace Annotation on/off is supported.

If trace math is being performed with a trace, then the trace math annotation will replace the detector annotation.

SCPI Command not available in SCPI LC Mode

Preset	OFF
State Saved	Saved in instrument state

4.3.4.4 Control Annotation

Turns on and off the display of values on the Active Function controls for all measurements in the current Mode. This is a security feature.

SCPI Command not available in SCPI LC Mode

Preset	ON This should remain Off through a Preset when **System Settings**, **User Interface**, **Annotation** is set to **All Off**
State Saved	Saved in instrument state

Notes

Grayed-out and forced to OFF when **System Settings**, **User Interface**, **Annotation** is set to **All Off**.

4.3.4.5 Frequency Annotation

This control turns on and off the absolute frequency annotation in the main display for all windows in all measurements in the current Mode for which Frequency Annotation on/off is supported.

The affected annotations include Center frequency, Start/Stop frequency, Frequency Offset, Marker frequency. Any relative frequency annotation such as Span and Marker Delta are not affected.

The frequency annotations in any other associated display such as in Active Function, Softkey label, Limit Editor, Amp Corr Editor and Marker Table are not changed.

Frequency annotations that are not associated with the spectrum such as RBW, IBW, Sweep Time are excluded and they are shown regardless of this selection.

For details of the SCPI commmand and parameter details, see "DISPlay:ANNotation:FREQuency " on page 686

4.3.4.6 Meas Bar

This function turns the Measurement Bar at the top of the screen on and off for all measurements in the current Mode. When off, the graticule area expands to fill the area formerly occupied by the Measurement Bar. This is the measurement bar.

SCPI Command not available in SCPI LC Mode

Preset	On This should remain Off through a Preset when System Display Settings, Annotation is set to Off
State Saved	Saved in instrument state.

Notes

Grayed-out and forced to OFF when System Display Settings, Annotation is set to Off.

4.3.4.7 Display Enable (Remote Command Only)

Turns the display on/off, including the display drive circuitry. The backlight stays lit so you can tell that the instrument is on. The display enable setting is mode global. The reasons for turning the display off are three:

– To increase speed as much as possible by freeing the instrument from having to update the display

– To reduce emissions from the display, drive circuitry

– For security purposes

If you have turned off the display:

– and you are in local operation, the display can be turned back on by pressing any key or by sending the SYSTem:DEFaults MISC command or the DISPlay:ENABle ON (neither *RST nor SYSTem:PRESet enable the display.)

– and you are in remote operation, the display can be turned back on by pressing the **Local** or **Esc** keys or by sending the SYSTem:DEFaults MISC command or the DISPlay:ENABle ON (neither *RST nor SYSTem:PRESet enable the display.)

and you are using either the SYSTem:KLOCk command or GPIB local lockout, then no front-panel key press will turn the display back on. You must turn it back on remotely.

If you have turned off the display, many SCPI commands related to User Views and Multiscreen functionality will not work, and will return the error messages “-221,Settings conflict;Screen SCPI cannot be used when Display is disabled” or “221,Settings conflict;View SCPI cannot be used while Display is disabled”. These commands include:

Select User View :DISPlay:VIEW:ADVanced:SELect

Rename User View :DISPlay:VIEW:ADVanced:REName

Delete user View :DISPlay:VIEW:ADVanced:DELete

Create User View :DISPlay:VIEW:ADVanced:NAME

Select Screen :INSTrument:SCReen:SELect

Delete Screen :INSTrument:SCReen:DELete

Delete All But This Screen :INSTrument:SCReen:DELete:ALL

Add Screen :INSTrument:SCReen:CREate

Rename Screen :INSTrument:SCReen:REName

Sequencer On/Off :SYSTem:SEQuencer

Remote Command	`:DISPlay:ENABle OFF | ON | 0 | 1` `:DISPlay:ENABle?`
Example	`:DISP:ENAB OFF`
Couplings	DISP:ENAB OFF turns Backlight OFF and DISP:ENAB ON turns Backlight ON. However, settings of Backlight do not change the state of DISP:ENAB
Preset	On Set by SYST:DEF MISC, but Not affected by *RST or SYSTem:PRESet.
State Saved	Not saved in instrument state.

Backwards Compatibility Notes	SYST:PRES no longer turns on DISPlay:ENABle as it did in legacy analyzers

4.3.4.8 Center Frequency

Pressing Center Freq sets the frequency that corresponds to the horizontal center of the graticule (when frequency Scale Type is set to linear). While adjusting the Center Frequency the Span is held constant, which means that both the Start Frequency and Stop Frequency will change.

The Center Freq function sets (and queries) the Center Frequency for the currently selected input. If your analyzer has multiple inputs, and you select another input, the Center Freq changes to the value for that input and the value is remembered as you go from input to input.

The instrument Min and Max values depend on instrument maximum frequency, mode, measurement, and selected input.

For SCPI command and parameters, see "[SENSe]:FREQuency:CENTer" on page 728

Dependencies

The Center Frequency can be limited by Start or Stop Freq limits, if the Span is so large that Start or Stop reach their limit

Couplings

When operating in “swept span”, any value of the Center Frequency or Span that is within the frequency range of the analyzer is allowed when the value is being set through the front panel numeric key pad or the SCPI command. The other parameter is forced to a different value if needed, to keep the Start and the Stop Frequencies within the analyzer’s frequency range

4.3.4.9 Span

Changes the displayed frequency range symmetrically about the center frequency. While adjusting the Span the Center Frequency is held constant, which means that both Start Frequency and Stop Frequency will change.

Span also sets the frequency entry mode to Center/Span. In Center/Span mode, the center frequency and span values are displayed below the graticule, and the default active function in the Frequency menu is Center Freq.

The Span control also includes a toggle switch to go back and forth between Swept Span and Zero Span. Zero Span is a special sweep type in which the analyzer stops sweeping over a range of frequencies and stays at the Center Frequency. In Zero Span, the analyzer sweeps in the time domain, showing you the instantaneous amplitude versus time at the Center Frequency. For more about Zero Span, see the

Zero Span section. Selecting Swept Span places the analyzer in Center/Span frequency entry mode.

While in swept spans, setting the span to 0 Hz through SCPI or the front panel numeric key pad puts the analyzer into zero span. However, using the Step keys and the RPG in swept spans, the Span can only go as far down as 10 Hz and cannot be set to zero.

When in Zero Span you can return to your last Swept Span by pressing the Swept Span/Zero Span toggle on the Span control. This replaces the “Last Span” function found on older HP/Agilent/Keysight Analyzers.

We use the term “Swept Span” to mean spans other than zero span, even though sometimes when we are in what we call a “swept span” we might be performing an FFT-style sweep, which is not a true “swept span”.

If the Span is set to a value greater than the maximum allowable span of the instrument, an error message is generated indicating the data is out of range and was clipped to upper limit.

For SCPI command and parameters, see "[SENSe]:FREQuency:SPAN" on page 730

Couplings

Span affects RBW, sweeptime, FFT & Sweep choice (including FFT Width, Phase Noise Optimization and ADC Dither auto couplings.)

When operating in “swept span”:

- When using the knob or the step up/down keys or the UP |DOWN keywords in SCPI, the value that is being changed i.e. the Center Frequency or Span, is limited so that the other parameter is not forced to a new value.
- Any value of the Center Frequency or Span that is within the frequency range of the analyzer is allowed when the value is being set through the front panel numeric keypad or the SCPI command. The other parameter is forced to a different value if needed, to keep the Start and the Stop Frequencies within the analyzer’s frequency range.
- The Span cannot be set to Zero by setting Start Frequency = Stop Frequency. The value of the last setting will be changed to maintain a minimum value of 10 Hz for the difference between start and stop frequencies.

Zero Span

While in Swept Span, pressing the Swept Span/Zero Span toggle on the Span control puts you in Zero Span. You can also go to Zero Span by setting the span to 0 Hz through SCPI or the front panel numeric key pad. However, you cannot go to Zero Span by setting Start freq = Stop freq using the numeric keypad, nor by using the Step keys and the RPG to “roll” down to zero, the Span can only go as far down as 10 Hz using this means.

Example	`:FREQ:SPAN 0 Hz` Sets the span to zero, switches to Zero Span Sending `:FREQ:SPAN 1 MHz` while in Zero Span, switches to Swept span
Dependencies	If the Zoomed Trace window is present, Zero Span is not allowed If the Zone Spectrum window is present, Zero Span is not allowed in the Spectrum window
Couplings	Switching to Zero Span: – Turns off Signal Track – Turns off the auto-coupling of RBW and sweep time – Places the analyzer in Center/Span frequency entry mode

Swept Span vs. Zero Span

When you enter Zero Span, the analyzer changes the displayed frequency span to 0 Hz. The horizontal axis changes to time rather than frequency. The amplitude displayed is the input signal level at the current center frequency. This is a time-domain mode that changes several measurement functions and couplings. The instrument behavior is similar to an oscilloscope with a frequency selective detector installed in front of the oscilloscope. See Application Note 150 for more information on how to use zero span.

While in zero span, setting the Span to a non-zero value through SCPI or Front Panel puts the analyzer back into Swept Span. You can also return to your last Swept Span by pressing the Swept Span/Zero Span toggle on the Span control. This replaces the “Last Span” function found on older HP/Agilent/Keysight Analyzers.

The following table summarizes the differences between Zero Span and Swept Spans:

Zero Span	Swept Spans
X axis is time	X axis is frequency
There is no auto-RBW selection unless the EMC Standard is CISPR or MIL	RBW coupled to Span when RBW is in auto
There is no auto sweep time	Sweep time is coupled to RBW when sweep time in auto
Interval Power is calculated in the Marker function	Band Power is calculated in Marker function
You can only define time limits when in zero span	You can only define frequency limits when in swept SA
Marker Count counts at the center frequency	Marker Count counts at the marker frequency
CF Step Size set to RBW value	CF Step autocouples to 10% of Span

Zero Span	Swept Spans
Some “Marker ->” commands are not available	Other “Marker ->” commands are not available
Freq entry mode is always Center/Span	Freq entry mode can be Center/Span or Start/Stop
N dB points reports a time difference	N dB points reports a frequency difference

4.3.4.10 Full Span

Changes the frequency span of the analyzer to the Preset frequency span of the analyzer and sets the Frequency entry mode to Center/Span.

The span is dependent on the currently selected Input (see the Section “Input/Output”). For example, when using external mixing, it changes the frequency to the Preset frequency range specified for the selected external mixing band.

Pressing this key while in zero span puts the analyzer back in swept span.

For SCPI command and parameters, see "[SENSe]:FREQuency:SPAN:FULL" on page 730

Couplings

Turns off signal tracking (span zoom). It does **not** turn off the markers, nor the current active function.

4.3.4.11 Start Freq

Sets the frequency at the left side of the graticule. While adjusting the start frequency, the stop frequency is held constant, which means that both the center frequency and span will change.

Start Freq also sets the frequency entry mode to Start or Stop. In Start or Stop mode, the start frequency and stop frequency values are displayed below the graticule, and the default active function in the Frequency menu is Start Freq.

Preset and Max values are dependent on hardware options.

For SCPI command and parameters, see "[SENSe]:FREQuency:STARt" on page 730

Dependencies

By direct entry:

You cannot set the Stop frequency < Start frequency. You cannot set Start frequency = Stop frequency. You cannot select zero span by setting Start = Stop. You cannot set Stop Frequency to a value that would create a span of less than 10 Hz. If you try to do any of these, Start Frequency will change to maintain a minimum value of 10 Hz for the difference between Start and Stop

With the knob or step keys:

Cannot decrement Stop Freq to a value less than Start Freq + 10 Hz. If already in zero span, cannot decrement at all, and the first increment will be forced to at least 10 Hz.

The Stop Frequency can be limited by Span limits, if the Start Frequency is above its preset value.

If the electronic/soft attenuator is enabled, any attempt to set the Stop Frequency >3.6 GHz fails and results in an advisory message. If the equivalent SCPI command is sent, this same message is generated as part of a "-221, Settings conflict" warning.

If Source Mode is set to Tracking, and the Max or Min Stop Freq is therefore limited by the limits of the source, a warning message is generated -222, "Data out of range;clipped to source max/min" if these limits are exceeded. Note that for an external source, these limits can be affected by the settings of Source Numerator, Source Denominator and Power Sweep.

Couplings

In the Spectrum Analyzer, the four parameters Center Freq, Start Freq, Stop Freq and Span are interdependent, as changing one necessarily affects one or more of the others. The couplings between Center Freq and Span are detailed under the key descriptions for those keys. These couplings also affect Start Freq and Stop Freq.

You cannot set Start frequency = Stop frequency. You cannot select zero span by setting Start = Stop. The instrument will alter the value of the last setting to maintain a minimum value of 10 Hz for the difference between Start and Stop.

4.3.4.12 Stop Freq

Sets the frequency at the right side of the graticule. While adjusting the stop Frequency, the start frequency is held constant, which means that both the center frequency and span will change.

Stop Freq also sets the frequency entry mode to Start or Stop. In Start or Stop mode, the start frequency and stop frequency values are displayed below the graticule, and the default active function in the Frequency menu is Start Freq.

For SCPI command and parameters, see "[SENSe]:FREQuency:STOP" on page 731

Min

-79.999999999 MHz, unless Source Mode is set to Tracking, in which case it is limited by the minimum frequency of the Source

If the knob or step keys are being used, depends on the value of the other three interdependent parameters.

While in External Mixing, the minimum Stop Freq you can set is determined by the external mixing parameters. It will be close to the minimum LO frequency (3.8 GHz if undoubled, 8.6 GHz if doubled) times the harmonic number, for the lowest harmonic range in the Harmonic Table for the current mixer setup. It can be queried with the SCPI command :FREQ:STOP? MIN.

Max

Depends on instrument maximum frequency. Note that, if the Source Mode is set to Tracking, the effective instrument maximum frequency may be limited by the source maximum frequency.

If the knob or step keys are being used, depends on the value of the other three interdependent parameters.

While in External Mixing, the maximum Stop Freq you can set is determined by the external mixing parameters. It will be close to the maximum LO frequency (7 GHz if undoubled, 14 GHz if doubled) times the harmonic number, for the highest harmonic range in the Harmonic Table for the current mixer setup. It can be queried with the SCPI command :FREQ:STOP? MAX.

Dependencies

By direct entry:

You cannot set the Stop frequency < Start frequency. You cannot set Start frequency = Stop frequency. You cannot select zero span by setting Start = Stop. You cannot set Stop Frequency to a value that would create a span of less than 10 Hz. If you try to do any of these, Start Frequency will change to maintain a minimum value of 10 Hz for the difference between Start and Stop

With the knob or step keys:

Cannot decrement Stop Freq to a value less than Start Freq + 10 Hz. If already in zero span, cannot decrement at all, and the first increment will be forced to at least 10 Hz.

The Stop Frequency can be limited by Span limits, if the Start Frequency is above its preset value.

If the electronic/soft attenuator is enabled, any attempt to set the Stop Frequency >3.6 GHz fails and results in an advisory message. If the equivalent SCPI command is sent, this same message is generated as part of a "-221, Settings conflict" warning.

If Source Mode is set to Tracking, and the Max or Min Stop Freq is therefore limited by the limits of the source, a warning message is generated -222.2001, "Data out of range;clipped to source max/min" if these limits are exceeded. Note that for an external source, these limits can be affected by the settings of Source Numerator, Source Denominator and Power Sweep.

Couplings

In the Spectrum Analyzer, the four parameters Center Freq, Start Freq, Stop Freq and Span are interdependent, as changing one necessarily affects one or more of the others. The couplings between Center Freq and Span are detailed under the key descriptions for those keys. These couplings also affect Start Freq and Stop Freq.

You cannot set Start frequency = Stop frequency. You cannot select zero span by setting Start = Stop. The instrument will alter the value of the last setting to maintain a minimum value of 10 Hz for the difference between Start and Stop

4.3.4.13 Auto Tune

Auto Tune is an immediate action control. When it is pressed, it causes the analyzer to change Center Frequency to the strongest signal in the tunable span of the analyzer, excluding the LO. It is designed to quickly get you to the most likely signal (s) of interest, with no signal analysis knowledge required. As such, there are no configurable parameters for this feature. There are only preselected values that work in most real world situations.

Auto Tune performs a Preset as part of its function, so it always returns you to the Normal View and a preset state, although it does leave the AC/DC coupling and Single/Cont state unaffected.

You will see an hourglass, and you may see a slight pause, until the signal of interest is presented at mid-screen.

SCPI Command not available in SCPI LC Mode

Dependencies

If the Zoomed Trace or Zone Spectrum window is present, Auto Tune is not present.

Auto Tune is not available (grayed out) when Source Mode = Tracking.

4.3.4.14 CF Step

Changes the step size for the center frequency and start and stop frequency functions. Once a step size has been selected and the center frequency function is active, the step function (and the UP|DOWN parameters for Center Frequency from remote commands) changes the center frequency by the step-size value. The step size function is useful for finding harmonics and sidebands beyond the current frequency span of the analyzer.

Note that the start and stop frequencies also step by the CF Step value.

Preset and Max values are dependent on hardware options.

For SCPI command and parameters, see "[SENSe]:FREQuency:CENTer:STEP" on page 728

Dependencies

Span, RBW, Center frequency

If the electronic/soft attenuator is enabled, any attempt to change the value of the center frequency >3.6 GHz by pressing the Up-arrow key, fails and results in an advisory message. If the equivalent SCPI command is sent, this same message is generated as part of a “-221, Settings conflict” warning.

Couplings

When auto-coupled in a non-zero span, the center frequency step size is set to 10% of the span. When auto-coupled in zero span, the center frequency step size is set to the equivalent -3 dB RBW value.

4.3.4.15 Freq Offset

Enables you to set a frequency offset value to account for frequency conversions outside of the analyzer. This value is added to the display readout of the marker frequency, center frequency, start frequency, stop frequency, and all other absolute frequency settings in the analyzer including frequency count. When a frequency offset is entered, the value appears below the center of the graticule. To eliminate an offset, perform a Mode Preset or set the frequency offset to 0 Hz.

Preset and Max values are dependent on the hardware options.

For SCPI command and parameters, see "[SENSe]:FREQuency:OFFSet" on page 732

Dependencies

Freq Offset is not available in External Mixing. In this case Freq Offset is grayed out and shows a value of zero. However, the value of CF Offset that was set for the RF Input is retained and restored when the user switches back to the RF Input.

More Information

This command does not affect any bandwidths or the settings of relative frequency parameters such as delta markers or span. It does not affect the current hardware settings of the analyzer, but only the displayed frequency values. Entering an offset does not affect the trace position or display, just the value of the start and stop frequency and the values represented by the trace data. The frequency values of exported trace data, queried trace data, markers, trace data used in calculations such as N dB points, trace math, etc., are all affected by Freq Offset. Changing the offset, even on a trace that is not updating will immediately change all of the above, without taking new data needing to be taken.

If a trace is exported with a nonzero Freq Offset, the exported data will contain the trace data with the offset applied. Therefore, if that trace were to be imported back into the analyzer, you would want Freq Offset to be 0, or the offset would be applied again to data which is already offset. No such care need be taken when saving a State+Trace file because the data and state are saved together.

4.3.4.16 X Axis Scale

Selects either linear or logarithmic scaling for the frequency axis.

The scaling can be changed at any time and determines only how the data is displayed; it has no impact on the actual sweep or measurement of trace data (with the exception that the detector auto-rules never select the Normal detector while in Log Scale Type). Changing the scaling does not restart the sweep (unless the detector changes) and has no impact on the number of sweep points. The scaling can be changed while traces are in View and they will scale appropriately. Markers stay at their set frequency, so they may move on the display.

Note that the actual trace data does not change as you go between Log and Linear Scale Type; hence trace data saved while the display is in log will look identical to trace data saved while the display is in linear. When recalling trace data, the current value of Scale Type is used to display the data. (Trace +State files will of course recall with whatever Scale Type setting was in effect when they were saved, since the State is saved with them).

This function has no effect on the zero span display, although it is available while in zero span.

See "More Information" on page 173

SCPI Command not available in SCPI LC Mode

Dependencies

Has no effect in Zero Span, but if changed while in Zero Span then it will be changed on returning to nonzero span.

The Normal detector will never be selected by the detector auto-rules while in Log, the rules select Sample if Normal would have been selected.

Couplings

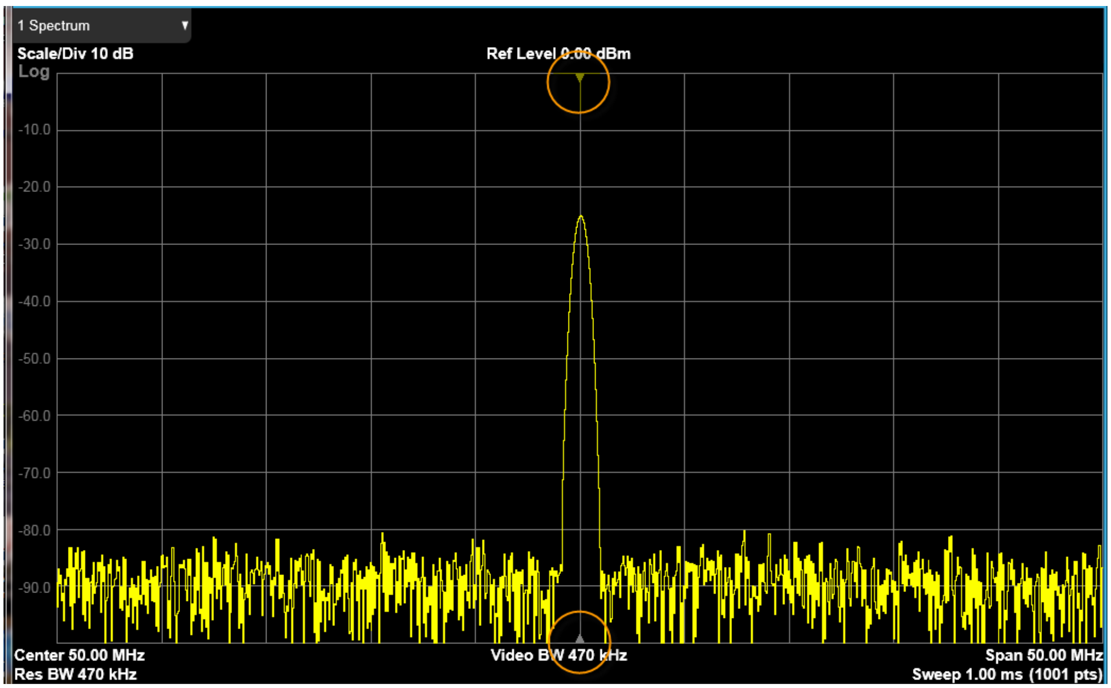
In Linear the Frequency controls and notation at the bottom of the screen default to Center/Span. In Log they default to Start/Stop. When switching from Linear to Log, the notation at the bottom of the screen changes to Start/Stop, and.if the active function was one of the frequency controls (Center Freq, Start Freq, Stop Freq, or Span), it changes to Start Freq. When switching from Log to Linear, the notation at the bottom of the screen changes to Center/Span, and if the active function was one of the frequency controls (Center Freq, Start Freq, Stop Freq, or Span), it changes to Center Freq.

When switching to Log, if the Start Frequency is 0 Hz it is changed to 10 Hz.

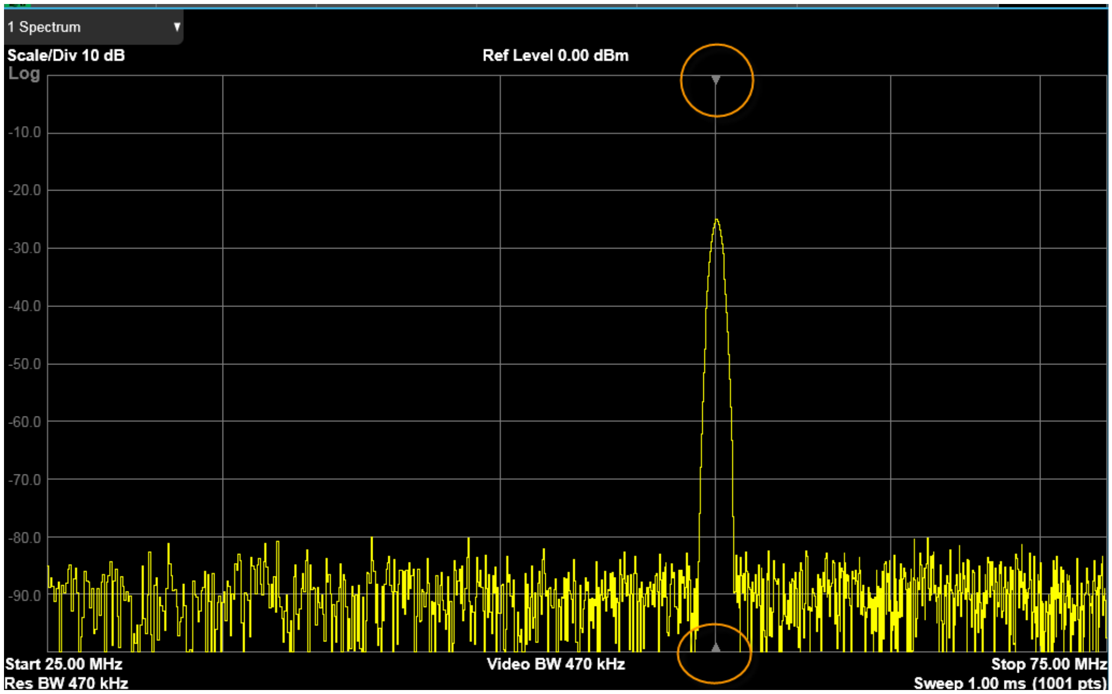
More Information

The log graticule is drawn to optimize the display based on the range of frequencies being shown. The center frequency is marked with a small triangle at the top and bottom of the display, regardless of whether the scaling is log or linear.

Center Freq mark in Linear Scale Type is in the center of the display:



Center Freq mark in Log Scale Type is to the right of center:



4.3.4.17 Signal Track

When Marker 1 is placed on a signal and Signal Track is pressed, the marker remains on the signal while the analyzer retunes the center frequency to the marker frequency. The analyzer keeps the signal at the center of the display, as long as the amplitude of the signal does not change by more than +/–3 dB from one sweep to another. If Marker 1 is not in Normal or Delta, turning on Signal Track sets it to Normal, perform a peak search, and centers the marker on the display.

SCPI Command not available in SCPI LC Mode

Preset	OFF
State Saved	Saved in instrument state

Dependencies

Signal Track is not available (grayed out) when the Waterfall window is present.

Signal Track is associated with Marker 1. When marker 1 is turned off or set to Fixed, signal track is turned off as well.

Signal Track is not available (grayed out) when Source Mode=Tracking.

Signal Track is not available (grayed out) when Signal ID = on.

Signal Track and Continuous Peak Search cannot be used with each other. If one is on, the other is grayed out.

Signal Track is grayed out if in Zero Span.

But if Zero Span is entered while in Signal Track, Signal Track is turned off.

Signal Track can only function properly if the trace Marker 1 is on is updating. Therefore if Signal Track is on and the trace Marker 1 is on is put into View, Signal Track is turned off and the Signal Track key grayed out. Whenever the trace Marker 1 is on is not updating, the Signal Track key is grayed out.

Signal Track is only available in the Swepts SA measurement.

Couplings

Signal Track can only function properly if the trace Marker 1 is on, is in Trace Update = Active. Therefore if the trace Marker 1 is on is in Update Off when Signal Track is turned on, it is changed to Update On. If the trace Marker 1 is on is set to Update Off while Signal Track is on, it turns off Signal Track.

Backwards Compatibility Notes

1. Signal Track is now in the Span menu. It was located in the Frequency menu in ESA and PSA, under its own hardkey in 859xA, under Marker Function (and called Marker Track) in 859xB/C/D/E. It was placed in Span in the X-Series because of the value that one of Signal Track's features, Auto Zoom, provides when changing span (see below)
2. In ESA and PSA the Span Zoom key (in the Span menu) turned on Signal Track in order to let the user enter a new span with Auto Zoom on; by putting Signal Track into the Span menu we achieve the same functionality more clearly. Hence Span Zoom is eliminated as a separate function. There never was a remote command for Span Zoom so there are no SCPI issues with this
3. Signal Track now obeys the Excursion and Threshold criteria, allowing the user to control the search better; but this may cause low level signals that could previously be tracked to need the Excursion and Threshold adjusted
4. Signal Track is now bound to only Marker 1, and cannot be enabled for any other marker. ESA/PSA allowed a subopcode to specify the marker to use. In X-Series, no subopcode is allowed and the marker is always assumed to be marker 1
5. Signal Track now turns off when it finds an unstable signal. In the past it kept searching which caused inpredictable results

More Information

If marker 1 is off when Signal Track is turned on, marker 1 is turned on in the center of the screen and a peak search is performed. If marker 1 is already on, it stays on and is used where it is. If it is Fixed, it is set to Normal.

If you move the marker during Signal Track, a Mkr-> CF is performed and the signal track function starts over.

If the signal is lost, an attempt will be made to find it again and continue tracking. If there are other signals on screen that are near the same amplitude, one of them may be found instead since the algorithm is seeking a signal with amplitude similar to the amplitude of the original signal

Signals near 0 Hz cannot be tracked effectively as they cannot be distinguished from the LO feed-through, which is excluded by intent from the search algorithm.

As a speed optimization, the center frequency is only changed if it differs from the marker position by 1% or more of the span.

If the analyzer is in Single Sweep and Signal Track is turned on, then nothing happens until a sweep is actually initiated (i.e. by an INIT:IMM or Single key press, and a trigger). Once the sweep is initiated, the entire set of sweeps necessary to complete a pass through the signal track algorithm ensues before the analyzer returns *OPC true, returns results to a READ or MEASure, or returns to the idle state.

If the span is changed while in Signal Track, either by you or because moving the instrument to the signal's frequency results in Span Limiting (as described under the Frequency key), an "auto-zoom" algorithm is executed to get to the new span without losing the signal. In "auto zoom", the span is reduced in stages, with a sweep between each stage. You will see this zooming occur as each sweep is performed, and the new span is set.

When auto-zooming, the set of steps necessary to achieve the target span is to be considered a "measurement," thus the entire process executes even if the analyzer is in single sweep. *OPC will not return true until the process is complete nor will results be returned to a READ or MEASure command. Note further that if the analyzer is in a measurement such as averaging when this happens, the act of changing the span restarts averaging but the first average trace is the last trace of the auto zoom.

When you increase the span, we go directly to the new span. No zooming is required.

This function is intended to track signals with a frequency that is changing (drifting), and an amplitude that is not changing. It keeps tracking if you are in continuous-sweep mode. If in single-sweep mode, as described above, the analyzer only does one center frequency adjustment as necessary.

4.3.4.18 Marker Frequency|Time

The Marker Frequency control is the fundamental control that you use to move a marker around on the trace. Because it is the default active function in the Marker menu, all you need to do is press Marker and turn the knob to move the marker left and right on the display. This is always the first control on any Marker menu page which follows the Selected Marker.

When in Zero Span (for measurements that support Zero Span), the label on this control changes to “Marker Time”. When the Marker Mode is Delta, the label changes to “Marker Δ Frequency” or Marker Δ Time”

The SCPI command sets the marker X Axis value in the current marker X Axis Scale unit. The marker that is addressed becomes the selected marker. It has no effect (other than to cause the marker to become selected) if the control mode is Off, but it is the SCPI equivalent of entering an X value if the control mode is Normal, Delta, or Fixed.

For SCPI command and parameters, see "CALCulate:MARKer:X" on page 659

Notes

If no suffix is sent it will use the fundamental units for the current marker X Axis Scale. If a suffix is sent that does not match the current marker X Axis Scale unit, an invalid suffix message will be generated.

If the specified marker is Fixed and a Marker Function is on, a message is generated. If the key is pressed, an advisory message is generated. If the equivalent SCPI command is sent, this same message is generated as part of a “–221, Settings conflict” warning.

The query returns the marker’s absolute X Axis value if the control mode is Normal or Fixed. It returns the offset from the marker’s reference marker if the control mode is Delta. The query is returned in the fundamental units for the current marker X Axis scale: Hz for Frequency and Inverse Time, seconds for Period and Time. If the marker is Off the response is not a number.

Dependencies

Grayed out and displays three dashes for the value when the selected Marker is Off.

You cannot directly set the X value of a Fixed marker which has a marker function turned on.. If an attempt is made to actually adjust it while a Marker Function is on, a warning message is generated.

Marker Backwards Compatibility

In earlier HP/Agilent/Keysight analyzers, markers were position markers, which means that Normal and Delta markers stayed at the same screen position when X Axis parameters were changed. So a marker at center screen stayed at center screen even if Center Frequency was changed (which means that the marker’s frequency changed). In the X-Series, markers are value markers, which means that when the analyzer’s X Axis settings are changed, the marker’s X Axis value in fundamental X Axis units remains unchanged. For example, if you put a marker at a particular frequency, it will stay at that frequency regardless of whether or not you change the Center Frequency of the analyzer, even if that means that the marker ends up offscreen.

While this change resulted in an overall higher level of usability of the marker system, there are some use cases where the user depends on the marker staying at the center of the screen. The most common one is where the user turns on a marker at center screen and uses it to measure the trace amplitude at the center frequency or at a series of center frequencies, without the need to ever move the marker. In the X-Series, to mimic the legacy behavior for this use case, the user must turn the marker off and then back on after changing the center frequency of the analyzer. This causes the marker to reappear in the center of the screen.

Also as a result of the change from position markers to value markers, markers can be at a frequency which is offscreen, whereas in the past, they were clipped to the screen edges and hence were never offscreen. Users who depended on this clipping behavior to force markers to the edges of the screen will have to rewrite their code. Furthermore, since markers could never be offscreen they always returned a valid result. In the X-Series, markers which are offscreen return not a number as a result; hence the potential now exists for not a number to be returned for a marker query.

4.3.4.19 Marker Mode

There are four control modes for markers:

- Normal (POSition) - A marker that can be moved to any point on the X Axis by specifying its X Axis value, and whose absolute Y Axis value is then the value of the trace point at that X Axis value
- Delta (DELTa) - A marker that can be moved to any point on the X Axis by specifying its X Axis offset from a reference marker, and whose absolute Y Axis value is then the value of the trace point at that X Axis value
- Fixed (FIXed) - A marker whose X Axis and Y Axis values may be directly or indirectly specified by you, but whose Y Axis value remains fixed, once specified, and does not follow the trace. Fixed markers are useful as reference markers for Delta markers, as operands in a Peak Search operation, and as arbitrary reference points settable by you. These markers are represented on the display by an “X” rather than a diamond. Not every measurement supports Fixed markers
- Off (OFF) - A marker that is not in use

See "Marker Modes" on page 179 for more information.

The SCPI command in the table below selects the marker and sets the marker control mode as described under Normal, Delta, Fixed and Off, below. All interactions and dependencies detailed under the key description are enforced when the remote command is sent.

SCPI Command not available in SCPI LC Mode

Preset	OFF (all markers)
State Saved	The marker control mode (Normal, Delta, Fixed, Off) and X Axis value are saved in instrument state

Backwards Compatibility

In legacy analyzers, only a Reference marker could be Fixed, and it was always Fixed. Additionally it could not be moved. In the X-Series, any marker can be set to Fixed and can be moved to any X or Y value.

Marker Modes

Value	Example	Notes
Normal	:CALC:MARK2:MODE POS	A Normal marker can be moved to any point on the X Axis by specifying its X Axis value. Its absolute Y Axis value is then the value of the trace point at that X Axis value
Delta	:CALC:MARK2:MODE DELT	In Delta mode the marker result shows the relative result between the selected (Delta) marker and its reference marker. A delta marker can be moved to any point on the X Axis by specifying its X Axis offset from a reference marker. Its absolute Y Axis value is then the value of the trace point at that X Axis value
Fixed	:CALC:MARK2:MODE FIX	A fixed marker is fixed in the sense that it stays where you place it. It can be directly moved in both X and Y. It can be moved with a Peak Search. It can also be indirectly moved by re-zeroing the delta if it is a relative marker. If it is moved, it again becomes fixed at the X Axis point it moved to and it has a Y-axis result that it took on when it moved there. If a Normal or Delta marker is changed to Fixed it becomes fixed at the X Axis point it was at, and with the Y-axis result it had when it was set to Fixed. In Fixed mode the marker result shows: – If no Marker Function is on, the absolute X Axis and Y axis value of the marker – If a Marker Function is on, the X Axis value and the Y-axis function result the marker had when it became fixed
Off	:CALC:MARK2:MODE OFF	Off turns off the marker, removes the marker annunciation from the display, turns off any active function and any marker function, and resets the following properties to their default value: – X Axis scale: Auto – Band Span: 0

Value	Example	Notes
		– Auto Trace: On Off does not affect which marker is selected

4.3.4.20 Marker Table

When set to On, the display is split into a measurement window and a marker data display window. For each marker which is on, information is displayed in the data display window, which includes the marker number, control mode, trace number, X axis scale, X axis value, and the Y-axis result. Additional information is shown for markers which have marker functions turned on.

Turning the Marker Table on turns the Peak Table off and *vice versa*.

SCPI Command not available in SCPI LC Mode

Preset	OFF
State Saved	The on/off state of the Marker Table is saved in instrument state.

4.3.4.21 All Markers Off

Turns off all markers.

For SCPI command and parameters, see "CALCulate:MARKer:AOFF" on page 658

4.3.4.22 Couple Markers

When this function is On, moving any marker causes an equal X Axis movement of every other marker which is not Fixed or Off. By “equal X Axis movement” we mean that we preserve the difference between each marker’s X Axis value (in the fundamental x-axis units of the trace that marker is on) and the X Axis value of the marker being moved (in the same fundamental x-axis units).

Note that Fixed markers do not couple. They stay where they were while all the other markers move. Of course, if a Fixed marker is being moved, all the non-fixed markers do move with it.

This may result in markers going off screen.

SCPI Command not available in SCPI LC Mode

Preset	OFF, presets on Mode Preset and All Markers Off
State Saved	Saved in instrument state.

4.3.4.23 Marker Frequency|Time

The Marker Frequency control is the fundamental control that you use to move a marker around on the trace. Because it is the default active function in the Marker menu, all you need to do is press Marker and turn the knob to move the marker left and right on the display. This is always the first control on any Marker menu page which follows the Selected Marker.

When in Zero Span (for measurements that support Zero Span), the label on this control changes to “Marker Time”. When the Marker Mode is Delta, the label changes to “Marker Δ Frequency” or Marker Δ Time”

The SCPI command sets the marker X Axis value in the current marker X Axis Scale unit. The marker that is addressed becomes the selected marker. It has no effect (other than to cause the marker to become selected) if the control mode is Off, but it is the SCPI equivalent of entering an X value if the control mode is Normal, Delta, or Fixed.

For SCPI command and parameters, see "CALCulate:MARKer:X" on page 659

Notes

If no suffix is sent it will use the fundamental units for the current marker X Axis Scale. If a suffix is sent that does not match the current marker X Axis Scale unit, an invalid suffix message will be generated.

If the specified marker is Fixed and a Marker Function is on, a message is generated. If the key is pressed, an advisory message is generated. If the equivalent SCPI command is sent, this same message is generated as part of a “–221, Settings conflict” warning.

The query returns the marker’s absolute X Axis value if the control mode is Normal or Fixed. It returns the offset from the marker’s reference marker if the control mode is Delta. The query is returned in the fundamental units for the current marker X Axis scale: Hz for Frequency and Inverse Time, seconds for Period and Time. If the marker is Off the response is not a number.

Dependencies

Grayed out and displays three dashes for the value when the selected Marker is Off.

You cannot directly set the X value of a Fixed marker which has a marker function turned on.. If an attempt is made to actually adjust it while a Marker Function is on, a warning message is generated.

Marker Backwards Compatibility

In earlier HP/Agilent/Keysight analyzers, markers were position markers, which means that Normal and Delta markers stayed at the same screen position when X Axis parameters were changed. So a marker at center screen stayed at center screen even if Center Frequency was changed (which means that the marker's frequency changed). In the X-Series, markers are value markers, which means that when the analyzer's X Axis settings are changed, the marker's X Axis value in fundamental X Axis units remains unchanged. For example, if you put a marker at a particular frequency, it will stay at that frequency regardless of whether or not you change the Center Frequency of the analyzer, even if that means that the marker ends up offscreen.

While this change resulted in an overall higher level of usability of the marker system, there are some use cases where the user depends on the marker staying at the center of the screen. The most common one is where the user turns on a marker at center screen and uses it to measure the trace amplitude at the center frequency or at a series of center frequencies, without the need to ever move the marker. In the X-Series, to mimic the legacy behavior for this use case, the user must turn the marker off and then back on after changing the center frequency of the analyzer. This causes the marker to reappear in the center of the screen.

Also as a result of the change from position markers to value markers, markers can be at a frequency which is offscreen, whereas in the past, they were clipped to the screen edges and hence were never offscreen. Users who depended on this clipping behavior to force markers to the edges of the screen will have to rewrite their code. Furthermore, since markers could never be offscreen they always returned a valid result. In the X-Series, markers which are offscreen return not a number as a result; hence the potential now exists for not a number to be returned for a marker query.

4.3.4.24 Peak Search

Pressing the Peak Search control moves the selected marker to the trace point which has the maximum y-axis value for that marker's trace.

NOTE

Pressing the **Peak Search** hardkey automatically moves you to the Peak Search page of the Marker menu **and** performs a Peak Search.

In the Swept SA measurement, the Pk Search Config menu enables you to define specific search criteria to determine which signals can be considered peaks, excluding unwanted signals from the search.

For SCPI command and parameters, see "CALCulate:MARKer:MAXimum[:PEAK]" on page 664

More Information

The behavior of a Peak Search is dependent on settings under the Peak Criteria control on the second page of the menu. If Same as "Next Peak" Criteria is selected, and either Pk Excursion or Pk Threshold are on, a signal must meet those criteria to be considered a peak. If no valid peak is found, a "No peak found" message is generated and the marker is not moved. When Highest Peak is on, or both Pk Excursion and Pk Threshold are off, the marker is always placed at the point on the trace with the maximum y-axis value, even if that point is on the very edge of the trace (exception: negative frequencies and signals close to the LO are not searched at all.

Pressing Peak Search with the selected marker off causes the selected marker to be set to Normal at the center of the screen, then a peak search is immediately performed.

Pressing the front panel Peak Search key always does a peak search. Occasionally, you may need to get to the Peak Search menu key functions without doing a peak search. You can do this by first accessing the Peak Search menu. Then go to the other menus that you need to access. Finally, you can get back to the Peak Search key menu by using the front panel Return key and pressing it as many times as required to navigate back through the previously accessed menus until you get back to the Peak Search menu.

4.3.4.25 Next Peak

Pressing Next Peak moves the selected marker to the peak that has the next highest amplitude less than the marker current value. Only peaks which meet all enabled peak criteria are considered. If there is no valid peak lower than the current marker position, a “No peak found” message is generated and the marker is not moved.

If the selected marker was off, then it is turned on as a normal marker and a peak search is performed.

For SCPI command and parameters, see "CALCulate:MARKer:MAXimum:NEXT" on page 664

4.3.4.26 Next Pk Right

Pressing Next Peak moves the selected marker to the peak that has the next highest amplitude less than the marker current value. Only peaks which meet all enabled peak criteria are considered. If there is no valid peak lower than the current marker position, a “No peak found” message is generated and the marker is not moved.

If the selected marker was off, then it is turned on as a normal marker and a peak search is performed.

For SCPI command and parameters, see "CALCulate:MARKer:MAXimum:RIGHt" on page 665

4.3.4.27 Next Pk Left

Pressing Next Pk Left moves the selected marker to the nearest peak left of the current marker that meets all enabled peak criteria. If there is no valid peak to the left of the current marker position, a “No peak found” message is generated and the marker is not moved.

If the selected marker was off, then it is turned on as a normal marker and a peak search is performed.

For SCPI command and parameters, see "CALCulate:MARKer:MAXimum:LEFT" on page 664

4.3.4.28 Minimum Peak

Moves the selected marker to the minimum y-axis value on the current trace. Minimum (negative) peak searches do not have to meet the peak search criteria. It just looks for the lowest y-axis value. If the selected marker is Off, it is turned on before the minimum search is performed.

For SCPI command and parameters, see "CALCulate:MARKer:MINimum[:PEAK]" on page 666

4.3.4.29 Pk-Pk Search

Finds and displays the amplitude and frequency (or time, if in zero span) differences between the highest and lowest y-axis value. It places the selected marker on the minimum value on its selected trace. And it places that marker’s reference marker on the peak of its selected trace.

This function turns on the reference marker and sets its mode to Fixed or Normal if it is not already on. (These markers may be on two different traces.)

The rules for finding the maximum peak are exactly the same as for Peak Search, including the use of the peak criteria rules. However, the minimum trace value is not required to meet any criteria other than being the minimum y-axis value in the trace.

If the selected marker is off, a delta type marker is turned on and the peak-to-peak search is done. If the selected marker is on, but it is not a delta marker, then it is changed to delta which turns on the reference marker if needed, and then it performs the peak-to-peak function.

SCPI Command not available in SCPI LC Mode

Notes

Turns on the Marker Δ active function.

Dependencies

Pk-Pk Search is grayed out when Coupled Markers is on.

Couplings

The selected marker becomes a delta marker if not already in delta mode.

4.3.4.30 Marker Delta

This function is exactly the same as the “Delta” selection on the Marker Mode radio button on the Settings tab. The selected marker becomes a Delta Marker. If the selected marker is already a Delta marker, the reference marker is moved to the current position of the selected marker, thus resetting the Delta to zero.

The is duplicated here in the Peak Search Menu to allow you to conveniently perform a peak search and change the marker’s control mode to Delta without having to access two separate menus.

4.3.4.31 Marker -> CF

Assigns the selected marker’s frequency to the Center Frequency setting.

The is duplicated here in the Peak Search Menu to allow you to conveniently perform a peak search and marker to CF without having to access two separate menus.

4.3.4.32 Marker -> Ref Lvl

Assigns the selected marker’s level to the Reference Level setting. The is duplicated here in the Peak Search Menu to allow you to conveniently perform a peak search and marker to RL without having to access two separate menus.

4.3.4.33 Peak Threshold

Turns the peak threshold requirement on/off and sets the threshold value. The peak threshold value defines the minimum signal level (or min threshold) that the peak identification algorithm uses to recognize a peak.

When both Pk Excursion and Pk Threshold are on, a signal must rise above the Pk Threshold value by at least the Peak Excursion value and then fall back from its local maximum by at least the Peak Excursion value to be considered a peak.

For example, if a threshold value of –90 dBm is selected, the peak search algorithm will only consider signals with amplitude greater than the –90 dBm threshold. If a threshold value of –90 dBm is selected, and Peak Excursion is On and set to 6 dB, the peak search algorithm will only consider signals with amplitude greater than the –90 dBm threshold which rise 6 dB above the threshold and then fall back to the threshold.

NOTE

If a signal comes onto the screen falling and falls all the way to the threshold without ever rising, it is considered a peak at the far left edge of the display. Similarly, if a signal rises from the threshold and leaves the screen without ever falling, it is considered a peak at the far right edge of the display.

SCPI Command not available in SCPI LC Mode

Preset	–90.0 dBm ON
Min/Max	Min: The current displayed Ref Level – 200 dB. The current displayed Ref Level is the current Ref Level, offset by the Ref Level Offset. Max: The current displayed Ref Level. This means the current Ref Level, offset by the Ref Level Offset.
State Saved	Saved in instrument state.

Dependencies

When Ref Level Offset changes, Peak Threshold must change by the same amount.

Couplings

Whenever you adjust the value of Pk Threshold, the Peak Threshold Line is turned on and, if Peak Excursion is also on, the Peak Excursion Region is displayed.

4.3.4.34 Peak Excursion

Turns the peak excursion requirement on/off and sets the excursion value. The value defines the minimum amplitude variation (rise and fall) required for a signal to be identified as peak. For example, if a value of

6 dB is selected, peak search functions like the marker Next Pk Right function move only to peaks that rise and fall 6 dB or more.

When both Pk Excursion and Pk Threshold are on, a signal must rise above the Pk Threshold value by at least the Peak Excursion value and then fall back from its local maximum by at least the Peak Excursion value to be considered a peak

NOTE

In the event that a sequence of trace points with precisely the same values represents the maximum, the leftmost point is found.

If a signal comes onto the screen falling and falls all the way to the threshold without ever rising, it is considered a peak at the far left edge of the display. Similarly, if a signal rises from the threshold and leaves the screen without ever falling, it is considered a peak at the far right edge of the display.

See "More Information" on page 187.

For SCPI command and parameters, see "CALCulate:MARKer:PEXCursion " on page 668

Dependencies

Available only when Y axis unit is amplitude units, otherwise grayed out.

Couplings

Whenever you adjust the value of Pk Excursion (with the knob, step keys, or by completing a numeric entry), if the Peak Threshold is turned ON, the Peak Threshold Line is turned on and the Peak Excursion Region is displayed.

More Information

If two signals are very close together and the peak excursion and threshold criteria are met at the outside edges of the combined signals, this function finds the highest of these two signals as a peak (or next peak). However, if a signal appears near the edge of the screen such that the full extent of either the rising or falling edge cannot be determined, and the portion that is on screen does not meet the excursion criteria, then the signal cannot be identified as a peak.

When measuring signals near the noise floor, you can reduce the excursion value even further to make these signals recognizable. To prevent the marker from identifying noise as signals, reduce the noise floor variations to a value less than the peak-excursion value by reducing the video bandwidth or by using trace averaging.

4.3.4.35 Peak Table

Turns Peak Table on/off. When turned on, the display is split into a measurement window and a peak table display window.

When the Peak Table turns on, if Peak Threshold is On then it becomes the active function.

Turning the Peak Table on turns the Marker Table off and vice versa.

SCPI Command not available in SCPI LC Mode

Preset	OFF
State Saved	Saved in instrument state.

4.3.4.36 Peak Table Sort

Sets the peak table sorting routine to list the peaks in order of descending amplitude or ascending frequency.

The remote command can also be used to sort the peaks found using the :CALCulate:DATA:PEAKs command (see the Trace key documentation).

SCPI Command not available in SCPI LC Mode

Preset	AMPLitude
State Saved	Saved in instrument state.

4.3.4.37 Peak Table Readout

Shows up to twenty signal peaks as defined by the setting:

- All (ALL) - lists all the peaks defined by the peak criteria, in the current sort setting.
- Above Display Line (GTDLine) - lists the peaks that are greater than the defined display line, and that meet the peak criteria. They are listed in the current sort order.
- Below Display Line (LTDLine) - lists the peaks that are less than the defined display line, and that meet the peak criteria. They are listed in the current sort order.

If the Peak Threshold and/or the Peak Excursion are turned on, then only peaks that meet the defined criteria will be found.

Turning Display Line off forces Readout to ALL.

If GTDL or LTDL, then if the display line is not already on, it is turned on (it has to be on or it cannot be used to exclude peaks).

See "More Information" on page 188

SCPI Command not available in SCPI LC Mode

Preset	ALL
State Saved	Saved in instrument state.

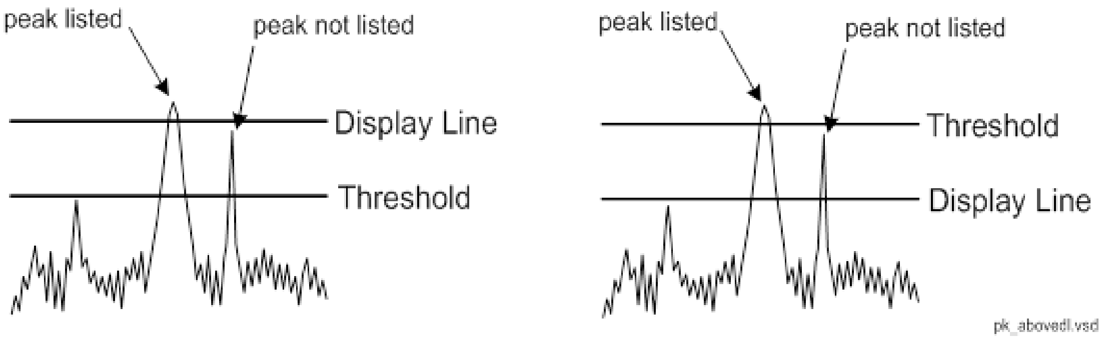
Backwards Compatibility

In ESA the display line does not have to be on for a peak to be qualified “above display line” or “below display line.” In X-Series the display line has to be on to be used to exclude peaks.

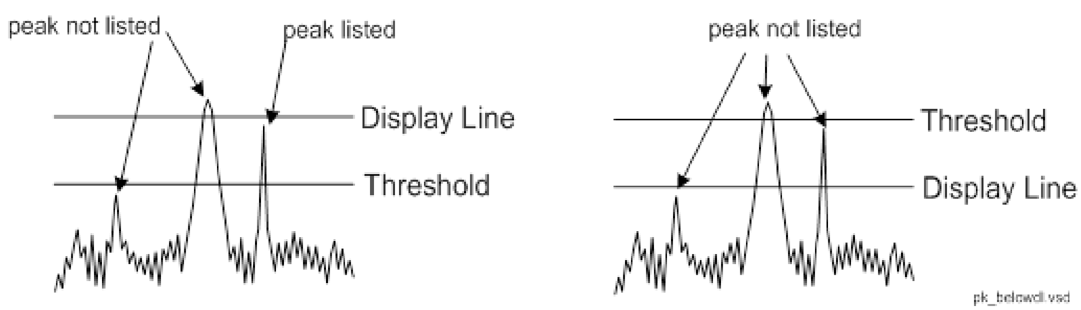
More Information

If the Display Line is turned on, the Peak Table can be selected to include all peaks, only those above the Display Line, or only those below the Display Line. See the diagrams below to understand what happens if both Display Line and Pk Threshold are turned on.

Above Display Line Peak Identification



Below Display Line Peak Identification



4.3.4.38 Δ to Limit

Selects the Limit to be used for the Δ to Limit column in the Peak Table and turns the Δ to Limit column on and off.

When on, this column shows the difference between each peak and the specified Limit.

SCPI Command not available in SCPI LC Mode

Preset	LLINE1 OFF

4.3.4.39 Marker Frequency|Time

The Marker Frequency control is the fundamental control that you use to move a marker around on the trace. Because it is the default active function in the Marker menu, all you need to do is press Marker and turn the knob to move the marker left and right on the display. This is always the first control on any Marker menu page which follows the Selected Marker.

When in Zero Span (for measurements that support Zero Span), the label on this control changes to “Marker Time”. When the Marker Mode is Delta, the label changes to “Marker Δ Frequency” or Marker Δ Time”

The SCPI command sets the marker X Axis value in the current marker X Axis Scale unit. The marker that is addressed becomes the selected marker. It has no effect (other than to cause the marker to become selected) if the control mode is Off, but it is the SCPI equivalent of entering an X value if the control mode is Normal, Delta, or Fixed.

For SCPI command and parameters, see "CALCulate:MARKer:X" on page 659

Notes

If no suffix is sent it will use the fundamental units for the current marker X Axis Scale. If a suffix is sent that does not match the current marker X Axis Scale unit, an invalid suffix message will be generated.

If the specified marker is Fixed and a Marker Function is on, a message is generated. If the key is pressed, an advisory message is generated. If the equivalent SCPI command is sent, this same message is generated as part of a “–221, Settings conflict” warning.

The query returns the marker’s absolute X Axis value if the control mode is Normal or Fixed. It returns the offset from the marker’s reference marker if the control mode is Delta. The query is returned in the fundamental units for the current marker X Axis scale: Hz for Frequency and Inverse Time, seconds for Period and Time. If the marker is Off the response is not a number.

Dependencies

Grayed out and displays three dashes for the value when the selected Marker is Off.

You cannot directly set the X value of a Fixed marker which has a marker function turned on.. If an attempt is made to actually adjust it while a Marker Function is on, a warning message is generated.

Marker Backwards Compatibility

In earlier HP/Agilent/Keysight analyzers, markers were position markers, which means that Normal and Delta markers stayed at the same screen position when X Axis parameters were changed. So a marker at center screen stayed at center screen even if Center Frequency was changed (which means that the marker’s frequency changed). In the X-Series, markers are value markers, which means that when the analyzer’s X Axis settings are changed, the marker’s X Axis value in fundamental X Axis units remains unchanged. For example, if you put a marker at a particular frequency, it will stay at that frequency regardless of whether or not you change the Center Frequency of the analyzer, even if that means that the marker ends up offscreen.

While this change resulted in an overall higher level of usability of the marker system, there are some use cases where the user depends on the marker staying at the center of the screen. The most common one is where the user turns on a marker at center screen and uses it to measure the trace amplitude at the center frequency or at a series of center frequencies, without the need to ever move the marker. In the X-Series, to mimic the legacy behavior for this use case, the user must turn the marker off and then back on after changing the center frequency of the analyzer. This causes the marker to reappear in the center of the screen.

Also as a result of the change from position markers to value markers, markers can be at a frequency which is offscreen, whereas in the past, they were clipped to the screen edges and hence were never offscreen. Users who depended on this clipping behavior to force markers to the edges of the screen will have to rewrite their code. Furthermore, since markers could never be offscreen they always returned a valid result. In the X-Series, markers which are offscreen return not a number as a result; hence the potential now exists for not a number to be returned for a marker query.

4.3.4.40 Relative To

Selects the marker to which the selected marker is relative (its reference marker).

Every marker has another marker to which it is relative. This marker is referred to as the “reference marker” for that marker. This attribute is set by the Marker, Properties, Relative To key. The marker must be a Delta marker to make this attribute relevant. If it is a Delta marker, the reference marker determines how the marker is controlled and how its value is displayed. A marker cannot be relative to itself.

SCPI Command not available in SCPI LC Mode

Preset	The preset default “Relative To” marker (reference marker) is the next higher numbered marker (current marker +1). For example, if marker 2 is selected, then it’s default reference marker is marker 3. The exception is marker 12, which has a default reference of marker 1. Set to the defaults by using Restore Mode Defaults. This is not reset by Marker Off, All Markers Off, or Preset.
Min/Max	1/12
State Saved	Saved in instrument state. Not affected by Marker Off and hence not affected by Preset or power cycle.

Notes

A marker cannot be relative to itself so that choice is grayed out. If the grayed out key is pressed, an advisory message is generated.

Couplings

The act of specifying the selected marker’s reference marker makes the selected marker a Delta marker.

If the reference marker is off it is turned on in Fixed or Normal mode at the delta marker location.

4.3.4.41 X Axis Scale

Accesses a menu that enables you to affect how the X Axis information for the selected marker is displayed in the marker area (top-right of display) and the active function area of the display, and how the marker is controlled. The available settings for the X Axis Scale are Frequency, Period, Time, and Inverse Time.

SCPI Command not available in SCPI LC Mode

Preset	AUTO Marker Preset (selected when a marker is turned Off). In most measurements the Auto settings results in Frequency being the preset readout. ON
State Saved	Saved in instrument state.

More Information

Value	Example	Notes
Frequency	:CALC:MARK2:X:READ FREQ	Displays the absolute frequency of a normal marker or the frequency of the delta marker relative to the reference marker.
Period	:CALC:MARK2:X:READ PER	Displays the reciprocal of the frequency of the marker, or the reciprocal of the frequency separation of the two markers in a delta-marker mode. The units are those of time (sec, msec, etc.). If the markers are at the same frequency in a delta marker mode, the result will be the reciprocal of 0, which is infinitely large. The display will show "---" and a SCPI query will return infinity.
Time	:CALC:MARK2:X:READ TIME	Displays the time interval between a normal marker and the start of a sweep or the time of the delta marker relative to the reference marker. Time is the auto setting for time domain traces. In a delta-marker mode it is the (sweep) time interval between the two markers.
Inverse Time	:CALC:MARK2:X:READ ITIM	Displays the reciprocal time. It is useful in a delta mode to show the reciprocal of (sweep) time between two markers. This function is only meaningful when on a time domain trace and in the Delta control mode. If the markers are at the same X Axis value, the time between them is 0, so the reciprocal of sweep time is infinitely large. The display will show "---" and a SCPI query will return infinity.

The X Axis Scale of a marker is the scale of its X Axis value. This affects the units displayed in the Marker Result block and used to specify the marker's X Axis location. The X Axis Scale is specified using the Marker, Properties, X Axis Scale key.

All markers in swept spans have both a time and frequency value. Which of these is used for the result display, and for positioning the marker, depends on the X Axis Scale setting. The X Axis Scale setting can be Frequency or Time, as well as the reciprocal of either (Period or Inverse Time). There is also an Auto setting - when in Auto, a marker's X Axis Scale changes whenever the domain of the trace, upon which it set, changes. All choices for X Axis Scale are allowed. Note that this behavior differs from the behavior in previous instruments: previously the instrument remembered a different X Axis Scale (formerly called Readout) for each domain, and the choices of X Axis Scale were restricted. These restrictions were based on the current domain of the instrument.

When in Auto, the X-Axis Scale is Frequency if the Marker Trace is a frequency domain trace, Time if the Marker Trace is a time domain trace. When in Auto, if the marker changes traces, or the domain of the trace the marker is on changes, the auto result is re-evaluated. If the X Axis Scale is chosen manually, that Scale is used regardless of the domain of the trace.

If Frequency or Period is selected for a time domain trace, all of the points in the trace will show the same value. Attempting to use the knob or step keys to adjust the X Axis value of the marker or entering an X Axis value from the numeric keypad or remotely will have no effect but will generate no error.

Frequency domain traces taken in FFT mode have no valid time data. Therefore when Time or Inverse Time is selected for markers on such traces, the X Axis value is taken as the appropriate percentage of the displayed sweep time, which is a calculated estimate.

4.3.4.42 Lines

When on, displays a vertical line of graticule height and a horizontal line of graticule width, intersecting at the indicator point of the marker (that is, the center of the X or the bottom tip of the diamond. The lines are blue in color.

If the marker is off screen the lines should be extended from the marker so that they go thru the screen area if possible. This is really useful for off screen Fixed markers as it lets you see their amplitude even though they are off the X Axis.

SCPI Command not available in SCPI LC Mode

Preset	OFF
State Saved	Saved in instrument state.

4.3.4.43 Marker Trace

Selects the trace on which you want your marker placed. A marker is associated with one and only one trace. This trace is used to determine the placement, result, and X Axis Scale of the marker. All markers have an associated trace, even Fixed markers; it is from that trace that they determine their attributes and behaviors, and it is to that trace that they go when they become Normal or Delta markers.

In measurements that support Auto Initialize, if Auto Initialize is on (the default state) the trace is automatically chosen when the Marker is turned on.

Specifying a Marker Trace manually or with this command associates the marker with the specified trace and turns Auto Initialize OFF for that marker. If the marker is not Off it moves the marker from the trace it was on to the new trace. If the marker is Off it stays off but is now associated with the specified trace.

The query returns the number of the trace on which the marker is currently placed, even if that marker is in Auto mode.

For SCPI command and parameters, see "CALCulate:MARKer:TRACe " on page 659

Notes

A marker may be placed on a blanked and/or inactive trace, even though the trace is not visible and/or updating.

An application may register a trace name to be displayed on the key instead of a trace number.

Couplings

The state of Marker Trace is not affected by the Auto Couple key.

If a Marker Trace is chosen manually, Auto Initialize goes to Off for that marker.

Sending the remote command causes the addressed marker to become selected.

4.3.4.44 Auto Initialize

When Auto Initialize is true for a given marker, the marker's trace is re-determined automatically by the analyzer whenever the marker turns on (Normal, Delta or Fixed) from an Off state. This is the default state of Markers. (The trace attribute is also determined for all markers that are on, whenever Auto Init is turned on).

When Auto Initialize is turned off for a given marker, the Marker remains associated with the trace it is currently on regardless of whether the marker and/or the marker's trace is subsequently turned on or back off. If the marker is Off it stays off but is now associated with the specified trace.

Auto Initialize is turned off automatically whenever Marker Trace is used to directly specify a marker's trace.

- See "Marker Trace" on page 194 for more information.
- See "More Information" on page 195

SCPI Command not available in SCPI LC Mode

Preset	ON

Notes

Turning Marker Trace Auto Init off has no effect on the trace on which the marker is currently placed.

The response to the query will be 0 if OFF, 1 if ON.

Couplings

The state of Auto Init is not affected by the Auto Couple key.

Auto Init is set to True on a Preset or All Markers Off.

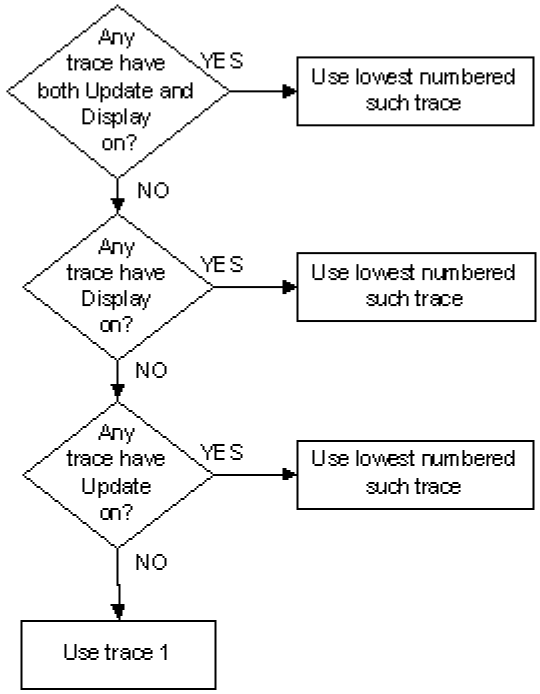
More Information

When the marker moves between traces the marker's X position in trace points is retained as it moves. For moving between active traces this generally means the x-axis value of the marker will not change. But for moving to or from an inactive trace, the x-axis value will take on that of the new trace at the bucket the marker was on the old trace (and is still on, on the new trace, since the bucket doesn't change).

Note this is true even if the marker is off screen. Thus, a marker that is at the center of the screen on the old trace stays at the center of the screen on the new trace. A marker that is off screen one whole screen to the left on the old trace remains off screen one whole screen to the left on the new trace – even if this means it will be at negative time!

Auto Init Rules Flowchart

The following flowchart depicts the Auto Init rules:



This flowchart makes it clear that putting all lower-numbered traces in View is the simplest way to specify which trace you want the markers to go to when they turn on. For example, if you want all Markers to go to trace 2 when they turn on, put trace 1 in View.

4.3.4.45 Marker Frequency|Time

The Marker Frequency control is the fundamental control that you use to move a marker around on the trace. Because it is the default active function in the Marker menu, all you need to do is press Marker and turn the knob to move the marker left and right on the display. This is always the first control on any Marker menu page which follows the Selected Marker.

When in Zero Span (for measurements that support Zero Span), the label on this control changes to “Marker Time”. When the Marker Mode is Delta, the label changes to “Marker Δ Frequency” or Marker Δ Time”

The SCPI command sets the marker X Axis value in the current marker X Axis Scale unit. The marker that is addressed becomes the selected marker. It has no effect (other than to cause the marker to become selected) if the control mode is Off, but it is the SCPI equivalent of entering an X value if the control mode is Normal, Delta, or Fixed.

For SCPI command and parameters, see "CALCulate:MARKer:X" on page 659

Notes

If no suffix is sent it will use the fundamental units for the current marker X Axis Scale. If a suffix is sent that does not match the current marker X Axis Scale unit, an invalid suffix message will be generated.

If the specified marker is Fixed and a Marker Function is on, a message is generated. If the key is pressed, an advisory message is generated. If the equivalent SCPI command is sent, this same message is generated as part of a "–221, Settings conflict" warning.

The query returns the marker's absolute X Axis value if the control mode is Normal or Fixed. It returns the offset from the marker's reference marker if the control mode is Delta. The query is returned in the fundamental units for the current marker X Axis scale: Hz for Frequency and Inverse Time, seconds for Period and Time. If the marker is Off the response is not a number.

Dependencies

Grayed out and displays three dashes for the value when the selected Marker is Off.

You cannot directly set the X value of a Fixed marker which has a marker function turned on.. If an attempt is made to actually adjust it while a Marker Function is on, a warning message is generated.

Marker Backwards Compatibility

In earlier HP/Agilent/Keysight analyzers, markers were position markers, which means that Normal and Delta markers stayed at the same screen position when X Axis parameters were changed. So a marker at center screen stayed at center screen even if Center Frequency was changed (which means that the marker's frequency changed). In the X-Series, markers are value markers, which means that when the analyzer's X Axis settings are changed, the marker's X Axis value in fundamental X Axis units remains unchanged. For example, if you put a marker at a particular frequency, it will stay at that frequency regardless of whether or not you change the Center Frequency of the analyzer, even if that means that the marker ends up offscreen.

While this change resulted in an overall higher level of usability of the marker system, there are some use cases where the user depends on the marker staying at the center of the screen. The most common one is where the user turns on a marker at center screen and uses it to measure the trace amplitude at the center frequency or at a series of center frequencies, without the need to ever move the marker. In the X-Series, to mimic the legacy behavior for this use case, the user must turn the marker off and then back on after changing the center frequency of the analyzer. This causes the marker to reappear in the center of the screen.

Also as a result of the change from position markers to value markers, markers can be at a frequency which is offscreen, whereas in the past, they were clipped to the screen edges and hence were never offscreen. Users who depended on this clipping behavior to force markers to the edges of the screen will have to rewrite their code.

Furthermore, since markers could never be offscreen they always returned a valid result. In the X-Series, markers which are offscreen return not a number as a result; hence the potential now exists for not a number to be returned for a marker query.

4.3.4.46 Band Function

Band Functions are Marker Functions that allow you to define a band of frequencies around the marker. The band defines the region of data used for the numerical calculations. These marker functions also allow you to perform mathematical calculations on trace and marker data and report the results of these calculations in place of the normal marker result.

NOTE **Unlike regular markers, Band Function markers are not placed directly on the trace. They are placed at a location which is relative to the result of the function calculation.**

For SCPI command and parameters, see "CALCulate:MARKer:FUNCtion:POWer Subsystem" on page 674

Notes

The zero-width case and the case of a width less than .499 buckets is treated as one bucket wide although it shows a width of 0.

When the trace the marker is on crosses domains, the width crosses domains as well, to remain the same percentage of the trace.

Sending this command selects the specifies marker

Dependencies

Fixed markers: It is not possible to change the Band Function for a Fixed marker; so the Band Function selections are grayed out for a Fixed marker.

If a marker function was already on when the marker became Fixed, then the selected Band Function is shown but cannot be changed. Therefore, you cannot directly set the X or Y value of a Fixed marker that has a marker function turned on. To turn off the function, turn off the marker.

Average detector and Power Averaging are auto selected when Marker Noise on

If the selected (specified) marker is off, selecting Marker Noise via front panel or SCPI will turn the marker on.

Couplings

When you choose any Band Function and Band Span Auto/Man is in the Auto state, the Band Span is set to 5% of the screen width.

Adjusting the Band Span sets Band Span Auto/Man to Man.

While in Marker Noise and with Band Span Auto/Man in the Auto state, if the analyzer Span is changed Band Span will stay at 5% of the new span.

If the selected (specified) marker is off, selecting a Band Function via front panel or SCPI will turn the marker on.

If the detector mode for the detector on the marker's trace is set to Auto, the average detector is selected. If the Average type is set to Auto, Power Averaging is selected. Other choices for the detector or Average type will usually cause measurement inaccuracy.

Backwards Compatibility

The introduction of adjustable-width Band Functions in the X-Series fundamentally changes the way Band Power markers are controlled. See the section entitled Band Function Backwards Compatibility below for a complete discussion of programming Band Functions in a backwards compatible fashion.

More Information

The Band Functions are Marker Noise, Band Power, and Band Density, only one of which can be on for a given marker.

Value	Example	Notes
Marker Noise	CALC:MARK:FUNC NOIS !turns on marker 1 as a noise marker.	When Marker Noise is on, the marker's Y Axis Result is the average noise level, normalized to a 1 Hz noise power bandwidth, in the band specified under the Band Adjust key. To guarantee accurate data for noise-like signals, a correction for equivalent noise bandwidth is made by the analyzer. The Marker Noise function accuracy is best when the detector is set to Average or Sample, because neither of these detectors will peak-bias the noise. The tradeoff between sweep time and variance of the result is best when Average Type is set to Power Averaging. Therefore, Auto coupling chooses the Average detector and Power Averaging when Marker Noise is on. Though the Marker Noise function works with all settings of detector and Average Type, using the positive or negative peak detector gives less accurate measurement results. Noise Markers assume that the signal to be measured is noise-like. Based on this assumption, we can actually make reasonable measurements under very non-ideal

Value	Example	Notes
		conditions: any detector may be used, any averaging type, any VBW. In contrast, the Band Power and Band Density markers make no assumption about the statistics of the signal.
Band Power	CALC:MARK:FUNC BPOW !turns on marker 1 as a band power marker.	The band power marker computes the total power within a span in a nonzero span. The results computation must include the RBW. In zero span the band power marker measures the average power across a time interval. This is sometimes referred to as the interval power.
Band Density	CALC:MARK3:FUNC BDEN !turns on marker 3 as a band density marker.	On frequency domain traces, the band density across a band is the total band power divided by the bandwidth over which it is measured. In zero span the band density marker measures the average power across a time interval, divided by Bn. Bn is the noise bandwidth of the RBW filter, as noted and used within the Band Power computation. This is sometimes referred to as the interval density. It may seem like the band density marker function is exactly like a function of a noise marker with variable width. But they are somewhat different. The Noise marker assumes that the signal to be measured is noise-like and applies a correction based on that assumption. The Band Density markers make no assumption about the statistics of the signal
Off	:CALC:MARK:FUNC OFF turns off band functions for marker 1	Off turns off all Band Functions. Turning off the marker function has no effect on the band span nor does it turn the marker off.

4.3.4.47 Band Span

Determines whether the Band Span for Marker Noise will track the analyzer’s Span.

When you choose any Band Function and Band Span Auto/Man is in the Auto state, the Band Span is set to 5% of the screen width.

Adjusting the Band Span sets Band Span Auto/Man to Man.

This function only affects Marker Noise. While in Marker Noise and with Band Span Auto/Man in the Auto state, if the analyzer Span is changed Band Span will stay at 5% of the new span.

If Band Span Auto/Man is in the Man state, the Band Span does not change when the Span is changed. Also, if any Band Function but Marker Noise is in effect, the Band Span does not change when the Span is changed.

The Band Span is set to 5% regardless of whether or not this would place part of the Band offscreen. The Marker Noise function is well able to function with part of the band offscreen.

Note that, if in Zero Span, “Span” should be replaced by “Sweep Time” in the discussion above.

Command	`:CALCulate:MARKe [1|2|3|4|5|6|7|8|9|10|11|12:FUNCtion:BAND:SPAN:AUTO ON|OFF` `:CALCulate:MARKer[1]|2|3|4|5|6|7|8|9|10|11|12:FUNCtion:BAND:SPAN:AUTO?`
Example	:CALC:MARK12:FUNC:BAND:SPAN:AUTO ON sets the band span of marker 12 to Auto :CALC:MARK:FUNC:BAND:SPAN:AUTO? queries the auto band span state of Marker 1
Preset	Auto
State Saved	Saved in instrument state.

Dependencies

This only appears when the Marker Function for the selected marker is Marker Noise.

If the SCPI command is sent to a marker that does not have Marker Noise selected, it is honored but of course, the user will not see any indication of this.

Couplings

When Auto Band Span is turned on, it immediately adjusts the band span to 5% of the Span. If you select Marker Noise, and Auto Band Span is on, the Band Span will immediately change to 5% of Span.

If the Band Span is changed, either by the Band Span key, the Band Left key, or the Band Right key, or the equivalent SCPI commands, this function is set to Man.

Backwards Compatibility

In legacy analyzers, the Noise Marker had a width that was always equal to 5% of the span. But in the X-Series it is possible for the user to change the span of the Marker Noise band using the Band Adjust function. To preserve the legacy behavior, the Band Span Auto/Man function is provided. When it is in Auto, which it is by default, the Maker Noise band is always held at 5% of Span, even if the Span changes. When the user adjusts the Marker Noise Band Span, Band Span Auto/Man is set to Manual. So the legacy behavior is preserved, but now the user can set the Marker Noise Span as well and that setting will be preserved when Span is changed.

4.3.4.48 Band Left

Sets the left edge frequency or time for the band of the selected marker. The right edge is unaffected.

Command	`:CALCulate:MARKer[1]|2|3|4|5|6|7|8|9|10|11|12:FUNCtion:BAND:LEFT <freq>` `:CALCulate:MARKer[1]|2|3|4|5|6|7|8|9|10|11|12:FUNCtion:BAND:LEFT?`

Example	:CALC:MARK12:FUNC:BAND:LEFT 20 GHz sets the left edge of the band span of marker 12 to 20 GHz :CALC:MARK:FUNC:BAND:LEFT? queries the band span of Marker 1
Preset	If 0, Band Span is set to 5% of span, when a marker function is turned on, which affects Band Left.
Min/Max	Min: 0 Hz Max: Infinity. Unlike legacy analyzers, where the markers were forced to be on screen, X-Series marker values are not limited and do not clip.
State Saved	Saved in instrument state.

Notes

Units are those of the trace's domain, Hz for frequency domain, s for time domain. When the left edge is moved, the right edge stays anchored; thus, the marker's frequency will change.

Sending this command selects the subopcoded marker

The unit of the parameter must match the current domain of the trace the selected marker is on, or an invalid suffix error will be generated. If no unit is sent the fundamental unit for the trace domain will be used (Hz for freq domain traces, s for time domain traces).

Note that all the values provided in this table are only valid for frequency domain traces. If the current domain of the trace is time domain, values and unit will be different. In frequency domain, the Preset value is dependent on the frequency range of the instrument. The default value 1.3245 GHz is appropriate only if the instrument is a 26.5 GHz instrument (Option 526). In a 26.5 GHz Instrument, the default span is 26.49 GHz, so 5% of the span corresponds to 1.3245 GHz.

Couplings

Changing the Band Left necessarily changes the Band Span and Band Center values.

Band Span is set to 0 when the marker is turned off so that means Band Left is set to the center value at this time.

Band Span is set to 5% of span when any marker function is turned on if and only if it is zero at that time.

Backwards Compatibility

:CALCulate:MARKer[1]|2|3|4:X:STARt

4.3.4.49 Band Right

Sets the right edge frequency or time for the band of the selected marker. The left edge is unaffected.

Command	`:CALCulate:MARKer[1]|2|3|4|5|6|7|8|9|10|11|12:FUNCtion:BAND:RIGHt <freq>` `:CALCulate:MARKer[1]|2|3|4|5|6|7|8|9|10|11|12:FUNCtion:BAND:RIGHt?`

Example	:CALC:MARK12:FUNC:BAND:RIGHt 20 GHz sets the right edge of the band span of marker 12 to 20 GHz :CALC:MARK:FUNC:BAND:RIGHt? queries the band span of Marker 1
Preset	If 0, Band Span is set to 5% of span, when a marker function is turned on, which affects Band Right.
Min/Max	Min: 0 Hz Max: Infinity. Unlike legacy analyzers, where the markers were forced to be on screen, X-Series marker values are not limited and do not clip.
State Saved	Saved in instrument state.

Notes

Units are those of the trace's domain, Hz for frequency domain, s for time domain. When the right edge is moved, the left edge stays anchored; thus, the marker's frequency will change.

Sending this command selects the subopcoded marker

The unit of the parameter must match the current domain of the trace the selected marker is on, or an invalid suffix error will be generated. If no unit is sent the fundamental unit for the trace domain will be used (Hz for freq domain traces, s for time domain traces).

Note that all the values provided in this table are only valid for frequency domain traces. If the current domain of the trace is time domain, values and unit will be different. In frequency domain, the Preset value is dependent on the frequency range of the instrument. The default value 1.3245 GHz is appropriate only if the instrument is a 26.5 GHz instrument (Option 526). In a 26.5 GHz Instrument, the default span is 26.49 GHz, so 5% of the span corresponds to 1.3245 GHz.

Couplings

Changing the Band Right necessarily changes the Band Span and Band Center values

Band Span is set to 0 when the marker is turned off so that means Band Right is set to the center value at this time

Backwards Compatibility

:CALCulate:MARKer[1]|2|3|4:X:STOP

:CALCulate:MARKer[1]|2|3|4:X:POSition:STOP <integer>

:CALCulate:MARKer[1]|2|3|4:X:POSition:STOP?

:CALCulate:MARKer[n]:X:POSition:STOP <param>

! was used to control the Delta marker in trace points (buckets) in Band Pair/Delta Pair mode. There is no new command for setting the stop of a Band Function in trace points. So, when this command is received, the analyzer first converts the specified span in trace points to the current X Axis Scale Units (e.g., frequency or time) of the trace upon which the marker resides. Then, that value is sent to the

:CALC:MARKer[n]:FUNCtion:BAND:RIGHt <param>

! command to set the stop of the marker's Band Function.

! The query form of the command will return the marker function RIGHt value in trace points (buckets) by translating back based on the current X Axis Scale settings at the time the query is sent.

See "Band Function" on page 198, Band Functions Backwards Compatibility for more information.

4.3.4.50 N dB Points

Turns N dB points on and off and allows you to set the N dB value. N dB uses the selected marker. If the selected marker is not on when N dB is turned on, the selected marker turns on, as a Normal marker, at center screen, and is used by N dB.

If the selected marker is turned Off it turns off N dB Points.

N dB Points is unaffected by Auto Couple.

SCPI Command not available in SCPI LC Mode

Preset	–3.01dB
Min/Max	–140 dB/–0.01 dB
State Saved	The on/off status and the offset value are both saved in instrument state.

Backwards Compatibility

In ESA, N dB points paid attention to the peak excursion and peak threshold set in the Search Criteria menu under Peak Search. This is not the case in the X-Series.

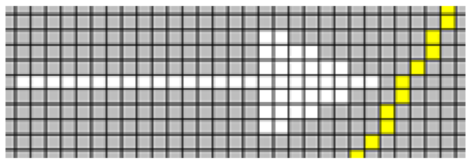
In ESA, an invalid N dB reading was indicated, both onscreen and remotely, with a value of –100. In the X-Series it is indicated on screen by --- but remotely still by –100 Hz

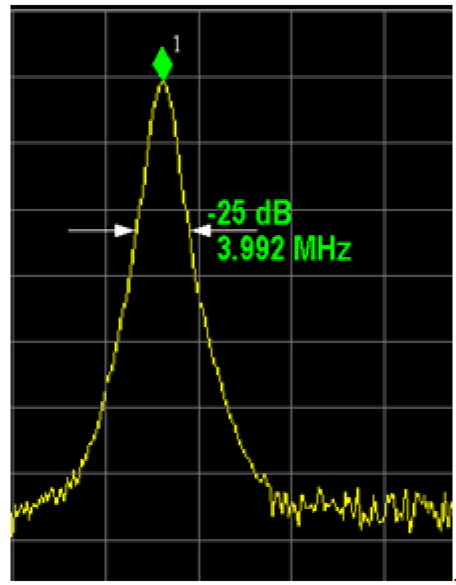
More Information

A marker should be placed on the peak of interest before turning on N dB

points. The N dB points function looks for the two points on the marker's trace closest to the marker's X Axis value that are N dB below the marker's amplitude, one above and the other below the marker's X Axis value. (That is, one point is to the right and one is to the left of the selected marker.) The selected N dB value is called the offset. The function reports the frequency difference (for frequency domain traces) or time difference (for time domain traces) between those two points.

Each point is identified by a horizontal arrow pointing towards the marker, next to the trace. The arrows used by the N dB Points function will be as shown in the figure below (where each square represents one pixel). They point in, horizontally, at the trace below a peak, on either side of its skirts. There is one pixel between the arrow and the trace, as shown below:

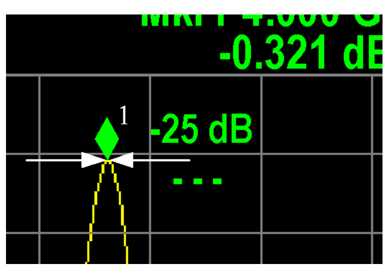




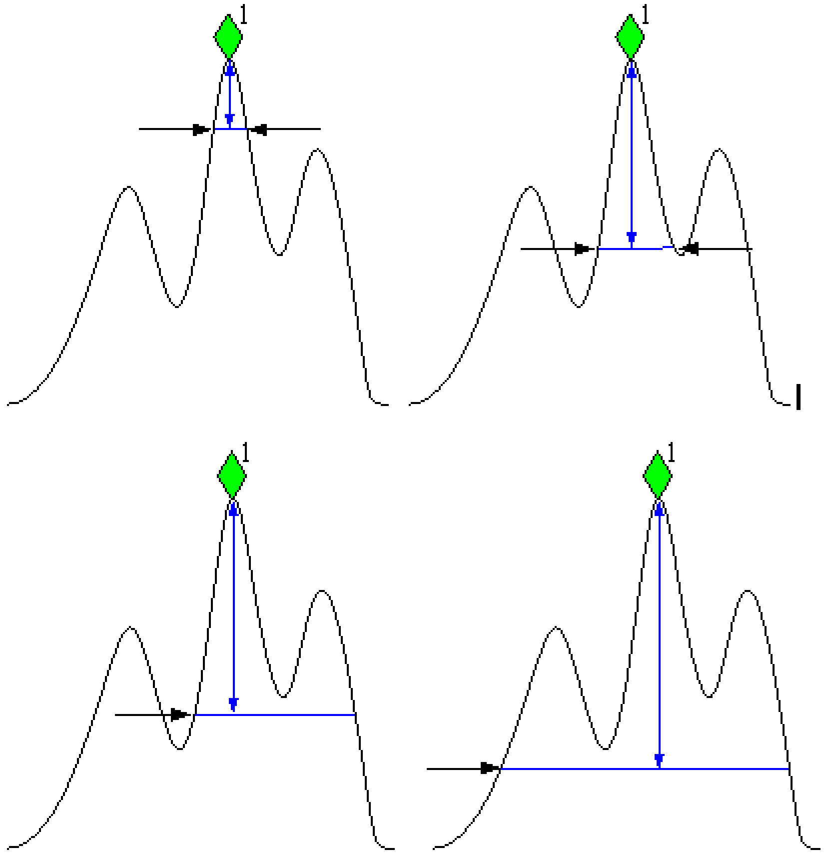
N dB Points can be used to measure the bandwidth of a signal; it is commonly used in conjunction with a tracking generator to measure filter bandwidths.

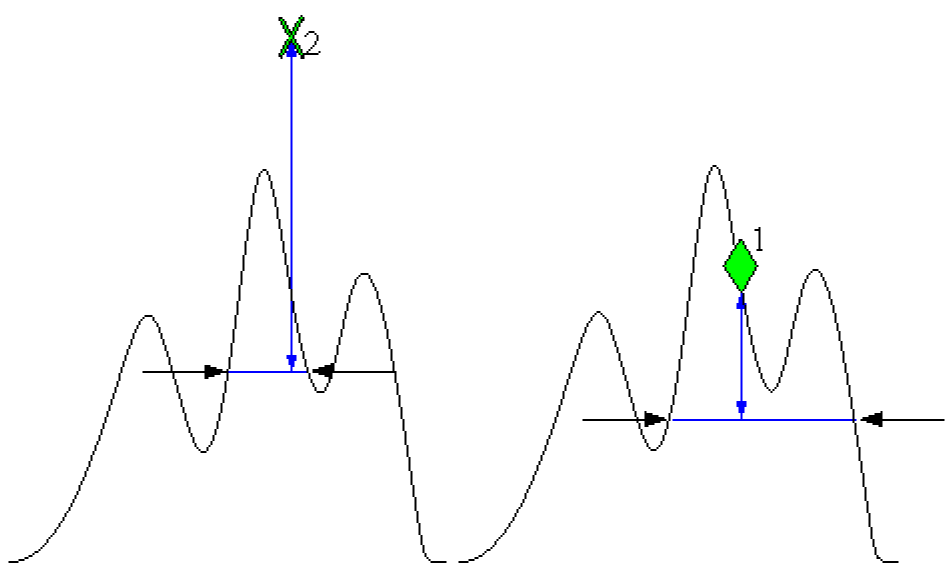
In one of the common use cases, the marker is placed on a peak, and the arrows are displayed N dB down the skirt from the marker on either side of the peak. The N dB value and the frequency difference between the two arrows is displayed around the arrow as shown in the figure above. Normally this displays on the right hand arrow, but if this would place any part of the text offscreen to the right then it displays on the left arrow.

If the analyzer is unable to find data that is N dB below the marker on either side of the marker, the arrows are displayed at the indicator point of the marker, no value (---) will be displayed as the result and –100 Hz returned remotely (see figure below):



Some sample N dB scenarios are shown below to illustrate how the function works in various cases. In each case, the two-headed blue arrow represents N dB of amplitude.





4.3.4.51 Measure at Marker

When this key is pressed, the analyzer executes one Measure at Marker function and then returns. Measure at Marker goes to the frequency of the selected marker and takes a reading with each of the three detectors selected in the Detectors menu, using the dwell times specified there, then displays the readings in a window on the display, using the current Y-Axis Unit.

When the Measure at Marker is complete, the analyzer restores all settings to their pre-Measure-at-Marker values and normal sweeps resume.

SCPI Command not available in SCPI LC Mode

Dependencies

This control only appears with the N6141A or W6141A application or when Option EMC is installed and licensed.

If BW & Avg Type is in an Autocoupled state, the (up to three) measurements taken by Measure at Marker are taken with Auto Coupled settings for the functions in the BW menu, even if those functions are in manual.

Couplings

If the specified Marker is not on, the analyzer turns it on at the center of the screen and does a peak search before performing the function.

4.3.4.52 Measure at Marker Config

Measure at Marker Config opens up a dialog that allows you to configure the Measure at Marker Function.

The two most important settings are the detectors and the dwelltime associated with each. Any of the analyzer’s detectors (up to three) can be used as the Measure at Marker detectors, or any of the three can be turned off. The dwell time for each detector is also settable.

When performing a Meas at Marker, the dwell time settings that you select will depend on the characteristics of the emission you are measuring. The default dwell time (200 ms) should work well for typical EUT emissions, but sometimes you will encounter emissions for which the defaults are not optimal. This is especially the case for emissions that vary slowly over time or have a slow repetition rate. By lengthening the dwell times you can increase the likelihood of accurately measuring these low repetition rate signals.

When Measure at Marker is activated, the receiver makes a zero span measurement for each of the (up to) three detectors selected, using the Dwell Time set for each detector. If the signal's repetition period is greater than 200 ms (the default setting), the dwell time should be increased to capture at least two and preferably more repetitions of the signal. Additionally, if you do not need or do not wish to use a detector to make a measurement, that specific detector may be turned off.

If the Measure at Marker window is being displayed, and one of the detectors is changed, any value being displayed for that detector changes to “---“ until the next successful reading from that detector.

Measure at Marker Window

This control turns the Measure at Marker window on and off. It turns on automatically when Measure at Marker is initiated and turns off on a Preset. If the Window is turned on without a Measure at Marker result, “---“ is displayed for each result for which the detector is not “Off”.

Command	`:DISPlay:WINDow:MAMarker[:STATe] ON|OFF|1|0` `:DISPlay:WINDow:MAMarker[:STATe]?`
Example	DISP:WIND:MAM ON
Preset	OFF
State Saved	Saved in instrument state.

4.3.4.53 Marker Frequency|Time

The Marker Frequency control is the fundamental control that you use to move a marker around on the trace. Because it is the default active function in the Marker menu, all you need to do is press Marker and turn the knob to move the marker left and right on the display. This is always the first control on any Marker menu page which follows the Selected Marker.

When in Zero Span (for measurements that support Zero Span), the label on this control changes to “Marker Time”. When the Marker Mode is Delta, the label changes to “Marker Δ Frequency” or Marker Δ Time”

The SCPI command sets the marker X Axis value in the current marker X Axis Scale unit. The marker that is addressed becomes the selected marker. It has no effect (other than to cause the marker to become selected) if the control mode is Off, but it is the SCPI equivalent of entering an X value if the control mode is Normal, Delta, or Fixed.

For SCPI command and parameters, see "CALCulate:MARKer:X" on page 659

Notes

If no suffix is sent it will use the fundamental units for the current marker X Axis Scale. If a suffix is sent that does not match the current marker X Axis Scale unit, an invalid suffix message will be generated.

If the specified marker is Fixed and a Marker Function is on, a message is generated. If the key is pressed, an advisory message is generated. If the equivalent SCPI command is sent, this same message is generated as part of a “–221, Settings conflict” warning.

The query returns the marker's absolute X Axis value if the control mode is Normal or Fixed. It returns the offset from the marker's reference marker if the control mode is Delta. The query is returned in the fundamental units for the current marker X Axis scale: Hz for Frequency and Inverse Time, seconds for Period and Time. If the marker is Off the response is not a number.

Dependencies

Grayed out and displays three dashes for the value when the selected Marker is Off.

You cannot directly set the X value of a Fixed marker which has a marker function turned on.. If an attempt is made to actually adjust it while a Marker Function is on, a warning message is generated.

Marker Backwards Compatibility

In earlier HP/Agilent/Keysight analyzers, markers were position markers, which means that Normal and Delta markers stayed at the same screen position when X Axis parameters were changed. So a marker at center screen stayed at center screen even if Center Frequency was changed (which means that the marker's frequency changed). In the X-Series, markers are value markers, which means that when the analyzer's X Axis settings are changed, the marker's X Axis value in fundamental X Axis units remains unchanged. For example, if you put a marker at a particular frequency, it will stay at that frequency regardless of whether or not you change the Center Frequency of the analyzer, even if that means that the marker ends up offscreen.

While this change resulted in an overall higher level of usability of the marker system, there are some use cases where the user depends on the marker staying at the center of the screen. The most common one is where the user turns on a marker at center screen and uses it to measure the trace amplitude at the center frequency or at a series of center frequencies, without the need to ever move the marker. In the X-Series, to mimic the legacy behavior for this use case, the user must turn the marker off and then back on after changing the center frequency of the analyzer. This causes the marker to reappear in the center of the screen.

Also as a result of the change from position markers to value markers, markers can be at a frequency which is offscreen, whereas in the past, they were clipped to the screen edges and hence were never offscreen. Users who depended on this clipping behavior to force markers to the edges of the screen will have to rewrite their code. Furthermore, since markers could never be offscreen they always returned a valid result. In the X-Series, markers which are offscreen return not a number as a result; hence the potential now exists for not a number to be returned for a marker query.

4.3.4.54 Marker -> CF

Sets the center frequency of the analyzer to the frequency of the selected marker. The marker stays at this frequency, so it moves to the center of the display. In delta marker mode, this function sets the center frequency to the x-axis value of the delta marker. When the frequency scale is in log mode, the center frequency is not at the center of the display.

If the currently selected marker is not on when this key is pressed, it will be turned on at the center of the screen as a normal type marker.

SCPI Command not available in SCPI LC Mode

Dependencies

This function is not available (key is grayed out) when x-axis is the time domain

Couplings

All the usual couplings associated with setting Center Frequency apply.

4.3.4.55 Marker -> CF Step

Sets the center frequency (CF) step size of the analyzer to the marker frequency, or in a delta-marker mode, to the frequency difference between the delta and reference markers.

If the currently selected marker is not on when this key is pressed, it will be turned on at the center of the screen as a normal type marker.

SCPI Command not available in SCPI LC Mode

Dependencies

This function is not available (key is grayed out) when x-axis is the time domain.

Couplings

All the usual couplings associated with setting CF Step apply.

4.3.4.56 Marker -> Start

Changes the start frequency to the frequency of the selected marker. The marker stays at this frequency, so it moves to the left edge of the display. In delta marker mode, this function sets the start frequency to the x-axis value of the delta marker.

If the currently selected marker is not on when this key is pressed, it will be turned on at the center of the screen as a normal type marker.

SCPI Command not available in SCPI LC Mode

Dependencies

This function is not available (key is grayed out) when x-axis is the time domain.

Couplings

All the usual couplings associated with setting Start Frequency apply.

4.3.4.57 Marker -> Stop

Changes the stop frequency to the frequency of the selected marker. The marker stays at this frequency, so it moves to the right edge of the display. In delta marker mode, this function sets the stop frequency to the x-axis value of the delta marker.

If the currently selected marker is not on when this key is pressed, it will be turned on at the center of the screen as a normal type marker.

SCPI Command not available in SCPI LC Mode

Dependencies

This function is not available (key is grayed out) when x-axis is the time domain.

Couplings

All the usual couplings associated with setting Stop Frequency apply.

4.3.4.58 Marker -> Ref Lvl

Sets the reference level to the amplitude value of the selected marker, moving the marked point to the reference level (top line of the graticule). The marker's mode (Normal, Delta, Fixed) doesn't matter in this case. For example, given a delta marker, if the delta marker is the selected marker, its amplitude is applied to the reference level. If the reference marker is selected, its amplitude is applied to the reference level.

If the currently selected marker is not on when this key is pressed, it will be turned on at the center of the screen as a normal type marker, and its amplitude applied to the reference level.

SCPI Command not available in SCPI LC Mode

Couplings

All the usual couplings associated with setting Reference Level apply.

Backwards Compatibility

Mkr-> RefLvl behavior for a delta marker is slightly different from earlier models. ESA would calculate the delta amplitude (difference between reference marker and delta marker in dB) and assign that value to the reference level (in dBm). PSA would just assign the delta marker's amplitude to the reference level, ignoring the reference marker altogether. The X-Series products allow the user to select either the reference or the delta marker individually. It is the selected marker's amplitude that will be applied to the reference level.

4.3.4.59 Marker Δ -> CF

Sets the center frequency to the frequency difference between the selected marker and its reference marker. The marker is then changed to a Normal marker and placed at the center of span.

SCPI Command not available in SCPI LC Mode

Dependencies

This function is only available when the selected marker is a delta marker. Otherwise the key is grayed out.

In addition, this function is not available when x-axis is the time domain.

4.3.4.60 Marker Δ -> Span

Sets the start and stop frequencies to the values of the delta markers. That is, it moves the lower of the two marker frequencies to the start frequency and the higher of the two marker frequencies to the stop frequency. The marker mode is unchanged and the two markers (delta and reference) end up on opposite edges of the display.

SCPI Command not available in SCPI LC Mode

Dependencies

This function is only available when the selected marker is a delta marker. Otherwise the key is grayed out.

In addition, this function is not available when x-axis is the time domain.

Couplings

All the usual couplings associated with setting Span apply.

4.3.4.61 Marker Count

Turns the marker frequency counter on and off. The selected marker is counted, and if the selected marker is a delta marker and its reference marker is not fixed, the reference marker is counted as well.

See "Understanding Marker Count" on page 214:

– "Delta Marker" on page 214

– "Fixed Markers" on page 214

– "More Information on "Counter"" on page 215

SCPI Command not available in SCPI LC Mode

Preset	OFF
State Saved	The state of the counter (on/off) is saved in instrument state. In the case of Fixed markers, the count stored in the marker is saved in instrument state.

Notes

Fixed markers are not counted, but a Fixed marker will have a count stored in it if it is selected or is the reference marker for the selected marker. The count already in the marker is stored when the marker becomes fixed and if there is none or the marker moves (for example, Pk Search) it is counted and stored after the next sweep.

If a Fixed marker has a count stored in it, that count will be displayed when the marker is selected, and used as the reference count when that marker is a reference marker.

If a Fixed marker has a count stored in it, that count will be deleted if the marker X is adjusted.

If a Fixed marker has a count stored in it, and a Search function is performed using the Fixed marker, while the counter is on, the count stored in the marker will be updated.

If a Fixed marker has a count stored in it, and is a reference marker, and the reference is moved to a valid trace point by re-zeroing the delta (by pressing Delta again), while the counter is on, the count stored in the marker will be updated.

Dependencies

Marker Count is unavailable (grayed out and Off) if the Gate function is on

Couplings

If the selected marker is Off when the counter is turned on, the selected marker is set to Normal and placed at center of screen on the trace determined by the Marker Trace rules.

Backwards Compatibility

In some legacy analyzers (e.g., the 8560 series) the FreqOffset value was applied to the Marker Count. In others (e.g., ESA and PSA) it was not. The X-Series follows the ESA/PSA model and does not apply Freq Offset to the Marker Count.

In ESA and PSA the reference marker for Delta markers was always counted. In the X-Series the marker is counted for Normal and Delta markers; but for the reference marker, if it is a Fixed marker, we use the count stored in the Fixed marker. This enhanced capability may require a change to some users' code and/or test procedures.

Understanding Marker Count

Using the internal counter we can count the frequency of a marker, but we cannot count while we are actually sweeping. So, once we are done with a sweep, we move to the selected marker frequency and count that frequency. Then, if the marker is a Delta marker, the count is also taken for its reference marker. The count is actually performed by moving the LO to the frequency (or frequencies in the case of a delta marker) we wish to count. The count is executed on a marker by marker basis and no further count is taken until after the next sweep (even if the marker moves before another sweep has completed).

The Marker Count is taken by tuning the instrument to the frequency of the marker and counting the IF, with the instrument not sweeping. The count is adjusted for display by adding or subtracting it (as appropriate) from the LO frequency, so that you see a count that represents the signal frequency. This is true even if External Mixing is on. Since all this happens between sweeps, you never see the instrument retuning to do the counts.

If you wish to see the entered frequency of a counted marker it will appear in the active function area when that marker is selected (for Fixed markers, you have to press the Marker, Fixed key to select Fixed markers and then press it a second time to view or adjust the x or y marker values).

Counting Off-screen Markers

If the selected marker is off the X-axis the instrument can still be tuned to the marker (unless it is outside the current range of the instrument), so the count can still be displayed. This means you can see a count for an off-screen marker even though there may be no valid Y-value for the marker. If the marker frequency is outside the range of the instrument, the display will show three dashes in the count block (---), and not a number is returned to a SCPI count query

Delta Marker

When a Delta Marker is selected while Marker Count is on:

1. If the reference marker is not a fixed marker, the display shows the difference between the count of the selected marker and the count of the reference marker

2. If the reference marker is a fixed marker and there is a count stored in the marker (because Marker Count was on when the marker became a fixed marker), the display shows the difference between the count at the marker and the count stored in the reference marker.

Marker Count works in zero span as well as in Swept SA. The instrument tunes to the frequency of the selected marker, which, for active zero span traces, is simply the center frequency of the analyzer.

Fixed Markers

Fixed markers have a count stored in them that is generally kept fixed and not updated. If a fixed marker is selected, or used as a reference, the signal at the marker frequency is not counted; rather the stored count is seen or used as the reference. The count is stored, if Count is on, when the marker becomes fixed or when, while fixed, the marker is moved by re-zeroing the reference (if it is the reference marker) or via a peak search (since both of these, by definition, use valid trace data). The count stored in a Fixed marker is lost if the counter is turned off, if the marker is moved to an inactive trace, or if the marker is moved by adjusting its x-value.

More Information on "Counter"

When the counter is on, the count (or the delta count) for the selected marker is displayed.

The invalid data indicator (*) will turn on until the completion of the first count.

Marker Count frequency readings are corrected using the Freq Offset function (in some previous analyzers, they were not). Note however that Marker Delta readings are not corrected, as any offset would be applied to both.

In zero span on active traces the counter continues to function, counting any signal near the center frequency of the analyzer.

NOTE	**No signal farther from the marker frequency than the Res BW will be seen by the counter.**

The above command turns on or off the frequency counter. If the specified marker number in the command is not the selected marker, it becomes the selected marker. If the specified marker number is not on, FCOunt ON sets it to Normal and places it at center of screen on the trace determined by the Marker Trace rules. Once the marker count is on, it is on for any selected marker, not just for the one used in the command. A 1 is returned to the state query only if marker count is on and the specified number is the selected marker. The invalid data indicator (*) will turn on until the completion of the first count but this does not keep a value from being returned.

4.3.4.62 Counter Gate

Controls the length of time during which the frequency counter measures the signal frequency. Longer gate times allow for greater averaging of signals whose frequency is “noisy”, though the measurement takes longer. If the gate time is an integer multiple of the length of a power-line cycle (20 ms for 50 Hz power, 16.67 ms for 60 Hz power), the counter rejects incidental modulation at the power line rate. The shortest gate time that rejects both 50 and 60 Hz modulation is 100 ms, which is the value chosen in Auto, or on Preset or when Auto Couple is pressed.

The start time of the Gate Time of the counter must be controlled by the same trigger parameters as controls the sweep. Thus, if the Trigger is not in Free Run, the counter gate must not start until after the trigger is received and delayed.

SCPI Command not available in SCPI LC Mode

Preset	100 ms ON
Min/Max	1 µs/500 ms
State Saved	Saved in instrument state.

Notes

When Auto Couple is pressed, Gate Time is set to 100 ms.

4.3.5 SCPILC Setting Tab

This tab appears only when the SCPI LC Mode is selected. It contains controls that are specific to this application.

4.3.5.1 Compatibility Model

The command allows you to set the model you want to emulate.

The query returns the model currently being emulated.

This setting affects the response string of "*IDN?", and the entire SCPI tree, according to the current selection.

Remote Command	`[:SENSe]:RLC:TYPE FSE|FSP|FSU|ESU|FSL|FSV|FSW` `[:SENSe]:RLC:TYPE?`
Example	`SENS:RLC:TYPE FSU` `RLC:TYPE?`
State Saved	PON
Range	FSE | FSP| FSU | ESU | FSL | FSV | FSW

R&S FSE

Selects emulation of the R&S FSE.

Example	`RLC:TYPE FSE`

R&S FSP

Selects emulation of the R&S FSP.

Example	`RLC:TYPE FSP`

R&S FSU

Selects emulation of the R&S FSU.

Example	`RLC:TYPE FSU`

R&S ESU

Selects emulation of the R&S ESU.

Example	`RLC:TYPE ESU`

R&S FSL

Selects emulation of the R&S FSL.

Example	`RLC:TYPE FSL`

R&S FSV

Selects emulation of the R&S FSV.

Example	`RLC:TYPE FSV`

R&S FSW

Selects emulation of the R&S FSW.

Example	`RLC:TYPE FSW`

4.3.5.2 Mode IDN Response

The command allows you to set or query the Mode IDN Response type.

This setting affects the response string of "*IDN?", and the whole SCPI tree, according to the current selection.

The query returns the current state of this setting.

– When set to "COMPatibility", the response of "*IDN?" is of the form "Rohde&Schwarz,FSx-00,000000/000,00.00". "FSx" is determined by the current selected model.

– When set to “SYSTem”, the response of “*IDN?” is of the form “Keysight Technologies,N9040B,AA00000000,A.21.00”.

– When set to “USER”, please refer to "User IDN Response" on page 218.

Remote Command	`[:SENSe]:RLC:IDN:TYPE SYSTem|COMPatibility|USER` `[:SENSe]:RLC:IDN:TYPE?`
Example	`SENS:RLC:IDN:TYPE SYSTem` `RLC:IDN:TYPE?`
State Saved	PON
Range	SYSTem | COMPatibility | USER

Compatibility Model

Sets the response to the *IDN command to be a string describing the emulated instrument, such as “FSP”.

Example	`RLC:IDN:TYPE COMP`

System IDN Response

Sets the response to the *IDN command to be a string describing the analyzer model, such as “N9020A”.

Example	`RLC:IDN:TYPE SYST`

User IDN Response

Allows you to set or query the user-defined mode IDN response.

This setting affects the response string of “*IDN?”, and the whole SCPI tree, according to the current selection.

The query returns the current User IDN Response string, unless the string is empty, in which case the System IDN Response is returned instead.

Remote Command	`[:SENSe]:RLC:IDN:USER <string>` `[:SENSe]:RLC:IDN:USER?`
Example	`SENS:RLC:IDN:USER “abc”` `RLC:IDN:USER?`
State Saved	PON

4.3.5.3 Preferences

Band Type FFT

Enables/Disables FFT in Band Type SCPI command.

When this setting is ON, FFT may be available, depending on the configuration or the user's selection.

When this setting is OFF, FFT will not be enabled in any case, even if "BAND:TYPE FFT" is received.

Preset	On
State Saved	PON
Range	ON | OFF

Max FFT Width

Limit FFT max width.

- When this setting is AUTO, SCPILC uses the auto calculated MAX FFT width.
- When this setting is anything other than AUTO, if the auto calculated MAX FFT width is larger than the selection, SCPILC uses the selection as the FFT max width.

Preset	AUTO
State Saved	PON
Range	AUTO | <4.01 kHz | <28.81 kHz | <167.4kHz | <411.9kHz | ≤7.99 MHz | ≤10.00 MHz | ≤25.00 MHz | ≤40.00 MHz | ≤160.00 MHz

Config Error Report

The settings in this menu enable/disable "SYST:ERR?" responses for some specific errors.

Invalid Character

Enables/Disables invalid character error report for "SYST:ERR?".

When it is OFF, "SYST:ERR?" does not return an "Invalid Character" error if the SCPI command contains any invalid character, for example, "FREQ:%CENT 1GHZ".

Preset	On

State Saved	PON
Range	ON | OFF

Data Out Of Range

Enables/Disables data out of range error report for “SYST:ERR?”.

When this setting is OFF, “SYST:ERR?” does not return “Data Out Of Range” error if the parameter of the SCPI command is out of range, for example, “BAND -10MHZ”.

Preset	On
State Saved	PON
Range	ON | OFF

4.3.5.4 Average/Hold Number

Sets the terminal count number N for Average, Max Hold and Min Hold trace types. This number is an integral part of how the average trace is calculated. Basically, increasing N results in a smoother average trace.

Restarting any of these functions (Average, Max Hold or Min Hold) restarts all of them, as there is only one count.

– See "More Information" on page 220

For SCPI command and parameters, see "[SENSe]:AVERage:COUNt" on page 716

Backwards Compatibility Notes

In older analyzers, when changing the Average Count (now Average/Hold Number), you had to re-start the trace at the beginning of a sweep to ensure valid average data. Now, the system will ensure valid results when changing the count limit.

More Information

When in Single, the sweep stops when N is reached. You can add more sweeps by increasing the Average/Hold Number. For example, if you want to add one more Average, or one more trace to Max Hold or Min Hold, simply increment this number by one, which you can do by pressing the Up key while Average/Hold Number is the active function.

In Cont (continuous), averaging and holding continues even after N is reached. Therefore, using doing trace holding in Cont, the value of N is irrelevant. But for averaging, each new sweep is exponentially averaged in with a weighting equal to N.

For details of how the average trace is calculated and how this depends on the Average/Hold Number, see "Average Type" on page 221. For details on how the various control functions in the instrument start and restart averaging, see "Average Type" on page 221.

4.3.5.5 Average Type

Lets you control the way averaging is done by choosing one of the following averaging scales: Log-Power (Video), Power (RMS), or Voltage averaging. Also lets you choose Auto Average Type (default).

There are four different averaging processes in the Swept SA measurement, and all of them are affected by this setting: Trace Averaging, the Average detector, the Noise Marker, and VBW filtering.

See "More Information" on page 221

For SCPI command and parameters, see "[SENSe]:AVERage:TYPE" on page 717

More Information

There are four different averaging processes in the Swept SA measurement that are affected by this setting:

- Auto – When Auto is selected, the analyzer chooses the optimum type of averaging for the current instrument measurement settings. When one of the average types is selected manually, the analyzer uses that type regardless of other analyzer settings, and shows Man on the Average Type toggle.
- Trace Averaging – averages signal amplitudes on a trace-to-trace basis. When performing Trace Averaging, the equation that is used to calculate the averaged trace depends on the average type. The average type applies to all traces in Trace Average (it is not set on a trace-by-trace basis).
- Average detector – averages signal amplitudes during the time or frequency interval represented by a particular measurement point.
- Noise Marker – averages signal amplitudes across measurement points to reduce variations for noisy signals.
- VBW filtering – adds video filtering which is a form of averaging of the video signal.

Averaging is done by choosing one of the following averaging scales:

Auto

When Auto is selected, the analyzer chooses the optimum type of averaging for the current instrument measurement settings. When one of the average types is selected manually, the analyzer uses that type regardless of other analyzer settings, and shows Man on the Average Type toggle.

Here are the auto-select rules for Average Type:

Auto selects Voltage Averaging if the Detector for any active trace is EMI Average or QPD or RMS Average; otherwise it selects Power (RMS) Averaging if a Marker Function (Marker Noise, Band/Intvl Power) is on, or Detector is set to Man and Average; otherwise if Amplitude, Scale Type is set to Lin it selects Voltage Averaging; otherwise, if the EMC Standard is set to CISPR, it selects Voltage; otherwise Auto selects Log-Power Average.

Note that these rules are only applied to active traces. Traces which are not updating do not impact the auto-selection of Average Type.When you select log-power averaging, the measurement results are the average of the signal level in logarithmic units (decibels). When you select power average (RMS), all measured results are converted into power units before averaging and filtering operations, and converted back to decibels for displaying. Remember: there can be significant differences between the average of the log of power and the log of the average power.

Log-Power (Video)

The Log-Power averaging type selects the logarithmic (decibel) scale for all filtering and averaging processes. This scale is sometimes called “Video” because it is the most common display and analysis scale for the video signal within a spectrum analyzer. This scale is excellent for finding CW signals near noise, but its response to noise-like signals is 2.506 dB lower than the average power of those noise signals. This is compensated for in the Marker Noise function.

The equation for trace averaging on the log-pwr scale is shown below, where K is the number of averages accumulated. (In continuous sweep mode, once K has reached the Average/Hold Number, K stays at that value, providing a continuous running average.)

New avg = ((K−1)Old avg + New data)/K

This equation assumes all values in decibel scale.

Power (RMS)

In this average type, all filtering and averaging processes work on the power (the square of the magnitude) of the signal, instead of its log or envelope voltage. This scale is best for measuring the true time average power of complex signals. This scale is sometimes called RMS because the resulting voltage is proportional to the square root of the mean of the square of the voltage.

In the equation for averaging on this scale (below), K is the number of averages accumulated. (In continuous sweep mode, once K has reached the Average/Hold Number, K stays at that value, providing a running average.)

$$\text{New avg} = 10 \log ((1/K)((K-1)(10^{\text{Old avg}/10})+10^{\text{New data}/10}))$$

This equation assumes all values are in the decibel scale.

Voltage Averaging

In this Average type, all filtering and averaging processes work on the voltage of the envelope of the signal. This scale is good for observing rise and fall behavior of AM or pulse-modulated signals such as radar and TDMA transmitters, but its response to noise-like signals is 1.049 dB lower than the average power of those noise signals. This is compensated for in the Marker Noise function.

In the equation for averaging on this scale (below), K is the number of averages accumulated. (In continuous sweep mode, once K has reached the Average/Hold Number, K stays at that value.)

New avg = 20 log ((1/K)((K−1)($10^{\text{Old avg}/20}$)+$10^{\text{New data}/20}$))

This equation assumes all values are in the decibel scale.

4.3.5.6 Auto Couple

The Auto Couple control immediately puts all Auto/Man functions into Auto for the current measurement only. It does not affect other measurements in the mode.

In the Auto state, Auto/Man functions are said to be “coupled”, meaning their value will change depending on changes you make to other values in the measurement. This helps ensure accurate measurements and optimum dynamic range. Auto Couple is an immediate action function, and when it is executed, all the Auto/Man controls for the current measurement are set to Auto and all measurement settings coupled to the Auto/Man parameters are automatically set to their optimal value.

SCPI Command not available in SCPI LC Mode

4.3.5.7 Meas Preset

This control returns the Meas Local variables in the Swept SA measurement to their preset values.

The only exception is Limits On/Off, which is a persistent Meas Local variable. It will be set to Off by a Mode Preset but not by Meas Preset.

4.3.5.8 Select Limit

Specifies the selected limit. The term “selected limit” is used throughout to specify which limit will be affected by the functions.

The selected limit is remembered even when not in the Limit Menu.

Preset	Limit 1, not affected by Mode Preset, preset by Restore Mode Defaults.
State Saved	Saved in instrument state.

4.3.5.9 Limit

Selects whether the limit and margin are displayed. If Test Limits is on, this also determines whether the test trace will be tested against the limit. If Limit On/Off is On, the following occurs:

- The limit line is displayed, in the same color as the limited trace, but paler. Portions of traces which fail the limits will be displayed in red.
- The margin line is displayed if Margin is on and the Margin Value is non-zero. The margin line is displayed in the same color as the limit line, but paler still and dashed. Portions of traces which pass the limits but fail the margin will be displayed in amber.
- The trace is tested for the purpose of the “Trace Pass/Fail” indication in the graticule if, in addition to Limit On/Off being On, the trace is displayed and Test Limits (All Limits) is on. If the trace is not tested, no report of the trace passing or failing is seen on the graticule. Note that the SCPI queries of Limit Pass/Fail are independent of these conditions. The test is always performed when queried over SCPI.

The PASS/FAIL box in the corner of the Meas Bar is only displayed if there is at least one “Trace Pass/Fail” indication displayed in the graticule.

Note that the red and amber coloring of traces that fail the limits and/or margins only applies to traces whose X-axis corresponds to the current analyzer X-axis. Traces that are not updating (in View, for example) will not change color if the analyzer X-axis settings (e.g., start and stop frequency) do not match those of the trace, for example if they have been changed since the trace stopped updating. In this case, the Invalid Data indicator (*) will appear in the upper right corner.

When the limits are frequency limits but the trace is a zero-span trace, the limit trace is drawn at the limit amplitude of the center frequency. When the limits are time limits but the trace is a frequency domain trace, the limit trace is drawn according to the current time axis, with the left of the screen being 0 and the right being equal to sweep time.

SCPI Command not available in SCPI LC Mode

Preset	OFF
State Saved	Saved in instrument state

Dependencies

This command will generate an “Option not available” error message unless you have the proper option installed in your instrument.)

Couplings

Limit display ON selects the limit.

Testing is done on all displayed limits if Test Limits (All Limits) is ON.

Entering the limit menu from the User Interface turns on the selected limit.

4.3.5.10 Margin

Selects a margin for this limit, which will cause a trace to Fail Margin when the trace is between the limit line and the margin line. Portions of the traces which pass the limit but fail the margin will be displayed in an amber color.

A margin is always specified in dB relative to a limit – an upper limit will always have a negative margin, and a lower limit will always have a positive margin. If a value is entered with the incorrect sign, the system will automatically take the negative of the entered value.

If the limit type is switched from lower to upper while margin is present, the margin will reverse sign.

When the Margin is selected, it may be turned off by pressing the **Margin** key until Off is underlined. This may also be done by performing a preset. Margin is the default active function whenever the margin is on, and it is not the active function whenever the margin is off.

The margin lines are displayed in the same color as limit lines, but paler. If the limited trace is blanked then the limit line and the margin line will be blanked as well.

SCPI Command not available in SCPI LC Mode

Preset	Not affected by Mode Preset, set to 0 dB for all Limits by Restore Mode Defaults.
Min/Max	Min:–40 dB (Upper); 0 dB (Lower) Max:0 dB (Upper); 40 dB (Lower)
State Saved	Saved in instrument state.

4.3.5.11 Type

Selects whether the limit you are editing is an upper or lower limit. An upper limit fails if the trace exceeds the limit. A lower limit fails if the trace falls below the limit.

SCPI Command not available in SCPI LC Mode

Preset	Upper for Line 1, 3, and 5; Lower for Line 2, 4, 6. Not affected by Mode Preset, preset by Restore Mode Defaults.
State Saved	Saved in instrument state.

Couplings

If a margin has already been set for this limit line, and this key is used to change the limit type, then the margin value will reverse sign.

4.3.5.12 Edit Limit

The Edit Limit dialog allows you to edit the content and the properties of the Limit Line.

When entering the menu, the editor window (with the limit table) turns on, the selected Limit is turned On and the amplitude scale is set to Log, and the **Δ**Limit peak table is turned off. The display of the trace to which the selected limit applies is turned on (thus, traces in Blank are set to View and traces in Background are set to On). Turning on the Limit means it's display will be on, and it's testing mode will be on as well. You should turn off any other limits that are on if they interfere with the editing of the selected limit.

The table editor will only operate properly if the analyzer is sweeping, because its updates are tied to the sweep system. Thus, you should not try to use the editor in single sweep, and it will be sluggish during compute-intensive operations like narrow-span FFT sweeps.

When exiting the edit menu (by using the **Return** key or by pressing an instrument front panel key), the editor window turns off, however the Limit is still on and displayed, the **Δ**Limit peak table remains off, and the amplitude scale remains Log.

Limits are turned off by a Preset, but the Limits arrays (data) are only reset (deleted) by Restore Mode Defaults. They survive shutdown and restarting of the analyzer application, which means they will survive a power cycle.

When editing a limit, the editor remembers which limit and which element in the limit array you were editing, and returns you to that limit and that element when you return to the editor after leaving it.

"Select Limit" on page 223

Navigate - lets you move through the table to edit the desired point

Insert Point Below - inserts a point below the current point. The new point is a copy of the current point. And becomes the current point The new point is not yet entered into the underlying table, and the data in the row is displayed in light gray

Delete Point - immediately deletes the currently selected point, whether or not that point is being edited, and selects Navigate. The point following the currently selected point (or the point preceding if there is none) will be selected.

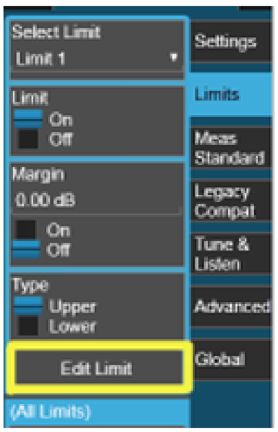
Navigate

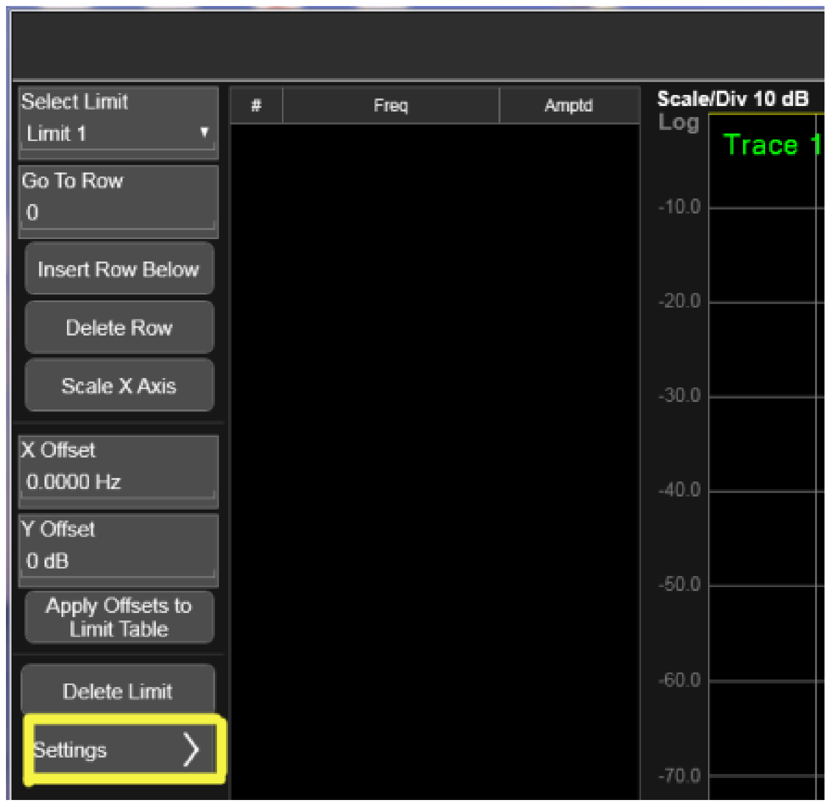
Lets you move through the table to edit the desired point

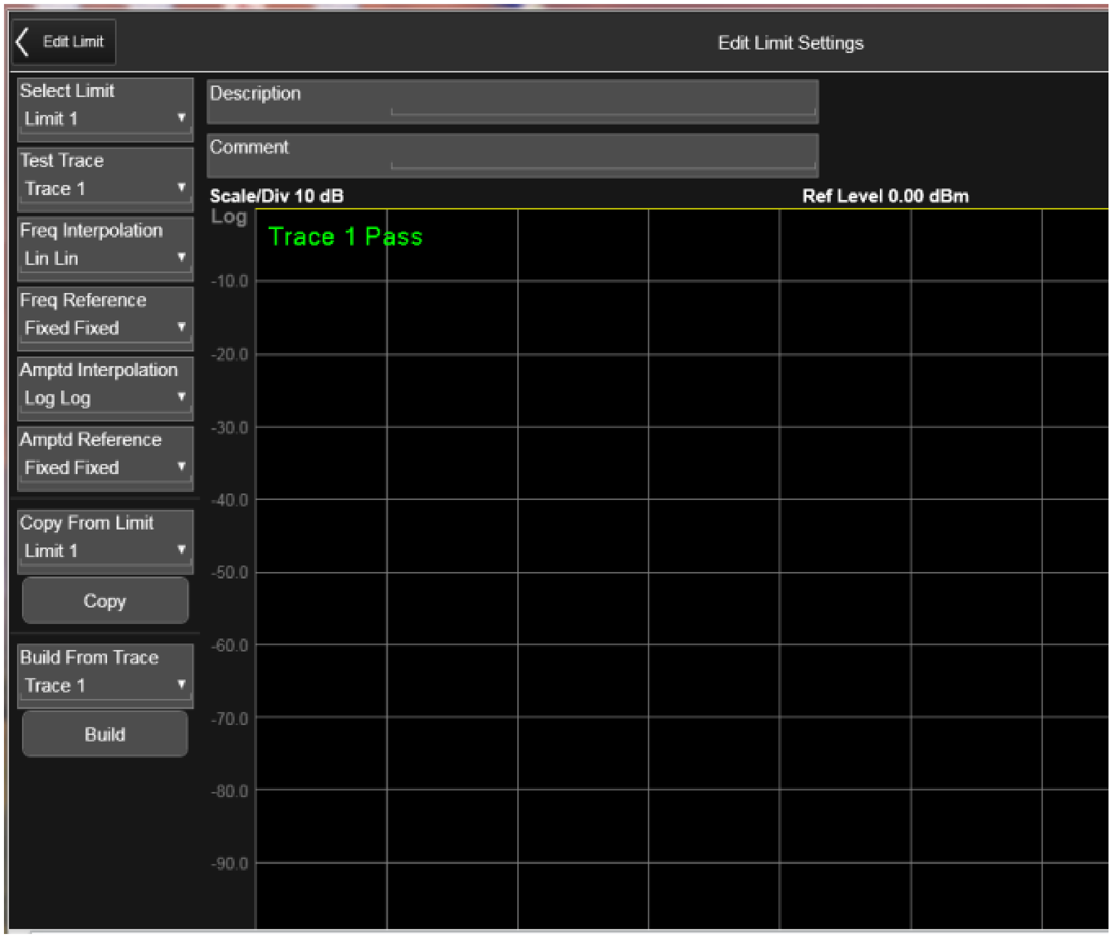
Edit Limit Settings

The Edit Limit Settings dialog is the second page of the Edit Limits dialog.

To access this dialog, press Edit Limits on the Settings tab. When the Edit Limits dialog appears, press Settings.







4.3.5.13 Test Limits

Selects whether the displayed traces are tested against the displayed limits (i.e. those for which Limit On/Off is set to On).

For each displayed trace for which a Limit is turned on, a message will be displayed in the upper-left corner of the graticule to notify whether the trace passes or fails the limits.

If the trace is at or within the bounds of all applicable limits and margins, the text “Trace x Pass” will be displayed in green, where x is the trace number. A separate line is used for each reported trace.

If the trace is at or within the bounds of all applicable limits, but outside the bounds of some applicable margin, the text “Trace x Fail Margin” will be displayed in amber, where x is the trace number. A separate line is used for each reported trace.

If the trace is outside the bounds of some applicable limits, the text “Trace x Fail” will be displayed in red, where x is the trace number. A separate line is used for each reported trace.

If the trace has no enabled limits, or the trace itself is not displayed, no message is displayed for that trace.

The PASS/FAIL box in the corner of the Meas Bar is only displayed if there is at least one “Trace Pass/Fail” indication displayed in the graticule.

If two amplitude values are entered for the same frequency, a single vertical line is the result. In this case, if an upper line is chosen, the lesser amplitude is tested. If a lower line is chosen, the greater amplitude is tested.

SCPI Command not available in SCPI LC Mode

Preset	On, not affected by Mode Preset, preset by Restore Mode Defaults.
State Saved	Saved in instrument state.

4.3.5.14 X-Axis Unit

Selects how the limit-line segments are defined. Pressing X Axis Unit selects whether the limit lines will be entered using frequency (Freq) or sweep time (Time) to define the segments. They can be specified as a table of limit-line segments of amplitude versus frequency, or of amplitude versus time.. When the X-Axis Unit is set to Time, a time value of zero corresponds to the start of the sweep, which is at the left edge of the graticule, and the column and softkey in the Limit Table Editor will read Time instead of Frequency.

Switching the limit-line definition between Freq and Time will erase all of the current limit lines. When you do this from the front panel, a warning dialog will appear letting you know that you are about to erase all the limit lines, and prompting you to select “OK” if you are sure:

Changing the X Axis Unit will erase all your limit lines. Are you sure you want to do this? Press Enter or OK to proceed, or Cancel(Esc) to cancel.

SCPI Command not available in SCPI LC Mode

Preset	Freq, not affected by Mode Preset, preset by Restore Mode Defaults.
State Saved	Saved in instrument state.

Couplings

This affects all limit lines simultaneously, and resets all limit line data except the .wav file and email address stored in the Actions.

4.3.5.15 Delete All Limits

Purges the data from all limit line tables. All limit data will be cleared and returned to factory preset settings.

When pressed a prompt is placed on the screen that says:

`“Please press Enter or OK key to delete all limits. Press ESC or Cancel to close this dialog.”`

The deletion is only performed if you press OK or Enter. After a deletion, the informational message `“All Limits deleted”` appears in the MSG line.

SCPI Command not available in SCPI LC Mode

4.3.5.16 Radio Standard Presets

Allows you to specify the radio standard to be used. Spectrum Analyzer mode supports many radio standards. You can select the desired radio standard using the Radio Std Presets control.

SCPI Command not available in SCPI LC Mode

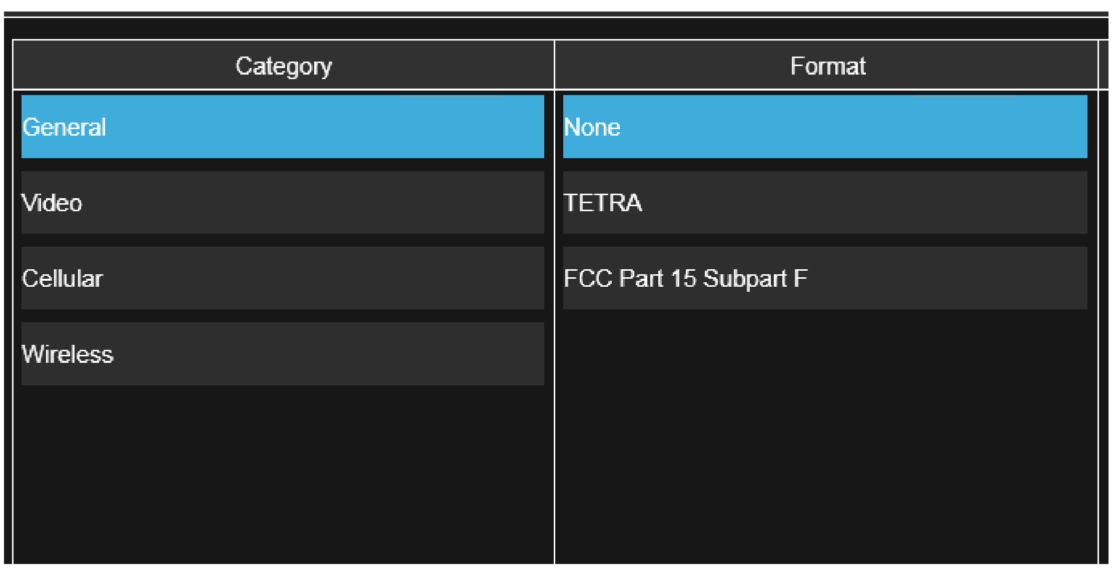
Preset	NONE
State Saved	Saved in instrument state

Couplings

By changing the radio standard, the measurement parameters will be automatically set to an appropriate default value.

Radio Std Preset Table

The Radio Std Preset Table enables you to select the standard for the current measurement.



4.3.5.17 Enable Non-Std Meas

Allows you to specify whether all measurements and radio standards are enabled or not. In default, Enable All Measurements is set to No, so you can select only the valid combination of preset available standard and measurement. Any measurement or standard that make the combination that have no valid preset value are grayed out. When Enable Non-Std Measurements is set to Yes, all measurements and standard selections are enabled so that you can choose any.

NOTE **If you select an unavailable measurement or unavailable radio standard using the Enable Non-Std Meas control, the measurement results may not conform to the selected standard.**

SCPI Command not available in SCPI LC Mode

Preset	NO
Range	Yes|No
State Saved	Saved in instrument state.

4.3.5.18 EMC Standard

This menu allows you to select None (no EMI standard), CISPR (CISPR 16–1–1), and MIL (MIL–461A). Each standard has a unique way of determining the couplings between detectors and RBWs, as well as its own set of available RBW's.

Note that Auto Couple has no effect on the EMC Standard setting.

SCPI Command not available in SCPI LC Mode

State Saved	Saved in instrument state

Dependencies

When the EMC Standard changes to CISPR or MIL, the RBW Control key is grayed out. The Filter Type is then always Gaussian; the Filter BW is chosen as appropriate for the filter and the standard.

When the EMC Standard changes to None, the Filter Type is set to Gaussian and the Filter BW is set to –3 dB.

Only appears with Option EMC installed and licensed. If not, the SCPI command generates a message.

Couplings

The auto rules for detector select Peak for any trace in Auto when the EMI Standard is CISPR or MIL.

Choosing a CISPR detector or CISPR presets automatically picks the CISPR Standard, however switching from a CISPR detector has no impact on EMC Standard.

4.3.5.19 CISPR Presets

This group of controls lets you easily set up the analyzer for CISPR measurements.

Selecting a CISPR preset sets the EMI Standard to CISPR, performs an autocouple all, and sets the Y Axis Unit to dBµV (unless dBuV is grayed out, in which case it will leave the Y Axis Unit unaffected).

SCPI Command not available in SCPI LC Mode

Controls in the CISPR Group

This group contains controls to set the following Presets:

CISPR A	9 kHz – 150 kHz
CISPR B	150 kHz – 30 MHz
CISPR C	30 MHz – 300 MHz
CISPR C/D	30 MHz – 1 GHz
CISPR D	300 MHz – 1 GHz
CISPR E	1 GHz – 18 GHz

SetupBand

The number of sweep points for each band is roughly calculated by the formula 2*(Stop Frequency-Start Frequency)/RBW, so that you get two points for every RBW width. This number is increased as necessary to make it an odd integer, so that you always end up with an odd number of sweep points. This is desirable so that you always have a sweep point at the Center Freq.

Band Setup	Band A	Band B	Band C	Band D	Band C&D	Band E
Start Frequency	9kHz	150kHz	30MHz	300MHz	30MHz	1GHz
Stop Frequency	150kHz	30MHz	300MHz	1GHz	1GHz	Max freq of analyzer or 18 GHz, whichever is lower
Sweep Points	1411	6635	4501	11667	16167	See below

The table above is based on the fact that the Res BW autocouples to the center frequency when in the CISPR EMC standard as follows:

Center Frequency	RBW
<150 kHz	200 Hz
150 kHz to 30 MHz	9 kHz
>30 MHz to 1 GHz	120 kHz
>1 GHz	1 MHz

Sweep Points in Band E

Note that the Res BW will be 1 MHz in band E. The number of sweep points for band E is dependent on the maximum frequency of the analyzer. The formula above gives the following values for Band E:

Option	Max Analyzer Freq (nominal)	Width of Band E	Number of Points
503 (3.0 GHz models)	3.0 GHz	2.0 GHz	4001
503 (3.6 GHz models	3.6 GHz	2.6 GHz	5201
507 (7 GHz models)	7.0 GHz	6.0 GHz	12001
507 (7.5 GHz models)	7.5 GHz	6.5 GHz	13001
508	8.4 GHz	7.4 GHz	14801
513	13.2 GHz	12.2 GHz	24401
526	26.5 GHz	17 GHz	34001
544 (and above)	44 GHz	43 GHz	40001 (max)

4.3.5.20 Average/Hold

In the X-Series analyzers, Max Hold and Min Hold traces were added to the trace types that were controlled by the Average Number (which became the Average/Hold Number). For example, setting an Average/Hold number of 100 and then performing a Max Hold in Single sweep takes 100 traces and then stops, and pressing Restart restarts the Max Hold Sequence. This allows you to exactly control how the number of Max Hold traces are taken. However, many users need a way of stopping and then resuming a Max/Min Hold without clearing the accumulated result.

Previously you could stop and start Max Hold by going back and forth between Single and Continuous. Currently, neither the X-Series nor the legacy analyzers like ESA and PSA clear the Max or Min Hold when going from Cont to Single and vice versa. You can go to Single to stop temporarily and then resume the Max or Min Hold by going back to Cont. However, in the X-Series, because Max and Min Hold obey the Average/Hold number, this is not an effective method for stopping a sweep, until you have reached the terminal count. Also, Restart is sometimes used as part of this method and in the X-Series, Restart clears the accumulated Max/Min Hold, whereas in the PSA (for example) it does not.

The Average/Hold switch in the Legacy Compatibility menu solves this problem. When this switch is in the "Legacy" position, the following is true for traces in Max Hold or Min Hold:

- They pay no attention to the Average/Hold number; "Single" for Max Hold and Min Hold causes one sweep only, so going to Single stops after the current sweep, and going to Cont starts you going again without clearing the accumulated result.
- They don't clear the Max or Min Hold on a Restart or Single or INIT:IMM (changing a measurement parameter like frequency or bandwidth, etc. would still restart the Max/Min Hold).

Note that whenever any trace is in Average, the Single/Cont controls *do* tie in to the Avg/Hold number and pressing Single *will* cause a set of sweeps (100 by default). This is also true in PSA.

SCPI Command not available in SCPI LC Mode

State Saved	Saved in instrument state.

4.3.5.21 *RST - Reset

`*RST` is equivalent to `:SYST:PRES;:INIT:CONT OFF`, which is a Mode Preset in the Single measurement state. This remote command is preferred over the Mode Preset remote command `:SYST:PRES`, because optimal remote programming occurs with the instrument in the single measurement state.

`*RST` clears all pending OPC bits and sets the Status Byte to 0.

Remote Command	`*RST`
Example	`*RST`
Notes	Sequential
Couplings	`*RST` causes the currently running measurement to be aborted and causes the default measurement to be active. `*RST` gets the mode to a consistent state, with all of the default couplings set
Status Bits/OPC dependencies	Clears all pending OPC bits. The Status Byte is set to 0
Backwards Compatibility Notes	In legacy analyzers, `*RST` did not set the analyzer to **Single**, but in the X-Series it does, for compliance with the IEEE 488.2 specification. In the Swept SA measurement, you can configure the instrument to be compatible with legacy analyzers in this regard, using the Meas Setup, Legacy Compat, `*RST` function

In the X-Series, *RST does not do a *CLS (clear the status bits and the error queue). In legacy analyzers, *RST used to do the equivalent of :SYSTem:PRESet, *CLS and :INITiate:CONTinuous OFF. But to be 488.2 compliant, *RST in the X-Series does not do a *CLS

4.3.5.22 Demod Type

Selects the type and state of the demodulation.

SCPI Command not available in SCPI LC Mode

Preset	OFF
State Saved	Saved in instrument state.

Dependencies

When Tune & Listen is turned on, all active traces are forced to use the same detector.

CISPR detectors (QPD, EMI Avg, RMS Avg) and Tune & Listen are mutually exclusive. No sound output will be heard if one of these detectors is selected.

Backwards Compatibility Notes

The X-Series implementation of Demod Tune and Listen does not include Squelch Control as was supported in ESA.

The speaker control for Tune and Listen for X-Series is done with the volume up/down and mute hardkeys in the System Settings dialog and is handled by the Windows operating system. There is no software speaker on/off control as was supported in ESA.

4.3.5.23 Demod Time

Sets the amount of time the instrument demodulates the signal after each sweep. The demodulated signal can be heard through the speaker during demodulation. In zero span, demodulation can be performed continuously, making this parameter not applicable, hence it is grayed out in zero span.

SCPI Command not available in SCPI LC Mode

Preset	500 ms
Min/Max	2 ms/100 s
State Saved	Saved in instrument state.

4.3.5.24 AM Channel BW

Sets the RBW setting used by the hardware during the demodulation period in nonzero spans. Note that this is a separate parameter only for the demodulation function and does not affect the RBW setting in the BW menu which is used during the normal sweep. The flat top filter type must be used during the demodulation period. A 5 kHz Video Bandwidth filter is used.

In Zero Span, the instrument's RBW & VBW filters are used for the demodulation; thus, the Channel BW (and RBW filter type) will match those of the instrument. This allows gap-free listening. The Channel BW key is grayed out and the value displayed on the key matches the current RBW of the instrument. Upon leaving zero span, the non-zero-span setting of Channel BW is restored as well as the flattop filter type.

In zero span only, the value is set equal to the instrument's current RBW value and it displays that value, but the selection is grayed out.

SCPI Command not available in SCPI LC Mode

Preset	30 kHz
Min/Max	390 Hz/8 MHz
State Saved	Saved in instrument state.

4.3.5.25 FM Channel BW

Sets the RBW setting used by the hardware during the demodulation period in nonzero spans. Note that this is a separate parameter only for the demodulation function and does not affect the RBW setting in the BW menu which is used during the normal sweep. The flat top filter type must be used during the demodulation period. A 5 kHz Video Bandwidth filter is used.

In Zero Span, the instrument's RBW & VBW filters are used for the demodulation; thus, the Channel BW (and RBW filter type) will match those of the instrument. This allows gap-free listening. The Channel BW key is grayed out and the value displayed on the key matches the current RBW of the instrument. Upon leaving zero span, the previous setting of Channel BW and the flattop filter type are restored.

In zero span only, the value is set equal to the instrument's current RBW value and it displays that value, but the control is grayed out.

SCPI Command not available in SCPI LC Mode

Preset	150 kHz
Min/Max	390 Hz/8 MHz
State Saved	Saved in instrument state.

4.3.5.26 PM Channel BW

Sets the RBW setting used by the hardware during the demodulation period in nonzero spans. Note that this is a separate parameter only for the demodulation function and does not affect the RBW setting in the BW menu which is used during the normal sweep. The flat top filter type must be used during the demodulation period. A 5 kHz Video Bandwidth filter is used.

In Zero Span, the instrument's RBW & VBW filters are used for the demodulation; thus, the Channel BW (and RBW filter type) will match those of the instrument. This allows gap-free listening. The Channel BW key is grayed out and the value displayed on the key matches the current RBW of the instrument. Upon leaving zero span, the previous setting of Channel BW and the flattop filter type are restored.

In zero span only, the value is set equal to the instrument's current RBW value and it displays that value, but the control is grayed out.

SCPI Command not available in SCPI LC Mode

Preset	100 kHz
Min/Max	390 Hz/8 MHz
State Saved	Saved in instrument state.

4.3.5.27 FM Demod De-emphasis

The De-emphasis setting controls a single-pole filter (6 dB/octave roll off), usually to counter intentional pre-emphasis in the transmitter. When De-emphasis state is OFF the hardware digital filter is bypassed, otherwise the setting is applied.

The choices are Off, 25 µs, 50 µs, 75 µs, and 750 µs.

The De-emphasis control is only available when FM is the demod selected. It is grayed out for AM and ΦM.

SCPI Command not available in SCPI LC Mode

Preset	US75 (recommended for US commercial FM 75 µs pre-emphasis)
State Saved	Saved in instrument state.

4.3.5.28 Phase Noise Optimization

Selects the LO (local oscillator) phase noise behavior for various desired operating conditions.

See "Phase Noise Optimization Auto Rules" on page 240.

SCPI Command not available in SCPI LC Mode

Preset	Because this function is in Auto after preset, and because Span after preset > 314.16 kHz, the state of this function after Preset will be 2 ON
Range	EP0: "Best Close-in Φ Noise" on page 238|"Best Wide-offset Φ Noise" on page 239|"Fast Tuning" on page 239|"Balance Noise and Spurs" on page 239|"Best Spurs" on page 239 See "Range (Long Form)" on page 240

Notes

Parameter:

1. balances close-in phase noise with spur avoidance. In instruments without EP0 optimizes phase noise for small frequency offsets from the carrier.
2. optimizes phase noise for wide frequency offsets from the carrier.
3. optimizes LO for tuning speed
4. balances close-in phase noise with spur avoidance. In instruments without EP0 this setting is accepted but no action taken.
5. emphasizes spur avoidance with close-in phase noise performance. In instruments without EP0 this setting is accepted but no action taken.

The actual behavior varies somewhat depending on model number and option; you always get fast tuning by choosing #3, but in some models, the “Fast Tuning” choice is identical to the “Best Close-In” choice. Specifically:

Dependencies

Does not appear in all models. The control is blank in those models, but the SCPI command is accepted for compatibility (although no action is taken).

More Information

The Phase Noise Optimization control lets you optimize the setup and behavior of the Local Oscillator (LO) depending on your specific measurement conditions. You may wish to trade off noise and speed, for example, to make a measurement faster without regard to noise or with optimum noise characteristics without regard to speed.

Auto

SCPI Example FREQ:SYNT:AUTO ON

Selects the LO (local oscillator) phase noise behavior to optimize dynamic range and speed for various instrument operating conditions. See Phase Noise Optimization Auto Rules for details on the Auto rules.

Best Close-in Φ Noise

The LO phase noise is optimized for smaller offsets from the carrier, at the expense of phase noise farther out.

The actual frequency offset within which noise is optimized is shown with in square brackets, as this can vary depending on the hardware set in use. For example, in some analyzers this annotation appears as [offset <20 kHz]

The LO is configured for the best possible phase noise at offsets up to 600 kHz from the carrier, regardless of spurious products that occur with some center frequencies.

Balance Noise and Spurs

Tthe LO is configured for the best possible phase noise at offsets up to 600 kHz from the carrier whenever there are no significant spurs within the span observed with an on-screen carrier. When there will be such a spur, the LO is reconfigured in a way that allows the phase noise to increase by 7 dB mostly within ±1 octave around 400 kHz offset. The spurs will always be below –70 dBc.

Best Spurs

The LO is configured for better phase noise than the “Wide-Offset” case close to the carrier, but the configuration has 11 dB worse phase noise than the “Best Close-In” case mostly within ±1 octave around 300 kHz offset. Spurs are even lower than in the “Balance Noise and Spurs” case at better than –90 dBc, whether or not the carrier is on-screen.

This setting is never selected when Phase Noise Optimization is in Auto, you must select it manually.

Best Wide-offset Φ Noise

The LO phase noise is optimized for wider offsets from the carrier. Optimization is especially improved for offsets from 70 kHz to 300 kHz. Closer offsets are compromised and the throughput of measurements (especially remote measurements where the center frequency is changing rapidly), is reduced.

The actual frequency offset beyond which noise is optimized is shown with in square brackets, as this can vary depending on the hardware set in use. For example, in some analyzers this annotation appears as [offset >30 kHz]

The LO is configured for the best possible phase noise at offsets up to 600 kHz from the carrier whenever there are no significant spurs within the span observed with an on-screen carrier. When there will be such a spur, the LO is reconfigured in a way that allows the phase noise to increase by 7 dB mostly within ±1 octave around 400 kHz offset. The spurs will always be below –70 dBc.

Fast Tuning

In this mode, the LO behavior compromises phase noise at many offsets from the carrier in order to allow rapid measurement throughput when changing the center frequency or span. The term “fast tuning” refers to the time it takes to move the local oscillator to the start frequency and begin a sweep; this setting does not impact the actual sweep time in any way.

The LO behavior compromises phase noise at offsets below 4 MHz in order to improve measurement throughput. The throughput is especially affected when moving the LO more than 2.5 MHz and up to 10 MHz from the stop frequency to the next start frequency.

In instruments with Option EP0, this is the same configuration as the Best Spurs configuration. It is available with this “Fast Tuning” label to inform the user, and to make the user interface more consistent with other X-Series analyzer family members.

(In models whose hardware does not provide for a fast tuning option, the settings for Best Close-in Φ Noise are used if Fast Tuning is selected. This gives the fastest possible tuning for that hardware set.)

Range (Long Form)

Best Close-In ΦNoise

[offset < 600 kHz] |

Balance Noise & Spurs

[offset < 600 kHz] |

Best Spurs

[offset < 600 kHz] |

Best Wide-Offset ΦNoise

[offset > 800 kHz] |

Fast Tuning

[same as Close-in]

Phase Noise Optimization Auto Rules

Auto will choose:

Balanced Noise and Spurs whenever:

Center frequency is < 699.9 kHz

Otherwise, Auto will choose Fast Tuning whenever:

Span > 114.1 MHz, or when

RBW > 800 kHz

Otherwise, Auto will choose Best Wide-offset Φ Noise whenever:

RBW > 290 kHz, or when

Span > 4.2 MHz

Otherwise, Auto will choose Balanced Noise and Spurs.

The RBW to be used in the calculations above is the equivalent –3 dB bandwidth of the current RBW filter.

These rules apply whether in swept spans, zero span, or FFT spans.

4.3.5.29 ADC Dither

Accesses the menu to control the ADC Dither function. The dither function enhances linearity for low level signals at the expense of reduced clipping-to-noise ratio. The reduced clipping-to-noise ratio results in higher noise, because we work to ensure that the clipping level of the ADC relative to the front terminals remains unchanged with the introduction of dither, and this results in reduced ADC dynamic range. So making measurements with ADC dither gives you better amplitude linearity, but turning ADC dither off gives you a lower noise floor (better sensitivity).

With dither on, the third-order distortions are usually invisible for mixer levels below –35 dBm. With dither off, these distortions can be visible, with typical power levels of –110 dBm referred to the mixer. Detection nonlinearity can reach 1 dB for dither off at mixer levels around –70 dBm and lower, while the specified nonlinearity is many times smaller with dither on.

When ADC Dither is on, the linearity of low-level signals is improved. The enhanced linearity is mostly improved scale fidelity. The linearity improvements of dither are most significant for RBWs of 3.9 kHz and less in swept mode, and FFT widths of 4 kHz and less in FFT mode.

The increased noise due to turning dither on is most significant in low band (0 to 3.6 GHz) with IF Gain set to Low, where it can be about 0.2 dB.

SCPI Command not available in SCPI LC Mode

Preset	AUTO ON
Range	High | Medium | Off
State Saved	Saved in instrument state.

Dependencies

In some models, the “High” parameter is not available. (Models without the 16-bit ADC) In some instruments, the HIGH parameter is honored and the HIGH state set, and returned to a query, but the Medium dither level is actually used.

More information

Auto

Sets the ADC dither to automatic. The analyzer then chooses the dither level according to which is most likely to be the best selection, based on other settings within the digital IF.

When in Auto, the analyzer sets the dither to Medium whenever the effective IF Gain is Low by this definition of IF Gain = Low:

- When Sweep Type = Swept, IF Gain = Low whenever Swept IF Gain is set to Low Gain, whether by autocoupling or manual selection.
- When Sweep Type = FFT, IF Gain = Low whenever FFT IF Gain is set to "Low Gain," which cannot happen by autocoupling.

Whenever the IF Gain is not low by this definition, Auto sets the dither to Off.

Medium (Log Accy)

The Medium setting of ADC Dither (known as “On” in earlier versions of the instrument software) improves the linearity of low-level signals at the expense of some noise degradation.

Off (Best Noise)

When ADC Dither is Off, the instrument noise floor is improved, because without the need to make room for the dither, you get a lower noise floor and better sensitivity.

4.3.5.30 Swept IF Gain

To take full advantage of the RF dynamic range of the analyzer, there is an added switched IF amplifier with approximately 10 dB of gain. When you can turn it on without overloading the analyzer, the dynamic range is always better with it on than off. The Swept IF Gain key can be used to set the IF Gain function to Auto, or to High Gain (the extra 10 dB), or to Low Gain. These settings affect sensitivity and IF overloads.

This function is only active when in Swept sweeps. In FFT sweeps, the FFT IF Gain function is used instead.

SCPI Command not available in SCPI LC Mode

Preset	Off ON
Range	Low Gain | High Gain where ON = high gain OFF = low gain
State Saved	Saved in instrument state.

Dependencies

The IF Gain control (FFT IF Gain and Swept IF Gain) have no effect when the U7227A USB Preamplifier is connected. This is not annotated or reflected on any control. There are no controls grayed out nor any SCPI locked out. The analyzer simply behaves as though both FFT IF Gain and Swept IF Gain are set to Low regardless of the setting on the controls.

Couplings

The ‘auto’ rules for Swept IF Gain depend on attenuation, preamp state, start and stop frequency and the setting of FFT IF Gain. Set the Swept IF Gain to High (On) when the total input attenuation is 0 dB, the preamp is off, the start frequency is 10 MHz or more, and the FFT IF Gain is autocoupled, or manually set to Autorange, or manually set to High. Also set the Swept IF Gain to High (On) when the total input attenuation is 2 dB or less, the preamp is on, the start frequency is 10 MHz or more, and the stop frequency is 3.6 GHz or less and the FFT IF Gain is autocoupled, or manually set to Autorange, or manually set to High. Under all other circumstances, set the Swept IF Gain to Low (Off).

If the sweep type is Swept, the start frequency of the instrument is less than 10 MHz, and you put Swept IF Gain in Manual On, a warning condition is generated and remains in effect as long as this condition exists. The warning message is about a possible IF overload.

As with most parameters with an AUTO state, AUTO COUPLE sets it to Auto, and setting any specific value (for example on or off) will set the AUTO state to false.

Auto

Activates the auto rules for Swept IF Gain.

Low Gain (Best for Large Signals)

Forces Swept IF Gain to be off.

High Gain (Best Noise Level)

Dependencies The High setting for Swept IF Gain is grayed out when FFT IF Gain is manually set to Low (not when Low is chosen by the auto-rules).

4.3.5.31 FFT IF Gain

Accesses thecontrols to set the ranging in the digital IF when doing FFT sweeps. When in Autorange mode, the IF checks its range once for every FFT chunk, to provide the best signal to noise ratio. You can specify the range for the best FFT speed, and optimize for noise or for large signals.

When the sweep type is FFT and this function is in Autorange, the IF Gain is set ON initially for each chunk of data. The data is then acquired. If the IF overloads, then the IF Gain is set OFF and the data is re-acquired. Because of this operation, the Auto setting uses more measurement time as the instrument checks/resets its range. You can get faster measurement speed by forcing the range to either the high or low gain setting. But you must know that your measurement conditions will not overload the IF (in the high gain range) and that your signals are well above the noise floor (for the low gain range), and that the signals are not changing.

AUTO COUPLE sets the state to Auto, which then picks AUTOrange, and setting any specific value (AUTOrange, LOW or HIGH) will set the AUTO state to false.

SCPI Command not available in SCPI LC Mode

Dependencies	The IF Gain controls (FFT IF Gain and Swept IF Gain) have no effect when the U7227A USB Preamplifier is connected. This is not annotated or reflected on any control. There are no controls grayed out nor any SCPI locked out. The analyzer simply behaves as though both FFT IF Gain and Swept IF Gain are set to Low regardless of the setting on the keys.
Preset	AUTOrange ON
State Saved	Saved in instrument state.

Auto

Allows the instrument to pick the FFT IF Gain method as appropriate. When in Auto, the FFT IF Gain is set as follows:

- when the Sweep Type Rules are set to “Best Speed,” the instrument selects Low Gain as the auto choice
- when the Sweep Type Rules are not “Best Speed,” the instrument selects Autorange as the auto choice

“Auto” is selected when Auto Couple is pressed.

Autorange (Slower: Follows Signals)

Turns the ADC ranging to automatic which provides the best signal to noise ratio.

Low Gain (Best for Large Signals)

Forces FFT IF Gain to be off.

High Gain (Best Noise Level)

Forces FFT IF Gain to be on.

4.3.5.32 Noise Floor Extension

Allows you to turn on the Noise Floor Extension function in either of two states, Full or Adaptive.

- Full NFE: the expected noise power of the analyzer (derived from a factory calibration) is subtracted from the trace data. This will usually reduce the apparent noise level by about 10 dB in low band, and 8 dB in high band (>~3.6 GHz).

- **Adaptive NFE**: there is not the same dramatic visual impact on the noise floor as there is in Full NFE. Adaptive NFE controls the amount of correction that is applied based on other analyzer settings like RBW, averaging and sweep time. Adaptive NFE controls the degree of potential improvement in the noise floor to give more improvement for those analyzer settings that can make good use of the potential improvement, such as settings that provide more averaging. The result is that when not much averaging is being performed, the signal displays more like the NFE-off case. When lots of averaging is being performed, the signal displays more like the full-NFE case. Adaptive NFE is recommended for general-purpose use. For fully ATE (automatic test equipment) applications, where the distraction of a person using the instrument is not a risk, Full NFE is recommended.

Noise Floor Extension works with any RBW, VBW, detector, any setting of Average Type, any amount of trace averaging, and any signal type. It is ineffective when the trace is not smoothed (smoothing processes include narrow VBWs, trace averaging, and long sweep times with the detector set to Average or Peak). It works best with extreme amounts of smoothing, and with the average detector, with the Average Type set to Power.

In those cases where the cancellation is ineffective, it nonetheless has no undesirable side-effects. There is no significant speed impact to having Noise Floor Extension on.

The best accuracy is achieved when substantial smoothing occurs in each point before trace averaging. Thus, when using the average detector, results are better with long sweep times and fewer trace averages. When using the sample detector, the VBW filter should be set narrow with less trace averaging, instead of a wide VBW filter with more trace averaging.

NOTE

Noise Floor Extensions has no effect unless the RF Input is selected, therefore it does nothing when External Mixing is selected.

With the introduction of Adaptive NFE, in firmware version A.18.00, the default state of NFE is now Adaptive. Before the introduction of Adaptive NFE, NFE was Off by default.

With the introduction of Adaptive NFE, the menu control is changed from On|Off to Full|Adaptive|Off.

See "More Information" on page 246

SCPI Command not available in SCPI LC Mode

Couplings	When NFE is enabled in any mode manually, a prompt will be displayed reminding you to perform the

	Characterize Noise Floor operation if it is needed. If NFE is enabled through SCPI and a Characterize Noise Floor operation is needed, an error will be entered in the system error queue. To turn Adaptive on, you must issue the commands in the proper order, as shown in the example above.
Preset	Unaffected by Mode Preset. Turned ON at startup and by Restore Mode Defaults.

More Information

The analyzer is characterized in the factory (or during a field calibration) with a model of the noise, referred to the input mixer, versus frequency in each band and path combination. Bands are 0 (low band) and 1 through 4 (high band) in a 26.5 GHz instrument, for example. Paths include normal paths, preamp paths, the electronic attenuator, etc.

In most band/path combinations, the noise can be well characterized based on just two parameters and the analyzer frequency response before compensation for frequency-dependent losses.

After the noise density at the input mixer is estimated, the effects of the input attenuator, RBW, detector, etc. are computed to get the estimated input-port-referred noise level.

In the simplest case, the measured power (signal plus analyzer noise) in each display point (bucket) is compensated by subtracting the estimated noise power, leaving just the signal power. This is the operation when the detector is Average and the Average Type is set to Power.

In other cases, operation is often not quite as good but still highly effective. With peak detection, the noise floor is estimated based on the RBW and the duration of the bucket using the same equations used in the noise marker function. The voltage of the noise is subtracted from the voltage of the observed signal-plus-noise measurement to compute the estimated signal voltage. The peak detector is one example of processing that varies with detector to give good estimates of the signal level without the analyzer noise.

For best operation, the average detector and the power scale are recommended, as already stated. Peak detection for pulsed-RF can still give excellent effectiveness. FFT analysis does not work well, and does not do NFE well, with pulsed-RF signals, so this combination is not recommended. Negative peak detection is not very useful, either. Sample detection works well, but is never better than the average detector because it doesn't smooth as well. The Normal detector is a combination of peak and negative peak behaviors, and works about as well as these.

For best operation, extreme smoothing is desirable, as already stated. Using narrow VBWs works well, but using very long bucket durations and the average detector works best. Reducing the number of trace points will make the buckets longer.

For best operation, the power scale (Average Type = Power) is optimum. When making CW measurements in the presence of noise without NFE, averaging on the decibel scale has the advantage of reducing the effect of noise. When using NFE, the NFE does an even better job than using the log scale ever could. Using NFE with the log scale is not synergistic, though; NFE with the power scale works a little better than NFE with log averaging type.

The results from NFE with internal preamp can often be lower than the theoretical noise in a signal source at room temperature, a noise density of -174 dBm/Hz. This is expected and useful behavior, because NFE is designed to report the amount of input signal that is in excess of the thermal noise, not the amount that includes the thermal noise. This can be a useful behavior because thermal noise often interferes with what you want to measure, instead of being part of what you want to measure. Note that NFE is not adequately accurate to always be able to read below kTB.

Adaptive NFE provides an alternative to fully-on and -off NFE. Fully-on NFE can, notably in cases with little or no averaging of the spectrum, result in a display that is distractingly unfamiliar in the variability in response to low level signals. Fully-off NFE fails to achieve the potential improvement in dynamic range and associated accuracy of measurement of low level signals. Adaptive NFE controls the degree of potential improvement in the noise floor to give more improvement for those analyzer settings that can make good use of the potential improvement—those settings with high degrees of variance reduction through some variant of averaging. When the potential improvement is small, the display acts like the NFE-off case, and when it is high, it acts like the fully-on case, and in-between, application is a compromise between atractiveness and effectiveness.

On instruments with the NF2 license installed, the calibrated Noise Floor used by Noise Floor Extensions should be refreshed periodically. Keysight recommends that the Characterize Noise Floor operation be performed after the first 500 hours of operation, and once every calendar year. The key to perform this is located in the System, Alignments, Advanced menu. If you have not done this yourself at the recommended interval, then when you turn on Noise Floor Extensions, the analyzer will prompt you to do so with a dialog that says:

"This action will take several minutes to perform. Please disconnect all cables from the RF input and press Enter to proceed. Press ESC to cancel, or Postpone to postpone for a week."

If you Cancel, you will be prompted again the next time you turn NFE on. If you postpone, you will be prompted again after a week passes and you then turn NFE on.

4.3.5.33 Noise Source

This control allows you to turn the noise source power on or off and select the type of Noise Source to be used when making manual noise figure measurements.

If no SNS is connected, this parameter will be set to "Normal"

When Type is set to "SNS" and the SNS is disconnected, this parameter gets bumped to "Normal"

When an SNS is not connected, the SNS type will be grayed (disabled).

	SCPI Command not available in SCPI LC Mode
Preset	Normal OFF
State Saved	Saved in instrument state.

More Information

There are several types of noise sources:

- 346/7 Series
- N4000 series Smart Noise Source (SNS)
- USB Noise Source (connects via USB rather than via the Noise Source connector on the rear panel)

This menu allows the user to control any of these.

When an SNS is connected the user can then select it from the “Type” dropdown, allowing the State parameter to then control the SNS. The "Normal" source is controlled by a BNC connector that supplies 28V. If SNS is NOT connected then the “state” parameter controls the "Normal" noise source 28V BNC port. If both are connected the “Type” parameter will determine which source the “State” parameter will control. Two sources can never be controlled together. The “SNS attached” SCPI query detailed below can be used remotely to determine if an SNS is connected. SNS functionality is limited to turning on and off only. The SNS ENR data and temperature cannot be queried, unless the Noise Figure application is installed. The SNS ENR data is issued in printed form when an SNS is purchased or can be read from the analyzer’s Noise Figure application if installed, or other Keysight noise figure instruments that support the SNS (NFA and ESA with option 219).

Only one SNS is supported at a time. To switch to a different SNS (a USB SNS or an N4000 series SNS), disconnect the one that is no longer being used prior to connecting a new one.

When first entering the Swept SA measurement the “State” will be set to OFF and the 28v BNC drive and SNS turned off to ensure the two are in sync. When the Swept SA measurement is exited, the “State” parameter will be set to OFF and the 28v BNC and SNS drive turned off.

For making manual noise figure measurements the following setup is recommended:

- Set the SPAN to Zero
- Set attenuation to 0 dB
- Set the PRE-AMP ON
- Set the RBW to 4 MHz
- Set the Detector to AVERAGE

- Set the sweep time to 16 ms - sets the variance correctly for good results.
- Set a Band/Interval Power Marker function and set the interval over the full width of trace i.e. Left to 0s and Right to 16 ms

4.3.5.34 ACP Enhanced Dynamic Range

The ACP Enhanced Dynamic Range function causes a 300 kHz SAW filter (also called the “ACP Filter”) to be switched into the signal path to allow third-order critical measurements, such as ACP measurements, to be made with improved dynamic range when the spectrum is substantially wider than 300 kHz. When ACP Enhanced Dynamic Range is on:

- When RBW ≤ 300 kHz, the “ACP filter” is switched in. This means that the RBW shape is affected, but not excessively.
- When RBW > 300 kHz, ACP Enhanced Dynamic Range causes no changes in the signal path.

NOTE **This function should be used only under specific measurement scenarios, such as ratio measurements of intermodulation, to avoid adding other measurement inaccuracies, such as Frequency Readout Accuracy, RBW amplitude accuracy, power bandwidth accuracy and absolute amplitude accuracy.**

Preset	OFF
State Saved	Saved in instrument state.

4.3.6 Global

The controls in this menu apply to all Modes in the instrument.

Some controls (e.g., Global center Freq) allow you to switch certain Meas Global parameters to a Mode Global state. These switches apply to all Modes that support global settings. For example, no matter what Mode you are in when you set the “Global Center Frequency” switch to on, it applies to all Modes that support Global Settings.

Other controls (e.g., Extend Low Band) are actually set in this menu but apply to all Modes.

4.3.6.1 Global Center Freq

The software maintains a Mode Global value called “Global Center Freq”.

When the **Global Center Freq** control is switched to **On** in any mode, the current mode’s center frequency is copied into the Global Center Frequency, and from then on all modes that support global settings use the Global Center Frequency. So you can switch between any of these modes and the Center Freq will remain unchanged.

Adjusting the Center Freq of any mode which supports Global Settings, while **Global Center Freq** is **On**, will modify the Global Center Frequency.

When **Global Center Freq** is turned **Off**, the Center Freq of the current mode is unchanged, but now the Center Freq of each mode is once again independent.

When **Mode Preset** is pressed while **Global Center Freq** is **On**, the Global Center Freq is preset to the preset Center Freq of the current mode.

This function is reset to Off when the Restore Defaults control is pressed in the Global Settings menu, or when **System**, **Restore Defaults**, **All Modes** is pressed.

Preset	Set to Off on Global Settings, Restore Defaults and System, Restore Defaults, All Modes
Range	On|Off

Preset	Off

4.3.6.2 Global EMC Std

When the **Global EMC Std** control is switched to On in any mode, the current mode's EMC Std is copied into the Global EMC Std, and from then on all modes that support global settings use the Global EMC Std. So you can switch between any of these modes and the EMC Std will remain unchanged.

Adjusting the EMC Std of any mode that supports Global Settings, while Global EMC Std is On, will modify the Global EMC Std.

When Global EMC Std is turned Off, the EMC Std of the current mode is unchanged, but now the EMC Std of each mode is once again independent. When Mode Preset is pressed while Global EMC Std is On, the Global EMC Std is preset to the preset EMC Std of the current mode.

This function is reset to Off when the Restore Defaults control is pressed in the Global Settings menu, or when System, Restore Defaults, All Modes is pressed.

Dependencies	Only available if option EMC is installed. On N9048B model with option WF1, the EMI Receiver Mode does not support an EMC Standard of NONE, although the Swept SA measurement does. Since, when Global EMC Standard is on, Swept SA and EMI Receiver must have the same setting for EMC Standard, "NONE" is grayed out on the N9048B in the Swept SA measurement when Global EMC Standard is On. Furthermore, when Global EMC Standard is turned from Off to On, both Swept SA and EMI Receiver take on the value of EMC Standard currently set for the EMI Receiver and an advisory message is generated.
Preset	Set to Off on Global Settings, Restore Defaults and System, Restore Defaults, All Modes
Range	On|Off

4.3.6.3 Restore Defaults

This control resets all of the functions in the Global Settings menu to Off. This also occurs when **System**, **Restore Defaults**, **All Modes** is pressed.

4.3.6.4 RF Output

Allows you to turn the source RF Power on or off.

Note: as stated below, when the RF Output is turned on, the Source Mode is set to Tracking. See the Source Mode control description for special considerations concerning how to configure your N5172B or N5182B source for use with External Source Control.

SCPI Command not available in SCPI LC Mode

Dependencies	Grayed out in measurements that do not support a source. If you go to such a measurement the output will be forced to Off. Grayed out if there is no valid source selection, in this case go to the Select Source menu to choose, configure and/or verify your source When there is no available Source Mode (other than Off), due to other couplings, then the RF Ouput control is grayed out.
Couplings	When RF Output is turned On, Source Mode is set to Tracking When Source Mode is turned Off, RF Output is turned Off. When Source Mode is turned Off (or forced to Off by another coupling), RF Output is turned Off. Turning RF Output Off does not affect Source Mode or other settings.
Preset	OFF (on either a Mode Preset, a Source Preset, or Restore Input/Output Defaults)
State Saved	Part of the Input/Output system, which means it is Loaded and Saved with state.

4.3.6.5 Source Amplitude

Allows you to adjust the power level of the selected source. Note that the actual amplitude is also affected by the Amplitude Offset and Power Sweep parameters.

SCPI Command not available in SCPI LC Mode

Dependencies	If the requested setting of Source Amplitude causes the calculated external source start or stop Amplitude to exceed the external source capability, a warning status message is generated, "Data out of Range; clipped to source max/min" The "Show Source Capabilities and Settings" menu can then be examined to check the source capabilities. This parameter test and clip is also performed at source acquisition.
Preset	-10.00 dBm (On Source Preset and Restore Input/Output Defaults) Not affected by Mode Preset
Min/Max	Min:The range of the amplitude parameter is dependent on the amplitude range of the source that is

	selected, and the settings of Amplitude Offset and Power Sweep. Max:The range of the amplitude parameter is dependent on the amplitude range of the source that is selected, and the settings of Amplitude Offset and Power Sweep.
State Saved	Part of the Input/Output system, which means it is Loaded and Saved with state.

4.3.6.6 Source Mode

This control lets you select Tracking mode or Independent mode for the Source, and also allows you to set the Source Mode to OFF

The Source Mode can be set to Tracking without the user setting it directly. There are several couplings that cause Source Mode to be automatically set to Tracking (detailed in the table below). One important coupling is that Source Mode is forced to Tracking when the RF Output is turned on if the measurement supports Tracking. Since Source Mode is set to Off on a Mode Preset, this means that you will rarely need to change the Source Mode setting directly.

NOTE

When the Source Mode is set to Tracking, the analyzer acquires control of the source. When this happens the source is told to save its state and then perform a preset. Usually both of these operations take very little time; however, on an N5172B or an N5182B, if many Source real-time apps are in use, both save and preset can take many seconds. If it takes longer than the analyzer expects to acquire control, you will see an error: “Source connection lost, check interface connection”. If you see this error, and you are using an N5172B or an N5182B, you can shorten the acquire time by presetting your MXG before attempting to use External Source Control.

SCPI Command not available in SCPI LC Mode

Dependencies	Grayed out if no Source is selected, in this case go to the Select Source menu to choose, configure and/or verify your source. Grayed out and forced to Off if either BBIQ or External Mixing are selected. Grayed out in Measurements that do not support a source. Tracking is grayed out when the RF Preselector is on (in MXE and other models which support the RF Preselector).
Couplings	When RF Output is turned On, Source Mode is set to Tracking. When Source Mode is turned Off, RF Output is turned Off. Whenever you switch to an application (Mode) in which the Source Mode was previously set to Tracking, it is again set to Tracking. That is, the last setting of the Source Mode is remembered when you leave an application (Mode) and restored when you return Source Mode is forced to Tracking when the RF Output is turned on if the measurement supports Tracking If Source Mode is set to Tracking, then it is forced to Off when you select a measurement that does not support Tracking. If Source Mode is set to Tracking, then it is forced to Off when you turn on the RF Preselector (in models which support the RF Preselector). Whenever the Source Mode is set to Tracking, the analyzer acquires the Source. Similarly, the Source is released whenever the Source Mode is set to Off. This is true whether the Source Mode was set directly by you, was set indirectly through a coupling, if you switched to an application (Mode) that had previously been set to Tracking, or if you switched to an application (Mode) in which the Source Mode is not set to Tracking. For an external

	source, “acquiring the source” involves contacting the external instrument over the remote interface (which puts it into Remote) and taking control of it. When you set the Source Mode to OFF, it releases the Source (and puts it into Local). For an external source, this means you are now free to operate the source for other purposes. When the Source is acquired, its previous state is saved, and when it is released, that state is restored, so that you can acquire and then release the source and it will return to the state it was in before you acquired it.
Preset	OFF
State Saved	Saved in instrument state.

Point Trigger

Shows point trigger type selected and navigates to the Point Trigger menu.

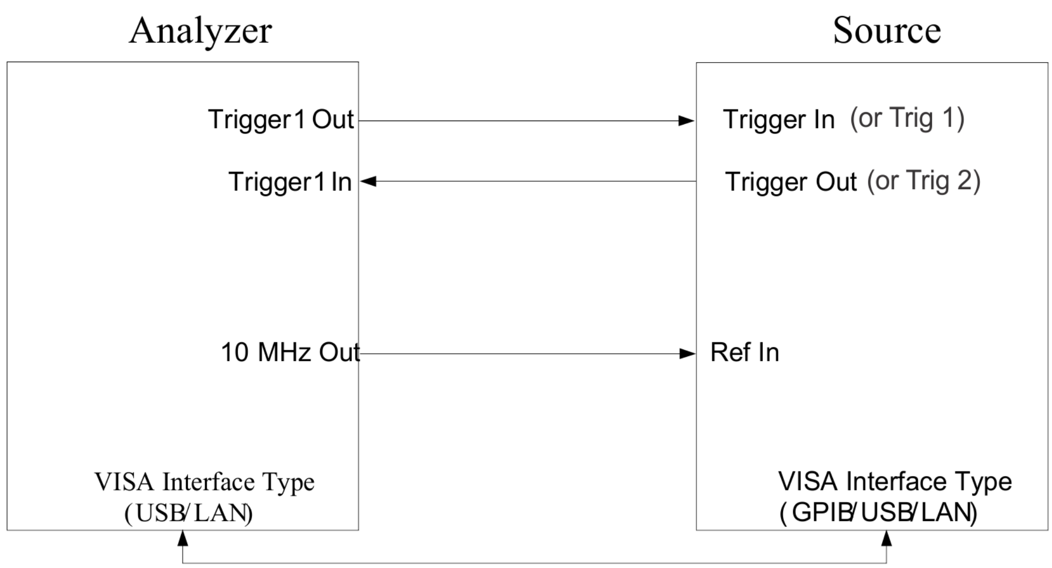
The Point Trigger menu lists all analyzer point trigger types. The analyzer and source point trigger synchronization can be done using SCPI bus commands or by using external trigger output and input lines.

NOTE **For X-Series software versions earlier than A.10.01, hardware triggering was unavailable in stepped tracking at frequencies above 3.6 GHz, so above 3.6 GHz, software triggering was always used. This is no longer the case.**

Command	`:SOURce:TRIGger:TYPE BUS|EXTernal[1]|EXTernal2` `:SOURce:TRIGger:TYPE?`
Example	:SOUR:TRIG:TYPE EXT1 Selects analyzer external trigger 1 in and out for point trigger synchronization with selected source.
Dependencies	If an internal Tracking Generator is selected, then this menu is unavailable. Additionally, the External 1 and External 2 Trigger keys on the Spectrum Analyzer are released from any grayout that may have been forced on them by the external source Point Trigger selection. In some models, there is no second External input. In these models, the External 2 selection does not appear and the EXTernal2 parameter will generate a “Hardware missing; Not available for this model number” message.
Couplings	The source control point trigger selection can select external trigger 1 or 2 in for synchronized point triggering. This can conflict with the selection under the Trigger hardkey, if it has External 1 or 2 selected. If there is a conflict when the selection is made under the Point Trigger menu, the Trigger selection under the Trigger hardkey will be changed to Free Run.
Preset	This is unaffected by “Mode Preset” but is set to EXTernal1 on a “Source Preset” or "Restore Input/Output Defaults".
State Saved	Part of the Input/Output system, which means it is Loaded and Saved with state

Tracking Setup Details

When an external source is operating in Tracking Mode, operation can be greatly enhanced by using hardware triggers Below is a typical connection diagram showing a hardware handshake using Trigger 1 inputs and outputs on the analyzer (trigger 2 in and out is also a valid connection).



Typical Analyzer-Source connection

Analyzer Trigger 1 Out: Triggers the external source to step to next point in the frequency step/list.

Analyzer Trigger 1 In: Triggers the analyzer to make a measurement on this point

Source Trigger In (or "Trig 1" at default setting for N5181B/82B, N5183B MXG or N5171B/72B, N5173B EXG):

Triggers the source to step to the next point.

Source Trigger Out (or "Trig 2" at default setting for N5181B/82B, N5183B MXG or N5171B/72B, N5173B EXG): Indicates that the source has settled.

IO interface Connection: analyzer can connect to sources with its GPIB, USB or LAN interface.

Notes:

- Trigger sync connections are optional – synchronization can be done via remote commands if Bus Trigger is enabled in the Source Setup menu.
- Connection from the SA external frequency reference output to the source frequency reference input (10 MHz Out to Ref In) is not required, but may improve the measurement accuracy.

SW Trigger

Analyzer and source point trigger synchronization is setup using the SCPI commands. Source is stepped via SCPI commands. Analyzer waits for source to settle by polling source.

SCPI example: :SOUR:TRIG:TYPE BUS

Ext Trigger 1

SCPI example: :SOUR:TRIG:TYPE EXT1

Analyzer and source point trigger synchronization is setup using the analyzer Trigger 1 Output and Trigger 1 Input. The Source is stepped via Trigger 1 Output. The Analyzer waits for source to settle via Trigger 1 Input.

With an acquired source, selecting this point trigger mode overrides existing external trigger 1 output level, slope, and delay, and external trigger 1 type and polarity.

External trigger 1 input level = 1.20 V

External trigger 1 input slope = Positive

External trigger 1 input delay = Off

External trigger 1 output type = Source Point Trigger

External trigger 1 output polarity = Positive

When this selection is made:

- The External 1 selection in the Trigger menu (under the Trigger hardkey) does not appear and, if External 1 was previously selected, it will be changed to Free Run.
- Trig 1 Out selected under Output Config in the Input/Output menu will be changed to Source Point Trigger

If the user subsequently goes into the Trig 1 Out menu and selects a different Trigger Output, the Point Trigger will revert to SW Trigger.

Ext Trigger 2

Analyzer and source point trigger synchronization is setup using the analyzer Trigger 2 Output and Trigger 2 Input. The Source is stepped via Trigger 2 Output. The Analyzer waits for source to settle via Trigger 2 Input.

SCPI example: :SOUR:TRIG:TYPE EXT2

With an acquired source, selecting this point trigger mode overrides existing external trigger 2 output level, slope, and delay, and external trigger 2 type and polarity.

External trigger 2 input level = 1.20 V

External trigger 2 input slope = Positive

External trigger 2 input delay = Off

External trigger 2 output type = Source Point Trigger

External trigger 2 output polarity = Positive

When this selection is made:

- The External 2 selection in the Trigger menu (under the Trigger hardkey) does not appear and, if External 2 was previously selected, it will be changed to Free Run.
- Trig 2 Out selected under Output Config in the Input/Output menu will be changed to Source Point Trigger

If the user subsequently goes into the Trig 2 Out menu and selects a different Trigger Output, the Point Trigger will revert to SW Trigger.

Power Sweep

Allows you to set up a Power Sweep. Power Sweep is useful for measuring saturation behavior in a test device, such as a power amplifier.

The source will sweep the power between the start power defined by the Amplitude function and the stop power = start power + power sweep value:

Source (start) amplitude = Amplitude – Amplitude Offset

Source (stop) amplitude = Amplitude – Amplitude Offset + Power Sweep

In Stepped Tracking, such as is used with an external source, the analyzer controls the source with step sweep mode, which provides a linear progression from one selected frequency, amplitude, or both, to another, pausing at linearly spaced points (steps) along the sweep. The analyzer continues to sweep the specified frequency range when power sweep is on, although generally Power Sweep is performed in Zero Span.

With CXA options T03, T06 and SCT, the hardware is capable of continuous power sweeps. This makes it possible to use the swept sweep time rules and should be employed for faster sweeps. Care should be taken to limit the sweep time you use as there are no sweep time couplings to Power Sweep settings. The recommended minimum sweep time depends on the RBW and power-sweep range. Start by computing (1.28/RBW)* (abs(startPower – stopPower)/(5 dB)). The recommended minimum sweep time is the larger of this value and 50 ms.

Some external Sources have mechanical attenuators, which are not used in Power Sweep in order to save wear on the attenuators. To allow an acceptable range of Power Sweep without changing the mechanical attenuation, the Sources are put in a mode that allows the Source to handle a wide amplitude range without switching the attenuators. When the Power Sweep settings put the Source in an amplitude range that requires the mechanical attenuators, the analyzer displays a condition warning message:

`Settings Alert;Src pwr ramp>ALC range`

Command	`:SOURce:POWer:SWEep <rel_ampl>`

	:SOURce:POWer:SWEep? :SOURce:POWer:SWEep:STATe ON|OFF|1|0 :SOURce:POWer:SWEep:STATe?
Example	:SOUR:POW -5 :SOUR:POW:SWE:STAT ON :SOUR:POW:SWE 10 Set source start power to – 5 dBm and stop power + 5dBm (-5 + 10). :SOUR:POW:SWE:STAT ON
Dependencies	If the requested setting of Power Sweep causes the calculated external source start or stop Amplitude to exceed the external source capability, a warning status message is generated, -222.2001 “Data out of Range; clipped to source max/min”. The Show Source Capabilities and Settings menu can then be examined to check the source capabilities. This parameter test and clip is also performed at source acquisition.
Preset	This is unaffected by “Mode Preset” but is set to 0dB on a “Source Preset” or "Restore Input/Output Defaults".
Min/Max	-500 dB/+500 dB
State Saved	Part of the Input/Output system, which means it is Loaded and Saved with state.

Backwards Compatibility

This alias is for the ESA tracking generator and PSA option 215. It specifies the range of power levels through which the source output will sweep just as does :SOURce:POWer:SWEep.

:SOURce[:EXTernal][:SWEep]:POWer:SPAN <rel_ampl>

:SOURce[:EXTernal][:SWEep]:POWer:SPAN?

:SOURce[:EXTernal]:POWer:MODE FIXed|SWEep

:SOURce[:EXTernal]:POWer:MODE?

The ESA tracking generator and the PSA option 215 support this SCPI command. It sets the source output to be at a single amplitude (fixed) or to sweep through a range of power levels

SOURce:POWer:MODE FIXed

is equivalent to :SOURce:POWer:SWEep:STATe OFF

SOURce:POWer:MODE SWEep

is equivalent to :SOURce:POWer:SWEep:STATe ON

Amptd Offset

Offsets the displayed power of the source in the Amplitude parameter. Using the amplitude offset allows you to take into account any system losses or gains (for example, due to cable loss), thereby displaying the actual power delivered to the device under test. See the equations under the Source, Amplitude, Power Sweep key.

Command	`:SOURce:CORRection:OFFSet <rel_ampl>` `:SOURce:CORRection:OFFSet?`
Example	:SOUR:CORR:OFFS 5
Dependencies	If the requested setting of Amptd Offset causes the calculated external source start or stop Amplitude to exceed the external source capability, a warning status message is generated, -222.2001 “Data out of Range; clipped to source max/min”. The Show Source Capabilities and Settings menu can then be examined to check the source capabilities. This parameter test and clip is also performed at source acquisition.
Preset	This is unaffected by Mode Preset but is set to 0.00dBm on a Source Preset or Restore Input/Output Defaults.
Min/Max	-1000 dB/+1000 dB
State Saved	Part of the Input/Output system, which means it is Loaded and Saved with state.

Amptd Step

Allows you to set the step size associated with the Source Amplitude key. When auto-coupled, the step size is the current Scale/Div setting under the Amplitude hardkey (note that this is true even if the analyzer is currently in Linear amplitude scale).

Once a step size has been selected and the Source Amplitude function is active, the step keys (and the UP|DOWN parameters for Source Amplitude from remote commands) change the Source Amplitude by the step-size value.

You may change the step size manually by pressing Amptd Step and entering a value. The function (and the step size) will return to Auto when a Mode Preset or Auto Couple is performed.

Command	`:SOURce:POWer:STEP[:INCRement] <ampl>`
	`:SOURce:POWer:STEP[:INCRement]?`
	`:SOURce:POWer:STEP:AUTO OFF|ON|0|1`
	`:SOURce:POWer:STEP:AUTO?`

Example	:SOUR:POW:STEP 0.1 :SOUR:POW:STEP:AUTO ON

Couplings	In Auto, coupled to the size of one logarithmic vertical graticule division.
Preset	10 dB Auto
Min/Max	0.1 dB/20 dB
State Saved	Part of the Input/Output system, which means it is Loaded and Saved with state.

Multiplier Numerator

The multiplier numerator parameter offsets the source frequency from the analyzer frequency. The source frequency tracks the SA frequency according to the source frequency equation shown at the bottom of the Source Setup Table.

The multiplier numerator must be restricted to operate within the range of the source minimum and maximum frequencies.

Command	`:SOURce:FREQuency[:MULTiplier]:NUMerator <integer>` `:SOURce:FREQuency[:MULTiplier]:NUMerator?`
Example	:SOUR:FREQ:NUM 3
Dependencies	If the currently selected source does not support this capability (for example, an internal Tracking Generator which must track the LO), this control is forced to its Preset value and grayed out
Preset	This is unaffected by Mode Preset but is set to 1 on a Source Preset or Restore Input/Output Defaults.
Min/Max	1/1000
State Saved	Part of the Input/Output system, which means it is Loaded and Saved with state.

Multiplier Denominator

The multiplier denominator parameter offsets the source frequency from the analyzer frequency. The source frequency tracks the SA frequency according to the source frequency equation shown at the bottom of the Source Setup Table.

The multiplier denominator must be restricted to operate within the range of the source minimum and maximum frequencies.

Command	`:SOURce:FREQuency[:MULTiplier]:DENominator <integer>` `:SOURce:FREQuency[:MULTiplier]:DENominator?`
Example	:SOUR:FREQ:DEN 3
Dependencies	If the currently selected source does not support this capability (for example, an internal Tracking Generator which must track the LO), this control is forced to its Preset value and grayed out.
Preset	This is unaffected by Mode Preset but is set to 1 on a Source Preset or Restore Input/Output Defaults.
Min/Max	1/1000
State Saved	Part of the Input/Output system, which means it is Loaded and Saved with state

Source Sweep Reverse

Allows you to reverse the source sweep direction

Normally, the source will sweep from a lower frequency to a higher frequency. However, there are test scenarios in which the source sweep needs to be “reversed”. In this case, it sweeps from a higher frequency to a lower frequency. For example, when the DUT is a frequency converter and a measurement of the Lower Side Band characteristics is desired, a reverse sweep is employed. Reverse sweeps are supported for such scenarios, but two cautions are in order:

1. Reverse Sweep only reverses the direction of the source’s sweep, not the analyzer’s sweep. Unless you are actually using a device like a frequency converter and looking at the lower sideband, thus effectively reversing the direction of the source’s sweep, the source will be sweeping in the opposite direction from the analyzer, and it will not be possible track the desired device output frequency.

2. Any time you are using a frequency converter, care must be taken in setting up all of the sweep parameters, including analyzer start/stop frequency and source multiplier, to make sure that the analyzer’s sweep tracks the output of the converter device.

Command	`:SOURce:FREQuency:SSReverse:ON|OFF|0|1` `:SOURce:FREQuency:SSReverse?`
Example	SOUR:FREQ:SSR:OFF SOUR:FREQ:SSR?
Dependencies	If the currently selected source does not support this capability (for example, an internal Tracking Generator which must track the LO), this control is forced to its Preset value and grayed out.
Preset	This is unaffected by Mode Preset but is set to OFF on a Source Preset or Restore Input/Output Defaults.
State Saved	Part of the Input/Output system, which means it is Loaded and Saved with state

Freq Offset

The frequency offset parameter offsets the source frequency from the analyzer frequency. The source frequency tracks the SA frequency according to the equations at the bottom of the Source Setup Table.

The frequency offset must be restricted to operate within the range of the source minimum and maximum frequencies.

Command	`:SOURce:FREQuency:OFFSet <freq>` `:SOURce:FREQuency:OFFSet?`

	:SOURce:FREQuency:OFFSet:STATe ON|OFF|1|0 :SOURce:FREQuency:OFFSet:STATe?
Example	:SOUR:FREQ:OFFS 10MHz
Dependencies	If the currently selected source does not support this capability (for example, an internal Tracking Generator which must track the LO), this control is forced to its Preset value and grayed out.
Preset	This is unaffected by Mode Preset but is set to 0.00Hz on a Source Preset or Restore Input/Output Defaults.
Min/Max	-500 GHz/500 GHz
State Saved	Part of the Input/Output system, which means it is loaded and saved with state.

Backwards Compatibility

The PSA option 215 supports this SCPI command. This command is equivalent to :SOURce:FREQuency:OFFSet

:SOURce:EXTernal:SWEep:OFFSet:FREQuency <freq>

:SOURce:EXTernal:SWEep:OFFSet:FREQuency?

The PSA option 215 supports this SCPI command. This command is equivalent to :SOURce:FREQuency:OFFSet:STATe

:SOURce:EXTernal:SWEep:OFFSet:STATe ON|OFF|1|0

:SOURce:EXTernal:SWEep:OFFSet:STATe?

4.3.6.7 Source Preset

The Source Preset control forces all the settings in the analyzer’s Source State to their preset condition.

The Source State is the set of Source settings that is maintained and remembered by the analyzer for use in the Tracking Source Mode. The Source State variables are controlled and set in the menus under the Source front panel key. These settings include:

- RF Output Off
- Amplitude = - 10 dBm
- Amplitude Step = Auto
- Power Sweep = 0 dB
- Amplitude Offset = 0 dB
- Source Sweep Reverse = Off
- Multiplier Numerator = 1

- Multiplier Denominator = 1
- Freq Offset = 0 Hz
- Point trigger is set to "Ext1"

The Source State is saved along with the state of the current Mode when you save a State, and is recalled when that Mode State is recalled.

When the analyzer first starts up, a Source Preset is performed. In the Input/Output menu, Restore Input/Output Defaults will also perform a Source Preset.

A Mode Preset, from modes that support the External Source, turns the RF Off but does **not** perform a Source Preset. By the same token, Source Preset does **not** perform a Mode Preset.

Source Preset does **not** change the Source Mode nor the selection of which physical source is being used, nor does it release the current source (the source remains under the control of the analyzer) nor exit the Source menu.

Command	`:SOURce:PRESet`
Example	:SOUR:PRES
Preset	Initiates a Source Preset

4.3.7 Sweep/Control

This tab contains controls for the Sweep and Control functions of the instrument, such as Sweep Time and Continuous/Single.

4.3.7.1 Sweep Time

Controls the time the instrument takes to sweep the current frequency span when the Sweep Type is Swept, displays the sweep time in swept measurements, and displays the equivalent Sweep Time when the Sweep Type is FFT.

NOTE **In instruments without sweeping hardware, such as some modular instruments, this control may be labeled “Acquisition Time”**

When Sweep Time is in Auto, the instrument computes a time that will give accurate measurements based on other settings of the instrument , such as RBW and VBW.

You can choose a shorter sweep time to improve the measurement throughput (with some potential unspecified accuracy reduction), but the Meas Uncal indicator will come on if the sweep time you set is less than the calculated Auto Sweep time. You can also select a longer sweep time, which can be useful (for example) for obtaining accurate insertion loss measurements on very narrowband filters. The number of measurement points can also be reduced to speed the measurement (at the expense of frequency resolution).

You might need to specify a specific sweep speed to accommodate a specific condition in your transmitter. For example, you may have a burst signal and need to measure an exact portion of the burst.

Because there is no “Auto Sweep Time” when in zero span, the Auto/Man toggle on this control disappears when in Zero Span.

When Sweep Type is FFT, you cannot control the sweep time, it is simply reported by the instrument to give you an idea of how long the measurement is taking. The Auto/Man toggle therefore disappears when in an FFT sweep. In this case the sweep time function is grayed out.

NOTE

In VXT Models M9410A/11A, the Sweep Type is *always* set to FFT, as these models do not have sweeping hardware. Therefore, in VXT Models M9410A/11A, the Sweep Time control is *always* grayed out unless you are in Zero Span. The value reported on the control is the approximate time that will be taken to acquire the trace data for one measurement cycle. This is basically the acquisition time for each frequency segment (“chunk”) multiplied by the number of segments. The “chunk” time is determined by other parameters, such as RBW and VBW. The value displayed represents, as close as can be estimated, the time to “take one sweep”.

When the control is grayed out, sending the Sweep Time SCPI command generates an error.

If you need a longer total acquisition time than that represented by the Sweep Time readout in VXT Models M9410A/11A, use the Minimum Acquisition Time control.

Note that although some overhead time is required by the instrument to complete a sweep cycle, the sweep time reported when Sweep Type is Swept does not include the overhead time, just the time to sweep the LO over the current Span. When Sweep Type is FFT, however, the reported Sweep Time takes into account both the data acquisition time and the processing time, in order to report an equivalent Sweep Time for a meaningful comparison to the Swept case.

In the ACP measurement, use `[:SENSe]:ACP:OFFSet:LIST:SWEep:TIME` to set the number of points used for measuring the offset channels for Basic and cdmaOne. For cdma2000, 1xEVDO and W-CDMA, this command sets the sweep time when using the sweep mode. See `[:SENSe]:ACP:SWEep:TYPE`.

In the Spot Frequency measurement, when sweep time mode is set to auto, the sweep time is calculated as:

sweeptime = maxOf(1e-3, (4.222 / rbw)) thus

sweeptime = maxOf(1e-3, (17.8084 / rbw))

NOTE

Significantly faster sweep times are available for the Swept SA measurement with Option FS1.

NOTE The Meas Uncal (measurement uncalibrated) warning is given in the Status Bar at the bottom of the screen when the manual Sweep time entered is faster than the time computed by the instrument's Sweep time equations, that is, the Auto Sweep Time. The instrument's computed Sweep time will give accurate measurements; if you sweep faster than this your measurements may be inaccurate. A Meas Uncal condition may be corrected by returning the Sweep Time to Auto; by entering a longer Sweep Time; or by choosing a wider RBW and/or VBW.

On occasion other factors such as the Tracking Generator's maximum sweep rate, the YTF sweep rate (in high band) or the LO's capability (in low band) can cause a Meas Uncal condition. The most reliable way to correct it is to return the Sweep Time to Auto.

If the instrument calculates that the Auto Sweep Time would be greater than 4000s (which is beyond its range), the warning message "Settings Alert; Sweep Rate Unavailable" is displayed. In this case increase the RBW or reduce the span.

If the instrument's estimated sweep time in an FFT sweep is greater than 4000s, the warning message "Settings Alert; Span:RBW Ratio too big" is displayed. In this case reduce the span or increase the RBW and/or FFT Width.

NOTE When using a Tracking Source (**Source**, **Source Mode** set to "**Tracking**"), the sweep time shown includes an estimate of the source's settling time. This estimate may contain inaccuracies, particularly when software triggering is used for the source. This can result in the reported sweep time being shorter than the actual sweep time.

Remote Command	`[:SENSe]:SWEep:TIME <time>`
	`[:SENSe]:SWEep:TIME?`
	`[:SENSe]:SWEep:TIME:AUTO OFF | ON | 0 | 1`
	`[:SENSe]:SWEep:TIME:AUTO?`

Example	`:SWE:TIME 500 ms`
	`:SWE:TIME?`
	Swept SA
	`:SWE:TIME:AUTO OFF`
	`:SWE:TIME:AUTO?`

Notes	The values shown in this table reflect the "swept spans" conditions, which are the default settings after a preset. See "Couplings" for values in the zero span domain
Dependencies	The Auto/Man toggle disappears in Zero Span. The SCPI command `SWEep:TIME:AUTO ON` if sent in Zero Span generates an error message In FFT sweeps, the Sweep Time control is grayed out. Pressing the control or sending the SCPI for sweep time while the instrument is in FFT sweep generates a -221, "Settings Conflict;" error In certain instruments without sweeping hardware, such as VXT and UXM, the Auto/Man toggle disappears and the Sweep Time control is grayed out The SCPI command `:SWEep:TIME:AUTO ON` if sent in FFT sweeps generates an error

	Sweep Time is grayed out while in Gate View, to avoid confusing those who want to set GATE VIEW Sweep Time Control is grayed out in Measurements that do not support swept mode Control is not displayed in Modes that do not support Swept mode Set to Auto when **Auto Couple** is pressed or sent remotely
Couplings	Sweep time is coupled to RBW when in a non-zero span. If **Sweep Time** is set to Auto, then the sweep time is changed as the RBW changes, to maintain amplitude calibration Sweep Time is also coupled to the Video Bandwidth (VBW). As the VBW is changed, the sweep time (when set to Auto) is changed to maintain amplitude calibration. This occurs because of common hardware between the two circuits Although the VBW filter is not “in-circuit” when using the average detector and the EMI detectors, the Video BW control can have an effect on (Auto) sweep time in these cases, and is not disabled. Because the purpose of the average detector and the VBW filter are the same, either can be used to reduce the variance of the result. In this case, reducing the VBW setting increases the sweep time, which increases the averaging time, producing a lower-variance trace Span, Center Frequency, and the number of sweep points also can have an effect. So changing these parameters may change the Sweep Time The Sweep Time used upon entry to Zero Span is the same as the Sweep Time that was in effect before entering Zero Span. The Sweep Time can be changed while in Zero Span. Upon leaving Zero Span, the Auto/Man state of Sweep Time that existed before entering Zero Span is restored If Sweep Time was in Auto before entering Zero Span, or if it is set to Auto while in zero span (which can happen via remote command or if **Auto Couple** is pressed) it returns to Auto and recouples when returning to non-zero spans If Sweep Time was in Man before entering Zero Span, it returns to Man when returning to non-zero spans, and any changes to Sweep Time that were made while in Zero Span are retained in the non-zero span (except where constrained by minimum limits, which are different in and out of zero span)
Preset	Auto ON
State Saved	Saved in instrument state
Min	In zero span: 1 ms In swept span: 1 ms In the ACP measurement, when Meas Method is Fast Power, the minimum sweep time is 'span' dependent and automatically calculated 1.0e-6 Burst Power In Stepped Tracking (as with option ESC): same as auto sweep time (In Swept Tracking, with Tracking Generator option T03 or T06, the minimum sweep time is 1 ms, but the Meas Uncal indicator is turned on for sweep times faster than 50 ms)
Max	In zero span: 6000 s In swept span: 4000 s In VXT: depends on current settings in Swept spans
Annotation	The sweep time is displayed in the lower-right corner of the screen. The number of points is displayed parenthetically, as Sweep 13.3 ms (1001 points) If in an FFT sweep, the word (FFT) is added in parentheses and a ~ is used to indicate “approximate”, as

	Sweep (FFT) ~13 ms (1001 points) A "#" mark appears before "Sweep" in the annotation when it is switched from Auto to Manual coupling. Note that this # does *not* appear when in zero span, as there is neither an autocoupled nor a manual state in zero span; there is no coupling at all
Status Bits/OPC dependencies	Meas Uncal is Bit 0 in the `:STATus:QUEStionable:INTegrity:UNCalibrated` register

4.3.7.2 Sweep/Measure

Allows you to toggle between Continuous and Single sweep or measurement operation. The Single/Continuous state is Meas Global, so the setting affects *all* measurements.

The front-panel key **Single/Cont** performs exactly the same function

NOTE In the `WAVeform` measurement, this control only appears in the Meas Bar, and not in the **Sweep/Control** tab.

See "More Information" on page 266

Remote Command	`:INITiate:CONTinuous OFF | ON | 0 | 1` `:INITiate:CONTinuous?`

Example	`:INIT:CONT 0`
	`:INIT:CONT OFF`
	puts instrument into Single measurement operation
	`:INIT:CONT 1`
	`:INIT:CONT ON`
	puts instrument into Continuous measurement operation

Preset	ON Note that `:SYST:PRES` sets `:INIT:CONT` to `ON` but `*RST` sets `:INIT:CONT` to `OFF`
State Saved	Saved in instrument state
Annunciation	The **Single/Continuous** icon in the Meas Bar changes depending on the setting: – A line with an arrow is Single – A loop with an arrow is Continuous

More Information

With **Avg/Hold Num** (in the **Meas Setup** menu) set to **Off** or set to **On** with a value of 1, a sweep is taken after the trigger condition is met; and the instrument continues to take new sweeps after the current sweep has completed and the trigger condition is again met. However, with **Avg/Hold Num** set to On with a value >1, multiple sweeps (data acquisitions) are taken for the measurement. The trigger condition must be met prior to each sweep. The sweep is not stopped when the average count k equals the number N set for Avg/Hold Num is reached, but the number k stops incrementing. A measurement average usually applies to all traces, marker results, and numeric results, but sometimes only applies to the numeric results.

If the instrument is in Single measurement, pressing the **Cont/Single** toggle control does not change k and does not cause the sweep to be reset; the only action is to put the instrument into Continuous measurement operation.

If it is already in Continuous sweep:

- the `:INIT:CONT 1` command has no effect
- the `:INIT:CONT 0` command will place the instrument in Single Sweep but will have no effect on the current sequence until k = N, at which point the current sequence will stop and the instrument will go to the idle state.

See "Restart" on page 267 control description for details on the `:INIT:IMM` (Restart) function.

If you are already in Single sweep, the `:INIT:CONT OFF` command has no effect.

If you are already in Single Sweep, then pressing the **Cont/Single** toggle control in the middle of a sweep does not restart the sweep or sequence. Similarly, pressing the **Cont/Single** toggle control does not restart the sweep or sequence if the sweep is not in the idle state (for example, if you are taking a very slow sweep, or the instrument is waiting for a trigger). Even though pressing the **Cont/Single** toggle control in the middle of a sweep does *not* restart the sweep, sending `:INIT:IMM` *does* reset it.

4.3.7.3 Restart

The **Restart** function restarts the current sweep, or measurement, or set of averaged/held sweeps or measurements. In measurements that support pausing, if you are Paused, pressing **Restart** performs a **Resume**.

The Restart function is accessed in several ways:

- Pressing the **Restart** key
- Sending the remote command `:INIT:IMM`
- Sending the remote command `:INIT:REST`

See "More Information" on page 268

Remote Command	`:INITiate[:IMMediate]` `:INITiate:RESTart`
Example	`:INIT:IMM` `:INIT:REST`

Notes	`:INIT:REST` and `:INIT:IMM` and the front-panel **Restart** key perform exactly the same function
Couplings	Resets average/hold count k For the first sweep, overwrites all active (update=on) traces with new current data For application modes, resets other parameters as required by the measurement
Status Bits/OPC dependencies	This is an Overlapped command The `:STATus:OPERation` register bits 0 through 8 are cleared The `:STATus:QUEStionable` register bit 9 (INTegrity sum) is cleared The `SWEEPING` bit is set The `MEASURING` bit is set
Backwards Compatibility Notes	For Spectrum Analysis mode in ESA and PSA, the **Restart** hardkey and the `:INIT:REST` command restart trace averages (displayed average count reset to 1) for a trace in **Clear Write**, but did not restart **Max Hold** and **Min Hold** In the X-Series, the **Restart** hardkey and the `:INIT:REST` command restart not only **Trace Average**, but **Max Hold** and **Min Hold** traces as well For wireless comms modes in ESA and PSA, the **Restart** hardkey and the `:INIT:REST` command restarted every measurement, including all traces and numeric results. There is no change to this operation

More Information

The **Restart** function first aborts the current sweep or measurement as quickly as possible. It then resets the sweep and trigger systems, sets up the measurement and initiates a new data measurement sequence with a new data acquisition (sweep) taken once the trigger condition is met.

If the instrument is in the process of aligning when a Restart is executed, the alignment finishes before the restart function is performed.

Even when set for Single operation, multiple sweeps may be taken when **Restart** is pressed (for example, when averaging/holding is on). Thus when we say that Restart "restarts a measurement," depending on the current settings, we may mean:

- It restarts the current sweep
- It restarts the current measurement
- It restarts the current set of sweeps if any trace is in Trace Average, Max Hold or Min Hold
- It restarts the current set of measurements if Averaging, or Max Hold, or Min Hold is on for the measurement

With Average/Hold Number (in Meas Setup menu) set to 1, or Averaging off, or no trace in Trace Average or Hold, a single sweep is equivalent to a single measurement. A single sweep is taken after the trigger condition is met; and the instrument stops sweeping once that sweep has completed. However, with Average/Hold Number >1 and at least one trace set to Trace Average, Max Hold, or Min Hold (SA Measurement) or Averaging on (most other measurements), multiple sweeps/data acquisitions are taken for a single measurement. The trigger condition must be met prior to each sweep. The sweep is stopped when the average count k equals the number N set for Average/Hold Number. A measurement average usually applies to all traces, marker results, and numeric results, but sometimes only applies to the numeric results.

Once the full set of sweeps has been taken, the instrument will go to the idle state. To take one more sweep without resetting the average count, increment the average count by 1, by pressing the step up key while Average/Hold Number is the active function, or by sending the remote command `:CALC:AVER:TCON UP`.

4.3.7.4 Sweep Type

Chooses between the FFT and Sweep types of sweep.

Sweep Type refers to whether or not the instrument is in Swept or FFT analysis. When in Auto, the selection of sweep type is governed by two different sets of rules, depending on whether you want to optimize for dynamic range or for speed.

FFT “sweeps” should not be used when making EMI measurements. When a CISPR detector (Quasi Peak, EMI Average, RMS Average) is selected for any active trace (one for which Update is on), the FFT key in the Sweep Type menu is grayed out, and the Auto Rules only choose Swept. If Sweep Type is manually selected to be FFT, the CISPR detectors are all grayed out.

FFT sweeps will never be auto-selected when Screen Video, Log Video or Linear Video are the selected Analog Output.

SCPI command not supported in SCPI LC Mode.

Preset	AUTO ON
State Saved	Saved in instrument state.

Dependencies

Grayed out in Zero Span, however, the setting can be changed remotely with no error indication.

Grayed out or blanked in measurements that do not support swept mode.

When Gate is on, Gate Method selection affects Sweep Type availability:

When Gate Method is FFT, Swept grayed out and rules choose FFT

When Gate Method is Video or LO, FFT grayed out and rules choose Swept

Swept is Grayed out while in Gated FFT (meaning Gate is ON and Gate Method is FFT).

When a CISPR detector (Quasi Peak, EMI Average, RMS Average) is selected for any active trace, the FFT selection is grayed out.

When the RF Preselector is on, the FFT selection is grayed out.

When Signal ID is on, Manual FFT is grayed out.

While in Gated LO (meaning Gate is ON and Gate Method is LO), the FFT selection is grayed out.

While in Gated Video (meaning Gate is ON and Gate Method is Video), the FFT selection is grayed out.

Couplings

Pressing Auto Couple always sets Sweep Type to Auto.

Swept is always chosen whenever any form of Signal ID is on, or any EMI detector is selected, or the RF Preselector is ON.

4.3.7.5 Sweep Type Rules

Selects which set of rules will be used for automatically choosing the Sweep Type when Sweep Type is in Auto.

SCPI command not supported in SCPI LC Mode.

Preset	DRANge ON
State saved	Saved in instrument state.

Dependencies

Grayed out in Zero Span, however, the setting can be changed remotely with no error indication.

Couplings

Pressing Auto Couple always sets Sweep Type Rules to Auto.

Backwards Compatibility Notes

The legacy parameter DYNamicrange is unsupported.

4.3.7.6 Sweep Time Rules

Allows the choice of three distinct sets of sweep time rules. These are the rules that are used to set the sweep time when Sweep Time is in Auto mode. Note that these rules only apply when in the Swept Sweep Type (either manually or automatically chosen) and not when in FFT sweeps.

If any selection is manually chosen, the AUTO/MAN toggle is set to MAN.

See "More Information" on page 271

SCPI command not supported in SCPI LC Mode.

Preset	AUTO ON
State Saved	Saved in instrument state.

Dependencies

Grayed out in Zero Span, however, the setting can be changed remotely with no error indication.

Grayed out in FFT sweeps. Pressing this selection while the instrument is in FFT sweep generates an advisory message. The SCPI is acted upon if sent, but has no effect other than to change the readout on the control, as long as the analyzer is in an FFT sweep.

Couplings

Set to Auto on Auto Couple.

More Information

Value	Example	Notes
Auto	:SWE:TYPE:AUTO:RUL:AUTO ON	When in Auto, the Sweep Type Rules are set to Best Dynamic Range. It seems like a very simple Auto function but the use of this construct allows a consistent statement about what the Auto Couple control does.
SA - Normal	:SWE:TIME:AUTO:RUL NORM	This selection selects auto rules for optimal speed and generally sufficient accuracy.
SA - Accuracy	:SWE:TIME:AUTO:RUL ACC	This selection selects auto rules for specified absolute amplitude accuracy.
Stimulus/Response	:SWE:TIME:AUTO:RUL SRES	This selection selects auto rules for the case where the analyzer is sweeping in concert with a source. Automatically selected when the Source is on (Source Mode not set to OFF).

The first set of rules is called SA – Normal. Sweep Time Rules is set to SA-Normal on a Preset or Auto Couple. These rules give optimal sweep times at a loss of accuracy. Note that this means that in the Preset or Auto Coupled state, instrument amplitude accuracy specifications do not apply.

Setting Sweep Time Rules to SA-Accuracy will result in slower sweep times than SA-Normal, usually about three times as long, but with better amplitude accuracy for CW signals. The instrument absolute amplitude accuracy specifications only apply when Sweep Time is set to Auto, and Sweep Time Rules are set to SA-Accuracy. Additional amplitude errors that occur when Sweep Time Rules are set to SA-Normal are usually well under 0.1 dB with non-EMI detectors (though this is not guaranteed). With EMI detectors (Quasi Peak, EMI Average and RMS Average), the errors are usually well under 0.5 dB. For best accuracy when using EMI detectors, zero span is the preferred measurement technique. For the EMI detectors, zero span measurements will not fully agree with swept measurements except at extremely slow sweep rates.

Because of the faster sweep times and still low errors, SA-Normal is the preferred setting of Sweep Time Rules.

The third set of sweep time rules is called Stimulus/Response and is automatically selected when an integrated source is turned on, such as a Tracking Generator or a synchronized external source.

Note that there are two types of source-synchronized sweeping, one where the source sweeps (as with a built in tracking generator) and one where the source steps. The former is usually much faster than even general purpose sweeps because when sweeping along with a swept source the RBW and VBW filters do not directly interact with the Span. However, sweeping in concert with a stepped source usually slows the sweep down because it is necessary to wait for the stepped source and the analyzer to settle at each point. The analyzer chooses one of these methods based on what kind of a source is connected or installed. It picks the former if there is no source in use, which means that by selecting Stimulus/Response rules manually when there is no source in use, you can achieve faster sweep times than SA – Normal.

Stimulus-response auto-coupled sweep times are typically valid in stimulus-response measurements when the system's frequency span is less than 20 times the bandwidth of the device under test. As noted above you can select these rules manually (even if not making Stimulus-Response measurements), which will allow you to sweep faster before the "Meas Uncal" warning comes on, but you are then not protected from the over-sweep condition and may end up with uncalibrated results. However, it is commonplace in measuring non-CW signals such as noise to be able to get excellent measurement accuracy at sweep rates higher than those required for CW signal accuracy, so this is a valid measurement technique.

When the X-series analyzer is in Auto Sweep Time, the sweep time is estimated and displayed in the Sweep/Control menu as well as in the annotation at the bottom of the displayed measurement. Since this can be dependent on variables outside the analyzer's control, the actual sweep time may vary slightly from this estimate.

4.3.7.7 FFT Width

This menu displays and controls the width of the FFT's performed while in FFT mode. The "FFT width" is the range of frequencies being looked at by the FFT, sometimes referred to as the “chunk width” -- it is not the resolution bandwidth used when performing the FFT.

It is important to understand that this function does not directly set the FFT width, it sets the limit on the FFT Width. The actual FFT width used is determined by several other factors including the Span you have set. Usually the instrument picks the optimal FFT Width based on the current setup, but on occasion you may wish to limit the FFT Width to be narrower than the one the instrument would have set.

NOTE **This function does not allow you to widen the FFT Width beyond that which the instrument might have set; it only allows you to narrow it. You might do this to improve the dynamic range of the measurement or eliminate nearby spurs from your measurement.**

Note that the FFT Width setting will have no effect unless in an FFT sweep.

See "More Information" on page 274

SCPI command not supported in SCPI LC Mode.

Preset	The Preset is Auto, but Preset will also pick Best Dynamic Range and hence this function will be set to ~Maximum ON
Min/Max	Min:4.01 kHz Max:The maximum available FFT width is dependent on the IF Bandwidth option. The maxim mum available width is: Standard, 10 MHz; Option B25, 25 MHz, Option B40, 40 MHz
State Saved	Saved in instrument state

Notes

The parameter is in units of frequency.

Dependencies

In some models, the analog prefilters are not provided. In these models the FFT Width function is always in Auto. The FFT Width key is blanked in these models, and the SCPI commands are accepted without error but have no effect.

Grayed out in Zero Span, however, the setting can be changed remotely with no error indication.

Couplings

The FFT Width affects the ADC Dither function (see Meas Setup key) and the point at which the instrument switches from Swept to FFT acquisition.

More Information

An FFT measurement can only be performed over a limited span known as the "FFT segment". Several segments may need to be combined to measure the entire span. For advanced FFT control in the X-Series, you have direct control over the segment width using the FFT Width control. Generally, in automatic operation, the X-Series sets the segment width to be as wide as possible, as this results in the fastest measurements.

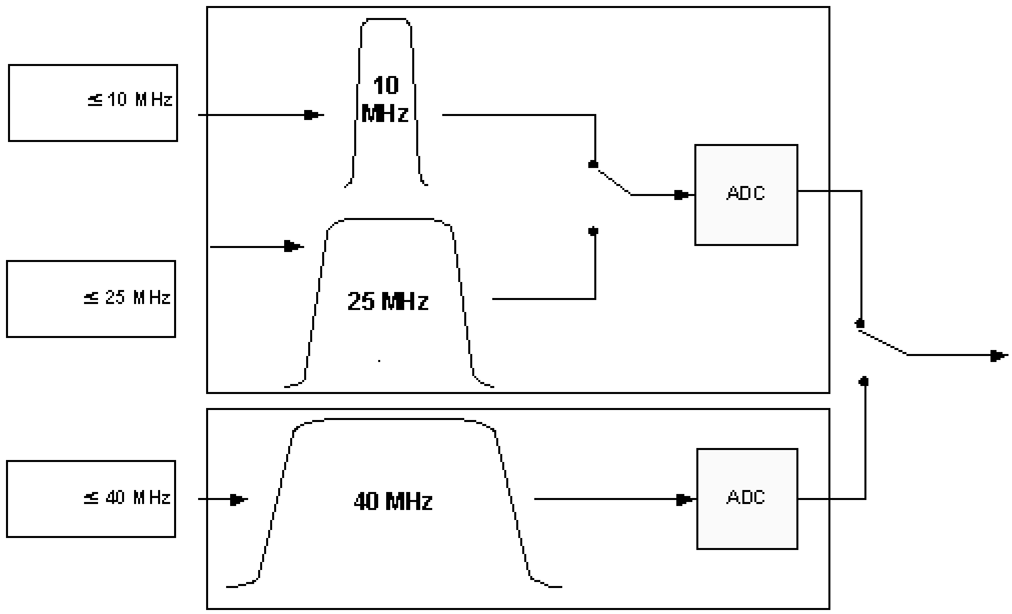
However, to increase the dynamic range, most X-series models provide a set of analog prefilters that precede the ADC. Unlike swept measurements, which pass the signal through a bandpass before the ADC, FFT measurements present the full signal bandwidth to the ADC, making them more susceptible to overload, and requiring a lower signal level. The prefilters act to alleviate this phenomenon - they allow the signal level at the ADC to be higher while still avoiding an ADC overload, by eliminating signal power outside the bandwidth of interest, which in turn improves dynamic range.

Although narrowing the segment width can allow higher dynamic ranges in some cases, this comes at the expense of losing some of the speed advantages of the FFT, because narrower segments require more acquisitions and proportionately more processing overhead.

However, the advantages of narrow segments can be significant. For example, in pulsed-RF measurements such as radar, it is often possible to make high dynamic range measurements with signal levels approaching the compression threshold of the analyzer in swept spans (well over 0 dBm), while resolving the spectral components to levels below the maximum IF drive level (about –8 dBm at the input mixer). But FFT processing experiences overloads at the maximum IF drive level even if the RBW is small enough that no single spectral component exceeds the maximum IF drive level. If you reduce the width of an FFT, an analog filter is placed before the ADC that is about 1.3 times as wide as the FFT segment width. This spreads out the pulsed RF in time and reduces the maximum signal level seen by the ADC. Therefore, the input attenuation can be reduced and the dynamic range increased without overloading the ADC.

Further improvement in dynamic range is possible by changing the FFT IF Gain (in the Meas Setup menu of many measurements). If the segments are reduced in width, FFT IF Gain can be set to High, improving dynamic range.

Depending on what IF Bandwidth option you have ordered, there can be up to three different IF paths available in FFT sweeps, as seen in the diagram below:



The 10 MHz path is always used for Swept sweeps. It is always used for FFT sweeps as well, unless you specify ~25 MHz in which case the 25 MHz path will be used for FFT sweeps, or ~40 MHz, in which case the 40 MHz path will be used for FFT sweeps. Note that, although each of these selections pick the specified path, the analyzer may choose an FFT width less than the full IF width, to optimize speed, trading off acquisition time versus processing time.

4.3.7.8 Points

Sets the number of points taken per sweep, and displayed in the traces. The current value of points is displayed parenthetically, next to the sweep time in the lower-right corner of the display. Using more points provides greater resolution. Using fewer points compacts the data and decreases the time required to access a trace over the remote interface.

Increasing the number of points does not increase the sweep time. However, it can slightly impact the trace processing time and therefore the overall measurement speed. Decreasing the number of points does not decrease the sweep time, but it may speed up the measurement, depending on the other sweep settings (for example, in FFT sweeps). Fewer points will always speed up the I/O.

Due to minimum sweep rate limitations of the hardware, the minimum sweep time available to the user will increase above its normal value of 1 ms as the number of sweep points increases above 15001.

Changing the number of sweep points has several effects on the analyzer. The sweep time resolution will change. Trace data for all the traces will be cleared and, if

Sweep is in Cont, a new trace taken. If any trace is in average or hold, the averaging starts over.

When in a split screen display each window may have its own value for points.

When sweep points is changed, an informational message is displayed, "Sweep points changed, all traces cleared."

For SCPI command and parameters, see "[SENSe]:SWEep:POINts" on page 747

Dependencies

- This function is not available when Signal ID is set to On in External Mixing.
- Neither the knob nor the step keys can be used to change this value. If it is tried, a warning is given.
- Clipped to 1001 whenever you are in the Spectrogram View.
- Grayed out in measurements that do not support swept.
- Blanked in modes that do not support Swept.
- Grayed out if Normalize is on. You cannot change the number of sweep points with Normalize on, as it will erase the reference trace.

Couplings

Whenever the number of sweep points change:

- All trace data is erased
- Any traces with Update Off will also go to Display Off (like going from View to Blank in the older analyzers)
- Sweep time is re-quantized
- Any limit lines that are on will be updated
- If averaging/hold is on, averaging/hold starts over

Backwards Compatibility Notes

1. In ESA and PSA, Sweep Points was adjustable with the knob and step keys. This caused the sweep time to increase whenever Points was adjusted (either up or down), due to excessive application of the quantization rules. In the X-Series the value of Sweep Points must be entered manually, which avoids this anomaly
2. In ESA the preset value of Sweep Points is 401, in PSA it is 601. In X-Series it is 1001.

4.3.7.9 Abort (Remote Command Only)

This command stops the current measurement. It aborts the current measurement as quickly as possible, resets the sweep and trigger systems, and puts the measurement into an "idle" state. If the instrument is in the process of aligning when `:ABORt` is sent, the alignment finishes before the abort function is performed, so `:ABORt` does *not* abort an alignment.

If the instrument is set for Continuous measurement, it sets up the measurement and initiates a new data measurement sequence with a new data acquisition (sweep) taken once the trigger condition is met.

If the instrument is set for Single measurement, it remains in the "idle" state until an `:INIT:IMM` command is received.

Remote Command	`:ABORt`
Example	`:ABOR`
Notes	If `:INIT:CONT` is `ON`, then a new continuous measurement will start immediately, with sweep (data acquisition) occurring once the trigger condition has been met If `:INIT:CONT` is `OFF`, then `:INIT:IMM` is used to start a single measurement, with sweep (data acquisition) occurring once the trigger condition has been met
Dependencies	For continuous measurement, `:ABORt` is equivalent to the **Restart** key Not all measurements support the abort command
Status Bits/OPC dependencies	The `:STATus:OPERation` register bits 0 through 8 are cleared The `:STATus:QUEStionable` register bit 9 (INTegrity sum) is cleared Since all the bits that feed into OPC are cleared by `:ABORt`, the `:ABORt` will cause the *OPC query to return true

4.3.7.10 Trace Type

There are four trace Types: **Clear/Write, Trace Average, Max Hold** and **Min Hold**.

These types are described below. You may select one of these types for each trace. Re-selecting the current Trace Type initiates the same action that selecting it the first time did, even though it is already selected. For example, selecting Clear/Write while Clear/Write is already selected will nonetheless clear the trace and begin rewriting it.

Besides the **Trace Type**, the **View/Blank** state must be set to **Active** (**Update** On, **Display** On) for a trace to be updating and visible. Selecting any **Trace Type** automatically makes the trace **Active**. See also the **View/Blank** menu description.

See:

– "Trace Mode Backwards Compatibility" on page 278

– "Trace Writing Types" on page 278

– "Clear/Write" on page 279
– "Trace Average" on page 279
– "Max Hold" on page 280
– "Min Hold" on page 280

Couplings	Selecting a trace type sets the Trace to **Active** (**Update** On, **Display** On), even if that trace type was already selected
Preset	`WRITe` After a Preset, all traces are cleared (all trace points set to mintracevalue)
State Saved	The type of each trace is saved in instrument state
Annunciation	The type for each trace is indicated in the Trace annunciator panel on the Measurement Bar

Trace Mode Backwards Compatibility

In earlier analyzers, the Trace Modes were Clear/Write, Max Hold, Min Hold, View and Blank. Averaging was global to all traces and was controlled under the BW/Avg menu.

In the X-Series, trace averaging can be done on a per-trace basis. The Trace Modes (now called Types) are Clear/Write, Trace Average, Max Hold and Min Hold. View and Blank are set separately under the View/Blank key.

While this gives the user more flexibility it also gives rise to potential backwards compatibility problems. To mitigate these, the old Trace Mode command has been retained and a new command, Trace Type, has been added. What were formerly called trace modes are now called trace types.

When the Average/Hold switch in the Mode Setup, Legacy Compatibility menu is in the “On” position, the following is true for traces in Max Hold and Min Hold:

– They pay no attention to the Average/Hold number; “Single” for Max Hold causes one sweep only, so going to Single stops after the current sweep, and going to Cont starts you going again without clearing the accumulated result

– They don’t clear the Max Hold on a Restart or Single or INIT:IMM (changing a measurement parameter like frequency or bandwidth etc. would still restart the max hold).

Trace Writing Types

Here are details about the four trace writing types:

Value	Notes
Clear/Write	In **Clear/Write** type each trace update replaces the old data in the trace with new data. Selecting Clear/Write clears the trace and initiates a new sweep

Value	Notes
Trace Average	In **Trace Average** type the analyzer maintains and displays an average trace, which represents the cumulative average on a point-by-point basis of the new trace data and previous averaged trace data Selecting **Trace Average** will clear the trace, initiate a new sweep, and restart the Average sequence
Max Hold	In **Max Hold** type the analyzer maintains and displays a max hold trace, which represents the maximum data value on a point-by-point basis of the new trace data and previous trace data Selecting **Max Hold** will clear the trace, initiate a new sweep, and restart the hold sequence
Min Hold	In **Min Hold** type the analyzer maintains and displays a min hold trace, which represents the minimum data value on a point-point basis of the new trace data and previous trace data Selecting **Min Hold** will clear the trace, initiate a new sweep, and restart the hold sequence

Clear/Write

In **Clear/Write** type each trace update replaces the old data in the trace with new data. Pressing the **Clear/Write** selection for the selected trace, sets the trace type to **Clear/Write** and causes the trace to be cleared, even if you are already in Clear/Write. Then a new sweep is initiated. Trigger conditions must be met before the sweep actually starts, and if in Single the sweep won't start until Restart is pressed.

Because pressing **Clear/Write** stops the current sweep and initiates a new one, **Trace Average, Max Hold** and **Min Hold** data may be interrupted in mid-sweep when **Clear/Write** is pressed, and therefore may not accurately reflect the displayed count. Therefore, when **Clear/Write** is pressed for one trace, **Trace Average, Max Hold** and **Min Hold** must restart for all traces.

When in **Clear/Write**, if a measurement-related instrument setting is changed (that is, one which requires new data to be taken, like Center Frequency or Attenuation), a new sweep is initiated but the trace is not cleared.

Trace Average

In **Trace Average** type the analyzer maintains and displays an average trace, which represents the cumulative average on a point-by-point basis of the new trace data and previous averaged trace data. Pressing the **Trace Average** key (for the selected trace), sets the trace type to **Trace Average** and causes the average to be restarted

Details of the count limiting behavior and the averaging calculations may be found under **Avg|Hold Number** and **Average Type** in the Meas Setup Section**.**

When in **Trace Average**, if a measurement-related instrument setting is changed (that is, one which requires new data to be taken, like Center Frequency or

Attenuation), the average restarts and a new sweep is initiated but the trace is not cleared.

Restarting the average means:

- The average/hold count k is set to 1, so that the next time the average trace is displayed it simply represents one trace of new data
- A new sweep is initiated
- Once the new sweep starts, the trace is overwritten with current trace data as the first trace of the new average

Remember that restarting averaging also restarts **Max Hold** and **Min Hold**, as there is only one count for Trace Average and Hold.

Max Hold

In **Max Hold** type the analyzer maintains and displays a max hold trace, which represents the maximum data value on a point-by-point basis of the new trace data and previous trace data. Details of the count limiting behavior may be found under **Avg|Hold Number** in the Meas Setup section.

Pressing the **Max Hold** key for the selected trace, sets the trace type to **Max Hold,** causes the trace to be cleared, and causes the **Max Hold** sequence to be (re)started, even if you are already in Max Hold.

When in **Max Hold**, if a measurement-related instrument setting is changed(that is, one which requires new data to be taken, like Center Frequency or Attenuation), the **Max Hold** sequence restarts and a new sweep is initiated but the trace is not cleared.

Restarting the **Max Hold** sequence means:

- The average/hold count k is set to 1, so that the next time the max hold trace is displayed it simply represents one trace of new data
- A new sweep is initiated.

Remember that restarting **Max Hold** also restarts averaging and **Min Hold**, as there is only one count for Trace Average and Hold.

Min Hold

In **Min Hold** type the analyzer maintains and displays a min hold trace, which represents the minimum data value on a point-point basis of the new trace data and previous trace data. Details of the count limiting behavior may be found under **Avg|Hold Number** in the Meas Setup section.

Pressing the **Min Hold** key for the selected trace, sets the trace type to **Min Hold,** causes the trace to be cleared, and causes the **Min Hold** sequence to be (re)started, even if you are already in Min Hold.

When in **Min Hold**, if a measurement-related instrument setting is changed(that is, one which requires new data to be taken, like Center Frequency or Attenuation), the **Min Hold** sequence restarts and a new sweep is initiated but the trace is not cleared.

Restarting the **Min Hold** sequence means:

- The average/hold count k is set to 1, so that the next time the min hold trace is displayed it simply represents one trace of new data
- A new sweep is initiated

Remember that restarting **Min Hold** also restarts **Max Hold** and averaging, as there is only one count for Trace Average and Hold.

4.3.7.11 View/Blank

This key lets you set the state of the two trace values, Update and Display. The four choices available in this dropdown menu are:

- Active: Update and Display both On
- View: Update Off and Display On
- Blank: Update Off and Display Off
- Background: Update On, Display Off (this allows a trace to be blanked and continue to update “in the background”, which was not possible in the past)

A trace with Display Off is indicated by a strikethrough thru the type letter in the trace annotation panel in the Measurement bar. A trace with Update Off is indicated by dimming the type letter in the trace annotation panel in the Measurement bar.

In the example below, Traces 3, 4, 5 and 6 have Update Off, and Traces 4 and 6 have Display Off.

See:

- "Trace Update State On/Off" on page 282
- "Trace Display State On/Off" on page 282
- "More Information" on page 282

Notes	The four states of this Dropdown actually set two variables, Update and Display, to their four possible combinations:

	– **Active**: Update and Display both On – **View**: Update Off and Display On – **Blank**: Update Off and Display Off – **Background**: Update On, Display Off See tables below for detail on the SCPI to control these two variables.
Dependencies	When Signal ID is on, this key is grayed out.
Couplings	Selecting a trace type (Clear/Write, Trace Average, Max Hold, Min Hold) for a trace puts the trace in **Active** (**Update On and Display On)**, even if that trace type was already selected. Selecting a detector for a trace puts the trace in **Active** (**Update On and Display On)**, even if that detector was already selected. Selecting a math mode other than Off for a trace (pressing the key or sending the equivalent SCPI command) puts the trace in **Active** (**Update On and Display On)**, even if that math mode was already selected. Loading a trace from a file puts that trace in View regardless of the state it was in when it was saved; as does being the target of a **Copy** or a participant in an **Exchange.**

Trace Update State On/Off

Couplings	Whenever you set **Update** to **On** for any trace, the **Display** is set to **On** for that trace.
Preset	1|0|0|0|0|0 (On for Trace 1; Off for 2–6)
State Saved	Saved in instrument state

Trace Display State On/Off

Couplings	Whenever you set Update to On for any trace, the Display is set to On for that trace.
Preset	1|0|0|0|0|0 (On for Trace 1; Off for 2–6)
State Saved	Saved in instrument state

More Information

When a trace becomes inactive, any update from the SENSe system (detectors) immediately stops – this does not wait for the end of the sweep. The trace data remains unchanged but stops updating. If the trace is blanked this still does not affect the data in the trace. Traces that are blanked (Display=off) do not display nor appear on printouts but their data stays intact and they may be queried and markers may be placed on them

In most cases, inactive traces are static and unchanging; however, there are cases when an inactive trace will update, specifically:

– if data is written to that trace from remote

– if trace data is loaded from mass storage

– if the trace is the target of a Copy or participant in an Exchange

– if the trace is cleared using the Clear Trace function (below)

Inactive traces that are also being displayed (traces in **View**) are displayed at half intensity. Traces in **View** display across the entire X-Axis of the instrument. Their horizontal placement does not change even if X-Axis settings subsequently are changed, although Y-axis settings will affect the vertical placement of data.

When a trace becomes active (Update=On), the trace is cleared, the average count is reset, and a new sweep is initiated.

Note that the action of putting a trace in Display=Off and/or Update=Off does not restart the sweep and does not restart Averaging or Hold functions for any traces.

4.3.7.12 Detector

Opens a dropdown list that enables you to select a specific detector for the current measurement. The detector selected is then applied to the selected trace.

The analyzer is in Auto detection by default, and normally Auto detection will choose the best detector for you automatically. If you choose a detector manually, this will turns Auto detection off for the selected trace.

For the SCPI UI, two commands are provided. One is a legacy command, which affects all traces. There is also a command which is new for the X-Series, which uses a subopcode to specify to which trace the specified detector is to be applied.

The three detectors at the end of the Detector menu, Quasi Peak, EMI Average, and RMS Average, are referred to collectively as the “CISPR detectors” because their behaviors are specified by the CISPR 16–1–1 specification.

See "More Information" on page 286

NOTE **The analyzer can typically provide 3 different detectors simultaneously. Occasionally the analyzer can only provide 2 simultaneous detectors, typically when the Average detector is selected. When one of the CISPR detectors is selected, it is only possible to have that one detector so all active traces change to that detector. It is never possible to have more than 3 simultaneous detectors.**

For SCPI command and parameters, see "[SENSe]:DETector[:FUNCtion]" on page 721

Notes

The query returns a name that corresponds to the detector type as shown below, and indicates the setting for Trace 1.

String Returned	Definition
NORM	Normal
AVER	Average/RMS
POS	Positive Peak
SAMP	Sample
NEG	Negative Peak
QPE	Quasi peak
EAV	EMI Average
RAV	RMS Average

Dependencies

When Tune & Listen is turned on, or Demod Audio is the selected Analog Output, all active traces are forced to use the same detector.

CISPR detectors are grayed out when you have manually selected FFT sweep. Conversely, if any CISPR detector is selected on an active trace, the auto rules for sweep type will never select FFT, and manual FFT selection will be grayed out.

When Signal ID is on, the Detector key is grayed out for Traces 2-6 in Image Suppress mode and for Traces 3-6 in Image Shift Mode.

The VBW filter is not used for the Average detector or any of the CISPR detectors (Quasi Peak, EMI Average, RMS Average), as indicated by a * after the VBW value on the graph if any of these detectors is selected for any updating trace.

It is never possible to have more than 3 simultaneous detectors, and sometimes fewer than three. If the analyzer has to enforce this limit a message is generated, “Detector n changed due to physical constraints” where “n” is the detector number.

Couplings

Selecting a detector for a trace (pressing the key or sending a [:SENS]:DET:TRAC command) puts Update On and Display On for that trace, even if that detector was already selected. Note that the legacy command [:SENS]:DET[:FUNC] does **not** exhibit this behavior.

The auto detector rules depend upon marker type, averaging state and type, trace state writing mode, and trace active state

Selecting a detector, whether by pressing the control or sending the equivalent SCPI command, will turn trace math to Off for the selected/specified trace.

Use of the Average detector affects the VBW setting because of its effect on the VBW/RBW coupling.

Selecting any CISPR detector on any active trace sets the EMC Standard to CISPR. If any trace with a CISPR detector becomes active, the EMC Standard is set to CISPR.

If the Avg Type is in Auto, and any of the CISPR detectors is selected on any active trace, the Voltage Averaging type is auto-selected.

In Tracking Source mode, if a stepped source is used, the best detector is Average, as this gives optimal sensitivity. Therefore, when operating a source in Tracking Source mode, Auto selection is Average. All other detector selections are allowed, but in most cases the user will want to stick with the Auto selection, which gives optimal sensitivity.

Backwards Compatibility

Command	`[:SENSe]:DETector[:FUNCtion] NORMal| AVERage| POSitive| SAMPle| NEGative| QPEak| EAVerage| EPOSitive| MPOSitive| RMS` `[:SENSe]:DETector[:FUNCtion]?`
Example	DET AVER sets detector to average for all traces DET:FUNC? returns trace 1's detector setting
Notes	This is a SCPI only legacy command to preserve the classic functionality wherein all traces are affected when a detector is selected (in the X-Series, the detector is set on a per-trace basis). The query returns a name that corresponds to the detector type as shown below, and indicates the setting for Trace 1. The RMS selection sets the detector type to AVERage and the Average Type to RMS. Therefore if RMS has been selected, the query will return the "AVER" string. The EPOS selection sets the detector type to Peak and the EMC Standard to CISPR. A query will then return POS. The MPOS selection sets the detector type to Peak and the EMC Standard to MIL Impulse. A query will then return POS. The RAV parameter is not included in the command because this is not a legacy detector; nonetheless, if it happens to be the detector on Trace 1 then RAV will be returned.

String Returned	Definition
NORM	Normal
AVER	Average/RMS
POS	Positive Peak
SAMP	Sample
NEG	Negative Peak
QPE	Quasi peak
EAV	EMI Average
RAV	RMS Average

Preset	NORMal
State Saved	Saved in instrument state.

Notes:

1. In ESA and E7400, selecting QPD or EMI Average sets the Amplitude Scale Type to Linear and performs an auto-ranging function resulting in the Reference Level being adjusted such that the highest level of the trace is near (but below) the Reference Level. Subsequent selection of Peak, Negative Peak, Sample, or Average (the 'non-EMI Detectors') will return the Reference Level and Amplitude Scale Type to their pre-EMI Detector values. The X-Series does not perform this scale and reference level change because the digital IF makes it unnecessary..
2. The commands which select the CISPR detectors are not generally compatible with pre-PSA instruments, because the CISPR detectors are now part of the overall detector set, rather than a separate set. However, the basic behavior of coupling the resolution bandwidth to the selected detector is similar to the behavior of previous EMI analyzers, like the E4400B series.
3. In the past, selecting Auto Couple All did not change the selected CISPR detector. Now, since the CISPR detectors are part of the full set of detectors, pressing Auto Couple All will switch from the selected CISPR detector to an auto coupled detector according to the Auto Detector rules in the Detector, Auto key description below.
4. The following ESA/E7400 detector commands are no longer accepted:

[:SENSe]:DETector[:FUNCtion]:EMI QPD|AVERage|OFF

[:SENSe]:POWer:QPGain[:STATe]

[:SENSe]:ARDT

More Information

Value	Example	Notes
Normal	:DET:TRAC3 NORM	Determines the peak of CW-like signals, and yields alternating maximums and minimums of noise-like signals. This is also referred to as Rosenfell detection.
Average	:DET:TRAC3 AVER	Determines the average of the signal within the bucket. The averaging method depends upon Average Type selection (voltage, power or log scales) and delivers: RMS detection when Avg Type = Power Video detection when Avg Type = Log-Pwr Scalar detection when Avg Type = Voltage
Peak	:DET:TRAC3 POS	Determines the highest signal within the bucket.
Sample	:DET:TRAC3 SAMP	Determines the instantaneous level of the signal at the center of the bucket
Negative Peak	:DET:TRAC3 NEG	Determines the minimum of the signal within the bucket
Quasi Peak	:DET:TRAC3 QPE	EMI – CISPR detector Only appears with the N6141A or W6141A application or Option EMC installed and licensed.

Value	Example	Notes
		A fast-rise, slow-fall detector used in making CISPR compliant EMI measurements, compliant with the latest CISPR 16-1-1standard.
EMI Average	:DET:TRAC3 EAV	EMI – CISPR detector Only appears with the N6141A or W6141A application or Option EMC installed and licensed. Provides a standard means to "smooth" the signal while still providing compliance to CISPR pulse response standards. It displays the average value of the amplitude envelope, rather than the average value of sample-detected amplitude, and uses an advanced algorithm to realize a lowpass filter that conforms to the latest CISPR 16-1-1standard.
RMS Average	:DET:TRAC3 RAV	EMI – CISPR detector Not to be confused with the RMS mode of the regular Average detector, this is a special frequency-dependent EMI filter which only appears when the N6141A or W6141A application or Option EMC is installed and licensed. This filter conforms to the latest revision of the CISPR 16–1–1 standard.

Detector Basics

To understand detectors you must understand the concept of trace buckets. For every trace point in swept and zero span analysis, there is a finite time during which the data for that point is collected. The analyzer has the ability to look at all of the data collected during that time and present a single point of trace data based on the detector type. We call the interval during which the data is being collected the "bucket." Often the term "trace point" is used to mean the same thing.

However, it is important to understand that a trace is more than a series of single points. The data is sampled rapidly enough within each "bucket" and processed so that the detector results are equivalent to those that would be achieved with a continuous time (non-sampled) system.

Detector Notes

– The VBW filter is not used for the Average detector or any of the CISPR detectors (Quasi Peak, EMI Average, RMS Average), so varying the VBW will have no effect for any traces for which this detector is selected (other than to slow down the sweep, because of the coupling to Sweep Time of VBW). If any traces for which VBW does not apply are in Update On state (traces with Average, EMI Average, RMS Average or Quasi Peak detectors selected), then an * displays after the VBW annotation on the front panel.

– Rosenfell (Normal) detection: when the signal is CW-like, it displays the peak-detected level in the interval (bucket) being displayed. If the signal is noise-like (within a bucket the signal both rose and fell), it alternates displaying the max/min values. That is, an even bucket shows the peak (maximum) within a two-bucket wide interval centered on the even bucket. And an odd bucket will show the negative peak (minimum) within a two-bucket wide interval. For example, for an even bucket the two-bucket wide interval is a combination of one-half bucket to the left of the even bucket, the even bucket itself, and one-half bucket to the right of the even bucket, so the peak found will be displayed in the correct relative location on screen. The odd buckets are similar.

– The Average Detector result depends on the Average Type. To explicitly set the averaging method, use the Meas Setup, Average Type key.

– Because they may not find a spectral component's true peak, neither average nor sample detectors measure amplitudes of CW signals as accurately as peak or normal, but they do measure noise without the biases of peak detection.

– Peak detection is used for CW measurements and some pulsed-RF measurements. For FFT analysis, the highest amplitude across the frequency width of a bucket is displayed, even if that peak amplitude falls between samples of the spectrum computed in the FFT process.

– Sample detection is good for displaying noise or noise-like signals but is not the best choice for making amplitude measurements of CW-like signals. This is because:

  - the peak response to a signal can occur between samples. So unless the Span to RBW ratio is lower than usual, then the highest sample can be well below the peak signal amplitude.

  - for the high sweep rates normally used, the peak response of the RBW filters is up to –0.5 dB. This sweeping error is compensated when using the peak and normal detectors by changing the overall gain. But the gain is not changed when in the sample detector, because doing so would cause errors in the response to noise. Instead, the auto-couple rules for sweep time are modified to give slower sweeps (see the Sweep/Control Section).

– When the Detector choice is Auto, the detector selected depends on marker functions, trace functions, average type, and the trace averaging function.

– When you manually select a detector (instead of selecting Auto), that detector is used regardless of other analyzer settings.

CISPR Detector Notes

– Quasi Peak

This is a fast-rise, slow-fall detector used in making CISPR compliant EMI measurements and defined by CISPR Publication 16–1–1. Quasi-peak detection displays a weighted, sample-detected amplitude using specific, charge, discharge, and meter time constants derived from the legacy behaviors of analog detectors and meters. It is used for EMI measurements to provide a specific and consistent response to EMI-like signals.

Also in the past, EMI analysis equipment would need to perform a ranging operation to set the reference level when one of these detectors was turned on, but the X-series analyzers do not - because of its digital IF, there is no need to set the reference level (range) to improve the accuracy nor to allow visibility of the detected level.

– EMI Average

The EMI Average detector in Agilent’s X-Series analyzers is so called to distinguish it from the Average detector, although EMI users typically refer to it simply as the “Average detector”. The intent of this detector is to provide a standard means to “smooth” the signal while still providing compliance to CISPR pulse response standards.

Unlike the regular Average detector, which averages on a bucket-by-bucket basis using either a power, log-power or voltage scale (a bucket is the same as a trace point), the EMI Average detector displays the average value, on the voltage scale, of the overall amplitude envelope, independent of the trace bucket width. It is defined for EMI measurements by the CISPR 16–1–1 standard and, in the X-series, uses a sophisticated algorithm to implement a lowpass filter that conforms to the latest CISPR standard.

Note that CISPR standard operation is to perform the envelope averaging on the voltage scale. You can manually set the Average Type to Log-Power or Power, but the results will no longer be CISPR compliant. See note under Quasi-Peak.

– RMS Average

Not to be confused with the RMS mode of the regular Average detector, this is a special filter for making EMI measurements. It is a frequency dependent RMS/Averaging filter, used in making CISPR compliant EMI measurements. This filter conforms to the 2007 revision of the CISPR 16–1–1 standard. This detector does one averaging process (in the VBW hardware) on the "power" (a.k.a. RMS) scale and another process on the voltage scale using a "meter movement simulator" similar to the one used in the QPD filter.

Note that CISPR standard operation is to perform the envelope averaging on the voltage scale. You can manually set the Average Type to Log-Power or Power, but the results will no longer be CISPR compliant. See note under Quasi-Peak.

Multiple Detectors

The analyzer always provides the requested detector on the specified trace. Depending on the detectors requested the analyzer can provide up to three different detectors simultaneously within the constraints of its digital processing algorithms. Some detectors utilize more resources; the Quasi-Peak detector, for example, utilizes most of the digital IF's resources, and the hardware in some analyzers is incapable of providing another detector when Quasi-Peak is on. If the limit of system resources is exceeded, detectors on some existing traces may be forced to change. When this happens, they change to match the detector just requested, and a message is generated: "Detector <X> changed due to physical constraints", where X might contain multiple values.

Example: User has traces 1, 2, and 3 with Peak, Average, and Negative Peak. User specifies QPD for trace 1. Traces 2 and 3 also change to QPD and we generate the message "Detector 2,3 changed due to physical constraints". Now all three traces have the QPD.

4.3.7.13 Detector Select

This toggle sets the Detector mode to Auto or Manual. In Auto, the proper detector is chosen based on rules that take into account the measurement settings and other analyzer settings.

When you manually select a detector, this toggle automatically sets to Man (manual).

For SCPI command and parameters, see "[SENSe]:DETector[:FUNCtion]:AUTO " on page 722

Dependencies

The auto detector rules depend upon marker type, averaging state and type, trace state writing mode, and trace active state.

Couplings

Selecting AUTO, whether by toggling the control or sending the equivalent SCPI command, turns trace math to Off for the selected/specified trace.

Backwards Compatibility

Command	[:SENSe]:DETector:AUTO ON | OFF | 1 | 0 [:SENSe]:DETector:AUTO?
Example	DET:AUTO ON
Notes	SCPI only. Turns AUTO on or off for ALL detectors. This is a legacy command to preserve the classic functionality wherein all traces are affected when a detector is addressed The query returns the Auto state of Trace 1.

4.3.7.14 Detector Auto All Traces

Returns the selected set of detectors to the “preset” state, which is auto-selected.

When Signal ID is on, this control is grayed out.

4.3.7.15 Detector Average Preset

This control is used to make a measurement of the average power and the signal envelope. This is a one-time setting of a commonly used detector set. It is quicker than making many individual changes and the detectors are free to change afterward. The effect is identical to just setting the traces’ detectors individually.

When Signal ID is on, this control is grayed out.

Couplings

Trace 1: Set to peak detection, and Clear-Write.

Trace 2: Set to average detection, and Clear-Write.

Trace 3: Set to negative peak detection, and Clear-Write.

4.3.7.16 Detector Sample Preset

This control is used to a measurement that displays a power sample and the signal envelope. This is a one-time setting of a commonly used detector set. It is quicker than making many individual changes and the detectors are free to change afterward. The effect is identical to setting the traces’ detectors individually.

When Signal ID is on, this key is grayed out.

Couplings

Trace 1: Set to peak detection, and Clear-Write.

Trace 2: Set to sample detection, and Clear-Write.

Trace 3: Set to negative peak detection, and Clear-Write.

4.3.8 Math

The Math tab lets you turn on and configure trace math functions.

4.3.8.1 Math Function

Trace math functions perform mathematical operations between traces and, in some cases, user-specified offsets. When in a trace math function, the indicated function is performed during the sweep with the math function used in place of a detector.

The trace operands for the math function are set using the **Trace Operands** key.

See "More Information" on page 292.

See "How trace math is processed" on page 294

Dependencies	Trace Math is not available if **Normalize** is on. Trace Math is not available if Signal ID is on. None of the trace operands can be the destination trace. If any of the three trace math commands is sent with a destination trace number matching one of the operands a warning is generated and the function does not turn on.
Couplings	Whenever a math function other than "Off" is selected for a trace, that trace is set to Display=On and Update=On.
Preset	OFF, TRACE5, TRACE6, 0, 0 | OFF, TRACE6, TRACE1, 0, 0 | OFF, TRACE1, TRACE2, 0, 0 | OFF, TRACE2, TRACE3, 0, 0 | OFF, TRACE3, TRACE4, 0, 0 | OFF, TRACE4, TRACE5, 0, 0
State Saved	The trace math function for each trace is saved in instrument state.
Annunciation	An "f" is shown on the trace annunciation panel in the Measurement Bar when a math function is on; and the function is annotated on the trace if Trace Annotation is on.
Status Bits/OPC dependencies	*OPC can be used to detect the completion of a sweep, which will also correspond to the completion of the math operation, since all math takes place during the sweep

More Information

IMPORTANT

To generate a trace math result, *you must take a sweep*. The trace math engine, described below, operates in concert with the sweep engine in the analyzer. Until a sweep has been taken, even if the constituent traces are not in Update mode, no result is generated.

Note that certain events can affect the trace in ways that affects all points at once. This can happen in any number of ways, including:

- A trace clear taking place
- A trace being loaded from the file system
- Trace data being sent in from the remote interface
- A copy or exchange of trace data

You should try to avoid these occurrences during a sweep, as they will tend to invalidate the math result being accumulated.

The Trace Math functions are:

Power Diff (Op1 – Op2)

Calculates a power difference between the **First Trace** operand and the **Second Trace** operand and puts the result in the destination trace.

During the sweep, the following formula is executed for each point in the trace operands, and the corresponding point is generated for the destination trace:

DestinationTrace = 10 log(10(1/10)(FirstTrace) – 10(1/10)(SecondTrace))

The values of the trace points are assumed to be in a decibel scale, as they are internally stored.

If a point in FirstTrace is equal to maxtracevalue, the resultant point is also maxtracevalue.

Otherwise, if the result of the subtraction is less than or equal to 0, the resultant point is mintracevalue.

Power Sum (Op1 + Op2)

Calculates a power sum between the **First Trace** operand and the **Second Trace** operand and puts the result in the destination trace.

During the sweep, the following formula is executed for each point in the trace operands, and the corresponding point is generated for the destination trace.:

DestinationTrace = 10 log(10(1/10)(FirstTrace) + 10(1/10)(SecondTrace))

The values of the trace points are assumed to be in a decibel scale, as they are internally stored.

If a point in either trace operand is equal to maxtracevalue, the resultant point is also maxtracevalue.

Log Offset (Op1 + Offset)

Calculates a log offset from the **First Trace** operand and puts the result in the destination trace. This is like the B-DL function in some older analyzers. The offset is entered on the **Offset** control, which only appears when this math function is in force for the selected trace. Each destination trace has its own offset.

During the sweep, the following formula is executed for each point in the trace operand, and the corresponding point is generated for the destination trace.:

DestinationTrace = FirstTrace + Offset

The values of the trace points are assumed to be in dBm (as they are internally stored) and the offset is in dB.

If a point in the trace operand is equal to maxtracevalue, the resultant point is also maxtracevalue.

If a point in the trace operand is equal to mintracevalue, the resultant point is also mintracevalue.

Example: If offset is 25 dB, then our destination trace will be higher than the operand trace by 25 dB.

Note that the **Second Trace** operand is not used for this function.

Log Diff (Op1 - Op2 + Ref)

Offsets the difference between the **First Trace** operand and the **Second Trace** operand by a reference and puts the result in the destination trace. This is like the A-B+DL function in some older analyzers. The Reference is entered on the **Reference** control, which only appears when this math function is in force for the selected trace. Each destination trace has its own reference.

During the sweep, the following formula is executed for each point in the trace operands, and the corresponding point is generated for the destination trace:

DestinationTrace = (FirstTrace - SecondTrace) + Reference

The values of the operand trace points are assumed to be in decibel units (as they are internally stored) and the reference is in dBm so the result is in dBm.

Example: If the first operand trace 1 is at 5 dBm, the second operand trace 2 is at –5 dBm, and the reference is –25 dBm, then the destination trace will be –15 dBm.

Example: If the first operand trace1 is at 60 dBuV, the second operand trace 2 is at 50 dBuV, and the reference is 35 dBuV, then the destination trace will be 45 dBuV.

If a point in FirstTrace is equal to maxtracevalue, the resultant point is also maxtracevalue.

If a point in FirstTrace is equal to mintracevalue, the resultant point is also mintracevalue.

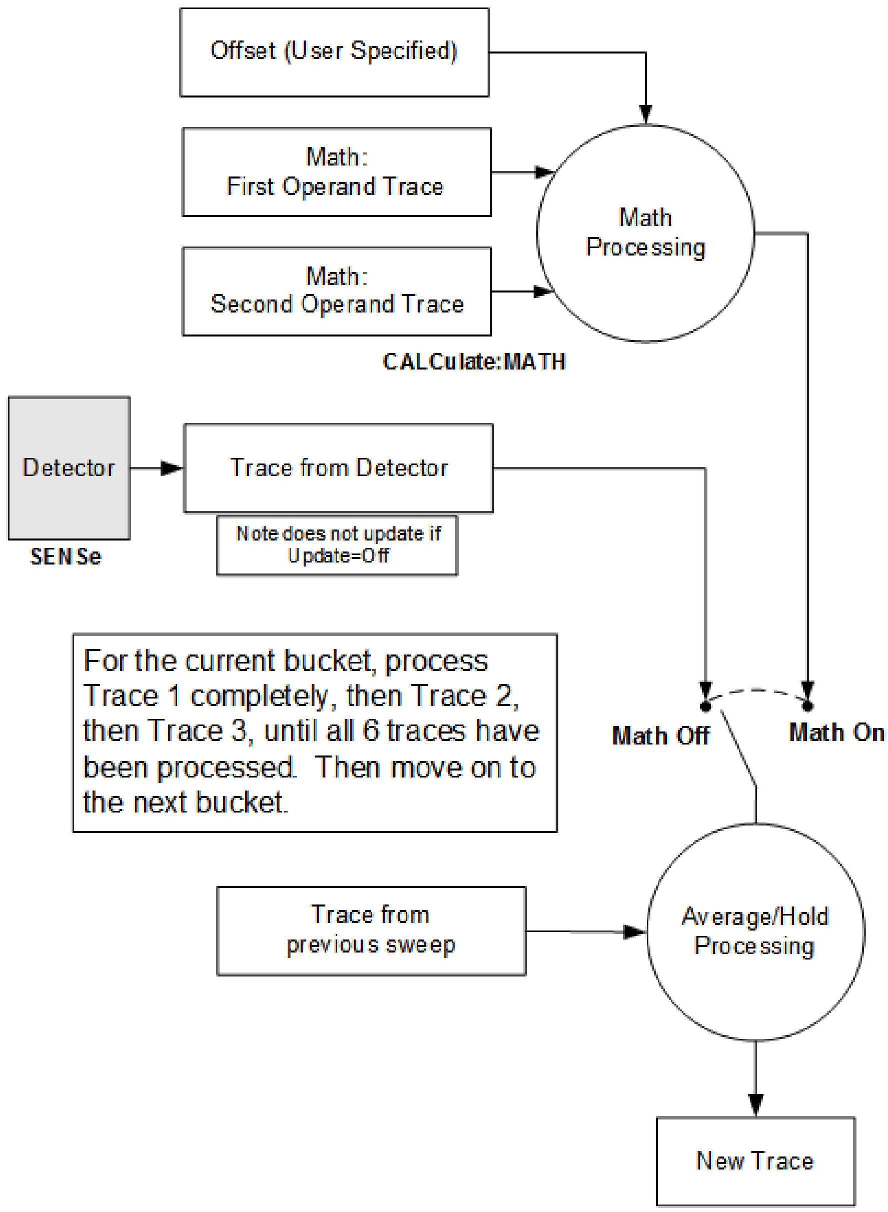
If neither of the above is true for a given point, then:

- If that point in SecondTrace is equal to maxtracevalue, the resultant point is mintracevalue.
- If that point in SecondTrace is equal to mintracevalue, the resultant point is maxtracevalue.

How trace math is processed

Whenever a trace math function is turned on, or the parameters and/or operands of an existing trace math function are changed, the destination trace is cleared. After the trace is cleared, all x-axis values in the trace, and the domain of the trace, are set to match the X Axis settings of the first trace operand. When this is complete, a new sweep is initiated.

The process of acquiring data, processing it using the math and average/hold functions, and presenting it to the user as trace data, consists of several functional blocks, as shown below:



NOTE ABOUT OFFSETS: When either External Gain or Ref Level Offset is on, an offset is applied to the trace operands, and when Trace Math is on this offset is applied before any math processing is performed. Since the operands have already been offset the result trace should NOT be offset. Therefore when any Trace Math operation is performed, the sum of (External Gain - Ref Level Offset) is added to the result before it is stored in the result trace.

For each active trace, the current trace point is processed for Trace 1, then Trace 2, then Trace 3, etc. Trace data is taken from either the detector for that trace, or from the mathematical result of up to two other traces and an offset, depending on whether trace math is on or not. The resultant data is then fed to the Average/Hold processing block, where (if the trace type is Average, Max Hold, or Min Hold) it is processed with previous trace data. The new trace data resulting from this process is then available for display, storage or remote output.

When the processing is complete for Trace 1, Trace 2 is processed, and so on until all six traces have been processed. This allows a downstream trace to use as one of its math components a fully processed upstream trace. In other words, if math is on for Trace 4, and its operand traces are Trace 2 and Trace 3, all detector, math, average and hold processing for traces 2 and 3 is complete before the math is performed for trace 4. When the current trace point is completed for all traces, the analyzer moves on to the next trace point.

This allows very flexible and powerful math functions to be configured. For example, Trace 1 can be an average trace, which can be fed with an offset to Trace 2, which can also be in Max Hold, allowing the user to take the Max Hold of an Average trace.

Note that none of this processing is performed on inactive traces.

Note also that for any active trace with math on, you want your operand traces to have a lower number than the trace (e.g., using Trace 4 as an operand for Trace 1 will cause the data coming from Trace 4 to be delayed by one sweep). This does not pertain if the operand trace is inactive, so we have decided to make no attempt to enforce this condition. It is up to the user to understand and conform.

4.3.8.2 Operand 1

Selects the first trace operand to be used for the trace math functions for the destination trace.

Dependencies	The destination trace cannot be an operand. The destination trace number is gray on the dropdown.
Preset	Trace number minus 2 (wraps at 1). For example, for Trace 1, Operand 1 presets to Trace 5; for Trace 6, it presets to Trace 4
State Saved	Operand 1 for each trace is stored in instrument state

4.3.8.3 Operand 2

Selects the second trace operand to be used for the trace math functions for the destination trace. The operands are common to all math functions for a given trace.

Dependencies	The destination trace cannot be an operand. The destination trace number is gray on the dropdown.
Preset	Trace number minus 1 (wraps at 1). For example, for Trace 1, Operand 2 presets to Trace 6; for Trace 6, it presets to Trace 5.
State Saved	Operand 2 for each trace is stored in instrument state

4.3.8.4 Offset

The Offset value is used by the Log Offset math function.

Example	:CALC:MATH TRACE1,LOFF,TRACE4,,−6.00, sets Trace 1 to Log Offset trace math function, sets the First Trace operand (for Trace 1) to Trace 4, leaves the Second Trace operand (for Trace 1) unchanged (it is irrelevant for this function) and sets the Log Offset (for Trace 1) to −6 dB.
Min/Max	−100 dB/100 dB
State Saved	The Log Offset value for each trace is saved in instrument state.

Log Offset (Op1 + Offset)

Calculates a log offset from the First Trace operand and puts the result in the destination trace. This is like the B-DL function in some older analyzers. The offset is entered on the Offset control, which only appears when this math function is in force for the selected trace. Each destination trace has its own offset.

During the sweep, the following formula is executed for each point in the trace operand, and the corresponding point is generated for the destination trace:

DestinationTrace = FirstTrace + Offset

The values of the trace points are assumed to be in dBm (as they are internally stored) and the offset is in dB.

If a point in the trace operand is equal to maxtracevalue, the resultant point is also maxtracevalue.

If a point in the trace operand is equal to mintracevalue, the resultant point is also mintracevalue.

Example: If offset is 25 dB, then our destination trace will be higher than the operand trace by 25 dB.

Note that the Second Trace operand is not used for this function.

4.3.8.5 Reference

The Reference value is used by the Log Diff math function.

Example	:CALC:MATH TRACE1,LDIF,TRACE4,TRACE5,,−6.00 !Sets Trace 1 to Log Diff trace math function, sets the First Trace operand (for Trace 1) to Trace 4, sets the Second Trace operand (for Trace 1) to Trace 5, and sets the Log Difference reference for Trace 1 to −6 dBm.
Min/Max	Same as reference level /Same as reference level
State Saved	The Log Difference reference value for each trace is saved in instrument state.

Log Diff (Op1 - Op2 + Ref)

Offsets the difference between the First Trace operand and the Second Trace operand by a reference and puts the result in the destination trace. This is like the A-B+DL function in some older analyzers. The Reference is entered on the Reference control, which only appears when this math function is in force for the selected trace. Each destination trace has its own reference.

During the sweep, the following formula is executed for each point in the trace operands, and the corresponding point is generated for the destination trace:

DestinationTrace = (FirstTrace - SecondTrace) + Reference

The values of the operand trace points are assumed to be in decibel units (as they are internally stored) and the reference is in dBm so the result is in dBm.

Example: If the first operand trace 1 is at 5 dBm, the second operand trace 2 is at –5 dBm, and the reference is –25 dBm, then the destination trace will be –15 dBm.

Example: If the first operand trace1 is at 60 dBuV, the second operand trace 2 is at 50 dBuV, and the reference is 35 dBuV, then the destination trace will be 45 dBuV.

If a point in FirstTrace is equal to maxtracevalue, the resultant point is also maxtracevalue.

If a point in FirstTrace is equal to mintracevalue, the resultant point is also mintracevalue.

If neither of the above is true for a given point, then:

- If that point in SecondTrace is equal to maxtracevalue, the resultant point is mintracevalue.
- If that point in SecondTrace is equal to mintracevalue, the resultant point is maxtracevalue.

4.3.9 Trace Function

The Trace Function includes controls to:

- Copy and Exchange traces
- Preset or Clear all traces

4.3.9.1 Copy

This button executes a Trace Copy based on the From Trace and To Trace parameters. The Copy is done from the From Trace to the To Trace. The action is performed once.

The X-Axis settings and domain of a trace go with it when it is copied.

SCPI command not supported in SCPI LC Mode.

Preset	TRACE1, TRACE2

Dependencies

When Signal ID is on, this key is grayed out.

Couplings

The destination trace is put in View (Update=Off, Display=On) after the copy.

Backwards Compatibility Notes

The copy and exchange operations menu in ESA and PSA is replaced with the more general purpose Trace Function menu. The remote commands are unaffected, as they were already general.

The 2-DL->2 function in ESA and PSA (which was really a trace math function) has been eliminated, because its use case was very rare. It actually subtracted the dB-equivalent of the dBm-expressed display line, regardless of the y axis unit. For example, if DL = +21.99 dBmV, it subtracted –25.00 dB (i.e. add +25.00 dB) to trace 2. New, more useful functions are provided in the new Trace, Math menu.

4.3.9.2 Exchange

This button executes a Trace Exchange based on the From Trace and To Trace parameters. The From Trace and To Trace are exchanged with each other. The action is performed once.

The X-Axis settings and domain of a trace go with it when it is exchanged with another trace.

SCPI command not supported in SCPI LC Mode.

Couplings

Both traces are put in View (Update=Off, Display=On) after the exchange.

Backwards Compatibility Notes

The copy and exchange operations menu in ESA and PSA is replaced with the more general purpose Trace Function menu. The remote commands are unaffected, as they were already general.

4.3.9.3 Preset All Traces

Turns on Trace 1 and blanks all other traces. Useful when you have many traces on and you want to go back to having only Trace 1 on the display. Does not affect the trace type, detector or any other aspect of the trace system.

When Signal ID is on, this key is grayed out.

4.3.9.4 Clear All Traces

Clears all traces. Does not affect the state of any function or variable in the instrument. Loads mintracevalue into all of the points all traces, except traces in Min Hold in which case it loads maxtracevalue. Does so even if Update=Off.

When Signal ID is on, this control is grayed out.

4.3.9.5 Normalize

Normalize (On) activates the normalize function. On each sweep, the normalized trace (Trace 3) is subtracted from Trace 1 and the result is added to the normalized reference level. This arithmetic assumes all values are in decibel units, so we are actually taking a ratio.

The steps to perform the Normalize function are:

1. Store the current Trace 1 into the reference trace, which is Trace 3

2. Turn on Normalize

If you try to turn on Normalize without first storing a reference trace, you will get an error.

See "More Information" on page 300, "Measurement Details" on page 301, "Normalize Block Diagram" on page 302

SCPI command not supported in SCPI LC Mode.

Couplings	When Normalize is turned on, Trace 1 is placed in Clear/Write with Update = On and Display = On.
Preset	OFF
State Saved	Saved in instrument state.

Dependencies

- If Normalize (On) is pressed before Store Ref (1→ 3), an error message is generated. Normalize remains off in this case.
- Normalize is not available (grayed out) if any Trace Math function is on.
- Normalize is not available if Amplitude, Scale Type is set to 'Lin".

More Information

The normalize function is most useful for applying correction data to a trace while making a stimulus-response measurement with a tracking generator (or synchronized source). For example, connect the cables and a through line, in place of the device to be measured, between the tracking generator and the analyzer input. Notice that the frequency response is not perfectly flat, showing the response of the cables, as well as the flatness of both the tracking generator and the analyzer. Now press Store Ref (1→3), Normalize On. Notice that the displayed trace is now flat, or normalized. The position of the normalized trace can now be moved to a different position on the display by changing the normalized reference position. This may be useful if the device to be tested has positive gain, such as an amplifier. Now replace the through line with the device under test, and an accurate measurement of the gain or loss can be made.

The normalize function can also be used to perform a scalar reflection measurement (return loss). In this case a directional coupler or bridge is used to extract the reflected signal. In the simplest reflection measurement a Short is placed at the end of the cable and the result is stored to trace 3 (as before). When Normalize is turned on, the result is the calibrated return loss in dB. For a more accurate calibration, an Open and Short can be used. To do the Open/Short calibration, the Open/Short control at the bottom of the Normalize menu is pressed. This will initiate a guided calibration procedure, which captures the reference trace. This is then stored to Trace 3, as before. When Normalize is turned on the corrected return loss is displayed.

Measurement Details

First the following calculation is performed:

Trace 1 = (Trace 1D – Normalized Trace)

Where:

Trace 1D is the measured value of trace 1, as it comes from the SENSe subsystem.

Normalized Trace is Trace 3, in which you have previously stored a reference trace

All values are in decibel units.

This Trace 1 contains the values that will be returned from a trace query, or if the marker is placed on the trace.

For example, let's say bucket 1 on Trace 1 is at 0 dBm, and bucket 1 on Trace 3 is at 10 dBm. The resultant bucket is at 0 dBm – 10 dBm = –10 dB (just like with a delta marker).

You are also given the ability to define what (dB) value to use for Ref Level, and to define where on the screen the Ref Lvl line will appear using Normalized Reference Position. This flexibility in displaying the result allows a wide range of devices, including amplifiers, to be tested using Normalize.

In the example above, bucket 1 has the value of –10 dB. Let us assume you have set Norm Ref Lvl to 5 dB. Thus bucket 1 will display 1.5 divisions below the Reference Level line (assuming 10 dB per division).

The Reference Level line is normally the top line of the graticule. If Norm Ref Position is set to 10, this is the case. If it is set to 9, it is the next line down. If it is set to 5, it is the middle line of the graticule. If set to 0 it is the bottom line.

So in the example above, if Norm Ref Position is set to 9, then bucket 1 will display 2.5 divisions below the top line of the graticule.

None of the manipulations of Norm Ref Position and Norm Ref Lvl affect the data in the trace.

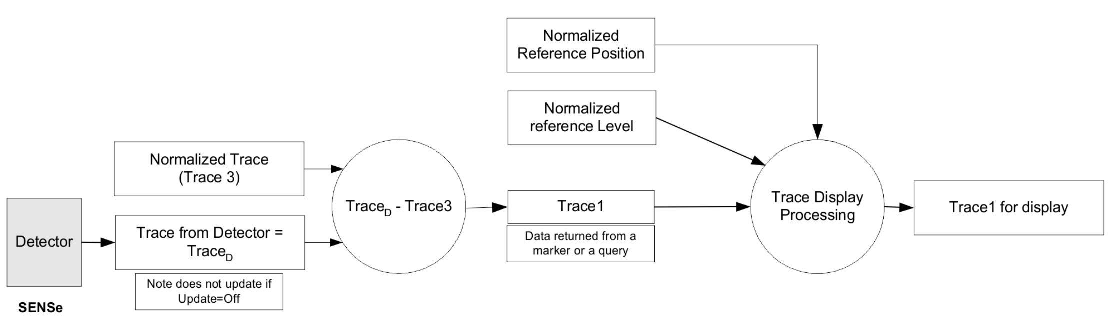
As Normalize displays a ratio between two traces (a difference, in dB) the Y-Axis Unit while in Normalize is dB in Log Amplitude and dimensionless in Linear. The Y Axis Unit chosen in the Y Axis Unit menu is unaffected by Normalize. When you leave Normalize the Y Axis Unit returns to the value set in the Y Axis Unit menu. While in Normalize, all amplitude functions, such as Marker Y and the values in other traces, should be always in dB unit, and so should the returned trace query results. In other words, both trace query result and marker Y become independent of the Y Axis Unit chosen in the Y Axis Unit menu when normalize is on.

(In Linear, the equivalent calculation is performed but it yields a dimensionless ratio, so the normalized ref level will be unitless, presetting to 1, just as in Log it presets to 0 dB. Linear normalization is not currently available in the X-Series).

Y Axis annotation is blanked while in Normalize. Any other traces on the display are plotted in dB, where the dB value used is equivalent to the dBm value of the trace. For example, if bucket 1 in trace 2 is at –40 dBm, that bucket is plotted at –40 dB. All traces use Norm Ref Lvl and Norm Ref Position for positioning on the display. When Normalize exits, the normal Ref Lvl is restored. This normal Ref Level is unaffected by Normalize.

Normalize Block Diagram

A block diagram showing how Normalize works is presented below:



4.3.9.6 Store Ref Trace 1->Trace 3

Copies trace 1 into trace 3. Store Reference (Trace 1→Trace 3) must be pressed before pressing Normalize (On). Note that this puts Trace 3 in Update=Off (not updating) and Display=On (visible).

4.3.9.7 Show Reference Trace 3

Views or blanks the reference trace on the display. The reference trace is trace 3, so this is the same as setting Trace 3's "Display" attribute.

Trace 3 is always the reference trace by definition.

State Saved	Saved in instrument state.

4.3.9.8 Norm Ref Lvl

Sets the level (in dB) of the normalized reference. This is the Level of the line specified by the Norm Ref Position control.

SCPI command not supported in SCPI LC Mode.

Preset	0 dB
Min/Max	–327.6 dB/327.6 dB
State Saved	Saved in instrument state.

4.3.9.9 Norm Ref Position

Sets the graticule line that represent the Norm Ref Lvl. This function may be used to offset the displayed trace without affecting the instrument gain or attenuation settings. This allows the displayed trace to be moved off the top of the screen so that it may be completely seen, but without decreasing measurement accuracy.

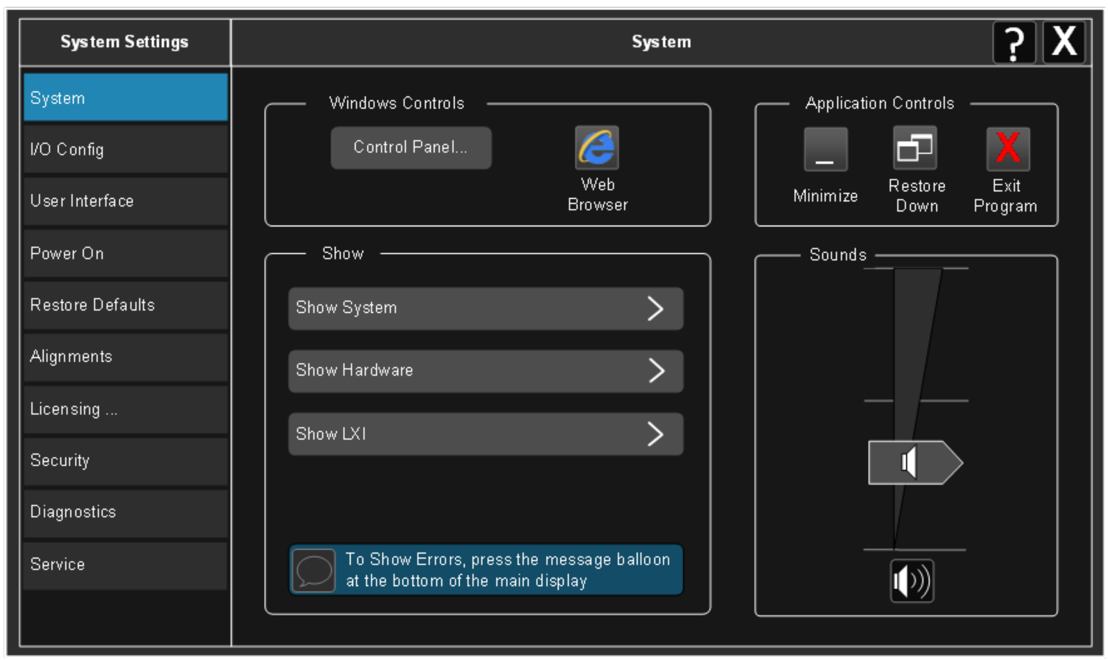
The top and bottom graticule lines correspond to 10 and 0, respectively. The normalized reference position is indicated with a white right arrow on the left side of the display and a white left arrow on the right side of the display, just inside the graticule

SCPI command not supported in SCPI LC Mode.

Preset	10
Min/Max	0/10
State Saved	Saved in instrument state.

5 System

The System hardkey and the “gear” icon both open the System Settings dialog, which allows you to access various configuration menus and dialogs. There are a line of tabs down the left side that let you choose various pages for configuring your instrument.



Notes	No remote command for this key specifically

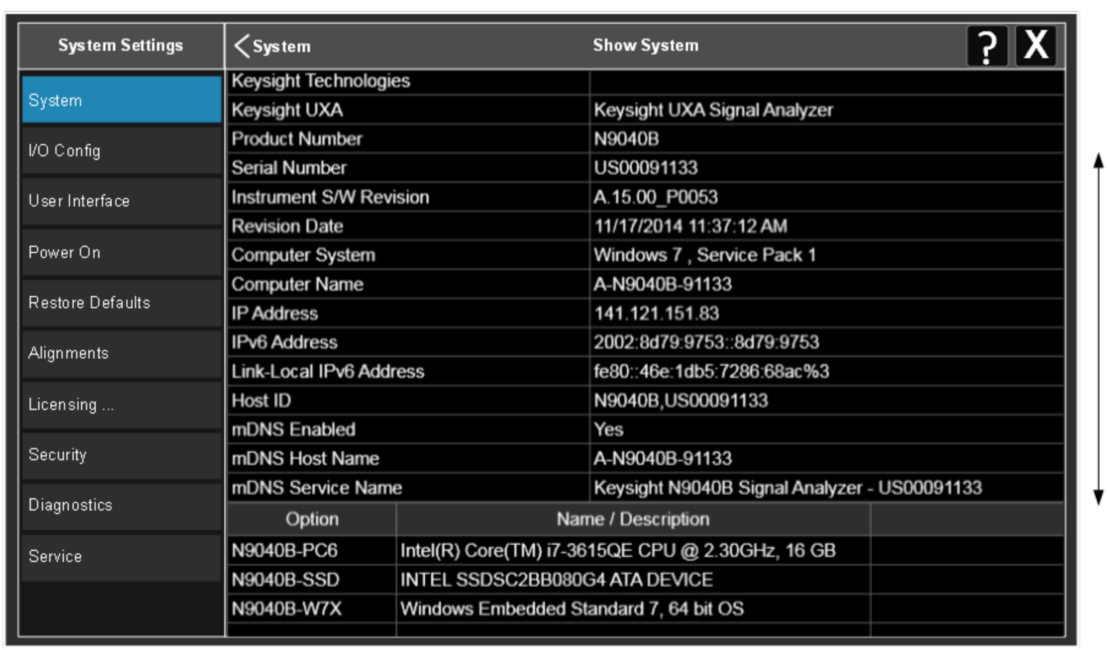
5.1 System

The System page allows access to several general system functions including three “Show” screens for viewing system parameters. Several such “Show” screens are available on this and other System menu pages. They can also be accessed with the following SCPI command:

Remote Command	`:SYSTem:SHOW OFF | ERRor | SYSTem | HARDware | LXI | HWSTatistics | ALIGnment | SOFTware | CAPPlication` `:SYSTem:SHOW?`
Example	`:SYST:SHOW SYST`
Notes	This command displays (or exits) the various System information screens
Preset	`OFF`
State Saved	No
Range	`OFF| ERRor | SYSTem | HARDware | LXI | HWSTatistics | ALIGNment | SOFTware | CAPPlication`

5.1.1 Show System

The Show System screen is formatted into three groupings: product descriptive information, options tied to the hardware, and software products. Swipe up and down on this screen with your finger to scroll the display and see more information.



Example	`:SYST:SHOW SYST`

Backwards Compatibility Notes	The hardware statistics that are displayed in the PSA Show System screen have been moved to a dedicated Show Hardware Statistics screen in the Service Menu

5.1.1.1 Show System contents (Remote Command Only)

A remote command is available to obtain the contents of the Show System screen (the entire contents, not just the currently displayed page).

Remote Command	`:SYSTem:CONFigure[:SYSTem]?`
Example	`:SYST:CONF?`
Notes	The output is an IEEE Block format of the Show System contents. Each line is separated with a new-line character

5.1.1.2 Computer System description (Remote Command Only)

A remote command is available to obtain the Computer System description. The Computer System is the operating system and patch level as reported by operating system.

Remote Command	`:SYSTem:CSYStem?`
Example	`:SYST:CSYS?`
Notes	The return value is the Computer System name and service pack level

5.1.2 Show Hardware

The show hardware screen is used to view details of the installed hardware. This information can be used to determine versions of hardware assemblies and field programmable devices, in the advent of future upgrades or potential repair needs.

The screen is formatted into two groupings: product descriptive information and hardware information. The hardware information is listed in a table format.

Example	`:SYST:SHOW HARD`

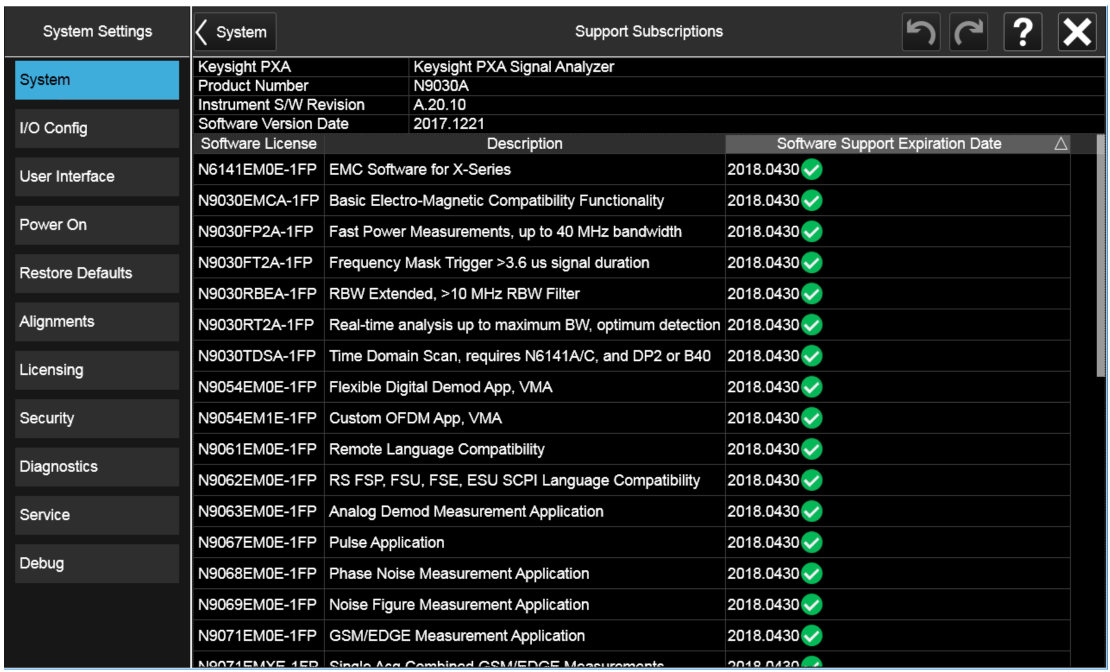
5.1.3 Show LXI

Shows you the product number, serial number, firmware revision, computer name, IP address, Host ID, LXI Class, LXI Version, MAC Address, and the Auto-MDIX Capability.

Example	`:SYST:SHOW LXI`

5.1.4 Show Support Subscriptions

Shows you the software support subscription information for the licenses you have available on the instrument. It shows the software license, description, software support expiration date (format is YYYY.MMDD), and the software support status. The Software Version Date (format is YYYY.MMDD) shown in the header indicates the date required to access the latest software enhancements included in this version of the software. If any license has a software support expiration date earlier than the Software Version Date, then there may be enhancements available that the license does not enable.



Example	`:SYST:SHOW SSINformation`

5.1.5 Show Support ID

This key shows you the Support ID for each license available for the instrument. It shows the software license, descriptions, software support expiration date, and the Support ID for that license.

Each license has a copy icon, which copies just the Support ID for that license to the Windows clipboard. This is useful to avoid typing mistakes when entering the Support ID into another program or web site.

The “Copy all to clipboard ...” button copies all the data in comma-separated values (CSV) format to the Windows clipboard.

Example	`:SYST:SHOW SID`

5.1.6 Control Panel...

Opens the Windows Control Panel. The Control Panel is used to configure certain elements of Windows that are not configured through the Multitouch UI System menus.

NOTE This feature is not available if option SF1 is installed.

The Control Panel is a separate Windows application, so to return to the analyzer once you are in the Control Panel, you may either:

Exit the Control Panel by tapping on the red X in the upper right hand corner.

Or use **Alt+Tab**: press and hold the **Alt** key and press and release the **Tab** key until the Analyzer logo is showing in the window in the center of the screen, then release the **Alt** key.

Notes	No remote command for this key

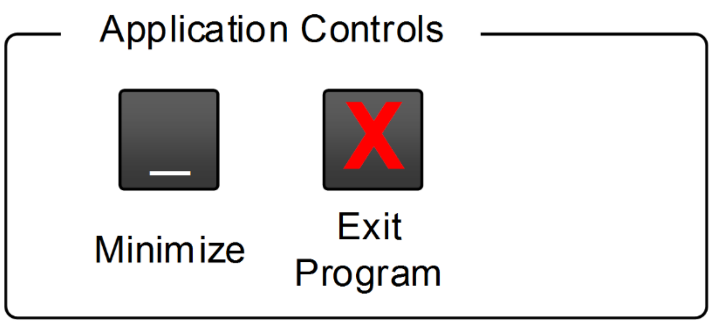
5.1.7 Web Browser

This launches whatever Web Browser you have defined as your default, usually Microsoft Internet Explorer. A mouse and external keyboard are highly desired for using Internet Explorer. Close Internet Explorer to return focus to the Instrument Application (or use Alt-Tab).

NOTE This feature is not available if option SF1 is installed.

5.1.8 Application Controls

The Application controls let you Minimize and Exit the application.



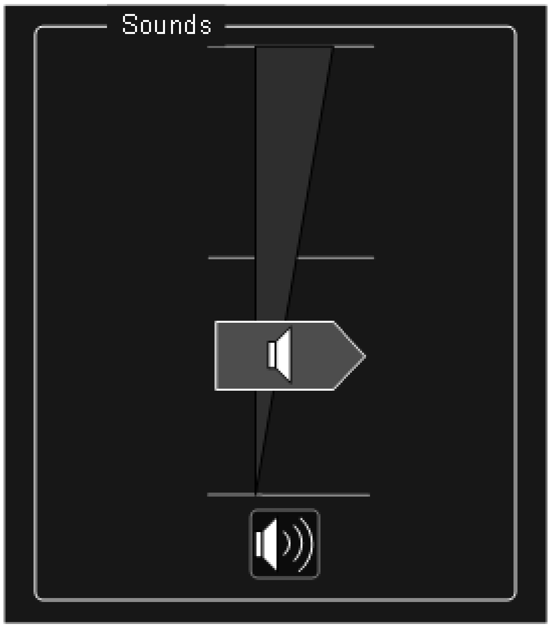
Pressing the Exit Program icon will put up a prompt asking if you are sure you want to close the program. If you choose “OK” the entire analyzer application will shut down, and you will lose any unsaved trace or measurement data.

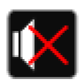
Notes	No equivalent remote command for this key

5.1.9 Sounds

The Sounds panel lets you adjust the speaker volume with the slider and Mute/Unmute the speaker by tapping the Speaker icon.

Moving the slider up and down changes the speaker volume. It unmutes the speaker if muted.





Icon when muted

5.2 I/O Config

Activates a menu for identifying and changing the I/O configuration for remote control. Controls in this menu allow configuration of the I/O ports used for SCPI remote control over GPIB and LAN.

The SCPI LAN parameters are set using the I/O Config menu, but configuration of the LAN settings themselves is performed using the Windows® Control Panel (DHCP, Gateway, Subnet Mask, etc.).

The USB port is also available for remote control, but requires no configuration.

5.2.1 GPIB

Activates a menu for configuring the GPIB I/O port.

Dependencies	This control is not available on the M9391A, M9393A, UXM or E7760

5.2.1.1 GPIB Address

Select the GPIB remote address.

Remote Command	`:SYSTem:COMMunicate:GPIB[1][:SELF]:ADDRess <integer>` `:SYSTem:COMMunicate:GPIB[1][:SELF]:ADDRess?`
Example	`:SYST:COMM:GPIB:ADDR 17`
Notes	Changing the Address on the GPIB port requires all further communication to use the new address
Dependencies	This control is not available on the M9391A, M9393A, or E7760
Preset	This is unaffected by Preset but is set to 18 on a “Restore System Defaults->Misc”
State Saved	No
Min	0
Max	30

5.2.1.2 GPIB Controller

Sets the GPIB port into controller or device mode. In the normal state, GPIB controller is disabled, which allows the analyzer to be controlled by a remote computer. When GPIB Controller is enabled, the instrument can run software applications that use the instrument's computer as a GPIB controller; controlling devices connected to the instrument's GPIB port.

NOTE	When GPIB Controller is enabled, the analyzer application itself cannot be controlled over GPIB. In this case it can easily be controlled via LAN or USB. The

GPIB port cannot be a controller and device at the same time. Only one controller can be active on the GPIB bus at any given time. If the analyzer is the controller, an external PC cannot be a controller.

To control the instrument from the software that is performing GPIB controller operation, you can use an internal TCP/IP connection to the analyzer application. Use the address TCPIP0:localhost:inst0:INSTR to send SCPI commands to the analyzer application.

Remote Command	`:SYSTem:COMMunicate:GPIB[1][:SELF]:CONTroller[:ENABle] ON | OFF | 0 | 1` `:SYSTem:COMMunicate:GPIB[1][:SELF]:CONTroller[:ENABle]?`

Example	`:SYST:COMM:GPIB:CONT ON`
	Will set GPIB port to Controller
	`:SYST:COMM:GPIB:CONT OFF`
	Will set GPIB port to Device

Notes	When the instrument becomes the Controller bit 0 in the Standard Event Status Register is set (and when the instrument relinquishes Controller capability bit 0 is cleared in the Standard Event Status Register)
Dependencies	This control is not available on the M9391A, M9393A, or E7760
Preset	This is unaffected by Preset but is set to OFF on a “Restore System Defaults->Misc”
State Saved	No
Range	Disabled|Enabled

5.2.2 SCPI LAN

Activates a menu for identifying and changing the SCPI over a LAN configuration. There are a number of different ways to send SCPI remote commands to the instrument over LAN. It can be a problem to have multiple users simultaneously accessing the instrument over the LAN. These controls limit that somewhat by disabling the telnet, socket, and/or SICL capability.

NOTE

When multiple instances of the application are running, Telnet port 5023, socket port 5025, SICL server inst0 and HiSLIP server Device 0 will be assigned to the first instance; Telnet port 5123, socket port 5125, SICL server inst1 and HiSLIP server Device 1 will be assigned to the second instance; Telnet port 5223, socket port 5225, SICL server inst2 and HiSLIP server Device 2 will be assigned to the third instance; Telnet port 5323, socket port 5325, SICL server inst3 and HiSLIP server Device 3 will be assigned to the fourth instance.

– "SCPI Telnet" on page 313

– "SCPI Socket" on page 313

– "SICL Server" on page 314
– "HiSLIP Server" on page 314
– "Verbose SCPI On/Off" on page 315
– "SCPI Socket Control Port (Remote Command Only)" on page 316

5.2.2.1 SCPI Telnet

Turns the SCPI LAN telnet capability On or Off allowing you to limit SCPI access over LAN through telnet.

Remote Command	`:SYSTem:COMMunicate:LAN:SCPI:TELNet:ENABle OFF | ON | 0 | 1` `:SYSTem:COMMunicate:LAN:SCPI:TELNet:ENABle?`
Example	`:SYST:COMM:LAN:SCPI:TELN:ENAB OFF`
Preset	This is unaffected by Preset but is set to ON with a "Restore System Defaults->Misc" Secure Instrument Communications configuration setting: if not set up or specified, it is ON
State Saved	No
Range	On | Off

5.2.2.2 SCPI Socket

Turns the capability to establish Socket LAN sessions ON or OFF, to limit SCPI access over LAN through socket sessions.

Configuration String & Copy Button

In the SCPI LAN dialog, to the right of the **SCPI Socket**ON/OFF control, the full SCPI connection string is displayed. Pressing the **Copy** button to the right of the string copies the displayed connection string to the Windows clipboard.

Remote Command	`:SYSTem:COMMunicate:LAN:SCPI:SOCKet:ENABle OFF | ON | 0 | 1` `:SYSTem:COMMunicate:LAN:SCPI:SOCKet:ENABle?`
Example	`:SYST:COMM:LAN:SCPI:SOCK:ENAB OFF`
Dependencies	If the Secure Instrument Communications configuration has disabled this connection, local changes are not allowed, and an attempt to do so results in error -221,"Disabled by Secure Instrument Communications configuration"
Preset	This is unaffected by **Preset** but is set to ON by **Restore System Defaults->Misc** If not set up or specified, the Secure Instrument Communications configuration setting: is ON
State Saved	No
Range	OFF | ON

5.2.2.3 SICL Server

Turns the **SICL Server** capability ON or OFF, to limit SCPI access over LAN through the SICL server. (SICL IEEE 488.2 protocol.)

Parameter	Description	Setting
Maximum Connections	The maximum number of connections that can be accessed simultaneously	5
Instrument Name	The name (same as the remote SICL address) of your instrument	inst0
Instrument Logical Unit	The unique integer assigned to your instrumentwhen using SICL LAN	8
Emulated GPIB Name	The name (same as the remote SICL address) of the device used when communicating with your instrument	gpib7
Emulated GPIB Logical Unit	The unique integer assigned to your device when it is being controlled using SICL LAN	8
Emulated GPIB Address	The emulated GPIB address assigned to your transmitter tester when it is a SICL server (the same as your GPIB address)	18

Configuration String & Copy Button

In the SCPI LAN dialog, to the right of the **SICL Server**ON/OFF control, the full connection string is displayed. Pressing the **Copy** button to the right of the string copies the displayed connection string to the Windows clipboard.

Remote Command	`:SYSTem:COMMunicate:LAN:SCPI:SICL:ENABle OFF | ON | 0 | 1` `:SYSTem:COMMunicate:LAN:SCPI:SICL:ENABle?`
Example	`:SYST:COMM:LAN:SCPI:SICL:ENAB OFF`
Dependencies	This control is not available on the M9391A or M9393A or UXM If the Secure Instrument Communications configuration has disabled this connection, local changes are not allowed, and an attempt to do so results in error -221,"Disabled by Secure Instrument Communications configuration"
Preset	This is unaffected by **Preset**, but is set to ON by **Restore System Defaults->Misc** Secure Instrument Communications configuration setting: is ON if not set up or specified
State Saved	No
Range	OFF|ON

5.2.2.4 HiSLIP Server

Turns the **HiSLIP Server** capability ON or OFF, to limit SCPI access over LAN through the HiSLIP server.

HiSLIP stands for High Speed LAN Instrument Protocol, and is part of the IVI-6.1 specification.

Here is an example of a VISA connection string used to connect to the HiSLIP Server on an X-Series Spectrum Analyzer:

```
TCPIP0::a-n9030a-93016::hislip0::INSTR
```

In the example above, `hislip0` is the HiSLIP device name that VISA users must include in HiSLIP VISA Address strings. Your HiSLIP device name may differ,depending on your VISA settings.

Configuration String & Copy Button

In the SCPI LAN dialog, to the right of the **HiSLIP Server**`ON/OFF` control, the full connection string is displayed. Pressing the **Copy** button to the right of the string copies the displayed connection string to the Windows clipboard.

Remote Command	`:SYSTem:COMMunicate:LAN:SCPI:HISLip:ENABle OFF | ON | 0 | 1` `:SYSTem:COMMunicate:LAN:SCPI:HISLip:ENABle?`
Example	`:SYST:COMM:LAN:SCPI:HISL:ENAB OFF`
Preset	This is unaffected by **Preset**, but is set to `ON` by **Restore System Defaults->Misc** Secure Instrument Communications configuration setting: is `ON` if not set up or specified
State Saved	No
Range	`OFF|ON`

5.2.2.5 Verbose SCPI On/Off

When you turn Verbose SCPI on, additional information is returned when you send the :SYSTem:ERRor? query. The additional information consists of the characters that stimulated the error. This can aid you in debugging your test programs by indicating where in the parsing of a SCPI command the instrument encountered an invalid command or query.

Specifically, with Verbose SCPI on, the SYSTem:ERRor? query is expanded to show the SCPI data received, with the indicator <Err> at the point in the stream that the error occurred.

Verbose SCPI has no effect on the Show Errors screen or front panel Message Line; it only changes the response to the :SYST:ERR? query.

See the example below, where the invalid command “SENS:BOGUS” is sent:

Normal response to :SYST:ERR (using the Telnet window):

```
SCPI> SENS:BOGUS
SCPI> SYST:ERR?
-113,"Undefined header"
```

Now after turning on Verbose SCPI:

```
SCPI> SYST:BOGUS
SCPI> SYST:ERR?
-113,"Undefined header;SYST:BOGUS<Err>"
```

Remote Command	`:SYSTem:ERRor:VERBose OFF | ON | 0 | 1` `:SYSTem:ERRor:VERBose?`
Example	`:SYST:ERR:VERB ON`
Preset	This is unaffected by Preset but is set to OFF on a "Restore System Defaults->Misc"
State Saved	No
Range	On | Off

5.2.2.6 SCPI Socket Control Port (Remote Command Only)

Returns the TCP/IP port number of the control socket associated with the SCPI socket session. This query enables you to obtain the unique port number to open when a device clear is to be sent to the instrument. Every time a connection is made to the SCPI socket, the instrument creates a peer control socket. The port number for this socket is random. You must use this command to obtain the port number of the control socket. To force a device clear on this socket, open the port and send the string "DCL\n" to the instrument.

If this SCPI command is sent to a non SCPI Socket interface, then 0 is returned.

Remote Command	`:SYSTem:COMMunicate:LAN:SCPI:SOCKet:CONTrol?`
Example	`:SYST:COMM:LAN:SCPI:SOCK:CONT?`
Preset	This is unaffected by Preset or "Restore System Defaults->Misc"
State Saved	No
Range	0 to 65534
Min	0
Max	65534
Backwards Compatibility SCPI	`:SYSTem:COMMunicate:TCPip:CONTrol?`

5.2.3 Web Password Reset

The embedded web server contains certain capability which are password protected; modifying the LAN configuration of the instrument, and access to web pages that can change the settings of the instrument. The default password from the factory is 'measure4u' (without the quotes). The control provided here is the means to set the web password as desired, or to reset the password to the factory default.

Selecting Reset web password displays a control for resetting the password as desired, or to the factory default. The built-in alpha keyboard appears. You may change the password from the factory default of “measure4u”.

You can cancel this entry by pressing the Cancel (ESC) front-panel key.

Dependencies	This control is not available on the M9391A or M9393A or UXM

5.2.4 LXI

Opens a menu that allows you to access the various LXI configuration properties.

Dependencies	This control is not available on the M9391A or M9393A or UXM

5.2.4.1 LAN Reset

Resets the LAN connection. This will result in the following settings and will restart the LAN operation:

- DHCP: Enabled
- Automatic IP Address: Enabled
- ICMP Ping Responder: Enabled
- Web Password: keysight
- Dynamic DNS: Enabled
- mDNS and DNS-SD: Enabled
- Dynamic Link Local Addressing: Enabled
- Auto Negotiation: Enabled

There is no SCPI command for this function.

5.2.4.2 Device Identification (Remote Command Only)

Enabling the LXI device identification will place the LXI Status Indicator to the ‘Identify’ state. Disabling the LXI device identification will place the LXI Status Indicator to the ‘No Fault’ state. The LXI Status indicator is in the upper left region of the instrument’s graphical user interface.

For the EXT-C (E6607C), the controlling test software can use this capability to instruct the operator that the instrument is under remote operation. For example, the test software can enable identification to indicate the instrument is in use, and disable identification when the test procedure is finished.

Remote Command	`:LXI:IDENtify[:STATe] OFF | ON | 0 | 1`

	:LXI:IDENtify[:STATe]?
Example	:LXI:IDEN ON
Preset	Not part of Preset, but reset to OFF on Restore System Defaults All
State Saved	No
Range	On | Off

5.2.5 System IDN Response

This control allows you to specify a response to the *IDN? query, return the analyzer to the Factory response if you have changed it, or, if your test software is expecting the *IDN response to indicate Agilent Technologies, configure the instrument to respond with Agilent as the manufacturer.

The current *IDN response is displayed at the top of the panel, followed by the System IDN Response and User IDN controls.

5.2.5.1 System IDN Response

To choose the factory-set response, select **Factory**. To specify your own response, select **User**. You can enter your desired response using the next control (User IDN).

If your test software is expecting the response to indicate Agilent Technologies as the Manufacturer, you can configure this response by selecting Agilent.

See "More Information" on page 318

Remote Command	:SYSTem:IDN:CONFigure FACTory | AGILent | USER :SYSTem:IDN:CONFigure?
Example	:SYST:IDN:CONF FACT
Notes	This affects the response given in all Modes of the Analyzer, unless the current Mode has also specified a custom response, in which case the current Mode's custom IDN response takes precedence over the System's, but only while that Mode is the current Mode It survives shutdown and restart of the software and therefore survives a power cycle
Preset	The *IDN response is reset to FACTory by Restore Misc Defaults or Restore System Defaults All and survives subsequent running of the software

More Information

Here are details about the several options available for the System *IDN response:

Factory

SCPI example: :SYST:IDN:CONF FACT

Selects the factory default configuration of *IDN?, which indicates the Manufacturer as Keysight Technologies. For example,

“Keysight Technologies,N9040B,MY00012345,A.15.00”

where the fields are manufacturer, model number, serial number, firmware revision.

Note: In products that run multiple instances of the X-Series Application, all instances use the same factory System IDN response.

Agilent

SCPI example: `:SYST:IDN:CONF AGIL`

Starting with software version x.14.50, the *IDN? response in the Factory configuration will indicate the Manufacturer as Keysight Technologies. If your test software is expecting the response to indicate Agilent Technologies you can conveniently configure the response with this menu selection or SCPI command.

For example:

“Agilent Technologies,N9020A,MY00012345,A.05.01”

Note: In products that run multiple instances of the X-Series Application, all instances use the same Agilent System IDN response.

User

SCPI example: `:SYST:IDN:CONF USER`

Selects your customized configuration of *IDN?

Enter your desired response using the User IDN control.

5.2.5.2 User IDN

This control allows you to specify your own response to the *IDN? query. You may enter your desired response with the Alpha Editor or a plugin PC keyboard. Once the value is entered select “User” under System IDN Response.

When you select this control, the active function becomes the current User string and is highlighted, so typing replaces it. If instead you wish to edit the existing string press the left or right arrow to go to the beginning or the end.

If you enter a null string (for example, by clearing the User String while editing and then pressing **Done**) the analyzer automatically reverts to the Factory setting.

Note: In products that run multiple instances of the X-Series Application, all instances use the same User System IDN response.

Remote Command	`:SYSTem:IDN <string>` `:SYSTem:IDN?`

Notes	The format of the <string> must be four fields each separated by a comma, example: `:SYST:IDN “XYZ Corp,Model 12,012345,A.01.01”` The four fields are <manufacturer>, <model number>, <serial number>, <firmware revision>. Thus, the text within a field cannot contain a comma This affects the response given in all Modes of the Analyzer, unless the current Mode has also specified a custom response, in which case the current Mode’s custom IDN response takes precedence over the System’s, but only while that Mode is the current Mode It survives shutdown and restart of the software and therefore survives a power cycle Null string as parameter restores the Factory setting, example: :SYST:IDN ""
Preset	This is unaffected by Preset but is set to the original factory setting on a “Restore System Defaults->Misc”

5.2.5.3 SYSTem:PERSona (Remote Commands Only)

The SYSTem:PERSona set of commands permit setting of individual fields of the *IDN? Response.

– "SYSTem:PERSona:DEFault" on page 320
– "SYSTem:PERSona:MANufacturer" on page 320
– "SYSTem:PERSona:MANufacturer:DEFault" on page 321
– "SYSTem:PERSona:MODel" on page 321
– "SYSTem:PERSona:MODel:DEFault" on page 321

SYSTem:PERSona:DEFault

This command will reset the *IDN response to the instrument default.

Remote Command	`:SYSTem:PERSona:DEFault` `:SYSTem:PERSona:DEFault?`
Notes	The query SYST:PERS:DEF? returns the default value of *IDN? even if the current setting of *IDN? is the non-default value. The return value of SYST:PERS:DEF? is a <string> SYST:PERS:DEF is equivalent to: SYSTem:IDN “” SYSTem:IDN:CONF DEF

SYSTem:PERSona:MANufacturer

This command will set the Manufacturer field of the *IDN? response. The Manufacturer field is the first field of the *IDN? response.

Remote Command	`:SYSTem:PERSona:MANufacturer <string>` `:SYSTem:PERSona:MANufacturer?`
Notes	When setting the manufacturer field, the current IDN response string is modified to replace the manufacturer field with the string specified by the command. If the resulting IDN response matches one of the predefined responses (SYSTem:IDN:CONFigure FACT | AGIL), then the SYSTem:IDN:CONFigure is set to the corresponding value. If the IDN response with the new manufacturer field is not one of the predefined values, then SYSTem:IDN:CONFigure will be set to USER and SYSTem:IDN will be set to the new IDN response string The query SYST:PERS:MAN? returns the current value of the *IDN? Manufacturer field

SYSTem:PERSona:MANufacturer:DEFault

This command will reset the Manufacturer field of the *IDN? response to the default value.

Remote Command	`:SYSTem:PERSona:MANufacturer:DEFault` `:SYSTem:PERSona:MANufacturer:DEFault?`
Notes	The query SYST:PERS:MAN:DEF? returns the default Manufacturer Field value of *IDN? even if the current setting of *IDN? is the non-default value. The return value of SYST:PERS:MAN:DEF? is a <string>

SYSTem:PERSona:MODel

This command will set the Model field of the *IDN? response. The Model field is the second field of the *IDN? response.

Remote Command	`:SYSTem:PERSona:MODel <string>` `:SYSTem:PERSona:MODel?`
Notes	When setting the model field, the current IDN response string is modified to replace the model field with the string specified by the command. If the resulting IDN response matches one of the predefined responses (SYSTem:IDN:CONFigure FACT | AGIL), then the SYSTem:IDN:CONFigure is set to the corresponding value. If the IDN response with the new model field is not one of the predefined values, then SYSTem:IDN:CONFigure will be set to USER and SYSTem:IDN will be set to the new IDN response string The query SYST:PERS:MOD? returns the current value of the *IDN? Model field

SYSTem:PERSona:MODel:DEFault

This command will reset the Model field of the *IDN? response to the default value.

Remote Command	`:SYSTem:PERSona:MODel:DEFault` `:SYSTem:PERSona:MODel:DEFault?`
Notes	The query SYST:PERS:MOD:DEF? returns the default Model Field value of *IDN? even if the current setting of *IDN? is the non-default value. The return value of SYST:PERS:MOD:DEF? is a <string>

1.

5.2.6 Restore I/O Config Defaults

Causes the group of settings associated with the I/O Config menu to be reset to their default values. This also happens on a Restore Misc Defaults, which has a SCPI command.

When Restore I/O Config Defaults is selected, a message appears saying:

"This will reset all of the I/O Config variables to their default state, including the GPIB address and SCPI LAN settings.

It will not affect Alignment data or settings.

This action cannot be undone. Do you want to proceed?"

The message provides an OK and Cancel button for you to affirm or cancel the operation.

5.2.7 Query USB Connection (Remote Command Only)

Enables you to determine the speed of the USB connection.

Remote Command	:SYSTem:COMMunicate:USB:CONNection?
Example	:SYST:COMM:USB:CONN?
Notes	NONE – Indicates no USB connection has been made LSPeed – Indicates a USB low speed connection (1.5 Mbps) NOTE: This is reserved for future use, the T+M488 protocol is not supported on low speed connections HSPeed – Indicates that a USB high speed connection (480 Mbps) has been negotiated FSPeed – Indicates that a USB full speed connection (12 Mbps) has been negotiated
Dependencies	This control is not available in E7760
State Saved	No
Range	NONE|LSPeed|HSPeed|FSPeed

5.2.8 USB Connection Status (Remote Command Only)

Enables you to determine the current status of the USB connection.

Remote Command	:SYSTem:COMMunicate:USB:STATus?
Example	:SYST:COMM:USB:STAT?
Notes	SUSPended – Indicates that the USB bus is currently in its suspended state. The bus is in the suspended state when:

	– The bus is not connected to any controller – The controller is currently powered off – The controller has explicitly placed the USB device into the suspended state When in the suspended state, no USB activity, including start of frame packets are received ACTive – Indicates that the USB device is in the active state. When the device is in the active state, it is receiving periodic start of frames but it isn't necessarily receiving or transmitting data
Dependencies	This control is not available in E7760
State Saved	No
Range	`SUSPended|ACTive`

5.2.9 USB Packet Count (Remote Command Only)

Enables you to determine the number of packets received and transmitted on the USB bus.

Remote Command	`:SYSTem:COMMunicate:USB:PACKets?`
Example	`:SYST:COMM:USB:PACK?`
Notes	Two integers are returned. The first is the number of packets received since application invocation, the second is the number of packets transmitted since application invocation. If no packets have been received or transmitted the response is 0,0 The packet count is initialized to 0,0 when the instrument application is started
Dependencies	This control is not available in E7760
State Saved	No

5.2.10 Lock Remote I/O Session (Remote Command only)

An instrument can support multiple remote I/O sessions at the same time. However, you cannot *simultaneously* send remote commands from multiple sessions to the same instrument. The results in such a case are undefined.

Care must be taken so that only *one* session actively controls the instrument at a time. Other sessions must wait until the active session finishes the instrument control.

To help achieve this cooperative instrument sharing, the following remote commands are provided:

- Lock Remote I/O Request (Remote Command only)
- "Unlock Remote I/O Session (Remote Command only)" on page 325
- "Remote I/O Session Lock Name (Remote Command only)" on page 325
- "Remote I/O Session Lock Owner (Remote Command only)" on page 325

Example of Lock Usage

1. Each session tries to obtain a lock by sending a `:SYSTem:LOCK:REQuest?` query
   This query can be sent simultaneously from multiple sessions
2. Only one session will be granted. The granted session receives `1` in response to its query
3. The granted session actively controls the instrument
   Meanwhile, other sessions must wait, and must periodically send `:SYSTem:LOCK:REQuest?` queries, trying to obtain the lock
4. When the active session finishes its task, it releases the lock by sending a `:SYSTem:LOCK:RELease` command
5. Now the lock has become available, so when one of the waiting sessions sends a `:SYSTem:LOCK:REQuest?` query, it receives `1` in response, granting the lock to that session

By repeating steps 3, 4, and 5 above, multiple sessions can share the same instrument in a cooperative fashion.

NOTE

A session can query its own unique session name by sending a `:SYSTem:LOCK:NAME?` query. This session name is determined by the instrument.

A session also can query the name of the currently granted session by sending a `:SYSTem:LOCK:OWNer?` query.

NOTE

Remote I/O interfaces are grouped in two types: single-session interface and multi-session interface. Both types of interface can be used for cooperative instrument sharing.

The recommended interface is LAN HiSLIP.

Interface	Single-session	Multi-Session
GPIB	x	
USB-488	x	
LAN VXI-11 (SICL)	x	
LAN Socket		x
LAN HiSLIP		x
LAN Telnet		x

If using a single-session interface, care must be taken to ensure only one client uses the single-session interface.

In particular, LAN VXI-11 (SICL) interface is a single-session interface, even though multiple clients could simultaneously connect to this interface. Such multiple VXI-11 clients share the same session context; the same status registers and the same error queue. Even a SCPI query response can be received by another client.

Furthermore, the lock obtained by `:SYSTem:LOCK:REQuest?` is shared among all VXI-11 clients, allowing all of them to actively control the instrument.

If a LAN VXI-11 (SICL) interface must be used by multiple clients for a cooperative instrument sharing, then VISA locking *must* be used, *in addition to* Remote I/O Session Lock.

5.2.11 Unlock Remote I/O Session (Remote Command only)

You can unlock the SCPI control of the current I/O Interface and Session by sending a `:SYSTem:LOCK:RELease` command. Lock requests on an individual interface and session can be nested, and each request will increase an internal lock count by 1. For every granted request, you will need to perform a release. The lock is not relinquished until the internal lock count is at 0.

Remote Command	`:SYSTem:LOCK:RELease`
Example	`:SYST:LOCK:REL`
Notes	When the instrument is unlocked bit 0 is cleared in the Operation Instrument status register

5.2.12 Remote I/O Session Lock Name (Remote Command only)

You can obtain the name of the current I/O Interface and Session with the query `:SYSTem:LOCK:NAME?`.

Remote Command	`:SYSTem:LOCK:NAME?`
Example	`:SYST:LOCK:NAME?`
Notes	The information returned is a string of the format: `<I/O Interface>[/<IP address>/<Session ID>]` Where IP address and Session ID are only provided for interfaces that provide multiple sessions Single Session interfaces (GPIB, USB-488, and LAN VXI-11) only list interface name The Session ID is an internally generated identifier. It is not guaranteed to be consistent across instrument software versions (the identifier is subject to change when the software of the instrument is updated). The absolute value of the Session ID is not significant, but the identifier will be consistent for a given software version, and can be relied upon for lock owner logic comparisons

5.2.13 Remote I/O Session Lock Owner (Remote Command only)

You can determine which I/O Interface and Session has the SCPI locked with the query `:SYSTem:LOCK:OWNer?`.

If no interface and session has the SCPI locked, then the return value is `NONE`.

Remote Command	`:SYSTem:LOCK:OWNer?`

Example	`:SYST:LOCK:OWN?`
Notes	The information returned is a string of the format: `<I/O Interface>[/<IP address>/<Session ID>]` Where IP address and Session ID are only provided for interfaces that provide multiple sessions Single Session interfaces (GPIB, USB-488, and LAN VXI-11) only list interface name The Session ID is an internally generated identifier. It is not guaranteed to be consistent across instrument software versions (the identifier is subject to change when the software of the instrument is updated). The absolute value of the Session ID is not significant, but the identifier will be consistent for a given software version, and can be relied upon for lock owner logic comparisons If no interface and session has the SCPI locked, then the return value is `NONE`

5.3 User Interface

Causes the group of settings associated with the User Interface menu to be reset to their default values. This also happens on a Restore Misc Defaults.

When User Interface is selected, a message appears saying:

This will reset all of the User Interface variables to their default state, including the menu panel location, display theme, and language.

It will not affect Alignment data or settings.

This action cannot be undone. Do you want to proceed?

The message provides an OK and Cancel button for you to affirm or cancel the operation.

Example	`:SYST:DEF UINT`

5.3.1 Menu Panel Position

Allows the Menu Panel to be positioned on the Right or Left side of the display.

Remote Command	`:SYSTem:DISPlay:MPPosition RIGHt | LEFT` `:SYSTem:DISPlay:MPPosition?`
Example	`:SYST:DISP:MPP LEFT`
Preset	This is unaffected by a Preset but is set to RIGHt on a "Restore User Interface Defaults" or "Restore System Defaults->All"
State Saved	Power On Persistent (survives shutdown and restart)

5.3.2 Menu Panel Tabs

Allows the Menu Panel Tabs to be positioned on the Right or Left side of the menu panel.

Remote Command	`:SYSTem:DISPlay:MPTab RIGHt | LEFT` `:SYSTem:DISPlay:MPTab?`
Example	`:SYST:DISP:MPT LEFT`
Preset	This is unaffected by a Preset but is set to RIGHt on a "Restore User Interface Defaults" or "Restore System Defaults->All"
State Saved	Power On Persistent (survives shutdown and restart)

5.3.3 Annotations Local Settings/All Off

This function overrides the annotation settings for all measurement in all modes and turns them all off. This provides the security based "annotation off" function of previous analyzers; hence it uses the legacy SCPI command.

When this control is set to **All Off,** the **Screen Annotation, Meas Bar, Trace Annotation,** and **Control Annotation** controls under the **Display, Annotation** menu are grayed out and forced to **Off** for all measurements in all modes. When **Local Settings** is selected, you are able to set the local annotation settings on a measurement by measurement basis.

Remote Command	`:DISPlay:WINDow[1]:ANNotation[:ALL] OFF | ON | 0 | 1` `:DISPlay:WINDow[1]:ANNotation[:ALL]?`
Example	`:DISP:WIND:ANN OFF`
Preset	This is unaffected by a Preset but is set to ON on a "Restore User Interface Defaults", “Restore Misc Defaults” or "Restore System Defaults->All"
State Saved	Power On Persistent (survives shutdown and restart)
Backwards Compatibility Notes	The `WINDow` parameter and optional subopcode is included for backwards compatibility but ignored – all windows are equally affected

5.3.4 Display Theme

This control allows you to change the Display theme. This is similar to the Themes selection under Page Setup and Save Screen Image.

The two available themes are:

– Filled: this is the normal theme using filled objects

– Outline: this theme uses color but does not use fill for most areas on the display. It is ideal for images that need to be printed on inkjet printers. Although setting the Display Theme to Outline will not affect screen image saves or prints, it will show you exactly how screen images will look when using the Outline theme under Save Screen Image, and how prints will look when using the Outline theme under Page Setup.

NOTE

Although the Outline theme eliminates most of the filled area, some objects remain filled. In particular, the selected marker remains filled with the green marker color, in order to distinguish it from the other markers. This is important, as it is the selected marker whose readout appears in the upper right corner of the display.

Remote Command	`:DISPlay:THEMe TDColor | TDMonochrome | FCOLor | FMONochrome | FILLed | OUTLine`

	`:DISPlay:THEMe?`
Example	`:SYST:DISP:THEM OUTL` sets the display style to Outline
Notes	To permit code compatibility with A-model X-Series Signal Analyzer instruments, the command parameters from the A-models will be mapped as follows: – TDColor and TDMonochrome are both mapped to FILLed – (exact full color representation of what is on the screen) – FCOLor and FMONochrome are both mapped to OUTLine – (uses color for traces and other items, but most filled areas are white) There is no Monochrome theme in the B-model instruments, so the monochrome commands for the A-model instruments yield color themes The query of `:DISPlay:THEMe?` always returns FILLed or OUTLine. It never returns FCOLor, FMONochrome, TDColor, or TDMonochrome
Preset	This is unaffected by a Preset but is set to FILLed on a "Restore User Interface Defaults", “Restore Misc Defaults” or "Restore System Defaults->All"
State Saved	Power On Persistent (survives shutdown and restart)

5.3.5 Backlight

Turns the display backlight on and off. This setting may interact with settings under the Windows "Power" menu.

When the backlight is off, pressing ESC, TAB, SPACE, ENTER, UP, DOWN, LEFT, RIGHT, DEL, BKSP, CTRL, or ALT turns the backlight on without affecting the application. Pressing any other key will turn backlight on and could potentially perform the action as well.

Remote Command	`:DISPlay:BACKlight ON | OFF` `:DISPlay:BACKlight?`

Example	`:DISP:BACK ON`
	Turns backlight on
	`:DISP:BACK OFF`
	Turns backlight off

Preset	Pressing any key turns the backlight back on, and so does "Restore User Interface Defaults", “Restore Misc Defaults” or "Restore System Defaults->All"
State Saved	Not saved in State

5.3.6 Hints

Hints are descriptions that provide additional information for a control. This function allows you to have Hints enabled or disabled.

Remote Command	`:SYSTem:DISPlay:HINTs[:STATe] OFF | ON | 0 | 1` `:SYSTem:DISPlay:HINTs[:STATe]?`
Example	`:SYST:DISP:HINT OFF`
Preset	This is unaffected by a Preset but is set to ON on a "Restore User Interface Defaults" or "Restore System Defaults->All"
State Saved	Power On Persistent (survives shutdown and restart)

5.3.7 Numeric Entry Auto Open

Configures whether the Numeric Entry Panel will appear immediately when an active function control is activated (Auto Open On), or be deferred until you touch it again or begin to enter a value (Auto Open Off). When configured for Auto Open Off (the default), adjusting the value with the front panel Up/Down keys or the RPG will hide the Numeric Entry Panel.

Remote Command	`:SYSTem:DISPlay:NEPimmediate ON | OFF | 1 | 0` `:SYSTem:DISPlay:NEPimmediate?`
Example	`:SYST:DISP:NEP OFF`
Preset	This is unaffected by a Preset but is set to ON on a "Restore User Interface Defaults" or "Restore System Defaults->All"
State Saved	Power On Persistent (survives shutdown and restart)

5.3.8 Touch On/Off

Turns the touch functionality on and off on the display. If Off, you can turn it back on using the front panel Touch On/Off key, or by using a mouse to toggle this control.

Preset	Always starts up “ON”. Unaffected by a Preset but is turned on by "Restore User Interface Defaults" or "Restore System Defaults->All"
State Saved	Not saved in state, not affected by preset, not Power On Persistent (does not survive shutdown and restart)

5.3.9 Control Size

Configures the size of the controls in the user interface. This can be used to make screen dumps from a large screen instrument match those from a smaller screen instrument, to make the controls more readable on a large-screen instrument, or to display more information on a smaller screen instrument.

Remote Command	`:DISPlay:UINTerface:CSIZe SMALl | LARGe` `:DISPlay:UINTerface:CSIZe?`
Example	`:DISP:UINT:CSIZ LARG`
Preset	This is unaffected by a Preset but is set to SMALl on a "Restore User Interface Defaults" or "Restore System Defaults->All"
State Saved	Power On Persistent (survives shutdown and restart)

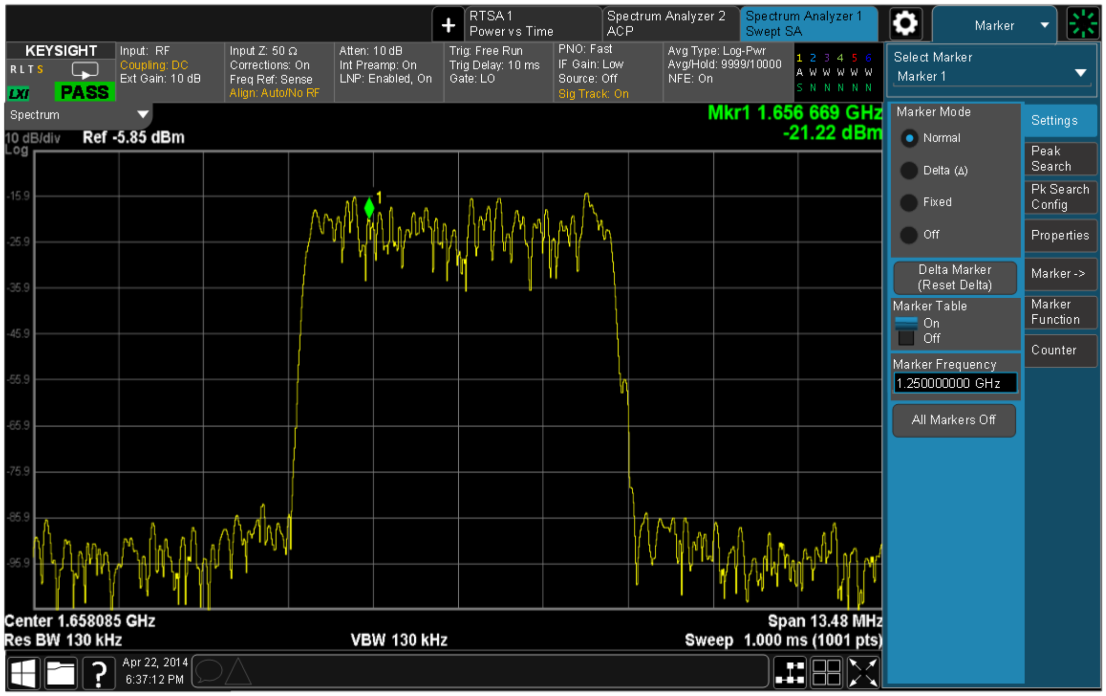
5.3.10 Quick Save Mode

When Quick Save Mode is in Normal (the default setting), the instrument does an immediate save of a new file of the same type and to the same directory as the previous Save action. When Quick Save Mode is in the Prompt state, instead of immediately performing a Save, the Alpha Keyboard appears with the proposed auto-filename in the entry area. You can then press **Enter** to accept the auto filename, or edit the name then press **Enter**. This allows you to easily save a file with a custom file name.

Remote Command	`:MMEMory:STORe:QSAVe NORMal | PROMpt` `:MMEMory:STORe:QSAVe?`
Example	`:MMEM:STOR:QSAV PROM`
Preset	This is unaffected by a Preset but is set to NORMal on a "Restore User Interface Defaults" or "Restore System Defaults->All"
State Saved	Power On Persistent (survives shutdown and restart)

5.3.11 Screen Tabs Left/Right

This switch, when in the “Right” position, makes the screen tabs start on the right and build across to the left, thus minimizing the finger travel over to the screen tab when there is only one screen. When tabs are added from right to left, they appear as below:

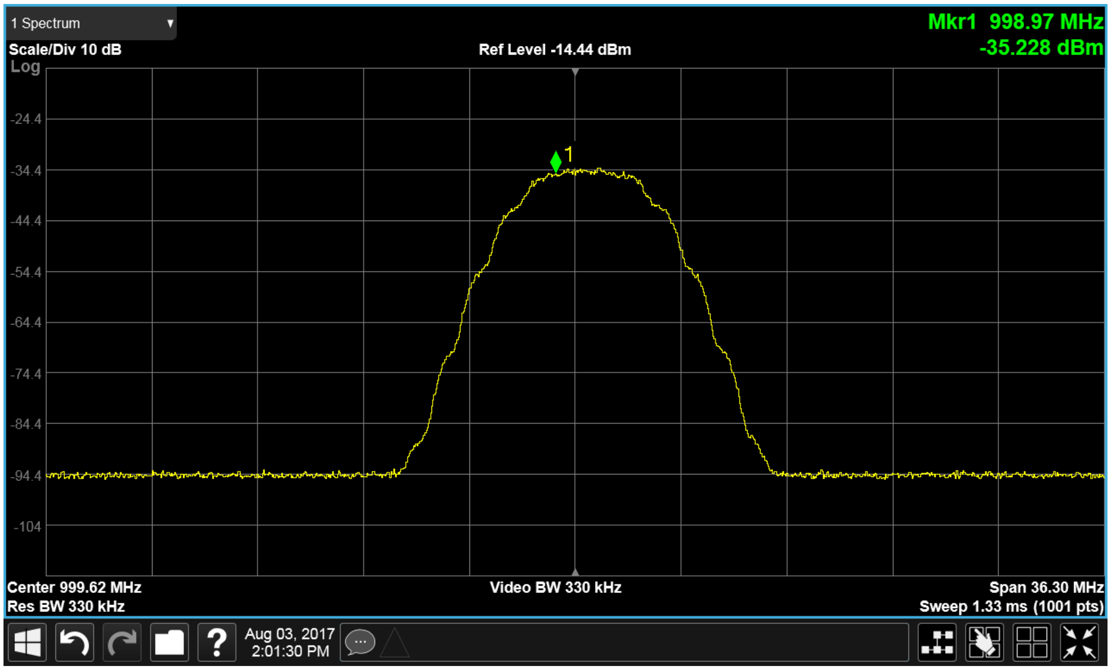


The default is the “Left” position.

Remote Command	`:DISPlay:UINTerface:STAB RIGHt | LEFT` `:INSTrument:SCReen:STAB?`
Example	`:DISP:UINT:STAB RIGH`
Preset	This is unaffected by a Preset but is set to LEFT on a "Restore User Interface Defaults" or "Restore System Defaults->All"
State Saved	Power On Persistent (survives shutdown and restart)

5.3.12 Hide Screen Tabs in Full Screen

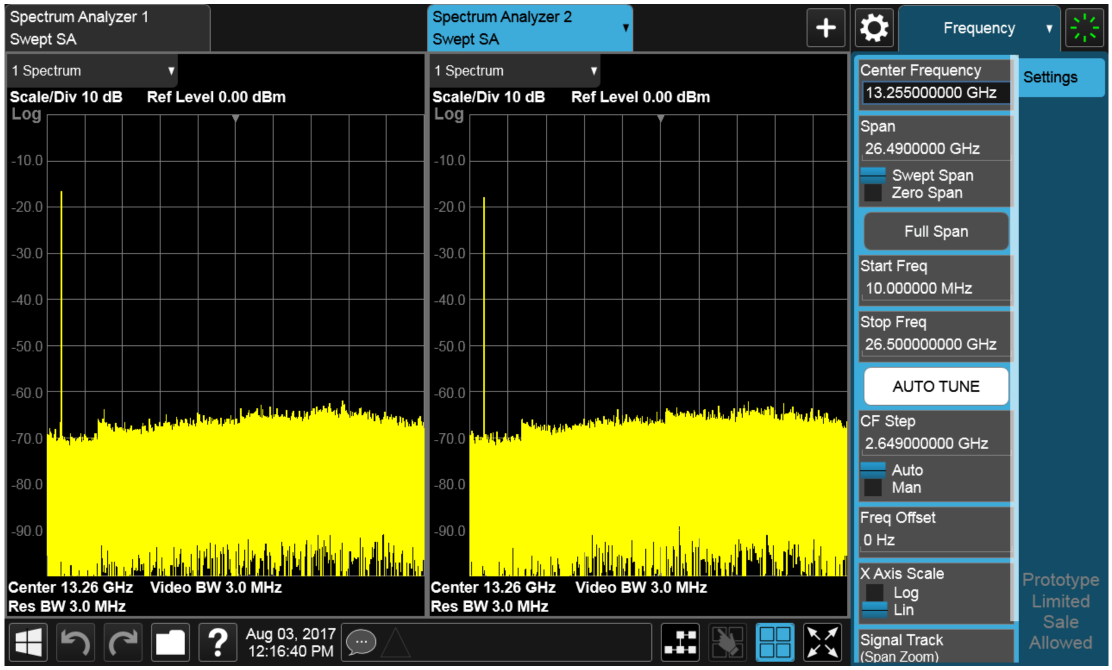
This switch, when in the “True” position, causes the Screen Tabs to be hidden when in Full Screen view, thus maximizing the display area available for results. If you also turn off the Meas Bar (in the Display, Annotation menu), you get the maximum available area for results, as shown below:



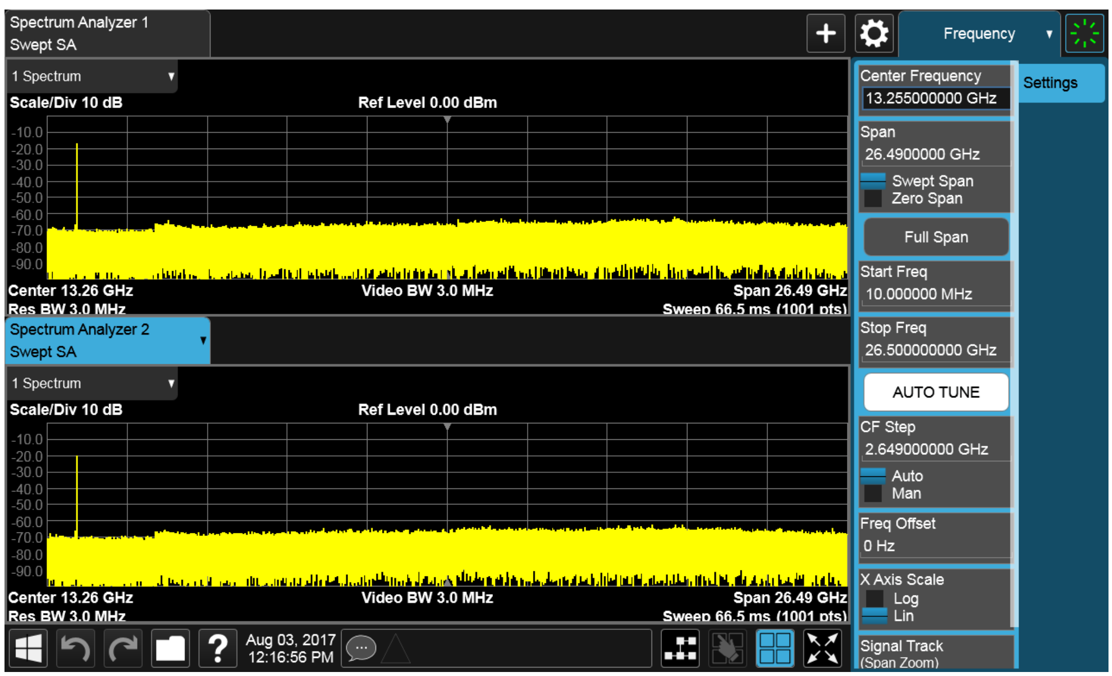
Remote Command	`:DISPlay:UINTerface:HTABs ON | OFF | 1 | 0` `:DISPlay:UINTerface:HTABs?`
Example	`:DISP:UINT:HTAB ON` Hide the tabs in full screen
Preset	This is unaffected by a Preset but is set to OFF on a "Restore User Interface Defaults" or "Restore System Defaults->All"
State Saved	Power On Persistent (survives shutdown and restart)

5.3.13 2-Screen Orientation

When you add a second Screen using the “+” control on the Screen Tabs bar, normally the screen is added to the right of the first screen. However, sometimes it is better to add the new screen below the first screen rather than to the right, as shown below.



New screen added to the right (horizontal orientation)



New screen added below (vertical orientation)

The “2-Screen Orientation” switch allows you to choose between these two orientations for 2-Screen configurations. The default is the horizontal configuration, two Screens side-by-side.

Remote	`:INSTrument:SCReen:ORIentation VERTical | HORizontal`

Command	
Example	`:INST:SCR:ORI VERT` Set the 2 screens to be above/below each other
Preset	`HOR` This is unaffected by a Preset but is set to HORizontal on a "Restore User Interface Defaults" or "Restore System Defaults->All"

5.3.14 Language

Accesses the selection of language displayed on the menus and controls. English is the default language.

All Measurement Applications that share common controls will display the localized controls.

The description on the control labels is bounded by the control size. Any given language will have labels in that language which are shorter or longer than the equivalent label in English. Any localized text on the controls that does not fit the label size will remain in English. Thus for any given menu, controls may be displayed in English and the selected language. Also, labels that are acronyms, engineering, or technology specific terms may remain in English.

All Application and Measurement names will remain in English.

All data in exported files will remain in English.

The Diagnostic and Service menus in the System Subsystem will remain in English.

The Windows operating system must remain in English. Changing the Region and Language settings in the Windows Control Panel is not supported.

External keyboards in English are supported. Localized external keyboards are not supported. When the language selected is not English, a message is presented to the user that any external keyboards must remain English.

Other aspects of the Graphical User Interface remain in the English language. The Remote User Interface, SCPI, remains in English.

Remote Command	`:SYSTem:DISPlay:LANGuage ENGLish | RUSSian` `:SYSTem:DISPlay:LANGuage?`

Example	`:SYST:DISP:LANG ENGL`
	`:SYST:DISP:LANG RUSS`
	Requires Option AKT

Preset	This is unaffected by a Preset but is set to ENGLish on a "Restore User Interface Defaults", “Restore Misc Defaults" or "Restore System Defaults->All"

5.3.15 Restore User Interface Defaults

Causes the group of settings associated with the User Interface menu to be reset to their default values. This also happens on a Restore Misc Defaults.

When User Interface is selected, a message appears saying:

“This will reset all of the User Interface variables to their default state, including the menu panel location, display theme, and language.

It will not affect Alignment data or settings.

This action cannot be undone. Do you want to proceed?”

The message provides an OK and Cancel button for you to affirm or cancel the operation.

Example	`:SYST:DEF UINT`

5.3.16 User Interface Type (Remote only command)

This query-only command can be used to determine if the instrument is running the Multi-Touch user interface or Softkey user interface. This is an easy way to distinguish between A-models instruments and Touch UI instruments.

Remote Command	`:DISPlay:UINTerface:TYPE?`
Example	`:DISP:UINT:TYPE?`
Notes	The query returns `MULTITOUCH` for instruments with the Multi-Touch UI or `SOFTKEY` for instruments with the Softkey UI

5.4 Power On

Enables you to select how the instrument should power on.

NOTE In products that run multiple instances of the X-Series Application, the same Power On type is shared between all the instances.

Dependencies	This menu is not available on the M9391A or M9393A

5.4.1 Power On State

Enables you to select whether the instrument powers up in a default state or some other state. The options are: Mode and Input/Output Defaults, User Preset and Last State.

Remote Command	`:SYSTem:PON:TYPE MODE | USER | LAST` `:SYSTem:PON:TYPE?`

Example	`:SYST:PON:TYPE MODE`
	`:SYST:PON:TYPE USER`
	`:SYST:PON:TYPE LAST`

Preset	This is unaffected by a Preset but is set to Mode on a “Restore System Defaults->All”
State Saved	No
Backwards Compatibility SCPI	`:SYSTem:PON:TYPE PRESet` the PRESet parameter is supported for backward compatibility only, and behaves the same as MODE

Mode and Input/Output Defaults

When the analyzer is powered on in Mode and Input/Output Defaults, it performs a Restore Mode Defaults to all modes in the instrument and also performs a Restore Input/Output Defaults.

Persistent parameters (such as Amplitude Correction tables or Limit tables) are not affected at power on, even though they are normally cleared by Restore Input/Output Defaults and/or Restore Mode Defaults.

User Preset

Sets Power On to User Preset. When the analyzer is powered on in User Preset, it will User Preset each mode and switch to the power-on mode. Power On User Preset will not affect any settings beyond what a normal User Preset affects.

Backward Compatibility Note: Power On User Preset will cause the instrument to power up in the power-on mode, not the last mode the instrument was in prior to shut down. Also, Power On User Preset will User Preset all modes. This does not exactly match legacy behavior.

NOTE In products that run multiple instances of the X-Series Application, the same User Preset is shared between all the instances.

NOTE An instrument could never power up for the first time in User Preset.

Last State

Sets **Power On** to **Last**. When the analyzer is powered on, it will put all modes in the last state they were in prior to when the analyzer was put into Power Standby and it will wake up in the mode it was last in prior to powering off the instrument. The saving of the active mode prior to shutdown happens behind the scenes when a controlled shutdown is requested by using the front panel power **Standby** key or by using the remote command `SYSTem:PDOWn`. The non-active modes are saved as they are deactivated and recalled by Power On Last State.

Power on Last State only works if you have done a controlled shutdown prior to powering on in Last. If a controlled shutdown is not done when in Power On Last State, the instrument will power up in the last active mode, but it may not power up in the active mode’s last state. If an invalid mode state is detected, a Mode Preset will occur. To control the shutdown under remote control use the :SYSTem:PDOWn command.

Backward Compatibility Note: It is no longer possible to power-up the analyzer in the last mode the analyzer was running with that mode in the preset state. (ESA/PSA SYST:PRESET:TYPE MODE with SYST:PON:PRESET) You can power-on the analyzer in the last mode the instrument was running in its last state (SYST:PON:TYPE LAST), or you can specify the mode to power-up in its preset state (SYST:PON:MODE <mode>).

NOTE In products that run multiple instances of the X-Series Application, each instance has a unique Last State.

NOTE An instrument can never power up for the first time in Last.

If line power to the analyzer is interrupted, for example by pulling the line cord plug or by switching off power to a test rack, Power On Last State may not work properly. For proper operation, Power On Last State depends on your shutting down the instrument using the **Standby** key or the SYSTem:PDOWn SCPI command. This ensures the last state of each mode is saved and can be recalled during a power up.

5.4.2 Power On Application

Accesses a menu that lists the available Modes and lets you select which Mode is to be the power-on application. Whichever application is selected runs at power on when the Power On Type is set to “Mode and Input/Output Defaults”.

NOTE In products that run multiple instances of the X-Series Application, the same Power On Application is shared between all the instances.

Remote Command	`:SYSTem:PON:MODE <mode>`
	where <mode> is the identical list from the :INSTrument[:SELect] command
	`:SYSTem:PON:MODE?`

Example	`:SYST:PON:MODE SA`
Notes	The list of possible modes (and remote parameters) to choose from is dependent on which modes are installed in the instrument
Preset	This is unaffected by a Preset but is set on a “Restore System Defaults->All” to SA, except in the cases noted below: – For N8973B, N8974B, N8975B, or N8976B: NFIG – For E7760: BASIC
State Saved	No

5.4.3 FPGA Configuration

The FPGA Configuration dialog lets you choose which FPGA image you want loaded into the analyzer.

Depending on your hardware configuration, your analyzer may contain a Field Programmable Gate Array (FPGA) which handles much of the processing for some of the mathematically intensive features, such as Time Domain Scan (option TDS) and Enhanced Sweep Speed (option FS2). The FPGA is not big enough to hold the functionality for both options, so you have to decide which FPGA program you want loaded.

When licenses allow for both FPGA image versions to be available, and you have not explicitly chosen an FPGA image version, then when the firmware is updated the Time Domain Scan version will be loaded. In the absence of all licenses, the Enhanced Sweep Speed version will be loaded. Once you have explicitly chosen an FPGA image version, using the FPGA Configuration dialog, any future firmware updates will continue to load the chosen version as long as it is licensed.

Example: loading the Time Domain Scan FPGA image, removing the TDS license, and then updating the firmware will result in the Enhanced Sweep Speed version being loaded.

When multiple capabilities are licensed, the FPGA Configuration presents a dialog which tells you that there is insufficient space to fit all the licensed capabilities, and asks you to choose one of the FPGA programs (images).

If you remove licenses, it is possible to end up with an unlicensed capability loaded in the FPGA while a licensed capability is not loaded. In this case, the dialog will not present the Preference group and will show a message about unlicensed/licensed capabilities. You can dismiss the dialog if the licensed capability isn't currently needed and you don't want to take the time to load the licensed FPGA image. However, this dialog will continue to pop-up each time the instrument is restarted.

Behavior when the Enhanced Sweep Speed FPGA Image is Loaded

When the Enhanced Sweep Speed version of the FPGA image is loaded, sweep behavior still depends on the licenses:

- FS2 gives full FPGA enhanced sweep speed
- FS1 gives software implemented enhanced sweep speed
- Neither FS1 nor FS2 – no enhanced sweep speed
- Both FS1 and FS2 – same as FS2, the full FPGA enhanced sweep speed

If the EMI Receiver application and TDS option are licensed and the Enhanced Sweep Speed FPGA image is loaded, then you will not have the proper FPGA image loaded to fully support the EMI Receiver application. In particular, the Frequency Scan measurement cannot use the Scan Type of "Time Domain Scan" (this is the normally the default Scan Type for instruments with the TDS option). Instead, the EMI Receiver Application will behave as if the TDS option is not licensed.

Behavior when the Time Domain Scan FPGA Image is loaded

When the Time Domain Scan version of the FPGA image is loaded, The EMI Receiver application will work as expected with the TDS option licensed, but the FS2 capability will silently revert back to FS1 behavior.

Switching Between Enhanced Sweep Speed and Time Domain Scan FPGA Images

You can't have both full TDS and FS2 images at the same time, so to switch to the other image you must go through the process of reloading the FPGA by choosing the desired image with the Selected FPGA control and pressing Load FPGA or issuing the "Load FPGA" SCPI command below with the proper parameter.

Incorrect FPGA Configuration

If the EMI Receiver application, TDS, or FS2 license is removed while the FPGA image for that license is loaded, the instrument ends up in an incorrect configuration since the loaded FPGA image version has support for unlicensed functionality that is not accessible and does not support the currently licensed functionality. It will still function, but when the instrument recognizes this situation at startup, it will automatically enter the FPGA Configuration dialog. The only selections available will be the licensed ones, but you can choose to dismiss the dialog and continue with the current FPGA image version if you do not want to take the time to load the correct FPGA image. The dialog will continue to be presented at each startup until the correct FPGA image is loaded.

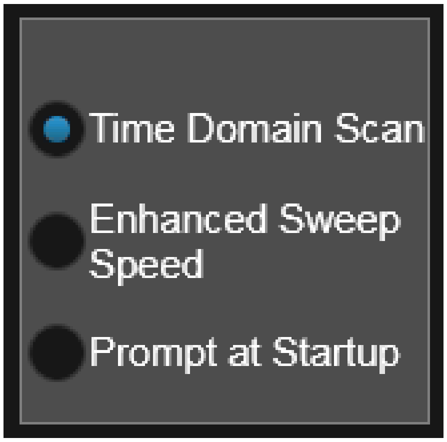
FPGA Updates When Firmware Installs

The FPGA image and X-Series firmware are tightly coupled, so whenever the firmware is updated, the FPGA image is also checked and updated if needed. The rules for choosing between Time Domain Scan and Enhanced Sweep Speed versions of the FPGA image are as:

1. Always use Time Domain Scan FPGA image for MXE
2. If neither the EMC Application nor TDS nor FS2 are licensed, the Enhanced Sweep Speed FPGA image is loaded
3. If EMC Application and TDS are licensed and FS2 is not licensed, the Time Domain Scan FPGA image is loaded
4. If EMC Application and TDS are not licensed and FS2 is licensed, the Enhanced Sweep Speed FPGA image is loaded
5. If all are licensed
   a. If the FPGA Configuration Preference is Time Domain Scan, the Time Domain Scan FPGA image is loaded
   b. If the FPGA Configuration Preference is Enhanced Sweep Speed, the Enhanced Sweep Speed FPGA image is loaded
   c. If FPGA Configuration Preference is Prompt
      a. If the last FPGA Configuration Load was Time Domain Scan, the Time Domain Scan FPGA image is loaded
      b. If the last FPGA Configuration Load was Enhanced Sweep Speed, the Enhanced Sweep Speed FPGA image is loaded
      c. If no FPGA has been explicitly loaded, the Time Domain Scan FPGA image is loaded

5.4.3.1 FPGA Load Preference

You may choose one image or the other from the radio buttons at the top of the dialog:



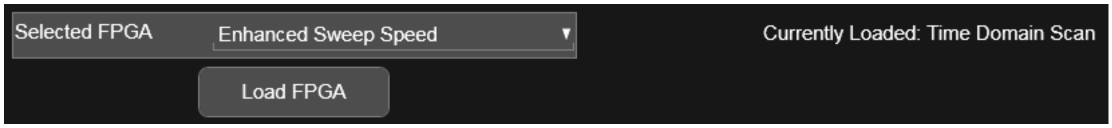
If you choose the one that is already loaded, you will not be prompted again. If you choose the other one, the Selected FPGA control will change to that one and the **Load FPGA** button will become active; you must press it to load the other image.

When installing new firmware, the FPGA Load Preference setting will be used to load the preferred FPGA image version if more than one version is available. It also allows you to be prompted at each startup which version of the FPGA image is wanted at that time, by selecting “Prompt at Startup”.

Remote Command	`:SYSTem:PON:FPGA:PREFerence TDS | FS2 | PROMpt`
Example	`:SYST:PON:FPGA:PREF TDS` `:SYST:PON:FPGA:PREF?`
Notes	– TDS = Load the Time Domain Scan version of the FPGA image – FS2 = Load the Enhanced Sweep Speed version of the FPGA image – PROMpt = Prompt at each startup, show the FPGA Configuration dialog. The user can choose to continue with the currently loaded FPGA image version or load a different version This SCPI is always available, but if the hardware does not support multiple FPGA image choices, the value will always be: – NA = Not available for this hardware Also when not supported, any attempt to change away from NA will result in the error -224, “Illegal parameter value”
Dependencies	Dialogs and menus available only when EMC Application, TDS and FS2 are all licensed
Preset	PROMpt (not affected by Mode Preset but set to PROMpt by “Restore System Default” -> “All” or “Power On”)

5.4.3.2 Load FPGA

Depending on what you choose under FPGA Load Preferences, you may end up with a mismatch between the desired FPGA image and the one that is currently loaded. In that case the **Load FPGA** button at the bottom of the dialog will not be grayed out, and you must press it in order to actually load the desired FPGA image. The one that is currently loaded shows to the right:



If you have a mismatch but don't actually load the other image, the FPGA Load Preference will be remembered, but the image you had before will remain until you return to this dialog and press **Load FPGA**, or until the next time the analyzer firmware is updated.

If you press **Load FPGA**, the X-series software will exit, the FPGA update program will run, and the analyzer will reboot. After rebooting the new image will be loaded in the FPGA.

NOTE This can take 15 minutes or more.

CAUTION If power is lost during the FPGA load process, the FPGA can become corrupted, and the only fix is to return it to Keysight for servicing.

Remote Command	`:SYSTem:PON:FPGA:LOAD TDS | FS2`
Example	`:SYST:PON:FPGA:LOAD TDS` `:SYST:PON:FPGA:LOAD?`
Notes	If the specified FPGA image version is the one already loaded, then the command does nothing. If the FPGA image needs to change, it will exit the analyzer software (terminating the SCPI session) and launch the FPGA update utility. When the FPGA is updated, the instrument will reboot This SCPI is always available, but if the hardware does not support multiple FPGA image choices, the value returned will always be: NA = Not available for this hardware Also when not supported, any attempt to change away from NA results in the error -224, “Illegal parameter value”
Dependencies	Available only when there are multiple versions of the FPGA image that could be loaded Selection limited to licensed features: – TDS selection requires the EMC Application and the TDS hardware option – FS2 requires the FS2 hardware option The UI is blanked when there is only one licensed selection and that selection is already loaded. Sending the SCPI for an unlicensed selection results in error -224, “Illegal parameter value; <option> is not licensed”
Preset	None. Not affected by Mode Preset or any Restore Defaults

5.4.4 Restore Power On Defaults

This selection causes the Power On settings to be reset to their default value.

When this button is pressed, a message appears saying:

This will reset Power On State and Power On Application to their default state.

It will not affect Alignment data or settings.

This action cannot be undone. Do you want to proceed?

The message provides an OK and Cancel button for you to affirm or cancel the operation.

Example	`:SYST:DEF PON`

5.4.5 Configure Applications – Desktop application

The Configure Applications utility is run from the Desktop of the instrument. You must close the analyzer application before running Configure Applications.

Configure Applications can be used to:

– select applications for preload

– determine how many applications can fit in memory at one time

– specify the order of the Modes in the Mode menu.

This utility consists of a window with instructions, a set of “Select Application” checkboxes, a “fuel bar” style memory gauge, and keys that help you set up your configuration.

NOTE **In products that run multiple instances of the X-Series Application, the same Configure Applications Utility is shared between all the instances.**

For more information, see the following topics:

– "Preloading Applications" on page 344

– "Access to Configure Applications utility" on page 345

– "Virtual memory usage" on page 346

Example	`:SYST:SHOW CAPP` Displays the Config Applications screen

Preloading Applications

During runtime, if a Mode that is not preloaded is selected using the Mode menu or sending SCPI commands, there will be a pause while the Application is loaded. During this pause a message that says “Loading application, please wait ...” is displayed. Once loaded, the application stays loaded, so the next time you select it during a session, there is no delay.

Preloading enables you to “preload” at startup, to eliminate the runtime delay. Preloading an application will cause it to be loaded into the analyzer’s memory when the analyzer program starts up. If you do this, the delay will increase the time it takes to start up the analyzer program, but this may be preferable to having to wait the first time you select an application. Note that, once an application is loaded into memory, it cannot be unloaded without exiting and restarting the analyzer program.

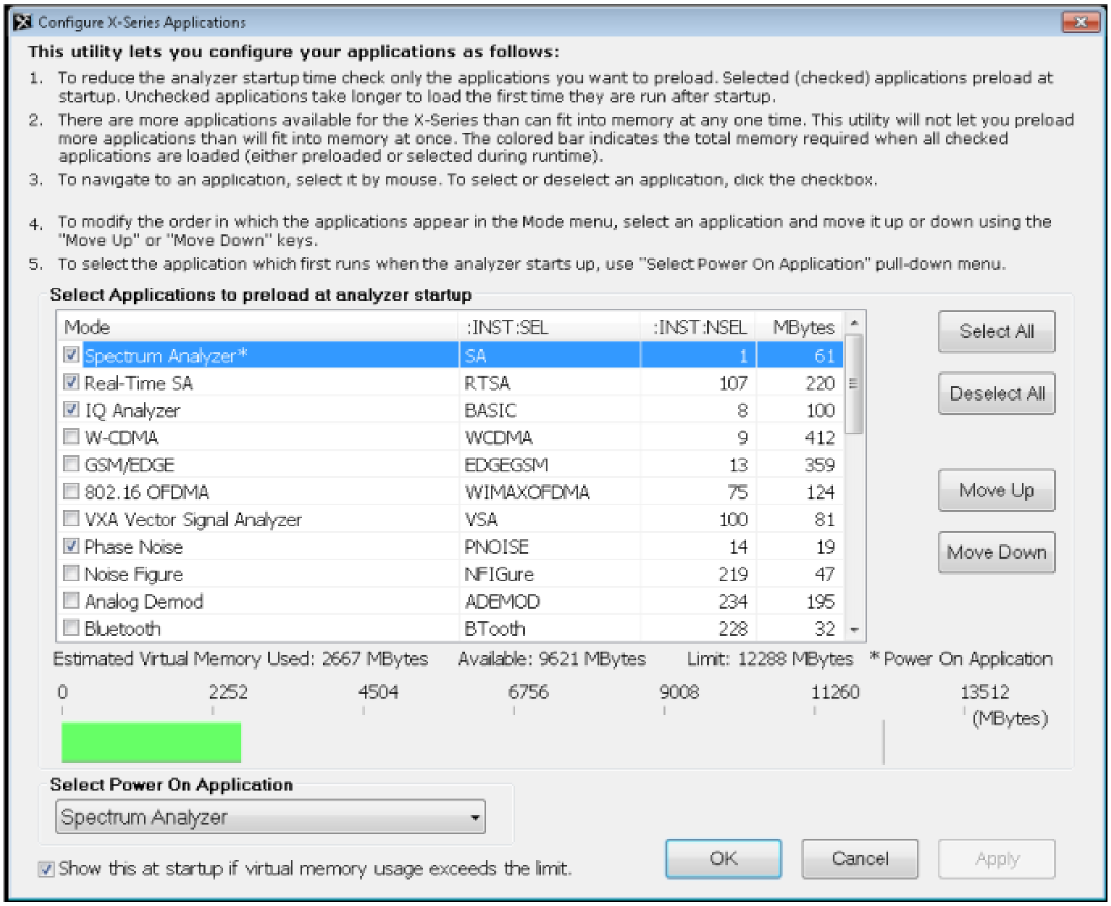
Note that there are more applications available for the X-Series than can fit into Windows Virtual Memory. By allowing you to choose which licensed applications to load at startup, the Configure Applications utility allows you to make optimal use of your memory.

Access to Configure Applications utility

A version of the utility runs the first time you power up the analyzer after purchasing it from Keysight. The utility automatically configures preloads so that as many licensed applications as possible are preloaded while keeping the total estimated virtual memory usage below the limit. This auto-configuration only takes place at the very first run, and after analyzer software upgrades.

You may, at any time, manually call up the Configure Applications utility by closing the analyzer application and double-tapping the Configure Applications icon on the desktop.

When you run it, the utility looks like this:



Instructions are provided below and on the utility. Use the utility to find a configuration that works best for you, and then restart the analyzer program.

Select All	Marks all applications in the selection list. This allows you to enable all applications licensed on the instrument for pre-loading, or is a convenience for selecting all applications in one operation and then letting you deselect individual applications
Deselect All	Clears the marks from all applications in the selection list, except the Power On application. The Power On application cannot be eliminated from the pre-load list
Move Up/Move Down	The application list is the order that applications appear in the Mode Menu. These keys enables you to shift the selected application up or down in the list, thus moving the selected application earlier or later in the Mode Menu
Select Power On Application	This is the same as the “Power On Application” selection on the Power On page of the System Settings dialog

Virtual memory usage

There are more applications available for the X-Series than can fit into memory at any one time, so the Configure Applications utility includes a memory tracker that serves two purposes:

1. It will not let you preload more applications than will fit into memory at once.
2. You can determine how many of your favorite applications can reside in memory at one time.

The utility provides a graphical representation of the amount of memory (note that the memory in question here is Virtual memory and is a limitation imposed by the operating system, not by the amount of physical memory you have in your analyzer). You select applications to preload by checking the boxes on the left. Checked applications preload at startup. The colored fuel bar indicates the total memory required when all the checked applications are loaded (either preloaded or selected during runtime).

Here is what the fuel bar colors mean:

RED: the applications you have selected cannot all fit into the analyzer's memory. You must deselect applications until the fuel bar turns yellow.

YELLOW: the applications you have selected can all fit into the analyzer's memory, but there is less than 10% of the memory left, probably not enough to load any other applications, either via preload or by selecting a Mode while the analyzer is running..

GREEN: The indicator is green when <90% of the memory limit is consumed. This means the applications you have selected can all fit into the analyzer's memory with room to spare. You will likely be able to load one or more other applications without running out of memory.

All apps that are part of the sequencer mode (GSM/EDGE, WCDMA, CDMA2K and 1xEVDO) will be preloaded (if licensed) if Sequence Analyzer is selected to be preloaded.

5.4.6 Configure Applications - Instrument boot-up

At start-up of the analyzer programa dialog box similar to the one you see when you run **Configure Applications** will be displayed allowing you to choose which licensed applications are to be loaded. This dialog will only be displayed if the memory required to pre-load all of the licensed applications exceeds the Virtual Memory available.

5.4.7 Configure Applications - Remote Commands

The following topics provide details on using remote commands to configure the list of applications you want to load into the instrument memory or query the Virtual Memory utilization for your applications.

- "Configuration list (Remote Command Only)" on page 348
- "Configuration Memory Available (Remote Command Only)" on page 348

– "Configuration Memory Total (Remote Command Only)" on page 348
– "Configuration Memory Used (Remote Command Only)" on page 348
– "Configuration Application Memory (Remote Command Only)" on page 349

5.4.7.1 Configuration list (Remote Command Only)

This remote command is used to set or query the list of applications to be loaded in-memory.

Remote Command	`:SYSTem:PON:APPLication:LLISt <string of INSTrument:SELect names>` `:SYSTem:PON:APPLication:LLISt?`
Example	`:SYST:PON:APPL:LLIS "SA,BASIC,WCDMA"`
Notes	<string of INSTrument:SELect names> are from the enums of the :INSTrument:SELect command The order of the <INSTrument:SELect names> is the order that the applications are loaded into memory, and the order that they appear in the Mode Menu Error message -225 "Out of Memory" is reported when more applications are listed than can reside in Virtual Memory. When this occurs, the existing applications load list is unchanged
Preset	Not affected by Preset
State Saved	Not saved in instrument state

5.4.7.2 Configuration Memory Available (Remote Command Only)

This remote command is used to query the amount of Virtual Memory remaining.

Remote Command	`:SYSTem:PON:APPLication:VMEMory[:AVAilable]?`
Example	`:SYST:PON:APPL:VMEM?`
Preset	Not affected by Preset

5.4.7.3 Configuration Memory Total (Remote Command Only)

This remote command is used to query the limit of Virtual Memory allowed for applications.

Remote Command	`:SYSTem:PON:APPLication:VMEMory:TOTal?`
Example	`:SYST:PON:APPL:VMEM:TOT?`
Preset	Not affected by Preset

5.4.7.4 Configuration Memory Used (Remote Command Only)

This remote command is a query of the amount of Virtual Memory used by all measurement applications.

Remote Command	`:SYSTem:PON:APPLication:VMEMory:USED?`
Example	`:SYST:PON:APPL:VMEM:USED?`
Preset	Not affected by Preset

5.4.7.5 Configuration Application Memory (Remote Command Only)

This remote command is used to query the amount of Virtual Memory a particular application consumes.

Remote Command	`:SYSTem:PON:APPLication:VMEMory:USED:NAME? <INSTrument:SELect name>`
Example	`:SYST:PON:APPL:VMEM:USED:NAME? CDMA2K`
Notes	<INSTrument:SELect name> is from the enums of the :INSTrument:SELect command If the name provided is invalid, the value 0 (zero) is returned
Preset	Not affected by Preset

5.5 Restore Defaults

Provides initialization of system setting groups, including the option to set the entire instrument back to a factory default state.

NOTE **In products that run multiple instances of the X-Series Application, all instances have the same factory default states for Restore Defaults.**

Remote Command	`:SYSTem:DEFault [ALL] | ALIGn | INPut | MISC | MODes | PON | UINTerface | SCReen`
Example	`:SYST:DEF`
State Saved	No

5.5.1 Input/Output

Input/Output Preset resets the group of settings and data associated with the Input/Output front-panel key to their default values. These settings are not affected by a Mode Preset because they are generally associated with connections to the instrument, and most users would not want these resetting every time they pressed the Mode Preset key.

By using Input/Output Preset and Restore Mode Defaults, a full preset of the current mode will be performed, with the caveat that since Input/Output Preset is a global function it will affect ALL modes.

This is the same as the Input/Output Preset button in the Preset dropdown and the Input/Output menu.

When Input/Output is selected, a message appears saying:

This will reset all of the Input/Output variables to their default state, including which input is selected, all Amplitude Correction settings and data, all External Mixing settings, all Frequency Reference settings and all Output settings.

It will not affect Alignment data or settings.

This action cannot be undone. Do you want to proceed?

The message provides an OK and Cancel button for you to affirm or cancel the operation.

Example	`:SYST:DEF INP`

5.5.2 I/O Config

Causes the group of settings associated with the I/O Config menu to be reset to their default values. This also happens on a Restore Misc Defaults, which has a SCPI command, although I/O Config does not.

When I/O Config is selected, a message appears saying:

This will reset all of the I/O Config variables to their default state, including the GPIB address and SCPI LAN settings.

It will not affect Alignment data or settings.

This action cannot be undone. Do you want to proceed?

The message provides an **OK** and **Cancel** button for you to affirm or cancel the operation.

Dependencies	This control is not available on the M9391A or M9393A

5.5.3 User Interface

Causes the group of settings associated with the User Interface menu to be reset to their default values. This also happens on a Restore Misc Defaults.

When User Interface is selected, a message appears saying:

This will reset all of the User Interface variables to their default state, including the menu panel location, display theme, and language.

It will not affect Alignment data or settings.

This action cannot be undone. Do you want to proceed?

The message provides an **OK** and **Cancel** button for you to affirm or cancel the operation.

Example	`:SYST:DEF UINT`

5.5.4 Power On

This selection causes the Power On settings to be reset to their default value.

The Power On settings are Power On State and Power On Application.

When Power On is selected, a message appears saying:

This will reset Power On State and Power On Application to their default state.

It will not affect Alignment data or settings.

This action cannot be undone. Do you want to proceed?

The message provides an **OK** and **Cancel** button for you to affirm or cancel the operation.

Example	`:SYST:DEF PON`
Dependencies	This control is not available on the M9391A or M9393A

5.5.5 Alignments

This selection causes the Alignment system settings to be reset to their default values. This does not affect any Alignment data stored in the system.

After performing this function, it may impact the auto-alignment time of the instrument until a new alignment baseline has been established.

When Alignments is selected, a message appears saying:

This will reset all of the settings for the Alignment system to their default values.

No alignment data will be erased.

This action cannot be undone. Do you want to proceed?

The message provides an **OK** and **Cancel** button for you to affirm or cancel the operation.

Example	`:SYST:DEF ALIG`

5.5.6 Misc

This selection causes miscellaneous system settings to be reset to their default values. With this reset, you lose the GPIB address and it is reset to 18, so this should be used with caution.

When Misc is selected, a message appears saying:

This will reset miscellaneous system settings to their default values. This includes settings for I/O Config (GPIB and SCPI LAN), the User Interface, the Save/Recall system, and the Preset type.

It will not affect Alignment data or settings.

This action cannot be undone. Do you want to proceed?

The message provides an **OK** and **Cancel** button for you to affirm or cancel the operation.

This miscellaneous group contains the rest of the settings that have not been part of the other Restore System Defaults groups. These include:

All settings on the I/O Config page of the System Settings dialog

All settings in the following table:

Miscellaneous Setting	Default Value
The SYST:PRES:TYPE	MODE
Auto File Name Number	000
Save Type	State
State Save To	Register 1
Screen Save To	SCREEN000.png
Save/Recall Shortcuts	Deleted
Display Theme	Filled
Backlight	ON
System Annotation	Local Settings
Language	English
DISP:ENABle	ON
Full Screen	Off

Example	`:SYST:DEF MISC`

5.5.7 All

This performs a comprehensive reset of ALL analyzer settings to their factory default values. It resets all of the system setting groups, causes a Restore Mode Defaults for all modes in the instrument, and switches back to the power-on mode. It does not affect the User Preset file or any user saved files.

When All is selected, a message appears saying:

This will reset all of the settings in the instrument to their factory default values, including the state of all Modes and Screens, the GPIB settings, the Alignment settings, and the Power On Mode.

It will not affect Alignment data or settings.

This action cannot be undone. We recommend canceling this operation and restoring settings individually (I/O Config, User Interface, Alignments, etc.) instead.

Do you want to proceed?

The message provides an **OK** and **Cancel** button for you to affirm or cancel the operation.

NOTE **If you are using a Keysight USB External Mixer, then you will need to perform a Refresh USB Mixer Connection after Restoring All Defaults.**

Example	`:SYST:DEF ALL`
Notes	If using a Keysight USB External Mixer, perform a Refresh USB Mixer Connection (SCPI command

	:MIX:BAND USB) following a Restore All Defaults
Couplings	An All causes the currently running measurement to be aborted, and gets all modes to a consistent state, so it is unnecessary to couple any settings

Remote Command	`:SYSTem:PRESet:PERSistent`
Example	`:SYST:PRES:PERS`
Notes	`:SYST:PRES:PERS` is exactly the same as `:SYST:DEF ALL`

5.6 Alignments

The Alignments menu gives you access to the alignment system of the instrument. You can control the automatic alignments, view alignment statistics and manually perform alignments.

The current setting of the alignment system is displayed in the Meas Bar along the top of the display. This annotation will be in amber for conditions that may cause specifications to be impacted.

5.6.1 Auto Align

Lets you configure the automatic background alignments and the alerts from the automatic alignment system.

Dependencies	Does not appear in VXT

5.6.1.1 Auto Align

Configures the method the automatic background alignment will use when it runs.

Automatic background alignments are run periodically between measurement acquisitions. The instrument's software determines when alignments are to be performed to maintain warranted operation. The recommended setting for Auto Align is Normal.

An Auto Align execution cannot be aborted with the Cancel (ESC) key. To interrupt an Auto Align execution, select **Auto Align Off**.

Remote Command	`:CALibration:AUTO ON | LIGHt | PARTial | OFF` `:CALibration:AUTO?`
Example	`:CAL:AUTO ON`
Notes	While Auto Align is executing, bit 0 of Status Operation register is set
Couplings	Auto Align is set to Off if Restore Align Data is invoked
Preset	This is unaffected by Preset but is set to ON upon a "Restore System Defaults->Align"
State Saved	No
Annotation	In the Meas Bar: – Normal with "All But RF" off: Auto (white) – Normal with "All But RF" on: Auto/No RF (amber) – Partial: Partial (amber) Off: Off (amber)
Status Bits/OPC	When Auto Align is executing, bit 0 in the Status Operational register is set

dependencies	An interfering signal at the RF Input may prevent automatic alignment of the RF subsystem. If this occurs, the Error Condition message “Align RF skipped” is reported, the Status Questionable Calibration bit 11 is set, and the alignment proceeds. When a subsequent alignment of the RF subsystem succeeds, either by the next cycle of automatic alignment or from an Align Now, RF, the Error Condition and Status Questionable Calibration bit 11 are cleared
Backwards Compatibility SCPI	`:CALibration:AUTO ALERt` Parameter ALERt is for backward compatibility only and is mapped to PARTial
Backwards Compatibility Notes	ESA SCPI for Auto Align is :CALibration:AUTO <Boolean>. The command for X-Series is an enumeration. Thus the parameters of “0” and “1” are not possible in X-Series Similarly, the ESA SCPI for :CALibration:AUTO? returned the Boolean value 1 or 0, in X-Series it is an Enumeration (string). Thus, queries by customer applications into numeric variables will result in an error In PSA Auto Align OFF was not completely off, it is equivalent to `PARTial` in X-Series. In X-Series, `OFF` will be fully OFF. This means users of PSA SCPI who choose `OFF` may see degraded performance and should migrate their software to use `PARTial`

The available settings for Auto Align are as follows:

Normal

SCPI example `:CAL:AUTO ON`

Auto Align, Normal turns on the automatic alignment of all measurement systems. The Auto Align, Normal selection maintains the instrument in warranted operation across varying temperature and over time.

If the condition “Align Now All required” is set, transition to Auto Align, Normal will perform the required alignments and clear the “Align Now All required” condition and then continue with further alignments as required to maintain the instrument adequately aligned for warranted operation.

When **Auto Align**, **Normal** is selected the Auto Align Off time is set to zero.

When **Auto Align**, **Normal** is selected the Meas Bar indicates Align: Auto (in white) or Align: Auto/No RF (in amber). The amber color is intended to inform you that you are responsible for maintaining the RF alignment of the instrument.

Alignment processing as a result of the transition to Normal will be executed sequentially. Thus, *OPC? or *WAI following CAL:AUTO ON will return when the alignment processing is complete.

Light

SCPI example `:CAL:AUTO LIGH`

Auto Align, Light turns on the automatic alignment of all measurement systems. The Auto Align, Light selection allows considerably more drift in amplitude accuracy in order to allow much less frequent measurement interruptions to perform alignments. The temperature changes required to trigger each alignment are increased by a factor of three. Alignments also expire from time as well as temperature. In a stable thermal environment, the alignments occur one-ninth as often as in Normal. With these less frequent alignments, all accuracy specifications (those expressed with ±x dB tolerances) change by nominally a factor of 1.4.

If the condition "Align Now, All required" is set, transition to Auto Align, Light will perform the required alignments and clear the "Align Now, All required" condition and then continue with further alignments as required to maintain the instrument adequately aligned for warranted operation.

Alignment processing as a result of the transition to LIGHT will be executed sequentially. Thus, *OPC? or *WAI following CAL:AUTO LIGHT will return when the alignment processing is complete.

When **Auto Align**, Light is selected the Auto Align Off time is set to zero.

When **Auto Align**, Light is selected the Settings Panel indicates Align: Light.

Partial

SCPI example `:CAL:AUTO PART`

Auto Align, Partial disables the full automatic alignment and the maintenance of warranted operation for the benefit of improved measurement throughput. Accuracy is retained for the Resolution Bandwidth filters and the IF Passband, which is critical to FFT accuracy, demodulation, and many measurement applications. With Auto Align set to Partial, you are now responsible for maintaining warranted operation by updating the alignments when they expire. The Auto Align, Alert mechanism will notify you when alignments have expired. One solution to expired alignments is to perform the Align All, Now operation. Another is to return the Auto Align selection to Normal.

Auto Align, Partial is recommended for measurements where the throughput is so important that a few percent of improvement is more valued than an increase in the accuracy errors of a few tenths of a decibel. One good application of Auto Align, Partial would be an automated environment where the alignments can be called during overhead time when the device-under-test is exchanged.

When **Auto Align**, **Partial** is selected the elapsed time counter begins for Auto Align Off time.

When **Auto Align**, **Partial** is selected the Settings Panel indicates Align: Partial in an amber color. The amber color is to inform the operator that they are responsible for maintaining the warranted operation of the instrument.

Off

SCPI example `:CAL:AUTO OFF`

Auto Align Off disables automatic alignment and the maintenance of warranted operation, for the benefit of maximum measurement throughput. With Auto Align set to Off, you are now responsible for maintaining warranted operation by updating the alignments when they expire. The Auto Align, Alert mechanism will notify you when alignments have expired. One solution to expired alignments is to perform the Align All, Now operation. Another is to return the Auto Align selection to Normal.

The Auto Align Off setting is rarely the best choice, because Partial gives almost the same improvement in throughput while maintaining the warranted performance for a much longer time. The choice is intended for unusual circumstances such as the measurement of radar pulses where you might like the revisit time to be as consistent as possible.

When **Auto AlignOff** is selected the Auto Align Off time is initialized and the elapsed time counter begins.

When **Auto AlignOff** is selected the Settings Panel indicates Align: Off in an amber color. The amber color is to inform the operator that they are responsible for maintaining the warranted operation of the instrument.

5.6.1.2 All but RF

All but RF configures automatic alignment to include or exclude the RF subsystem. (Eliminating the automatic alignment of the RF subsystem prevents the input impedance from changing. The normal input impedance of 50 ohms can change to an open circuit when alignments are being used. Some devices under test do not behave acceptably under such circumstances, for example by showing instability.) When All but RF is ON is selected, the operator is responsible for performing an Align Now RF when RF-related alignments expire. The Auto Align, Alert mechanism will notify the operator to perform an Align Now All when the combination of time and temperature variation is exceeded.

When All But RF is ON the Settings Panel indicates Align: Auto/No RF (in amber). The amber color is intended to inform you that you are responsible for maintaining the RF alignment of the instrument.

Remote Command	`:CALibration:AUTO:MODE ALL | NRF` `:CALibration:AUTO:MODE?`
Example	`:CAL:AUTO:MODE NRF`
Preset	This is unaffected by Preset but is set to ALL on a “Restore System Defaults->Align”
State Saved	No

5.6.1.3 Alert

The instrument will signal an Alert when conditions exist such that you will need to perform a full alignment (for example, Align Now All). The Alert can be configured in one of four settings; Time & Temperature, 24 hours, 7 days, or None.

With Auto Align set to Normal, the configuration of Alert is not relevant because the instrument’s software maintains the instrument in warranted operation.

A confirmation is required when a selection other than Time & Temperature is chosen. This prevents accidental deactivation of alerts. When setting Alert from the front panel to any value but Time and Temperature, confirmation is required to transition into this setting of Alert. The confirmation dialog is:

“This will suppress alerts from the Alignment system, which would notify you when an Alignment is required to maintain warranted operation. Without the alerts you will be responsible for performing an Align Now All at appropriate intervals to maintain warranted operation.

Do you want to proceed?”

The message provides an **OK** and **Cancel** button for you to affirm or cancel the setting change.

No confirmation is required when Alert is configured through a remote command.

For more information see "Time & Temperature" on page 359

Remote Command	`:CALibration:AUTO:ALERt TTEMperature | DAY | WEEK | NONE` `:CALibration:AUTO:ALERt?`
Example	`:CAL:AUTO:ALER TTEM`
Preset	This is unaffected by Preset but is set to `TTEMperature` on a “Restore Alignment Defaults
State Saved	No
Status Bits/OPC dependencies	When an alert is generated, the condition message “Align Now All required” appears in the Status Bar, and bit 14 is set in the Status Questionable Calibration register

The settings for alert are detailed below.

Time & Temperature

SCPI example `CAL:AUTO:ALER TTEM`

With Auto Align Alert set to Time & Temperature the instrument will signal an alert when alignments expire due to the combination of the passage of time and changes in temperature. The alert is the Error Condition message “Align Now All required”. If this choice for Alert is selected, the absence of an alert means that the analyzer alignment is sufficiently up-to-date to maintain warranted accuracy.

24 hours

SCPI example `CAL:AUTO:ALER DAY`

With Auto Align Alert set to 24 Hours the instrument will signal an alert after a time span of 24 hours since the last successful full alignment (for example, Align Now All or completion of a full Auto Align). You may choose this selection in an environment where the temperature is stable on a daily basis at a small risk of accuracy errors in excess of the warranted specifications. The alert is the Error Condition message “Align Now All required”.

7 days

SCPI example `CAL:AUTO:ALER WEEK`

With Auto Align Alert is set to 7 days the instrument will signal an alert after a time span of 168 hours since the last successful full alignment (for example, Align Now All or completion of a full Auto Align). You may choose this selection in an environment where the temperature is stable on a weekly basis, at a modest risk of accuracy degradations in excess of warranted performance. The alert is the Error Condition message “Align Now All required”.

None

SCPI example `CAL:AUTO:ALER NONE`

With Auto Align Alert set to None the instrument will not signal an alert. This is provided for rare occasions where you are making a long measurement which cannot tolerate Auto Align interruptions, and must have the ability to capture a screen image at the end of the measurement without an alert posted to the display. Keysight does not recommend using this selection in any other circumstances, because of the risk of accuracy performance drifting well beyond expected levels without the operator being informed.

5.6.1.4 Execute Expired Alignments (Remote Command Only)

Alignments can be expired in the situation where Auto Align is in the state of Partial or Off. This feature runs the alignments that have expired. This is different than performing an Align All, Now operation. Align All, Now performs an alignment of all subsystems regardless of whether they are needed or not, with Execute Expired Alignments, only the individual subsystems that have become due are aligned.

Remote Command	`:CALibration:EXPired?`
Example	`:CAL:EXP?`
Notes	`:CALibration:EXPired?` returns 0 if successful, or 1 if failed

5.6.2 Align Now

Accesses alignment processes that are immediate action operations. They perform complete operations and run until they are complete.

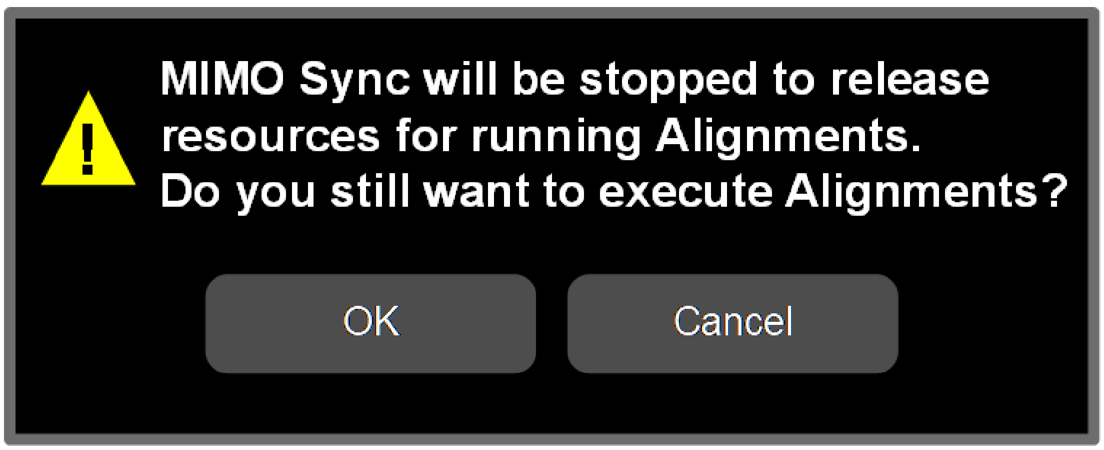
Executing immediate alignments from SCPI can be problematic due to the length of time required for the alignments to complete. Alignment commands are by their nature sequential, meaning they must complete before any other SCPI commands can be processed. In many cases the alignment itself will take longer than the typical SCPI timeout value. Furthermore status cannot be easily queried while a sequential command is running.

For this reason, overlapped versions of the Align Now commands are provided. When using these No-Operation-Pending (NPENDing) commands, the SCPI thread will not be blocked (will be released immediately), so that you can use “:STATus:OPERation:CONDition?” to query the alignment status bit and use “STATus:QUEStionable:CALibration:CONDition?” to check the alignment results. As an example: :CALibration[:ALL]:NPENding is the overlapped replacement of :CALibration[:ALL].

While the alignment is performing, the coming NOP calibration will be ignored, and error message “SettingConflict, Alignment is in process.” will be posted. Also, any other operations to the instrument will be pended and postponed until the alignment is completed. The operations include: Preset, Initiate a new measurement, Device clear and so on. Accordingly, changing parameters will not take effect although the UI is updated immediately. So to avoid unexpected timeouts and results, these operations are not suggested during any such alignments.

NOTE

The Alignments will not be performed if the MIMO Sync is running. As the MIMO and Alignments require the same hardware resource. If the instrument is in MIMO Sync and you press a button to execute Alignments, a pop-up window will be shown as below. Click the OK button to stop MIMO and execute Alignments.



If the instrument is in MIMO sync and you send a SCPI command to run Alignments, the align process will not be executed and a warning will be generated . To execute Alignments, you must stop MIMO by SCPI (or manually) firstly.

5.6.2.1 Align Now All

(In PXE the key label is “**Align Now All (plus RF Presel 20 Hz – 3.6 GHz)**”)

Immediately executes an alignment of all subsystems. The instrument stops any measurement currently underway, performs the alignment, then restarts the measurement from the beginning (similar to pressing the **Restart** key).

If an interfering user signal is present at the RF Input, the alignment is performed on all subsystems except the RF. After completion, the Error Condition message “Align RF skipped” is generated. In addition the Error Condition message “Align Now, RF required” is generated, and bits 11 and 12 are set in the Status Questionable Calibration register.

The query form of the remote commands (:CALibration[:ALL]? or *CAL?) invokes the alignment of all subsystems and returns a success or failure value. An interfering user signal is not grounds for failure; if the alignment was able to succeed on all portions but unable to align the RF because of an interfering signal, the resultant will be the success value.

Successful completion of **Align Now All** will clear the “Align Now All required” Error Condition, and clear bit 14 in the Status Questionable Calibration register. It will also begin the elapsed time counter for Last Align Now All Time, and capture the Last Align Now All Temperature.

If the Align RF subsystem succeeded in aligning (no interfering signal present), the elapsed time counter begins for Last Align Now, RF Time, and the temperature is captured for the Last Align Now, RF Temperature. In addition the Error Conditions “Align RF skipped” are cleared, the Error Condition “Align Now, RF required” is cleared, and bits 11 and 12 are cleared in the Status Questionable Calibration register

Align Now All can be interrupted by pressing the Cancel (ESC) front-panel key or remotely with Device Clear followed by the :ABORt SCPI command. When this occurs the Error Condition message “Align Now All required” is generated, and bit 14 is set in the Status Questionable Condition register. This is because new alignment data may be employed for an individual subsystem, but not a cohesive set of data for all subsystems.

In many cases, you might find it more convenient to change alignments to Normal, instead of executing Align Now All. When the Auto Align process transitions to Normal, the analyzer will immediately start to update only the alignments that have expired, thus efficiently restoring the alignment process.

Remote Command	`:CALibration[:ALL]` `:CALibration[:ALL]?`
Example	`:CAL`
Notes	:CALibration[:ALL]? returns 0 if successful, or 1 if failed :CALibration[:ALL]? is the same as *CAL? While Align Now All is performing the alignment, the Calibrating bit (bit 0 in the Status Operation register) is set. Completion, or termination, will clear bit 0 in the Status Operation register This command is sequential; it must complete before further SCPI commands are processed. Interrupting the alignment from remote is accomplished by invoking Device Clear followed by the `:ABORt` command Successful completion will clear bit 14 in the Status Questionable Calibration register An interfering user signal is not grounds for failure of Align Now All. However, bits 11 and 12 are set in the Status Questionable Calibration register to indicate Align Now, RF is required An interfering user supplied signal will result in the instrument requiring an Align Now, RF with the interfering signal removed
Couplings	Initializes the time for the Last Align Now All Time

	Records the temperature for the Last Align Now All Temperature If Align RF component succeeded, initializes the time for the Last Align Now, RF Time If Align RF component succeeded, records the temperature for the Last Align Now, RF Temperature
Status Bits/OPC dependencies	Bits 11, 12, or 14 may be set in the Status Questionable Calibration register

Remote Command	`*CAL?`
Example	`*CAL?`
Notes	Returns 0 if successful, or 1 if failed `:CALibration[:ALL]?` is exactly the same as `*CAL?`, including all conditions, status register bits, and couplings See additional remarks described with `:CALibration[:ALL]?`

Remote Command	`:CALibration[:ALL]:NPENding`
Example	`:CAL:NPEN`
Notes	`:CALibration[:ALL]:NPENding` is the same as `:CALibration[:ALL]`, including all conditions, status register bits, except this SCPI command does not BLOCK the SCPI session, so you should use status register bits to query if the calibration is successfully completed or not Typical usage is: 1. :CALibration:ALL:NPENding (Start a calibration) 2. :STATus:OPERation:CONDition? (Check if the calibration is completed or not, If bit 0 is set, then the system is doing calibration, you should repeat this SCPI query until the bit is cleared) :STATus:QUEStionable:CALibration:CONDition? (Check if there are any errors/failures in previous calibration procedure

5.6.2.2 Align Now All but RF

(In PXE the key label is "**Align Now All but RF (not including RF Presel)**")

Immediately executes an alignment of all subsystems except the RF subsystem. The instrument will stop any measurement currently underway, perform the alignment, and then restart the measurement from the beginning (similar to pressing the Restart key). This can be used to align portions of the instrument that are not impacted by an interfering user input signal.

This operation might be chosen instead of **All** if you do not want the device under test to experience a large change in input impedance, such as a temporary open circuit at the analyzer input.

The query form of the remote commands (:CALibration:NRF?) will invoke the alignment and return a success or failure value.

Successful completion of Align Now All but RF will clear the “Align Now All required” Error Condition, and clear bit 14 in the Status Questionable Calibration register. If “Align Now All required” was in effect prior to executing the All but RF, the Error Condition message “Align Now RF required” is generated and bit 12 in the Status Questionable Calibration register is set. It will also begin the elapsed time counter for Last Align Now All Time, and capture the Last Align Now All Temperature.

Align Now All but RF can be interrupted by pressing the Cancel (ESC) front-panel key or remotely with Device Clear followed by the :ABORt SCPI command. When this occurs the Error Condition message “Align Now All required” is generated, and bit 14 is set in the Status Questionable Condition register. This is because new alignment data may be used for an individual subsystem, but not a full new set of data for all subsystems.

Remote Command	`:CALibration:NRF` `:CALibration:NRF?`
Example	`:CAL:NRF`
Notes	Returns 0 if successful, or 1 if failed While Align Now All but RF is performing the alignment, bit 0 in the Status Operation register is set. Completion, or termination, will clear bit 0 in the Status Operation register This command is sequential; it must complete before further SCPI commands are processed. Interrupting the alignment from remote is accomplished by invoking Device Clear followed by the `:ABORt` command Successful completion will clear bit 14 in the Status Questionable Calibration register and set bit 12 if invoked with “Align Now All required”
Couplings	Initializes the time for the Last Align Now All Time Records the temperature for the Last Align Now All Temperature
Status Bits/OPC dependencies	Bits 12 or 14 may be set in the Status Questionable Calibration register

Remote Command	`:CALibration:NRF:NPENding`
Example	`:CAL:NRF:NPEN`
Notes	`:CALibration:NRF:NPENding` is the same as `:CALibration:NRF`, including all conditions, status register bits, except that this SCPI command does not BLOCK the SCPI session, so you should use status register bits to query if the calibration is successfully completed or not Typical usage is: 1. :CALibration:NRF:NPENding (start the All but RF calibration) 2. :STATus:OPERation:CONDition? (If bit 0 is set, then the system is doing calibration, you should do re-query until this bit is cleared) 3. :STATus:QUEStionable:CALibration:CONDition? (to check if there are any errors/failures in previous calibration procedure)

5.6.2.3 Align Now RF

(In PXE the key label is "**Align Now RF Only**")

Immediately executes an alignment of the RF subsystem. The instrument stops any measurement currently underway, performs the alignment, then restarts the measurement from the beginning (similar to pressing the **Restart** key).

This operation might be desirable if the alignments had been set to not include RF alignments, or if previous RF alignments could not complete because of interference which has since been removed.

If an interfering user signal is present at the RF Input, the alignment will terminate and generate the Error Condition message "Align RF skipped", and Error Condition "Align Now, RF required". In addition, bits 11 and 12 will be set in the Status Questionable Calibration register.

The query form of the remote commands (:CALibration:RF?) will invoke the alignment of the RF subsystem and return a success or failure value. An interfering user signal is grounds for failure.

Successful completion of Align Now, RF will begin the elapsed time counter for Last Align Now, RF Time, and capture the Last Align Now, RF Temperature.

Align Now, RF can be interrupted by pressing the **Cancel (ESC)** front-panel key or remotely with Device Clear followed by the :ABORt SCPI command. When this occurs, the Error Condition message "Align Now, RF required" is generated, and bit 12 is set in the Status Questionable Condition register. None of the new alignment data is used.

Remote Command	`:CALibration:RF` `:CALibration:RF?`
Example	`:CAL:RF`
Notes	Returns 0 if successful, or 1 if failed (including interfering user signal) While Align Now, RF is performing the alignment, bit 0 in the Status Operation register is set. Completion, or termination, will clear bit 0 in the Status Operation register This command is sequential; it must complete before further SCPI commands are processed. Interrupting the alignment from remote is accomplished by invoking Device Clear followed by the :ABORt command Successful completion clears the Error Conditions "Align RF skipped" and the Error Conditions "Align RF failed" and "Align Now, RF required", and clears bits 3, 11, and 12 in the Status Questionable Calibration register A failure encountered during alignment will generate the Error Condition message "Align RF failed" and set bit 3 in the Status Questionable Calibration register An interfering user signal will result in bits 11 and 12 to be set in the Status Questionable Calibration register to indicate Align Now, RF is required An interfering user supplied signal will result in the instrument requiring an Align Now, RF with the interfering signal removed

Couplings	Initializes the time for the Last Align Now, RF Time Records the temperature for the Last Align Now, RF Temperature
Status Bits/OPC dependencies	Bits 11, 12, or 14 may be set in the Status Questionable Calibration register

Remote Command	`:CALibration:RF:NPENding`
Example	`:CAL:RF:NPEN`
Notes	`:CALibration:RF:NPENding` is the same as `:CALibration:RF`, including all conditions, status register bits, except that this SCPI command does not BLOCK the SCPI session, so you should use status register bits to query if the calibration is successfully completed or not Typical usage is: 1. :CALibration:RF:NPENding (Start a RF calibration) 2. :STATus:OPERation:CONDition? (If bit 0 is set, then the system is doing calibration, you should do re-query until this bit is cleared) 3. :STATus:QUEStionable:CALibration:CONDition? (to check if there are any errors/failures in previous calibration procedure)

5.6.2.4 Align Now External Mixer

Immediately executes an alignment of the External Mixer that is plugged into the USB port. The instrument stops any measurement currently underway, performs the alignment, then restarts the measurement from the beginning (similar to pressing the Restart key). As this alignment calibrates the LO power to the mixer, this is considered an LO alignment; and failure is classified as an LO alignment failure.

The query form of the remote commands (:CALibration:EMIXer?) will invoke the alignment of the External Mixer and return a success or failure value.

Remote Command	`:CALibration:EMIXer` `:CALibration:EMIXer?`
Example	`:CAL:EMIX`
Notes	Returns 0 if successful, or 1 if failed While Align Now, Ext Mix is performing the alignment, bit 0 in the Status Operation register is set. Completion, or termination, will clear bit 0 in the Status Operation register This command is sequential; it must complete before further SCPI commands are processed. Interrupting the alignment from remote is accomplished by invoking Device Clear followed by the `:ABORt` command A failure encountered during alignment will generate the Error Condition message “Align LO failed” and set bit 5 in the Status Questionable Calibration register. Successful completion will clear the “Align LO failed” message and bit 5 in the Status Questionable Calibration register
Dependencies	This control does not appear unless option EXM is present and is grayed-out unless a USB mixer is

	plugged in to the USB
Status Bits/OPC dependencies	Bit3 may be set in the Status Questionable Calibration Extended Failure register

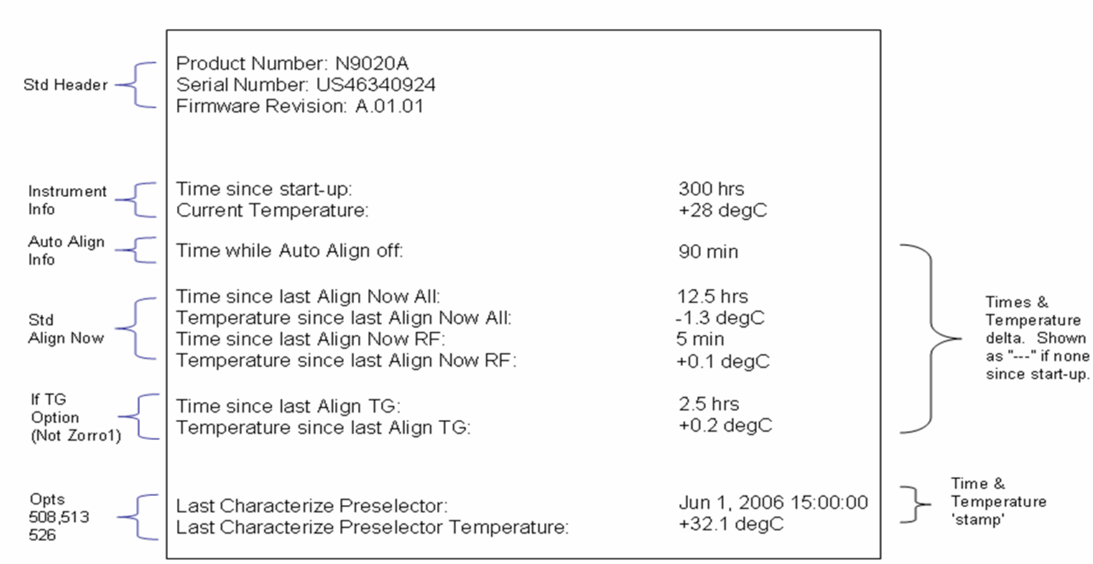
5.6.3 Show Alignment Statistics

Shows alignment information you can use to ensure that the instrument is operating in a specific manner. The Show Alignment Statistics screen is where you can view time and temperature information.

Values which are displayed are only updated when the Show Alignment Statistics screen is invoked, they are not updated while the Show Alignment Statistics screen is being displayed. The remote commands that access this information obtain current values.

Note that some of these statistics only display if your instrument supports them; for example, Last Source Align Now All Time only shows up in instruments which contain a source which supports auto alignments.

An example of the Show Alignment Statistics screen would be similar to:



“Time while Auto Align off” is not available in VXT models M9410A/11A.

A successful Align Now, RF will set the Last Align RF temperature to the current temperature, and reset the Last Align RF time. A successful Align Now All or Align Now All but RF will set the Last Align Now All temperature to the current temperature, and reset the Last Align Now All time. A successful Align Now All will also reset the Last Align RF items if the RF portion of the Align Now succeeded.

Example	`:SYST:SHOW ALIGN`
Notes	The values displayed on the screen are only updated upon entry to the screen and not updated while the screen is being displayed

The following data-specific queries are available:

Query Time since Startup

Remote Command	:SYSTem:PON:TIME?
Example	:SYST:PON:TIME?
Notes	Value is the time since the most recent start-up in seconds
State Saved	No

Query Current Temperature

Remote Command	:CALibration:TEMPerature:CURRent?
Example	:CAL:TEMP:CURR?
Notes	Value is in degrees Centigrade
State Saved	No

Query Time since Last Align Now All

Remote Command	:CALibration:TIME:LALL?
Example	:CAL:TIME:LALL?
Notes	Value is the elapsed time, in seconds, since the last successful Align Now All or Align Now All but RF was executed
State Saved	No

Query Temperature of Last Align Now All

Remote Command	:CALibration:TEMPerature:LALL?
Example	:CAL:TEMP:LALL?
Notes	Value is in degrees Centigrade at which the last successful Align Now All or Align Now All but RF was executed
State Saved	No

Query Time since Last Align Now Analyzer

Remote Command	:CALibration:TIME:INTernal:RECeiver?
Example	:CAL:TIME:INT:REC?
Notes	Value is the elapsed time, in hours, since the last successful Align Now Analyzer
Dependencies	Only appears in VXT models M9410/11A
State Saved	No

Query Temperature of Last Align Now Analyzer

Remote Command	:CALibration:TEMPerature:INTernal:RECeiver?
Example	:CAL:TEMP:INT:REC?
Notes	Value is in degrees Centigrade at which the last successful Align Now Analyzer was executed
Dependencies	Only appears in VXT models M9410/11A
State Saved	No

Query Time since Last Align Now Source

Remote Command	:CALibration:TIME:INTernal:SOURce?
Example	:CAL:TIME:INT:SOUR?
Notes	Value is the elapsed time, in hours, since the last successful Align Now Source
Dependencies	Only appears in VXT models M9410/11A
State Saved	No

Query Temperature of Last Align Now Source

Remote Command	:CALibration:TEMPerature:INTernal:SOURce?
Example	:CAL:TEMP:INT:SOUR?
Notes	Value is in degrees Centigrade at which the last successful Align Now Source was executed
Dependencies	Only appears in VXT models M9410/11A
State Saved	No

Query Time since Last Align Now Fast

Remote Command	:CALibration:TIME:INTernal:FAST?
Example	:CAL:TIME:INT:FAST?
Notes	Value is the elapsed time, in hours, since the last successful Align Now Fast
Dependencies	Only appears in VXT models M9410/11A
State Saved	No

Query Temperature of Last Align Now Fast

Remote Command	:CALibration:TEMPerature:INTernal:FAST?
Example	:CAL:TEMP:INT:FAST?
Notes	Value is in degrees Centigrade at which the last successful Align Now Fast was executed
Dependencies	Only appears in VXT models M9410/11A
State Saved	No

Query Time since Last Align Now LO Leakage

Remote Command	`:CALibration:TIME:INTernal:LOLeakage?`
Example	`:CAL:TIME:INT:LOL?`
Notes	Value is the elapsed time, in hours, since the last successful Align Now LO Leakage
Dependencies	Only appears in VXT models M9410/11A
State Saved	No

Query Temperature of Last Align Now LO Leakage

Remote Command	`:CALibration:TEMPerature:INTernal:LOLeakage?`
Example	`:CAL:TEMP:INT:LOL?`
Notes	Value is in degrees Centigrade at which the last successful Align Now LO Leakage was executed
Dependencies	Only appears in VXT models M9410/11A
State Saved	No

Query Time since Last Align Now IF Cable

Remote Command	`:CALibration:TIME:INTernal:IFCable?`
Example	`:CAL:TIME:INT:IFC?`
Notes	Value is the elapsed time, in hours, since the last successful Align Now IF Cable
Dependencies	Only appears in S9100
State Saved	No

Query Temperature of Last Align Now IF Cable

Remote Command	`:CALibration:TEMPerature:INTernal:IFCable?`
Example	`:CAL:TEMP:INT:IFC?`
Notes	Value is in degrees Centigrade at which the last successful Align Now IF Cable was executed
Dependencies	Only appears in S9100
State Saved	No

Query Time since Last Align Now RF

Remote Command	`:CALibration:TIME:LRF?`
Example	`:CAL:TIME:LRF?`
Notes	Value is the elapsed time, in seconds, since the last successful Align Now, RF was executed, either individually or as a component of Align Now All
State Saved	No

Query Temperature of Last Align Now RF

Remote Command	`:CALibration:TEMPerature:LRF?`
Example	`:CAL:TEMP:LRF?`
Notes	Value is in degrees Centigrade at which the last successful Align Now, RF was executed, either individually or as a component of Align Now All
State Saved	No

Query Time since Last Align IF

Remote Command	`:CALibration:TIME:LIF?`
Example	`:CAL:TIME:LIF?`
Notes	Value is the elapsed time, in seconds, since the last successful Align IF was executed
State Saved	No

Query Temperature of Last Align IF

Remote Command	`:CALibration:TEMPerature:LIF?`
Example	`:CAL:TEMP:LIF?`
Notes	Value is in degrees Centigrade at which the last successful Align IF was executed
State Saved	No

Query Time since Last Characterize Preselector

Remote Command	`:CALibration:TIME:LPReselector?`
Example	`:CAL:TIME:LPR?`
Notes	Value is the date and time the last successful Characterize Preselector was executed. The date is separated from the time by a space character. Returns “” if no Characterize Preselector has ever been performed on the instrument
Dependencies	In models that do not include preselectors, this command is not enabled and any attempt to set or query will yield an error
State Saved	No

Query Temperature of Last Characterize Preselector

Remote Command	`:CALibration:TEMPerature:LPReselector?`
Example	`:CAL:TEMP:LPR?`
Notes	Value is in degrees Centigrade at which the last successful Characterize Preselector was executed
Dependencies	In models that do not include preselectors, this command is not enabled and any attempt to set or query will yield an error
State Saved	No

Query Time since Auto Align Off

Remote Command	:CALibration:AUTO:TIME:OFF?
Example	:CAL:AUTO:TIME:OFF?
Notes	Value is the elapsed time, in seconds, since Auto Align has been set to Off or Off with Alert. The value is 0 if Auto Align is ALL or NORF
State Saved	No

Query Time since Last Align Now 20 Hz - 30 MHz

Remote Command	:CALibration:TIME:RFPSelector:LCONducted?
Example	:CAL:TIME:RFPS:LCON?
Notes	Values are the date and time the last successful Align Now, 20 Hz – 30 MHz was executed. The date is separated from the time by a semi-colon character
State Saved	No

Query Temperature of Last Align Now 20 Hz - 30 MHz

Remote Command	:CALibration:TEMPerature:RFPSelector:LCONducted?
Example	:CAL:TEMP:RFPS:LCON?
Notes	Value is in degrees Centigrade at which the last successful Align Now, 20 Hz – 30 MHz was executed
State Saved	No

Query Time since Last Align Now 30 MHz - 3.6 GHz

Remote Command	:CALibration:TIME:RFPSelector:LRADiated?
Example	:CAL:TIME:RFPS:LRAD?
Notes	Value is the date and time the last successful Align Now, 30 MHz – 3.6 GHz was executed. The date is separated from the time by a semi-colon character
State Saved	No

Query Temperature of Last Align Now 30 MHz - 3.6 MHz

Remote Command	:CALibration:TEMPerature:RFPSelector:LRADiated?
Example	:CAL:TEMP:RFPS:LRAD?
Notes	Value is in degrees Centigrade at which the last successful Align Now, 30 MHz – 3.6 GHz was executed
State Saved	No

Query Next Scheduled Alignment Time

Remote Command	`:CALibration:RFPSelector:SCHeduler:TIME:NEXT?` This query returns data using the following format: YYYY/MM/DD; HH:MM:SS
Example	`:CAL:RFPS:SCH:TIME:NEXT?`
Notes	The next run time will be updated based on the start date/time and recurrence set by the users "date" is representation of the date the task will run in the form of "YYYY/MM/DD" where: – YYYY is the four digit representation of year. (for example, 2009) – MM is the two digit representation of month. (for example, 01 to 12) – DD is the two digit representation of the day. (for example, 01 to 28, 29, 30 or 31 depending on the month and year) "time" is a representation of the time of day the task will run in the form of "HH:MM:SS" where: – HH is the two digit representation of the hour in 24 hour format – MM is the two digit representation of minute – SS is the two digit representation of seconds For model N9038A only
State Saved	No

Query Time since Last Align Now External Mixer Path

Remote Command	`:CALibration:TIME:INTernal:EMPath?`
Example	`:CAL:TIME:INT:EMP?`
Notes	Value is the elapsed time, in hours, since the last successful Align Now External Mixer Path Returns NaN if no Align Now External Mixer Path has ever been performed on the instrument
Dependencies	Only appears in VXT model M9415A, when Option MXP is installed
State Saved	No

Query Temperature of Last Align Now External Mixer Path

Remote Command	`:CALibration:TEMPerature:INTernal:EMPath?`
Example	`:CAL:TEMP:INT:EMP?`
Notes	Value is in degrees Centigrade at which the last successful Align Now External Mixer Path was executed Returns NaN if no Align External Mixer Path has ever been performed on the instrument
Dependencies	Only appears in VXT model M9415A, when Option MXP is installed
State Saved	No

Query Time since Last Align Now Low Band

Remote Command	`:CALibration:TIME:INTernal:LBANd?`
Example	`:CAL:TIME:INT:LBAN?`
Notes	Value is the elapsed time, in hours, since the last successful Align Now Low Band Returns NaN if no Align Now Now Low Band has ever been performed on the instrument
Dependencies	Only appears in VXT model M9415A
State Saved	No

Query Temperature of Last Align Now Low Band

Remote Command	`:CALibration:TEMPerature:INTernal:LBANd?`
Example	`:CAL:TEMP:INT:LBAN?`
Notes	Value is in degrees Centigrade at which the last successful Align Now Low Band was executed Returns NaN if no Align Now Now Low Band has ever been performed on the instrument
Dependencies	Only appears in VXT model M9415A
State Saved	No

Query Time since Last Align Now High Band

Remote Command	`:CALibration:TIME:INTernal:HBAN?`
Example	`:CAL:TIME:INT:HBAN?`
Notes	Value is the elapsed time, in hours, since the last successful Align Now High Band Returns NaN if no Align Now High Band has ever been performed on the instrument
Dependencies	Only appears in VXT model M9415A
State Saved	No

Query Temperature of Last Align Now High Band

Remote Command	`:CALibration:TEMPerature:INTernal:HBANd?`
Example	`:CAL:TEMP:INT:HBAN?`
Notes	Value is in degrees Centigrade at which the last successful Align Now High Band was executed Returns NaN if no Align Now High Band has ever been performed on the instrument
Dependencies	Only appears in VXT model M9415A
State Saved	No

5.6.4 Timebase DAC

This screen allows you to change the setting of the Timebase DAC from a factory calibrated setting to your own desired setting.

The display shows the current Timebase DAC setting at the top, and gives you a choice of Calibrated or User setting. There is also a field for you to enter your desired setting.

Dependencies	Does not appear in VXT

5.6.4.1 Timebase DAC

Allows control of the internal 10 MHz reference oscillator timebase. This may be used to adjust for minor frequency alignment between your signal's reference and the internal frequency reference. This adjustment has no effect if the instrument is operating with an External Frequency Reference.

If the value of the Timebase DAC changes (by switching to Calibrated from User with User Value set to a different value, or in User with a new value entered) an alignment may be necessary. The alignment system will take appropriate action; which will either invoke an alignment or cause an Alert.

The Calibrated setting sets the Timebase DAC to the value established during factory or field calibration. In this case the value displayed at the top of the screen is the calibrated value.

The User setting sets the Timebase DAC to the value set on the User Value control. In this case the value displayed at the top of the screen is the user value.

Remote Command	`:CALibration:FREQuency:REFerence:MODE CALibrated | USER` `:CALibration:FREQuency:REFerence:MODE?`
Example	`:CAL:FREQ:REF:MODE CAL`
Notes	If the value of the timebase is changed the alignment system automatically performs an alignment or alerts that an alignment is due
Dependencies	This menu is not available on the M9391A or M9393A or UXM
Preset	This is unaffected by Preset but is set to CALibrated on a "Restore System Defaults->Align"
State Saved	No

5.6.4.2 User Value

Allows setting the Timebase DAC to a value other than the value established during the factory or field calibration. The current value of the DAC is displayed at the top of the screen. This will be the Calibrated value if Timebase DAC is set to Calibrated.

Remote Command	`:CALibration:FREQuency:REFerence:FINE <integer>` `:CALibration:FREQuency:REFerence:FINE?`
Example	`:CAL:FREQ:REF:FINE 8191`
Notes	If the value of the timebase is changed the alignment system automatically performs an alignment or alerts that an alignment is due
Couplings	Setting :CAL:FREQ:REF:FINE sets :CAL:FREQ:REF:MODE USER

Preset	This is unaffected by Preset but is set to the factory setting on a “Restore System Defaults->Align”
State Saved	No
Min	0
Max	16383
Backwards Compatibility SCPI	`:CALibration:FREQuency:REFerence:COARse` ESA hardware contained two DAC controls for the Timebase. In X-Series the command :CALibration:FREQuency:REFerence:FINE is the method for adjusting the timebase. The COARse option is provided as an alias to FINE

Remote Command	`:CALibration:FREQuency:REFerence:COARse <integer>` `:CALibration:FREQuency:REFerence:COARse?`
Example	`:CAL:FREQ:REF:COAR 8191`
Notes	This is an alias for `:CAL:FREQ:REF:FINE`. Any change to `COARse` is reflected in `FINE` and *vice-versa*. See `:CAL:FREQ:REF:FINE` for description of functionality
Couplings	Setting `:CAL:FREQ:REF:COAR` sets `:CAL:FREQ:REF:MODE USER`

5.6.5 Advanced

Accesses alignment processes that are immediate action operations that perform operations that run until complete. Advanced alignments are performed on an irregular basis, or require additional operator interaction.

Dependencies	This menu is not available on VXT or M9391A or M9393A or UXM

5.6.5.1 Characterize Preselector

The Preselector tuning curve drifts over temperature and time. Recognize that the Amplitude, Presel Center function adjusts the preselector for accurate amplitude measurements at an individual frequency. Characterize Preselector improves the amplitude accuracy by ensuring the Preselector is approximately centered at all frequencies without the use of the Amplitude, Presel Center function. Characterize Preselector can be useful in situations where absolute amplitude accuracy is not of utmost importance, and the throughput savings or convenience of not performing a Presel Center is desired. Presel Center is required prior to any measurement for best (and warranted) amplitude accuracy.

Keysight recommends that the Characterize Preselector operation be performed yearly as part of any calibration, but performing this operation every three months can be worthwhile.

Characterize Preselector immediately executes a characterization of the Preselector, which is a YIG-tuned filter (YTF). The instrument stops any measurement currently underway, performs the characterization, then restarts the measurement from the beginning (similar to pressing the **Restart** key).

The query form of the remote command (`:CALibration:YTF?`) invokes the alignment of the YTF subsystem, and returns a success or failure value.

A failure encountered during alignment generates the Error Condition message "Characterize Preselector failure" and sets bit 3 in the STATus:QUEStionable:CALibration:EXTended:FAILure status register. Successful completion of Characterize Preselector clears this Condition. It also begins the elapsed time counter for Last Characterize Preselector Time, and captures the Last Characterize Preselector Temperature.

The last Characterize Preselector Time and Temperature survives across the power cycle as this operation is performed infrequently.

NOTE

The Characterize Preselector function can be interrupted by pressing the Cancel (ESC) front-panel key or remotely with Device Clear followed by the `:ABORt SCPI` command. None of the new characterization data is then used. However, since the old characterization data is purged at the beginning of the characterization, you now have an uncharacterized preselector. You should re-execute this function and allow it to finish before making any further preselected measurements.

Remote Command	`:CALibration:YTF` `:CALibration:YTF?`
Example	`:CAL:YTF`
Notes	`:CALibration:YTF?` returns 0 if successful, or 1 if failed (including interfering user signal) While Advanced, Characterize Preselector is performing the alignment, bit 0 in the Status Operation register is set. Completion, or termination, will clear bit 0 in the Status Operation register This command is sequential; it must complete before further SCPI commands are processed. Interrupting the alignment from remote is accomplished by invoking Device Clear followed by the `:ABORt` command Successful completion will clear bit 9 in the Status Questionable Calibration register A failure encountered during alignment will generate the Error Condition message "Characterize Preselector failed" and set bit 9 in the Status Questionable Calibration register For Options that support frequencies > 3.6 GHz only
Dependencies	This control does not appear in models that do not contain preselectors. In these models the SCPI command is accepted without error but no action is taken
Couplings	Initializes the time for the Last Characterize Preselector Time Records the temperature for the Last Characterize Preselector Temperature

Remote Command	`:CALibration:YTF:NPENding`
Example	`:CAL:YTF:NPEN`
Notes	`:CALibration:YTF:NPENding` is the same as `:CALibration:YTF`, including all conditions,

status register bits, except that this SCPI command does not BLOCK the SCPI session, so you should use status register bits to query if the calibration is successfully completed or not

Typical usage is:

1. :CALibration:YTF:NPENding (Start a YTF calibration)
2. :STATus:OPERation:CONDition? (Check if the calibration is completed or not, If bit 0 is set, then the system is doing calibration, you should repeat this query until the bit is cleared)
3. :STATus:QUEStionable:CALibration:EXTended:FAILure:CONDition? (Check if bit 2 is set or not. If this bit is set, that means there are some errors in previous internal source calibration)

5.6.5.2 Characterize Reference Clock

Characterize Reference Clock calibrates the Reference Input Phase with the External Reference Output. This feature is only available when either option DP2 or B40 is present. It requires connecting the 10 MHz OUT to the EXT REF IN port with a BNC cable before running the characterization.

See "Front panel guided calibration sequence" on page 379

Remote Command	`:CALibration:REFerence:CLOCk?`

Example	`:CAL:REF:CLOC:INIT?`
	connect cable
	`:CAL:REF:CLOC?`
	disconnect cable
	`:CAL:REF:CLOC:END?`

Notes	`:CALibration:REFerence:CLOCk?` returns 0 if successful, or 1 if failed
Dependencies	Option DP2 or B40
Couplings	Initializes the time for the Last Characterize Reference Clock Time Records the temperature for the Last Characterize Reference Clock Temperature. Expected to be run after `:CAL:REF:CLOC:INIT`, and before `:CAL:REF:CLOC:END`

Remote Command	`:CALibration:REFerence:CLOCk:INITialize?`
Example	`:CAL:REF:CLOC:INIT?`
Notes	Returns 0 if successful, or 1 if failed
Dependencies	Option DP2 or B40
Couplings	Expected to be run before sending the `:CAL:REF:CLOC?` query. This will stop the current measurement when it has completed (does not abort the current data acquisition), and prepare the instrument for the expected cabling

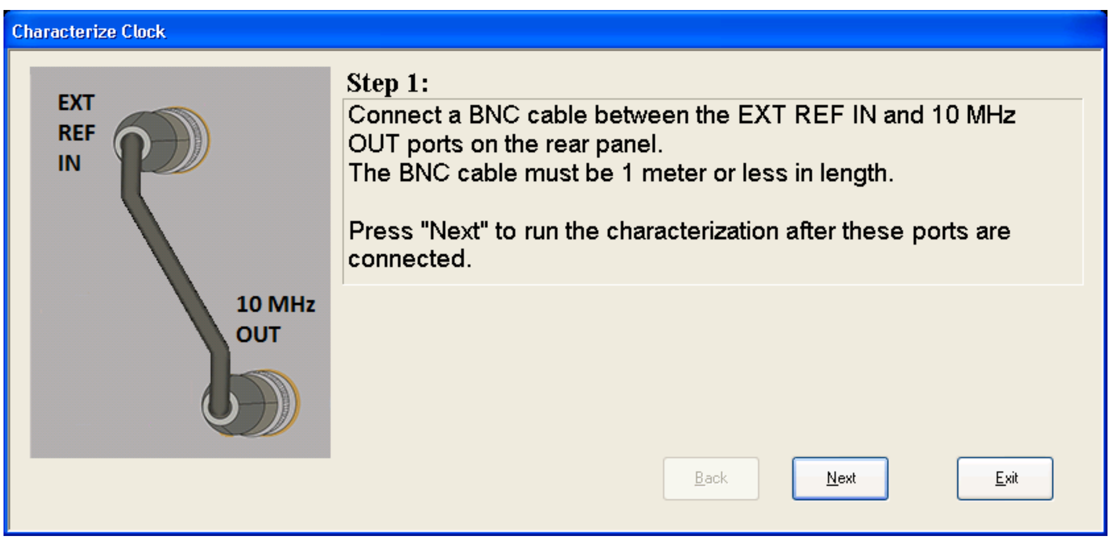
Remote Command	`:CALibration:REFerence:CLOCk:END?`
Example	`:CAL:REF:CLOC:END?`
Notes	Returns 0 if successful, or 1 if failed
Dependencies	Option DP2 or B40
Couplings	Expected to be run after sending the `:CAL:REF:CLOC?` query, and after removing the cable used in that Characterize Reference Clock step. This will resume any queued measurements, and concludes the reference clock characterization

Remote Command	`:CALibration:TIME:REFerence:CLOCk?`
Example	`:CAL:TIME:REFerence:CLOCk?`
Notes	Value is the date and time the last successful Characterize Reference Clock was executed. The date is separated from the time by a space character. Returns “” if Characterize Reference Clock has never been performed on the instrument
Dependencies	Option DP2 or B40
State Saved	No

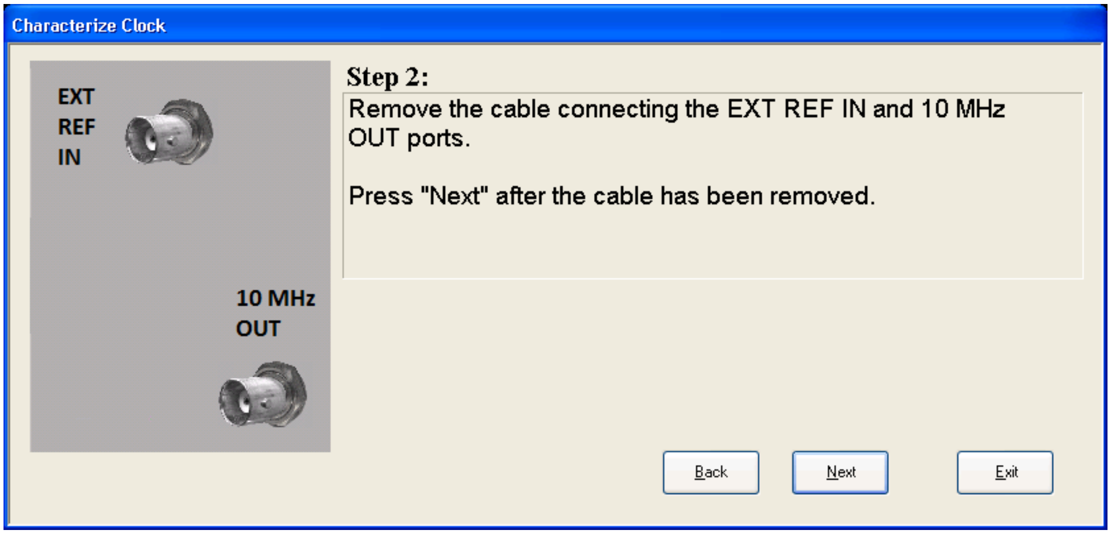
Front panel guided calibration sequence

When selecting “Characterize Reference Clock” through the front panel, the following form will be shown.

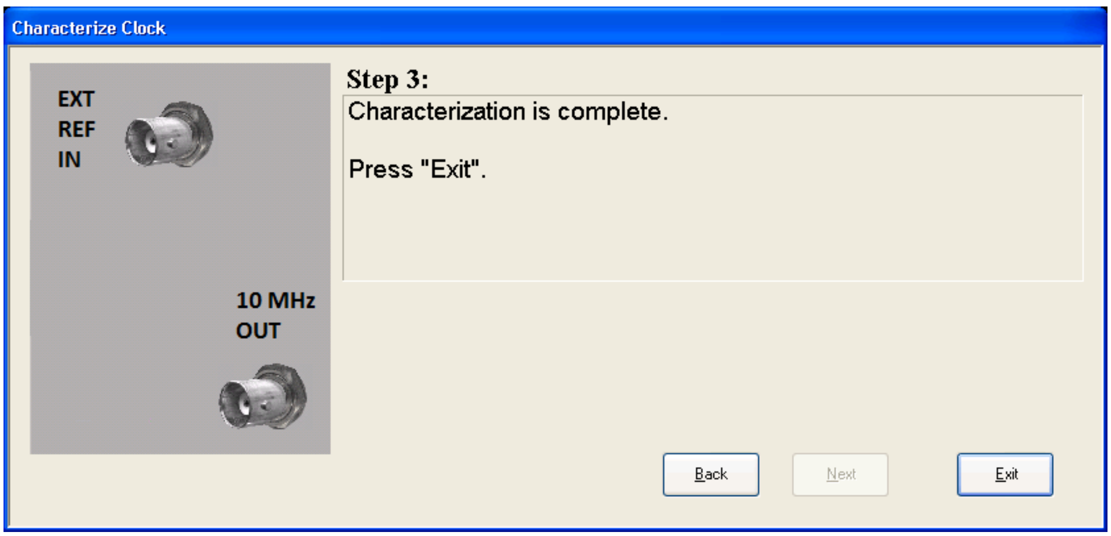
Step 1 of the guided calibration sequence:



Step 2 of the guided calibration sequence:



Step 3 of the guided calibration sequence:



5.6.5.3 Characterize Noise Floor

On instruments with the NF2 license installed, the calibrated Noise Floor used by Noise Floor Extensions should be refreshed periodically. To do this, press the **Characterize Noise Floor** control. When you press this control, the instrument stops any measurement currently underway, and a dialog appears with an **OK** and **Cancel** button that says:

“This action will take several minutes to perform. Please disconnect all cables from the RF input and press Enter to proceed. Press ESC to cancel.”

When you press **Enter** or **OK**, the characterization proceeds. After the characterization, the analyzer restarts the measurement from the beginning (similar to pressing the **Restart** key). The characterization takes many minutes to run.

The noise floor model used by Noise Floor Extensions includes an estimation of the temperature behavior of the noise floor, but this is only an estimation. The noise floor changes little with the age of the components. However, even small changes in the estimated level of the noise floor can make large changes in the effective noise floor, because the effective noise floor is the error in the estimation of the noise floor. Keysight recommends that the Characterize Noise Floor operation be performed when the analyzer is operating at an ambient temperature that is significantly different than the ambient temperature at which this alignment was last run. In addition, Keysight recommends that the Characterize Noise Floor operation be performed after the first 500 hours of operation, and once every calendar year.

The noise floor model from the last operation of Characterize Noise Floor survives across the power cycle.

NOTE	The Characterize Noise Floor function can be interrupted by pressing the **Cancel (ESC)** front-panel key or remotely with Device Clear followed by the `:ABORt SCPI` command. None of the new characterization data is then used. However, since the old characterization data is purged at the beginning of the characterization, you now have an uncharacterized noise floor. You should re-execute this function and allow it to finish before making any further measurements with NFE. Until you do, the analyzer will display a “Characterize Noise Floor required” message and set bit 12 in the Status Questionable Calibration register (`STATus:QUEStionable:CALibration:EXTended:NEEDed`).

Remote Command	`:CALibration:NFLoor` `:CALibration:NFLoor?`
Example	`:CAL:NFL`
Notes	`:CALibration:NFLoor?` returns 0 if successful, or 1 if failed (including interfering user signal) While Characterize Noise Floor is performing the alignment, bit ? in the Status Operation register is set. Completion, or termination, will clear bit ? in the Status Operation register This command is sequential; it must complete before further SCPI commands are processed. Interrupting the alignment from remote is accomplished by invoking Device Clear followed by the `:ABORt` command A failure encountered during characterization will generate the Error Condition message “Characterize Noise Floor failed” message and set bit ? in the Status Questionable Calibration register. Successful completion will clear bit ? in the Status Questionable Calibration register
Dependencies	This control does not appear in models that do not contain NF2. In these models the SCPI command is accepted without error but no action is taken
Couplings	Successful completion of Characterize Noise Floor will begin the elapsed time counter or the Last Characterize Noise Floor Time

Remote Command	`:CALibration:TIME:NFLoor?`
Example	`:CAL:TIME:NFL?`
Notes	Value is the date and time the last successful Characterize Noise Floor was executed. The date is separated from the time by a space character. Returns “” if no Characterize Noise Floor has ever been

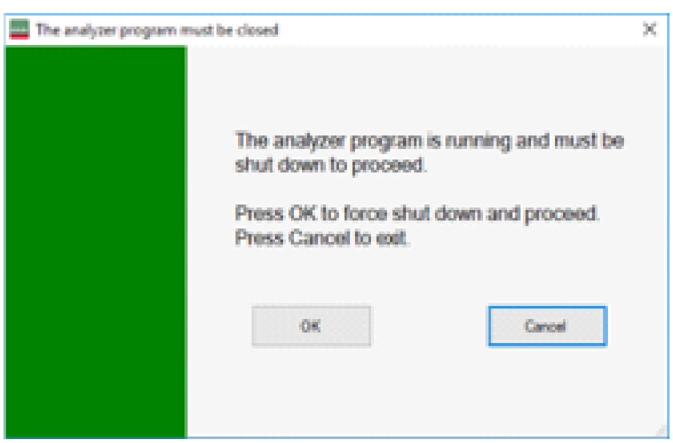
	performed on the instrument
Dependencies	In models that do not include NF2, this command is not enabled and any attempt to set or query yields an error
State Saved	No

Remote Command	`:CALibration:TEMPerature:NFLoor?`
Example	`:CAL:TEMP:NFL?`
Notes	Value is the temperature of the last successful Characterize Noise Floor was executed. Returns “” if no Characterize Noise Floor has ever been performed on the instrument
Dependencies	In models that do not include NF2, this command is not enabled and any attempt to set or query yields an error
State Saved	No

Remote Command	`:CALibration:TIME:ELAPsed:NFLoor?`
Example	`:CAL:TIME:ELAP:NFL?`
Notes	Value is the elapsed time the instrument was powered-on since the last successful Characterize Noise Floor was executed. Returns “” if no Characterize Noise Floor has ever been performed on the instrument
Dependencies	In models that do not include NF2, this command is not enabled and any attempt to set or query yields an error
State Saved	No

5.6.6 Backup or Restore Align Data...

Opens the utility for backing-up or restoring the alignment data. Since this utility cannot be run while the instrument software is running, a prompt tells you to shut down the instrument first:



Press **OK** and the instrument will shut down and open the backup utility.

Alignment data for the instrument resides on the hard drive in a database. Keysight uses high quality hard drives; however it is highly recommended the alignment data be backed-up to storage outside of the instrument. Additionally, for customers who use multiple CPU Assemblies or multiple disk drives, the alignment that pertains to the instrument must be transferred to the resident hard drive after a CPU or hard drive is replaced. This utility facilitates backing-up and restoring the alignment data.

NOTE **This utility allows you to navigate to any location of the Windows file system. If you are backing up alignment data to storage outside of the instrument, then it is assumed that you will use a USB memory device, or Mapped Network Drive.**

Processor Assembly types PC6 and PC7 contain a removable SD memory card. When one of these CPUs is installed, the Backup and Restore Alignment Data wizard defaults to the SD card as the backup location. At every power-on, the software will check to determine if the calibration data on the SD memory card (the backup) is newer than the data in use on the disk. In such situations, before the application is loaded, you are given the opportunity to restore the data from the backup. If you respond “Yes”, the Backup and Restore Alignment Data wizard (see "Alignment Data Wizard (without Flash)" on page 383) will be invoked to perform the restore.

Processor Assembly types PC6S and PC7S contain an internal flash EEPROM, as well as a removable SD card. When one of these CPUs is installed, the Backup and Restore Alignment Data wizard defaults to the internal flash as the backup location. As with the PC6 and PC7, at every power-on, the software compares the timestamp of the backup on the flash and the timestamp of the alignment data in use on the disk. If the backup on the flash has newer data, you are given the opportunity to restore the data from the backup before the application is loaded. If you respond “Yes”, the Backup and Restore Alignment Data wizard (see "Alignment Data Wizard (with Flash)" on page 393) will be invoked and will prompt you to restore that backup.

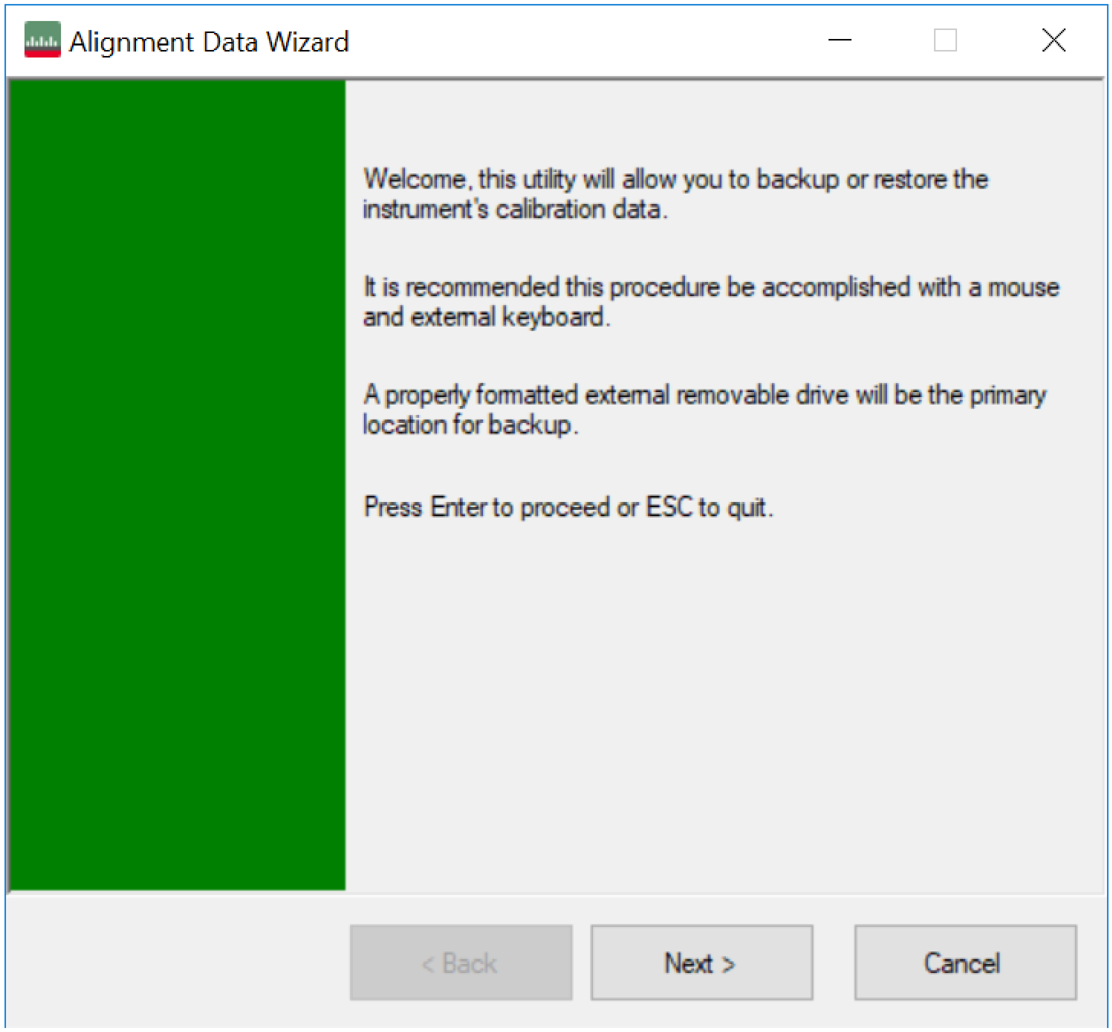
For purposes of these instructions, “alignment data” and “calibration data” are used interchangeably.

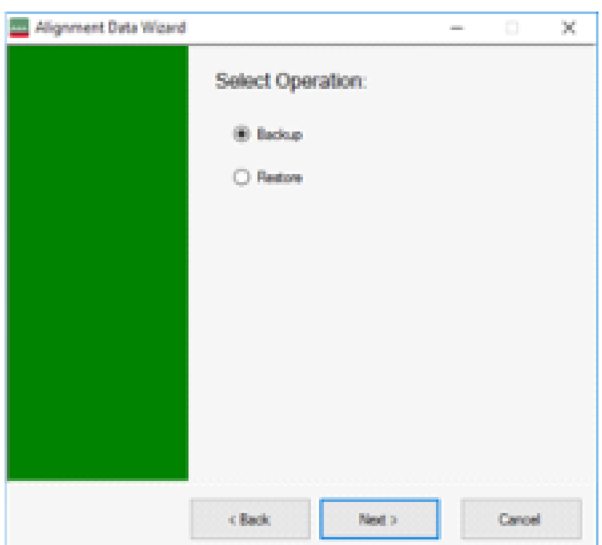
Dependencies	This menu is not available on the M9391A or M9393A or UXM

Remote Command	`:CALibration:DATA:DEFault`
Example	`:CAL:DATA:DEF`
Notes	Restores the alignment data files to their default state
Couplings	Sets Auto Align to Off. Sets bit 14 in the Status Questionable Calibration register. The Error Condition message “Align Now All required” is generated

5.6.6.1 Alignment Data Wizard (without Flash)

The Backup or Restore Alignment Data wizard guides you through the operation of backing-up or restoring the alignment data.

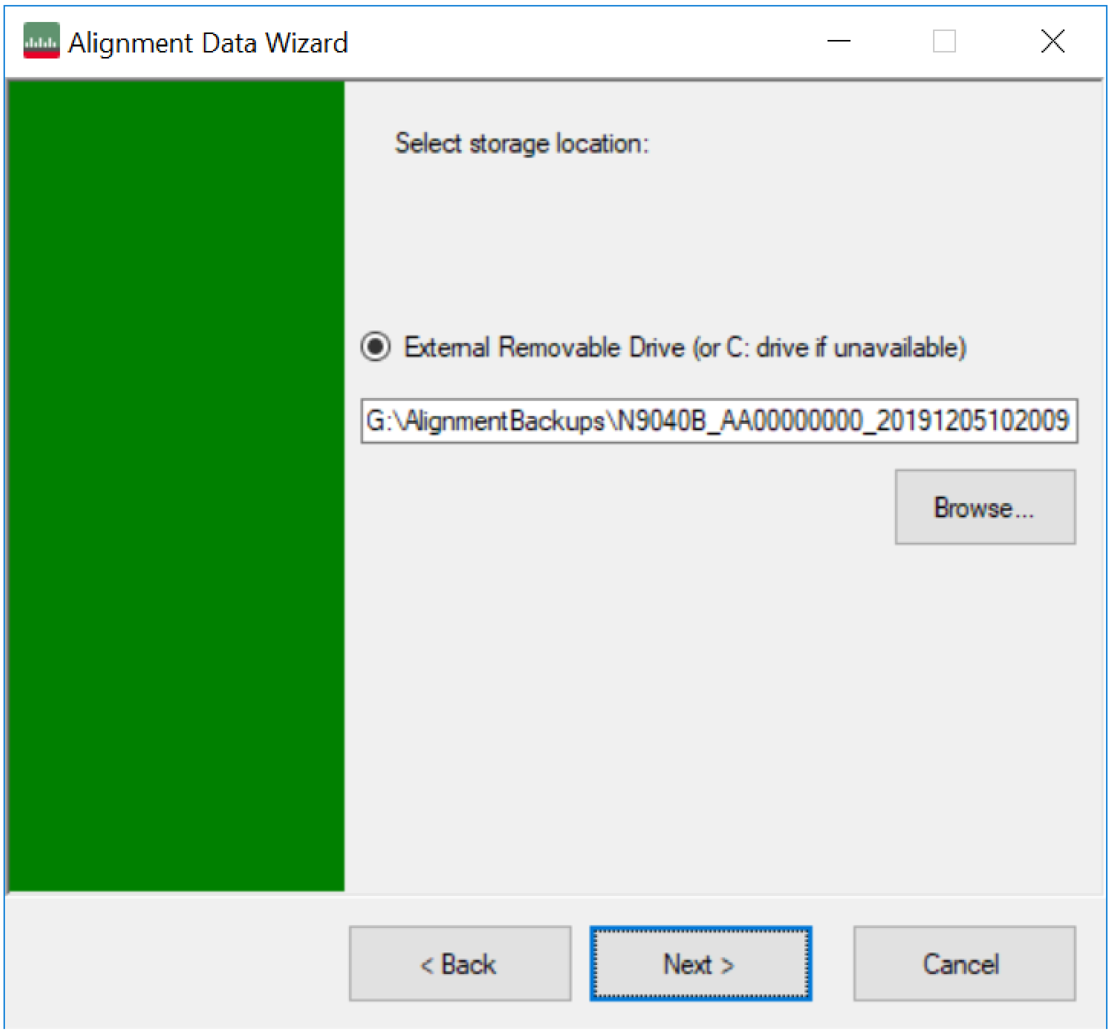

Alignment Data Wizard
Welcome, this utility will allow you to backup or restore the instrument's calibration data.
It is recommended this procedure be accomplished with a mouse and external keyboard.
A properly formatted external removable drive will be the primary location for backup.
Press Enter to proceed or ESC to quit.
< Back
Next >
Cancel


Alignment Data Wizard
Select Operation:
Backup
Restore
< Back
Next >
Cancel

The default backup location for instruments *without* internal flash will be the first drive identified as an external drive (USB or LAN) if such is available; or, if not, the internal D: partition.

The default file name is <model number>_<serial number>_<date in YYYYMMDDHHMMSS>.bkz.

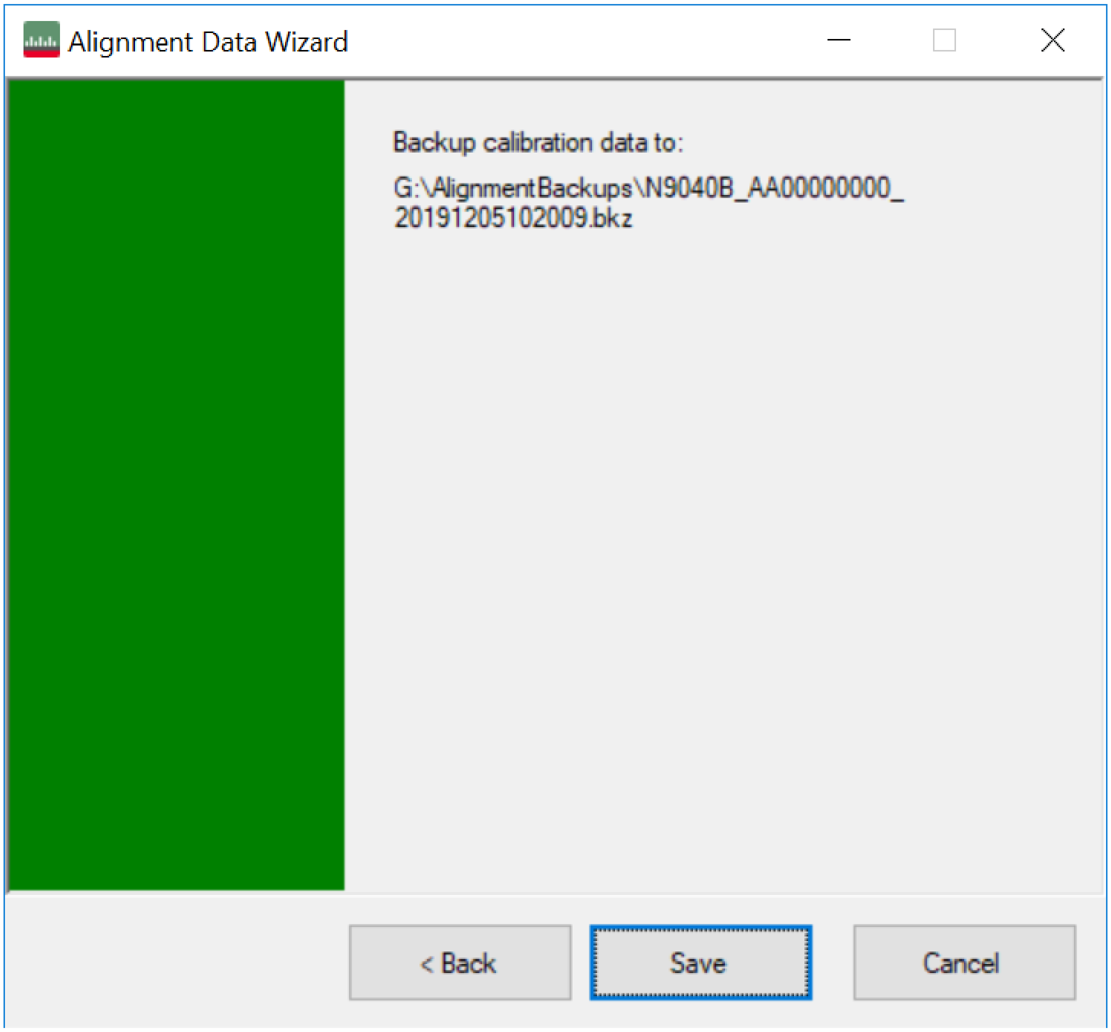
The default file extension for legacy backup files was .bak. The Backup and Restore operations support both the .bak (legacy format) and .bkz formats.

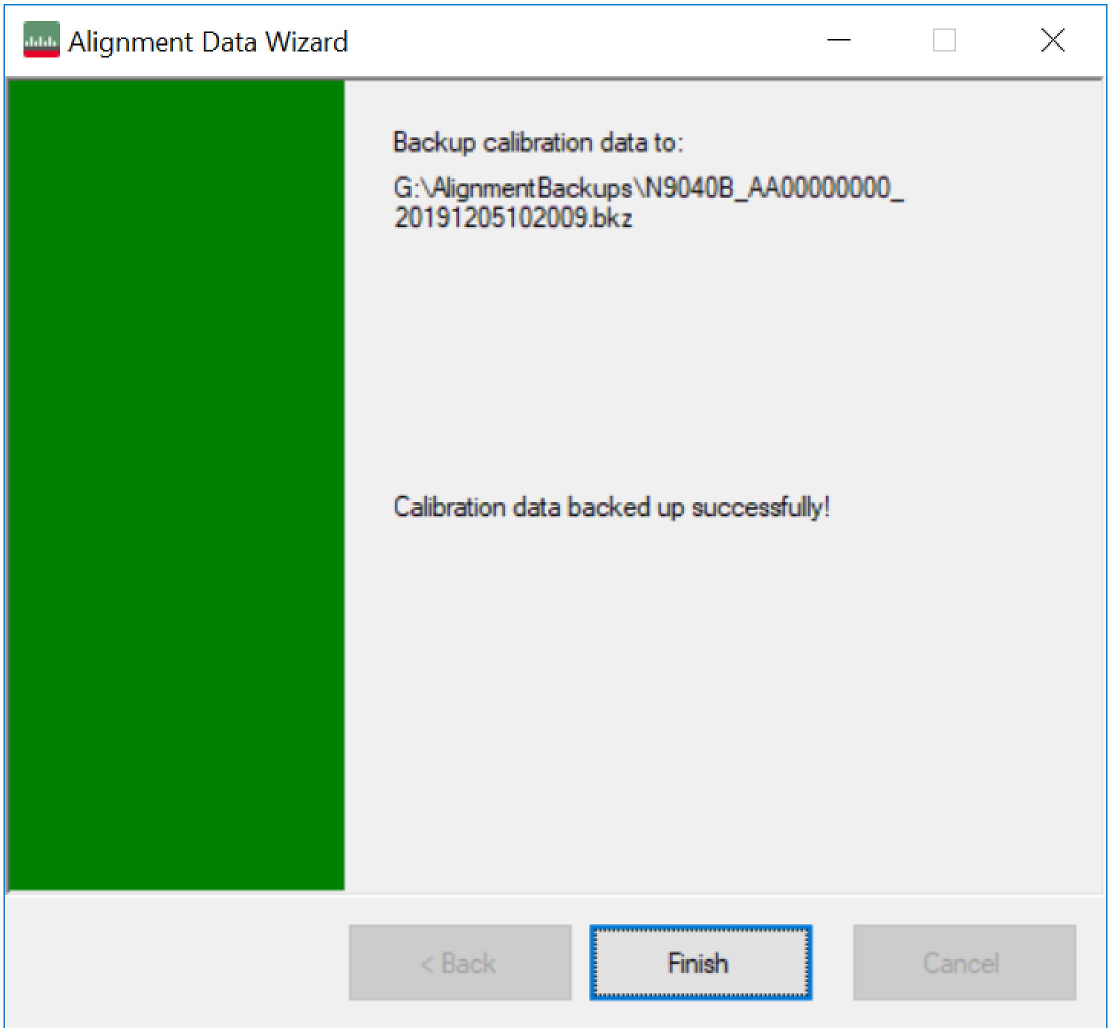


If a USB drive is present, it will be selected by default. The path defaults to the AlignmentBackups folder, and a filename is automatically created, in the form: <model>_<serial number>_<date><time>.bkz

If you wish to enter a customer filename, you can do so with an external keyboard, or by opening the onscreen Alpha keyboard, by pressing the **Keyboard** hardkey on the front panel:

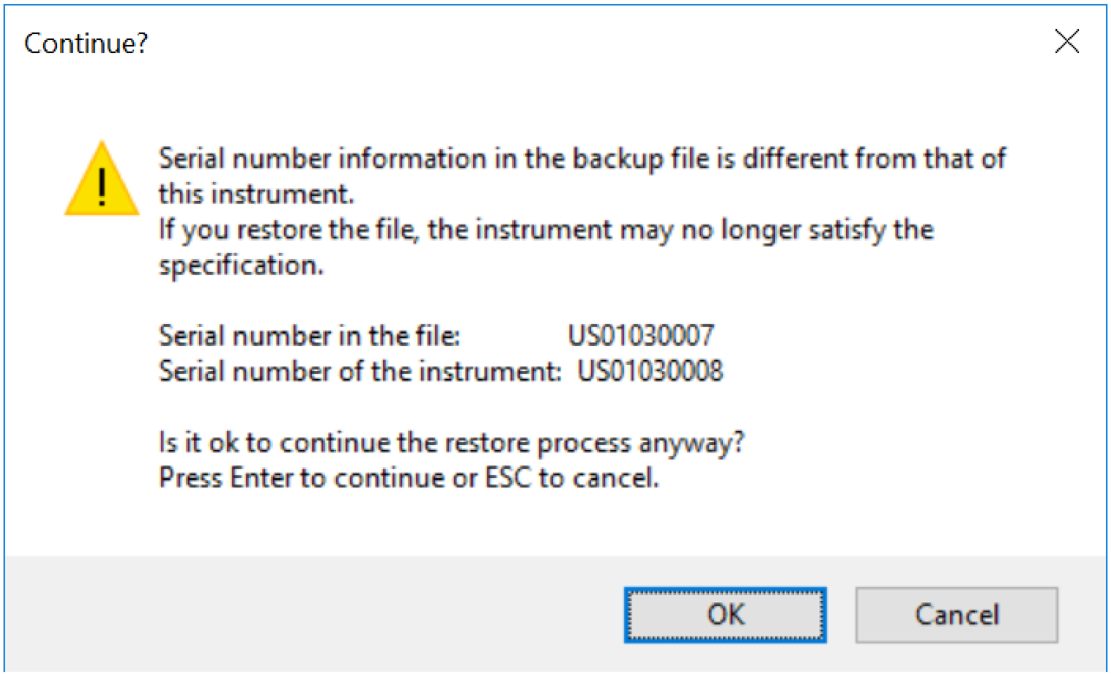
When the **Next >** button is pressed, you will be prompted to create a new folder if the chosen path does not yet exist.



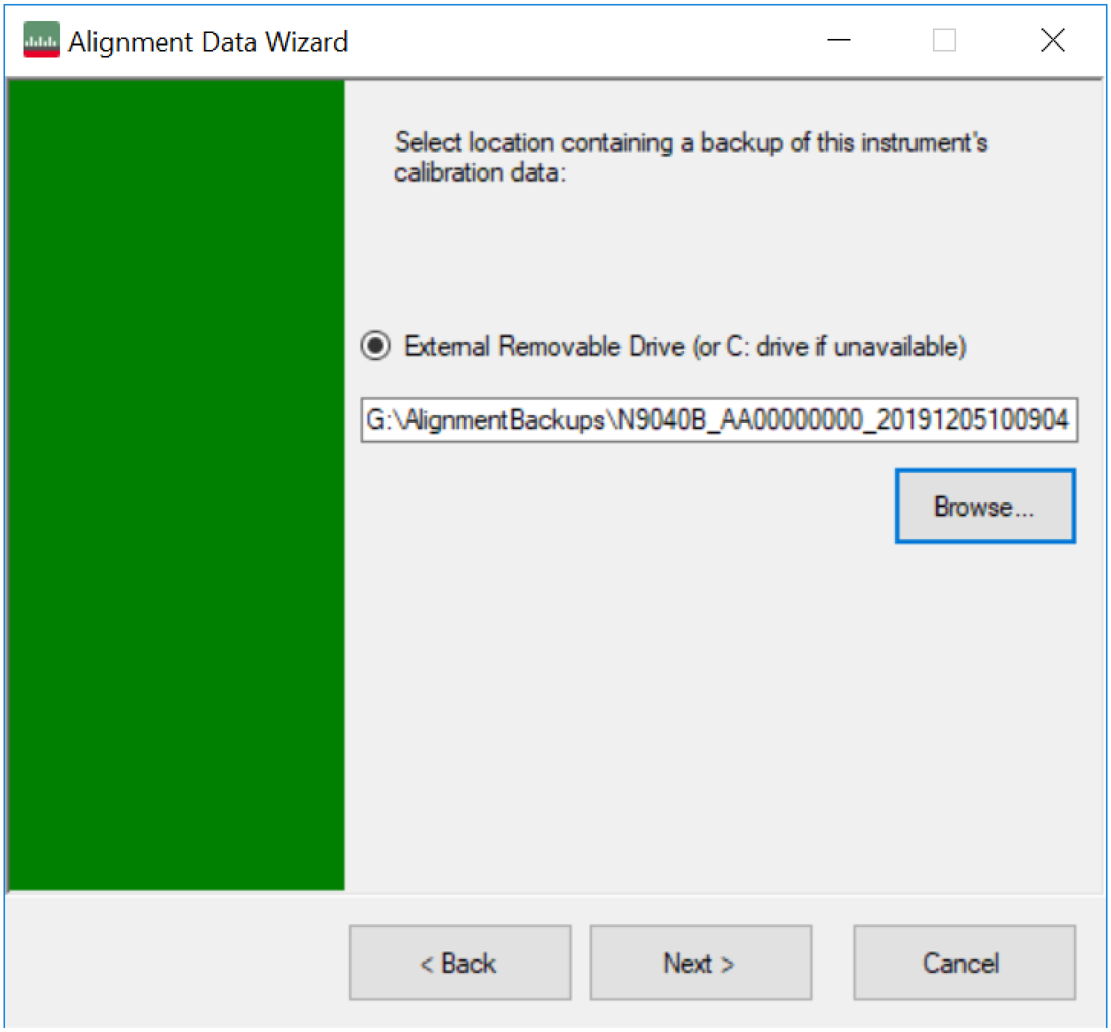


The restore operation checks the validity of the restore file using the database's built-in file validation. If the restore file is corrupt, the existing alignment data will remain in use.

If the serial number information in the backup file being restored is different from that of the instrument, the following message appears (the serial numbers shown are examples):

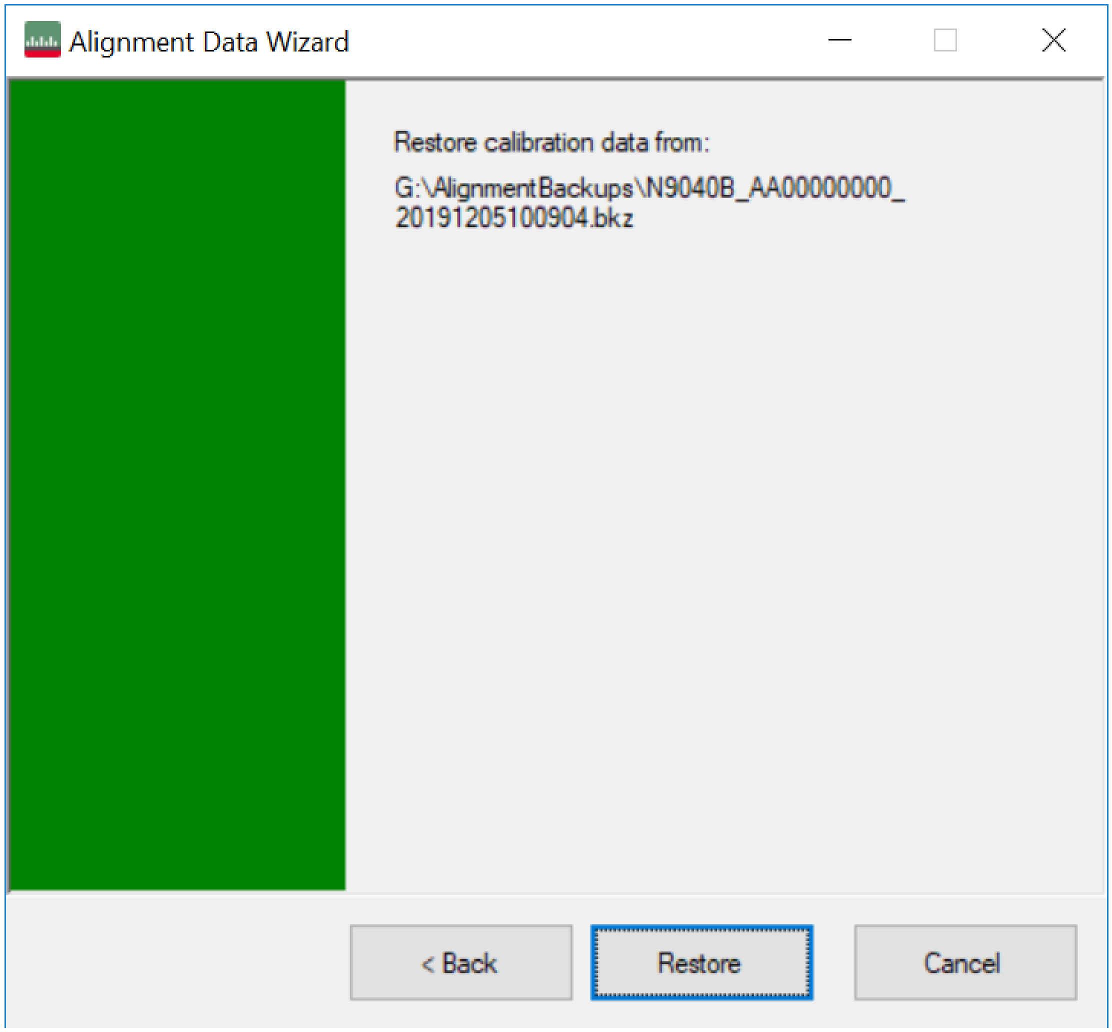


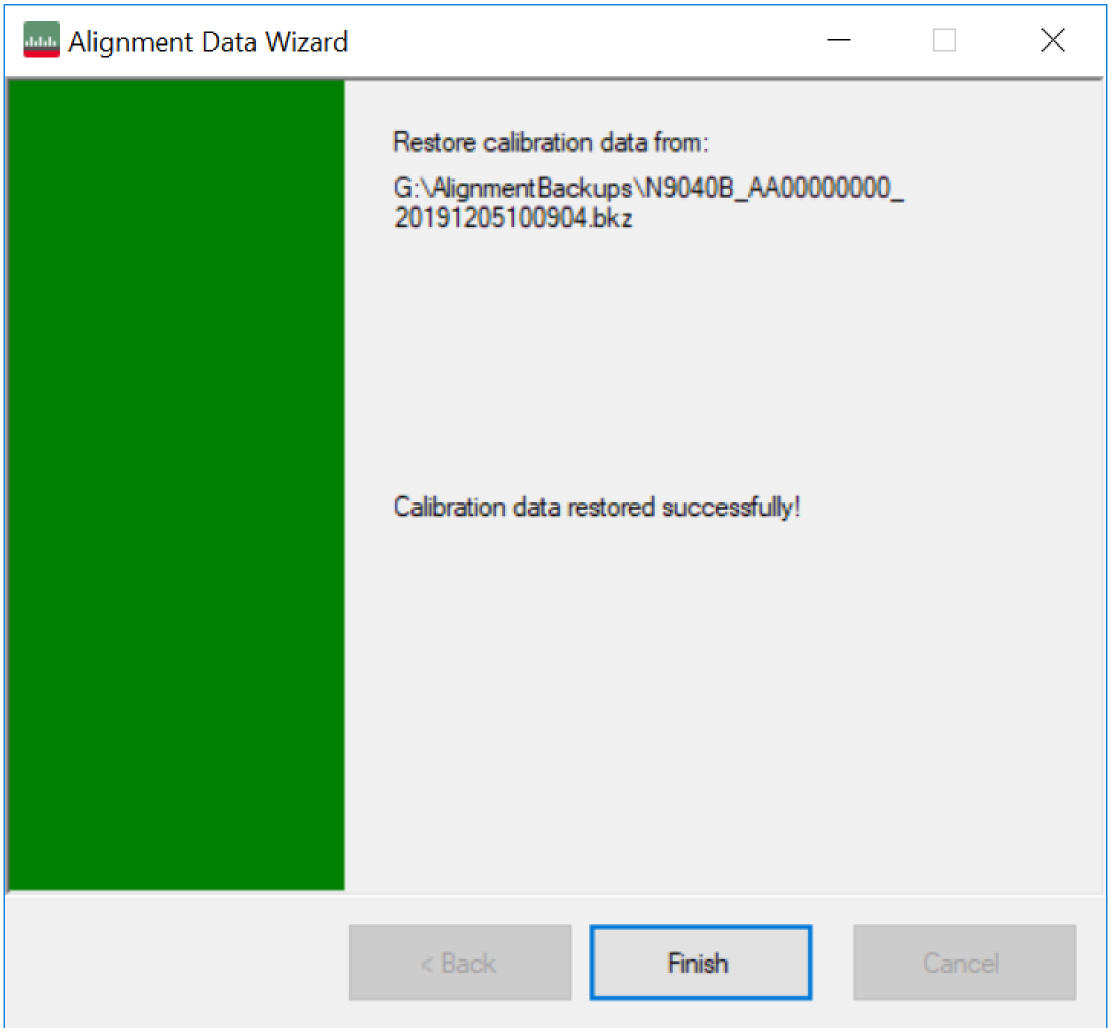
The default restore location for instruments *without* internal flash will be the first drive identified as an external drive (USB or LAN) if such is available; or, if not, the internal D: partition. The default restore file will be the most recent file that matches the default backup file name format: <model number>_<serial number>_<date>.bkz



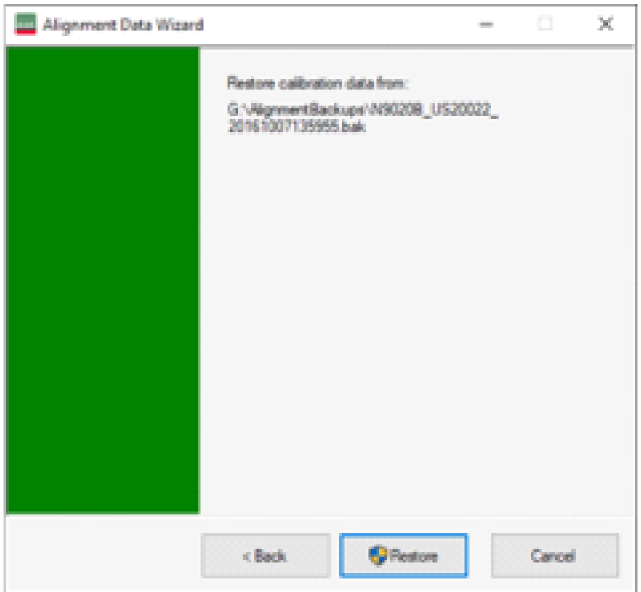
Changing the drive letter also modifies the path displayed in the box below. When this step is first loaded, the drive drop-down menu is populated with connected drives, which provide you with read access.

The path defaults to the `AlignBackups` folder. The most recent backup (`*.bkz` or `*.bak`) file in the folder will also be selected by default.


Alignment Data Wizard
Restore calibration data from:
G:\AlignmentBackups\N9040B_AA00000000_
20191205100904.bkz
< Back
Restore
Cancel



When restoring data in the legacy .bak format, Administrator privileges are required. You will be prompted when you attempt a restore (indicated by the UAC Shield on the **Restore** button below).



5.6.6.2 Perform Backup (without Flash) (Remote Command Only)

Invokes an alignment data backup operation to the provided Folder.

NOTE

It is recommended that the Folder provided is outside of the instrument (USB or Mapped Network Drive).

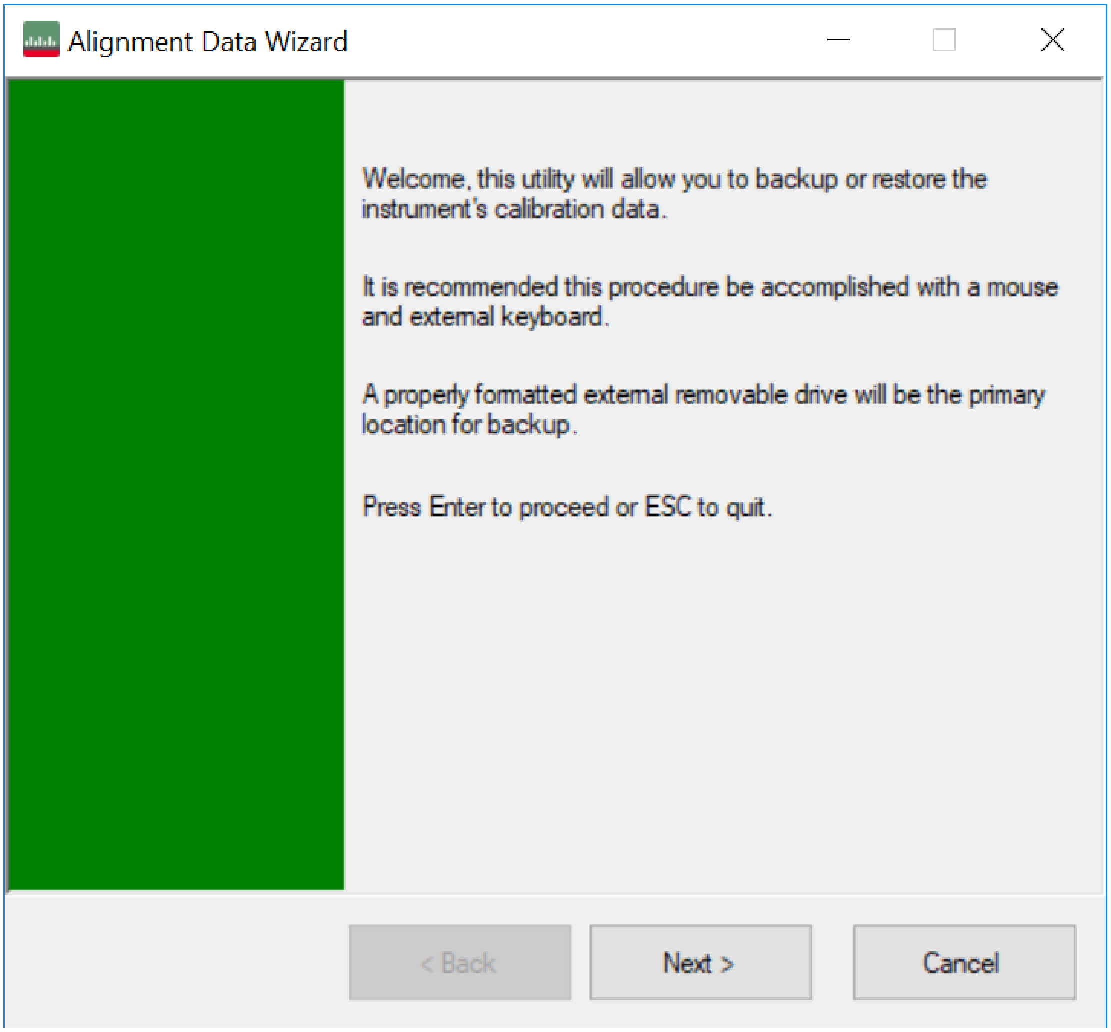
Remote Command	`:CALibration:DATA:BACKup <filename>`
Example	`:CAL:DATA:BACK "F:\AlignDataBackup_N9020A_US00000001_2008140100.bkz"`

5.6.6.3 Perform Restore (With Flash) (Remote Command Only)

Invokes an alignment data restore operation from the internal flash EEPROM.

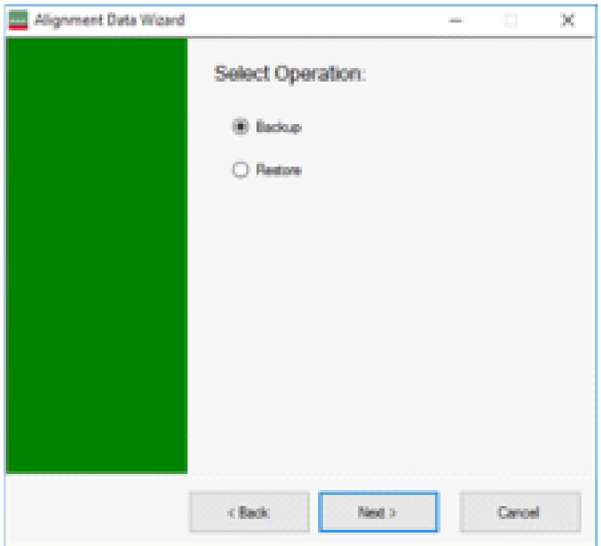
Remote Command	`:CALibration:DATA:INTernal:RESTore`
Example	`:CAL:DATA:INT:REST`

5.6.6.4 Alignment Data Wizard (with Flash)



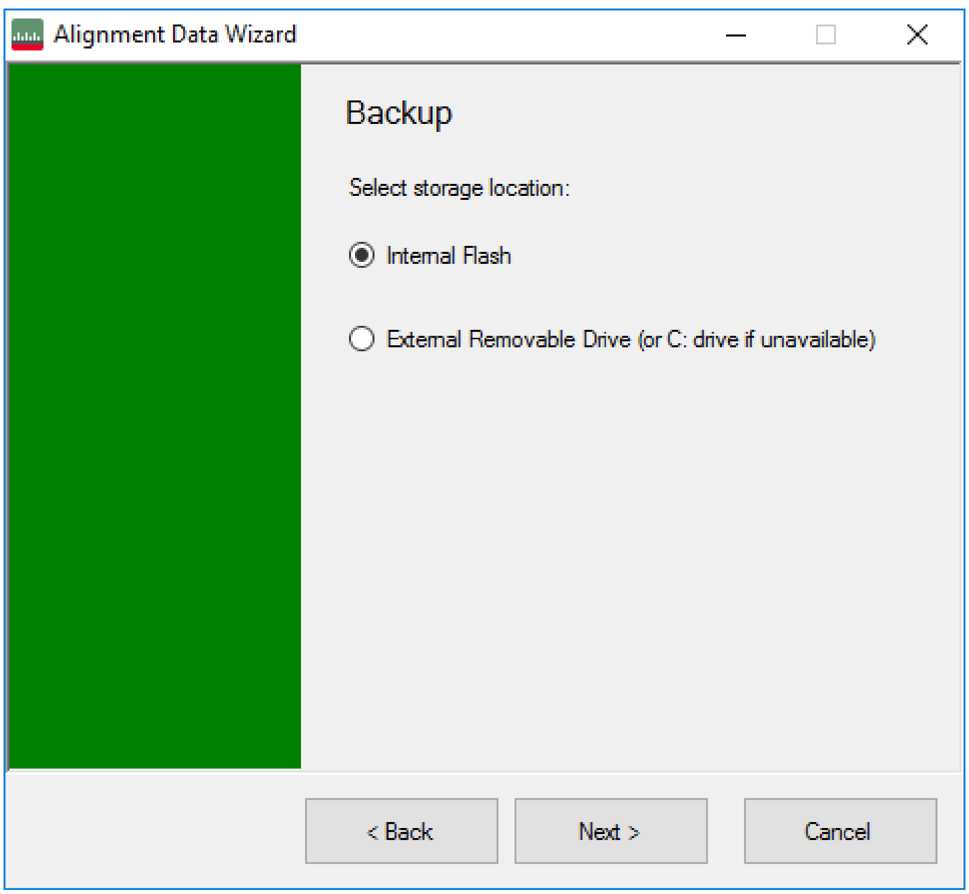
If your instrument has Processor Assembly type PC6S or PC7S (see "Show System" on page 305) the instrument has an internal flash EEPROM that can store a backup of the alignment data. In this case, the interface to the Alignment Data Wizard is enhanced to accommodate this internal storage. This section details the use of this internal flash. For details on using external storage, see the previous section ("Alignment Data Wizard (without Flash)" on page 383).

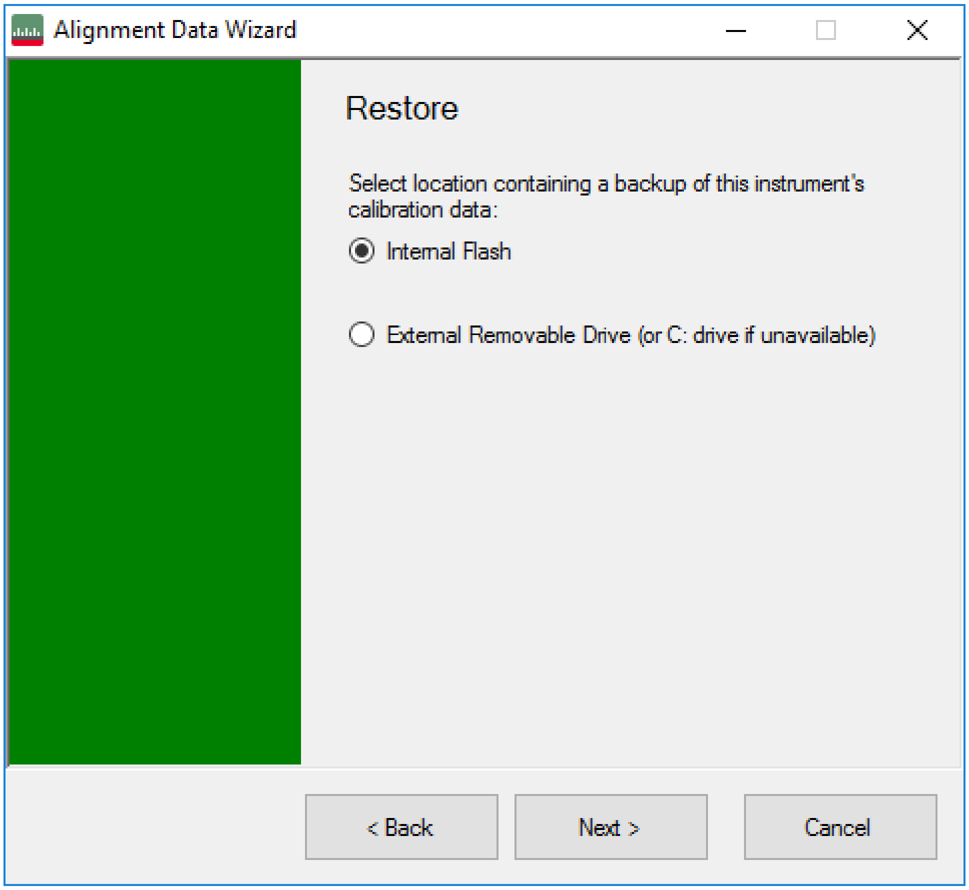
The Alignment Data Wizard guides you through the operations of backing up or restoring alignment data.



Having selected Backup or Restore, you then select the source or destination for the alignment data. As shown below, you can select either:

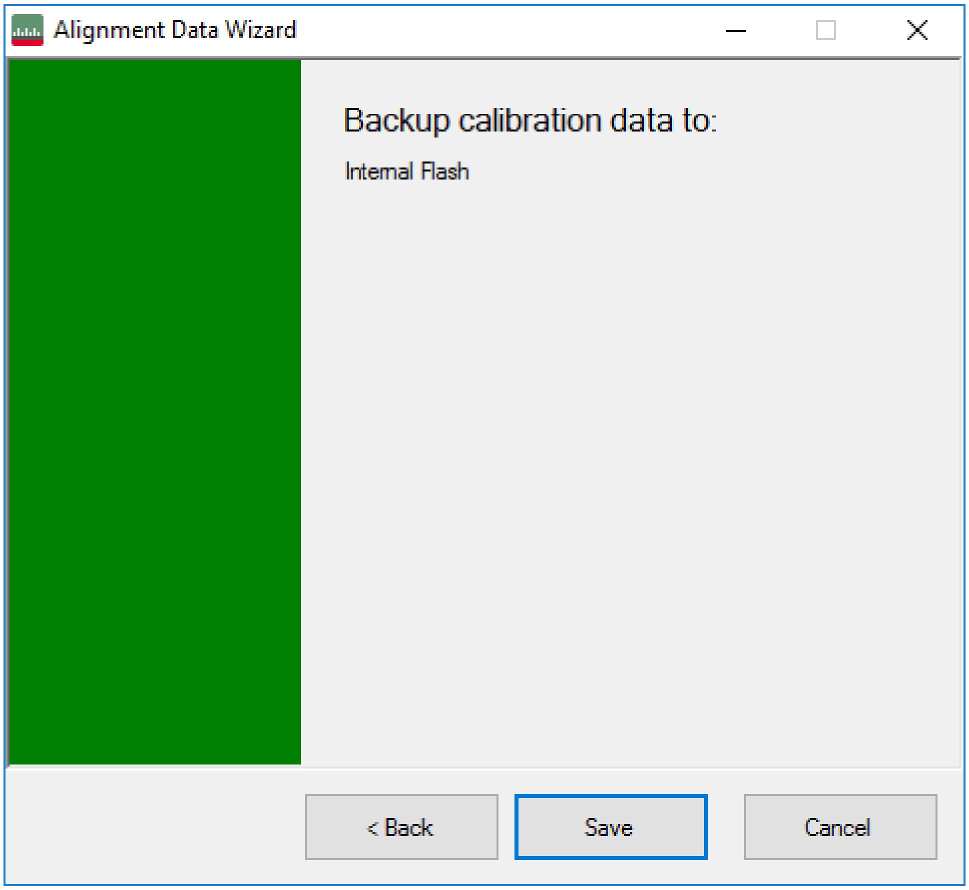
- Internal flash EEPROM, or,
- External Removable Drive (which includes the SD card described in "Backup or Restore Align Data..." on page 382)

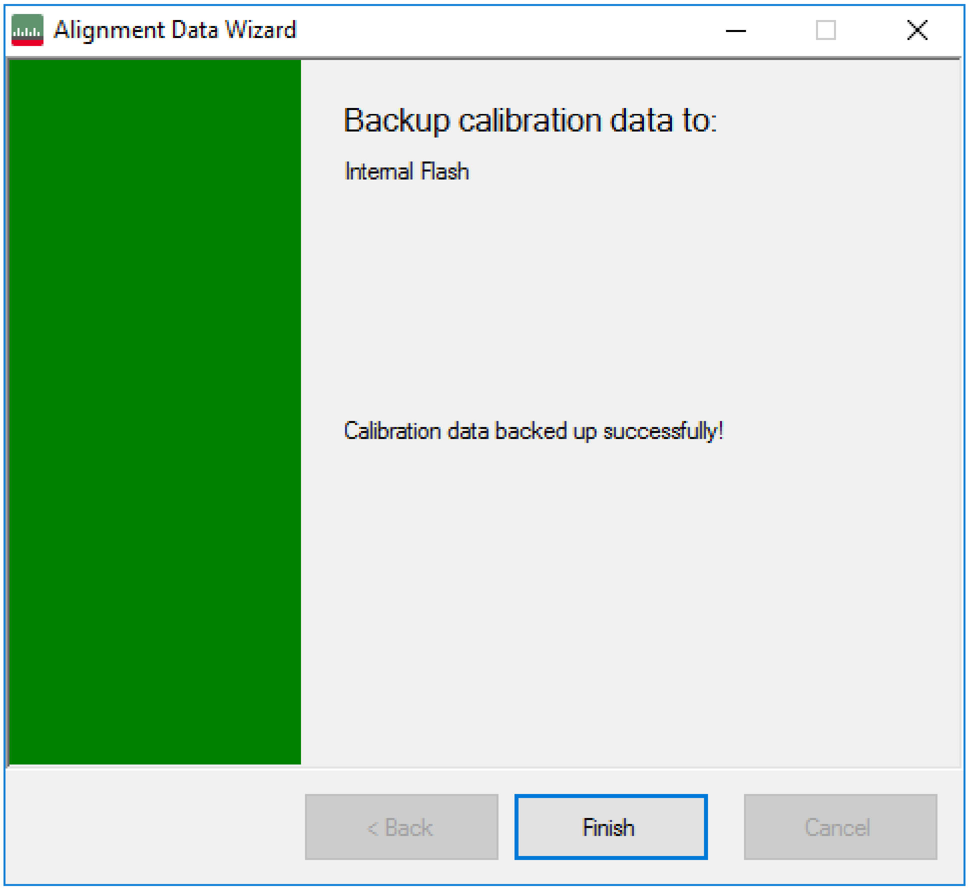




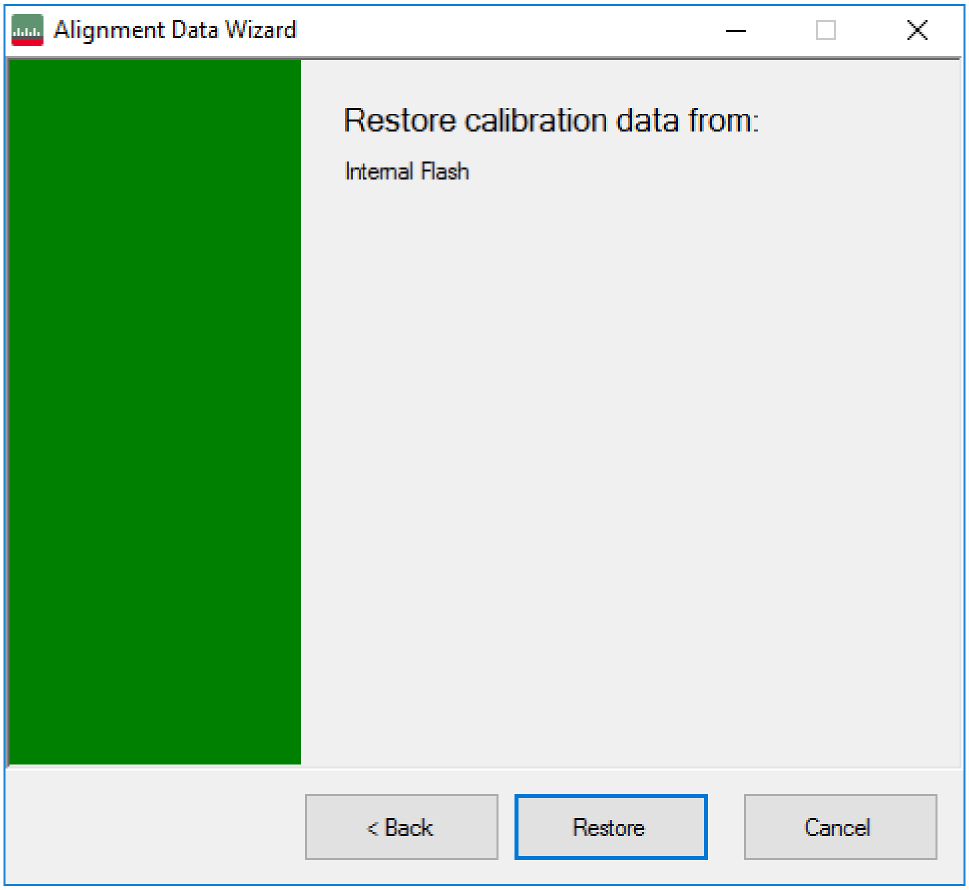
The final page of the wizard asks you to confirm the choices made in the previous pages. When the operation is complete, an indication is displayed on the same page, as below.

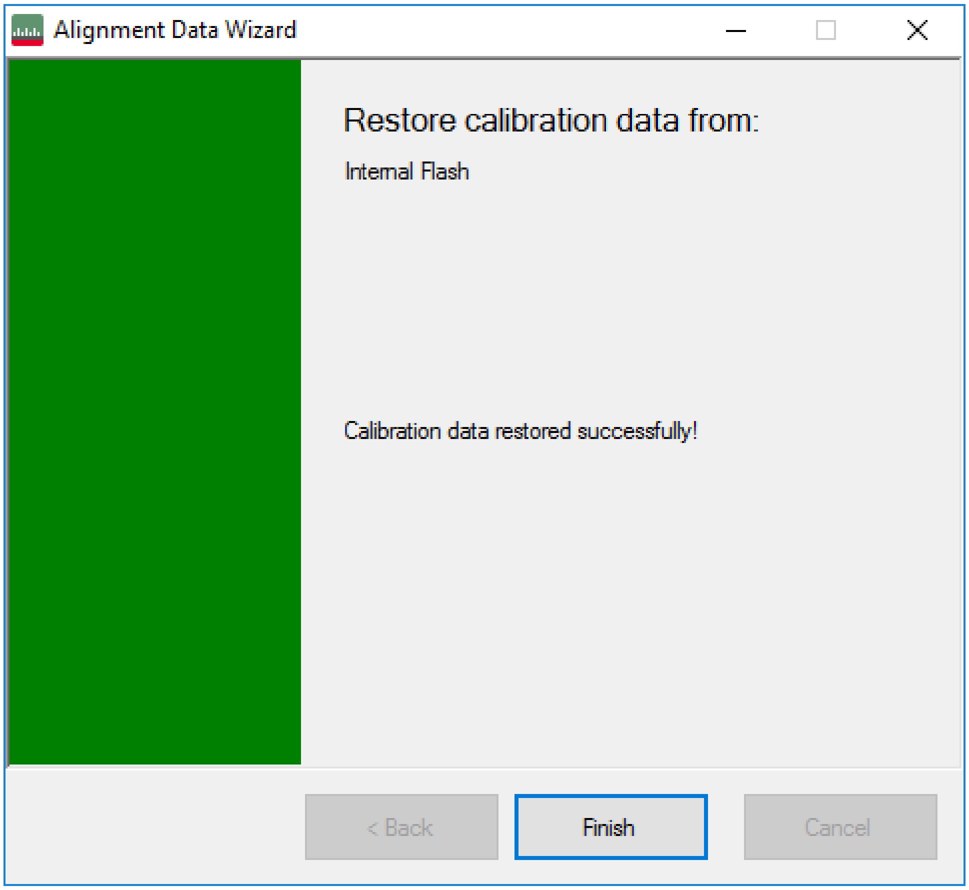
Backup:


Alignment Data Wizard
Backup calibration data to:
Internal Flash
< Back
Save
Cancel

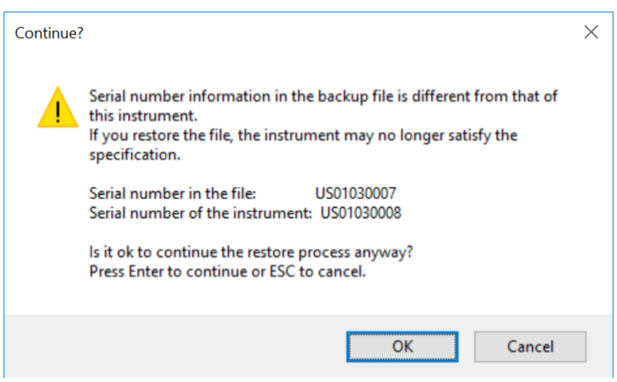

Alignment Data Wizard
Backup calibration data to:
Internal Flash
Calibration data backed up successfully!
< Back
Finish
Cancel

Restore:

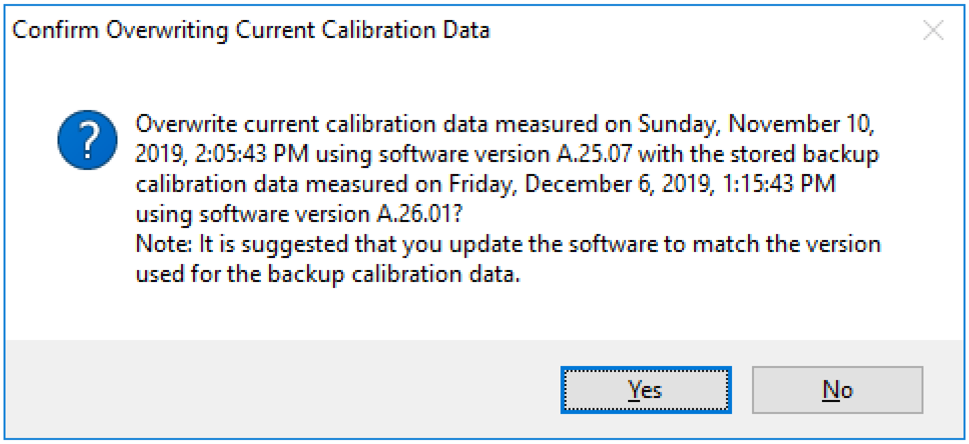

Alignment Data Wizard
Restore calibration data from:
Internal Flash
< Back
Restore
Cancel



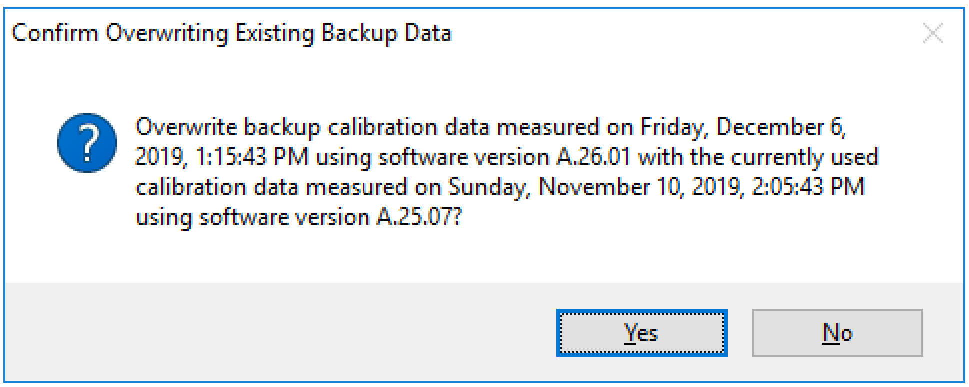
When restoring alignment data, if the serial number information in the backup file being restored is different from that of the instrument, the following message appears (the serial numbers shown are examples):



Immediately before the actual restoration, a final confirmation message is displayed detailing what is being restored and the current database that will be overwritten on the disk (the dates and versions are examples):



When backing up alignment data to the flash, if there is already an existing backup on the flash, a final confirmation message is displayed detailing what is being backed up and what will be overwritten on the flash (again, the dates and versions are examples):



5.6.6.5 Perform Backup (with Flash) (Remote Command Only)

Invokes an alignment data backup operation to the internal flash EEPROM.

Remote Command	`:CALibration:DATA:INTernal:BACKup`
Example	`:CAL:DATA:INT:BACK`

5.6.6.6 Perform Restore (With Flash) (Remote Command Only)

Invokes an alignment data restore operation from the internal flash EEPROM.

Remote Command	`:CALibration:DATA:INTernal:RESTore`
Example	`:CAL:DATA:INT:REST`

5.6.7 Restore Alignment Defaults

This selection causes the Alignment system settings to be reset to their default values. This does not affect any Alignment data stored in the system.

After performing this function, it may impact the auto-alignment time of the instrument until a new alignment baseline has been established.

When Alignments is selected, a message appears saying:

This will reset all of the settings for the Alignment system to their default values.

No alignment data will be erased.

This action cannot be undone. Do you want to proceed?

The message provides an OK and Cancel button for you to affirm or cancel the operation.

Align Now All must be executed if the value of the Timebase DAC results in a change.

Example	`:SYST:DEF ALIG`
Notes	Alignment processing that results as the transition to Auto Alignment Normal will be executed sequentially; thus `*OPC?` or `*WAI` will wait until the alignment processing is complete

The parameters affected are:

Parameter	Setting
Timebase DAC	Calibrated
Timebase DAC setting	Calibrated value
Auto Align State	Normal (if the instrument is not operating with default alignment data, Off otherwise)
Auto Align All but RF	Off
Auto Align Alert	Time & Temperature

5.7 Licensing

Accesses capabilities for configuring the licenses in your instrument.

5.7.1 License Manager

Pressing License Manager opens the license explorer for Fixed and Transportable licenses.

NOTE This feature is not available if option SF1 is installed.

For Help on licensing, select Help in the menu bar at the top of the license explorer window.

There are also five remote commands available for licensing. See:

– "Install License (Remote Command Only)" on page 403
– "Remove License (Remote Command Only)" on page 403
– "List Licenses (Remote Command Only)" on page 404
– "Validate License (Remote Command Only)" on page 404
– "Host ID Query (Remote Command Only)" on page 405
– "List Borrowed Licenses (Remote Command Only)" on page 405
– "Return a Borrowed License (Remote Command Only)" on page 405

Notes	No equivalent remote command for this control

Backwards Compatibility Notes	In ESA the SCPI command for displaying the Show Licenses screen is:
	`:SYSTem:CONFigure:LKEY:STATe OFF | ON | 0 | 1`
	`:SYSTem:CONFigure:LKEY:STATe?`
	There are no equivalent SCPI commands in the X-Series for displaying the License Explorer

5.7.2 Floating License Manager

Pressing Floating License Manager opens the license explorer for Network and USB Portable licenses.

NOTE This feature is not available if option SF1 is installed.

For Help on licensing, select Help in the menu bar at the top of the license explorer window.

5.7.3 Install License (Remote Command Only)

This command can be used to add a license to the instrument.

An example of such a command would be as below. The parameter is a unique 120 character code for each license.

SYST:LKEY “N9073A-1FP”,”027253AD27F83CDA5673A9BA5F427FDA5E4F25AEB1017638211AC9F60D9C639FE539735909C551DE0A91”

Another example using one of the optional clauses.

SYST:LKEY "N9063EM0E-1FP,2019.0330","02220210867E187713C9AFD4C90EA0DE2B674615DD0255798EE5B237A146A0D4E411E0ABFE04D3CAFDFA","ISSUED=30-Mar-2018"

NOTE: This command will not work for Transportable, Network or USB Portable licenses.

Remote Command	`:SYSTem:LKEY <”OptionInfo”>, <”LicenseInfo”>, <”Optional1”>, <”Optional2”>, <”Optional3”>, <”Optional4”>, <”Optional5”>`
Notes	`<”OptionInfo”>` contains the feature and the version. You must specify the feature but can omit the version. If you omit the version, the system regards it as the latest one, since the system knows which version is supported for each feature `<”LicenseInfo”>` contains the signature, the expiration date, and serial number for transport if transportable. You must specify the signature, but you can omit the other information. If you omit the expiration date, the system regards it as permanent. If you omit the serial number, the system regards it as non-transportable. As a result, this supports reverse compatibility `<”Optional#”>` are optional parameters that may be needed to match the information in the original license

5.7.4 Remove License (Remote Command Only)

Remove a particular license.

An example of such a command would be as below. The parameter is a unique 120 character code for each license.

SYST:LKEY:DEL “N9073A-1FP”,”027253AD27F83CDA5673A9BA5F427FDA5E4F25AEB1017638211AC9F60D9C639FE539735909C551DE0A91”

NOTE: This command will not work for Transportable, Network or USB Portable licenses.

Remote	`:SYSTem:LKEY:DELete <”OptionInfo”>,<”LicenseInfo”>`

Command	
Notes	<"OptionInfo"> contains the feature and the version. You must specify the feature but can omit the version. If you omit the version, the system regards it as the latest one, if more than one version is installed <"LicenseInfo"> contains the signature, the expiration date, and whether or not be transportable. You must specify the signature, but you can omit the other information. If you omit the expiration date, the system regards it as permanent. If you omit the transportability, the system regards it as non-transportable. As a result, this supports reverse compatibility

5.7.5 List Licenses (Remote Command Only)

Returns a list of installed licenses.

Remote Command	`:SYSTem:LKEY:LIST?`

Notes	Return Value:
	An <arbitrary block data> of all the installed instrument licenses
	The format of each license is as follows
	`<Feature>,<Version>,<Signature>,<Expiration Date>,<Serial Number for Transport>,…`
	Return Value Example:
	`#3136`
	`N9073A-1FP,1.000,B043920A51CA`
	`N9060A-2FP,1.000,4D1D1164BE64`
	`N9020A-508,1.000,389BC042F920`
	`N9073A-1F1,1.000,5D71E9BA814C,13-aug-2005`
	<arbitrary block data> is:
	`#NMMM<data>`
	Where:
	N is the number of digits that describes the number of MMM characters. For example if the data was 55 bytes, N would be 2
	MMM would be the ASCII representation of the number of bytes. In the previous example, N would be 55
	<data> ASCII contents of the data
	Additional fields may appear depending on the type of license (Fixed, Transportable, Network, USB Portable)

5.7.6 Validate License (Remote Command Only)

Allows you to query whether a particular license is currently valid.

Remote	`:SYSTem:LKEY? <"OptionInfo">`

Command	
Example	:SYST:LKEY? “N9073A-1FP”
Notes	<”OptionInfo”> contains the feature and the version. You must specify the feature but can omit the version. If you omit the version, the system regards it as the latest one Return Value: <”LicenseInfo”> if the license is valid, null otherwise <”LicenseInfo”> contains the signature, the expiration date, and serial number if transportable Return Value Example: “B043920A51CA”

5.7.7 Host ID Query (Remote Command Only)

Returns the host ID as a string.

Remote Command	:SYSTem:HID?

5.7.8 List Borrowed Licenses (Remote Command Only)

Remote Command	:SYSTem:LKEY:BORRow:LIST?
Example	:SYST:LKEY:BORR:LIST? #266 N9073EM0E,2018.0831,20-Aug-2018 N9077EM0E,2018.0831,20-Aug-2018

5.7.9 Return a Borrowed License (Remote Command Only)

Remote Command	:SYSTem:LKEY:BORRow:RETurn “<feature>”
Example	:SYST:LKEY:BORR:RET “N9080EM0E”
Dependencies	When the <feature> is not a valid license or when a license is not borrowed, one of the following errors will be issued: – -224, “Illegal Parameter Value; License is not installed” – -224, “Illegal Parameter Value; Unknown license feature” – -224, “Illegal Parameter Value; License not borrowed”

5.8 Security

Accesses capabilities for operating the instrument in a security controlled environment.

The Security page of the System menu has two controls on it, USB Read/Write and Restore Security Defaults.

Dependencies	This menu is not available on the M9391A or M9393A or UXM

5.8.1 USB Write Protect

The Windows operating system can be configured to disable write access to the USB ports for users who are in a secure environment where transferring data from the instrument is prohibited. The USB Write Protect control is a convenient way for the customer to disable write access to USB.

NOTE This control is only available to users with Administrator privileges.

Remote Command	`:SYSTem:SECurity:USB:WPRotect[:ENABle] ON | OFF | 0 | 1` `:SYSTem:SECurity:USB:WPRotect[:ENABle]?`

Example	`:SYST:SEC:USB:WPR ON`
	Sets USB ports to Read-only
	`:SYST:SEC:USB:WPR OFF`
	Sets USB ports to Read-Write

Notes	When the USB ports are in Read-only mode then no data can be stored to USB, including the internal USB memory used for a back-up location for the calibration data
Dependencies	This control is grayed-out unless the current user has Administrator privileges
Preset	This is unaffected by Preset or any Restore System Defaults. A Keysight Recovery sets the USB to write protect OFF
State Saved	No
Range	Read-Write|Read only

5.8.2 Restore Security Defaults

Pressing this button sets USB Read/Write to Enable.

NOTE This control is only available to users with Administrator privileges.

5.9 Diagnostics

The Diagnostics page of the System menu has a slider on it that allows you to view Hardware Statistics.

Dependencies	This menu is not available on the M9391A or M9393A or UXM

5.9.1 Show Hardware Statistics

Provides a display of various hardware statistics. The statistics include the following:

- Mechanical relay cycles (on models with mechanical relays)
- High and Low temperature extremes
- Elapsed time that the instrument has been powered-on (odometer)

The display should appear listing the statistics, product number, serial number, and firmware revision.

The CXA models in which the AC/DC Switch field is called Fixed Atten and that omit the mechanical attenuation fields are the N9000A-503/507 models.

Modular HWs only have time and temperature information in Show Hardware Statistics.

The data will be updated only when the Show Hardware Statistics control is pressed, it will not be updated while the screen is displayed.

The tabular data should be directly printable.

Example	`:SYST:SHOW HWST`
Notes	The values displayed on the screen are only updated upon entry to the screen and not updated while the screen is being displayed

5.9.2 Query the Mechanical Relay Cycle Count (Remote Command Only)

Return the count of mechanical relay cycles. For N9038A model, there are additional 2 Mechanical Relays which are <N9038A Input2>, <N9038A Bypass>.

Remote Command	`:SYSTem:MRELay:COUNt?`
Example	`:SYST:MREL:COUN?`
Notes	Query Only The return value is a comma separated list of the individual counts for each mechanical relay The position of the relays in the list is: "<Cal Signal>,<AC/DC>,<2dB #1 Atten>,<2dB #2 Atten>,<6dB Atten>,<10dB Atten>,<20dB

	Atten>,<30dB Atten>,<Fixed Atten>,<Low Noise Path Switch>,<Presel Bypass>,<N9038A Input2>, <N9038A Bypass>" Items in the list not pertaining to your particular hardware configuration will return as -999 for those items For the E7760, all items return -999
Dependencies	This SCPI command is *not* supported by the E6607C model

5.9.3 Query the Operating Temperature Extremes (Remote Command Only)

Returns the low operating temperature extreme value. The value survives a power-cycle and is the temperature extreme encountered since the value was reset by the factory or service center.

Remote Command	`:SYSTem:TEMPerature:LEXTreme?`
Example	`:SYST:TEMP:LEXT?`
Notes	Value is in degrees Celsius at which the lowest operating temperature has been recorded since 1st power-up
State Saved	No

Returns the high operating temperature extreme value. The value survives a power-cycle and is the temperature extreme encountered since the value was reset by the factory or service center.

Remote Command	`:SYSTem:TEMPerature:HEXTreme?`
Example	`:SYST:TEMP:HEXT?`
Notes	Value is in degrees Celsius at which the highest operating temperature has been recorded since 1st power-up
State Saved	No

5.9.4 Query the Elapsed Time since 1st power on (Remote Command Only)

Returns the elapsed on-time in minutes since 1st power-on.

Remote Command	`:SYSTem:PON:ETIMe?`
Example	`:SYST:PON:ETIM?`
Notes	Query Only

5.10 Service

Accesses capabilities performed in the factory or under instructions from repair procedures. This menu key is only visible when the logged-in user is “advanceduser” or “saservice”. The first access to the Service Menu after invoking the instrument application will require an authentication Service Code.

Dependencies	This menu is not available on the M9391A or M9393A or UXM

5.11 System Remote Commands (Remote Commands Only)

The commands listed below have no front-panel key equivalent.

– "List installed Options (Remote Command Only)" on page 410
– "Lock the Front-panel keys (Remote Command Only)" on page 410
– Lock Workstation (Remote Command Only)
– "List SCPI Commands (Remote Command Only)" on page 411
– "Front Panel activity history (Remote Command only)" on page 411
– "SCPI activity history (Remote Command only)" on page 412
– "Instrument start time (Remote Command only)" on page 412
– "SCPI Version Query (Remote Command Only)" on page 413
– "Date (Remote Command Only)" on page 413
– "Time (Remote Command Only)" on page 413

5.11.1 List installed Options (Remote Command Only)

Lists the installed options that pertain to the instrument (signal analyzer). .

Remote Command	`:SYSTem:OPTions?`
Example	`:SYST:OPT?`
Notes	The return string is a comma separated list of the installed options. For example: `“503,P03,PFR”` `:SYSTem:OPTions?` and `*OPT?` are the same
State Saved	No

5.11.2 Lock the Front-panel keys (Remote Command Only)

Disables the instrument keyboard to prevent local input when the instrument is controlled remotely. Annunciation showing a “K” for ‘Klock” (keyboard lock) alerts the local user that the keyboard is locked. Klock is similar to the GPIB Local Lockout function; namely that no front-panel keys are active with the exception of the Power Standby key. (The instrument is allowed to be turned-off if Klock is ON.) The Klock command is used in remote control situations where Local Lockout cannot be used.

Although primary intent of Klock is to lock-out the front panel, it will lock-out externally connected keyboards through USB. Klock has no effect on externally connected pointing devices (mice).

The front panel '**Local**' key (**Cancel**/**Esc**) has no effect if Klock is ON.

See also Local Button@1000.

Remote Command	`:SYSTem:KLOCk OFF | ON | 0 | 1` `:SYSTem:KLOCk?`
Example	`:SYST:KLOC ON`
Notes	Keyboard lock remains in effect until turned-off or the instrument is power-cycled
Preset	Initialized to OFF at startup, unaffected by Preset
State Saved	No

5.11.3 List SCPI Commands (Remote Command Only)

Outputs a list of the valid SCPI commands for the currently selected Mode.

Remote Command	`:SYSTem:HELP:HEADers?`
Example	`:SYST:HELP:HEAD?`
Notes	The output is an IEEE Block format with each command separated with the New-Line character (hex 0x0A)

5.11.4 Front Panel activity history (Remote Command only)

Instrument front panel usage can be monitored by using the query `:SYSTem:METRics:FPANel?`. The monitoring occurs for front panel hardkey or softkey operation (including mouse or touch operation on instruments with Multi-Touch User Interface). The information of the usage pertains to the activity since the instrument application was started; the information does not persist after the application is terminated, or the instrument has been rebooted.

To prevent the front panel from being placed into Remote the monitoring must occur via an I/O protocol such as LAN Socket, or the remote program performing the monitoring must explicitly place the instrument into Local after the query has been performed.

Remote Command	`:SYSTem:METRics:FPANel?`
Example	`:SYST:METR:FPAN?`
Notes	The return value is a string with the format "`YYYY-MM-DD<space>HH:MM:SS`", in instrument local time If no front panel activity has occurred since the instrument was booted (instrument application started), the return value will be the time the instrument application started. The instrument application start time can be obtained with the query `:SYSTem:METRics:STIMe?`

5.11.5 SCPI activity history (Remote Command only)

Instrument remote operation usage via SCPI can be monitored by using the query :SYSTem:METRics:SCPI?. The monitoring occurs for SCPI control from any I/O channel (GPIB, USB, or LAN). The information of the usage pertains to the activity since the instrument application was started; the information does not persist after the application is terminated, or the instrument has been rebooted.

Remote Command	:SYSTem:METRics:SCPI?
Example	:SYST:METR:SCPI?
Notes	The return value is a string with the format "YYYY-MM-DD<space>HH:MM:SS", in instrument local time The following commands are excluded from the history accounting: – *IDN? – *OPT? – :SYSTem:DATE? – :SYSTem:TIME? – :SYSTem:PON:TIME? – Queries in the :SYSTem:ERRor subsystem – Queries in the :SYSTem:LKEY subsystem – Queries in the :SYSTem:METRics subsystem – Queries in the :SYSTem:MODule subsystem If no SCPI activity has occurred since the instrument was booted (instrument application started), the return value will be the time the instrument application started. The instrument application start time can be obtained with the query :SYSTem:METRics:STIMe?

5.11.6 Instrument start time (Remote Command only)

To determine if instrument activity has occurred, the SCPI query :SYSTem:METRics:STIMe? can be used to determine the instrument application start time.

Remote Command	:SYSTem:METRics:STIMe?
Example	:SYST:METR:STIM?
Notes	The return value is a string with the format "YYYY-MM-DD<space>HH:MM:SS", in instrument local time

5.11.7 SCPI Version Query (Remote Command Only)

Returns the SCPI version number with which the instrument complies. The SCPI industry standard changes regularly. This command indicates the version used when the instrument SCPI commands were defined.

Remote Command	`:SYSTem:VERSion?`
Example	`:SYST:VERS?`

5.11.8 Date (Remote Command Only)

The recommended access to the Date, Time, and Time zone of the instrument is through the Windows native control (Control Panel or accessing the Task Bar). You may also access this information remotely, as shown in this command and Time (below).

Sets or queries the date in the instrument.

Remote Command	`:SYSTem:DATE “<year>,<month>,<day>”` `:SYSTem:DATE?`
Example	`:SYST:DATE “2006,05,26”`
Notes	`<year>` is the four digit representation of year (for example, 2006) `<month>` is the two digit representation of year (01 to 12) `<day>` is the two digit representation of day (01 to 28, 29, 30, or 31, depending on the month and year) Unless the current account has Power User or Administrator privileges, an error will be generated by this command and no action will be taken

5.11.9 Time (Remote Command Only)

Sets or queries the time in the instrument.

Remote Command	`:SYSTem:TIME “<hour>,<minute>,<second>”` `:SYSTem:TIME?`
Example	`:SYST:TIME “13,05,26”`
Notes	`<hour>` is the two digit representation of the hour in 24 hour format `<minute>` is the two digit representation of minute `<second>` is the two digit representation of second Unless the current account has Power User or Administrator privileges, an error will be generated by this command and no action will be taken

6 Preset

The Preset functions are available in two ways; either by pressing the **Mode Preset** or **User Preset** front panel keys, or from the Preset dropdown menu that appears when you press the green Preset icon in the upper right corner of the display.

Types of Preset

The table below shows all possible presets, their corresponding SCPI commands and front-panel access methods.

Instrument settings are tiered in scope from those local to the current measurement to those global to all measurements and modes. There are presets tailored to each scope. The table identifies the scope of each preset type.

NOTE

To get a Mode back to a fully predefined state, you should execute a Restore Mode Defaults and an Input/Output Preset, but since Input/Output Preset is a global function it will affect ALL modes.

Type Of Preset	SCPI Command	Scope of Preset	Front Panel Access
Auto Couple	`:COUPle ALL`	Local to the current measurement, only affects Auto/Man variables	Meas Setup Menu
Meas Preset	`:CONFigure:<meas>`	Local to the current measurement Does not preset the RF Source	Meas Setup Menu
Mode Preset	`:SYSTem:PRESet`	Local to the current mode, global to all measurements in the mode, affects most but not all parameters in the mode, does not affect Input/Output or System variables Presets the RF Source	Mode Preset (green key) and Preset Dropdown
Restore Mode Defaults	`:INSTrument:DEFault`	Local to the current mode, global to all measurements in the mode, affects all parameters in the mode but does not affect Input/Output or System variables, does not preset the RF Source.	Preset Dropdown
Restore Defaults All Modes	`:SYSTem:DEFault MODes`	Affects all parameters in ALL modes but does not affect Input/Output or	Preset Dropdown

Type Of Preset	SCPI Command	Scope of Preset	Front Panel Access
		System variables Presets the RF Source	
Restore Screen Defaults	`:SYSTem:DEFault SCReen`	Deletes all Screens but one, restores that screen to its default mode and performs a Mode Preset for that mode. Does not affect Input/Output or System variables Presets the RF Source	Preset Dropdown
User Preset	`:SYSTem:PRESet:USER`	Local to the current mode, global to all measurements in the mode, affects all parameters in the mode as well as the Input/Output variables Does not affect System variables	User Preset hardkey and Preset Dropdown
User Preset All Modes	`:SYSTem:PRESet:USER:ALL`	Same as User Preset but affects all Modes in the current Screen	Preset Dropdown
User Preset All Screens		Affects the entire Screen Configuration; global to all Modes and Screens	Preset Dropdown
*RST	`*RST`	Same as Mode Preset - and in addition always sets Single/Cont to Single	Not available from front panel
Input/Output Preset	`:SYSTem:DEFault INPut`	Affects all Input/Output variables	Input/Output menu, Preset dropdown, and

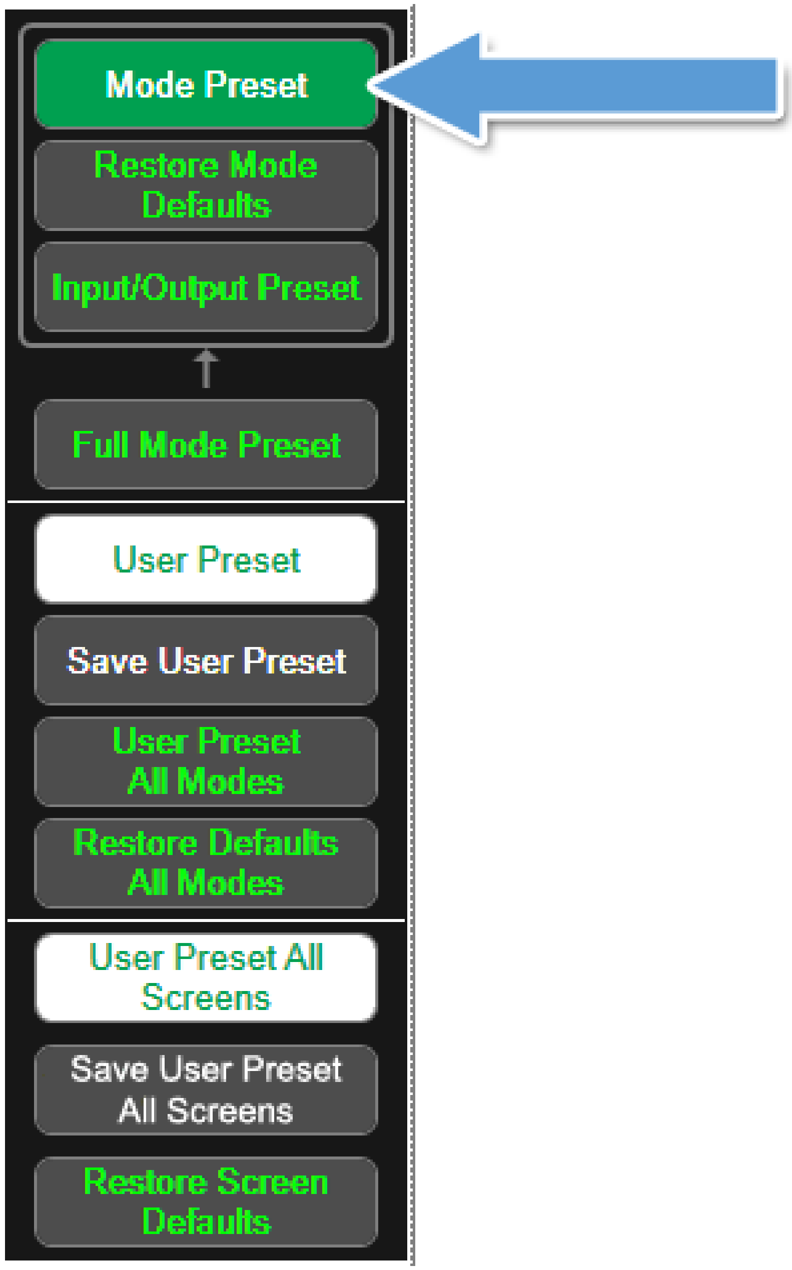
Type Of Preset	SCPI Command	Scope of Preset	Front Panel Access
		Does not preset the RF Source	System Menu, Restore Defaults
Full Mode Preset	`:SYSTem:PRESet:FULL`	Same as doing Mode Preset, Restore Mode Defaults and Input/Output Preset. Essentially a factory preset of the current Mode Presets the RF Source	Preset Dropdown
Restore User Interface Defaults	`:SYSTem:DEFault UINTerface`	Affects all variables in the "User Interface" group Does not preset the RF Source	System Menu, Restore Defaults and User Interface tabs
Restore Power On Defaults	`:SYSTem:DEFault PON`	Affects all variables in the "Power On" group Presets the RF Source	System Menu: Restore Defaults and Power On tabs
Restore Alignment Defaults	`:SYSTem:DEFault ALIGn`	Affects all variables in the "Alignments" group Presets the RF Source	System Menu, Restore Defaults and Alignments tabs
Restore Miscellaneous Defaults	`:SYSTem:DEFault MISC`	Affects various variables not reset by other commands Presets the RF Source	System Menu, Restore Defaults
Restore All Defaults	`:SYSTem:DEFault [ALL]` `:SYSTem:PRESet:PERSistent`	Affects all variables Presets the RF Source	System Menu, Restore Defaults

6.1 Mode Preset

Returns the current Mode to a known state. Mode Preset only presets the current Screen, it does not affect any other Screens.

Mode Preset also presets the RF Source. In this sense it is equivalent to pressing **Source Preset** on the **Input/Output, RF Source** menu panel.

Mode Preset can be executed from the Preset dropdown or by pressing the **Mode Preset** front panel key.



Mode Preset does the following for the currently active mode:

– Aborts the currently running measurement.

– Switches to the default measurement and brings up the default menu for that measurement.

– Sets most parameters for the Mode and all of its Measurements to a preset state.

– Clears the input and output buffers.

– Sets Status Byte to 0.

Mode Preset does not cause a Mode switch or affect any Input/Output or System settings (those set in the System Settings dialog).

Furthermore, there are some Mode settings that are unaffected by a Mode Preset (for example, Noise Floor Extensions, Limit Line data, reference marker numbers, etc.) These are only reset by Restore Mode Defaults, and in each parameter's definition table there is a note that indicates whether it is reset on a Mode Preset or on a Restore Mode Defaults.

See "Preset" on page 414 for more information.

Remote Command	`:SYSTem:PRESet`
Example	`:SYST:PRES`
Notes	`*RST` is preferred over :`SYST:PRES` for remote operation. `*RST` does a Mode Preset, as done by the `:SYST:PRES` command, and it sets the measurement mode to **Single** measurement rather than **Continuous**, for optimal remote control throughput See "*RST - Reset" on page 619
Status Bits/OPC dependencies	Clears all pending OPC bits. The Status Byte is set to 0
Backwards Compatibility Notes	In the X-Series, the legacy "Factory Preset" has been replaced with Mode Preset, which only presets the currently active mode, not the entire instrument. In the X-Series, the way to preset the entire instrument is by using System, Restore System Defaults All, which behaves essentially the same way as restore System Defaults does on ESA and PSA There is also no "Preset Type" as there is on the PSA. There is a green Mode Preset front-panel key that does a Mode Preset and a white-with-green-letters User Preset front-panel key that does a User Preset. The old PRESet:TYPE command is ignored (without generating an error), and SYST:PRES without a parameter does a Mode Preset, which should cover most backward code compatibility issues The settings and correction data under the Input/Output front-panel key (examples: Input Z Corr, Ext Amp Gain, etc.) are no longer part of any Mode, so they will not be preset by a Mode Preset. They are preset using Restore Input/Output Defaults, Restore System Defaults All. Note that because User Preset does a Recall State, and all of these settings are saved in State, they *are* recalled when using User Preset

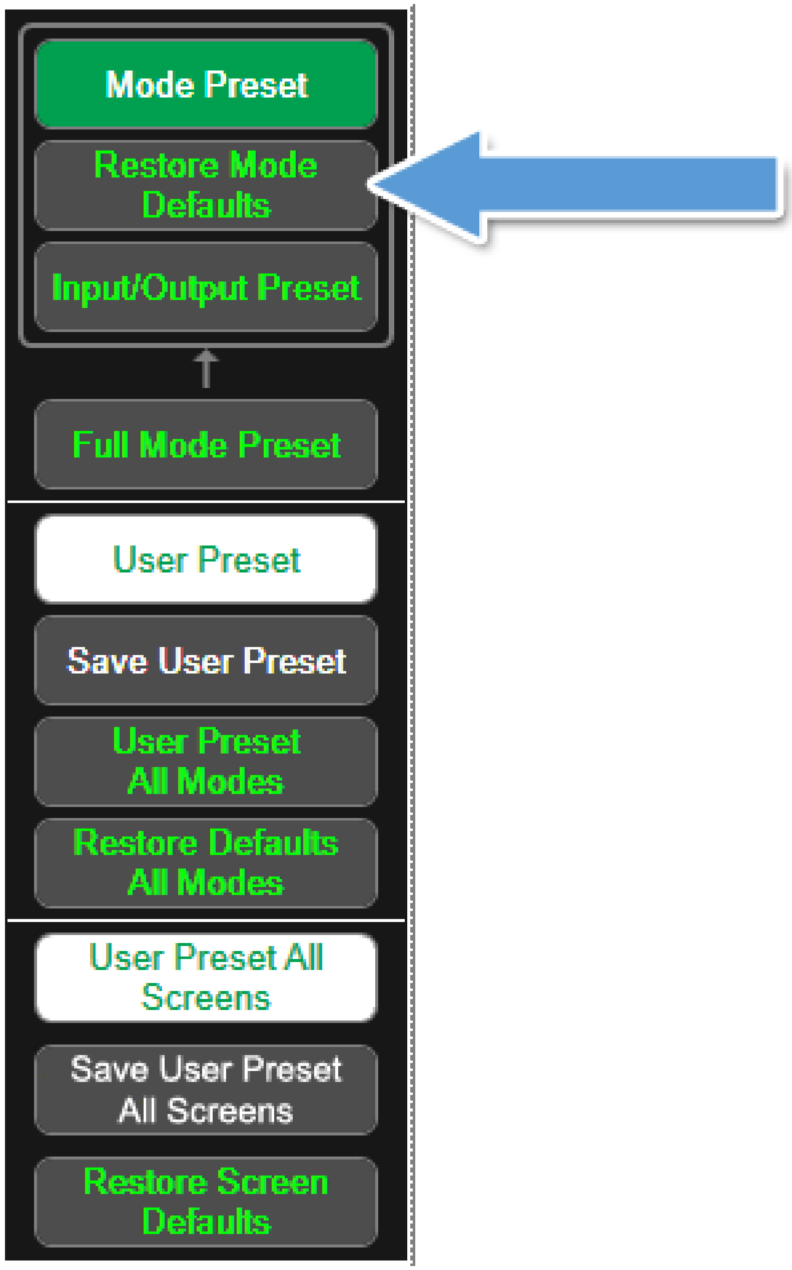
6.2 Restore Mode Defaults

Most settings within a mode are affected by Mode Preset, but there are some Mode settings that are unaffected by a Mode Preset (for example, Noise Floor Extensions, Limit Line data, reference marker numbers, etc.) **Restore Mode Defaults** resets all of these additional settings as well as all of the Mode Preset settings, *except* the RF Source.

In each parameter's definition table, there is a note that indicates whether that parameter is reset on **Mode Preset** or on **Restore Mode Defaults**.

Note that a Recall State affects all of a Mode's settings, both the Mode Preset settings and the ones additionally affected by Restore Mode Defaults.

Restore Mode Defaults can be executed from the Preset dropdown.



When **Restore Mode Defaults** is selected, a message appears saying

`This will reset all of the current Mode’s variables to their default state. This action cannot be undone. Do you want to proceed?`

The message provides **OK** and **Cancel** buttons, to let you affirm or cancel the reset operation.

Remote Command	`:INSTrument:DEFault`
Example	`:INST:DEF`
Notes	Clears all pending OPC bits. The Status Byte is set to 0

Couplings	Restore Mode Defaults causes the currently running measurement to be aborted and causes the default measurement to be active. It gets the mode to a consistent state with all of the default couplings set

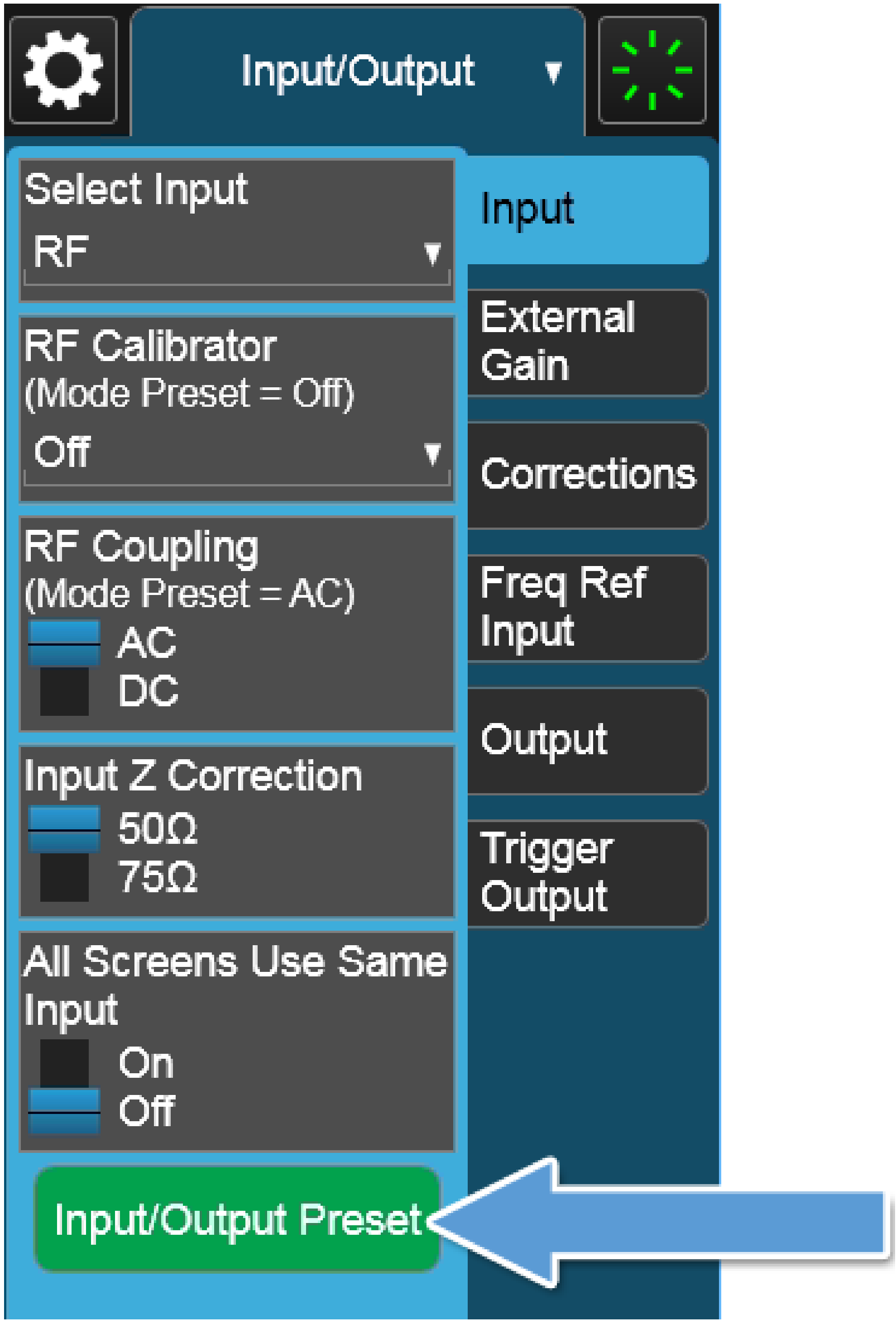
6.3 Input/Output Preset

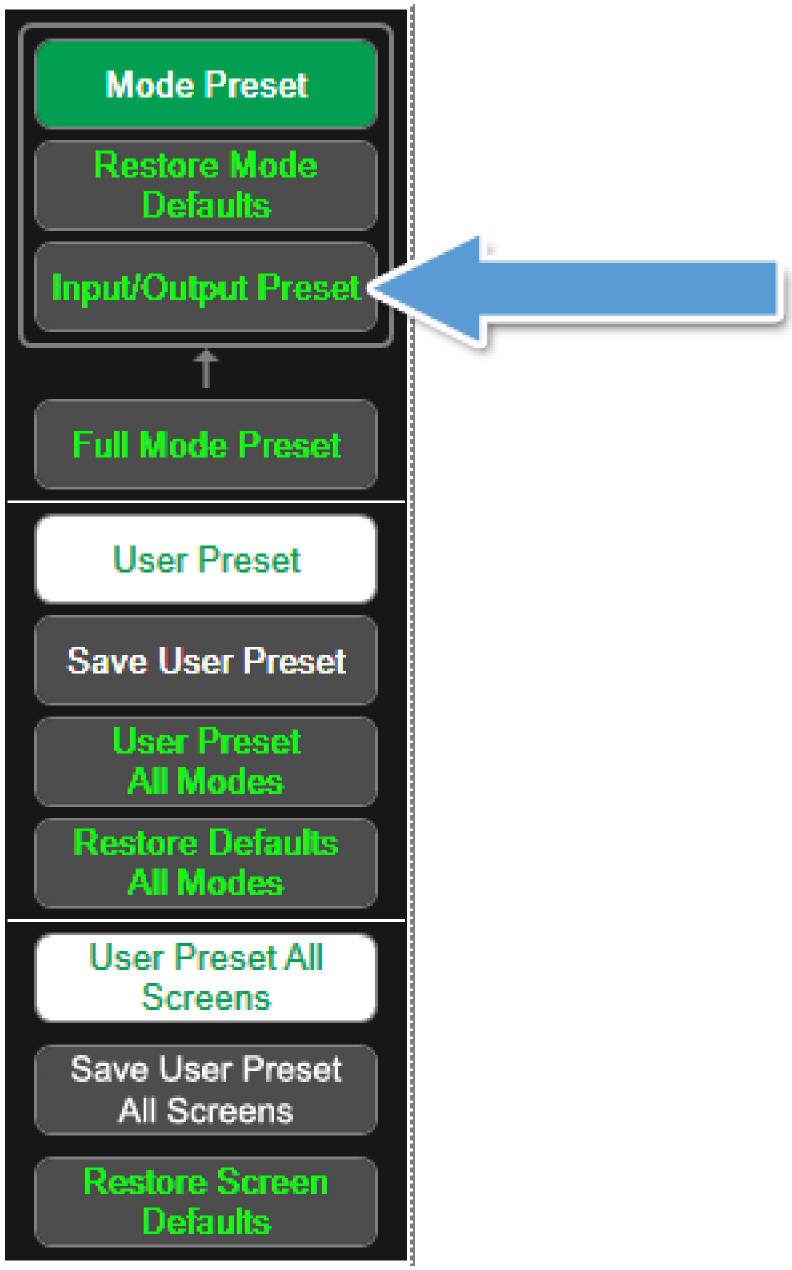
Input/Output Preset resets the group of settings and data associated with the Input/Output front-panel key to their default values. These settings are not affected by a Mode Preset because they are generally associated with connections to the instrument, and most users would not want these resetting every time they pressed the Mode Preset key.

All the variables set under the Input/Output front panel key are reset by Input/Output Preset, including Amplitude Corrections and Data (described in the Corrections section), with the exception of RF Source settings, which are unaffected.

By using Input/Output Preset and Restore Mode Defaults, a full preset of the current mode will be performed, with the caveat that since Input/Output Preset is a global function it will affect ALL modes.

Input/Output Preset can be executed from the Input/Output menu, from the Preset dropdown, or from the Restore Defaults menu under the System key.


Input/Output
Select Input
RF
RF Calibrator
(Mode Preset = Off)
Off
RF Coupling
(Mode Preset = AC)
AC
DC
Input Z Correction
50Ω
75Ω
All Screens Use Same Input
On
Off
Input/Output Preset
Input
External Gain
Corrections
Freq Ref Input
Output
Trigger Output


Mode Preset
Restore Mode Defaults
Input/Output Preset
Full Mode Preset
User Preset
Save User Preset
User Preset All Modes
Restore Defaults All Modes
User Preset All Screens
Save User Preset All Screens
Restore Screen Defaults

When Input/Output Preset is selected, a message appears saying:

“This will reset all of the Input/Output variables to their default state, including which input is selected, all Amplitude Correction settings and data, all External Mixing settings, all Frequency Reference settings and all Output settings.

It will not affect Alignment data or settings.

It will not affect RF Source settings.

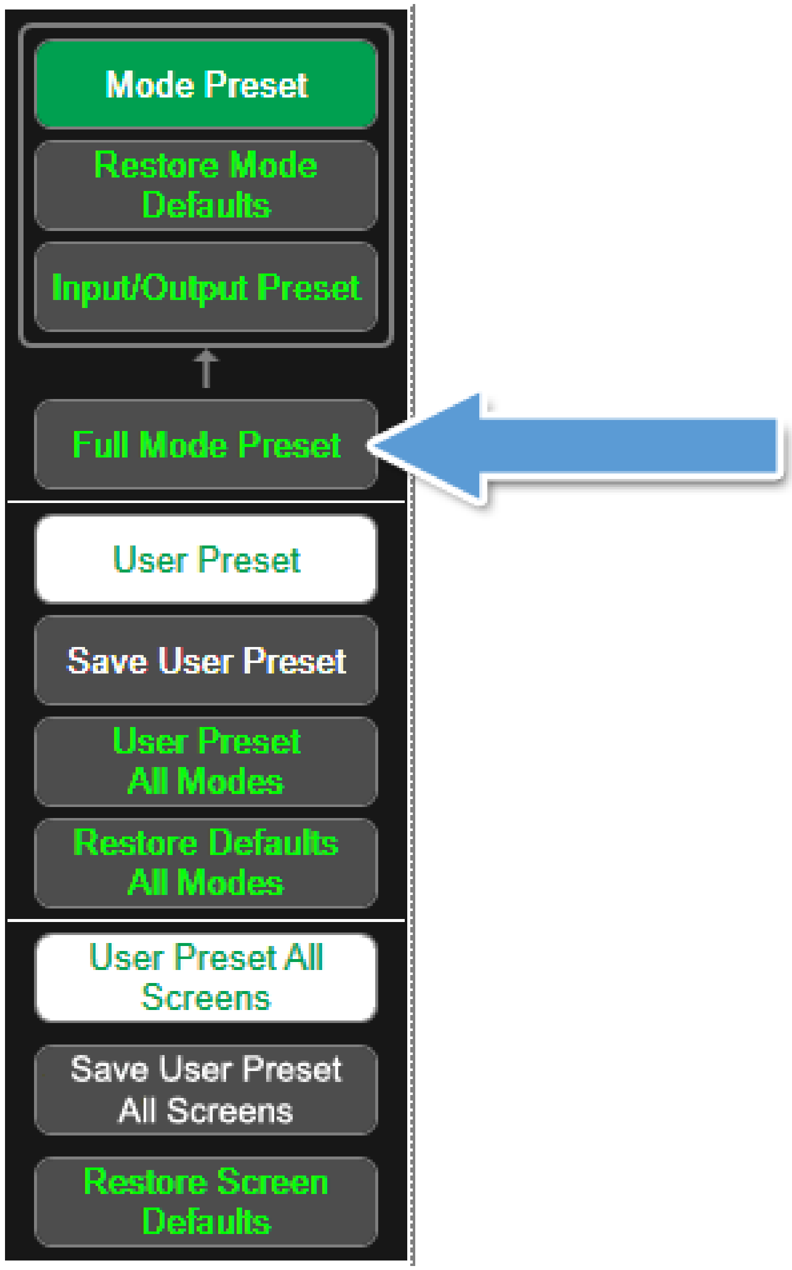
This action cannot be undone. Do you want to proceed?”

The message provides **OK** and **Cancel** buttons, to let you affirm or cancel the operation.

Example	`:SYST:DEF INP` Presets all the Input/Output variables to their factory default values

6.4 Full Mode Preset

Same as doing Mode Preset, Restore Mode Defaults and Input/Output Preset. Essentially a factory preset of the current Mode.



When Full Mode Preset is selected, a message appears saying:

"This will reset all of the current Mode's variables and all of the Input/Output variables to their default state, including Input and Output selection and settings, Amplitude Correction, Frequency Reference and RF Source settings.

It will not affect Alignment data or settings.

This action cannot be undone. Do you want to proceed?”

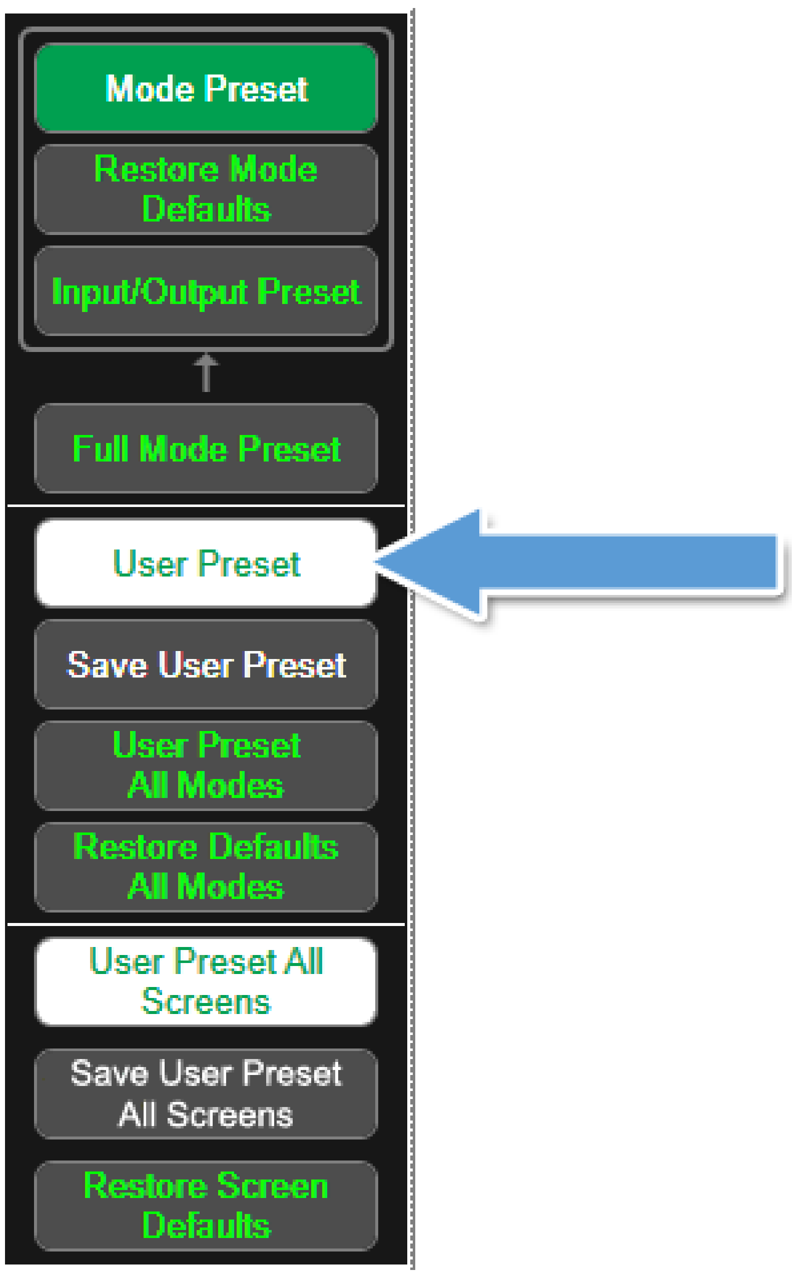
The message provides **OK** and **Cancel** buttons, to let you affirm or cancel the operation.

Remote Command	`:SYSTem:PRESet:FULL`
Example	`:SYST:PRES:FULL`
Status Bits/OPC dependencies	Clears all pending OPC bits. The Status Byte is set to 0

6.5 User Preset

User Preset recalls a state previously saved using the **Save User Preset** function. You can save a User Preset state for each Mode, allowing you to define your own favorite state for each Mode and recall it at the touch of a single button.

User Preset can be executed by pressing the **User Preset** front panel key or from the Preset dropdown.



Because User Preset is actually a Recall State, rather than a predefined Preset, it works a little differently than Mode Preset, in that it affects all of the variables that normally only reset on Restore Mode Defaults, and it affects the Input/Output variables, because both of these are included in State files.

A default User Preset file is provided for each Mode, which simply matches the current Mode's state after a Restore Mode Defaults and Input/Output Preset has been performed.

NOTE **In products that run multiple instances of the X-Series Application, all instances use the same location to save User Preset state. So Save User Preset of one instance will overwrite the Save User Preset of another instance.**

Remote Command	`:SYSTem:PRESet:USER`

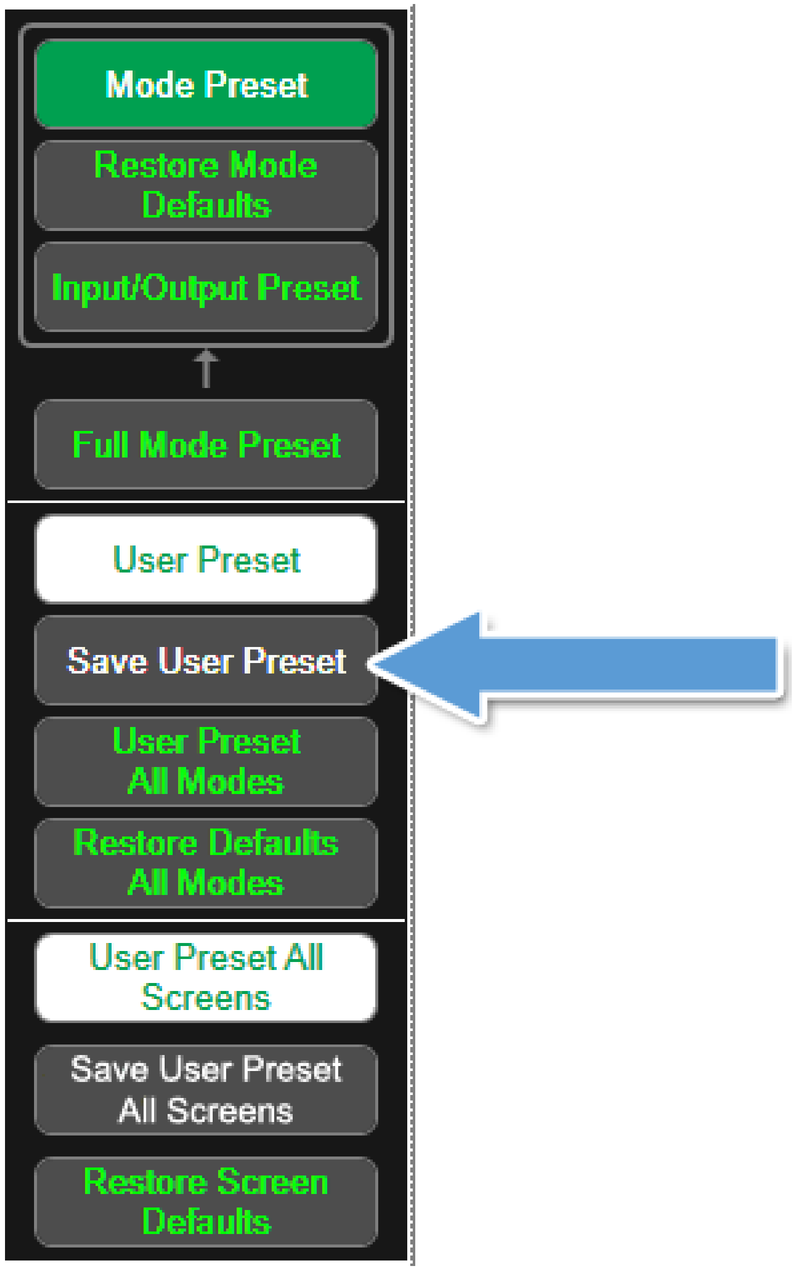
Example	`:SYST:PRES:USER:SAVE`
	Save the User Preset
	`:SYST:PRES:USER`
	Recall the User Preset

Notes	`:SYST:PRES:USER:SAVE` is used to save the current state as the user preset state If loading a User Preset file from a different instrument, some settings may be limited and/or coupled differently, since the capabilities of the mode may have changed from when the User Preset file was saved
Status Bits/OPC dependencies	Clears all pending OPC bits. The Status Byte is set to 0
Backwards Compatibility Notes	In the X-Series A-models, the **User Preset** hardkey opened a menu that let you select from User Preset, Save User Preset, or User Preset All Modes. In the B-models, the **User Preset** hardkey immediately performs a User Preset, and the aforementioned menu is found under the Preset dropdown User Preset actually loads a state, and in legacy analyzers, it was possible to load a state without affecting the trace data, limit lines or correction data. Similarly it was possible to do a User Preset without affecting the trace data, limit lines or correction data In the X-Series, "state" always includes all of this data; so whenever state is loaded, or User Preset is executed, all of the traces, limit lines and corrections are affected. Although this differs from previous behavior, it is desirable behavior, and should not cause adverse issues for users On ESA and PSA, User Preset affected the entire instrument's state. In the X-Series, User Preset only recalls the state for the active mode. There is a User Preset file for each mode. User Preset can never cause a mode switch as it can in legacy analyzers. If you want to recall all modes to their user preset file state, you will need to do a User Preset *after* mode switching into each mode User Preset recalls mode state, which can now include data like traces, whereas on ESA and PSA, User Preset did not affect data

6.6 Save User Preset

Saves the state of the currently active mode in a unique location for recall by the User Preset key. Each Mode has one such location, so for each Mode one User Preset can be defined.

Save User Preset can be executed from the Preset dropdown.



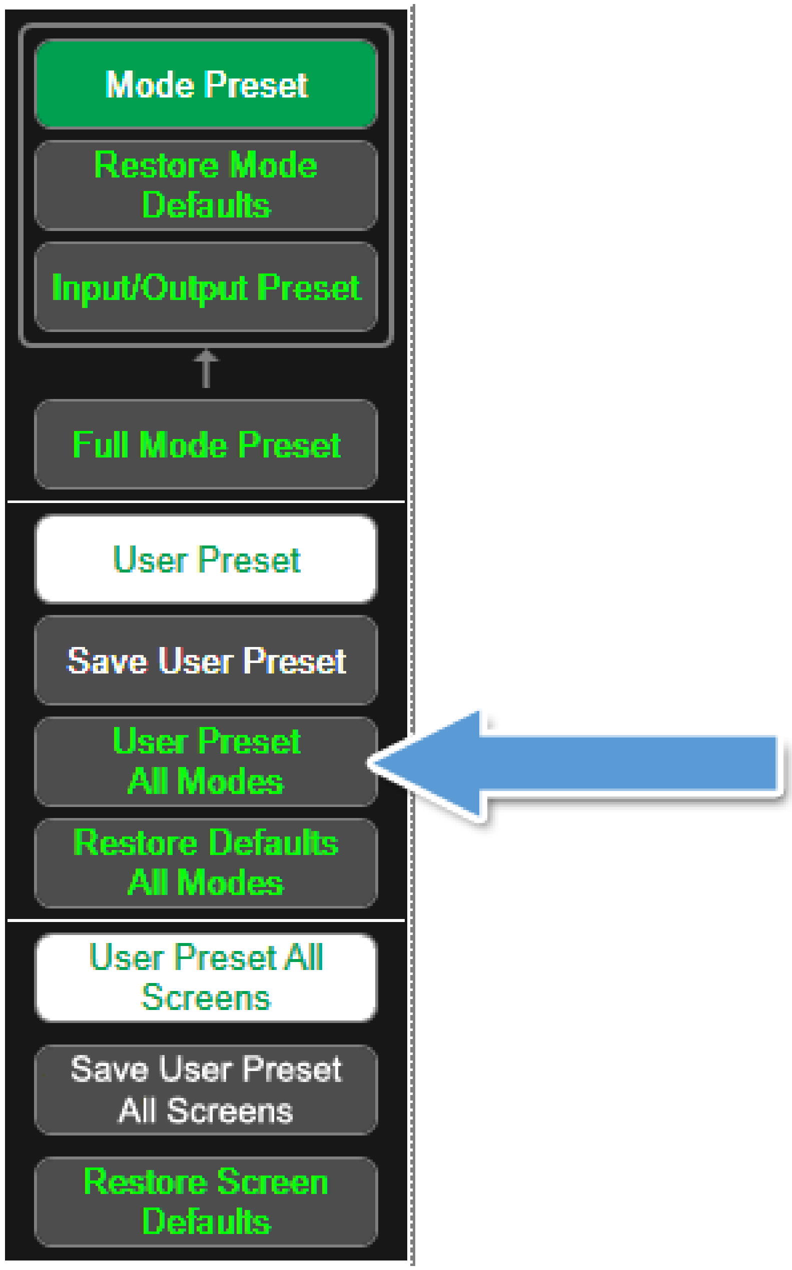
All of the Mode variables are saved, including those reset by Mode Preset and those only reset by Restore Mode Defaults, as well as all of the Input/Output variables, so when you subsequently press the **User Preset** key, the instrument returns to the exact same setup that existed when you pressed the **Save User Preset** control. Thus, User Preset is a preset of larger scope than Mode Preset.

Remote Command	`:SYSTem:PRESet:USER:SAVE`
Example	`:SYST:PRES:USER:SAVE`
Notes	`:SYST:PRES:SAVE` creates the same file as if you requested a `*SAV` or a `:MMEM: STOR:STAT`, except that User Preset Save does not allow you to specify the filename or the location of the file

6.7 User Preset All Modes

User Preset All Modes recalls all of the User Preset files for each mode, switches to the power-on mode, and activates the saved measurement from the power-on mode User Preset file.

User Preset All Modes can be executed from the Preset dropdown.



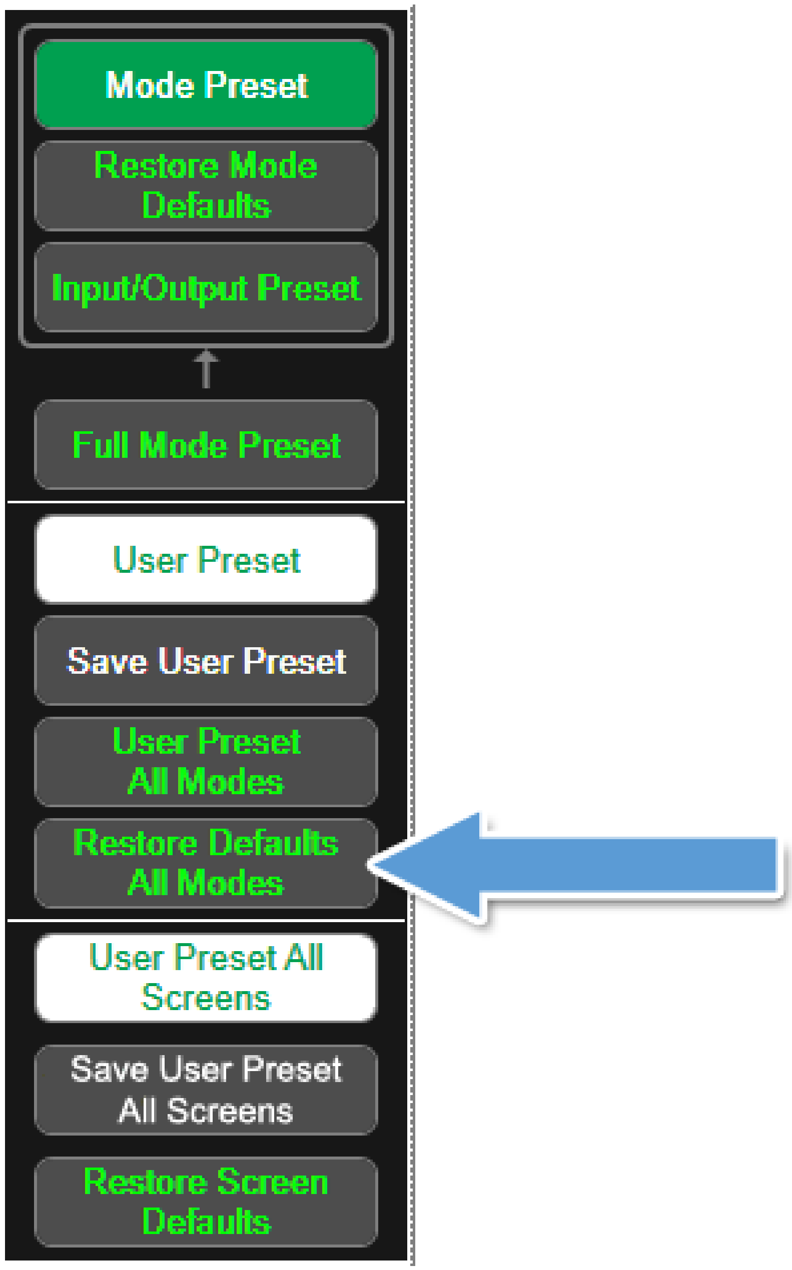
See the "User Preset" on page 431 description for more details on User Preset.

Remote Command	`:SYSTem:PRESet:USER:ALL`
Example	`:SYST:PRES:USER:SAVE` `:SYST:PRES:USER:ALL`
Notes	`:SYST:PRES:USER:SAVE` is used to save the current state as the user preset state
Status Bits/OPC dependencies	Clears all pending OPC bits. The Status Byte is set to 0

6.8 Restore Defaults All Modes

This selection resets all of the Modes in the current Screen back to their default state just as a **Restore Mode Defaults** does, switches the current Screen to the power-on mode, and causes the default measurement for the **Power On Mode** to be active in the current Screen. Only the current Screen is affected.

Restore Defaults All Modes can be executed from the Preset dropdown.



When Restore Defaults All Modes is selected, a message appears saying:

"This will reset all of the variables for all of the Modes in the current Screen to their default state. This action cannot be undone. Do you want to proceed?"

The message provides **OK** and **Cancel** buttons.

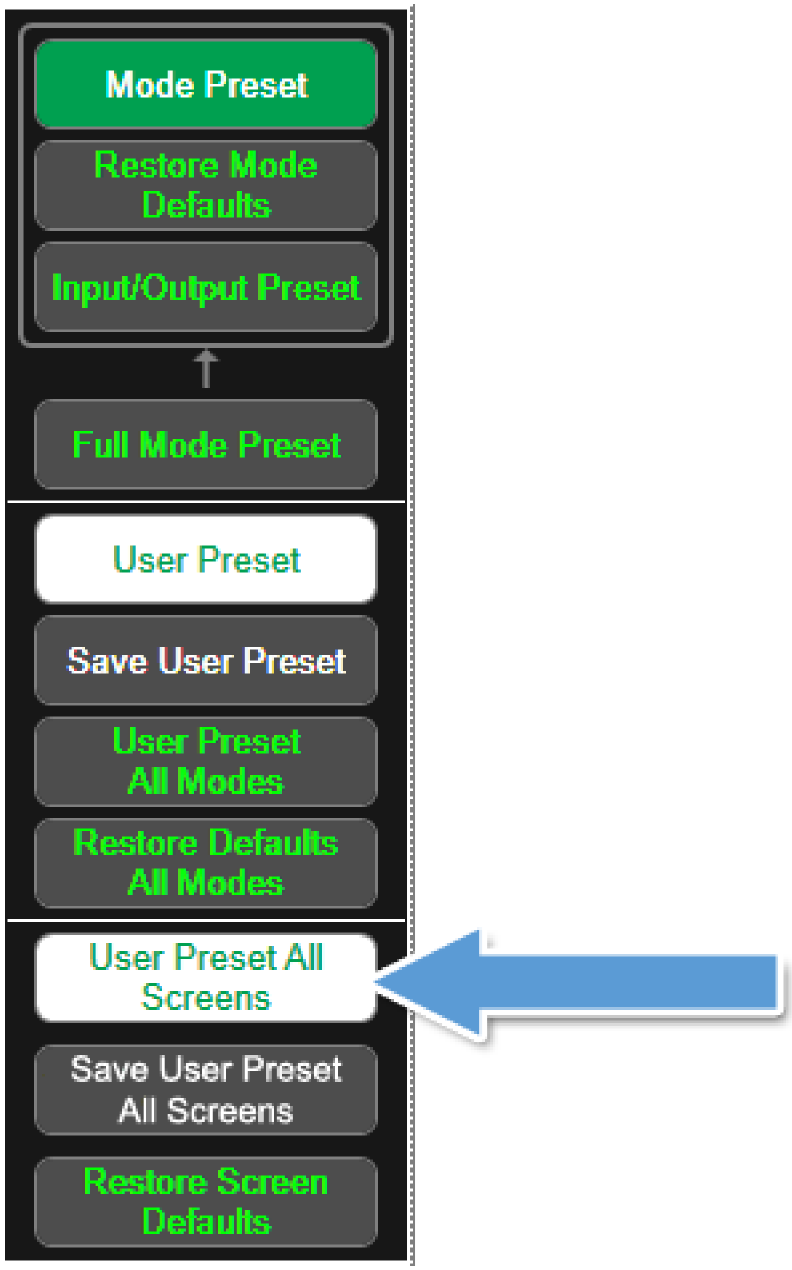
Example	`:SYST:DEF MOD`
Couplings	Causes the currently running measurement to be aborted, a mode switch to the power-on mode, and activates the default measurement for the power-on mode

6.9 User Preset All Screens

User Preset All Screens recalls a screen configuration previously saved using the Save User Preset All Screens function. The complete configuration of all your Screens is loaded, including the state of each Screen.

Because User Preset All Screens performs a Recall State as part of its function, it affects all of the variables that normally only reset on Restore Mode Defaults, and it affects the Input/Output variables, because both of these are included in State files.

Note that recalling a screen configuration in this manner will wipe out your current screen configuration and all states of all Screens.

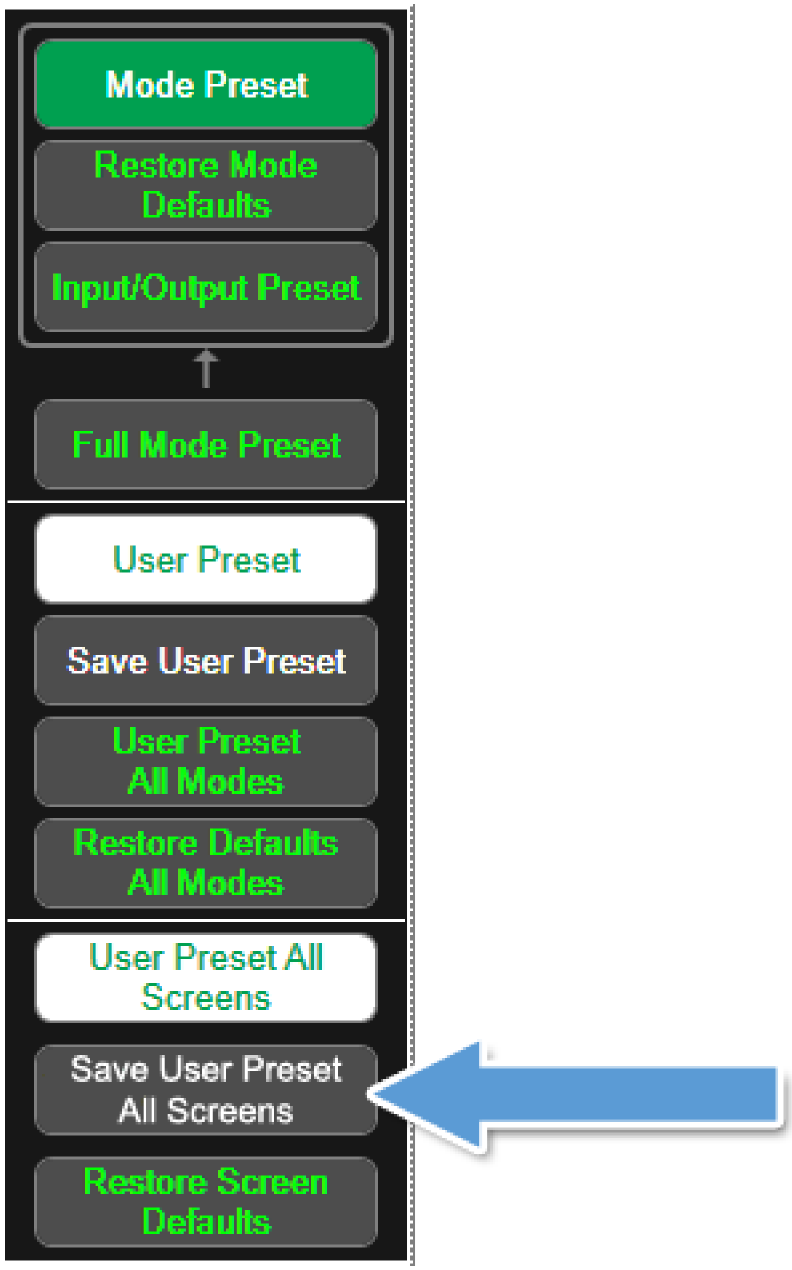


Notes	"Save User Preset All Screens" on page 441 is used to save the current screen configuration as the "user preset all screens" configuration If loading a User Preset All Screens file from a different instrument, some settings may be limited and/or coupled differently, since the capabilities of the mode may have changed from when the User Preset All Screens file was saved
Status Bits/OPC dependencies	Clears all pending OPC bits The Status Byte is set to 0

6.10 Save User Preset All Screens

Saves the current Screen Configuration in a unique location for recall by the **User Preset All Screens** key.

Save User Preset All Screens can be executed from the Preset dropdown.



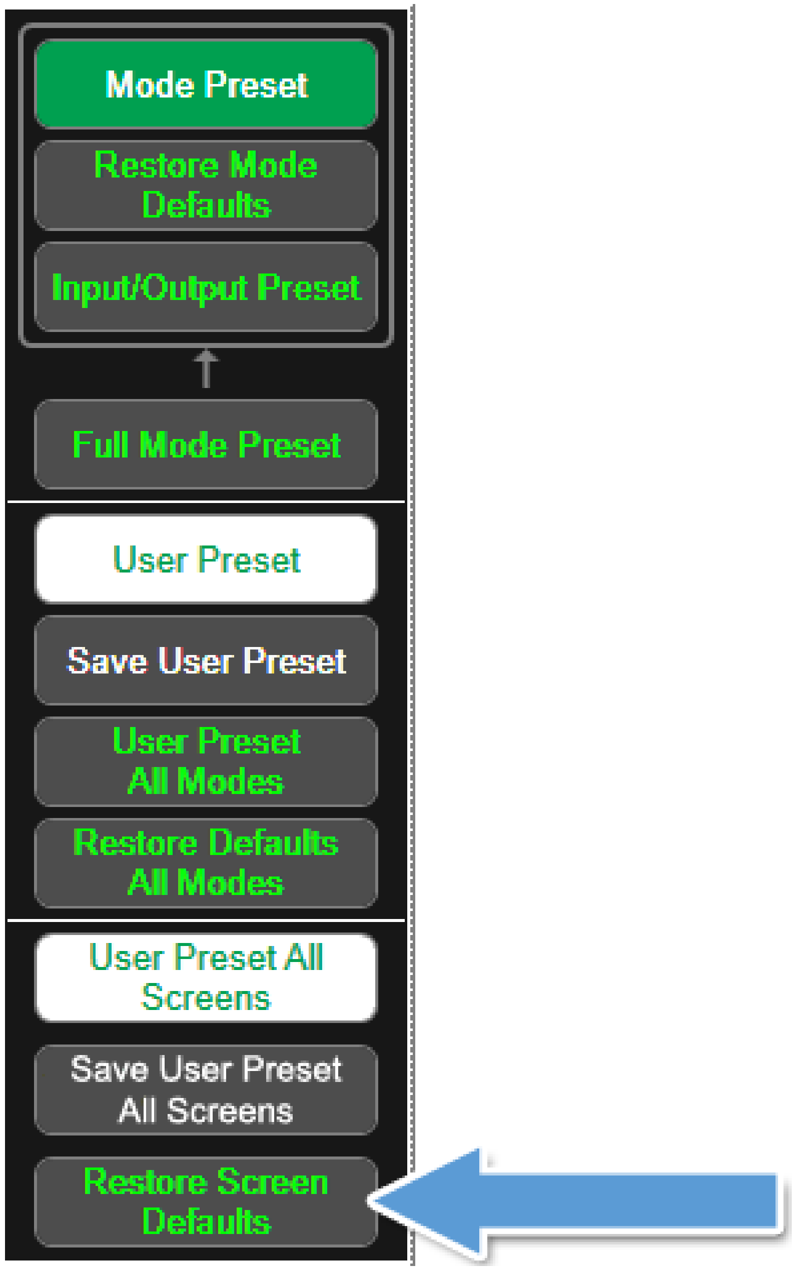
Besides the screen configuration, *all* of the Mode variables of all Screens are saved, including those reset by Mode Preset and those only reset by Restore Mode Defaults, as well as all of the Input/Output variables, so when you subsequently press the User Preset All Screens key, the instrument returns to the exact Screen setup that existed when you pressed the Save User Preset All Screens control.

Notes	Creates the same file as if you requested a Screen Config + State save, except that **Save User Preset All Screens** does not allow you to specify the filename or the location of the file

6.11 Restore Screen Defaults

This selection resets the Screen configuration to the factory default; deleting all screens, all screen names, all screen states, and setting Multi-Screen to Off. A single screen will remain, set to the power-on Mode in a preset state with the default screen name.

Restore Screen Defaults can be executed from the Preset dropdown.



When Restore Screen Defaults is selected, a message appears saying:

"This function will delete all defined screens and their settings. This action cannot be undone.

Do you want to proceed?"

The message provides **OK** and **Cancel** buttons.

Example	`:SYST:DEF SCReen`

6.12 Preset Type (Remote Command Only)

Remote Command	`:SYSTem:PRESet:TYPE FACTory | MODE | USER` `:SYSTem:PRESet:TYPE?`
Example	`:SYST:PRES:TYPE FACT`
Notes	This command is supported for backward compatibility only. It is a no-op, which does not change the behavior of any preset operation
Preset	This is unaffected by Preset but is set to `MODE` on “Restore System Defaults->All”
State Saved	No

6.13 Restart Application (Application Shutdown)

This command restarts the instrument application without rebooting the instrument. Before you send this command, make sure you have saved any trace or measurement data that you want to preserve.

Remote Command	:SYSTem:PUP:PROCess
Example	:SYST:PUP:PROC After sending this command, you must wait for the instrument software to restart
Notes	You cannot use *WAI or *OPC? to synchronize operation after a restart. This command stops and restarts the instrument application, thus the SCPI operation is terminated and restarted. A remote program must use fixed wait time to resume sending commands to the instrument. The wait time will be dependent upon which applications are pre-loaded

6.14 System Log Off (Remote Command Only)

This command provides a means to terminate all open Windows applications, and log off the current user. This is equivalent to performing the Windows command “shutdown –l –f –t0”.

Remote Command	:SYSTem:LOFF
Example	:SYST:LOFF
Notes	Initiates an immediate log off of the current user. This exits the instrument application, thus any unsaved measurement result will be lost. You cannot use *WAI or *OPC? to synchronize operation. In addition to the instrument application, all other Windows programs will be terminated, without the opportunity to save any work in progress. To perform a subsequent login and regain instrument operation, human intervention will be required

6.15 Power Standby (Instrument Shutdown)

Pressing the power switch powers down the instrument. You will be notified that shutting down will cause the application to lose unsaved data, and the instrument will wait for you to respond to this prompt before shutting down.

The command below shuts down the instrument in the same way, however you can choose between the normal way (`NORMal`) or the forced way (`FORCe`). In the `NORMal` mode, the system waits until you respond to the warning prompt. In the `FORCe` mode, the system shuts down after 20 seconds, and all data will be lost.

If the instrument is not properly shutdown prior to removal of line power, the system will validate the Journaling File System and the Power On Last State (if the instrument is in Power On Last State) during the following power-on. If a problem is detected, a message will be provided indicating that the system 'recovered' from an inappropriate shutdown. This is only an issue if Power On Type is Last State. If the Last State is not valid, the instrument will power up in the last active mode, but will do a Mode Preset.

Remote Command	`:SYSTem:PDOWn [NORMal | FORCe]`
Example	`:SYST:PDOW` Executes a normal shutdown
Notes	If no parameter is sent, `NORMal` is assumed

7 Input/Output

The Input/Output key accesses menus that let you control the Input/Output parameters of the instrument. In general, these are functions associated with external connections to the analyzer, either to the inputs or the outputs.

Since the Input/Output connections tend to be based on how you have your hardware set up, in general the input/output settings do not change when you perform a Mode Preset. They can be set to their default value in one of the three ways:

- by using the Restore Input/Output Defaults key on the first page of the input/output menu,
- by using the System->Restore System Defaults->Input/Output Settings or,
- by using the System -> Restore System Defaults->All. Also, they survive a Preset and a Power cycle.

A very few of the Input/Output settings do respond to a Mode Preset; for example, if the Calibrator is on it turns off on a Preset, and if DC coupling is in effect it switches to AC on a Preset. These exceptions are made in the interest of reliability and usability, which overrides the need for absolute consistency. Exceptions are noted in the SCPI table for the excepted functions.

The Input/Output features are common across multiple Modes and Measurements. In general they do not change when you change Modes or Measurements, although some controls appear only in certain measurements.

KEYSIGHT
TECHNOLOGIES

7.1 Input

The controls on this tab let you select and configure the instrument's inputs.

7.1.1 Select Input

Select Input lets you choose which signal input you want to analyze:

– "RF Input" on page 452

– "External Mixer" on page 452

– "I/Q" on page 455

See also:

– External Mixer Setup

– I/Q Setup

Remote Command	`[:SENSe]:FEED RF | AIQ | EMIXer` `[:SENSe]:FEED?`

Example	`:FEED RF`
	Selects the RF Input
	`:FEED EMIX`
	Selects External Mixing
	`:FEED AIQ`
	Selects BBIQ
	`:FEED?`

Dependencies	I/Q only appears when option BBA present Ext Mix only appears when option EXM present
Couplings	The act of connecting the U7227A USB Preamplifier to one of the analyzer's USB ports will cause the Input to automatically switch to the RF Input. If the RF Calibrator is on, it is turned off. Subsequently disconnecting the USB Preamp from USB does not change the Input selection nor restore the previous selection The [:SENSe]:FEED RF command turns the calibrator OFF
Preset	This setting is unaffected by a Preset or power cycle. It survives a Mode Preset and mode changes It is set to RF on a "Restore Input/Output Defaults" or "Restore System Defaults->All"
State Saved	Saved in instrument state
Annotation	Displayed in the Meas Bar as "Input::" followed by: RF or Ext Mix or I/Q depending on which input is selected

Backwards Compatibility SCPI	`[:SENSe]:FEED AREFerence`
	In the PSA the calibrator was one of the inputs and selected using the AREF parameter to the same :FEED command that switched the inputs. In the X-Series it is controlled in a separate menu and overrides the input selection. For code compatibility the [:SENSe]:FEED AREFerence command is provided, and is aliased to [SENSe]:FEED:AREF REF50, which causes the input to be switched to the 50 MHz calibrator. The [:SENSe]:FEED RF command switches the input back to the RF port and turns the calibrator OFF, thus providing full compatibility with the PSA calibrator function
	Note that after sending this, the query [:SENSe]:FEED? will NOT return "AREF" but instead the currently selected input
	`[:SENSe]:FEED IQ | IONLy | QONLy`
	`[:SENSe]:FEED?`
	The parameters IQ|IONLy|QONLy are supported for backwards compatibility with the E44406A
	`[:SENSe]:FEED IQ aliases to [:SENSe]:FEED: IQ:TYPE IQ`
	`[:SENSe]:FEED IONLy aliases to [:SENSe]:FEED:IQ:TYPE IONLy`
	`[:SENSe]:FEED QONLy aliases to [:SENSe]:FEED:IQ:TYPE QONLy`
	The query [:SENSe]:FEED? will always returns AIQ whatever the type of legacy parameters IQ|IONLy|QONLy has been used

Backwards Compatibility Notes	Most of the settings in the X-Series Input/Output system, including External Gain, Amplitude Corrections settings and data, etc., are shared by all modes and are not changed by a mode switch. Furthermore, most variables in the Input/Output system key are not affected by Mode Preset. Both of these behaviors represent a departure from legacy behavior In the X-Series. Input/Output settings are reset by using the "Restore Input/Output Defaults" function. They can also be reset to their default values through the System->Restore System Defaults-> In/Out Config key or through the System ->Restore System Defaults -> All key (and corresponding SCPI) While this matches most use cases better, it does create some code compatibility issues. For example, Amplitude Corrections are no longer turned off by a Mode Preset, but instead by using the "Restore Input/Output Defaults" key/SCPI Although Input/Output settings are not part of each Mode's State, they are saved in the Save State files, so that all of the instrument settings can be recalled with Recall State, as in legacy instruments

Remote Command	`:INPut:MIXer EXTernal | INTernal` `:INPut:MIXer?`
Example	`:INP:MIX INT` `:INP:MIX?`
Notes	In legacy analyzers you choose between the Internal mixer or an External Mixer. In the X-Series, the External Mixer is one of the choices for the Input and is selected using the FEED command (:SENSe:FEED EXTMixer) For compatibility, the INPut:MIXer EXTernal|INTernal legacy command is mapped as follows: 1. When INPut:MIXer EXTernal is received, SENSe:FEED EMIXer is executed 2. When INPut:MIXer INTernal is received, SENSe:FEED RF is executed

	3. When INPut:MIXer? is received, the response will be INT if any input other than the external mixer is selected and EXT if the external mixer is selected
Preset	INT
Backwards Compatibility Notes	PSA supports the following SCPI Command : :INPut:MIXer:TYPE PRESelected|UNPReselect :INPut:MIXer:TYPE? PXA does not support the :INPut:MIXer:TYPE command.

RF Input

Selects the front-panel RF input port to be the analyzer signal input. If RF is already selected, pressing this key accesses the RF input setup functions.

External Mixer

This control allows you to choose an External Mixer through which to apply signal input to the analyzer. When chosen, the LO/IF port becomes the input to the analyzer.

External Mixing requires option EXM. The External Mixer key will not appear unless option EXM is installed. The presence of the LO/IF connector alone does not indicate that you have Option EXM licensed. To verify that option EXM is installed, press **System, Show, System**

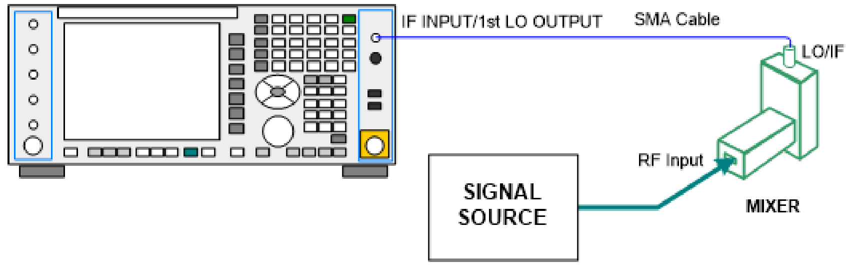
When External Mixer is selected, the **Center Freq** key controls the setting of the Center Freq in external mixing, which is separate from the settings of Center Freq for the RF Input or BBIQ. Each input retains its unique settings for Center Freq. A unique SCPI command is provided solely for the external mixing Center Freq (see the **Center Freq** key description), which only affects the External Mixer CF, although sending the generic Center Freq command while External Mixer is selected also controls the External Mixer CF.

Unless option EXM is present, the External Mixer key is blanked, and all SCPI commands associated with menus accessed by this key return an error

Manual FFT mode is available with external mixing, but not with Signal ID.

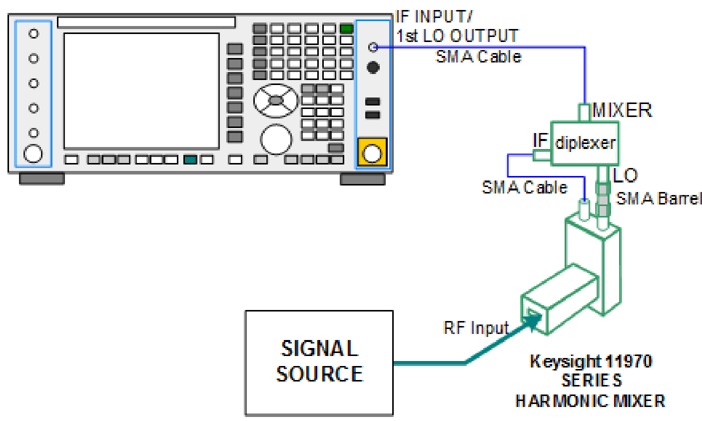
All settings under this key, and all Frequency settings, are remembered when you go out of External Mixer, so that when **External Mixer** is chosen again, all the external mixer functions will retain their previous settings, with the exception of Signal ID which is set to OFF (Signal ID is also set to Off unless External Mixer is the selected Input). Note that this differs from ESA and PSA, in which all external mixer settings including Center Frequency are lost when you turn off External Mixing or Preset the analyzer.

X-series analyzers have a combined LO Out/IF In connection, whereas earlier analyzers used separate ports for the LO Out and the IF in. Internal diplexers in the analyzer and the mixer simplify the connection for the user – only a single SMA cable is required.



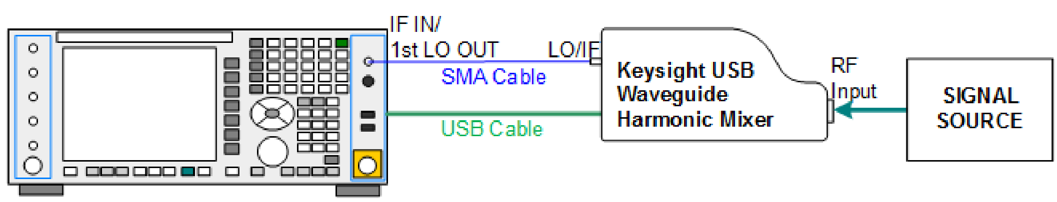
Legacy HP/Agilent and some third party mixers have separate LO In and IF out connections. This requires you to use an external diplexer to connect these mixers. A diplexer can easily be purchased for this purpose (for example, Diplexer Model # DPL.26 or # DPL.313B from OML Inc., Morgan Hill CA)

The connection diagram for such a legacy mixer is:



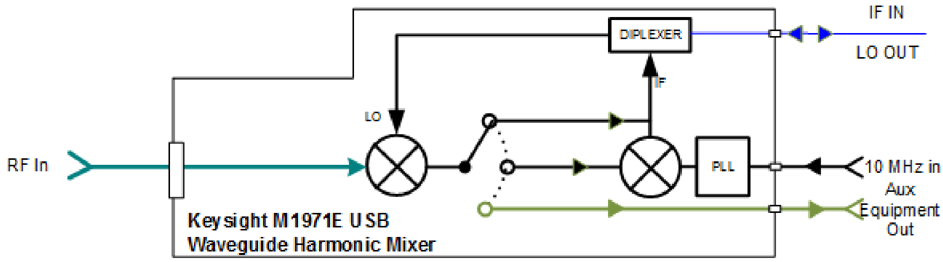
In addition, External Mixing in the X-Series supports the new Keysight M1970 series of Harmonic Mixers, which provide a USB connection for download of calibration data and additional control.

The connection diagram for one of the Keysight USB mixers is:

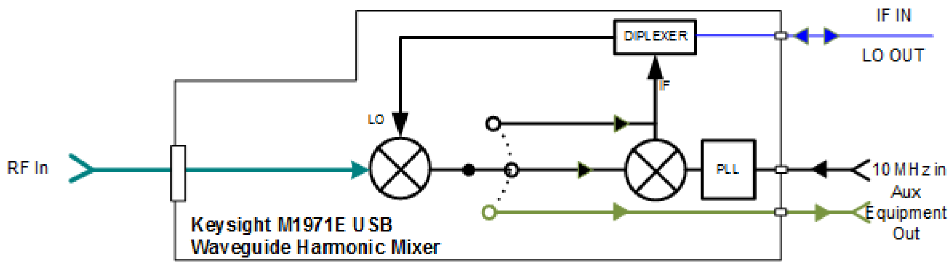


Also available in the M197x series are the M1971 series USB Mixers, which provide additional inputs and outputs for special functionality as described below. These mixers have multiple signal paths which allow them to function in three different states:

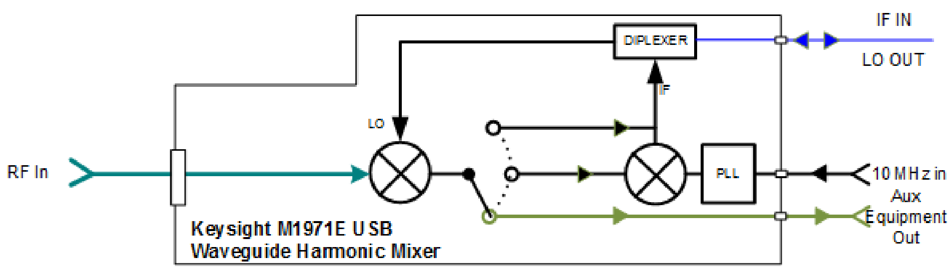
– Normal, in which the mixer functions as a classic external mixer with a single conversion:



- Dual Conversion, which gives you a wider image-free range. In Dual Conversion, the first conversion is to a higher IF frequency and you provide a 10 MHz signal to which an internal PLL is locked, to effect a second downconversion:



- Aux Equipment, wherein the first mixer output drives an output connector on the mixer and the analyzer is out of the circuit:



External Mixing is only supported in certain Modes and Measurements in the X-Series, as shown in the table below. When External Mixer is selected in a measurement that does not support it, the "No result; Meas invalid with Ext Mixing" error condition occurs:

Mode	Measurements	Sig ID (Image Suppress only)
Spectrum Analyzer	Swept SA	Y*
	TOI	Y
	Harmonics	N
	Spurious Emissions	Y
	Channel Power	Y
	Occupied BW	Y
	ACP	Y
	Spectrum Emissions Mask	Y
	CCDF	N
	Burst Power	N
	List Sweep	N
Phase Noise	Monitor Spectrum	Y
	Log Plot	Y
	Spot Frequency	N
	Waveform	N
I/Q Analyzer	Complex Spectrum	N
	Waveform	N
Vector Signal Analyzer	Vector Analysis	N
	Analog Demod	N
	Digital Demod	N
Analog Demod	AM	N
	FM	N
	PM	N
	FM Stereo	N

* the Swept SA measurement also supports Image Shift

I/Q

Selects the front-panel I/Q input ports to be the analyzer signal input. If I/Q is already selected, pressing this key accesses the I/Q setup menu.

The Baseband I/Q functionality is a hardware option. It is option BBA. If the option is not installed, none of the I/Q functionality is enabled.

The Baseband I/Q has four input ports and one output port. The input ports are I, I-bar, Q, and Q-bar. The I and I-bar together compose the I channel and the Q and Q-bar together compose the Q channel. Each channel has two modes of operation, Single-Ended (also called "unbalanced") and Differential Input (also called "balanced"). When in Single-Ended operation, only the main port (I or Q) is used and the complementary port (I-bar or Q-bar) is ignored. When in Differential Input mode, both main and complementary ports are used.

The input settings (range, attenuation, skew, impedance, external gain) apply to the channels, not the individual ports.

The system supports a variety of 1 MΩ input passive probes as well as the Keysight 113x Series active differential probes using the Infinimax probe interface.

The Keysight 113x Series active probes can be used for both single ended and differential measurements. In either case a single connection is made for each channel (on either the I or Q input). The input is automatically configured to 50 Ω single ended and the probe power is supplied through the Infinimax interface. The probe can be configured for a variety of input coupling and low frequency rejection modes. In addition, a wide range of offset voltages and probe attenuation accessories are supported at the probe interface. The active probe has the advantage that it does not significantly load the circuit under test, even with unity gain probing.

With passive 1 MΩ probes, the probe will introduce a capacitive load on the circuit, unless higher attenuation is used at the probe interface. Higher attenuation reduces the signal level and degrades the signal-to-noise-ratio of the measurement. Passive probes are available with a variety of attenuation values for a moderate cost. Most Keysight passive probes can be automatically identified by the system, setting the input impedance setting required as well as the nominal attenuation. For single ended measurements a single probe is used for each channel. Other passive probes can be used, with the attenuation and impedance settings configured manually.

For full differential measurements, the system supports probes on each of the four inputs. The attenuation of the probes should be the same for good common mode rejection and channel match.

Both active and passive probes in single ended and differential configurations can be calibrated. This calibration uses the Cal Out BNC connection and a probe connection accessory. The calibration achieves excellent absolute gain flatness in a probed measurement. It matches both the gain and frequency response of the I and Q channels as well as any delay skew, resulting in high accuracy in derived measurements such as Error Vector Magnitude (EVM).

When a probe is connected a status message will be displayed. The message will indicate if calibration data is available or not. Calibration data is saved for each type of probe (including "none") for each port and will be reapplied whenever that type of probe is re-connected to the same port. For probes with EEPROM identification, the calibration data will be stored based on the unique probe identifier and will reapply data for that particular probe if it is available. The data will not follow a probe from one port to another. For probes without EEPROM identification, the instrument cannot distinguish between different probes of the same type and it will use the data from the last calibration for that probe type on that port.

When in differential mode, both the main and complementary probes are expected to be of the same type.

In some situations, the I and Q channels should be configured identically. In other situations it is convenient to control them independently. Some menus have a "Q Same as I" setting that will cause the Q channel configuration to mirror the I channel configuration, avoiding the overhead of double data entry when the channels should be the same.

The output port is for calibrating the I/Q input ports, although it can also be manually controlled.

There are two types of calibrations available: cable calibration and probe calibration. The cable calibration will guide the user through connecting each input port in turn. All ports must be calibrated together. The probe calibration is done for a specific channel (I or Q). If in Single-Ended mode, only the main port is calibrated. When in Differential Input mode, the user is guided through calibrating both main and complementary ports.

The front panel I/Q port LEDs indicate the current state of that port. On (green) indicates it is active, and off (dark) indicates it is not in use. For example, the Cal Out port LED is on if and only if there is signal coming out of that port.

The input is a context and some parameters have separate values for each context. The SCPI for these parameters has an optional "[:RF|IQ]" node. If the specific context is omitted, the command acts on the current input context's value. Here are the parameters that are input context sensitive:

- Center Frequency
- Trigger Source

It is important to distinguish between the I and Q input ports and the displayed I and Q data values. The I and Q input ports feed into a digital receiver that does digital tuning and filtering. The I and Q data seen by the user (either on the display or through SCPI) corresponds to the real ("I") and the imaginary ("Q") output from the digital receiver. When the input path is I+jQ or I Only and the center frequency is 0 Hz the I input ends up in as the real output from the receiver and appears as "I" data. Likewise, when the input path is I+jQ and the center frequency is 0 Hz, the Q input ends up as the imaginary output from the receiver and appears as "Q" data. However, when the input path is Q Only, the Q input is sent to the receiver as Q+j0, so the receiver output has the Q input coming out on the real output, and so in Q Only, the signal from the Q input port appears as the "I" data. Another situation where the I and Q data do not necessarily correspond directly to the I and Q inputs is when the center frequency is non-zero. The digital processing involved in the tuning is a complex operation. This will result in I Only data appearing as both "I" and "Q" data, the same as that signal would appear if seen through the RF input port.

BBIQ is only supported in certain Modes and Measurements in the X-Series. When I/Q is selected in a measurement that does not support it, the “No Result; Meas invalid with I/Q inputs” message appears. This is error 135

Baseband I/Q Remote Language Compatibility

For the Agilent E4406A VSA Series Transmitter Tester, Option B7C provided baseband I/Q inputs. Code compatibility has been provided to allow many of the commands for option B7C to function properly with the X-Series. The X-Series has hardware differences and additional capabilities (e.g., E4406A does not have independent settings of I & Q nor does it provide for probe calibrations) which make 100% compatibility impossible.

1. The following commands are supported:

   :CALibration:IQ:FLATness

   :INPut:IMPedance:IQ U50|B50|U1M|B1M

   :INPut:IMPedance:REFerence <integer>

2. The [:SENSe]:FEED RF|IQ|IONLy|QONLy|AREFerence|IFALign command supports all parameters except IFALign. The FEED? query will return only RF|AIQ|AREF.

3. The following commands are not supported:

   :CALibration:GIQ

   :CALibration:IQ:CMR

   :INPut:IQ:ALIGn OFF|ON|0|1

The Rohde & Schwarz FSQ-B71 also provides baseband I/Q inputs. A certain amount of code compatibility is provided in the X-Series, however hardware differences make this a somewhat limited set.

Supported:

The "<1|2>" is supported as "[1]".

INPut<1|2>:IQ:BALanced[:STATe] ON | OFF

INPut<1|2>:IQ:TYPE I | Q | IQ

INPut<1|2>:IQ:IMPedance LOW | HIGH

Not Supported:

INPut<1|2>:SELect AIQ | RF

TRACe<1|2>:IQ:DATA:FORMat COMPatible | IQBLock | IQPair>

TRACe<1|2>:IQ:DATA:MEMory? <offset samples>,<# of samples>

TRACe<1|2>:IQ:DATA?

TRACe<1|2>:IQ:SET <filter type>,<rbw>,<sample rate>,<trigger source>,<trigger slope>, <pretrigger samples>, <# of samples>

TRACe<1|2>:IQ:SRATe 10.0kHz to 81.6MHz

TRACe<1|2>:IQ[:STATe] ON|OFF

The Rohde & Schwarz FMU has the following SCPI, which is not supported (these commands start/abort the probe calibration procedure, which is manually interactive from the front panel):

CALibration:ABORt

CALibration:PROBe[:STARt]

7.1.2 RF Calibrator

Lets you choose a calibrator signal to look at or turns the calibrator off.

Remote Command	`[:SENSe]:FEED:AREFerence REF50 | REF4800 | OFF` `[:SENSe]:FEED:AREFerence?`

Example	`:FEED:AREF REF50`
	selects the 50 MHz amplitude reference as the signal input.
	`:FEED:AREF REF4800`
	selects the 4.8 GHz amplitude reference as the signal input
	`:FEED:AREF OFF`
	turns the calibrator "off" (switches back to the selected input - RF or I/Q)

Dependencies	Only appears when RF Input is selected as the Input Selecting an input (RFExt Mix or I/Q) turns the Calibrator OFF. This is true whether the input is selected using the menu panel or with the [:SENSe]:FEED command. The 4.8 GHz internal reference is only available in some models and frequency range options. If the 4.8 GHz reference is not present, the **4.8 GHz** choice will not show, and if the REF4800 parameter is sent, the analyzer will generate an error.
Couplings	When one of the calibrator signals is selected, the analyzer routes that signal (an internal amplitude reference) to the analyzer, and changes the main input selection to RF so the calibrator signal can be seen. When you turn the calibrator off it does not switch back to the previously selected input.
Preset	OFF
State Saved	Saved in instrument state
Annunciation	An advisory message is sent, indicating that the input is set to internal.

Remote Command	`:CALibration:SOURce:STATe OFF | ON | 0 | 1` `:CALibration:SOURce:STATe?`
Notes	For ESA backwards compatibility. In the ESA the calibrator was a separate output which you connected to the input and switched on with this command. In the X-Series, the ON parameter is aliased to the [SENSe]:FEED:AREF REF50 command and the OFF parameter is aliased to [SENSe]:FEED:AREF OFF. When CALibration:SOURce:STATe? is received, 1 will be returned if any of the references is selected and 0 if the Calibrator is "Off"
Preset	OFF

7.1.3 RF Coupling

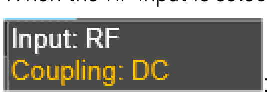
Specifies alternating current (AC) or direct current (DC) coupling at the analyzer RF input port. Selecting AC coupling switches in a blocking capacitor that blocks any DC voltage present at the analyzer input. This decreases the input frequency range of the analyzer, but prevents damage to the input circuitry of the analyzer if there is a DC voltage present at the RF input.

NOTE	When operating in DC coupled mode, ensure protection of the analyzer input circuitry by limiting the DC part of the input level to within 200 mV of 0 Vdc. In AC or DC coupling, limit the input RF power to +30 dBm (1 Watt).

Remote Command	`:INPut:COUPling AC | DC` `:INPut:COUPling?`
Example	`:INP:COUP DC`
Dependencies	Only appears when RF Input is selected as the Input This control does not appear in models that are always AC coupled. When the SCPI command to set DC coupling is sent to these models, it results in the error “Illegal parameter value; This model is always AC coupled” In these models, the SCPI query INP:COUP? always returns AC. This control does not appear in models that are always DC coupled.When the SCPI command to set AC coupling is sent to these models, it results in the error “Illegal parameter value; This instrument is always DC coupled” In these models, the SCPI query INP:COUP? always returns DC.
Preset	AC on models that support AC coupling On models that are always DC coupled, such as millimeter wave models (frequency ranges 30 GHz and above), the preset is DC.
State Saved	Saved in instrument state.
Annunciation	When the RF Input is selected, and AC coupling is selected, annunciators appear in the Meas Bar to that effect:

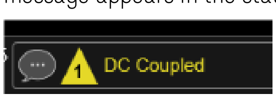
appears in the settings panel (the row of annunciators across the top of the display) to that effect, as shown below:

When the RF Input is selected, and DC coupling is in effect, the annunciator changes as shown below:



Note the amber color, which indicates that you should exercise caution when applying a signal to any DC coupled input (see note above this table for the specific cautions).

On models that support both AC and DC coupling: when DC coupling is selected, a warning condition message appears in the status line "DC coupled" as shown below:



On models that support both AC and DC coupling: when AC coupling is selected, and any part of the displayed frequency range is below 10 MHz, a warning condition message appears in the status line: "AC: Accy unspec'd below 10 MHz".

In AC coupling mode, you can view signals below the corner frequency of the DC block, but below a certain frequency the amplitude accuracy is not specified.

The lowest frequency for which specifications apply is:

X-Series Model	Lowest Freq for meeting specs when AC coupled	Lowest Freq for meeting specs when DC coupled
CXA-503/507	100 kHz	n/a
CXA-C75 Input 2	1 MHz	n/a
CXA-513/526	10 MHz	9 kHz
CXA-m	10 MHz	9 kHz
EXA	10 MHz	9 kHz
MXA	10 MHz	20 Hz
PXA	10 MHz	3 Hz
UXA	10 MHz	3 Hz

Some amplitude specifications apply only when coupling is set to DC. Refer to the appropriate amplitude specifications and characteristics for your analyzer.

7.1.4 Input Z Correction

Sets the input impedance for unit conversions. This affects the results when the y-axis unit is voltage or current units (dBmV, dBµV, dBµA, V, A), but not when it is power units (dBm, W). The impedance you select is for computational purposes only, since the actual impedance is set by internal hardware to 50 ohms. Setting the computational input impedance to 75 ohms is useful when using a 75 ohm to 50 ohm adapter to measure a 75 ohm device on an analyzer with a 50 ohm input impedance.

There are a variety ways to make 50 to 75 ohm transitions, such as impedance transformers or minimum loss pads. The choice of the solution that is best for your measurement situation requires balancing the amount of loss that you can tolerate with the amount of measurement frequency range that you need. If you are using one of these pads/adaptors with the **Input Z Corr** function, you might also want to use the **Ext Gain** key. This function is used to set a correction value to compensate for the gain (loss) through your pad. This correction factor is applied to the displayed measurement values.

Remote Command	`[:SENSe]:CORRection:IMPedance[:INPut][:MAGNitude] 50 | 75` `[:SENSe]:CORRection:IMPedance[:INPut][:MAGNitude]?`

Example	`:CORR:IMP 75`
	sets the input impedance correction to 75 ohms.
	`:CORR:IMP?`

Couplings	In CXA option C75, when RF Input 2 is selected, the Input Z Correction will automatically change to 75 ohms. You may then change it to whatever is desired. When the main RF Input is selected, the Input Z Correction will automatically change to 50 ohms. You may then change it to whatever is desired.
Preset	This is unaffected by a Preset but is set to 50 ohms on a "Restore Input/Output Defaults" or "Restore System Defaults->All" Some instruments/options may have 75 ohms available.
State Saved	Saved in instrument state

7.1.5 All Screens Use Same Input

If "All Screens Use Same Input" is On then all Screens share the same Input settings. This is the default state.

If "All Screens Use Same Input" is Off, then certain settings are allowed to be local to each Screen, meaning one Screen can have them set one way and another can have them set another way.

The Input settings which become local to each Screen when "All Screens Use Same Input" is Off are:

Input Tab:

- Selected Input (RF, Ext Mix, BBIQ)
- RF Input Port (only appears on boxes with multiple RF ports like N9041B, MXE, and CXA)
- RF Coupling (AC/DC)
- Input Z Correction

External Gain Tab:

- External Preamp
- MS
- BTS

Corrections Tab:

- For each Correction, whether it is on or off

Note that if "All Screens Use Same Input" is Off and you press the "+" control to create a new Screen, the new Screen contains a copy of the old Screen's state, including all its Input/Output variables.

Remote Command	`:INSTrument:COUPle:SCReen:INPut ON | OFF | 1 | 0` `:INSTrument:COUPle:SCReen:INPut?`
Example	`:INST:COUP:SCR:INP OFF`
Preset	ON (not affected by Input/Output Preset but set to ON by Restore Input/Output Defaults)

7.1.6 Input/Output Preset

Input/Output Preset resets the group of settings and data associated with the Input/Output front-panel key to their default values. These settings are not affected by a Mode Preset because they are generally associated with connections to the instrument, and most users would not want these resetting every time they pressed the Mode Preset key.

This is the same as the button found in the Preset dropdown, and also the same as the Input/Output button in the Restore Defaults menu under the System key.

All the variables set under the Input/Output front panel key are reset by Input/Output Preset, including Amplitude Corrections and Data (described in the Corrections section), with the exception of **RF Source** settings, which are unaffected.

By using Input/Output Preset and Restore Mode Defaults, a full preset of the current mode will be performed, with the caveat that since Input/Output Preset is a global function it will affect ALL modes.

When Input/Output Preset is selected, a message appears saying:

"This will reset all of the Input/Output variables to their default state, including which input is selected, all Amplitude Correction settings and data, all External Mixing settings, all Frequency Reference settings and all Output settings.

It will not affect Alignment data or settings.

It will not affect RF Source settings.

This action cannot be undone. Do you want to proceed?"

The message provides an **OK** and **Cancel** button for the user to affirm or cancel the operation.

Example	`:SYST:DEF INP` presets all the Input/Output variables to their factory default values.

7.2 External Gain

This tab contains controls which allow you to compensate for gain or loss in the measurement system outside the instrument. The External Gain is subtracted from the amplitude readout (or the loss is added to the amplitude readout). So, the displayed signal level represents the signal level at the output of the device-under-test, which can be the input of an external device that provides gain or loss.

Entering an External Gain value does not affect the Reference Level, therefore the trace position on screen changes, as do all of the values represented by the trace data. Thus, the values of exported trace data, queried trace data, marker amplitudes, trace data used in calculations such as N dB points, trace math, peak threshold, etc., are all affected by External Gain. Changing the External Gain, even on a trace that is not updating, will immediately change all of the above, without new data needing to be taken.

NOTE

Changing the External Gain causes the analyzer to immediately stop the current sweep and prepare to begin a new sweep. The data will not change until the trace data updates because the offset is applied to the data as it is taken. If a trace is exported with a nonzero External Gain, the exported data will contain the trace data with the offset applied.

In the Spectrum Analyzer mode, a Preamp is the common external device providing gain or loss. In a measurement application mode like GSM or W-CDMA, the gain or loss could be from a BTS (Base Transceiver Station) or an MS (Mobile Station). So in the Spectrum Analyzer mode MS and BTS would be grayed out and the only choice would be Ext Preamp. Similarly in some of the digital communications applications, Ext Preamp will be grayed out and you would have a choice of MS or BTS.

The Ext Preamp, MS, and BS controls may be grayed out depending on which measurement is currently selected. If any of the grayed out controls are pressed, or the equivalent SCPI command is sent, an advisory message is generated.

7.2.1 External Preamp

This function is similar to the reference level offset function. Both affect the displayed signal level. Ref Lvl Offset is a mathematical offset only, no analyzer configuration is affected. Ext Preamp gain is used when determining the auto-coupled value of the Attenuator. The External Gain value and the Maximum Mixer Level settings are both part of the automatic setting equation for the RF attenuation setting. (10 dB of Attenuation is added for every 10 dB of External Gain.)

Note that the Ref Lvl Offset and Maximum Mixer Level are described in the Amplitude section. They are reset by Mode Preset. The External Preamp Gain is reset by the "Restore Input/Output Defaults" or "Restore System Defaults->All functions.

The Swept SA Measurement only supports the “Ext Preamp” function under External Gain, the other External Gain functions are grayed out and generate a settings conflict if the SCPI for them is sent.

See "More Information" on page 465

Remote Command	`[:SENSe]:CORRection:SA[:RF]:GAIN <rel_ampl>` `[:SENSe]:CORRection:SA[:RF]:GAIN?`

Example	`:CORR:SA:GAIN 10`
	sets the Ext Gain value to 10 dB
	`:CORR:SA:GAIN -10`
	sets the Ext Gain value to -10 dB (that is, an attenuation of 10 dB)

Notes	Does not auto return
Dependencies	The reference level limits are determined in part by the External Gain/Atten, Max Mixer Level, and RF Atten This key is grayed out in Modes that do not support External Gain
Preset	This is unaffected by Preset but is set to 0 dB on a "Restore Input/Output Defaults" or "Restore System Defaults->All" 0.00 dB, Gain
State Saved	Saved in instrument state
Min	-120 dB
Max	120 dB
Annotation	Displayed in the Meas Bar as "Ext Gain <value>". When the gain is zero, no annotation is shown
Backwards Compatibility SCPI	`[:SENSe]:CORRection:OFFSet[:MAGNitude]` The legacy "Ext Preamp Gain" key is now called "Ext Gain" and the sub-menu has choices of Ext Preamp | MS | BTS for backwards compatibility

More Information

The U7227A USB Preamplifier is an accessory for the X-Series Signal Analyzer that provides gain externally, and whose gain settings are automatically loaded into the analyzer over USB whenever it is connected to one of the analyzer’s USB ports.

While the USB Preamplifier is plugged into one of the analyzer’s USB ports, the analyzer will consider it to be in the signal path of the RF Input and will apply the calibration data from the USB Preamp to measurements taken at the RF Input (on 2 input boxes, it will be considered to be in the signal path of RF Input 1; it is not supported for RF Input 2).

The USB Preamplifier contains its own cal data. This includes a noise trace suitable for use with NFE, for those models which support NFE. The act of connecting the Preamp to USB will cause the cal data to be downloaded from the preamp. When this happens an informational message is provided saying “Cal data loaded from

USB Preamp". The analyzer will then automatically apply the calibration factors loaded from the Preamp in any measurement that supports the USB Preamp.

The External Preamp Gain setting may still be used, even though it is not required for the USB Preamp (since the USB Preamp supplies its own gain data to the analyzer which is applied automatically). Connecting the USB Preamp does not change the External Preamp Gain setting, however unless you have another gain or attenuation element in the signal path, the appropriate setting for External Preamp Gain is 0 dB.

Overload detection and reporting will apply when the USB preamplifier is connected to USB. The USB Preamplifier has its own overload detector which reports overloads to the instrument over USB. This generates an error condition, "Input Overload;USB Preamp."

If, while the USB Preamp is connected to USB, a measurement is selected that does not support the USB preamplifier, the "No result; Meas invalid with Preamp" error condition is generated.

7.2.2 External Gain - MS

Sets an external gain/attenuation value for MS (Mobile Station) tests.

Remote Command	`[:SENSe]:CORRection:MS[:RF]:GAIN <rel_ampl>` `[:SENSe]:CORRection:MS[:RF]:GAIN?`

Example	`:CORR:MS:GAIN 10`
	sets the Ext Gain value to 10 dB
	`:CORR:MS:GAIN -10`
	sets the Ext Gain value to -10 dB (that is, a loss of 10 dB)

Notes	Does not auto return
Dependencies	The reference level limits are determined in part by the External Gain, Max Mixer Level, RF Atten This key is grayed out in modes that do not support MS
Preset	This is unaffected by a Preset but is set to 0 dB on a "Restore Input/Output Defaults" or "Restore System Defaults->All" 0.00 dB, Gain
State Saved	Saved in instrument state
Min	-100 dB
Max	100 dB

Remote Command	`[:SENSe]:CORRection:MS[:RF]:LOSS <rel_ampl>` `[:SENSe]:CORRection:MS[:RF]:LOSS?`

Example	`:CORR:MS:LOSS 10`
	sets the Ext Gain value to -10 dB, and subsequently querying :LOSS will give 10 dB
	`:CORR:MS:LOSS -10`

	sets the Ext Gain value to 10 dB, and subsequently querying :LOSS will give -10 dB
Notes	A positive value of <rel_ampl> in the above command means a loss and a negative value indicates a gain Anytime :LOSS is set it sets :GAIN to the negative value of the parameter sent Anytime :LOSS is queried it gives the negative of :GAIN
Preset	This is unaffected by a Preset but is set to 0 dB on a "Restore Input/Output Defaults" or "Restore System Defaults->All"
Min	100 dB
Max	-100 dB

7.2.3 External Gain - BTS

Sets an external attenuation value for BTS (Base Transceiver Station) tests.

Remote Command	`[:SENSe]:CORRection:BTS[:RF]:GAIN <rel_ampl>` `[:SENSe]:CORRection:BTS[:RF]:GAIN?`

Example	`:CORR:BTS:GAIN 10`
	sets the Ext Gain value to 10 dB
	`:CORR:BTS:GAIN -10`
	sets the Ext Gain value to -10 dB (that is, a loss of 10 dB)

Notes	Does not auto return
Dependencies	The reference level limits are determined in part by the External Gain, Max Mixer Level, RF Atten This key is grayed out in modes that do not support BTS
Preset	This is unaffected by a Preset but is set to 0 dB on a "Restore Input/Output Defaults" or "Restore System Defaults->All" 0.00 dB, Gain
State Saved	Saved in instrument state
Min	-100 dB
Max	100 dB

Remote Command	`[:SENSe]:CORRection:BTS[:RF]:LOSS <rel_ampl>` `[:SENSe]:CORRection:BTS[:RF]:LOSS?`

Example	`:CORR:BTS:LOSS 10`
	sets the Ext Gain value to -10 dB, and subsequently querying :LOSS will give 10 dB
	`:CORR:BTS:LOSS -10`
	sets the Ext Gain value to 10 dB, and subsequently querying :LOSS will give -10 dB

Notes	A positive value of <rel_ampl> in the above command means a loss and a negative value indicates a gain Anytime :LOSS is set it sets :GAIN to the negative value of the parameter sent

	Anytime :LOSS is queried it gives the negative of :GAIN
Preset	This is unaffected by a Preset but is set to 0 dB on a "Restore Input/Output Defaults" or "Restore System Defaults->All"
Min	100 dB
Max	-100 dB

7.2.4 I Ext Gain

This function affects the I channel input. However, when Q Gain in I+jQ is set to Same as I Gain, this value is applied to both I and Q channel inputs.

Remote Command	`[:SENSe]:CORRection:IQ:I:GAIN <rel_ampl>` `[:SENSe]:CORRection:IQ:I:GAIN?`

Example	Set the I Ext Gain to 10 dB
	`:CORR:IQ:I:GAIN 10`
	Set the I Ext Gain to -10 dB (that is, a loss of 10 dB.)
	`:CORR:IQ:I:GAIN -10`

Dependencies	Not available unless option BBA is installed Grayed out when I/Q Path is Q Only.
Preset	0 dB This is unaffected by a Preset but is set to 0 dB on a "Restore Input/Output Defaults" or "Restore System Defaults->All"
State Saved	Yes
Min	-100 dB
Max	100 dB
Annotation	Ext Gain: <I Ext Gain> dB No annotation is shown when Input is not I/Q. Also not shown when I Ext Gain is 0.00 dB. I Ext Gain is not shown for Input Path Q Only. When the Input Path is Independent I and Q and I Ext Gain is not the same as Q Ext Gain, both are shown. "Ext Gain: <I Ext Gain> dB, <Q Ext Gain> dB".

7.2.5 Q Ext Gain

This function affects the Q channel input.

Remote Command	`[:SENSe]:CORRection:IQ:Q:GAIN <rel_ampl>` `[:SENSe]:CORRection:IQ:Q:GAIN?`

Example	Set the Q Ext Gain to 10 dB
	`:CORR:IQ:Q:GAIN 10`
	Set the Q Ext Gain to -10 dB (that is, a loss of 10 dB.)
	`:CORR:IQ:Q:GAIN -10`

Dependencies	Not available unless option BBA is installed. Grayed out when Q gain in I+jQ is set to Same as I Gain.
Preset	0 dB This is unaffected by a Preset but is set to 0 dB on a "Restore Input/Output Defaults" or "Restore System Defaults->All"
State Saved	Saved in instrument state
Min	-100 dB
Max	100 dB
Annotation	Ext Gain: <Q Ext Gain> dB No annotation is shown when Input is not I/Q. Also not shown when Q Ext Gain is 0.00 dB. Q Ext Gain is not shown for Input Path I Only or I+jQ. When Input Path is Independent I and Q and when I and Q Ext Gain are both non-zero but are the same the annotation will be "Ext Gain: <Ext Gain> dB" and when I Ext Gain is not the same as Q Ext Gain, both are shown. "Ext Gain: <I Ext Gain> dB, <Q Ext Gain> dB".

7.2.6 Q Gain in I+jQ

When Same as I Gain is selected, I Ext Gain value is applied to both I and Q channel input if the Input Path is I+jQ. When Independent is selected, I and Q Ext Gain values are applied to I and Q channel input independently.

Remote Command	`[:SENSe]:CORRection:IQ:Q:GAIN:COUPle ON | OFF | 0 | 1` `[:SENSe]:CORRection:IQ:Q:GAIN:COUPle?`
Example	`:CORR:IQ:Q:GAIN:COUP ON` `:CORR:IQ:Q:GAIN:COUP?`
Preset	ON
State Saved	Yes
Range	Same as I Gain|Independent

7.3 Freq Ref Input

This tab lets you configure the External Frequency Reference input on the rear panel.

7.3.1 Freq Ref Input

Specifies the frequency reference as being the internal reference, an external reference at the rear panel input labeled EXT REF IN, a 1 pulse per second signal at the EXT REF IN input, or automatically sensing the appropriate reference.

See "More Information " on page 472

Remote Command	`[:SENSe]:ROSCillator:SOURce:TYPE INTernal | EXTernal | SENSe | PULSe` `[:SENSe]:ROSCillator:SOURce:TYPE?`

Example	`:ROSC:SOUR:TYPE SENS`
	`:ROSC:SOUR:TYPE INT`
	`:ROSC:SOUR:TYPE EXT`
	`:ROSC:SOUR:TYPE PULS`

Dependencies	The PULSe parameter, and support of the 1 pps signal at the EXT REF IN input, are not available in some model numbers. If not available, the choice will not appear, and sending the PULSe parameter via SCPI will generate an error. For VXT models M9420A/21A/10A/11A/15A the only available selection is EXTernal, unless M9420A/21A/10A/11A/15A is configured in MIMO mode as Primary module. If configured in MIMO mode as Primary module, the available selection is INTernal|EXTernal|SENSe. For EXM the only available selections are INTernal|EXTernal|SENSe For E7760 and M8920A the only available selections are INTernal|EXTernal This control is not available in UXM
Preset	This is unaffected by a Preset but is set to EXTernal for VXT models M9420A/21A/10A/11A/15A, INTernal for E7760, and SENSe for other models, on a "Restore Input/Output Defaults" or "Restore System Defaults->All".
State Saved	Saved in instrument state.
Annunciation	In the Meas Bar: If you set this to Internal and no external reference is plugged in: Freq Ref: Internal If you set this to Internal and an external reference between 1 and 50 MHz, or a 1 pps signal, IS plugged in: Freq Ref: Internal (in amber, as a warning sign) If you set this to External and an External Reference between 1 and 50 MHz is plugged in: Freq Ref: External If you set this to External and no External Reference is sensed: Freq Ref: External (in amber, as a warning sign)

	When set to Pulse and a 1 pps signal is plugged in: Freq Ref: Pulse If you set this to Pulse and no Pulse Reference is sensed: Freq Ref: Pulse (in amber, as a warning sign) When set to Sense and neither a signal between 1 and 50 MHz nor a 1 pps signal is detected at the EXT REF IN input, "Sense:Int" is displayed: Freq Ref: Sense,Int When set to Sense and a signal within 5 ppm of the External Ref Freq (as set on the Ext Ref Freq control) is detected at the EXT REF IN input: Freq Ref: Sense,Ext When set to Sense and a 1 pps signal is detected at the EXT REF IN input, "Sense:Pulse" is displayed: Freq Ref: Sense,Pls
Status Bits/OPC dependencies	STATus:QUEStionable:FREQuency bit 1 set if unlocked. Note: In the EXM, the status bit is not set for non-controlling instances. To determine if the frequency reference is unlocked, the controlling instance must be queried.
Backwards Compatibility Notes	Freq Ref In was not saved in state in the legacy instruments. It is a part of state in the X-Series.

Remote Command	`[:SENSe]:ROSCillator:SOURce?`
Notes	The query [SENSe]:ROSCillator:SOURce? returns the current switch setting. This means: 10. If it was set to SENSe but there is no external reference nor 1pps signal so the instrument is actually using the internal reference, then this query returns INTernal and not SENSe. 11. If it was set to SENSe and there is an external reference present, the query returns EXTernal and not SENSe. 12. If it was set to SENSe and there is a 1 pps signal present, the query returns PULSe and not SENSe. 13. If it was set to EXTernal, then the query returns "EXTernal" 14. If it was set to INTernal, then the query returns “INTernal”. 15. If it was set to PULSe, then the query returns “PULSe” Note: In the EXM, the SCPI query always returns “INTernal” for non-controlling instances.
Preset	For VXT models M9420A/21A/10A/11A/15A: EXTernal For E7760, M8920A: INTernal All other models: SENSe
Backwards Compatibility Notes	The query [:SENSe]:ROSCillator:SOURce? was a query-only command in ESA which always returned whichever reference the instrument was using. The instrument automatically switched to the ext ref if it was present. In PSA (which had no sensing) the command [:SENSe]:ROSCillator:SOURce set the reference (INT or EXT), so again its query returned the actual routing.

	Thus the query form of this command is 100% backwards compatible with both instruments.

Remote Command	[:SENSe]:ROSCillator:SOURce INTernal | EXTernal
Notes	For PSA compatibility the command form is provided and is directly mapped to [:SENSe]:ROSCillator:SOURce:TYPE Note: In the EXM, the SCPI command does nothing for non-controlling instances.

More Information

When the frequency reference is set to internal, the internal 10 MHz reference is used even if an external reference is connected.

When the frequency reference is set to external, the instrument will use the external reference. However, if there is no external signal present, or it is not within the proper amplitude range, a condition error message is generated. When the external signal becomes valid, the error is cleared.

When the frequency reference is set to Pulse, the instrument expects a 1 pulse per second signal at the EXT REF IN input. The instrument uses this signal to adjust the frequency of the internal reference.

If Sense is selected, the instrument checks whether a signal is present at the external reference connector. If it senses a signal within 5 ppm of the External Ref Freq (as set on the **External Ref Freq** control), it will automatically switch to the external reference. If it senses a 1 pulse per second signal, it enters Pulse mode, wherein the signal is used to adjust the internal reference. When no signal is present, it automatically switches to the internal reference. No message is generated as the reference switches between pulse, external and internal. The monitoring of the external reference occurs approximately on 1 millisecond intervals, and never occurs in the middle of a measurement acquisition, only at the end of the measurement (end of the request).

If for any reason the instrument's frequency reference is not able to obtain lock, Status bit 1 in the Questionable Frequency register will be true and a condition error message is generated. When lock is regained, Status bit 1 in the Questionable Frequency register will be cleared and the condition error will be cleared.

If an external frequency reference is being used, you must enter the frequency of the external reference if it is not exactly 10 MHz. The **External Ref Freq** key is provided for this purpose.

For VXT models M9420A/21A/10A/11A/15A, there is no internal frequency reference. To work correctly, a 100MHz external frequency reference signal is needed to connect to the front panel of the module. The default Freq Ref In setting is "External" and it cannot be set to any other types.

For VXT models M9410A/11A, External Freq Ref Input controls the “100 MHz In” port on the front panel. For VXT model M9415A, External Freq Ref Input controls the “REF In” port on the front panel.

NOTE

In the EXM, a common frequency reference module serves all instrument instances, but only one instance of the software application can change the reference input type (INT or EXT or SENSE). The software application allowed to change the reference input is called the primary or controlling instance; by default, the leftmost instrument instance is the controlling instance. This can be changed in the config file “E66XXModules.config” located under the folder E:\Keysight\Instrument. For the non-controlling instance(s) the reference input types (in SCPI commands, and in the Virtual Front Panel menus) are blanked and unavailable for use.

Sense

If Sense is selected, the instrument checks whether a signal is present at the external reference connector. If it senses a signal within 5 ppm of the External Ref Freq (as set on the External Ref Freq control), it will use this signal as an External Reference. If it senses a 1 pulse per second signal, it will use this signal to adjust the internal reference by adjusting the User setting of the Timebase DAC. When no signal is present, it automatically switches to the internal reference.

If set to SENSe and the analyzer senses a 1 pulse per second signal, it sets the System, Alignments, Timebase DAC setting to “User”. This setting survives Preset and Power Cycle but is set to “Calibrated” on a System, Restore Defaults, Align or a System, Restore Defaults, All

Internal

The internal reference is used. A 1 pps signal at the EXT REF IN port, or a signal there between 1 and 50 MHz, will cause a warning triangle to appear in the settings panel next to the word “INTERNAL”, but will otherwise be ignored.

External

The external reference is used.

Pulse

The internal reference continues to be the frequency reference for the instrument in that it determines the reference contribution to the phase noise, but its average frequency is adjusted to follow the 1 pps signal at the EXT REF IN input. Therefore, the analyzer frequency accuracy will be dominated by the aging rate of the 1 pps signal instead of the aging rate of the internal reference, except during the time it takes to lock to a new 1 pps signal, approximately 10 minutes.

Sets the System, Alignments, Timebase DAC setting to “User”. This setting survives Preset and Power Cycle but it set to “Calibrated” on a System, Restore Defaults, Align or a System, Restore Defaults, All

When a 1 pps signal is present at the EXT REF IN input, and either **Pulse** or **Sense** is selected, the internal reference frequency is affected by this signal; in effect, it “learns” a new accuracy setting. This setting can be seen by going to the **System, Alignments, Timebase Dac** menu, and looking at the **User** key in that menu. You will note that User has become automatically selected, and that the value shown on the **User** key is the updated value of the timebase DAC as “learned” from the 1 pps signal. Note that this replaces any value the user might have previously set on this key.

Once the setting is learned the user may remove the 1 pps signal; the User setting for the Timebase DAC is retained until you manually select “Calibrated” or execute a System, Restore Defaults, Align or a System, Restore Defaults, All. If you want to make the User setting permanent there is information in the Service Guide that tells you how to change the Calibrated setting of the Timebase DAC.

Note also that if the 1 pps signal is removed when Sense is selected, the analyzer will simply switch to the normal state of the Internal reference and display SENSE:INT in the Settings Panel. However, if the 1 pps signal is removed when Pulse is selected, the analyzer will generate an error

The J7203A Atomic Frequency Reference is an accessory for the X-Series Signal Analyzer that provides a highly accurate 1 pps timebase to use in conjunction with the Pulse setting. With the J7203A, the 1 pps signal is guaranteed to meet the input requirements of the EXT REF IN port, and the improved accuracy of the analyzer’s internal frequency reference is specified. This is the only 1 pps signal that is guaranteed to function properly with the X-Series.

7.3.2 Ext Ref Freq

This key tells the analyzer the frequency of the external reference. When the external reference is in use (either because the reference has been switched to External or because the Reference has been switched to Sense and there is a valid external reference present) this information is used by the analyzer to determine the internal settings needed to lock to that particular external reference signal.

For the instrument to stay locked, the value entered must be within 5 ppm of the actual external reference frequency. So it is important to get it close, or you risk an unlock condition.

Note that this value only affects the instrument’s ability to lock. It does not affect any calculations or measurement results. See "Freq Offset" in the Frequency section for information on how to offset frequency values.

Remote Command	`[:SENSe]:ROSCillator:EXTernal:FREQuency <freq>`

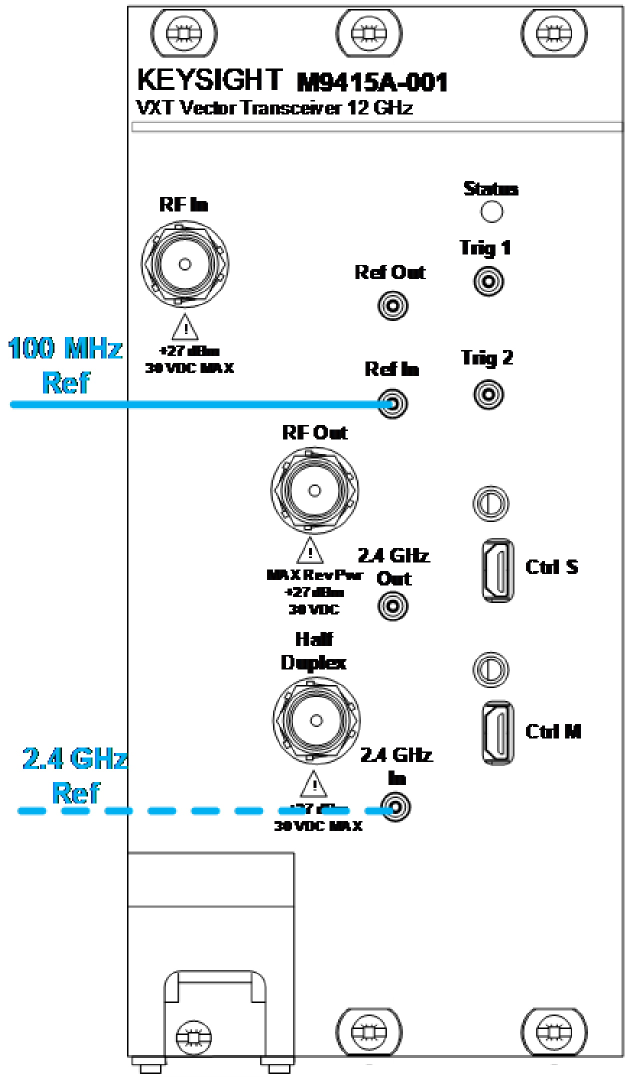
	`[:SENSe]:ROSCillator:EXTernal:FREQuency?`

Example	`:ROSC:EXT:FREQ 20 MHz`
	sets the external reference frequency to 20 MHz, but does not select the external reference.
	`:ROSC:SOUR:TYPE EXT`
	selects the external reference.

Dependencies	Still available with Internal or Pulse selected, to allow setup for when External is in use. However, the setting has no effect if the Internal Reference is in use (Freq Ref In set to Internal, Pulse, or SENSE:INT or SENSE:PULSE). This control is not available in UXM. For VXT models M9420A/21A/10A/11A: only 100 MHz is available For VXT model M9415A: only 100 MHz and 2.4 GHz are available. See More Information about VXT model M9415A.
Preset	This is unaffected by a Mode Preset or an "Input/Output Preset" or "Restore Defaults,Input/Output" but is set to 100 MHz for VXT models and 10 MHz for other models, on a "Restore Defaults, Misc" or "Restore Defaults,All" or by pressing the “Default External Ref Freq” button.
State Saved	Power On Persistent (survives power cycle)
Min	CXA, EXA, N897xB, E7760, M8920A, CXA-m: 10 MHz VXT models: 100 MHz All other models: 1 MHz
Max	CXA, EXA, N897xB, M8920A, CXA-m: 10 MHz EXA with option R13: 20 MHz MXA, PXA, EXM: 50 MHz VXT models M9420A/21A/10A/11A: 100 MHz VXT model M9415A: 2.4 GHz

More Information about VXT model M9415A

The following figure shows the front panel of VXT model M9415A:


KEYSIGHT M9415A-001
VXT Vector Transceiver 12 GHz
RF In
Status
Trig 1
Ref Out
100 MHz Ref
+27 dBm
30 VDC MAX
Ref In
Trig 2
RF Out
2.4 GHz Out
MAX Rev Pwr +27 dBm 30 VDC
Ctrl S
Half Duplex
Ctrl M
2.4 GHz Ref
2.4 GHz In
30 VDC MAX

To use 100 MHz reference signal, connect it to the REF In port. To use 2.4 GHz reference signal, connect it to the 2.4 GHz In port. 2.4 GHz reference provides better performance.

Invalid External Ref Freq will be clipped to the previous or the correct one. If neither 100 MHz nor 2.4 GHz reference were connected, a Reference Unlocked error will be reported. When reference unlocked happens, connect a valid reference signal to recover the system.

7.3.3 Default External Ref Freq

This button restores the External Ref Freq to its default of 10 MHz.

When you set an External Ref Freq value with the Ext Ref Freq control, that Frequency is persistent; is not affected by Mode Preset or Input/Output Preset, and survives shutdown and power cycle. This control allows you to reset the External Ref Freq to its default value.

NOTE: **The persistence of the External Ref Freq is a new behavior as of firmware version A.18.00, necessitating the addition of this control. In versions before A.18.00, the frequency reset on a power cycle/restart. Thus you may need to use this command to retain backwards compatibility.**

Remote Command	`[:SENSe]:ROSCillator:EXTernal:FREQuency:DEFault`
Example	`:ROSC:EXT:FREQ:DEF` resets the external ref frequency
Notes	This is command only, there is no query
Dependencies	Grayed out if the Ext Ref Freq is already set to the default This control does not appear in EXM, UXM, VXT models or M8920A.

7.3.4 Ref Lock BW

This control lets you adjust the Frequency Reference phase lock bandwidth. This control is available in some models of the X-Series.

It is possible to improve the phase noise of the analyzer by several dB, even tens of dB, by using an external reference with excellent phase noise. When an external reference is used the analyzer’s close-in phase noise improves to match that of the reference.

Normally a narrow loop bandwidth is used to phase lock to the external reference. However, the Ref Lock BW control allows you to choose a wider loop bandwidth to reduce the phase noise at low offset frequencies, especially 4 to 400 Hz offset. The Wide setting represents about a 60 Hz loop bandwidth, the Narrow setting about 15 Hz.

When using an external reference with superior phase noise, Keysight recommends setting the external reference phase-locked-loop bandwidth to Wide to take advantage of that superior performance.

When using an external reference with inferior phase noise performance, Keysight recommends setting the bandwidth to Narrow.

In these relationships, inferior and superior phase noise are with respect to –134 dBc/Hz at 30 Hz offset from a 10 MHz reference. Because most reference sources have phase noise behavior that falls off at a rate of 30 dB/decade, this is usually equivalent to –120 dBc/Hz at 10 Hz offset.

In instruments with EP1 or EP2, this control only affects the external reference loop bandwidth. In instruments with EP0, this control also affects the loop bandwidth used when the Internal reference is selected (reference set manually to Internal or Pulse, or set to Sense and set by sensing to Internal or Pulse).

Remote Command	`[:SENSe]:ROSCillator:BANDwidth WIDE | NARRow` `[:SENSe]:ROSCillator:BANDwidth?`
Example	`:ROSC:BAND WIDE`
Dependencies	In instruments with EP1 or EP2: the control is available (not grayed out) even with Internal or Pulse selected, to allow setup for when External is in use. However, the setting has no effect if the Internal Reference is in use. This key only appears in analyzers equipped with the required hardware. This control does not appear in EXM, UXM, VXT models or the E7760.
Preset	This is unaffected by a Preset but is set to Narrow on a "Restore Input/Output Defaults" or "Restore System Defaults -> All"
State Saved	Saved in Input/Output state.

7.4 Output

This tab accesses controls that configure various output settings, like the frequency reference output, IF outputs and analog output.

Not all measurements support all output functions. For example, the Swept SA Measurement does not support the Digital Bus function or the I/Q Cal Out function under the Output tab; although the controls display, the outputs do not function in this measurement.

In addition, if the appropriate license is not present, some controls may not appear. In Modes/Measurements that do not support particular controls, the controls may appear, but no output will be generated if they are selected.

This Tab does not appear in EXM or VXT models M9420A/21A.

This Tab does not appear in the M9393A or M9391A.

Backwards Compatibility Notes	In ESA there was not a user interface to enable the Video Output (Analog Output), Trigger Output, or Gate Output. In the X-Series each of these physical connectors requires configuration, thus the user interface has been added for X-Series, along with the potential for an output you think is always on to be switched off.

7.4.1 Analog Out

This menu lets you control which signal is fed to the “Analog Out” connector on the analyzer rear panel.

In the Auto state, the Analog Output will automatically be set to the most sensible setting for the current mode or measurement.

If you make a selection manually from the Analog Out menu, the manually selected choice will remain in force until you change it (or re-select Auto), even if you go to a mode or measurement for which the selected output does not apply.

See "More Information" on page 480

Remote Command	`:OUTPut:ANALog OFF | SVIDeo | LOGVideo | LINVideo | DAUDio`
	`:OUTPut:ANALog?`
	`:OUTPut:ANALog:AUTO OFF | ON | 0 | 1`
	`:OUTPut:ANALog:AUTO?`

Example	`:OUTP:ANAL SVIDeo`
	causes the analog output type to be Screen Video
	`:OUTP:ANAL:AUTO ON`

Preset	This is unaffected by Preset but is set to DAUDio on a "Restore Input/Output Defaults" or "Restore System Defaults->All

	ON
State Saved	Saved in Input/Output State
Backwards Compatibility Notes	Prior to A.04.00, OFF was the default functionality except when in the Analog Demod application or with Tune and Listen, in which case it was DAUDio, and there was no selection menu. So for backwards compatibility with earlier X-Series firmware versions, Auto (:OUTP:ANAL:AUTO ON) will duplicate the prior behavior. The DNWB and SANalyzer parameters, which were legal in PSA but perform no function in the X-Series, are accepted without error.

More Information

Here is information about the various Analog Outputs:

Source	Example	Notes
Off	`OUTP:ANAL OFF`	The Analog Output is off.
Screen Video	`OUTP:ANAL SVID`	Selects the analog output to be the screen video signal. In this mode, the pre-detector data is output to the Analog Out connector. The output looks very much like the trace displayed on the analyzer's screen, and depends on the Log/Lin display Scale, Reference Level, and dB per division, but is not influenced by the selected detector or any digital flatness corrections or trace post-processing (like Trace Averaging).
Log Video	`OUTP:ANAL LOGV`	Selects the analog output to be the log of the video signal. In this mode, the pre-detector data is output to the Analog Out connector with a Log scaling. The output is referenced to the current level at the mixer, does not depend on display settings like Reference Level or dB per division, and it is not influenced by the selected detector or any digital flatness corrections or trace post-processing (like Trace Averaging), but does change with input attenuation.
Linear Video	`OUTP:ANAL LINV`	Selects the analog output to be the envelope signal on a linear (voltage) scale. In this mode, the pre-detector data is output to the Analog Out connector with a Linear scaling. The output is based on the current Reference Level, and is not influenced by the selected detector or any digital flatness corrections or trace post-processing (like Trace Averaging).
Demod Audio	`OUTP:ANAL DAUD`	Selects the analog output to be the demodulation of the video signal. When Demod Audio is selected, the demodulated audio signal appears at this output whenever the Analog Demod application is demodulating a signal or when **Analog Demod Tune and Listen** is operating in the Swept SA measurement. When Analog Out is in the Auto state, this output is auto-selected when in the Analog Demod mode or when **Analog Demod Tune and Listen** is operating in the Swept SA measurement.

The table below gives the range for each output.

Analog Out	Nominal Range exc. (10% overrange)	Scale Factor	Notes
Off	0 V		
Screen Video	0 – 1 V open circuit	10%/division	8566 compatible
Log Video	0 – 1 V terminated	1/(192.66 dB/V)	dB referenced to mixer level, 1V out for –10 dBm at the mixer.
Linear Video	0 – 1 V terminated	100%/V	Linear referenced to Ref Level, 1 V out for RF envelope at the Ref Level.
Demod Audio	(varies with analyzer setting)		

Notes about the Analog Outputs:

Screen Video

This mode is similar to the Analog Output of the HP 8566 family and the Video Out (opt 124) capability of the Keysight PSA analyzer (E444x), although there are differences in the behavior.

Screen Video output changes while in FFT Sweeps, so for measurements that use exclusively FFT Sweeps, or if the user manually chooses FFT Sweeps, the Screen Video output will look different than it does in swept mode

Because the Screen Video output uses one of the two IF processing channels, only one detector is available while Screen Video is selected. All active traces will change to use the same detector as the selected trace when Screen Video is activated.

Screen Video output is not available while any EMI Detector is selected (Quasi Peak, RMS Average or EMI Average), because these detectors use both IF processing channels. Consequently, if the user chooses an EMI Detector, there will be no Screen Video output.

The output holds at its last value during an alignment and during a marker count. After a sweep:

– If a new sweep is to follow (as in Continuous sweep mode), the output holds at its last value during the retrace before the next sweep starts. If the analyzer is in zero-span, there is no retrace, as the analyzer remains tuned to the Center Frequency and does not sweep. Therefore, in zero-span, the output simply remains live between display updates.

– If no new sweep is to follow (as in Single sweep mode), the output remains live, and continues to show the pre-detector data

This function depends on optional capability; the selection is not available and the command will generate an “Option not available” error unless you have Option YAV or YAS licensed in your instrument.

The Screen Video function is intended to be very similar to the 8566 Video Output and the PSA Option 124. However, unlike the PSA, it is not always on; it must be switched on by the Screen Video key. Also, unlike the PSA, there are certain dependencies (detailed above) – for example, the Quasi Peak Detector is unavailable when Screen Video is on.

Furthermore, the PSA Option 124 hardware was unipolar and its large range was padded to be exactly right for use as a Screen Video output. In the X-Series, the hardware is bipolar and has a wider range to accommodate the other output choices. Therefore, the outputs won’t match up exactly and users may have to modify their setup when applying the X-Series in a PSA application.

Log Video

Log Video shows the RF Envelope with the Reference equal to the Mixer Level. The output is designed so that full scale (1 V) corresponds to -10 dBm at the mixer. The full range (0-1 V) covers 192.66 dB ; thus, 0 V corresponds to -202.66 dBm at the mixer.

Because the Log Video output uses one of the two IF processing channels, only one detector is available while Screen Video is selected. All active traces will change to use the same detector as the selected trace when Log Video is activated.

Log Video output is not available while any EMI Detector is selected (Quasi Peak, RMS Average or EMI Average), because these detectors use both IF processing channels. Consequently, if the user chooses an EMI Detector, there will be no Log Video output.

The output holds at its last value during an alignment, during a marker count, and during retrace (after a sweep and before the next sweep starts).

This function depends on optional capability. The choice will not appear and the command will generate an “Option not available” error unless you have Option YAV licensed in your instrument.

Log Video output changes while in FFT Sweeps, so for measurements that use exclusively FFT Sweeps, or if the user manually chooses FFT Sweeps, the Log Video output will look different than it does in swept mode.

Linear Video

Linear Video shows the RF Envelope with the Reference equal to the Ref Level. The scaling is set so that 1 V output occurs with an instantaneous video level equal to the reference level, and 0 V occurs at the bottom of the graticule. This scaling gives you the ability to control the gain without having another setup control for the key. But it requires you to control the look of the display (the reference level) in order to control the analog output.

This mode is ideal for looking at Amplitude Modulated signals, as the linear envelope effectively demodulates the signal.

Because the Linear Video output uses one of the two IF processing channels, only one detector is available while Linear Video is selected. All active traces will change to use the same detector as the selected trace when Log Video is activated.

Linear Video output is not available while any EMI Detector is selected (Quasi Peak, RMS Average or EMI Average), because these detectors use both IF processing channels. Consequently, if the user chooses an EMI Detector, there will be no Linear Video output.

The output holds at its last value during an alignment and during a marker count and during retrace (after a sweep and before the next sweep starts).

This function depends on optional capability; the choice will not appear and the command will generate an “Option not available” error unless you have Option YAV licensed in your instrument.

Linear Video output changes while in FFT Sweeps, so for measurements that use exclusively FFT Sweeps, or if the user manually chooses FFT Sweeps, the Linear Video output will look different than it does in swept mode.

Demod Audio

When Analog Out is in the Auto state, this output is auto-selected when in the Analog Demod mode or when **Analog Demod Tune and Listen** is operating in the Swept SA measurement.

If any other Analog Output is manually selected when in the Analog Demod mode or when **Analog Demod Tune and Listen** is operating in the Swept SA measurement, a condition warning message appears.

This choice only appears if the Analog Demod application (N9063A), the N6141A or W6141A application, or Option EMC is installed and licensed, otherwise the choice will not appear and the command will generate an “Option not available” error.

The output holds at its last value during an alignment and during a marker count. It is not held between sweeps, in order for Tune and Listen to work properly.

When Demod Audio is the selected Analog Output, all active traces are forced to use the same detector, and the CISPR detectors (QPD, EMI Avg, RMS Avg) are unavailable

7.4.2 Digital Bus Out

Turns on the LVDS Digital Output port for outputting digital acquisition data.

When Bus Out is on, all acquisitions are streamed to the output port including acquisitions for internal purposes such as Alignment. The internal processing and routing of acquisitions continues as usual and is unaffected by the state of Bus Out.

When Bus Out is off, no signal appears on the LVDS port.

Remote Command	`:OUTPut:DBUS[1][:STATe] ON | OFF | 1 | 0`

	:OUTPut:DBUS[1][:STATe]?
Example	:OUTP:DBUS ON
Dependencies	Requires option RTL or control is not displayed. Digital Bus and Wideband Digital Bus cannot be on at the same time, so: – When Wideband Bus is turned on, if Digital Bus is already on, an advisory message is displayed, "Wideband Digital Bus On, Digital Bus (narrow band) forced to Off." – When Digital Bus is turned on, if Wideband Digital Bus is already on, an advisory message is displayed, "Digital Bus (narrow band) On, Wideband Digital Bus forced to Off."
Preset	OFF (set by Restore Input/Output Defaults)
State Saved	Saved in Input/Output State

7.4.3 Wideband Digital Bus

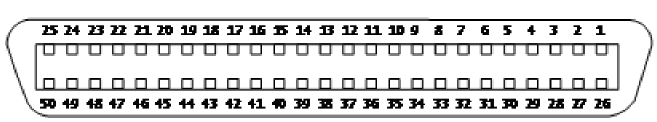
The Wideband Digital Bus control turns on the LVDS port on the Wideband IF, which causes the I/Q pairs from the current measurement to get sent to this port. The control is grayed out unless in the RTSA measurement application, which is the only measurement that supports wideband streaming.

When Wideband Digital Bus is on, the internal processing and routing of acquisitions continues as usual and the display of measurement data is unaffected.

When Wideband Digital Bus is off, no signal appears on the LVDS port.

Remote Command	:OUTPut:DBUS2[:STATe] OFF | ON | 0 | 1 :OUTPut:DBUS2[:STATe]?
Example	:OUTP:DBUS2 ON
Notes	If this command is sent while running a measurement that does not support Wideband Digital Bus, the message "Settings conflict; Feature not supported for this measurement" is displayed.
Dependencies	Requires option RTS or control is not displayed. Digital Bus and Wideband Digital Bus cannot be on at the same time, so: – When Wideband Bus is turned on, if Digital Bus is already on, an advisory message is displayed, "Wideband Digital Bus On, Digital Bus (narrow band) forced to Off." – When Digital Bus is turned on, if Wideband Digital Bus is already on, an advisory message is displayed, "Digital Bus (narrow band) On, Wideband Digital Bus forced to Off."
Preset	OFF (set by Restore Input/Output Defaults)
State Saved	Saved in Input/Output State

Here is the Wideband LVDS connector as viewed from the rear panel. The pin assignments are below:



I-Cable

Connection	“-“ pin #	“+” pin #
GND	1	26
N/C	2	27
Stream_I[00]	3	28
Stream_I[01]	4	29
Stream_I[02]	5	30
Stream_I[03]	6	31
GND	7	32
Stream_I[04]	8	33
Stream_I[05]	9	34
Stream_I[06]	10	35
Stream_I[07]	11	36
GND	12	37
Stream_I[08]	13	38
Stream_I[09]	14	39
Stream_I[10]	15	40
Stream_I[11]	16	41
GND	17	42
Stream_I[12]	18	43
Stream_I[13]	19	44
Stream_I[14]	20	45
Stream_I[15]	21	46
GND	22	47
GND	23	48
Stream_VALID	24	49
Stream_CLK	25	50

Q-Cable

Connection	“-“ pin #	“+” pin #
GND	1	26
Stream_ALT	2	27
Stream_Q[00]	3	28
Stream_Q[01]	4	29
Stream_Q[02]	5	30
Stream_Q[03]	6	31
GND	7	32
Stream_Q[04]	8	33
Stream_Q[05]	9	34

Connection	"-" pin #	"+" pin #
Stream_Q[06]	10	35
Stream_Q[07]	11	36
GND	12	37
Stream_Q[08]	13	38
Stream_Q[09]	14	39
Stream_Q[10]	15	40
Stream_Q[11]	16	41
GND	17	42
Stream_Q[12]	18	43
Stream_Q[13]	19	44
Stream_Q[14]	20	45
Stream_Q[15]	21	46
GND	22	47
GND	23	48
Stream_MARK_1	24	49
Stream_MARK_2	25	50

Stream_I	16 bit "I" Data
Stream_Q[15:0]	16 bit "Q" Data
Stream_VALID	Data valid, when '1' then I/Q data is valid
Stream_CLK	150 MHz DDR clock
Stream_MARK_1	Stream Mark Bit 1
Stream_MARK_2	Stream Mark Bit 2
Stream_ALT	currently unused.

7.4.4 I/Q Cal Out

The Baseband I/Q "Cal Out" port can be turned on with either a 1 kHz or a 250 kHz square wave. This can be turned on independent of the input selection. A Preset will reset this to Off.

Remote Command	`:OUTPut:IQ:OUTPut IQ1 | IQ250 | OFF` `:OUTPut:IQ:OUTPut?`
Example	`:OUTP:IQ:OUTP IQ1`
Dependencies	Only available with Option BBA.
Couplings	An I/Q Cable Calibration or an I/Q Probe Calibration will change the state of the Cal Out port as needed by the calibration routine. When the calibration is finished the I/Q Cal Out is restored to the pre-calibration state.

Preset	Off
State Saved	Saved in instrument state
Range	1 kHz Square Wave|250 kHz Square Wave|Off

7.4.5 Aux IF Out

This menu controls the signals that appear on the SMA output on the rear panel labeled “AUX IF OUT

NOTE **Aux IF Out is valid for the RF Input and for the External Mixer input. In external mixing, the Aux IF output level is set by factory default to accommodate expected IF levels for the RF path. When using the External Mixing path, the Aux IF Out levels (for all three options CR3, CRP and ALV) will therefore be uncalibrated..**

See:

– "More Information" on page 487

– "Notes on the Aux IF Outputs" on page 488

Remote Command	`:OUTPut:AUX SIF | AIF | LOGVideo | OFF` `:OUTPut:AUX?`
Dependencies	The control does not appear in models that do not support the Aux IF Out.
Preset	This is unaffected by a Preset but is set to OFF on a "Restore Input/Output Defaults" or "Restore System Defaults->All”
State Saved	Saved in Input/Output state
Backwards Compatibility Notes	In the PSA, the IF output has functionality equivalent to the "Second IF" function in the X-Series’ Aux IF Out menu. In the X-Series, it is necessary to switch the Aux IF Out to “Second IF” to get this functionality, whereas in PSA it is always on, since there are no other choices. Hence a command to switch this function to “Second IF” will have to be added by customers migrating from PSA who use the IF Output in PSA.

More Information

Here is information about the various Aux IF Outputs:

Source	Example	Notes
Off	`OUTP:AUX OFF`	In this mode nothing comes out of the “AUX IF OUT” connector on the rear panel. The connector appears as an open-circuit (that is, it is not terminated in any way).
Second IF	`OUTP:AUX SIF`	In this mode the 2nd IF output is routed to the rear panel connector. Annotation on the menu panel shows the current 2nd IF frequency in use in the analyzer.

Source	Example	Notes
Arbitrary IF	`OUTP:AUX AIF`	In this mode the 2nd IF output is mixed with a local oscillator and mixer to produce an arbitrary IF output between 10 MHz and 75 MHz with 500 kHz resolution. The phase noise in this mode will not be as good as in Second IF mode. The IF output frequency is adjustable, through an active function which appears on the menu panel, from 10 MHz to 75 MHz with 500 kHz resolution. NOTE: In instruments with Options B2X or B5X, the Arbitrary IF Output is only practical when the IF Bandwidth is <= 40 MHz, IF Path is <= 40 MHz, or FFT Width is <= 40 MHz.
Fast Log Video	`OUTP:AUX LOGV`	In this mode the 2nd IF output is passed through a log amp and the log envelope of the IF signal is sent to the rear panel. The open circuit output level varies by about 25 mV per dB, with a top-of-screen signal producing about 1.6 Volts. The output impedance is nominally 50 ohms. This mode is intended to meet the same needs as Option E4440A-H7L Fast Rise Time Video Output on the Keysight E4440A PSA Series, allowing you to characterize pulses with fast rise times using standard measurement suites on modern digital scopes.

Notes on the Aux IF Outputs

Second IF

The frequency of the 2nd IF depends on the current IF signal path as shown in the table below:

IF Path Selected	Frequency of "Second IF" Output
10 MHz	322.5 MHz
25 MHz	322.5 MHz
40 MHz	250 MHz
85-160 MHz	300 MHz
255 MHz	750 MHz
510 MHz	877.1484375 MHz

The signal quality, such as signal to noise ratio and phase noise, are excellent in this mode.

The Second IF choice does not appear unless Option CR3 is installed.

Arbitrary IF

The bandwidth of this IF output varies with band and center frequency, but is about 40 MHz at the -3 dB width. When the output is centered at lower frequencies in its range, signal frequencies at the bottom of the bandwidth will "fold". For example, with a 40 MHz bandwidth (20 MHz half-bandwidth), and a 15 MHz IF center, a signal -20 MHz relative to the spectrum analyzer center frequency will have a relative response of about -3 dB with a frequency 20 MHz below the 15 MHz IF center. This -

5 MHz frequency will fold to become a +5 MHz signal at the IF output. Therefore, lower IF output frequencies are only useful with known band-limited signals.

The Arbitrary IF choice does not appear unless Option CRP is installed.

Fast Log Video

The output is off during an alignment but not during a marker count, and is not blanked during retrace (after a sweep and before the next sweep starts).

The Fast Log Video choice does not appear unless Option ALV is installed.

7.5 Trigger Output

This tab accesses controls that configure the Trigger output settings.

7.5.1 Trig 1 Out

This control selects the type of output signal that will be output from the Trig 1 Out connector.

Although the Trig 1 Out control applies only to the Trig 1 output, the SCPI command (detailed in the table below) can be used for any of the Trig Out connectors by using the appropriate TRIGGER parameter (e.g. TRIG1, TRIG2, etc.).

See "More Information" on page 490

Remote Command	`:TRIGger|TRIGger1|TRIGger2|TRIGger3|TRIGger4[:SEQuence]:OUTPut HSWP | MEASuring | MAIN | GATE | GTRigger | OEVen | SPOint | SSWeep | SSETtled | S1Marker | S2Marker | S3Marker | S4Marker | PARB | FSYNc | OFF` `:TRIGger|TRIGger1|TRIGger2|TRIGger3|TRIGger4[:SEQuence]:OUTPut?`
Example	`:TRIG:OUTP HSWP` `:TRIG2:OUTP GATE`
Dependencies	You can only send TRIG parameters for the hardware you have; for example you cannot send a TRIG3 parameter if your hardware does not support TRIG3. Sending the SCPI command for an output you do not have generates an error, “Hardware missing; Not available for this model number” . Querying a nonexistent output returns OFF. For VXT models M9410A/11A: – When the Trig Out Device is `Analyzer`, only `MEASuring`, `MAIN` and `OFF` are available – When the Trig Out Device is `Source`, only `S1Marker`, `S2Marker`, `S3Marker`, `S4Marker`, `PARB`, `FSYNc` and `OFF` are available
Preset	Trigger 1: Sweeping (HSWP) Trigger 2: Gate Trigger 3: Sweeping (HSWP) (on models that support Trigger 3) Trigger 4: Gate (on models that support Trigger 4) This is unaffected by a Preset but is preset to the above values on a “Restore Input/Output Defaults” or “Restore System Defaults->All”
State Saved	Saved in instrument state

More Information

Here is information about the various Trigger Outputs:

Source	Example	Notes
Off	`TRIG1:OUTP OFF` `TRIG2:OUTP OFF`	Selects no signal to be output to the Trig 1 or Trig 2 Out connector.
Sweeping (HSWP)	`TRIG1:OUTP HSWP`	Selects the Sweeping Trigger signal to be output to the Trig 1 Out connector when a measurement is made. This signal has historically been known as "HSWP" (High = Sweeping), and is 5 V TTL level with 50 ohm output impedance.
Measuring	`TRIG1:OUTP MEAS`	Selects the Measuring trigger signal to be output to the Trig 1 Out connector. This signal is true while the Measuring status bit is true.
Main Trigger	`TRIG1:OUTP MAIN`	Selects the current instrument trigger signal to be output to the Trig 1 Out connector.
Gate Trigger	`TRIG1:OUTP GTR`	Selects the gate trigger signal to be output to the Trig 1 Out connector. This is the source of the gate timing, not the actual gate signal.
Gate	`TRIG1:OUTP GATE`	Selects the gate signal to be output to the Trig 1 Out connector. The gate signal has been delayed and its length determined by delay and length settings. When the polarity is positive, a high on the Trig Out connector represents the time the gate is configured to pass the signal.
Odd/Even Trace Point	`TRIG1:OUTP OEV`	Selects either the odd or even trace points as the signal to be output to the Trig 1 Out connector when performing swept spectrum analysis. When the polarity is positive, this output goes high during the time the analyzer is sweeping past the first point (Point 0) and every other following trace point. The opposite is true if the polarity is negative.
Source Point Trigger	`TRIG1:OUTP SPO`	Selects the gate signal to be output to the Trig 1 Out connector for use as the Point Trigger when operating an external source in Tracking mode. When Ext Trigger 1 is selected as the Point Trigger under Source, the Source Point Trigger under Trig1 Out automatically gets selected. A similar pattern is used for the other Ext Trigger inputs; for example, when Ext Trigger 2 is selected as the Point Trigger under Source, the Source Point Trigger under Trig 2 Out automatically gets selected
Source Marker 1	`TRIG2:OUTP S1M`	Selects the Trigger Output at Marker 1 in the Waveform file which is currently playing. Only available in VXT: for M9420/21A only for Trigger Output 2, for M9410A/11A available for both Trigger Output 1/2.
Source Marker 2	`TRIG2:OUTP S2M`	Selects the Trigger Output at Marker 2 in the Waveform file which is currently playing. Only available in VXT: for M9420/21A only for Trigger

Source	Example	Notes
		Output 2, for M9410A/11A available for both Trigger Output 1/2.
Source Marker 3	`TRIG2:OUTP S3M`	Selects the Trigger Output at Marker 3 in the Waveform file which is currently playing. Only available in VXT: for M9420/21A only for Trigger Output 2, for M9410A/11A available for both Trigger Output 1/2.
Source Marker 4	`TRIG2:OUTP S4M`	Selects the Trigger Output at Marker 4 in the Waveform file which is currently playing. Only available in VXT: for M9420/21A only for Trigger Output 2, for M9410A/11A available for both Trigger Output 1/2.
PerArb	`TRIG2:OUTP PARB`	Selects the Trigger Output as PerArb. PerArb is a synchronization trigger which is generated by the ARB at the beginning of each repetition of playing the signal. Only available in VXT Models M9410A/11A.
FSYNc	`:TRIG:FRAM:SYNC EXT1` `TRIG2:OUTP FSYNc`	Selects the Trigger Output as FSYNc. The FSYNc parameter means route the Periodic Timer Sync Source signal to the specified Trigger output. That is, the signal selected with the :TRIGger [:SEQuence]:FRAMe:SYNC EXTernal1|EXTernal2|RFBurst|PXI|OFF command will be routed to the specified trigger output. The example code means that the External 1 trigger will be used as the Periodic Timer Sync Source, and this signal will then be routed to the Trigger 2 output. Only available in VXT Models M9410A/11A.

7.5.2 Trig 1 Out Polarity

This control sets the output to the Trig 1 Out connector to trigger on either the positive or negative polarity.

Although the Trig 1 Polarity control applies only to the Trig 1 output, the SCPI command (detailed in the table below) can be used for any of the Trig Out connectors by using the appropriate TRIGGER parameter (e.g. TRIG1, TRIG2, etc.).

Remote Command	`:TRIGger|TRIGger1|TRIGger2|TRIGger3|TRIGger4[:SEQuence]:OUTPut:POLarity POSitive | NEGative` `:TRIGger|TRIGger1|TRIGger2|TRIGger3|TRIGger4[:SEQuence]:OUTPut:POLarity?`
Example	`:TRIG1:OUTP:POL POS`
Dependencies	You can only send TRIG parameters for the hardware you have; for example you cannot send a TRIG3 parameter if your hardware does not support TRIG3. Sending the SCPI command for an output you do not have generates an error, “Hardware missing; Not available for this model number” Note that a query of a nonexistent output returns OFF.

Preset	This is unaffected by a Preset but is set to POSitive on a "Restore Input/Output Defaults" or "Restore System Defaults->All"
State Saved	Saved in instrument state

7.5.3 Trig 2 Out

This control selects the type of output signal that will be output from the Trig 2 Out connector.

Although the Trig 2 Out control applies only to the Trig 2 output, the SCPI command (detailed in the table under Trig 1 Out) can be used for any of the Trig Out connectors by using the appropriate TRIGGER parameter (e.g. TRIG1, TRIG2, etc.).

Example	`:TRIG2:OUTP HSWP` `:TRIG2:OUTP GATE`
Notes	Trig 2 Out is used as the source trigger out in EXM and VXT, the available choices in EXM and VXT are S1Marker, S2Marker, S3Marker, S4Marker and OFF.
Dependencies	The second Trigger output (Trig 2 Out) does not appear in all models; in models that do not support it, the Trig 2 Out control is blanked, and sending the SCPI command for this output generates an error, “Hardware missing; Not available for this model number” In models that do not support the Trigger 2 output, this error is returned if trying to set Trig 2 Out and a query of Trig 2 Out returns OFF.

7.5.4 Trig 2 Out Polarity

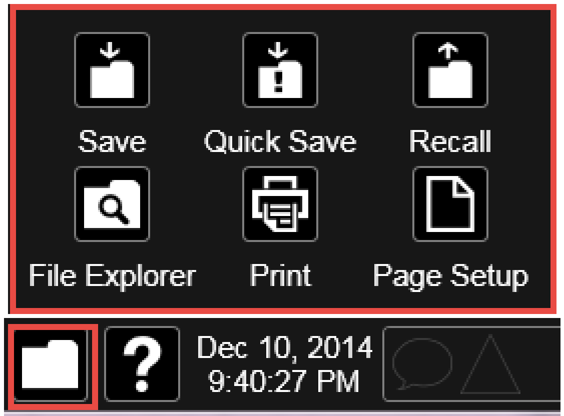
This control sets the output to the Trig 2 Out connector to trigger on either the positive or negative polarity.

Although the Trig 2 Out Polarity control applies only to the Trig 2 output, the SCPI command (detailed in the table under Trig 1 Out Polarity) can be used for any of the Trig Out connectors by using the appropriate TRIGGER parameter (e.g. TRIG1, TRIG2, etc.).

Example	`:TRIG2:OUTP:POL POS`
Dependencies	This control does not appear in EXM or VXT.
Preset	This is unaffected by a Preset but is set to POSitive on a "Restore Input/Output Defaults" or "Restore System Defaults->All"

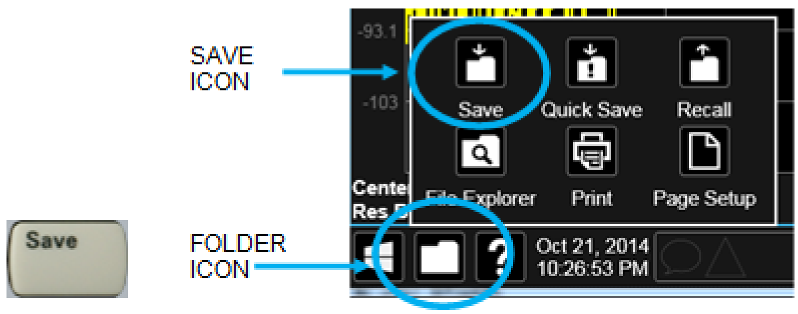
8 Save/Recall/Print

This section describes the functions that can be accessed via the front panel **Save**, **Quick Save**, and **Recall** hardkeys, as well as via the controls in the front-panel folder icon, as shown below.

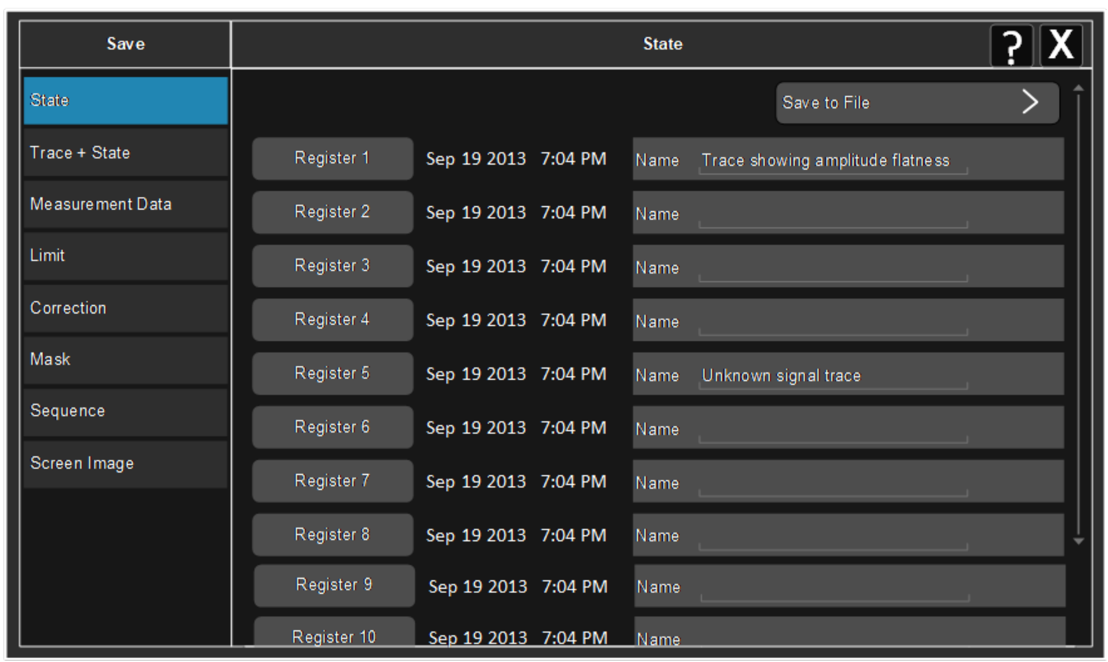


8.1 Save

The Save dialog lets you save states, traces, screen images and other items from the analyzer to files on the analyzer's internal storage, to removable devices, and to directories on the network. You access the Save dialog by pressing the Save hardkey, or by pressing the folder icon at the bottom of the display and then pressing the Save icon.



The Save dialog has section tabs running down the left side, which you use to specify what you want to save.



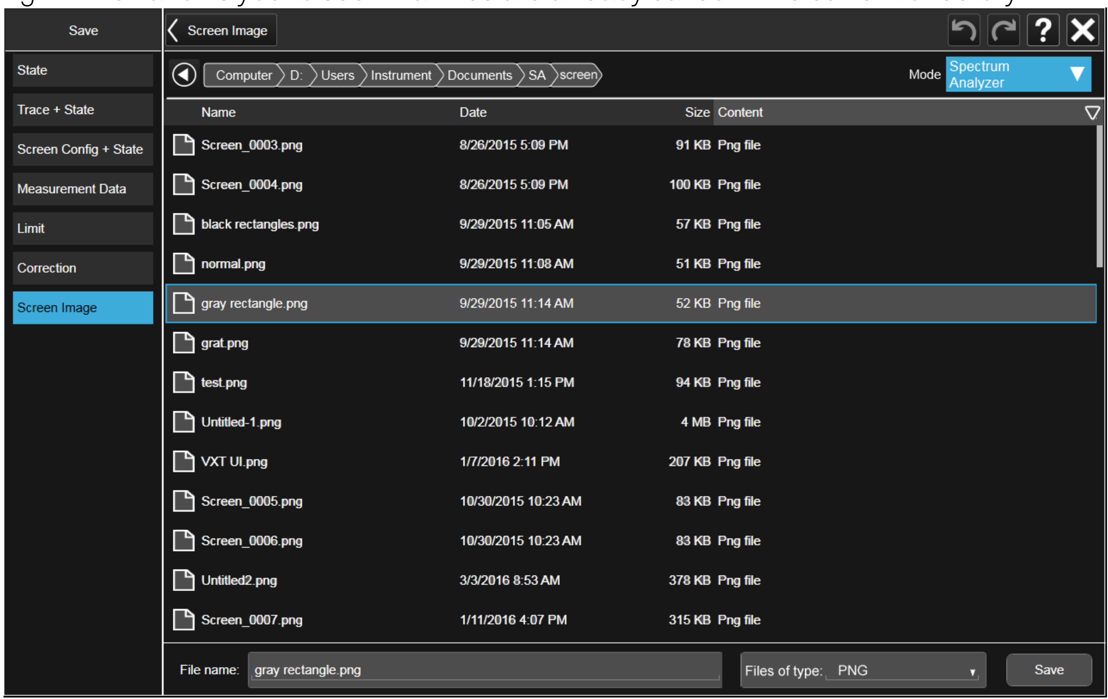
You choose the save item and then complete the save by choosing a register or file location to which to save the item.

Notes	No remote command for this key specifically, but the :MMEM:STORe command is available for specific file types. An example is :MMEM:STOR:STATe <filename>.

8.1.1 Save to File / Save As

For every Save type, a button appears called "Save to File" or "Save As". "Save to File" appears for save types that also include registers (like State and Trace+State), and "Save As" appears for all other save types.

When you push the "Save to File" or "Save As" button, a dialog slides in from the right which allows you to see what files are already saved in the current directory.



The default directory is the internal directory for the current Mode and save type, on the D: drive. You may also change to another Mode's state directory by pressing the dropdown in the upper right corner labeled "Mode". Once you have chosen a directory, the files in that directory whose extension matches the current data type (e.g., .state or .trace) are displayed in the right hand window of the dialog. You can sort this list by name, date, file size or extension by tapping the Name, Date, Size, or Content header at the top of each column. A second tap toggles the sort order between Ascending and Descending.

Also displayed is a path depiction showing the path to the current directory. In the example above, the path is D:\Users\Instrument\Documents\SA\screen. Tapping any element of this path lets you select an alternate route. Tapping the "Computer" arrow lets you select a different drive.

Tapping the "back" arrow navigates to the previously selected directory.

Note: Using the C: drive is strongly discouraged, since it runs the risk of being overwritten during an instrument software upgrade.

If you plug in a removable drive (e.g., a thumb drive), the browser immediately navigates to the root of that drive. Furthermore, if you had a thumb drive in and you were in a directory on the thumb, and then you exit the browser, when you come back in you are still in the same directory on that removable drive. If you remove the thumb drive, you return to the directory you had been in before the thumb drive was plugged in.

Note that for each data type there is a "current" directory and it is the last directory used by either Save or Recall for that Mode. For example if in SA Mode you save a Corrections file to a particular directory, then when you go to recall a Correction in SA Mode, you should be pointing at that directory. Or if in EMC Mode you recall a Limit from a particular directory then when in EMC Mode you go to save a Limit, it should be pointing at that same directory. There is one "current" directory for each data type for each Mode (not one for Save and one for Recall).

The Filename field, just below the Path field, shows the filename that will be used. The **File Name** field is initially loaded with an automatically generated filename specific to the appropriate Save Type. The automatically generated filename is guaranteed not to conflict with any filename currently in the directory. You may edit the filename by tapping it, which brings up the onscreen alpha keyboard. Press the "Done" button on this keyboard when you are done editing.

Select a file to overwrite, type in a file name, or use the name suggested by the analyzer (guaranteed not to conflict with any file in the current directory), and press Save. If the file specified already exists, a dialog will appear that allows you to replace the existing file by selecting **OK,** or you can Cancel the request.

After a successful save, a message "File <filename> saved" or "State Register <register number> saved" is displayed in an info box for a few seconds.

See the Quick Save documentation for more on the automatic file naming algorithm.

8.1.2 State

Save **State** lets you choose a register or file for saving the state.

State files contain essentially all the information required to return the analyzer to the measurement and settings that were in effect at the time of the save. State files are in a proprietary binary form (for speed) and cannot be read or edited by PC software, but can be loaded back into the analyzer to restore the state.

State files contain all of the settings of the **Input/Output** system as well, even though **Input/Output** variables are outside of the Mode's state and unaffected by **Mode Preset,** because these are needed to restore the complete setup.

Persistent **System** settings (for example, GPIB address) are affected by neither Mode Preset or Restore Mode Defaults**,** nor are they included in a saved State file.

For rapid saving, the State menu lists 16 registers to which you can save states. Pressing a Register button initiates the save. You can also select a file to which to save by pressing "Save to File".

The default path for all State Files is:

My Documents\<mode name>\state

where <mode name> is the parameter used to select the mode with the INST:SEL command (for example, SA for the Spectrum Analyzer).

State files have the extension ".state". The default filename is State_0000.state, where the 4 digit number is the lowest number that does not conflict with any filename in the current directory.

NOTE **In products that run multiple simultaneous instances of the X-Series Application, all instances share the same registers and file directories, so take care not to overwrite files and/or registers from one instance which were saved by another instance.**

Remote Command	`:MMEMory:STORe:STATe <filename>`
Example	`:MMEM:STOR:STATe "MyStateFile.state"` This stores the current instrument state data in the file MyStateFile.state in the default directory.
Notes	Both single and double quotes are supported for any filename parameter over remote. After saving to a register, that register's menu key is updated with the date the time, unless a custom label has been entered for that key. After saving to a register, you remain in the **Save State** menu, so that you can see the Register key update. After saving to a file, the analyzer automatically returns to the previous menu and any Save As dialog goes away.
Backwards Compatibility SCPI	`:MMEMory:STORe:STATe 1,<filename>` For backwards compatibility, the above syntax is supported. The "1" is simply ignored. The command is sequential.

8.1.2.1 Register 1 thru Register 16

Selecting any one of these register buttons causes the State of the currently active mode to be saved to the specified Register. The registers are provided for rapid saving and recalling, since you do not need to specify a filename or navigate to a file. Each of the register menu keys annotates whether it is empty or at what date and time it was last modified. In addition, you can edit any of the register names to enter custom names for any register.

Although these 16 registers are the only registers available from the front panel, there are 128 state registers available in the instrument. Registers 17-128 are only available from the SCPI interface, using the *SAV command.

There is one set of 128 state registers in the instrument, not one set for each Mode. When a state is saved, the Mode it was saved from is saved with it; then when it is recalled, the instrument switches to that Mode.

NOTE **In products that run multiple simultaneous instances of the X-Series Application, all instances share the same registers and file directories, so take care not to overwrite files and/or registers from one instance which were saved by another instance.**

The date displayed follows the format specified in the **Date Format** setting under the Control Panel. The time shows hours and minutes.

After the save completes, the corresponding register menu key annotation is updated with the date and time and the message "Register <register number> saved" is displayed.

Example	`*SAV 1`
Range	1-16 from front panel, 1-128 from SCPI

8.1.2.2 Edit Register Names

You may enter a custom name for any of the Registers, to help you remember what you are using that state to save. To do this, press the **Name** field for the register you want to rename, which brings up the onscreen alpha keyboard. Press the “Done” button on this keyboard when you are done editing.

The maximum number of characters for a register name is 30. If you delete all the characters in the custom name, it restores the default (time and date).

The register names are stored within the state files, but they are not part of the instrument state; that is, once you have edited a register name, loading a new state will not change that register name.Another consequence of this is that the names will be persistent through a power cycle. Also, if a named state file is transferred to another analyzer, it will bring its custom name along with it.

If you try to edit the name of an empty register, the analyzer will first save the state to have a file to put the name in. If you load a named state file into an analyzer with older firmware it will ignore the metadata.

The *SAV and *RCL commands will not be affected by the custom register names, nor will the MMEM commands.

Remote Command	`:MMEMory:REGister:STATe:LABel <reg number>,"label"` `:MMEMory:REGister:STATe:LABel? <reg number>`
Example	`:MMEM:REG:STAT:LAB 1,"my label"`
Notes	<reg number> is an integer from 1 to 16. If the SCPI specifies an invalid register number an error message is generated, -222,"Data out of range;Invalid register label number" "label" is a string from 0 to 30 characters in length. If a label exceeds 30 characters, an error message is generated, -150,"String data error;Label clipped to 30 characters" "label" of length 0 erases the custom label and restores the default (time and date) label. For example, :MMEM:REG:STAT:LAB 1,""
Preset	The names are unaffected by Preset or power cycle but are set to the default label (time and date) on a "Restore System Defaults->Misc"

8.1.3 Trace+State

Save **Trace+State** lets you choose a register or file for saving selected traces and the state.

Trace+State files contain essentially all the information required to return the analyzer to the measurement and settings that were in effect at the time of the save, as well as the data for one or all traces. Trace+State files are in a proprietary binary form (for speed) and cannot be read or edited by PC software, but can be loaded back into the analyzer to restore the state and trace(s).

Trace+State files contain all of the settings of the **Input/Output** system as well, even though **Input/Output** variables are outside of the Mode's state and unaffected by **Mode Preset,** because these are needed to restore the complete setup.

Persistent **System** settings (for example, GPIB address) are affected by neither Mode Preset or Restore Mode Defaults**,** nor are they included in a saved Trace+State file.

For rapid saving, the **Trace+State** menu lists 16 registers to which you can save trace+state files. The **Trace+State** registers are separate registers from the **State** registers. Pressing a Register button initiates the save. You can also select a file to which to save by pressing "Save to File".

The default path for all Trace+State files is the same as that for State files:

```
My Documents\<mode name>\state
```

where <mode name> is the parameter used to select the mode with the INST:SEL command (for example, Basic for the IQ Analyzer).

NOTE	**In products that run multiple simultaneous instances of the X-Series Application, all instances share the same registers and file directories, so take care not to overwrite files and/or registers from one instance which were saved by another instance.**

Trace+State files have the extension ".trace". The default filename is State_0000.trace, where the 4 digit number is the lowest number that does not conflict with any filename in the current directory.

The Trace+State selection only appears for measurements that support trace saves. It is blanked for modes that do not support trace saves. Saving **Trace** is identical to saving State except a .trace extension is used on the file instead of .state, and internal flags are set in the file indicating which trace was saved.

See "More Information" on page 502.

Remote Command	:MMEMory:STORe:TRACe TRACE1 | TRACE2 | TRACE3 | TRACE4 | TRACE5 | TRACE6 | ALL,<filename> :MMEMory:STORe:TRACe:REGister TRACE1 | TRACE2 | TRACE3 | TRACE4 | TRACE5 | TRACE6 | ALL,<integer>
Example	:MMEM:STOR:TRAC TRACE1,"myState.trace" saves the file myState.trace on the default path and flags it as a "single trace" file with Trace 1 as the single trace (even though all of the traces are in fact stored). :MMEM:STOR:TRAC ALL,"myState.trace" saves the file myState.trace on the default path and flags it as an "all traces" file :MMEM:STOR:TRAC:REG TRACE1,2 stores trace 1 data in trace register 2
Notes	This command actually performs a Save State, which in the Swept SA measurement includes the trace data. However it flags it (in the file) as a "save trace" file of the specified trace (or all traces). Some modes and measurements do not have available all 6 traces. The Phase Noise mode command, for example, is: MMEMory:STORe:TRACe TRACE1|TRACE2|TRACE3|ALL,<filename> Some modes and measurements have more than 6 traces available. The Realtime SA mode command, for example, is: MMEMory:STORe:TRACe TRACE1 | TRACE2 | TRACE3 | TRACE4 | TRACE5 | TRACE6 | TRACE7 | TRACE8 | TRACE9 | TRACE10 | TRACE11 | TRACE12 | ALL,<filename> The range for the register parameter is 1-5 When you initiate a save, if the file already exists, a dialog will appear that allows you to replace the existing file by selecting **OK** or you can Cancel the request. If you select **OK**, the file will be overwritten. Using the C: drive is strongly discouraged, since it runs the risk of being overwritten during an instrument software upgrade. Both single and double quotes are supported for any filename parameter over remote. After saving to a register, that register's menu key is updated with the date and time of the save. After saving to a register, you remain in the **Save Trace** menu, so that you can see the Register key update. After saving to a file, the analyzer automatically returns to the previous menu and any Save As dialog goes away.

More Information

In measurements that support saving Traces, for example, Swept SA, the Trace data is saved along with the State in the State file. When recalling the State, the Trace data is recalled as well. Traces are recalled exactly as they were stored, including the writing mode and update and display modes. If a Trace was updating and visible when the State was saved, it will come back updating and visible,and its data will be rewritten right away. When you use State to save and recall traces, any trace whose data must be preserved should be placed in View or Blank mode before saving.

The following table describes the Trace Save and Recall possibilities:

You want to recall state and one trace's data, leaving other traces unaffected.	Save Trace+State from 1 trace. Make sure that no other traces are updating (they should all be in View or Blank mode) when the save is performed.	On Recall, specify the trace you want to load the one trace's data into. This trace will load in View. All other traces' data will be unaffected, although their trace mode will be as it was when the state save was performed.
You want to recall all traces	Save Trace+State from ALL traces.	On Recall, all traces will come back in View (or Blank if they were in Blank or Background when saved)
You want all traces to load exactly as they were when saved.	Save State	On recall, all traces' mode and data will be exactly as they were when saved. Any traces that were updating will have their data immediately overwritten.

8.1.3.1 Save From Trace

This control enables you to select the trace to be saved. The default is the currently selected trace, selected in this this or any other menu with Trace selection. If you have chosen All then it remains chosen until you specifically change it to a single trace, regardless of the trace selected in the Trace menu.

When you select a trace, it makes that trace the current trace, so it displays on top of all of the other traces.

8.1.3.2 Register 1 thru Register 16

Selecting any one of these register buttons causes the specified trace(s) and the state of the currently active mode to be saved to the specified Register. The registers are provided for rapid saving and recalling, since you do not need to specify a filename or navigate to a file. Each of the register menu keys annotates whether it is empty or at what date and time it was last modified. In addition, you can edit any of the register names to enter custom names for any register.

There is one set of 16 trace+state registers in the instrument, not one set for each Mode. When trace+state is saved, the Mode it was saved from is saved with it; then when it is recalled, the instrument switches to that Mode.

NOTE	In products that run multiple simultaneous instances of the X-Series Application, all instances share the same registers and file directories, so take care not to overwrite files and/or registers from one instance which were saved by another instance.

The date displayed follows the format specified in the **Date Format** setting under the Control Panel. The time shows hours and minutes.

After the save completes, the corresponding register menu key annotation is updated with the date and time and the message "Register <register number> saved" is displayed.

Example	`*SAV 1`
Range	1-16

8.1.3.3 Edit Register Names

You may enter a custom name for any of the Registers, to help you remember what you are using that trace+state to save. To do this, press the **Name** field for the register you want to rename, which brings up the onscreen alpha keyboard. Press the “Done” button on this keyboard when you are done editing.

The maximum number of characters for a register name is 30. If you delete all the characters in the custom name, it restores the default (time and date).

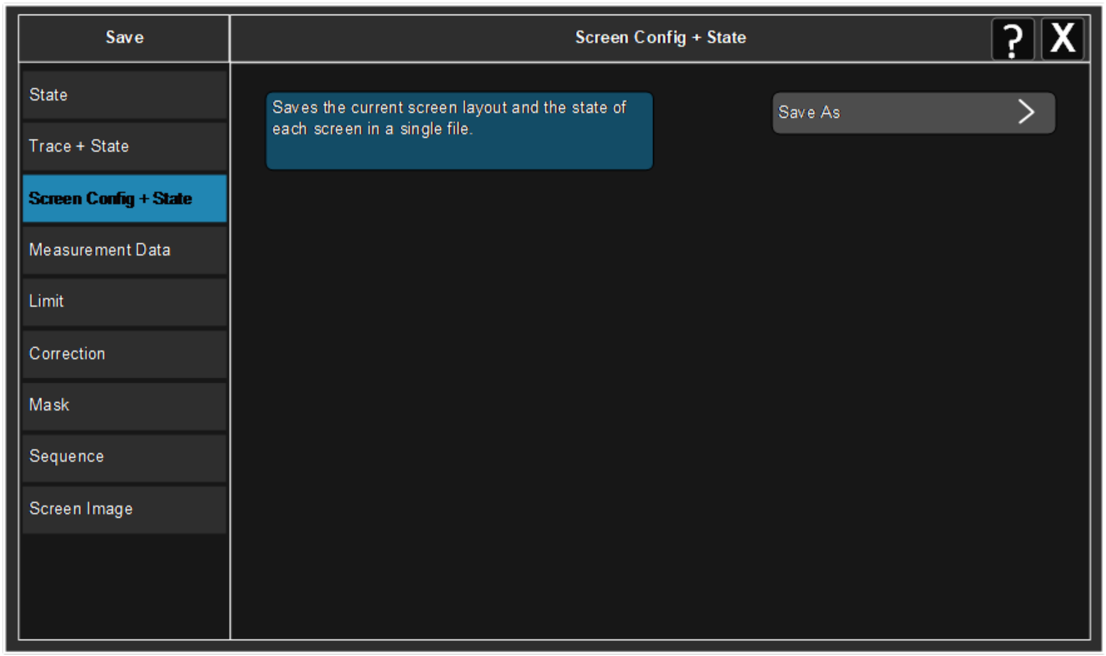
The register names are stored within the trace+state files, but they are not part of the instrument state; that is, once you have edited a register name, loading a new state will not change that register name.Another consequence of this is that the names will be persistent through a power cycle. Also, if a named state file is transferred to another analyzer, it will bring its custom name along with it.

If you try to edit the name of an empty register, the analyzer will first save the trace+state to have a file to put the name in. If you load a named state file into an analyzer with older firmware it will ignore the metadata.

Remote Command	`:MMEMory:REGister:TRACe:LABel <reg number>,”label”` `:MMEMory:REGister:TRACe:LABel? <reg number>`
Example	`:MMEM:REG:TRAC:LAB 1,”my label”`
Notes	<reg number> is an integer from 1 to 16. If the SCPI specifies an invalid register number an error message is generated, -222,"Data out of range;Invalid register label number" “label” is a string from 0 to 30 characters in length. If a label exceeds 30 characters, an error message is generated, -150,“String data error;Label clipped to 30 characters” “label” of length 0 erases the custom label and restores the default (time and date) label, e.g., :MMEM:REG:TRAC:LAB 1,””
Preset	The names are unaffected by Preset or power cycle but are set to the default label (time and date) on a “Restore System Defaults->Misc”

8.1.4 Screen Config + State

SaveScreen Config + State lets you save the complete configuration of all your screens to a file. You choose a file to which to export the data.



Remote Command	`:MMEMory:STORe:SCONfig <filename>`
Example	`:MMEM:STOR:SCON "myScreenConfig.screen"` This stores the current screen configuration in the file MyScreenConfig.screen in the default directory.

8.1.5 Measurement Data

Save Measurement Data lets you specify a data type (for example, trace data) and choose a file to which to export the data.

Measurement Data files are Comma-Separated Value (CSV) files, and contain the requested data in a form that can be imported into Excel or other spreadsheets, as well as header data that gives information on relevant instrument settings at the time the save occurred.

The main application of Measurement Data files is for importing data to a PC for analysis, but in some cases Measurement Data files can also be imported back into the instrument to recreate the data object that existed at the time of the save. For example, most Trace data files can be imported back into the instrument.

The default path for Measurement Data Files is:

`My Documents\<mode name>\data`

with the subdirectory reflecting the data type and where <mode name> is the parameter used to select the mode with the INST:SEL command (for example, SA for the Spectrum Analyzer) and <measurement name> is the parameter used to select the measurement with the CONF: command (for example, SAN for the Swept SA). So a Peak Table file from the Swept SA would be stored in

`My Documents\SA\data\SAN\results`

Measurement Data files have the extension ".csv". The default filename is `Prefix_0000.csv`, where the 4 digit number is the lowest number that does not conflict with any filename in the current directory, and "Prefix" is dependent on the data type:

Type	Default Prefix
Traces	Trace_
Measurement Result	MeasR_
Capture Buffer	CapBuf_

For example, the default filename for a trace data file in an empty directory would be `Trace_0000.csv`

8.1.5.1 Save From

This control enables you to select the specific item to be saved, for example, if you are exporting trace data you may specify Trace 1, Trace 2, etc.

The default for traces is the currently selected trace, selected in this this or any other menu with Trace selection. If you have chosen All then it remains chosen until you specifically change it to a single trace, regardless of the trace selected in the Trace menu. The **All** selection saves all six traces in one .csv file with the x-axis data in the first column and the individual trace data in succeeding columns. The header data and x-axis data in this file reflect the current settings of the measurement. Note that any traces which are in View or Blank may have different x-axis data than the current measurement settings; but this different x-axis data will not be output to the file.

Preset	Not part of Preset, but is reset to by Restore Mode Defaults; survives shutdown

8.1.5.2 Data Type

Allows you to recall IQ data from the measurement using a specified file type (CSV, SDF, TXT, BIN, BINX, BINF).

File Format Types:

Format Type	Format Description	Comments
CSV	Comma-Separated-Value	Excel-compatible Plain text, roughly three times the size of BINF

Format Type	Format Description	Comments
TXT	Plain Text	Plain text, roughly three times the size of BINF
SDF	Developed for Keysight 89600 VSA Software	Note that due to differences in the internal file structure, SDF files saved by X-Series are not guaranteed to work perfectly with 89600
BIN	Interleaved 16-bit Q15 signed IQ file, in Big-Endian format	Q15 is a DSP format, in which the most significant bit is the sign bit, followed by 15 fractional bits. The Q15 number has a decimal range between -32768 and -32767, and the data is scaled to fit within this decimal range BIN files do not include sampling rate information in the file, so after recalling a BIN file you will need to set the Sample Rate in the **Sweep**, **Playback** menu
BINX	Interleaved 16-bit Q15 signed IQ file, in Little-Endian format	The data is scaled to fit within the decimal range BINX files do not include sampling rate information in the file, so after recalling a BINX file you will need to set the Sample Rate in the **Sweep**, **Playback** menu
BINF	32-bit IEEE 754 floating-point number, in Little-Endian format	The data is raw IQ data BINF files do not include sampling rate information in the file, so after recalling a BIN file you will need to set the Sample Rate in the **Sweep**, **Playback** menu

For BIN, BINX and BINF files, you should have noted the Sample Rate that was displayed on the **Sweep**, **Recording** menu panel when you saved the file.

Example `:MMEM:LOAD:RECording "C:\TEMP\MyIQData.csv"`

8.1.6 Limit

Save > **Limit** lets you choose a file to which to export the Limit data.

Limit files are CSV files, and contain the limit data in a form that can be imported into Excel or other spreadsheets, as well as header data that gives information on the limit.

The default path for most Limits Files is:

```
\My Documents\<mode name>\data\limits
```

where `<mode name>` is the parameter used to select the mode with the `:INST:SEL` command (for example, `SA` for the Spectrum Analyzer). Hence a Limit file from any measurement in the Spectrum Analyzer mode would be stored in:

```
\My Documents\SA\data\limits
```

The default path for Limit files from the Log Plot measurement in the Phase Noise mode is:

```
\My Documents\PNOISE\data\LPL\limits
```

The default filename is `Limit_0000.csv`, where the 4 digit number is the lowest number that does not conflict with any filename in the current directory.

For backwards compatibility, older limit files with the extension `.lim` can be read into the analyzer, but you can only save limits as `.csv` files.

Remote Command	`:MMEMory:STORe:LIMit LLINE1 | LLINE2 | LLINE3 | LLINE4 | LLINE5 | LLINE6,<filename>`
Example	`:MMEM:STOR:LIM LLINE2,"myLimitLine2.csv"` Saves the 2nd Limit Line to the file myLimitLine2.csv in the current path.
Notes	If the save is initiated via SCPI, and the file already exists, the file will be overwritten. Using the C: drive is strongly discouraged, since it runs the risk of being overwritten during an instrument software upgrade. Both single and double quotes are supported for any filename parameter over SCPI.
Dependencies	This key will only appear if you have the proper option installed in your instrument. In the Log Plot measurement in the Phase Noise Mode, there are only three Limit Lines, so the valid parameters are LLINE1|LLINE2| LLINE3
Preset	1; not part of Preset, but is reset by Restore Mode Defaults and survives power cycles
State Saved	The selected Limit number is saved in instrument state.
Status Bits/OPC dependencies	Sequential - waits for previous measurement to complete

Limit File Contents

Limits may be exported into a data file with a .csv extension. They may be imported from that data file; they may also be imported from a legacy limit file with a .lim extension. The .lim files meet the specification for limit files contained in the EMI measurement guide, HP E7415A.

.csv file format

Except for information in quotes, limit line files are not case sensitive. Information in bold is required verbatim; other text is example text, and italic text is commentary which should not be present in the file.

The first five lines are system-required header lines, and must be in the correct order.

Limit	*Data file type name*
"FCC Part 15"	*File Description*
"Class B Radiated"	*Comment*
A.01.00,R0001,N9020A	*Instrument Version, Model Number*
P13 EA3 UK6 ,01	*Option List, File Format Version*

The next few lines describe the parameters; on export they will be in the order shown, on import they can be in any order. If some parameters are missing, they will revert to the default.

Type, Upper	*Upper|Lower*
X Axis Unit, MHz	*MHz|S; other units should be converted; this also specifies the domain*
Amplitude Unit, dBm	*dBm|V; all other units should be converted appropriately*
Frequency Interpolation, Linear	*Logarithmic|Linear*
Amplitude Interpolation, Logarithmic	*Logarithmic|Linear*
X Control, Fixed	*Fixed|Relative; on input we consider only the first three characters*
Y Control, Fixed	*Fixed|Relative; on input we consider only the first three characters*
Margin, 0	*Always in dB. A 0 margin is equivalent to margin off*
X Offset, 10	*Expressed in the X axis units*
Y Offset, 5	*Expressed in the Amplitude units*

The Amplitude Unit line in the limits file may contain a transducer (formerly "antenna") factor unit, for example:

Amplitude Unit=dBuV/m

Transducer factor units are dBuV/m, dBuA/m, dBpT, and dBG. In this case, the unit is treated exactly as though it were dBuV, meaning that all of the limits are interpreted to have units of dBuV. The box does NOT change Y Axis Units when such a limit is loaded in.

The X axis unit also specifies the domain (time or frequency). It is not possible to have both time-domain lines and frequency-domain lines at the same time; if a time-domain line is imported while the other lines are in the frequency domain (or vice-versa), all limit lines will be deleted prior to import.

If the sign of the margin is inappropriate for the limit type (for example a positive margin for an upper limit), the sign of the margin will be changed internally so that it is appropriate.

The remaining lines describe the data. Each line in the file represents an X-Y pair. The X values should be monotonically non-decreasing, although adjacent lines in the file can have the same X value as an aid to building a stair-stepped limit line. To specify a region over which there is no limit, use +1000 dBm for upper limits or –1000 dBm for lower limits.

The data region begins with the keyword DATA:

```
DATA
200.000000,–10.00
300.000000,–10.00
300.000000,–20.00
500.000000,–20.00
```

.lim file format

This is a legacy format which allows files saved from older analyzers to be loaded into the X-Series. Design of files in this format is not recommended.

Except for name and description text (which is taken verbatim), limit line files are not case sensitive.

The file may optionally start with a description block, consisting of the single line [DESCRIPTION] followed by arbitrary text. If there is no Limit Line Name header, the description text will be used as the limit line description in the GUI. If there is a Limit Line Name header, the Limit Line Name will be used instead.

Arbitrary text

The header block begins with the single line [HEADER], followed by some or all of the following fields, each with <parameter name>=<parameter value>. Excess white space around the "=" will be ignored. If a field is not present or the data is invalid, the value will not be changed when the limit line is loaded. Ordering of the fields is unimportant.

Limit Line Name="FCC Part 15;Class B Radiated"	
Type=Upper	Upper|Lower
Frequency Unit=MHz	For time domain limits, this should say "Time Unit"
Amplitude Unit=dBm	
Frequency Interpolation=Lin	Log|Lin; on input we consider only the first three characters
Amplitude Interpolation=Log	Log|Lin; on input we consider only the first three characters
Mode=Fixed	Fixed|Relative
Margin=0	Always in dB. A 0 margin is equivalent to margin off
Domain=Frequency	Frequency|Time
Delimiter=TAB	

The data block begins with the line "[DATA]", and consists of any number of segments.

The Data lines represent segments – X1, Y1, X2, Y2. If the list of segments includes a gap in the middle on input, the space inside the gap will be set to ensure the limit does not fail: for upper limits maxtracevalue, for lower limits mintracevalue. If two segments overlap on input, the stricter of the two segments is used – for upper limits the lower segment, for lower limits the upper segment.

Thus, the following segments indicate into a –5 dB limit from 10 MHz to 20 MHz and 30 MHz to 40MHz:

10	–5	20	–5
30	–5	40	–5

If this was an upper limit, this would be translated into the following set of limit points:

10	–5
20	–5
20	maxtracevalue

30	maxtracevalue
30	-5
40	-5

30	-29.5	88	-29.5	
88	-33	216	-33	note that we are stair-stepping the line
230	-35.6	960	-35.6	The gap between 216 MHz and 230 MHz will never fail
960	-43.5	5000	-43.5	

8.1.6.1 Select Limit

This control enables you to select the Limit register where the recalled Limit will be placed, e.g., Limit 1.

Preset	Not part of Preset, but is reset to LLINE1 by Restore Mode Defaults; survives shutdown

8.1.7 Correction

Selecting **Correction** allows you to export Amplitude Corrections files in the PC-readable .csv format.

Amplitude Correction files are Comma-Separated-Value (CSV) files, and contain the correction data in a form that can be imported into Excel or other spreadsheets, as well as header data that gives information on the correction.

The default filename is `Ampcor_0000.csv`, where the 4 digit number is the lowest number that does not conflict with any filename in the current directory.

The default path for Corrections files is:

`\My Documents\amplitudeCorrections`

For backwards compatibility, older limit files with the extension .amp, .cbl, .ant and .oth can be read into the instrument, but you can only save corrections as .csv files.

See "Correction Data File " on page 511

Remote Command	`:MMEMory:STORe:CORRection 1 | ... | 8, <filename>`
Example	`:MMEM:STOR:CORR 2 "myAmpcor.csv"` saves Correction 2 to the file `myAmpcor.csv` on the current path
Notes	If the save is initiated via SCPI, and the file already exists, the file will be overwritten Using the C: drive is strongly discouraged, since it runs the risk of being overwritten during an

	instrument software upgrade Both single and double quotes are supported for any filename parameter over SCPI
Dependencies	Corrections are not supported by all Measurements. If in a Mode in which some Measurements support it, this key will be grayed out in measurements that do not. The key will not show at all if no measurements in the Mode support it This key does not appear unless you have the proper option installed in your instrument
Annotation	After save is complete, an advisory is displayed in the message bar confirming which file was saved
Backwards Compatibility SCPI	`:MMEMory:STORe:CORRection ANTenna | CABLe | OTHer | USER, <filename>` For backwards compatibility, `ANTenna` maps to 1, `CABle` maps to 2, `OTHer` maps to 3, and `USER` maps to 4

Correction Data File

A Corrections Data File contains a copy of one of the analyzer correction tables. Corrections provide a way to adjust the trace display for predetermined gain curves (such as for cable loss).

The format for Corrections files is as follows.

Line #	Type of field	Example	Notes
1	File type, must be "Amplitude Correction"	Amplitude Correction	May not be omitted
2	File Description (in quotes)	"Correction Factors for 11966E"	60 characters max; may be empty but may not be omitted If exceeds 60 characters, error -233 Too much data reported
3	Comment (in quotes)	"Class B Radiated"	60 characters max; may be empty but may not be omitted If exceeds 60 characters, error -233 Too much data reported
4	Instrument Version, Model #	A.02.06,N9020A	May be empty but may not be omitted
5	Option List, File Format Version	K03 LFE EXM ,01	May be empty but may not be omitted
6	Freq Unit to be used for all frequency values in the file	Frequency Unit,MHz	assumed to be Hz if omitted
7	Transducer Unit	Antenna Unit,None	If omitted leaves the Transducer unit unchanged. The amplitude unit in the Transducer Unit field is a conversion factor that is used to adjust the Y Axis Units of the current mode, if the mode supports Transducer Units. For more

Line #	Type of field	Example	Notes
			details on transducer correction data, refer to the Input/Output,Corrections key description. Allowable values: dBuv/m, dBuA/m, dBG, dBpT, None
8	Freq Interpolation	Frequency Interpolation,Linear	if omitted leaves the Freq Interpolation unchanged. Allowable values: Linear, Logarithmic
9	Bias value in mA	Bias,0.00	If omitted leaves the Bias value unchanged (added as of A.08.50)
10	Bias State	Bias State,On	If omitted leaves the Bias State unchanged. Allowable values: On, Off (added as of A.08.50)
11	Overlap, two values, Freq1 and Freq2, separated by commas.	Overlap,33500,40000	Uses Freq Unit from line 6. Thus, in this example Freq1=33.5 GHz, Freq2= 40.0 GHz (see note below). If omitted leaves the overlap unchanged (added as of A.08.50)
12	DATA marker	DATA	Corrections data begins in the next line

Lines 2 through 5 can be empty, but must appear in the file. Lines 6 through 11 are optional, the lines can be left out of the file altogether.

The Overlap row and the two Bias rows apply only to external mixing. Both are read-only, they are never written by the analyzer. The only way to insert or modify these rows is to edit the file with a text editor or a spreadsheet editor. These rows are intended for use by mixer manufacturers, as they allow the manufacturer to insert data about how the mixer corrections were generated and how they should be applied. The Bias rows allow you to specify whether to turn Bias on or off when the Correction is turned on and to specify a Bias value (turning off the Correction does not change the Bias, but turning it back on again sets it to the value specified in the file). The Overlap row allows you to specify an overlap region in which two different corrections may be applied. It is expected that in the corrections data itself, there will be TWO corrections values exactly at Max Freq, otherwise Overlap is ignored. The way the overlap is processed is as follows: if at any given time the current analyzer Start Freq is greater than Freq 1 and lower than Freq 2, and the current Stop Freq is greater than Freq 2, extend the first correction point at or above Freq 2 down to Freq 1, rather than using the correction data between Freq1 and Freq2.

Only one Transducer unit can be on at any given time. Note that this means that if a correction file with a Transducer Unit is loaded into a particular Correction, all other Corrections are set to that same Transducer unit. Note that the legacy term “Antenna Unit” is still used in the correction file, even though the more modern term “Transducer Unit” is used in the user interface.

Similarly, the Bias rows can only be used in Correction register 1, because there can only be one setting for Bias at any given time. If a Correction file with a Bias or Bias

State row is loaded into any Correction register but 1, an error is generated: Mass storage error; Can only load Bias Settings into Correction 1

The data follows the DATA row, as comma-separated X, Y pairs; one pair per line.

For example, suppose you have an Antenna to correct for on an N9020A version A.02.06 and the correction data is:

- 0 dB at 200 MHz
- 17 dB at 210 MHz
- 14.8 dB at 225 MHz

Then the file will look like:

- Amplitude Correction
- "Correction Factors for 11966E"
- "Class B Radiated"
- A.02.06,N9020A
- P13 EA3 UK6,01
- Frequency Unit,MHz
- Antenna Unit,dBuV/m
- Frequency Interpolation,Linear
- DATA
- 200.000000,0.00
- 210.000000,17.00
- 225.000000,14.80

The choices for the 1 of N fields in the metadata are as follows:

- Frequency Unit: Hz, kHz, MHz, GHz
- Antenna Unit: dBuv/m, dBuA/m, dBG, dBpT, None
- Frequency Interpolation: Logarithmic, Linear

8.1.7.1 Select Correction

This control enables you to select the specific Correction to be saved, e.g., Correction 1.

Preset	Not part of a Preset, but is reset to Correction 1 by Restore Input/Output Defaults. Survives a shutdown.

8.1.8 Correction Group

Pressing this key selects Correction Group as the data type to be exported with a save request. The next step is to select the Save As key in the Save Data menu.

Remote Command	`:MMEMory:STORe:CORRection:GROup <filename>`
Example	`:MMEM:STOR:CORR:GRO "D:\myAmpcorGroup.csv"` saves Correction Group to the file myAmpcorGroup.csv.
Notes	If the save is initiated via SCPI, and the file already exists, the file and the directory will be overwritten. Using the C: drive is strongly discouraged, since it runs the risk of being overwritten during an instrument software upgrade. Both single and double quotes are supported for any filename parameter over SCPI.
Dependencies	This file type is supported in EMI Receiver mode and in Spectrum Analyzer mode if option EMC or EMI Receiver mode is present. None
Annotation	After save is complete, an advisory is displayed in the message bar confirming which file was saved.

Correction Group File

A Correction Group file contains the correction group settings (i.e., Antenna unit, break, description and comment) range table and correction files data. Corrections files are text files in .csv (comma separated values) form, to make them importable into Excel or other spreadsheet programs.

8.1.9 Screen Image

Save **Screen Image** lets you choose a file for saving the contents of the display.

Screen Image files are PNG files with the same resolution as the data display. They contain the picture that was on the screen before going into the Save dialog. When the Screen Image key is pressed, a "thumbnail" of the captured image is displayed, as shown below, with the note “This is the image that will be saved” below it, as shown below.

After you have completed the save, a message "File image.png saved" (assuming image.png was the filename you used).

NOTE

As of firmware release A.17.50, sending a *CLS (clear status) command will remove any message displayed on the screen. So if you do not want to see the "File saved" message after sending the MMEM:STOR:SCR command (described below), send the following sequence (substituting your file name for filename.png):

MMEM:STOR:SCR "filename.png";*CLS

NOTE

As of firmware release A.19.50, saving a screen image will remove any informational message displayed on the screen before it captures the screen. This is useful if you are sending "save image" commands in rapid sequence, as it keeps the "File saved" message from one screen capture from appearing in the next screen capture. Error messages will still be captured.

If you send a succession of screen image commands TOO rapidly, the system may not have time to remove the previous message before the next screen capture. Sending screen image commands more rapidly than twice a second is not advised.

The default path for State Files is:

`My Documents\<mode name>\screen`

where <mode name> is the parameter used to select the mode with the INST:SEL command (for example, SA for the Spectrum Analyzer).

Screen Image files have the extension ".png". The default filename is Screen_0000.png, where the 4 digit number is the lowest number that does not conflict with any filename in the current directory.

After you have completed the save, the **Quick Save** front-panel key lets you quickly repeat the last save performed, using an auto-named file, with new current screen data.

Remote Command	`:MMEMory:STORe:SCReen <filename>`
Example	`:MMEM:STOR:SCR "myScreen.png"` This stores the current screen image in the file MyScreenFile.png in the default directory.
Backwards Compatibility SCPI	`:HCOPy:SDUMp:DATA?` returns the screen image in a <DEFINITE LENGTH ARBITRARY RESPONSE DATA> element. The response data is IEEE Block format; the controlling computer can strip the header and store the result as a .png file.

8.1.9.1 Theme

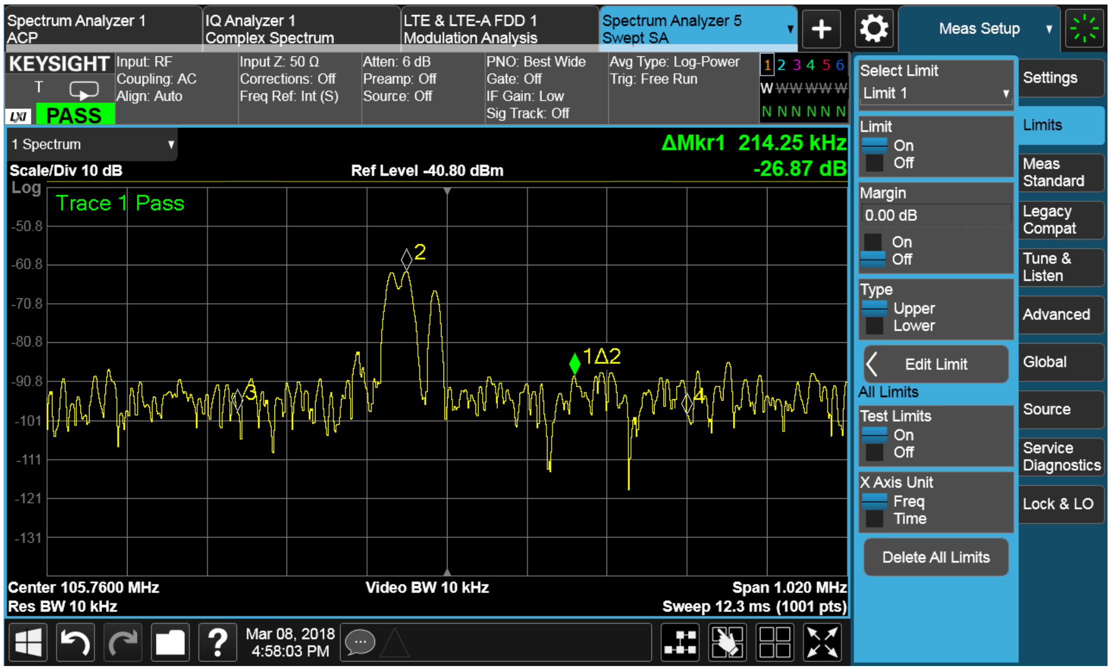
Accesses a menu of functions that enable you to choose the theme to be used when saving the screen image. It allows you to choose between themes to be used when saving the screen image.

See "More Information" on page 517 for examples of the themes.

Remote Command	`:MMEMory:STORe:SCReen:THEMe FILLed | OUTLine` `:MMEMory:STORe:SCReen:THEMe?`
Example	`:MMEM:STOR:SCR:THEM OUTL`
Preset	Filled; not part of Preset, but is reset by Restore Misc Defaults or Restore System Defaults All
Backwards Compatibility SCPI	`:MMEMory:STORe:SCReen:THEMe TDColor | TDMonochrome | FCOLor | FMONochrome`
Backwards Compatibility Notes	To permit code compatibility with A-model X-Series Signal Analyzer instruments, the command parameters from the A-models will be mapped as follows: TDColor and TDMonochrome are both mapped to FILLed (exact full color representation of what is on the screen) FCOLor and FMONochrome are both mapped to OUTLine (uses color for traces and other items, but most filled areas are white) There is no Monochrome theme in the B-models so the A-models monochrome commands will yield color. The query of :MMEM:STOR:SCR:THEM? will always return FILLed or OUTLine, it will not return FCOLor, FMONochrome, TDColor, or TDMonochrome. In ESA and PSA we offer the choice of "Reverse Bitmap" or "Reverse Metafile" when saving screen images. This is much like the "Outline" theme available in the X-Series Touch UI. There is no monochrome theme in the X-Series Touch UI.

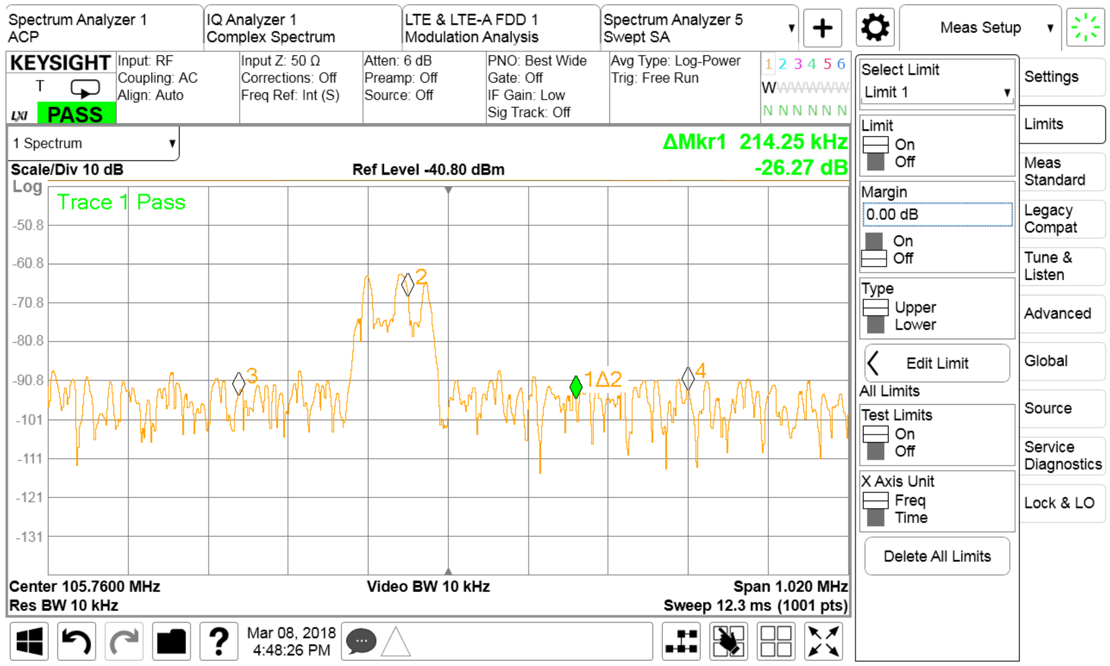
More Information

The Filled theme is an exact representation of the information on the display:



The Outline theme eliminates most of the filled areas, in order to save ink when the image is printed. In addition, the yellow trace color is changed to be more orange, to improve visibility against a white background.

Note that some objects remain filled. In particular, the selected marker remains filled with the green marker color, in order to distinguish it from the other markers. This is important, as it is the selected marker whose readout appears in the upper right corner of the display:



8.1.10 Remote Only Commands

The following commands execute file system operations such as move, copy and transfer data from a file.

8.1.10.1 Mass Storage Catalog (Remote Command Only)

Remote Command	`:MMEMory:CATalog? [<directory_name>]`
Example	`:MMEM:CAT? "C:\"`
Notes	The string <directory_name> must be a valid logical path. If no string then it uses the current directory. Queries disk usage information (drive capacity, free space available) and obtains a list of files and directories in a specified directory in the following format: <numeric_value>,<numeric_value>,{<file_entry>} It returns two numeric parameters and as many strings as there are files and directories. The first parameter indicates the total amount of storage currently used in bytes. The second parameter indicates the total amount of storage available, also in bytes. The <file_entry> is a string. Each <file_entry> indicates the name, type, and size of one file in the directory list: <file_name>,<file_type>,<file_size> As the windows file system has an extension that indicates file type, <file_type> is always empty. <file_size> provides the size of the file in bytes. For directories, <file_entry> is surrounded by square brackets and both <file_type> and <file_size> are empty

8.1.10.2 Mass Storage Change Directory (Remote Command Only)

Remote Command	:MMEMory:CDIRectory [<directory_name>] :MMEMory:CDIRectory?
Example	:MMEM:CDIR "C:\Program Files"
Notes	The string must be a valid logical path. Changes the current directory for a mass memory file system. The <directory_name> parameter is a string. If no parameter is specified, the directory is set to the *RST value. At *RST, this value is set to the default user data storage area, that is defined as System.Environment.SpecialFolder.Personal. Query returns full path of the current directory as a quoted string.

8.1.10.3 Mass Storage Copy (Remote Command Only)

Remote Command	:MMEMory:COPY <string>,<string>[,<string>,<string>]
Example	:MMEM:COPY "C:\TEMP\Screen_0000.png","C:\"
Notes	The string must be a valid logical path. Copies an existing file to a new file or an existing directory to a new directory. If no directory is specified, uses the current directory. Two forms of parameters are allowed. The first form has two parameters. In this form, the first parameter specifies the source, and the second parameter specifies the destination. The second form has four parameters. In this form, the first and third parameters specify the source. The second and fourth parameters specify the directories. The first pair of parameters specifies the source. The second pair specifies the destination. An error is generated if the source doesn't exist or the destination file already exists. This command will generate an "access denied" error if the destination is a restricted folder (e.g., C:\Windows) and the current user does not have Power User or Administrator privileges.

8.1.10.4 Mass Storage Device Copy (Remote Command Only)

This command transfers data to/from a file and a peripheral device.

Remote Command	:MMEMory:COPY:DEVice <source_string>,<dest_string>
Notes	The strings must be a valid logical path or a valid device keyword. If the dest_string is a device keyword, the data is copied from the source file to the device. If the source_string is a device keyword, the data is copied to the source file from the device. Valid device keywords are: SNS (smart noise source) An error is generated if the file or device is not found.

8.1.10.5 Mass Storage Delete (Remote Command Only)

Remote Command	`:MMEMory:DELete <file_name>[,<directory_name>]`
Example	`:MMEM:DEL “Screen_0000.png”`
Notes	The string must be a valid logical path. If no directory is specified, uses the current directory. Removes a file from the specified directory. The <file_name> parameter specifies the file name to be removed. This command will generate an “access denied” error if the file is in a restricted folder (e.g., C:\Windows) and the current user does not have Power User or Administrator privileges.

8.1.10.6 Mass Storage Data (Remote Command Only)

Creates a file containing the specified data OR queries the data from an existing file.

Remote Command	`:MMEMory:DATA <file_name>, <data>` `:MMEMory:DATA? <file_name>`
Example	`:MMEM:DATA? “MyFile.txt”`
Notes	The string must be a valid logical path. If no directory is specified, uses the current directory. The command form is MMEMory:DATA <file_name>,<data>. It loads <data> into the file <file_name>. <data> is in 488.2 block format. <file_name> is string data. The query form is MMEMory:DATA? <file_name> with the response being the associated <data> in block format.

8.1.10.7 Mass Storage Make Directory (Remote Command Only)

Remote Command	`:MMEMory:MDIRectory <directory_name>`
Example	`:MMEM:MDIR “C:\TEMP\NewDir”`
Notes	The string must be a valid logical path. Creates a new directory. The <directory_name> parameter specifies the name to be created. This command will generate an “access denied” error if the new directory would be in a restricted folder (e.g., C:\Windows) and the current user does not have Power User or Administrator privileges.

8.1.10.8 Mass Storage Move (Remote Command Only)

Remote Command	`:MMEMory:MOVE <string>,<string>[,<string>,<string>]`
Example	`:MMEM:MOVE "C:\TEMP\Screen_0000.png","C:\"`

Notes	The string must be a valid logical path. Moves an existing file to a new file or an existing directory to a new directory. Two forms of parameters are allowed. The first form has two parameters. In this form, the first parameter specifies the source, and the second parameter specifies the destination. The second form has four parameters. In this form, the first and third parameters specify the source. The second and fourth parameters specify the directories. The first pair of parameters specifies the source. The second pair specifies the destination. An error is generated if the source doesn't exist or the destination file already exists. This command will generate an "access denied" error if the destination is a restricted folder (e.g., C:\Windows) and the current user does not have Power User or Administrator privileges.

8.1.10.9 Mass Storage Remove Directory (Remote Command Only)

Remote Command	`:MMEMory:RDIRectory <directory_name>`
Example	`:MMEM:RDIR "C:\TEMP\NewDir"`
Notes	The string must be a valid logical path. Removes a directory. The <directory_name> parameter specifies the directory name to be removed. All files and directories under the specified directory shall also be removed. This command will generate an "access denied" error if the folder is a restricted folder (e.g., C:\Windows) or is in a restricted folder and the current user does not have Power User or Administrator privileges.

8.1.10.10 Mass Storage Determine Removable Media (Remote Command Only)

This command is used to determine if any removable media devices are connected to the instrument. Primarily, these are USB memory devices plugged-in to the front panel or rear panel USB ports. On instruments with PC6 or PC7 CPU's, one SD card slot is available for removable media. The instrument's primary disk drive is not a removable media device.

Remote Command	`:MMEMory:RMEDia:LIST?`
Example	`:MMEM:RMED:LIST?`
Notes	The return value will be a string containing a list of partition identifiers which are removable media devices. Each identifier will be separated by a comma. If no removable media is present, an empty string will be returned. Examples: – One removable device present will result in a return string of "F:". – Two removable devices present will result in a return string of "F:,G:". – No removable devices present will result in a return string of "".

8.1.10.11 Mass Storage Determine Removable Media Label (Remote Command Only)

This command is used to set or query a removable media device's label.

Remote Command	`:MMEMory:RMEDia:LABel <partition>,<string>` `:MMEMory:RMEDia:LABel? <partition>`
Example	`:MMEM:RMED:LAB "F:","My Device"`
Notes	If the <partition> specified does not exist or is not a removable media device the error -252,"Missing Media" will be generated. Setting the removable media label requires Administrative privileges. If the currently logged in use does not have appropriate privileges the error "-221.9900,Settings conflict;Administrator privileges required" is generated.

8.1.10.12 Mass Storage Determine Removable Media Write-protect status (Remote Command Only)

This command is used to query a removable media device's write-protect status.

Remote Command	`:MMEMory:RMEDia:WPRotect? <partition>`
Example	`:MMEM:RMED:WPR? "F:"`
Notes	The return value is 1 if the device is write-protected, and 0 if the device is write-enabled. If the <partition> specified does not exist or is not a removable media device the error -252,"Missing Media" will be generated.
Preset	The return value will be depending on SD card installed.

8.1.10.13 Mass Storage Determine Removable Media size (Remote Command Only)

This command is used to query a removable media device's total memory size (not available memory size).

Remote Command	`:MMEMory:RMEDia:SIZE? <partition>`
Example	`:MMEM:RMED:SIZE? "F:"`
Notes	The return value is integer value in GBytes. Any device which is less than 1 GB will return 0 GB. If the <partition> specified does not exist or is not a removable media device the error -252,"Missing Media" will be generated.

8.1.10.14 :SYSTem:SET (Remote Command Only)

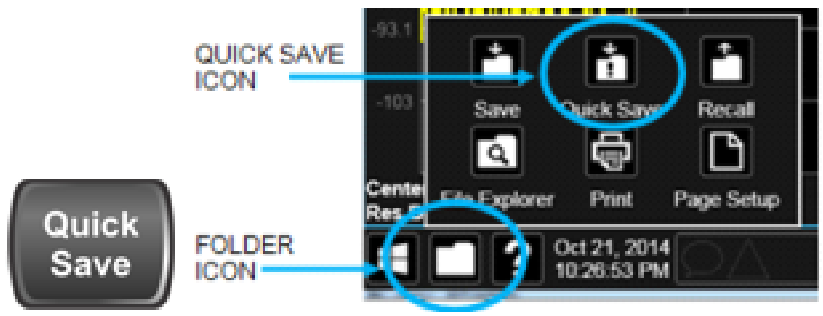
Remote command that allows the user to obtain the state of the currently active mode in a form that can then be loaded back into the instrument quickly.

Remote Command	`:SYSTem:SET <instrument state in IEEE Block>` `:SYSTem:SET?`
Notes	SYST:SET? returns current instrument state of the active mode in IEEE Block data format. The state is in a machine readable format only. Sending the query returns the following format: <syst set preamble><state block data> Where: <syst set preamble> is the format: #NMMM – N=number of digits that comprise MMM – MMM=length in bytes of following data <state block data> is machine readable state data Example response: #42016<state data> The state is recalled by sending the SYST:SET? Response data to the instrument. From example above: SYST:SET #42016<state data>

8.2 Quick Save

The Quick Save function repeats the previous Save at the touch of a single button. Whatever you saved before gets saved again to the same directory, and with a filename derived from the previous filename.

You access Quick Save by pressing the **Quick Save** hardkey, or by pressing the folder icon at the bottom of the display and then pressing the Quick Save icon. In addition, if you have a PC keyboard plugged in, the sequence CTL-Q will perform a Quick Save.



The Quick Save front-panel key repeats the most recent save that was performed from the Save menu, with the following exceptions:

- Register saves are not remembered as Saves for the purpose of the Quick Save function
- If the current measurement does not support the last non-register save that was performed, an informational message is generated, “File type not supported for this measurement”

Quick Save repeats the last type of qualified save (that is, a save qualified by the above criteria) in the last save directory by creating a unique filename using the Auto File Naming algorithm described below.

If the previous save was a Screen Image save, Quick Save saves a Screen Image when the Quick Save button is pressed. This image is EXACTLY what is on the screen when the Quick Save button is pressed. Quick Save does NOT force a dialog exit or navigate in any way, it simply snaps the image on the screen and saves it. This lets you save images of dialogs and setup screens that would be impossible to save using the Save dialog.

NOTE

When Quick Save is pressed the display theme changes to the theme specified by the Screen Image Theme control in order to take the screen shot, and then changes back to the Display Theme, but no navigation is performed and no dialogs are exited.

If Quick Save is pressed after startup and before any qualified Save has been performed, the Quick Save function performs a Screen Image save using the current settings for Screen Image saves (current theme, current directory), which then becomes the “last save” for the purpose of subsequent Quick Saves.

The Auto File Naming feature automatically generates a file name for use when saving a file. The filename consists of a prefix and suffix separated by a dot, as is standard for the Windows® file system. A default prefix exists for each of the available file types:

Type	Default Prefix	Menu
State	State_	(Save/Recall)
Trace + State	State_	(Save/Recall)
Screen	Screen_	(Save/Recall)
Amplitude Corrections	Ampcor_	(Import/Export)
Traces	Trace_	(Import/Export)
Limit Lines	Limit_	(Import/Export)
Measurement Result	MeasR_	(Import/Export)
Capture Buffer	CapBuf_	(Import/Export)

A four digit number is appended to the prefix to create a unique file name. The numbering sequence starts at 0000 within each Mode for each file type and updates incrementally to 9999, then wraps to 0000 again. It remembers where it was through a Mode Preset and when leaving and returning to the Mode. It is reset by Restore Misc Defaults and Restore System Defaults and subsequent running of the instrument application. So, for example, the first auto file name generated for State files is State_0000.state. The next is State_0001, and so forth.

One of the key features of Auto File Name is that we guarantee that the Auto File Name will never conflict with an existing file.The algorithm looks for the next available number. If it gets to 9999, then it looks for holes. If it find no holes, that is no more numbers are available, it gives an error.

For example, if when we get to State_0010.state there is already a State_0010.state file in the current directory, it advances the counter to State_0011.state to ensure that no conflict will exist (and then it verifies that State_0011.state also does not exist in the current directory and advances again if it does, and so forth).

If you enter a file name for a given file type, then the prefix becomes the filename you entered instead of the default prefix, followed by an underscore. The last four letters (the suffix) are the 4-digit number.

For example, if you save a measurement results file as “fred.csv”, then the next auto file name chosen for a measurement results save will be fred_0000.csv.

NOTE

Although 0000 is used in the example above, the number that is used is actually the current number in the Meas Results sequence, that is, the number that would have been used if you had not entered your own file name.

NOTE If the filename you entered ends with _dddd, where d=any number, making it look just like an auto file name, then the next auto file name picks up where you left off with the suffix being dddd + 1.

Quick Save Mode

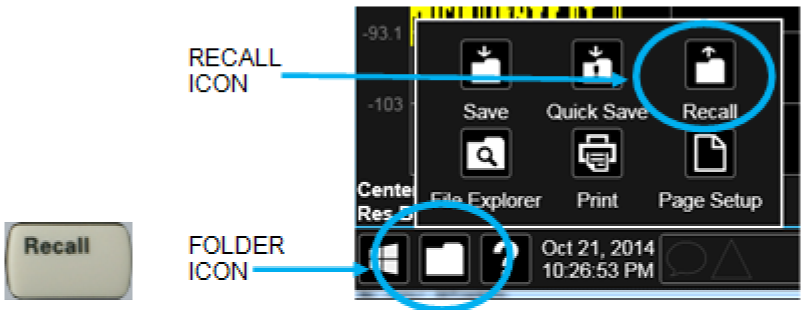
Quick Save can be operated in the Normal mode and in a special “Prompt” mode. There is a switch on the User Interface page of the System menus that lets you control this.

When Quick Save Mode is in Normal (the default setting), the instrument does an immediate save of a new file of the same type and to the same directory as the previous Save action. When Quick Save Mode is in the Prompt state, instead of immediately performing a Save, the Alpha Keyboard pops up with the proposed auto-filename in the entry area. The user can then press Enter to accept the auto filename, or edit the name and press Enter. This allows you to easily save a file with a custom file name.

Notes	No remote command for this key specifically.

8.3 Recall

The Recall dialog lets you recall previously saved states, traces and other items to the analyzer from files on the analyzer's internal storage, from removable devices, and from directories on the network. You access the Recall dialog by pressing the Recall hardkey, or by pressing the folder icon at the bottom of the display and then pressing the Recall icon.



The Recall dialog has section tabs running down the left side, which you use to specify what you want to recall, similar to the Save dialog. You choose the recall item and then complete the recall by choosing a register or file location from which to recall the item.

Notes	No remote command for this key specifically, but the :MMEM:LOAD command is available for specific file types. An example is :MMEM:LOAD:STATe <filename>. If you try to recall a State file for a mode that is not licensed or not available in the instrument, an error message will occur and the state will not change.
Backwards Compatibility Notes	In legacy analyzers, it was possible to load a state without affecting the trace data, limit lines or correction data. Similarly (since User Preset is actually loading a state), it was possible to do a User Preset without affecting the trace data, limit lines or correction data. In the X-Series, "state" always includes all of this data; so whenever state is loaded, all of the traces, limit lines and corrections are affected. Although this differs from previous behavior, it is desirable behavior, and should not cause adverse issues for users. Recall for the X-Series supports backward compatibility in the sense that you can recall a state file from any X-Series model number and any version of X-Series software. This is only possible if part of the recalling process goes through a limiting step after recalling the mode settings, at least for settings that may vary with version number, model number, option and license differences. If you try to recall a state file onto an instrument with less capability than what was available on the instrument during the save, the recall will ignore the state it doesn't support and it will limit the recalled setting to what it allows. Example: if the saved state includes preamp ON, but the recalling instrument does not have a preamp; the preamp is limited to OFF. Conversely, if you save a state without a preamp, the preamp is OFF in the state file. When this saved file is recalled on an instrument with a licensed preamp, the preamp is changed to OFF. Another example is if the saved state has center frequency set to 20 GHz, but the instrument recalling the saved state is a different model and only supports 13.5 GHz. In this case, the center frequency is limited along with any other frequency based settings. Since the center frequency can't be preserved in this case, the recall limiting tries to at least preserve span to keep the measurement setup as intact as possible. It may be appropriate to issue a warning if the state is limited on the recall; warnings do not go out to

SCPI so this would only affect the manual user.

Note that there is no state file compatibility outside of the X-Series. For example, you cannot recall a state file from ESA or PSA.

8.3.1 Recall From File / Open

For every Recall type, a button appears called “Recall From File” or “Open”. “Recall From File” appears for recall types that also include registers (like State and Trace+State), and “Open” appears for all other recall types.

When you push the “Recall From File” or “Open” button, a dialog slides in from the right which allows you to see what files are saved in the current directory. See the “Save to File/Save As” section (3.1) for a depiction of this screen for the Save menu, which is similar to Recall.

The default directory is the internal directory for the current Mode and save type, on the D: drive. You may also change to another Mode’s state directory by pressing the dropdown in the upper right corner labeled “Mode”. Once you have chosen a directory, the files in that directory whose extension matches the current data type (e.g., .state or .trace) are displayed in the right hand window of the dialog. You can sort this list by name, date, file size or extension by tapping the Name, Date, Size, or Content header at the top of each column. A second tap toggles the sort order between Ascending and Descending.

Also displayed is a path depiction showing the path to the current directory. In the example shown, the path is D:\Users\Instrument\Documents\SA\screen. Tapping any element of this path lets you select an alternate route. Tapping the “Computer” arrow lets you select a different drive.

Tapping the “back” arrow navigates to the previously selected directory.

If you plug in a removable drive (e.g., a thumb drive), the browser immediately navigates to the root of that drive. Furthermore, if you had a thumb drive in and you were in a directory on the thumb, and then you exit the browser, when you come back in you are still in the same directory on that removable drive. If you remove the thumb drive, you return to the directory you had been in before the thumb drive was plugged in.

Note that for each data type there is a “current” directory and it is the last directory used by either Save or Recall for that Mode. For example if in SA Mode you save a Corrections file to a particular directory, then when you go to recall a Correction in SA Mode, you should be pointing at that directory. Or if in EMC Mode you recall a Limit from a particular directory then when in EMC Mode you go to save a Limit, it should be pointing at that same directory. There is one “current” directory for each data type for each Mode (not one for Save and one for Recall).

The Filename field, just below the Path field, shows the filename that will be used. The File Name field is loaded with the name of the selected file. You may edit the filename by tapping it, which brings up the onscreen alpha keyboard. Press the “Done” button on this keyboard when you are done editing.

Select a file to load and press Recall. After a successful recall, a message "File <filename> recalled" or "State Register <register number> recalled" is displayed in an info box for a few seconds.

Files of Type

This field shows the file suffix for the type of file you have selected to recall. This field only appears for files which have multiple file types that can be recalled. These file types are:

Amplitude Corrections:

– Amplitude Corrections (*.csv)

– Legacy Cable Corrections (*.cbl)

– Legacy User Corrections (*.amp)

– Legacy Other Corrections (*.oth)

– Legacy Antenna Corrections (*.ant)

Limits:

– Limit Data (*.csv)

– Legacy Limit Data (*.lim)

8.3.2 State

Recall **State** lets you choose a register or file from which to recall the state.

See the Save State description for information on state files and their contents and the default paths. State files have the extension “.state”.

For rapid recall, the State menu lists 16 registers from which you can recall states. Pressing a Register button initiates the recall. You can also select a file from which to recall by pressing “Recall From File”.

Since each state file is only for one Mode, the settings for other Modes are unaffected when it is loaded. Recall State will cause a mode switch if the state being recalled is not from the current active mode.

NOTE	In products that run multiple simultaneous instances of the X-Series Application, all instances share the same registers and file directories, so make sure you know from what instance a file or register was saved before recalling it.

Remote Command	`:MMEMory:LOAD:STATe <filename>`

Example	`:MMEM:LOAD:STAT "MyStateFile.state"` This loads the state file data (on the default file directory path) into the instrument state.
Notes	When you pick a file to recall, the analyzer first verifies that the file is recallable in the current instrument by checking the software version and model number of the instrument. If there is a mismatch between the file and the instrument, the recall functiontries to recall as much as possible. It may limit settings that differ based on model number, licensing or version number. In general, variables in the instrument which are not contained in the state file will be unaffected, and variables in the state file which are not contained in the instrument will be ignored. The recall proceeds by aborting the currently running measurement, clearing any pending operations, and then loading the State from the saved state file. You can open state files from any Mode, so recalling a State file switches to the Mode that was active when the save occurred. After switching to the Mode of the saved state file, Mode settings and data (if any for the Mode) become those from the saved file. The active measurement becomes the measurement which was running when the state file was saved and the data relevant to the measurement (if there is any) is recalled. After recalling the state, the Recall State function does the following: – Clears the input and output buffers. – Status Byte is set to 0. – Executes a *CLS If the file specified is empty an error is generated. If the specified file does not exist, another error is generated. If there is a mismatch between the file and the proper file type, an error is generated. If there is a mismatch between file version or model number or instrument version or model number, a warning is displayed. Then it returns to the State menu and File Open dialog goes away. After the Recall, the analyzer exits the Recall menu and returns to the previous menu.
Backwards Compatibility SCPI	`:MMEMory:LOAD:STATe 1,<filename>` For backwards compatibility, the above syntax is supported. The "1" is simply ignored.

8.3.2.1 Recall Type

If you have a built-in Source in your Analyzer, you may wish, when recalling State, to recall only the part of the State file which applies to the Analyzer, and leave the Source unaffected. Or you may wish to recall only the part of the State file which applies to the Source, and leave the Analyzer unaffected.

This control lets you choose whether you wish to recall the entire Analyzer + Source state (ALL), just the Analyzer State ANALyzer), or just the Source State (SOURce).

Remote Command	`:MMEMory:LOAD:RTYPe: ALL | ANALyzer | SOURce`
Example	`:MMEMory:LOAD:RTYPe: ALL`
Dependencies	– This control is only available in models with a built-in source, such as VXT models.
Preset	– ALL
Range	– ALL|ANALyzer|SOURce

8.3.2.2 Register 1 thru Register 16

Selecting any one of these register buttons causes the State to be recalled from the specified Register. The registers are provided for rapid saving and recalling, since you do not need to specify a filename or navigate to a file. Each of the register menu keys annotates whether it is empty or at what date and time it was last modified. In addition, you can edit any of the register names to enter custom names for any register.

Although these 16 registers are the only registers available from the front panel, there are 128 state registers available in the instrument. Registers 17-128 are only available from the SCPI interface, using the *RCL command.

There is one set of 128 state registers in the instrument, not one set for each Mode. When a state is saved, the Mode it was saved from is saved with it; then when it is recalled, the instrument switches to that Mode.

NOTE **In products that run multiple simultaneous instances of the X-Series Application, all instances share the same registers and file directories, so make sure you know from what instance a file or register was saved before recalling it.**

The date displayed follows the format specified in the **Date Format** setting under the Control Panel. The time shows hours and minutes.

After the recall completes, the message "Register <register number> recalled" is displayed.

If you are in the Spectrum Analyzer Mode, and you are recalling a register that was saved in the Spectrum Analyzer Mode, then after the recall, you will still be in the Recall Register menu. If the Recall causes you to switch modes, then after the Recall, you will be in the Frequency menu.

If a requested register is empty an error is generated.

Example	`*RCL 1`
Range	1-16 from front panel, 1-128 from SCPI

8.3.2.3 Edit Register Names

You may enter a custom name on any of the Register keys, to help you remember what you are using that state to recall. To do this, press the **Name** field for the register you want to rename, which brings up the onscreen alpha keyboard. Press the “Done” button on this keyboard when you are done editing

The maximum number of characters for a register name is 30. If you delete all the characters in the custom name, it restores the default (time and date).

For more information and the SCPI command, see Edit Register Names under the **Save, State** function.

8.3.3 Trace+State

Recall **Trace+State** lets you choose a register or file for recalling the state.

See the Save State description for information on state files and their contents and the default paths. State files have the extension ".state".

For rapid recall, the Trace+State menu lists 16 registers from which you can recall trace+state files. Pressing a Register button initiates the recall. You can also select a file from which to recall by pressing "Recall From File".

Since each trace+state file is only for one Mode, the settings for other Modes are unaffected when it is loaded. **Recall Trace+State** will cause a mode switch if the trace+state being recalled is not from the current active mode.

NOTE **In products that run multiple simultaneous instances of the X-Series Application, all instances share the same registers and file directories, so make sure you know from what instance a file or register was saved before recalling it.**

Trace+State files have the extension ".trace".

The Trace+State selection only appears for measurements that support trace saves. It is blanked for modes that do not support trace saves. Saving **Trace** is identical to saving State except a .trace extension is used on the file instead of .state, and internal flags are set in the file indicating which trace was saved.

Remote Command	`:MMEMory:LOAD:TRACe TRACE1 | TRACE2 | TRACE3 | TRACE4 | TRACE5 | TRACE6,<-filename>` `:MMEMory:LOAD:TRACe:REGister TRACE1 | TRACE2 | TRACE3 | TRACE4 | TRACE5 | TRACE6,<integer>`

Example	`:MMEM:LOAD:TRAC TRACE2,"MyTraceFile.trace"`
	This loads the trace file data (on the default file directory path) into the specified trace; if it is a "single trace" save file, that trace is loaded to trace 2, andis set to be not updating.
	`:MMEM:LOAD:TRAC:REG TRACE1,2`
	restores the trace data in register 2 to Trace 1

Notes	When you perform the recall, the recalling Trace function must first verify the file is recallable in this instrument by checking instrument software version and model number, since it includes State. If everything matches, a full recall proceeds by aborting the currently running measurement, and loading the state from the saved state file to as close as possible to the context in which the save occurred. You can open .trace files from any mode that supports them, so recalling a Trace file switches to the mode that was active when the save occurred. After switching to the mode of the saved state file, mode settings and data (if any for the mode) are loaded with values from the saved file and the saved measurement of the mode becomes the newly active measurement, and the data relevant to the measurement (if there is any) is recalled. Once the state is loaded, the trace data must be loaded. The internal flags are consulted to see which trace to load and the "To Trace" setting to see where to load it. Trace data is always loaded with the

specified trace set to View, so that the data is visible and not updating(so as not to erase the recalled data). If the file is an "all trace" file, all traces are loaded with the saved data(to the original trace the data was saved from) and set to View. Traces whose data is not loaded are restored to the update state that existed when they were saved.

After the Recall the analyzer exits the Recall menu and returns to the previous menu.

Some modes and measurements do not have available all 6 traces. Phase Noise mode command, for example, is: MMEMory:LOAD:TRACe TRACE1|TRACE2|TRACE3,<filename>

Some modes and measurements have more than 6 traces available. The Realtime SA mode command, for example, is: MMEMory:STORe:TRACe TRACE1 | TRACE2 | TRACE3 | TRACE4 | TRACE5 | TRACE6 | TRACE7 | TRACE8 | TRACE9 | TRACE10 | TRACE11 | TRACE12 | ALL,<filename>

8.3.3.1 Recall To Trace

These menu selections let you choose the Trace where the recalled trace will go. Not all modes have the same number of traces available. The default is the currently selected trace, selected in this or any other menu with Trace selection. If you have chosen All then it remains chosen until you specifically change it to a single trace, regardless of the trace selected in the Trace menu.

If the .trace file is an "all trace" file, "To Trace" is ignored and the traces each go back to the trace from which they were saved.

8.3.3.2 Register 1 thru Register 16

Selecting any one of these register buttons causes the specified trace(s) and the state of the currently active mode to be recalled from the specified Register. The registers are provided for rapid saving and recalling, since you do not need to specify a filename or navigate to a file. Each of the register menu keys annotates whether it is empty or at what date and time it was last modified. In addition, you can edit any of the register names to enter custom names for any register.

There is one set of 16 trace+state registers in the instrument, not one set for each Mode. When trace+state is saved, the Mode it was saved from is saved with it; then when it is recalled, the instrument switches to that Mode.

NOTE: In products that run multiple simultaneous instances of the X-Series Application, all instances share the same registers and file directories, so make sure you know from what instance a file or register was saved before recalling it.

The date displayed follows the format specified in the Date Format setting under the Control Panel. The time shows hours and minutes.

After the recall completes, the message "Register <register number> recalled" is displayed. If a requested register is empty an error is generated.

Recalling state from a Register is the same as recalling state from a Trace+State File.

Example	`*RCL 1`
Range	1-16

8.3.3.3 Edit Register Names

You may enter a custom name on any of the Register keys, to help you remember what you are using that state to recall. To do this, press the **Name** field for the register you want to rename, which brings up the onscreen alpha keyboard. Press the “Done” button on this keyboard when you are done editing

The maximum number of characters for a register name is 30. If you delete all the characters in the custom name, it restores the default (time and date).

For more information and the SCPI command, see Edit Register Names under the **Save, State** function.

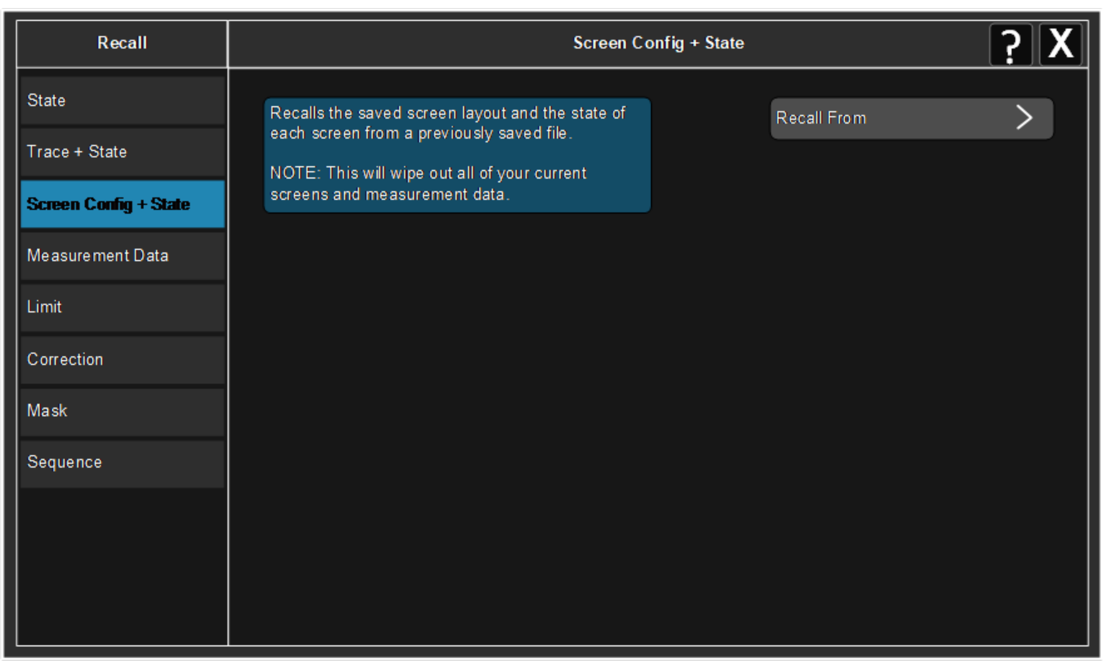
8.3.4 Screen Config + State

RecallScreen Config + State lets you load the complete configuration of all your screens from a file which you specify.

Note that recalling a screen config file will wipe out your current screen configuration; you don’t get a warning before it loads but there is a note on the Recall page letting you know what is going to happen.

The filenames are of the form:

State_0001.screen



Since we already used the “SCReen” parameter for Screen Image, the SCPI commands are:

Remote Command	`:MMEMory:LOAD:SCONfig <filename>`
Example	`:MMEM:LOAD:SCON "myScreenConfig.screen"` This loads the screen configuration from the file MyScreenConfig.screen in the default directory.

8.3.5 Measurement Data

Recall Measurement Data lets you specify a data type (for example, trace data) and choose a file from which to import the data.

Measurement Data files are Comma-Separated Value (CSV) files, and contain the requested data in a form that can be imported into Excel or other spreadsheets, as well as header data that gives information on relevant instrument settings at the time the save occurred.

For more on Measurement Data files see the "Measurement Data" on page 504 description under **Save**.

Since the commonly exported data files are in .csv format, you can edit the data prior to importing it. This allows youto export a data file, manipulate the data in Excel (for example) and then import it.

8.3.5.1 Data Type

You choose the data type to recall by using the radio button selection box.

Below are the specifications for Data files for each measurement.

Notes	There is no SCPI command for Data Type, as the type is implied in the SCPI command for each item.
Dependencies	The Data Type menu for any given measurement only contains data types that are supported by that measurement. Data Types which are not importable will not appear, even if they do appear in the corresponding **Save** menu.

Trace

Selecting **Trace** allows you to import Trace files in the PC-readable .csv format.

Trace data files have the extension “.csv”. The trace file contains a “metadata” header which describes the state of the analyzer when the file was saved. This metadata is compared to the current state of the analyzer when the file is recalled; if it doesn’t match the current state, the “invalid data indicator” (*) is displayed.

The metadata is detailed in Trace File Contents in the Save section.

Remote Command	`:MMEMory:LOAD:TRACe:DATA TRACE1 | TRACE2 | TRACE3 | TRACE4 | TRACE5 | TRACE6,<filename>`

Example	`:MMEM:LOAD:TRAC DATA TRACE2,"myTrace2.csv"` Imports the 2nd trace from the file myTrace2.csv in the current path. For SA mode, the default path is My Documents\SA\data\traces
Dependencies	For SA measurements, a trace cannot be recalled from a trace file that was exported with ALL traces selected. A trace cannot be imported if the number of trace points in the file do not match the number of sweep points currently set for the measurement. If this happens, an error message is generated. Errors are reported if the file is empty or missing, or if the file type does not match, or if there is a mismatch between the file type and the destination data type.
Couplings	When a trace is imported, **Trace Update** is always turned OFF for that trace and **Trace Display** is always turned ON.
Annotation	After recall is complete, an advisory is displayed in the message bar confirming which trace file was loaded.
Status Bits/OPC dependencies	Sequential - aborts the current measurement.

8.3.6 Limit

RecallLimit lets you choose a file from which to import the Limit data.

Limit files are.csv files, and contain the limit data in a form that can be imported into Excel® or other spreadsheets, as well as header data that gives information on the limit.

See the Save Limit description ("Limit" on page 506) for information on Limit files and their contents and the default paths. **Limit** files have the extension ".csv".

For backwards compatibility, older limit files with the extension .lim can be read into the analyzer, but you can only save limits as .csv files.

A set of preloaded Limits files can be found in the directory

`/My Documents/EMC Limits and Ampcor/Limits`

Remote Command	`:MMEMory:LOAD:LIMit LLINE1 | LLINE2 | LLINE3 | LLINE4 | LLINE5 | LLINE6,<filename>`
Example	`:MMEM:LOAD:LIM LLINE2,"myLimitLine2.csv"` Imports the 2nd Limit Line from the file myLimitLine2.csv in the current path.
Dependencies	Errors are reported if the file is empty or missing, or if the file type does not match, or if there is a mismatch between the file type and the destination data type. In the Log Plot measurement in the Phase Noise Mode, there are only three Limit Lines, so the valid parameters are LLINE1|LLINE2| LLINE3 This key will only appear if you have the proper option installed in your instrument.
Couplings	When a limit line is loaded from mass storage, it is automatically turned on. This allows the user to see it, thus confirming the load. The Margin settings will match those when the limit was saved

	The instrument cannot mix Limits domains (X Axis Unit must be Frequency or Time for both Limits). So when a Limits file is loaded, the analyzer will set the Limits domain (X Axis Unit) to match that of the file. If this changes the Limits domain from what it was before the file was loaded, all Limits data in all Limits sets will be erased before the data loads. If this operation is over the remote interface there will be no warning if this occurs, so care should be taken to know the domain of the file you are loading.
Annotation	After recall is complete, an advisory is displayed in the message bar confirming which limit file was loaded.
Status Bits/OPC dependencies	Sequential - aborts the current measurement

8.3.6.1 Select Limit

This control enables you to select the specific Limit to be saved, e.g., Limit 1.

Preset	Not part of Preset, but is reset to LLINE1 by Restore Mode Defaults; survives shutdown

8.3.7 Correction

Selecting **Correction** allows you to import Amplitude Corrections files in the PC-readable .csv format.

Amplitude Correction files are CSV files, and contain the correction data in a form that can be imported into Excel or other spreadsheets, as well as header data that gives information on the correction.

For backwards compatibility, older limit files with the extension .amp, .cbl, .ant and .oth can be read into the instrument.

A set of preloaded Corrections files can be found in the directory

`/My Documents/EMC Limits and Ampcor/Ampcor`

The default path for CSV files is:

`\My Documents\amplitudeCorrections\`

Antenna corrections are a particular kind of Amplitude Corrections – they are distinguished in the corrections file by having the Antenna Unit set to a value other than None. . When the Amplitude Correction is an Antenna correction and the Antenna Unit in the file is not **None**, the Y Axis Unit setting will change to match the Antenna (Transducer) Unit in the file.

Remote Command	`:MMEMory:LOAD:CORRection 1 | ... | 8, <filename>`
Example	`:MMEM:LOAD:CORR 2, "myAmpcor.csv"` recalls the Amplitude Correction data from the file myAmpcor.csv in the current directory to the 2nd Amplitude Correction table, and turns on Correction 2
Dependencies	Only one Transducer units can be on at any given time. Note that this means that if a correction file with a Transducer Unit is loaded into a particular Correction, all other Corrections are set to that same Transducer unit.

	Corrections are not supported by all Measurements. If in a Mode in which some Measurements support it, this key will be grayed out in measurements that do not. The key will not show at all if no measurements in the Mode support it. Errors are reported if the file is empty or missing, or if the file type does not match, or if there is a mismatch between the file type and the destination data type. This key does not appear unless you have the proper option installed in your instrument. This command will generate an "Option not available" error unless you have the proper option installed in your instrument.
Couplings	When a correction file is loaded from mass storage, it is automatically turned on (**Correction** ON) and **ApplyCorrections is** set to On. This allows you to see its effect, thus confirming the load.
Annotation	After recall is complete, an advisory is displayed in the message bar confirming which file was recalled.
Backwards Compatibility SCPI	`:MMEMory:LOAD:CORRection ANTenna | CABLe | OTHer | USER, <filename>` For backwards compatibility, ANTenna maps to 1, CABle maps to 2, OTHer maps to 3 and USER maps to 4

8.3.7.1 Select Correction

This control enables you to select the register where the recalled Correction will be placed, e.g. Correction 1.

Preset	Not part of a Preset, but is reset to Correction 1 by Restore Input/Output Defaults. Survives a shutdown.

8.3.8 Complex Correction

Selecting **Complex Correction** allows you to import Complex Corrections files in the PC-readable .s2p format.

Complex Correction files contain amplitude and phase correction data in a form that can be imported into Excel or other spreadsheets, as well as header data that gives information on the correction.

The default path for Complex Corrections files is:

`\My Documents\complexCorrections\`

Remote Command	`:MMEMory:LOAD:CCORrection <integer>, <filename>`
Example	`:MMEM:LOAD:CCOR 2, "mycor.s2p"` recalls the Complex Correction data from the file mycor.s2p in the current directory to the 2nd Complex Correction table, and turns on Complex Correction 2.
Dependencies	Complex Corrections are not supported by all Measurements. The tab will not show at all if no measurements in the Mode support it. Errors are reported if the file is empty or missing, or if the file type does not match, or if there is a mismatch between the file type and the destination data type.
Couplings	When a complex correction file is loaded from mass storage, it is automatically turned on (**Correction** ON) and **ApplyCorrections is** set to On. This allows you to see its effect, thus confirming the load.

Annotation	After recall is complete, an advisory is displayed in the message bar confirming which file was recalled.

8.3.8.1 Select Complex Correction

This control enables you to select the register where the recalled Complex Correction will be placed e.g., Complex Correction 1.

Preset	Not part of a Preset, but is reset to Correction 1 by Restore Input/Output Defaults. Survives a shutdown.

8.3.9 Correction Group

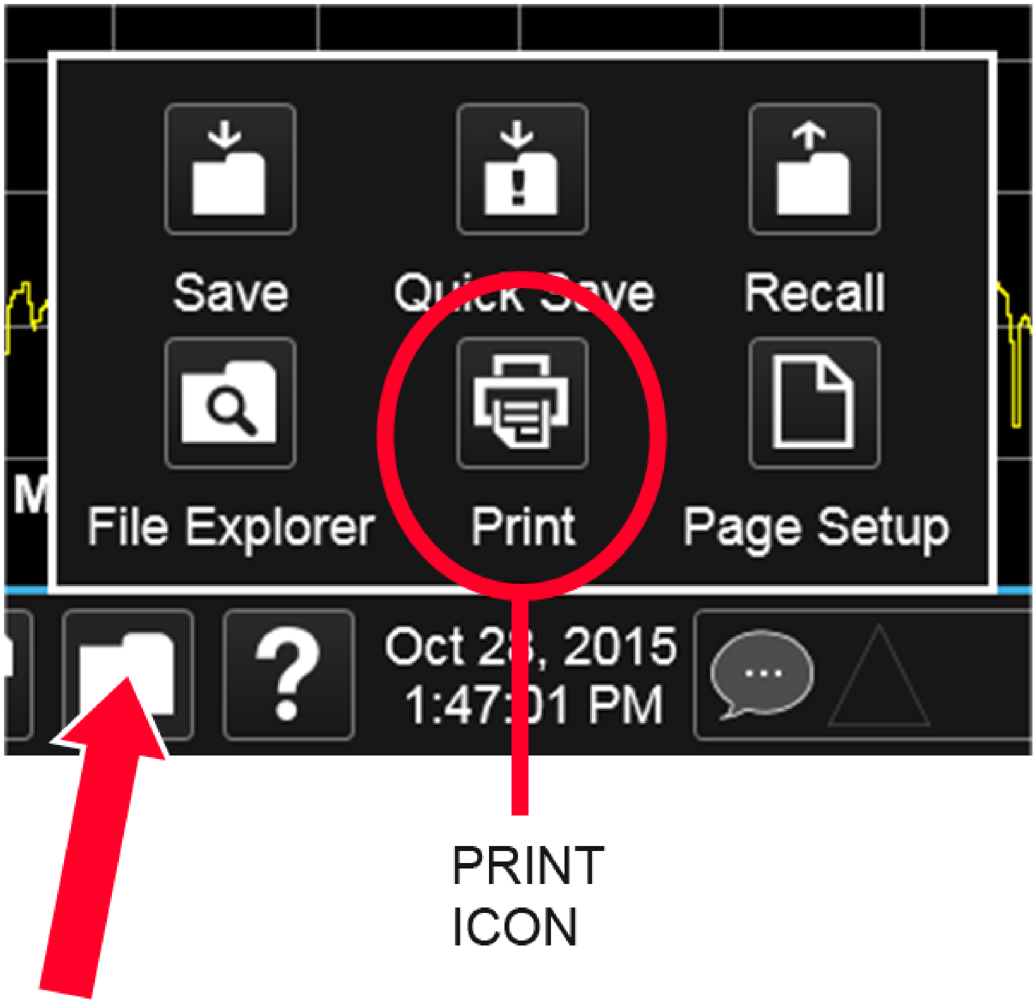
Selects the correction group as the data type to be imported. The next step is to press the Recall From control to open the file dialog. When recalling a correction group, the correction group settings, range table and correction files data will be loaded.

If there are values defined in the correction group range, and you accessed this function from the front panel, there will be a message prompt that asks for your confirmation as the values will be overwritten during the recall.

Remote Command	`:MMEMory:LOAD:CORRection:GROup <filename>`
Example	`:MMEM:LOAD:CORR:GRO "D:\myCorrGroup.csv"` Imports the Correction Group and the corresponding correction tables from the file myCorrGroup.csv.
Notes	Errors are reported if the file is empty or missing, or if the file type does not match, or if there is a mismatch between the file type and the destination data type. When recall is completed, the correction group will be turned ON. If any of the correction data loaded is found out of the frequency range, Execution error is generated. Error icon appears on the status column correction group table.
Dependencies	This file type is supported in EMI Receiver mode and in Spectrum Analyzer mode if option EMC or EMI Receiver mode is present. None
Annotation	After recall is complete, display an advisory in the message bar.
Status Bits/OPC dependencies	Sequential - aborts the current measurement

8.4 Print

The Print icon is found under the File Functions icon.



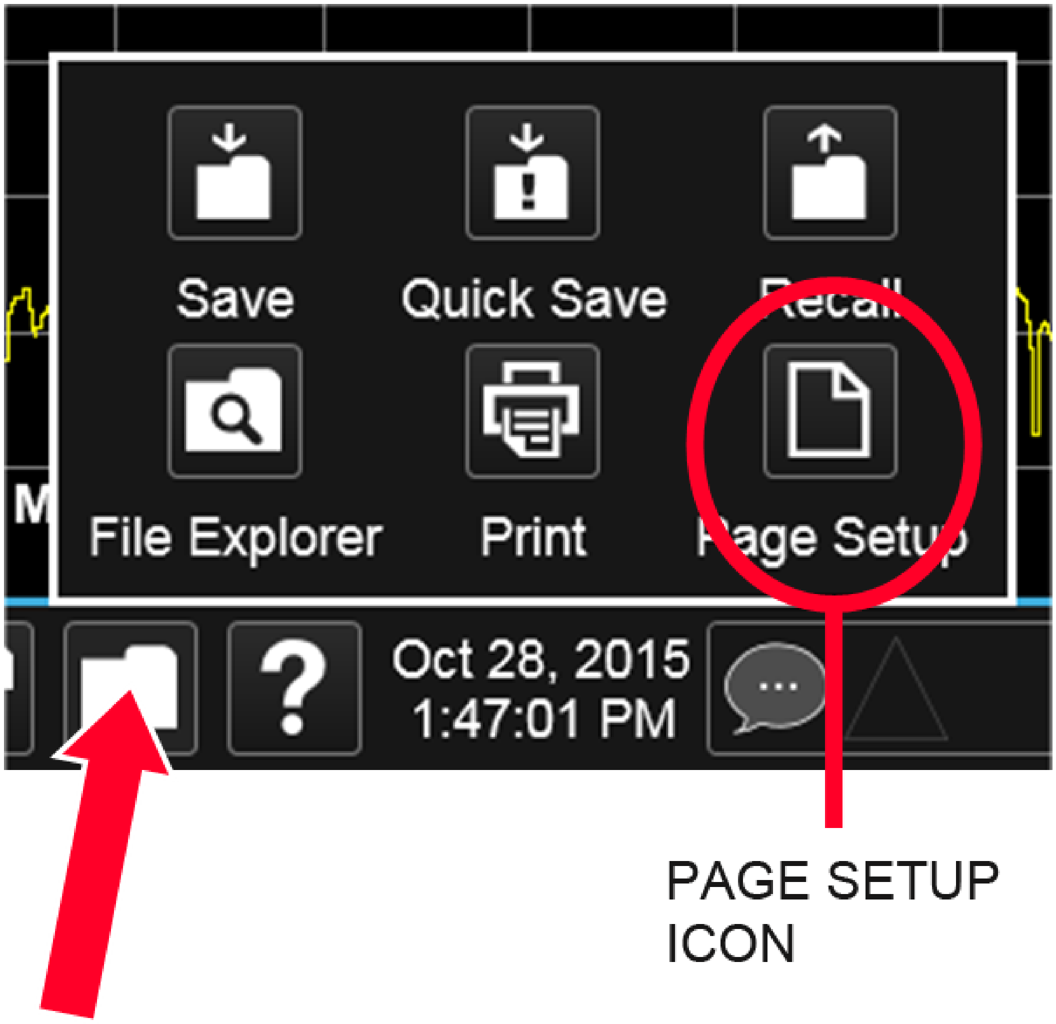
The Print icon opens a Print dialog for configured printing (for example, to the printer of your choice).

The :HCOPy command is equivalent to pressing the PRINT key.

Remote Command	`:HCOPy[:IMMediate]`
	The HCOPy:ABORt command can be used to abort a print which is already in progress. Sending HCOPy:ABORt will cause the analyzer to stop sending data to the printer, although the printer may continue or even complete the print, depending on how much data was sent to the printer before the user sent the ABORt command.
Remote Command	`:HCOPy:ABORt`

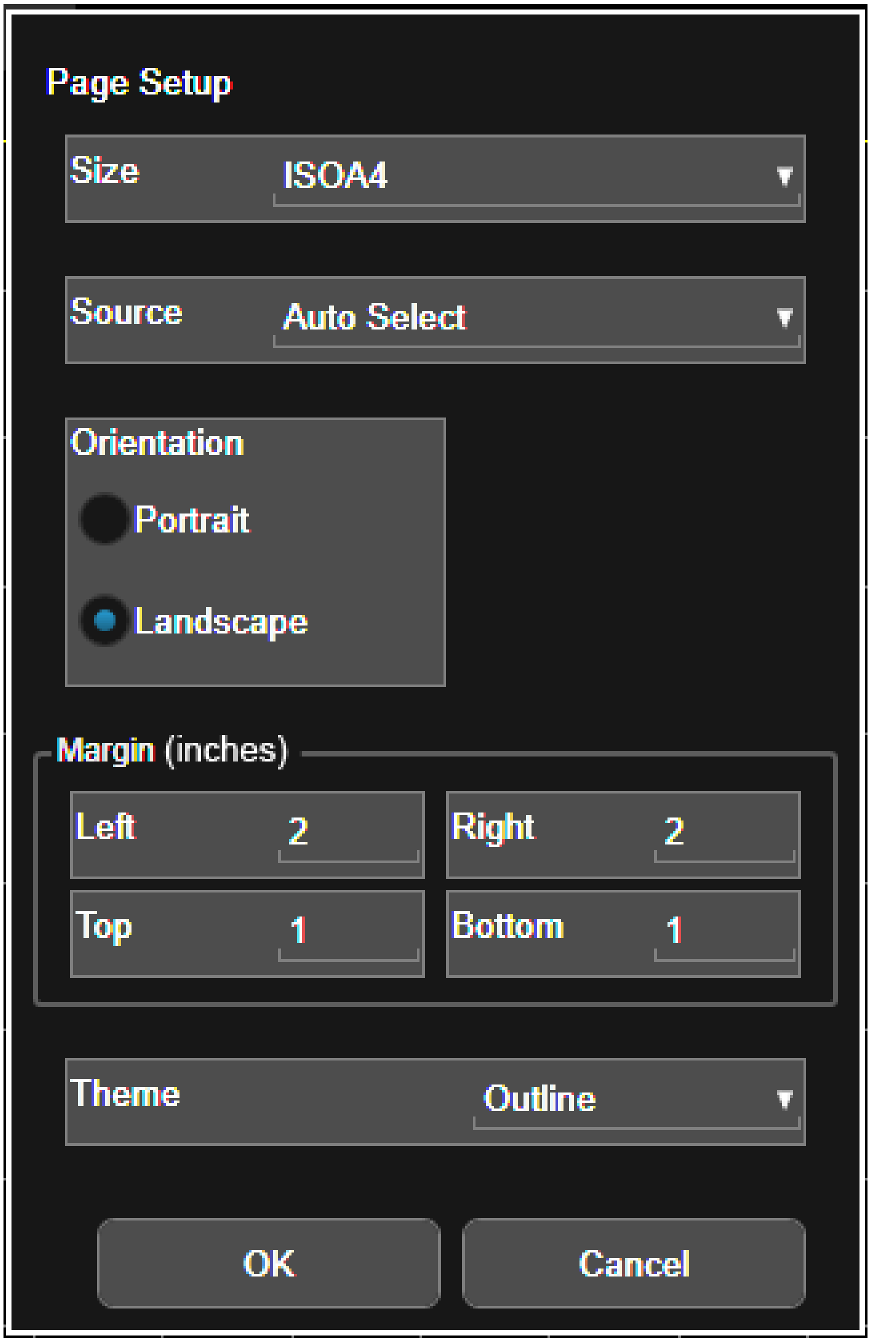
8.5 Page Setup

The Page Setup icon is found under the File Functions icon.



The Page Setup icon brings up a Windows Page Setup dialog that allows you to control aspects of the pages sent to the printer when the PRINT hardkey is pressed.

Paper size, the printer paper source, the page orientation and the margins are all settable. There are no SCPI commands for controlling these parameters.



Also contained in this dialog is a drop-down control that lets you select the display Theme to use when printing. The Page Setup themes are the same as those available for the Screen Image "Theme" on page 516.

The Theme control has a corresponding SCPI command:

Remote Command	`:SYSTem:PRINt:THEMe FILLed | OUTLine` `:SYSTem:PRINt:THEMe?`

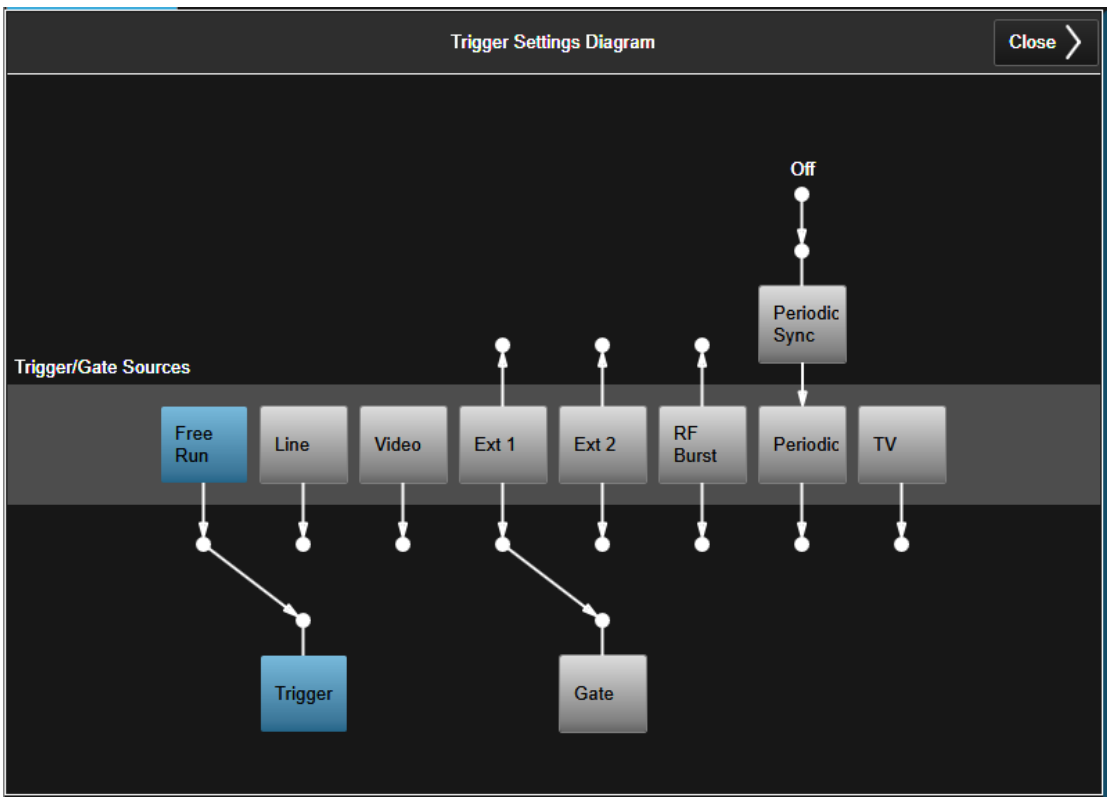
Example	`:SYST:PRIN:THEM OUTL`
Preset	OUTL; not part of Preset, but is reset by Restore Misc Defaults or Restore System Defaults All and survives subsequent running of the modes.
State Saved	No
Backwards Compatibility SCPI	`:SYSTem:PRINt:THEMe TDColor | TDMonochrome | FCOLor | FMONochrome`
Backwards Compatibility Notes	To permit code compatibility with A-model X-Series Signal Analyzer instruments, the command parameters from the A-models will be mapped as follows: TDColor and TDMonochrome are both mapped to FILLed (exact full color representation of what is on the screen) FCOLor and FMONochrome are both mapped to OUTLine (uses color for traces and other items, but most filled areas are white) There is no Monochrome theme in the B-models so the A-models monochrome commands will yield color. The query of :SYST:PRINT:THEM? will always return FILLed or OUTLine, it will not return FCOLor, FMONochrome, TDColor, or TDMonochrome.

9 Trigger

The **Trigger** key accesses menus that let you control the Trigger system of the instrument. In general, these are functions associated with internal triggers or trigger inputs. Trigger Output functions are configured under the **Input/Output** key.

The Trigger functions are common across multiple Modes and Measurements, although some controls appear only in certain Modes and/or certain Measurements. Additionally, some of the tabs on the Trigger menu are only available in certain Modes.

Many of the Trigger functions can be set graphically using the Trigger Setting Diagram. For more information see "Trigger Settings Diagram" on page 578.



In general, each Measurement can have a different Trigger and each Measurement remembers its previously-set Trigger.

9.1 Trigger

The Trigger tab contains controls which let you select the trigger source and setup of each of the trigger sources. The analyzer is designed to allow triggering from a number of different sources, for example, Free Run, Video, External, RF Burst, and so forth.

In general, each Measurement can have a different Trigger Source, and each Measurement remembers its previously-set Trigger Source.

9.1.1 Select Trig Source

Specifies the trigger source for the currently selected analyzer input (RF or I/Q). If you change inputs, the new input remembers the trigger source it was last programmed to for the current measurement, and uses that trigger source. When in External Mixing, the analyzer uses the RF trigger source. You can directly set the trigger source for the RF Input and for the I/Q input using SCPI commands; see "Trigger Source Presets" on page 551 and "I/Q Trigger Source (Remote Command Only)" on page 555.

In general, each Measurement can have a different Trigger Source, and each Measurement remembers its previously-set Trigger Source. Not every Trigger Source is available for every Measurement, so the available choices for Select Trig Source may vary from Mode to Mode and Measurement to Measurement. The trigger sources that are available for each measurement are shown in the “List of Available Trigger sources” dropdown below.

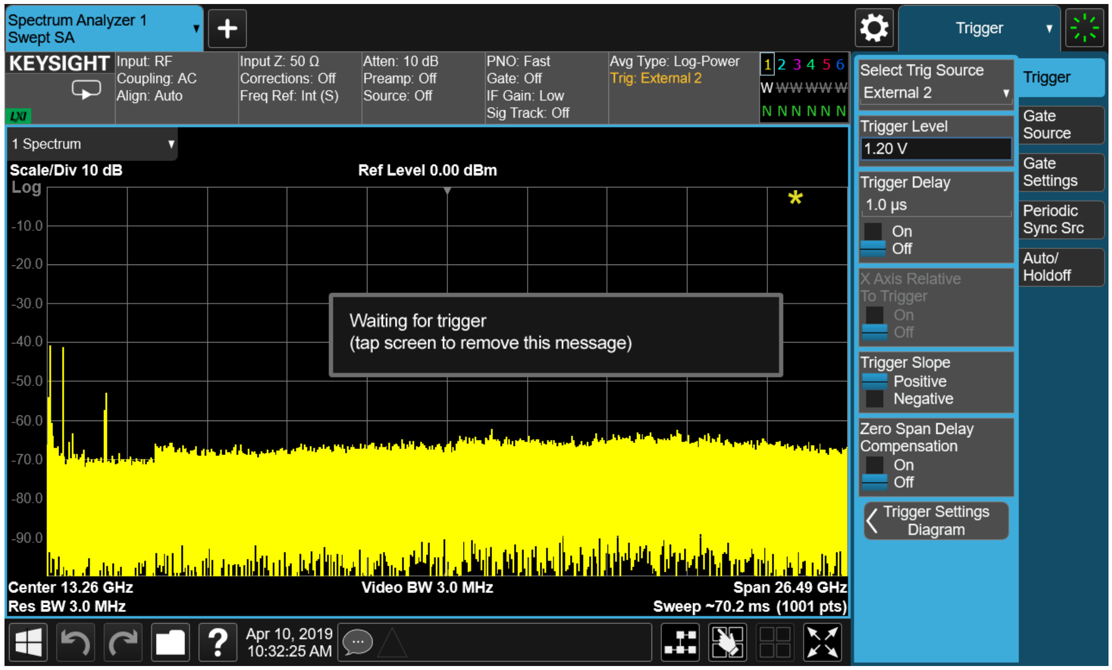
Note that the controls available on the Trigger Tab change depending on which trigger source is selected. Tap each trigger source in the table in the “List of Available Trigger sources” dropdown to see what parameters are available for that trigger source.

Note that most measurements require the inclusion of a <measurement> parameter in the Trigger Source command. However, for the Swept SA measurement and RTSA this is not the case; for backwards compatibility, no <measurement> parameter is used when setting the Trigger Source for the Swept SA measurement or RTSA.

Waiting for Trigger

After you select a trigger source, the analyzer will start its next measurement when that trigger source is satisfied. For example, if you choose External 1, the next measurement will start when the appropriate signal appears at the Trigger 1 In connector.

If the trigger source is not satisfied (for example, if no signal at the appropriate level appears at the Trigger 1 In connector), after approximately 2 seconds a popup message will appear which says “Waiting for trigger”. The trigger annotation in the Meas Bar will also turn amber, as shown below:



You may tap anywhere on the screen (except on the message itself) to clear the popup. The annotation will remain amber until the trigger conditions are satisfied.

List of available Trigger sources

This table shows which Trigger sources are available for which Modes and Measurements, with the following exceptions:

- the Noise Figure Mode does not support Triggering at all
- the Disturbance Analyzer measurement in the EMI Mode does not support Triggering
- the Tx Band Spur measurement in the GSM/EDGE Mode does not support Triggering
- For some models (like N9042B) with ADC trigger: some IF Paths do not support Video trigger, instead they support ADC trigger

"Free Run" on page 555	All Modes and measurements except those measurements that support no triggers at all
Video/ADC	All Modes except RTSA and Pulse
	In Spectrum Analyzer Mode, all measurements except ACP and List Sweep
	In WCDMA, MSR, Short Range Comms, VMA and LTE, all measurements except ACP
	In WLAN, all measurements
	In Phase Noise, all measurements except Log Plot and Spot Frequency
ADC	All Modes and measurements supporting Video, except Spectrum Analyzer

	mode (Only supported in certain model's IF Paths)
"Line" on page 556	All Modes except EMI, Avionics and Analog Demod In Spectrum Analyzer, all measurements except List Sweep In WLAN and GSM/EDGE, all measurements except Power vs. Time In LTE and 5G NR, all measurements except Transmit On/Off Power In Short Range Comms, all measurements except Modulation Analysis In MSR, all measurements
Level [Mode: RTSA, PULSEX]	RTSA and Pulse Modes only
FMT [Mode: RTSA, PULSEX]	RTSA and Pulse Modes only
"External 1" on page 557	All Modes and measurements
"External 2" on page 558	All Modes and measurements
External 3	All Modes except EMI, Avionics, GSM, Phase Noise, Bluetooth and Analog Demod In Spectrum Analyzer, LTE, Short Range Comms, VMA, WLAN and WCDMA, only in the Power Stat CCDF measurement
"RF Burst" on page 558	All Modes except EMI In Spectrum Analyzer, all measurements except List Sweep
"Periodic" on page 559	All Modes except EMI In Spectrum Analyzer, all measurements except List Sweep
TV [Mode: SA]	Spectrum Analyzer Mode only, and only in the Swept SA measurement
I/Q Triggers: I/Q Mag Input I Input Q I (Demodulated) Q (Demodulated) Aux I/Q Mag	All Modes except EMI, Avionics, RTSA, Analog Demod and Pulse In Spectrum Analyzer, only in Power Stat CCDF and Burst Power In WCDMA, only in Power Stat CCDF and IQ Waveform In GSM/EDGE, only in EVM, GMSK Phase & Freq Error, Transmit Power and IQ Waveform In Phase Noise, only in IQ Waveform In Bluetooth, only in Transmit Analysis In LTE, only in Power Stat CCDF, Modulation Analysis, Conformance EVM, and IQ Waveform In WLAN, only in Power Stat CCDF, Modulation Analysis, Spectral Flatness, and IQ Waveform In Short Range Comms, only in Power Stat CCDF and Modulation Analysis In VMA, only in Power Stat CCDF, Digital Demod and IQ Waveform
PXI	All Modes and measurements (only found in modular analyzers)
Internal	All Modes and measurements (only found in modular analyzers)

Backwards Compatibility SCPI

The following table contains information about SCPI commands provided for Backwards Compatibility:

Backwards Compatibility SCPI	`:TRIGger[:SEQuence]:SOURce EXTernal`
	For backward compatibility, the parameter EXTernal is mapped to EXTernal1
	`[:SENSe]:<measurement>:TRIGger:SOURce`
	This backwards compatibility alias command is provided for ESA/PSA compatibility
	This backwards compatibility command does not apply to the Swept SA measurement, for that just use :TRIGger:SOURCe
	This backwards compatibility command does not apply to the monitor spectrum, log plot and spot frequency measurements
	`[:SENSe]:<measurement>:TRIGger:SOURce IF`
	In earlier instruments, the parameter IF was used by apps for the video trigger, so using the IF parameter selects VIDeo triggering. Sending IF in the command causes VID to be returned to a query
	`[:SENSe]:ACPR:TRIGger:SOURce`
	This backwards Compatibility SCPI command is provided to support the same functionality as [:SENSe]:ACPr:TRIGger:SOURce (PSA W-CDMA, PSA cdma2000 and PSA 1xEVDO) due to the fact that the ACPr node conflicts with the ACPower node
	The legacy command:
	`:TRIGger[:SEQuence]:RFBurst:FSELectivity[:STATe] OFF | ON | 0 | 1`
	is not supported in the X-Series, as the hardware to do Frequency Selective burst triggers does not exist in X-Series

Backwards Compatibility Notes	In analyzers prior to the X-Series, the Average detector was not available when Video triggering was on, and consequently, functions that set the detector to average (such as Marker Noise or Band/Intvl Power) were not available when the video trigger was on. Similarly, Video triggering was not available when the detector was Average. In the X-Series, these restrictions are removed

More Information

The Trigger menus let you select the trigger source and trigger settings for a sweep or measurement. In triggered operation (basically, any trigger source other than Free Run), the analyzer will begin a sweep or measurement only when the selected trigger conditions are met, generally when your trigger source signal meets the specified trigger level and polarity requirements. (In FFT measurements, the trigger controls when the data acquisition begins for FFT conversion.)

For each of the trigger sources, you may define a set of operational parameters or settings which will be applied when that source is selected as the current trigger source. Examples of these settings are Trigger Level, Trigger Delay, and Trigger Slope. You may apply different settings for each source; so, for example, you could have a Trigger Level of 1v for External 1 trigger and -10 dBm for Video trigger.

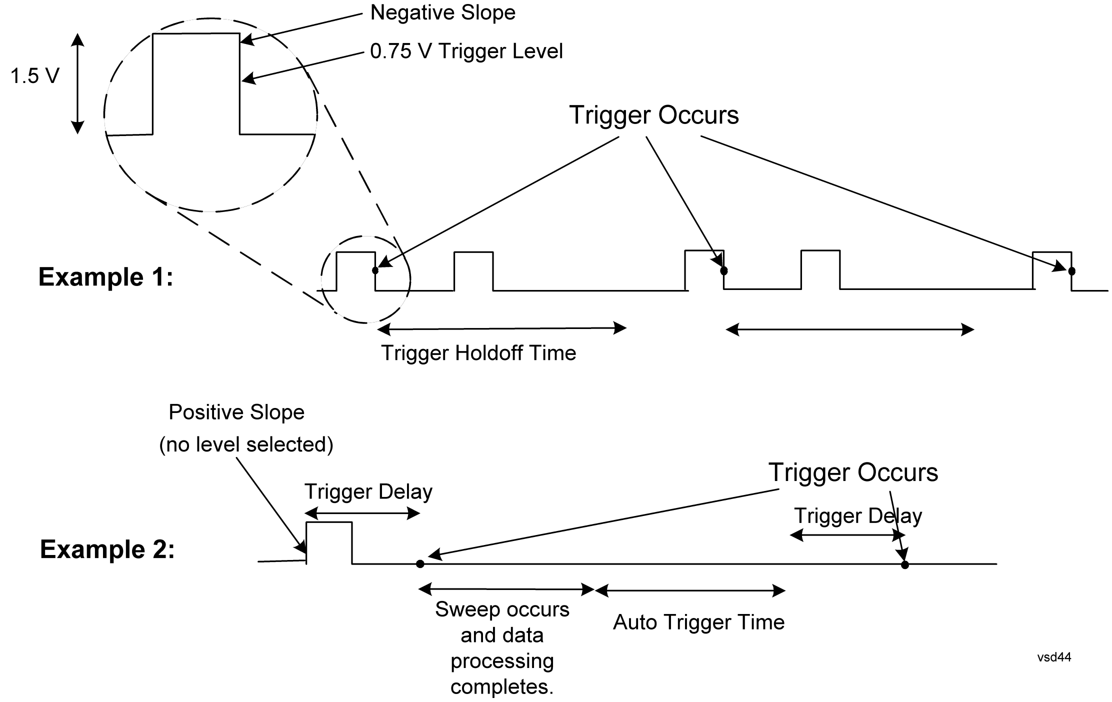
Once you have established the settings for a given trigger source, they generally will remain unchanged for that trigger source as you go from measurement to measurement within a Mode (although the settings can change as you go from Mode to Mode). Furthermore, the trigger settings within a Mode are the same for the **Trigger** menu, the **Gate Source** menu, and the **Periodic Sync Src** menu. That is, if **Ext1** trigger level is set to 1v in the **Trigger** menu, it will appear as 1v in both the **Gate Source** and the **Periodic Sync Src** menus. For these reasons the trigger settings commands are not qualified with the measurement name, the way the trigger source commands are.

Trigger Setup Parameters:

The following examples show trigger setup parameters using an external trigger source.

Example 1 illustrates the trigger conditions with negative slope and no trigger occurs during trigger Holdoff time.

Example 2 illustrates the trigger conditions with positive slope, trigger delay, and auto trigger time.



Remote Command	Swept SA and RTSA measurements:
	`:TRIGger[:SEQuence]:SOURce EXTernal1 | EXTernal2 | EXTernal3 | IMMediate | LINE | FRAMe | RFBurst | VIDeo | TV | PXI | INTernal`
	`:TRIGger[:SEQuence]:SOURce?`
	All other measurements
	`:TRIGger:<measurement>[:SEQuence]:SOURce EXTernal1 | EXTernal2 | EXTernal3 | AEXTernal | IMMediate | LEVel | FMT | LINE | FRAMe | RFBurst | VIDeo | IQMag | IDEMod | QDEMod | IINPut | QINPut | AIQMag | PXI |`

	`INTernal | PRTChandet | PRTFrame | PRTEvent` `:TRIGger:<measurement>[:SEQuence]:SOURce?`

Example	The following commands set the External 1 trigger input for various measurements.
	Swept SA and RTSA measurements:
	`:TRIG:SOUR EXT1`
	Other Spectrum Analyzer Mode measurements:
	Harmonics:
	`:TRIG:HARM:SOUR EXT1`
	TOI:
	`:TRIG:TOI:SOUR EXT1`

Notes	For some of the trigger parameters the tie-in to the parameter is not obvious. These are: IMMediate, which selects Free Run FRAMe , which selects Periodic Trigger FMT, which selects Frequency Mask Trigger AEXTernal, which selects Audio External trigger, using the TRIG IN connector on the M9260A Audio Analyzer module For most measurements, the <measurement> keyword follows TRIGger. For Swept SA and RTSA, do not use the <measurement> keyword. Using the wrong form will result in an Undefined Header error Other trigger-related commands are found in the INITiate and ABORt SCPI command subsystems *OPC should be used after requesting data. This will hold off any subsequent changes to the selected trigger source, until after the sweep is completed and the data is returned Available ranges and presets can vary from mode to mode **For FMT (Pulse and RTSA apps):** The amplitude resolution of the Frequency Mask is coupled to the Scale/Division. There are 256 vertical points therefore the amplitude resolution is computed using the algorithm: (10 * Scale/Div) / # Vertical Points
Dependencies	Not all trigger sources are available for each input. See the "RF Trigger Source (Remote Command Only)" on page 553 and "I/Q Trigger Source (Remote Command Only)" on page 555 commands for detailed information on which trigger sources are available for each input In some models, there is no second External input. In these models, the External 2 selection is not shown and the EXTernal2 parameter will generate a “Hardware missing; Not available for this model number” message EXTernal3 is available only when Option H1G is installed For the E7760 the only available selections are EXTernal1|IMMediate|INTernal|RFBurst|VIDeo For UXM the only available selections are EXTernal1|IMMediate| PRTChandet|PRTFrame|PRTEvent In the Pulse app, when Option B2X and H1G are installed and Digital IF BW is greater than 255.176 MHz, only three trigger sources, IMMediate, LEVel, and EXTernal3 are available **Level Trigger (Pulse and RTSA apps):** Level trigger is allowed in average detector mode When Level Trigger is the selected Trigger Source in the Spectrum measurement, Spectrum minimum Acquisition Time is limited to the PVT minimum Acquisition Time. If the Spectrum Acquisition Time changed as a result of going into Level Trigger, a message is posted “Min Acq Time is 200 usec when

	Level Trigger is ON". When Level Trigger is no longer the selected Trigger Source, Spectrum minimum Acquisition Time is restored **FMT (Pulse and RTSA apps):** If you were not in Free Run when you entered the FMT Setup View, you can change Trigger Source to Free Run while in the editor. This will allow you to configure the mask with a continually updating trace. When exiting FMT Setup View, the Trigger Source will be changed back to FMT
Couplings	**FMT (Pulse and RTSA apps):** A remote user can enter or access FMT data via `:TRIGger[:SEQuence]:FMT[1]|2:DATA` The upper and lower masks can have different freq/ampl pairs therefore subop code 1 is for the upper mask and subop code 2 is for the lower mask
Preset	See "Trigger Source Presets" below
Status Bits/OPC dependencies	The Status Operation Register bit 5 "Waiting for Trigger" is set at the same time as the Sweeping or Measuring bit is set. It is cleared when the trigger actually occurs (that is, after the trigger event occurs and all the applicable trigger criteria have been met). A corresponding pop-up message ("Waiting for trigger") is generated if no trigger signal appears after approximately 2 sec. This message goes away when a trigger signal appears

Trigger Source Presets

Here are the Trigger Source Presets for the various measurements. These are the Trigger Sources that will be used for these measurements after a Mode Preset or Meas Preset:

Meas	Mode	Preset for RF	Preset for IQ
Swept SA	SA	IMM	IQ not supported
CHP	SA, WCDMA, MSR,SRCOMMS, 5G NR	IMM	IQ not supported
OBW	SA, WCDMA, LTEAFDD, LTEATDD, BT, 5G NR	1xEVDO: EXT1 Others: IMM	IQ not supported
Transmit Analysis	BT	RFB	IQMag
Adjacent Channel Power	BT	IMM	IQ not supported
LE In-band Emissions	BT	IMM	IQ not supported
EDR In-band Spurious Emissions	BT	RF Burst	IQ not supported
CCDF	SA, WCDMA, LTEAFDD, LTEATDD, MSR,SRCOMMS, 5G NR	LTEATDD: - BTS: External 1 - MS: Periodic Timer Others: IMM	LTEATDD: - BTS: External 1 - MS: Periodic Timer Others: IMM
ACP	SA, WCDMA, LTEAFDD, LTEATDD, MSR,SRCOMMS, 5G NR	IMM	IQ not supported
Tx Power	SA, GSM	RFBurst	IMM

Meas	Mode	Preset for RF	Preset for IQ
SPUR	SA, WCDMA, MSR, LTEAFDD, LTEATDD, 5G NR	IMM	IQ not supported
SEM	SA, WCDMA, MSR, LTEAFDD, LTEATDD, SRCOMMS, 5G NR	IMM	IQ not supported
CDP	WCDMA	IMM	IMM
RHO	WCDMA	IMM	IMM
PCON	WCDMA	IMM	IMM
QPSK	WCDMA	EXT1	IMM
MON	All except SA and BASIC	IMM	IQ not supported
WAV	All except SA	LTEATDD: - BTS: External 1 - MS: Periodic Timer GSM/EDGE: RFBurst All others: IMM	LTEATDD: - BTS: External 1 - MS: Periodic Timer GSM/EDGE: IQMag All others: IMM
EVM	LTEAFDD, LTEATDD, SRCOMMS, 5G NR	IMM	IMM
SPEC	BASIC	IMM	IMM
LOG Plot	PN	IMM	IQ not supported
Spot Freq	PN	IMM	IQ not supported
GMSK PVT	EDGE/GSM	RFB	IMM
GMSK PFER	EDGE/GSM	RFB	IQMag
GMSK ORFS	EDGE/GSM	RF Burst	IQ not supported
EDGE PVT	EDGE/GSM	RFB	IMM
EDGE EVM	EDGE/GSM	RFB	IQMag
EDGE ORFS	EDGE/GSM	Periodic Timer	IQ not supported
Combined WCDMA	WCDMA	IMM	IQ not supported
Combined GSM	EDGE/GSM	RFB	IQ not supported
List Power Step	WCDMA, EDGE/GSM	IMM	IQ not supported
Transmit On/Off Power	LTETDD, LTEATDD, 5G NR	BTS: External 1 MS: Periodic Timer	BTS: External 1 MS: Periodic Timer
Transmit Analysis	BLUETOOTH	RFB	IQ not supported
Adjacent Channel Power	BLUETOOTH	IMM	IQ not supported
LE In-band	BLUETOOTH	IMM	IQ not supported

Meas	Mode	Preset for RF	Preset for IQ
Emissions			
EDR In-band Spurious Emissions	BLUETOOTH	Periodic Timer	IQ not supported
Conformance EVM	LTEAFDD, LTEATDD, MSR	IMM	IMM
Spectrum & PvT	RTSA	IMM	IQ not supported
Pulse	PULSEX	IMM	IQ not supported
AM, FM, PM, FM Stereo	Analog Demod	IMM	IQ not supported
PAvT	SA, 5G NR, VMA	IMM	IMM

RF Trigger Source (Remote Command Only)

The **RF Trigger Source** command selects the trigger to be used for the specified measurement when RF is the selected input. The RF trigger source can be queried and changed even while another input is selected, but it is inactive until RF becomes the selected input.

Note the inclusion of the `<measurement>` parameter in the command below. Because each measurement remembers its own Trigger Source, the command must be qualified with the measurement name. Note that for the Swept SA measurement this is not the case; for backwards compatibility, no `<measurement>` parameter is used when setting the Trigger Source for the Swept SA measurement.

Remote Command	`:TRIGger:<measurement>[:SEQuence]:RF:SOURce EXTernal1 | EXTernal2 | IMMediate | LEVel | FMT | LINE | FRAMe | RFBurst | VIDeo | IF | TV | PXI | INTernal | PRTChandet | PRTFrame | PRTEvent`
	`:TRIGger:<measurement>[:SEQuence]:RF:SOURce?`
	Note that the available parameters are model number and hardware dependent

Example	`:TRIG:ACP:RF:SOUR EXT1`
	Selects the external 1 trigger input for the ACP measurement and the RF input
	`:TRIG:RF:SOUR VID`
	Selects video triggering for the `SANalyzer` measurement and the RF input. For `SAN`, do not use the `<measurement>` keyword

Notes	Not all measurements have all the trigger sources available to them. Check the trigger source documentation for your specific measurement to see what sources are available Note that not all trigger sources are available for each input, and that the available parameters are model number and hardware dependent For the **RF Trigger Source,** the following trigger sources are available: IMMediate - free run triggering VIDeo - triggers on the video signal level LEVel - triggers on the video signal level with time qualified triggering

	FMT - triggers on the amplitude spectrum with frequency mask triggering LINE - triggers on the power line signal EXTernal1 (or EXTernal) - triggers on an externally connected trigger source marked “Trigger 1 In” on the rear panel of standalone instruments, “Trigger 3” on the front panel of EXM and VXT models M9420A/21A, and “Trigger 1” on the front panel of VXT models M9410A/11A EXTernal2 - triggers on an externally connected trigger source marked “Trigger 2 In” on the front panel of standalone instruments, and “Trigger 1” on the front panel of EXM and VXT models M9420A/21A, and “Trigger 2” on the front panel of VXT models M9410A/11A. In some models, there is no second External input. In these models, the External 2 selection is not shown and the EXTernal2 parameter will generate a “Hardware missing; Not available for this model number” message RFBurst - triggers on the bursted frame FRAMe - triggers on the periodic timer IF (video) - same as video, for backwards compatibility only PRTChandet – triggers on Base Station Emulation detecting a valid UL signal (PUSCH/PUCCH/PRACH/SRS) PRTFrame - triggers on the Base Station Emulation periodic technology format radio frame with data frame aligned to the BSE timing PRTEvent - triggers on the Base Station Emulation events INTernal triggers on the internal source trigger output, for models with an internal source such as VXT. PXI trigger, only supported in PXI (modular) instruments *OPC should be used after requesting data. This will hold off any subsequent changes to the selected trigger source, until after the sweep is completed and the data is returned Available ranges, and presets can vary from mode to mode
Dependencies	The available choices for VXT are: Free Run, Video, Internal, External 1, External 2, RF Burst, Periodic and PXI In VXT, Internal is only in VXT models M9410A/11A, not in models M9420/21A, and Internal and Periodic are not available in Spectrum Analyzer Mode PXI is only found in VXT The available choices for EXM are Free Run, Video, Internal, External 1, External 2, RF Burst, and Periodic The available choices for UXM are Free Run, External 1, Prot Channel Detection, Prot Frame Aligned, and Prot Event Prot Channel Detection, Prot Frame Aligned, and Prot Event are only available in UXM The available choices for E7760 are Free Run, External 1, Internal, Video and RF Burst In some models, there is no second External input. In these models, the External 2 selection is not shown and the EXTernal2 parameter will generate a “Hardware missing; Not available for this model number” error
Status Bits/OPC dependencies	The Status Operation Register bit 5 "Waiting for Trigger" is set at the same time as the Sweeping or Measuring bit is set. It is cleared when the trigger actually occurs (that is, after the trigger event occurs and all the applicable trigger criteria have been met). A corresponding pop-up message ("Waiting for trigger") is generated if no trigger signal appears after approximately 2 sec. This message goes away when a trigger signal appears

I/Q Trigger Source (Remote Command Only)

This command selects the trigger to be used for the specified measurement when I/Q (which requires option BBA) is the selected input. The I/Q trigger source can be queried and changed even while another input is selected, but it is inactive until I/Q becomes the selected input.

Remote Command	`:TRIGger:<measurement>[:SEQuence]:IQ:SOURce EXTernal1 | EXTernal2 | IMMediate | IQMag | IDEMod | QDEMod | IINPut | QINPut | AIQMag` `:TRIGger:<measurement>[:SEQuence]:IQ:SOURce?`
Example	`:TRIG:WAVeform:SOUR IQM` Selects I/Q magnitude triggering for the IQ Waveform measurement and the I/Q input
Notes	Not all measurements have all the trigger sources available to them. Check the trigger source documentation for your specific measurement to see what sources are available Note that not all trigger sources are available for each input, and that the available parameters are model number and hardware dependent For the **I/Q Trigger Source,** the following trigger sources are available: IMMediate - free run triggering EXTernal1 (or EXTernal) - triggers on an externally connected trigger source on the rear panel EXTernal2 - triggers on an externally connected trigger source on the front panel IQMag - triggers on the magnitude of the I/Q signal IDEMod - triggers on the I/Q signal's demodulated I voltage QDEMod - triggers on the I/Q signal's demodulated Q voltage IINPut - triggers on the I channel's ADC voltage QINPut - triggers on the Q channel's ADC voltage AIQMag - triggers on the magnitude of the auxiliary receiver channel I/Q signal *OPC should be used after requesting data. This will hold off any subsequent changes to the selected trigger source, until after the sweep is completed and the data is returned Available ranges, and from mode to mode presets can vary
Status Bits/OPC dependencies	The Status Operation Register bit 5 "Waiting for Trigger" is set at the same time as the Sweeping or Measuring bit is set. It is cleared when the trigger actually occurs (that is, after the trigger event occurs and all the applicable trigger criteria have been met). A corresponding pop-up message ("Waiting for trigger") is generated if no trigger signal appears after approximately 2 sec. This message goes away when a trigger signal appears

9.1.1.1 Free Run

Free run triggering occurs immediately after the sweep/measurement is initiated.

Example	`:TRIG:SOUR IMM`
	Swept SA measurement
	`:TRIG:<meas>:SOUR IMM`
	Measurements other than Swept SA

Annunciation	Free Run (in the Meas Bar)

9.1.1.2 Video/ADC

The Video trigger condition is met when the video signal at the left edge of the graticule (the filtered and detected version of the input signal, including both RBW and VBW filtering) crosses the video trigger level with the chosen slope.

The Video trigger level is shown as a labeled line on the display. The line is displayed as long as Video is the selected trigger source. The Trigger Level line can be adjusted using the step keys, knob, or numeric keypad. It can also be dragged on the display with your finger or with a mouse.

When the detector selected for all active traces is the average detector, the video signal for triggering does not include any VBW filtering.

Log Plot and Spot Frequency measurements in the Phase Noise application do not support Video Trigger.

The Trigger Tab contains the following Trigger Source dependent controls when Video Trigger is selected:

– Prot Frame Aligned

– "Trigger Delay" on page 563

– "Trigger Slope" on page 568

Additional controls are also present which are not dependent on the selected Trigger Source.

Note that Video Trigger is a software trigger of the acquired trace for some measurements and a hardware trigger of the IF envelope for others. Most measurements support one method or the other, although some (like ACP) don't support Video Trigger at all. For those measurements which support Video Trigger as a software trigger, the Trigger Level units will be dependent on the current Y Axis Unit for the measurement; for those which support Video Trigger as an IF Envelope trigger, the units are typically in dBm.

Example	`:TRIG:SOUR VID`
	Swept SA measurement
	`:TRIG:<meas>:SOUR VID`
	Measurements other than Swept SA

Annunciation	Video (in the Meas Bar)

9.1.1.3 Line

When Line is selected a new sweep/measurement will start synchronized with the next cycle of the line voltage.

Line trigger is not available when operating from a "dc power source", for example, when the instrument is powered from batteries

Line trigger is not available when using modular analyzers like the VXT.

The Trigger Tab contains the following Trigger Source dependent controls when Line Trigger is selected:

– "Trigger Delay" on page 563

– "Trigger Slope" on page 568

Additional controls are also present which are not dependent on the selected Trigger Source.

Example	`:TRIG:SOUR LINE`
	Swept SA measurement
	`:TRIG:<meas>:SOUR LINE`
	Measurements other than Swept SA

Annunciation	LINE (in the Meas Bar)

9.1.1.4 External 1

When External 1 is selected, a new sweep/measurement will start when the external trigger condition is met using the TRIGGER 1 IN input connector on the rear panel.

Grayed out if Ext 1 is in use by Point Trigger in the Source Setup menu of Swept SA.

Forced to Free Run if already selected and Point Trigger is set to External 1.

The Trigger Tab contains the following Trigger Source dependent controls when External 1 Trigger is selected:

– Prot Frame Aligned

– "Trigger Delay" on page 563

– "Trigger Slope" on page 568

Additional controls are also present which are not dependent on the selected Trigger Source.

Example	`:TRIG:SOUR EXT1`
	Swept SA measurement
	`:TRIG:<meas>:SOUR EXT1`
	Measurements other than Swept SA

Annunciation	External 1 (in the Meas Bar)

9.1.1.5 External 2

When External 2 is selected, a new sweep/measurement will start when the external trigger condition is met using the TRIGGER 2 IN input connector on the rear panel.

Grayed out if Ext 2 is in use by Point Trigger in the Source Setup menu of Swept SA.

Forced to Free Run if already selected and Point Trigger is set to External 2.

The Trigger Tab contains the following Trigger Source dependent controls when External 2 Trigger is selected:

- Prot Frame Aligned
- "Trigger Delay" on page 563
- "Trigger Slope" on page 568

Additional controls are also present which are not dependent on the selected Trigger Source.

Example	`:TRIG:SOUR EXT2`
	Swept SA measurement
	`:TRIG:<meas>:SOUR EXT2`
	Measurements other than Swept SA

Annunciation	External 2 (in the Meas Bar)

9.1.1.6 RF Burst

When RF Burst is selected, a new sweep/measurement will start when an RF burst envelope signal is identified from the signal at the RF Input connector.

In some models, a variety of burst trigger circuitry is available, resulting in various available burst trigger bandwidths. The analyzer automatically chooses the appropriate trigger path based on the hardware configuration and other settings of the analyzer.

The Trigger Tab contains the following Trigger Source dependent controls when RF Burst is selected:

- "Trigger Level Absolute/Relative" on page 569
- "Absolute Trigger Level" on page 569
- "Relative Trigger Level" on page 570

- "Trigger Delay" on page 563
- "Trigger Slope" on page 568

Additional controls are also present which are not dependent on the selected Trigger Source.

Example	`:TRIG:SOUR RFB`
	Swept SA measurement
	`:TRIG:<meas>:SOUR RFB`
	Measurements other than Swept SA

Annunciation	RF Burst (in the Meas Bar)

9.1.1.7 Periodic

When Periodic is selected, the analyzer uses a built-in periodic timer signal as the trigger. Trigger occurrences are set by the **Periodic Timer** parameter, which is modified by the **Offset** and Periodic Sync Src.

Use this trigger when there a periodic signal but no reliable signal on which to trigger. You can synchronize the periodic signal with outside events (using the Periodic Sync Src) to get closer to a reliable trigger signal (see Notes below).

If you do not have a sync source selected (it is Off), then the internal timer will not be synchronized with any external timing events.

The Trigger Tab contains the following Trigger Source dependent controls when Periodic Trigger is selected:

- "Period " on page 572
- "Offset" on page 572
- "Reset Offset Display " on page 573
- "Sync Source" on page 574
- "Trigger Delay" on page 563

Additional controls are also present which are not dependent on the selected Trigger Source.

See "More Information" on page 560

Example	`:TRIG:SOUR FRAM`
	Swept SA measurement
	`:TRIG:<meas>:SOUR FRAM`
	Measurements other than Swept SA

Annunciation	Periodic (in the Meas Bar)

More Information

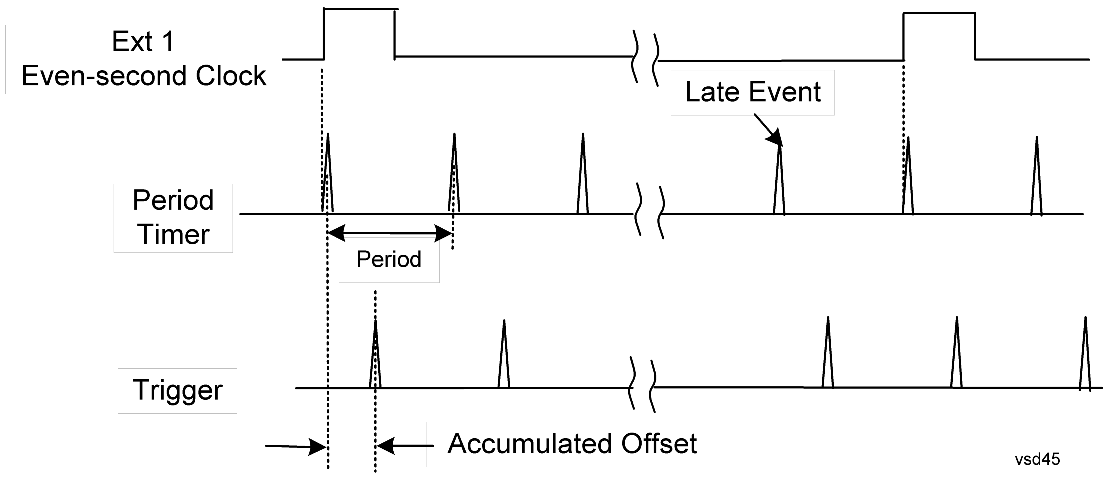
The figure below shows the action of the periodic timer trigger. Before reviewing the figure, we'll explain some uses for the periodic trigger.

A common application is measuring periodic burst RF signals for which a trigger signal is not easily available. For example, we might be measuring a TDMA radio which bursts every 20 ms. Let's assume that the 20 ms period is very consistent. Let's also assume that we do not have an external trigger source available that is synchronized with the period, and that the signal-to-noise ratio of the signal is not high enough to provide a clean RF burst trigger at all of the analysis frequencies. For example, we might want to measure spurious transmissions at an offset from the carrier that is larger than the bandwidth of the RF burst trigger. In this application, we can set the Periodic Timer to a 20.00 ms period and adjust the offset from that timer to position our trigger just where we want it. If we find that the 20.00 ms is not exactly right, we can adjust the period slightly to minimize the drift between the period timer and the signal to be measured.

A second way to use this feature would be to use Sync Source temporarily, instead of Offset. In this case, we might tune to the signal in a narrow span and use the RF Burst trigger to synchronize the periodic timer. Then we would turn the sync source off so that it would not miss-trigger. Miss-triggering can occur when we are tuned so far away from the RF burst trigger that it is no longer reliable.

A third example would be to synchronize to a signal that has a reference time element of much longer period than the period of interest. In some CDMA applications, it is useful to look at signals with a short periodicity, by synchronizing that periodicity to the "even-second clock" edge that happens every two seconds. Thus, we could connect the even-second clock trigger to Ext1 and use then Ext1 as the sync source for the periodic timer.

The figure below illustrates this third example. The top trace represents the even-second clock. It causes the periodic timer to synchronize with the leading edge shown. The analyzer trigger occurs at a time delayed by the accumulated offset from the period trigger event. The periodic timer continues to run, and triggers continue to occur, with a periodicity determined by the analyzer time base. The timer output (labeled "late event") will drift away from its ideal time due to imperfect matching between the time base of the signal being measured and the time base of the analyzer, and also because of imperfect setting of the period parameter. But the synchronization is restored on the next even-second clock event. ("Accumulated offset" is described in the in the Offset function section.)



9.1.2 Trigger Level

Sets the amplitude level for Trigger and Gate sources that use level triggering. When the video signal crosses this level, with the chosen slope, the trigger occurs.

For any given Trigger, Gate, or Periodic Sync Src, the same Trigger Level is used for the Trigger source in the Trigger menu, for the Gate source in the Gate Source menu, and for the Periodic Sync source in the Periodic Sync Src menu.

If Video is the selected trigger source, the trigger level displays as a green horizontal line with the label TRIG LVL just above it on the right:

If the value of trigger level is off screen low this line displays along the bottom of the graticule. If the value of trigger level is off screen high this line displays above the graticule but no farther above than 1.5 % of the graticule height (the same as the trace itself). Note that the TRIG LVL label cannot display above the graticule so the label itself stops at the top of the graticule.

For the I/Q Triggers, the I/Q reference impedance is used for converting between power and voltage.

Trigger Level Parameters

Source	Example	Min	Max	Preset	Resolution	Step Key Incr.	Knob Incr.
Video	TRIG:VID:LEV -40 dBm	-170 dBm	+30 dBm	-25 dBm	.01 dB	Scale/Div	Step/10, but

Source	Example	Min	Max	Preset	Resolution	Step Key Incr.	Knob Incr.
						(Log), 1 dB (Lin)	never < 0.1 dB
Level	TRIG:LEV:LEV -40 dBm	-170 dBm	+30 dBm	-25 dBm	.01 dB	Scale/Div (Log), 1 dB (Lin)	Step/10, but never < 0.1 dB
External 1|2	TRIG:EXT1:LEV 0.4 V	-5 V VXT models M9410A/11A: 0 V	5 V VXT models M9410A/11A: 2.5 V	1.2 V	10 mV	0.5 V	0.1 V
I/Q Mag	TRIG:IQM:LEV -30 dBm	-200 dBm	100 dBm	-25 dBm	.1 dB	Scale/Div (Log), 1 dB (Lin)	Step/10, but never < 0.1 dB
I (Demod)	TRIG:IDEM:LEV 0.5 V	-1 V	1 V	0.25 V	4 significant digits	Scale/Div	Step/100, but never < 1 µV
Q (Demod)	TRIG:QDEM:LEV 0.5 V	-1 V	1 V	0.25 V	4 significant digits	Scale/Div	Step/100, but never < 1 µV
Input I	TRIG:IINP:LEV 0.5 V	-1 V	1 V	0.25 V	4 significant digits	Scale/Div	Step/100, but never < 1 µV
Input Q	TRIG:QINP:LEV 0.5 V	-1 V	1 V	0.25 V	4 significant digits	Scale/Div	Step/100, but never < 1 µV
Aux Chan I/Q Mag	TRIG:AIQM:LEV -30 dBm	-200 dBm	100 dBm	-25 dBm	.1 dB	Scale/Div (Log), 1 dB (Lin)	Step/10, but never < 0.1 dB

Source	Example	Min	Max	Preset	Resolution	Step Key Incr.	Knob Incr.
Internal	TRIG:INT:LEV 1.2 V	-5 V VXT models M9410A/11A: 0 V	5 V VXT models M9410A/11A: 2.5 V	1.2 V	10 mV	.5 V	.1 V

More Information

For Video Trigger Level, when sweep type = FFT, the video trigger uses the amplitude envelope in a bandwidth wider than the FFT width as a trigger source. This might often be useful, but does not have the same relationship between the displayed trace and the trigger level as in swept triggering.

For Video Trigger Level the settable resolution of the function is 0.01 dB, even when the Y Axis Unit is linear. In Linear Y Axis Unit (for example, Volts) this requires 4 significant digits to display on the control.

For the Level trigger source, used in RTSA and other measurements, External Gain and Ref Level Offset modify the actual trace data as it is taken and are taken into account by Trig Level.

Remote Command	`:TRIGger[:SEQuence]:<trig_source>:LEVel <ampl>`
	`:TRIGger[:SEQuence]:<trig_source>:LEVel?`
	where `<trig_source>` is one of:
	`EXTernal1 | EXTernal2 | VIDeo | LEVel | IQMag | IDEMod | QDEMod | IINPut | QINPut | AIQMag | INTernal`

Example	`:TRIG:VID:LEV -40 dBm`
Dependencies	Only appears when Video, External 1|2, or an I/Q trigger is selected as the Trigger Source
State Saved	Saved in instrument state

Backwards Compatibility SCPI	`:TRIGger[:SEQuence]:IF:LEVel`
	taken as video trigger level
	`:TRIGger[:SEQuence]:IF:LEVel?`
	taken as video trigger level query
	`:TRIGger[:SEQuence]:EXTernal:LEVel`
	the parameter EXTernal is mapped to EXTernal1
	`:TRIGger[:SEQuence]:FRAMe:EXTernal1:LEVel`

9.1.3 Trigger Delay

Controls a time delay that the analyzer will wait to begin a sweep after meeting the trigger criteria, for Trigger and Gate sources that support Trigger Delay.

For any given Trigger, Gate, or Periodic Sync source, the same Trigger Delay is used for the Trigger source in the Trigger menu, for the Gate source in the Gate Source menu, and for the Periodic Sync source in the Periodic Sync Src menu.

Negative trigger delays can be used. Negative trigger delay makes intuitive sense in time domain and works well in FFT mode where the bandwidth of the filter before the video trigger is about 1.25 span. You can use negative delay to pre-trigger the instrument in the time domain or FFT, but not in swept spans. Video trigger delay may be set to negative values, in time domain, FFT and even swept, but in swept spans, negative settings of Trig Delay are treated as a zero setting within the internal hardware and the advisory message "Neg. Trig Delay unavailable in Swept Mode, zero delay used." is generated when such a delay is set.

Remote Command	`:TRIGger[:SEQuence]:<trig_source>:DELay <time>`
	`:TRIGger[:SEQuence]:<trig_source>:DELay?`
	`:TRIGger[:SEQuence]:<trig_source>:DELay:STATe OFF | ON | 0 | 1`
	`:TRIGger[:SEQuence]:<trig_source>:DELay:STATe?`
	where `<trig_source>` is one of:
	`LINE | EXTernal1 | EXTernal2 | AEXTernal | VIDeo | RFBurst | FRAMe | LEVel | FMT | IQMag | IDEMod | QDEMod | IINPut | QINPut | AIQMag PXI | INTernal`

Example	`:TRIG:VID:DEL:STAT ON` `:TRIG:VID:DEL 100 ms`
Dependencies	Only appears when Video, Line, External 1|2, RF Burst, Periodic Timer or an I/Q trigger is selected as the Trigger Source
Couplings	When FMT Trigger Criteria is INSIDE or OUTSIDE, FMT Trigger Delay State is forced to `OFF` FMT Trigger Delay MaxValue is dependent on the current AcquisitionTime. The equation is: MaxValue = 2^16 x AcqTime, but never to exceed 70 sec Example: In PVT View with a min PVT Acq Time of 200 us, this Trigger Delay MaxValue is 13.26 sec. In RT Spectrum and Spectrogram with a min Acq Time of 100 us, this Trigger Delay MaxValue is 6.55 sec. When the user increases the Acq Time, it will increase this MaxValue
Preset	`OFF`
State Saved	Saved in instrument state
Annotation	Trig Delay (in the Measurement Bar)

Backwards Compatibility Notes	For backward compatibility with VSA/PSA comms apps
	`:TRIGger[:SEQuence]:IF:DELay`
	`:TRIGger[:SEQuence]:DELay`
	The legacy `:TRIGger[:SEQuence]:DELay` command affects the delay for the VID, LINE, EXT1, EXT2, and RFB triggers.

Remote Command	`:TRIGger[:SEQuence]:DELay <time>`

	`:TRIGger[:SEQuence]:DELay?`
	`:TRIGger[:SEQuence]:DELay:STATe OFF | ON | 0 | 1`
	`:TRIGger[:SEQuence]:DELay:STATe?`

Example	`:TRIG:DEL 1 ms`
Preset	1 us
State Saved	Saved in instrument state
Backwards Compatibility Notes	In ESA/PSA, the Trigger Delay was global to all triggers. In the X-Series, the delay can be set individually for each Trigger Source. For backward compatibility, the global DELay command updates all instances of trigger slope (VID, LINE, EXT1, EXT2) except TV and RFBurst. The query returns the trigger delay setting of the currently selected trigger source

Remote Command	`:TRIGger[:SEQuence]:OFFSet <time>`
	`:TRIGger[:SEQuence]:OFFSet?`
	`:TRIGger[:SEQuence]:OFFSet:STATe OFF | ON | 0 | 1`
	`:TRIGger[:SEQuence]:OFFSet:STATe?`

Example	`:TRIG:OFFS ON` `:TRIG:OFFS -100 ms`
Notes	These are ESA commands for trigger offset that allowed you to use a positive or negative delay when in zero span and in a Res BW >= 1 kHz. For ESA compatibility, X-series analyzers keep track of this offset and adds it to the Trigger Delay for VIDeo, LINE, EXTernal1 or EXTernal2 whenever the value is sent to the hardware, if in Zero Span and RBW >= 1 kHz
Preset	Off, 0 s OFF
State Saved	Saved in instrument state
Min	-11 s
Max	+11 s

Trigger Delay Parameters

Note: in Swept SA, when transitioning from Zero Span to Swept spans, the trigger delay is clipped to -150 ms if it had been longer in Zero Span.

Source	Example	Preset	Min	Max	Resolution
Video	`TRIG:VID:DEL:STAT ON` `TRIG:VID:DEL 100 ms`	Off, 1 us	-150 ms (-10s in Swept SA Zero Span)	+500 ms	100 ns
Level	`TRIG:LEV:DEL:STAT ON` `TRIG:LEV:DEL 100`	Off, 30 ms	0 ms	70 sec (but dependent on Acq Time	Multiple of Acq Time (as is FMT)

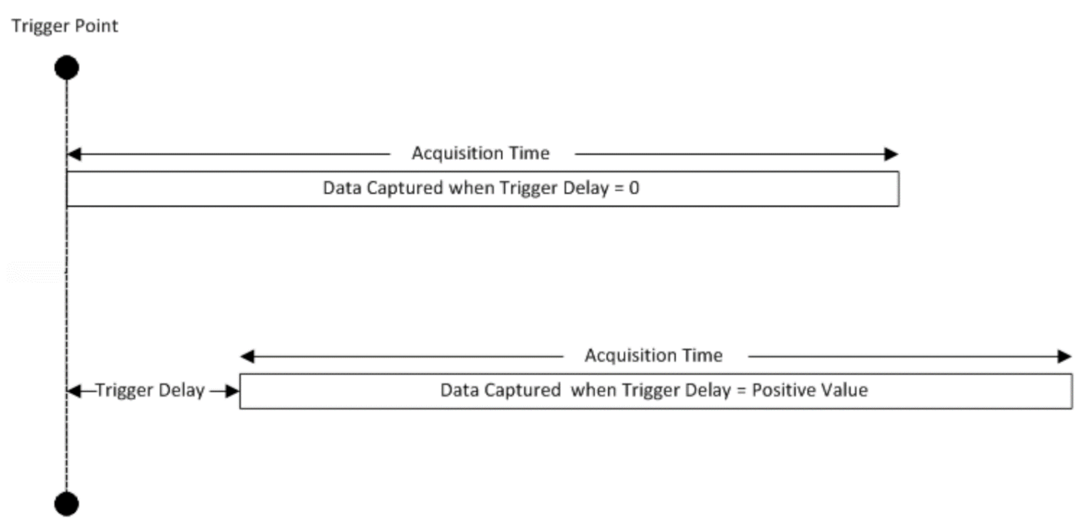
Source	Example	Preset	Min	Max	Resolution
	`ms`			like FMT)	
FMT	`TRIG:FMT:DEL:STAT ON` `TRIG:FMT:DEL 100 ms`	Off, 30 ms	0 ms	70 sec (but dependent on Acq Time like FMT)	Multiple of Acq Time (as is FMT)
External 1|2	`TRIG:EXT1:DEL:STAT ON` `TRIG:EXT2:DEL 100 ms`	Off, 1 us	-150 ms (-10s in Swept SA Zero Span)	+500 ms	100 ns
Line	`TRIG:LINE:DEL:STAT ON` `TRIG:LINE:DEL 100 ms`	Off, 1 us	-150 ms (-10s in Swept SA Zero Span)	+500 ms	100 ns
RF Burst	`TRIG:RFB:DEL:STAT ON` `TRIG:RFB:DEL 100 ms`	Off, 1 us	-150 ms (-10s in Swept SA Zero Span)	+500 ms	100 ns
Periodic Timer	`TRIG:FRAM:DEL:STAT ON` `TRIG:FRAM:DEL 100 ms`	Off, 1 us	-150 ms (-10s in Swept SA Zero Span)	+500 ms	100 ns
I/Q Mag	`TRIG:IQM:DEL:STAT ON` `TRIG:IQM:DEL 10 ms`	Off, 1 us	-2.5 s	+10 s	10 ns
I (Demod)	`TRIG:IDEM:DEL:STAT ON` `TRIG:IDEM:DEL 10 ms`	Off, 1 us	-2.5 s	+10 s	10 ns
Q (Demod)	`TRIG:QDEM:DEL:STAT ON` `TRIG:QDEM:DEL 10 ms`	Off, 1 us	-2.5 s	+10 s	10 ns
Input I	`TRIG:IINP:DEL:STAT ON` `TRIG:IINP:DEL 10 ms`	Off, 1 us	-2.5 s	+10 s	10 ns
Input Q	`TRIG:QINP:DEL:STAT ON` `TRIG:QINP:DEL 10 ms`	Off, 1 us	-2.5 s	+10 s	10 ns

Source	Example	Preset	Min	Max	Resolution
Aux Chan I/Q Mag	`TRIG:AIQM:DEL:STAT ON` `TRIG:AIQM:DEL 10 ms`	Off, 1 us	-2.5 s	+10 s	10 ns
PXI	`TRIG:PXI:DEL:STAT ON` `TRIG:PXI:DEL 10 ms`	Off, 1 us	-150 ms	+500 ms	100 ns
Internal	`TRIG:INT:DEL:STAT ON` `TRIG:INT:DEL 10 ms`	Off, 1 us	-150 ms	+500 ms	100 ns
Prot Channel Detection	`TRIG:PRTC:DEL:STAT ON` `TRIG:PRTC:DEL 1 ms`	Off, 1 ms	-10 ms	+10 ms	100 ns
Prot Frame Aligned	`TRIG:PRTF:DEL:STAT ON` `TRIG:PRTF:DEL 1 ms`	Off, 1 ms	-10 ms	+10 ms	100 ns
Prot Event	`TRIG:PRTE:DEL:STAT ON` `TRIG:PRTE:DEL 1 ms`	Off, 1 ms	-10 ms	+10 ms	100 ns

Note: in Bluetooth application, preset value of trigger delay is always (On, -20µs)

More Information

Here is the diagram for Frequency Mask Trigger (FMT) Trigger Delay:



9.1.4 Trigger Slope

Sets the trigger polarity for Trigger and Gate sources that support Trigger Slope. It is set positive to trigger on a rising edge and negative to trigger on a falling edge.

For any given Trigger, Gate, or Periodic Sync source, the same Trigger Slope is used for the Trigger source in the Trigger menu, for the Gate source in the Gate Source menu, and for the Periodic Sync source in the Periodic Sync Src menu.

Remote Command	`:TRIGger[:SEQuence]:<trig_source>:SLOPe POSitive | NEGative`
	`:TRIGger[:SEQuence]:<trig_source>:SLOPe?`
	where `<trig_source>` is one of:
	`LINE | EXTernal1 | EXTernal2 | AEXTernal | VIDeo | RFBurst | IQMag | IDEMod | QDEMod | IINPut | QINPut | AIQMag | PXI | INTernal`

Example	`:TRIG:VID:SLOP NEG`
	`:TRIG:VID:SLOP?`
	`:TRIG:EXT1: SLOP NEG`
	`:TRIG:EXT2: SLOP POS`
	`:TRIG:AEXT: SLOP POS`
	`:TRIG:LINE:SLOP NEG`
	`:TRIG:RFB:SLOP NEG`
	`:TRIG:IQM:SLOP POS`
	`:TRIG:IDEM:SLOP POS`
	`:TRIG:QDEM:SLOP POS`
	`:TRIG:IINP:SLOP POS`
	`:TRIG:QINP:SLOP POS`
	`:TRIG:AIQM:SLOP POS`
	`:TRIG:PXI:SLOP POS`
	`:TRIG:INT:SLOP POS`

Dependencies	Only appears when Video, Line, External 1|2, RF Burst or an I/Q trigger is selected as the Trigger Source
Preset	`POSitive`
State Saved	Saved in instrument state

Backwards Compatibility SCPI	`:TRIGger[:SEQuence]:IF:SLOPe NEGative | POSitive`
	`:TRIGger[:SEQuence]:IF:SLOPe?`
	For backward compatibility with VSA/PSA comms apps
	`:TRIGger[:SEQuence]:EXTernal:SLOPe`

	For backward compatibility, the parameter EXTernal is mapped to EXTernal1
	`:TRIGger[:SEQuence]:FRAMe:EXTernal1:SLOPe`
	`:TRIGger[:SEQuence]:FRAMe:EXTernal2:SLOPe`

Remote Command	`:TRIGger[:SEQuence]:SLOPe POSitive | NEGative` `:TRIGger[:SEQuence]:SLOPe?`
Example	`:TRIG:SLOP NEG`
Preset	`POSitive`
State Saved	Saved in instrument state

Note: when transitioning from Zero Span to Swept spans, the trigger delay is clipped to -150 ms if it had been longer in Zero Span.

9.1.5 Trigger Level Absolute/Relative

This control selects between Absolute and Relative Burst Triggering.

Remote Command	`:TRIGger[:SEQuence]:RFBurst:LEVel:TYPE ABSolute | RELative` `:TRIGger[:SEQuence]:RFBurst:LEVel:TYPE?`
Example	`:TRIG:RFB:LEV:TYPE REL` sets the trigger level type of the RF burst trigger to Relative.
Dependencies	Only appears when RF Burst is selected as the Trigger Source
Preset	ABSolute
State Saved	Saved in instrument state

9.1.6 Absolute Trigger Level

Sets the absolute trigger level for the RF burst envelope.

NOTE: When using the External Mixing path, the Absolute Trigger Level is uncalibrated because the factory default was set to accommodate the expected IF levels for the RF path.

Remote Command	`:TRIGger[:SEQuence]:RFBurst:LEVel:ABSolute <ampl>` `:TRIGger[:SEQuence]:RFBurst:LEVel:ABSolute?`
Example	`:TRIG:RFB:LEV:ABS 10 dBm` sets the trigger level of the RF burst envelope signal to the absolute level of 10 dBm
Notes	Sending this command does not switch the setting from relative to absolute; to switch it you need to send the :TRIGger[:SEQuence]:RFBurst:LEVel:TYPE command, below.

	If mode is Bluetooth, the default value is -50 dBm.
Dependencies	Only appears when RF Burst is selected as the Trigger, Gate or Periodic Sync Source
Couplings	This same level is used for the RF Burst trigger source in the Trigger menu, for the RF Burst selection in the Gate Source menu, and also for the RF Burst selection in the Periodic Sync Src menu.
Preset	-20 dBm
State Saved	Saved in instrument state
Min	-200 dBm
Max	100 dBm
Backwards Compatibility SCPI	`:TRIGger[:SEQuence]:FRAMe:RFBurst:LEVel:ABSolute`

9.1.7 Relative Trigger Level

Sets the relative trigger level for the RF burst envelope.

In some models, the relative burst trigger function is implemented in hardware. In other models, without the advanced triggering hardware required, the relative burst trigger function is implemented in software in some measurements, and is unavailable in other measurements.

When implemented in software, the relative RF Burst trigger function is implemented as follows:

16. The measurement starts with the absolute RF Burst trigger setting. If it cannot get a trigger with that level, auto trigger fires and the acquisition starts anyway. After the acquisition, the measurement searches for the peak in the acquired waveform and saves it.
17. Now, in the next cycle of the measurement, the measurement determines a new absolute RF Burst level based on the peak value from the first measurement and the Relative RF Burst Trigger Level (always 0 or negative dB) set by the user. The following formula is used:
18. absolute RF Burst level = peak level of the previous acquisition + relative RF Burst level
19. If the new absolute RF Burst level differs from the previous by more than 0.5 dB, the new level is sent to the hardware; otherwise it is not updated (to avoid slowing down the acquisition)

    Steps 2 and 3 repeat for subsequent measurements.

Remote Command	`:TRIGger[:SEQuence]:RFBurst:LEVel:RELative <rel_ampl>` `:TRIGger[:SEQuence]:RFBurst:LEVel:RELative?`
Example	`:TRIG:RFB:LEV:REL -10 dB` sets the trigger level of the RF burst envelope signal to the relative level of -10 dB

Notes	Sending this command does not switch the setting from absolute to relative; to switch it you need to send the :TRIGger[:SEQuence]:RFBurst:LEVel:TYPE command, above. The relative trigger level is not available in some measurements. In those measurements the RELative parameter, and the :TRIGger[:SEQuence]:RFBurst:LEVel:TYPE command (above), will generate an error if sent.
Dependencies	This control is grayed out and Absolute Trigger Level selected if the required hardware is not present in your analyzer and the current measurement does not support Relative triggering. Only appears when RF Burst is selected as the Trigger Source
Preset	-6 dB GSM: -25 dB
State Saved	Saved in instrument state
Min	-45 dB
Max	0 dB
Backwards Compatibility SCPI	`:TRIGger[:SEQuence]:RFBurst:LEVel` This legacy command is aliased to :TRIGger[:SEQuence]:RFBurst:LEVel:RELative because the PSA had ONLY relative burst triggering

In some models, a variety of burst trigger circuitry is available, resulting in various available burst trigger bandwidths. The analyzer automatically chooses the appropriate trigger path based on the hardware configuration and other settings of the analyzer. Here is the RF Burst Trigger Bandwidth table for Swept SA Measurement in SA mode:

Model	Option	Span	Swp Type	FFT Width	Trigger BW, –10 dB	Notes
EXA	any	All	all	all	16 MHz	
MXA	w/o B25	All	all	all	16 MHz	
MXA	B25	Zero	N/A	N/A	16 MHz	
MXA	B25	All	Swept	N/A	16 MHz	
MXA	B25	<8 MHz	FFT	all	16 MHz	
MXA	B25	≥8 MHz	FFT	25 MHz	30 MHz	
PXA	any	all	all	all	>80 MHz	Exceptions(*)

(*) Exceptions: When the RF Burst Trigger Level Type is Absolute, the start frequency is below 300 MHz, and the sweep type is either Swept or FFT with an FFT width of less than 25 MHz, then the RF Burst Trigger Bandwidth is not >80 MHz. It would be 16 MHz except in the subcase of Sweep Type = FFT and FFT Width between 8 and 25 MHz inclusive, where it would be 30 MHz.

9.1.8 Period

Sets the period of the internal periodic timer clock. For digital communications signals, this is usually set to the frame period of your current input signal. In the case that sync source is not set to OFF, and the external sync source rate is changed for some reason, the periodic timer is synchronized at the every external synchronization pulse by resetting the internal state of the timer circuit.

Remote Command	`:TRIGger[:SEQuence]:FRAMe:PERiod <time>` `:TRIGger[:SEQuence]:FRAMe:PERiod?`
Example	`:TRIG:FRAM:PER 100 ms`
Dependencies	The invalid data indicator turns on when the period is changed, until the next sweep/measurement completes. Only appears when Periodic Timer is selected as the Trigger or Gate Source
Couplings	The same period is used in the Gate Source selection of the period timer.
Preset	20 ms unless noted below. GSM: 4.615383 ms 5G NR: 10 ms
State Saved	Saved in instrument state
Min	100.000 ns
Max	559.0000 ms

9.1.9 Offset

Adjusts the accumulated offset between the periodic timer events and the trigger event. Adjusting the accumulated offset is different than setting an offset, and requires explanation.

The periodic timer is usually not synchronized with any external events, so the timing of its output events has no absolute meaning. Since the timing relative to external events (RF signals) is important, you need to be able to adjust (offset) it. However, you have no direct way to see when the periodic timer events occur. All that you can see is the trigger timing. When you want to adjust the trigger timing, you will be changing the internal offset between the periodic timer events and the trigger event. Because the absolute value of that internal offset is unknown, we will just call that the accumulated offset. Whenever the Offset parameter is changed, you are changing that accumulated offset. You can reset the displayed offset using Reset Offset Display. Changing the display does not change the value of the accumulated offset, and you can still make additional changes to accumulated offset.

To avoid ambiguity, we define that an increase in the "offset" parameter, either from the knob or the SCPI adjust command, serves to delay the timing of the trigger event.

Remote Command	:TRIGger[:SEQuence]:FRAMe:OFFSet <time> :TRIGger[:SEQuence]:FRAMe:OFFSet?
Example	:TRIG:FRAM:OFFS 1.2 ms
Notes	The front panel interface (for example, the knob), and this command, adjust the accumulated offset, which is shown on the control. However, the actual amount sent to the hardware each time the offset is updated is the delta value, that is, the current accumulated offset value minus the previous accumulated offset value. Note that the accumulated offset value is essentially arbitrary; it represents the accumulated offset from the last time the offset was zeroed (with the Reset Offset Display key). Note that this command does not change the period of the trigger waveform. Note also that Offset is used only when the sync source is set to OFF, otherwise delay is used, see section "Trigger Delay" on page 563. An increase in the "offset" parameter, either from the knob or the SCPI adjust command, serves to delay the timing of the trigger event. When the SCPI command is sent the value shown on the control is updated with the new value. However, the actual amount sent to the hardware is the delta value, that is, the current accumulated offset value minus the previous accumulated offset value. The SCPI query simply returns the value currently showing on the key.
Dependencies	The invalid data indicator turns on when the offset is changed, until the next sweep/measurement completes. Only appears when Periodic Timer is selected as the Trigger or Gate Source
Couplings	The same offset is used in the Gate Source selection of the period timer.
Preset	0 s
State Saved	Saved in instrument state
Min	-10.000 s
Max	10.000 s

9.1.10 Reset Offset Display

Resets the value of the periodic trigger offset display setting to 0.0 seconds. The current displayed trigger location may include an offset value defined with the **Offset** key. Pressing this control redefines the currently displayed trigger location as the new trigger point that is 0.0 s offset. The **Offset** control can then be used to add offset relative to this new timing.

Remote Command	:TRIGger[:SEQuence]:FRAMe:OFFSet:DISPlay:RESet
Example	:TRIG:FRAM:OFFS:DISP:RES
Dependencies	Only appears when Periodic Timer is selected as the Trigger or Gate Source

9.1.11 Offset Adjust (Remote Command Only)

This remote command does not work at all like the related front panel keys. This command lets you advance the phase of the frame trigger by the amount you specify.

It does not change the period of the trigger waveform. If the command is sent multiple times, it advances the phase of the frame trigger an additional amount each time it is sent. Negative numbers are permitted.

Remote Command	`:TRIGger[:SEQuence]:FRAMe:ADJust <time>`
Example	`:TRIG:FRAM:ADJ 1.2 ms`
Notes	Note also that Offset is used only when the sync source is set to OFF, otherwise delay is used, see section "Trigger Delay" on page 563. An increase in the "offset" parameter, either from the knob or the SCPI adjust command, serves to delay the timing of the trigger event. The front panel interface (for example, the knob) and the :TRIG:FRAM:OFFS command adjust the accumulated offset, which is shown on the active function display. However, the actual amount sent to the hardware is the delta value, that is, the current offset value minus the previous offset value. When the SCPI command is sent the value shown on the control (and the Active Function, if this happens to be the active function) is updated by increasing it (or decreasing it if the value sent is negative) by the amount specified in the SCPI command. This is a "command only" SCPI command, with no query.
Dependencies	The invalid data indicator turns on when the offset is changed, until the next sweep/measurement completes.
Couplings	The same offset is used in the Gate Source selection of the period timer.
Preset	0 s
State Saved	Saved in instrument state
Min	-10.000 s
Max	10.000 s

9.1.12 Sync Source

For convenience you can select the Periodic Timer Sync Source using this dropdown. You can also select it from the Periodic Sync Src tab, which also contains controls that let you configure the Sync Source.

Selects a signal source for you to synchronize your periodic timer trigger to, otherwise you might be triggering at some arbitrary location in the frame. Synchronization reduces the precision requirements on the setting of the period.

Example	`:TRIG:FRAM:SYNC EXT1`
	`:TRIG:FRAM:SYNC EXT2`
	`:TRIG:FRAM:SYNC RFB`
	`:TRIG:FRAM:SYNC OFF`

Dependencies	Only appears when Periodic Timer is selected as the Trigger or Gate Source
Preset	Off
State Saved	Saved in instrument state

9.1.13 TV Line

Selects the TV line number on which to trigger. Line number range is dependent on the settings of the **Standard** and **Field** menus within the TV trigger setup functions. When the line number is incremented beyond the upper limit, the value will change to the lower limit and continue incrementing from there. When the line number is decremented below the lower limit, the value will change to the upper limit and continue decrementing from there.

Remote Command	`:TRIGger[:SEQuence]:TV:LINE <integer>` `:TRIGger[:SEQuence]:TV:LINE?`
Example	`:TRIG:TV:LINE 20` `:TRIG:TV:LINE?`
Notes	The range of the TV line number is dependent on the settings of the Standard and Field menus within the TV trigger setup functions.
Dependencies	none Only available in the Swept SA measurement. Only appears when TV is selected as the Trigger Source
Preset	17
State Saved	Saved in instrument state
Min	1 The minimum value is the minimum line, and rolls over to the maximum value. The minimum line number depends on which Field and standard are selected.
Max	The maximum value is the maximum line, and rolls over to the minimum value. The maximum line number depends on which Field and standard are selected. Field 1 (ODD): – Maximum line is 263 for formats NTSC-M, NTSC-Japan, NTSC-4.43, PAL-M and PAL-60 – Maximum line is 313 for formats PAL-B, D, G, H, I, PAL-N, PAL-N Combin, and SECAM-L Field 2 (EVEN): – The maximum line 262 for formats NTSC-M, NTSC-Japan, NTSC-4.43, PAL-M and PAL-60 – The maximum line is 312 for formats PAL-B, D, G, H, I, PAL-N, PAL-N Combin, and SECAM-L Field = Entire Frame: – 525, for formats NTSC-M, NTSC-Japan, NTSC-4.43, PAL-M and PAL-60 – 625, for formats PAL-B, D, G, H, I, PAL-N, PAL-N Combin, and SECAM-L

9.1.14 Field

Selects the Field on which to trigger.

When you select Entire Frame it causes the selected line number to be viewed as an offset into the entire frame starting with line 1, the first line in Field One.

When you select Field One it causes the selected line number to be viewed as an offset into the first field starting with Line 1, the first line in Field One.

When you select Field Two it causes the selected line number to be viewed as an offset into the second field. If Line 1 is selected, it is the 264th line of the frame (NTSC-M, NTSC-Japan, NTSC-4.43, PAL-M, PAL-60) or the 314th line of the frame (PAL-B,D,G,H,I, PAL-N, PAL-N-Combin, SECAM-L).

Remote Command	`:TRIGger[:SEQuence]:TV:FMODe ENTire | ODD | EVEN` `:TRIGger[:SEQuence]:TV:FMODe?`

Example	`:TRIG:TV:FMOD ENT`
	`:TRIG:TV:FMOD EVEN`
	`:TRIG:TV:FMOD ODD`

Notes	ODD is Field 1 EVEN is Field 2
Dependencies	Only available in the Swept SA measurement. Only appears when TV is selected as the Trigger Source This command is available only when Option B7B (TV trigger) is installed.
Preset	ENTire
Range	Entire Frame|Field One|Field Two

9.1.15 Standard

Accesses the Standard menu keys which select from the following TV standards: **NTSC-M**, **NTSC-Japan**, **NTSC-4.43**, **PAL-M**, **PAL-B,D,G,H,I** , **PAL-N**, **PAL-N-Combin**, **PAL-60**, **SECAM-L**.

As the TV standard is changed, the current line value is clipped as necessary to keep it valid for the chosen standard and field mode. For example, line 600 is selected in Entire Frame mode in PAL-N; if NTSC-M is selected, the line number is clipped to 525. Or, if line 313 is selected in Field 1 mode in PAL-N and NTSC-M is selected, the line number is clipped to 263. Changing back to the PAL-N standard will leave the line number at 263.

Remote Command	`:TRIGger[:SEQuence]:TV:STANdard MNTSc | JNTSc | NTSC443 | MPAL | BPAL | NPAL | CPAL | PAL60 | LSEC` `:TRIGger[:SEQuence]:TV:STANdard?`

Example	Sets NTSC-M
	`:TRIG:TV:STAN MNTS`
	Sets NTSC-Japan
	`:TRIG:TV:STAN JNTS`

	Sets NTSC-4.43
	`:TRIG:TV:STAN NTSC443`
	Sets PAL-M
	`:TRIG:TV:STAN MPAL`
	Sets PAL-N
	`:TRIG:TV:STAN NPAL`
	Sets PAL-B,D,G,H,I
	`:TRIG:TV:STAN BPAL`
	Sets PAL-N Combin
	`:TRIG:TV:STAN CPAL`
	Sets PAL-60
	`:TRIG:TV:STAN PAL60`
	Sets L-SECAM
	`:TRIG:TV:STAN LSEC`
	Queries Standard
	`:TRIG:TV:STAN`

Dependencies	Only available in the Swept SA measurement. Only appears when TV is selected as the Trigger Source
Preset	MNTS
State Saved	Saved in instrument state
Range	NTSC-M|NTSC-Japan|NTSC-4.43|PAL-M|PAL-N|PAL-N Combin|PAL-B,D,G,H,I|PAL-60|SECAM-L

9.1.16 Zero Span Delay Compensation On/Off

In zero span, there is a natural delay in the signal path, which comes from the RBW filter. This is usually desirable, as it allows you to trigger on events and also see those events, because the signal is delayed from the trigger event. However, in some cases it is desirable to eliminate this delay, so that trigger events line up exactly with the zero time point in zero span. You can use the **Zero Span Delay Comp On/Off** feature to enable or disable zero span delay compensation.

Remote Command	`:TRIGger[:SEQuence]:EXTernal1|EXTernal2|RFBurst:DELay:COMPensation OFF | ON | 0 | 1` `:TRIGger[:SEQuence]:EXTernal1|EXTernal2|RFBurst:DELay:COMPensation?`

Example	`:TRIG:EXT1:DEL:COMP ON`
	`:TRIG:EXT1:DEL:COMP?`
	`:TRIG:EXT2:DEL:COMP ON`
	`:TRIG:RFB:DEL:COMP ON`

Dependencies	No effect except in zero-span, but not locked out in nonzero spans.

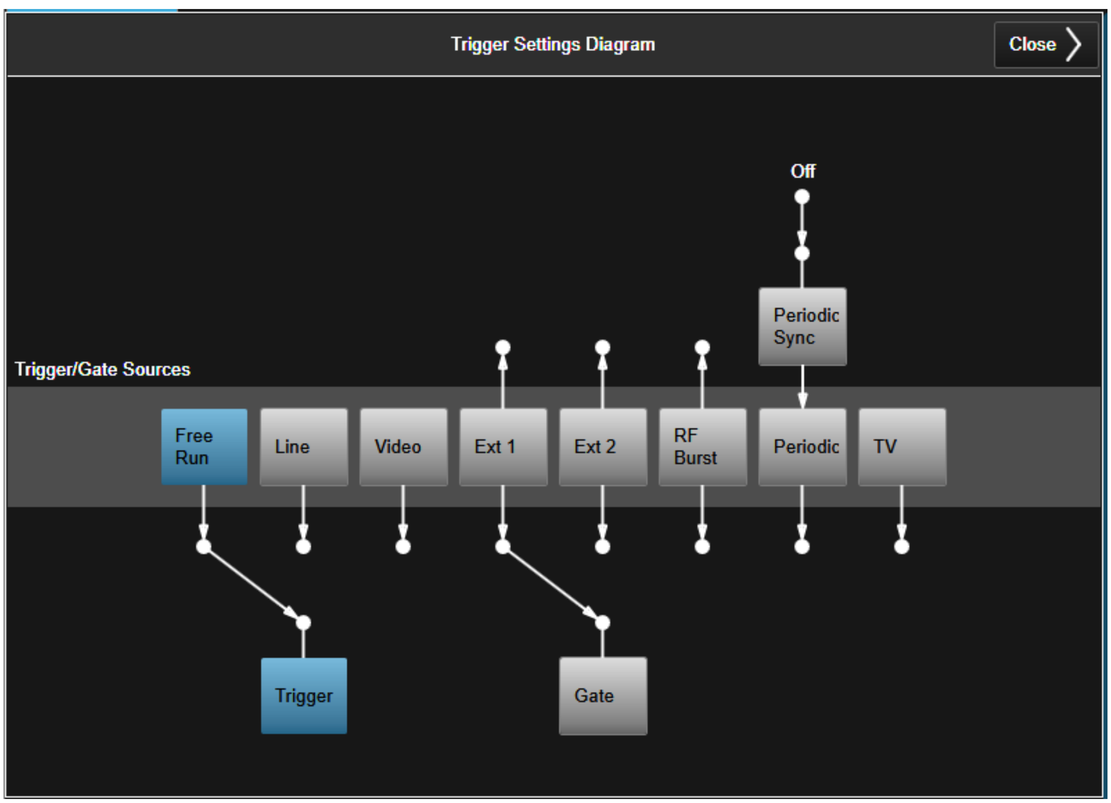
	Zero Span Delay Compensation only appears in the Swept SA and List Power Step measurements. Only External and RF Burst triggers support it. This control does not appear in VXT. If the SCPI command is sent when the control is not shown, an error is returned: -221, "Settings conflict; Feature not supported for this measurement" In analyzers shipping N9060A, this feature requires N9060A-7FP. Only appears when External 1|2 or RF Burst is selected as the Trigger, Gate or Periodic Sync Source
Preset	OFF
State Saved	Saved in instrument state

9.1.17 Trigger Settings Diagram

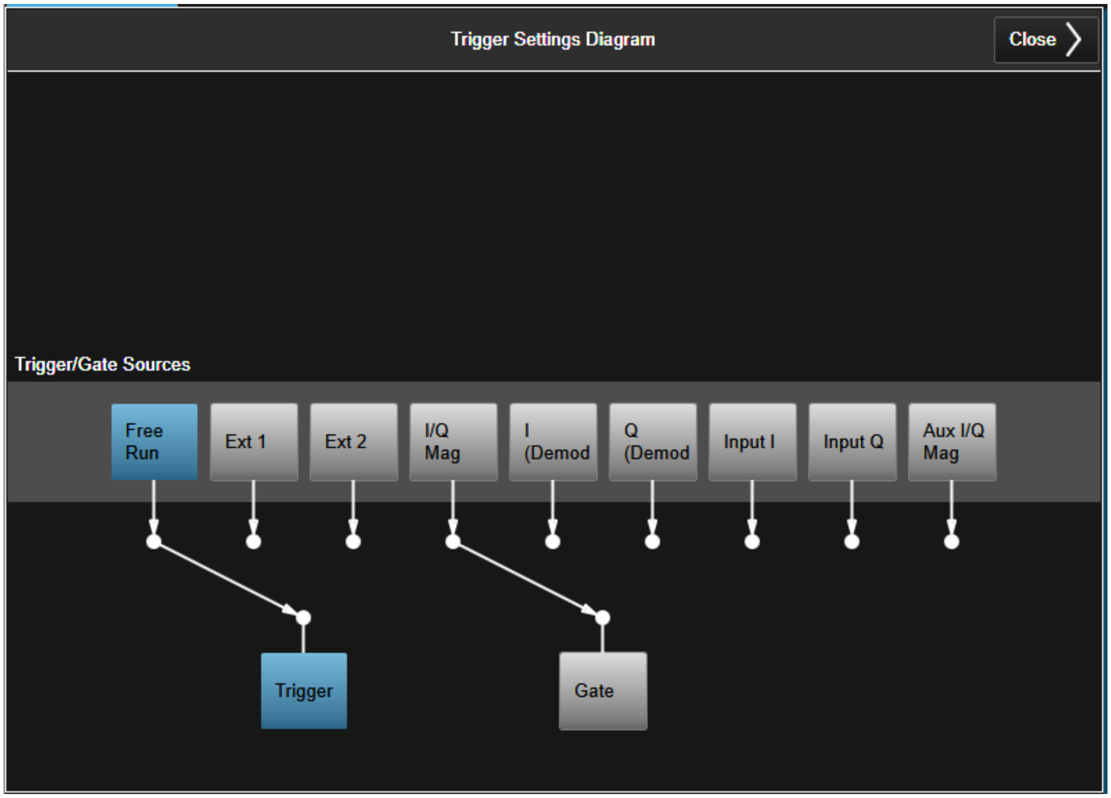
The Trigger Settings Diagram lets you configure the Trigger system using a visual utility.

First, pick what you want to configure (the Trigger, Gate or Periodic Sync Source) by clicking on the box for Trigger, Gate or Periodic Sync Source.

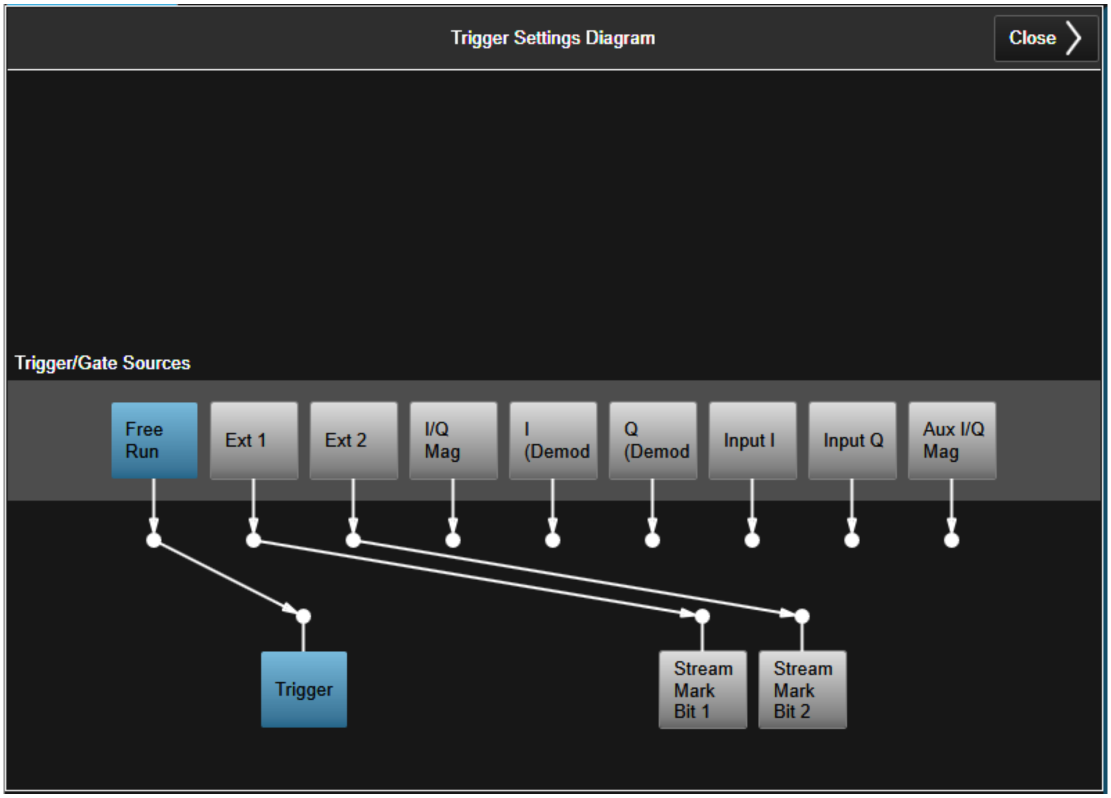
Next, click on any box in the gray row to choose a Trigger Source to connect to. For Periodic Sync Source you can also click on Off.



The Trigger Settings Diagram changes depending on context. The Trigger Sources that are available change depending on what input you have selected. For example, when you select the I/Q input you will see additional Trigger Sources, and no Periodic Sync Source:



Also, in RTSA and Pulse modes, the Stream Mark Bits appear in the Trigger Settings Diagram:


Trigger Settings Diagram
Close
Trigger/Gate Sources
Free Run
Ext 1
Ext 2
I/Q Mag
I (Demod
Q (Demod
Input I
Input Q
Aux I/Q Mag
Trigger
Stream Mark Bit 1
Stream Mark Bit 2

9.2 Gate Source

The Gate Source tab contains controls which let you select and configure Gate control signals.

The Gate Source tab appears in the Trigger menu panel for measurements that support gating. In measurements which do not support gating, the Gate Source tab does not appear.

The menus under the **Gate Source** tab are the same as those under the **Trigger** tab, with these exceptions:

- A smaller set of sources is available for gating.
- The Free Run and Video selections are not provided for Gate.
- The Trig Delay controls are not present
- Relative RF Burst Triggering is not available, just Absolute.
- There is an additional control, Sync Holdoff, under Gate Source.

Any changes to the settings in the setup menus under each Gate Source selection (for example: Trigger Level, Trigger Delay, etc.) also affect the corresponding settings under the Trigger menu keys. The gate system uses the Trigger SCPI commands for the setup functions, since each setting affects both Gate and Trigger.

Example: to set the Trigger Level for External 1 Trigger you use the command :TRIG:EXT1:LEV; to set the Trigger Level for External 1 Gate you use the same command, :TRIG:EXT1:LEV. By the same token, once you set the External 1 Trigger Level to 1v, it is 1v whether External 1 is being used as a Gate Source or a Trigger Source.

If SCPI is sent to the TRIG node to change or set the setup functions that are left out of the Gate Source menus (Auto Trig, Holdoff, Trig Delay) it is accepted and the values stored, but the values are not visible from the Gate Source menus.

9.2.1 Select Gate Source

Selects the source of the Gate signal for doing Gated Trigger measurements.

This version of the **Select Gate Source** function is used in all measurements except the Pulse measurement application.

Selecting a Gate Source is similar to selecting a Trigger Source; you pick from the same sources as for Trigger Source, but the choices are limited to

- Line
- External 1|2

- Internal
- RF Burst
- Periodic

For the selection of the gate source the SCPI node

:TRIGger[:SEQuence]:

is replaced by

[:SENSe]:SWEep:EGATe:

as shown in the remote command below. Because you can independently set the Gate Source and the Trigger Source, you need a different SCPI command for the Gate Source.

Remote Command	`[:SENSe]:SWEep:EGATe:SOURce EXTernal1 | EXTernal2 | LINE | FRAMe | RFBurst | TV | VIDeo | PXI | INTernal` `[:SENSe]:SWEep:EGATe:SOURce?`
Example	`:SWE:EGAT:SOUR EXT1` `:SWE:EGAT:SOUR?`
Dependencies	The available choices for VXT are: Video, Internal, External 1, External 2, RF Burst, Periodic and PXI. Internal and Periodic are not available in Spectrum Analyzer Mode. In VXT, Internal is only in VXT models M9410A/11A, not in models M9420/21A. PXI is only found in VXT. The available choices for EXM are Video, Internal, External 1, External 2, RF Burst, and Periodic. This control is not available in E7760. In some models, there is no second External input. In these models, the External 2 selection is not shown and the EXTernal2 parameter will generate a “Hardware missing; Not available for this model number” error.
Preset	EXTernal 1 GSM/EDGE: FRAMe MSR: EXTernal1 LTEATDD, 5G NR: EXTernal1 when Direction is Downlink, FRAMe when Direction is Uplink.
Backwards Compatibility Notes	In ESA, there is a single Gate input port. In PSA, the Gate Source may be taken from one of two specified input ports. In the X-Series, five Trigger Sources can be Gate Sources.

9.3 Gate Settings

The Gate Settings tab contains controls which let you control the gating function. The Gate functionality is used to view signals best viewed by qualifying them with other events.

The Gate Settings tab appears in the Trigger menu panel for measurements that support gating. In measurements which do not support gating, the Gate Settings tab does not appear.

In the Swept SA measurement, the Gate controls and all SCPI under the [:SENSe]:SWEep:EGATe SCPI node are unavailable when Source Mode is set to Tracking. This is because the Gate circuitry is used to sync the external source. If the Tracking Source is turned on, the Gate is turned off.

Gate setup parameters are the same for all measurements – they do not change as you change measurements. Settings like these are called “Meas Global” and are unaffected by Meas Preset.

Note that Sweep Time auto coupling rules and annotation are changed by Gate being on.

9.3.1 Gate On/Off

Turns the gate function on and off.

When the Gate Function is on, the selected Gate Method is used along with the gate settings and the signal at the gate source to control the sweep and video system with the gate signal. Not all measurements allow every type of Gate Methods.

If the Gate is turned on without a gate signal present, Marker Count operation is unreliable, so it is locked out whenever Gate is on for measurements that support Marker Count.

Dependencies	The function is unavailable (grayed out) and Off when: – Gate Method is LO or Video and FFT Sweep Type is manually selected. – Gate Method is FFT and Swept Sweep Type is manually selected. – Marker Count is ON. The following are unavailable whenever Gate is on: – FFT under Sweep Type when Method=LO or Video or Swept under Sweep Type when Method=FFT **Marker Count** While Gate is on, the Auto Rules for Sweep Type are modified so that the choice agrees with the Gate Method: i.e., FFT for Method = FFT and Swept for Method = LO or Video.

	When in the ACP measurement: – When Meas Method is RBW or FAST, this function is unavailable and the control is grayed out. – Whenever Gate is on, Meas Method, RBW, or FAST is unavailable and keys for those are grayed out. – When Gate is on, Offset Res BW and Offset Video BW are ignored (if you set these values) and the measurement works as if all Offset Res BW and all Offset Video BW are coupled with the Res BW and the Video BW under the BW menu. When Gate is on, the Offset BW control in the Offset/Limit menu is grayed out.
Preset	Off LTEATDD: On
State Saved	Saved in instrument state
Range	On|Off
Annunciation	Annunciated in the Meas Bar ; if Gate is on, the word "Gate:" followed by the gate type appears, where LO = Gated LO Vid = Gated Video FFT = Gated FFT
Backwards Compatibility SCPI	`[:SENSe]:SWEep:TIME:GATE[:STATe]  ESA compatibility`
Backwards Compatibility Notes	In ESA, Trig Delay (On) and Gate (On) could not be active at the same time. This dependency does not exist in PSA or in the X-Series.

9.3.2 Gate View On/Off

Turning on Gate View puts the analyzer into Gate View. When in Gate View, the regular view of the current measurement traces and results are reduced vertically to about 70% of the regular height. The Zero Span window, showing the positions of the Gate, is shown between the Measurement Bar and the reduced measurement window. By reducing the height of the measurement window, some of the annotation on the Data Display may not fit and is not shown.

Dependencies	In the Swept SA measurement: In Gate View, the regular Sweep Time (or Acquisition Time) control is grayed out, to avoid confusing the user who wants to set Gate View Sweep Time. When pressed, the grayed out control puts up the informational message "Use Gate View Sweep Time in the Gate menu." In the other measurements: When you turn Gate View on, the lower window takes on the current state of the instrument. Upon leaving Gate View, the instrument takes on the state of the lower window. When you turn Gate View on, the upper window Sweep Time (or Acquisition Time) is set to Gate View Sweep Time (or Gate View Acquisition Time).
Couplings	These couplings apply to the Swept SA measurement:

	– When Gate View is turned on, the instrument is set to Zero Span. – Gate View automatically turns off whenever a Span other than Zero is selected. – Gate View automatically turns off if you press the Swept Span toggle under Freq while in Gate View, and the instrument returns to the Span it was in before entering Gate View (even if that is Zero Span). – When Gate View is turned on, the sweep time used is the Gate View Sweep Time. This is set according to the rules in section "Gate View Sweep Time" on page 591 – When Gate View is turned off, Sweep Time is set to the normal Swept SA measurement sweep time. – If Gate View is on and Gate is off, then turning on Gate turns off Gate View.
Preset	OFF
State Saved	Saved in instrument state
Range	On|Off
Annunciation	For Gate View to work properly, a gate signal must be present at the selected Gate Source. Therefore, in Gate View, any time more than 2 seconds passes with no gate signal, a pop-up message "Waiting for gate input" appears. This message goes away when a gate signal appears.

Turning Gate View off returns the analyzer to the Normal measurement view.

In the Swept SA, the normal measurement view is the single-window Swept SA view. When returning to this view, the Swept SA measurement returns to the Span it was in before entering **Gate View** (even if that is Zero Span).

The **Gate View** window is triggered from the Gate Source, with zero trigger delay. Also, when updating the **Gate View** window, the Gate itself must not operate. So it is internally shut off while the gate view window is being updated. For the Swept SA measurement, this means that the Gate is internally shut off whenever the gate view window is displayed. The measurement bar and controls continue to show the Trigger source for the main sweep window and give no indication that the Gate is shut off or that the Gate View window is triggered from the Gate Source.

When in **Gate View**, vertical lines are displayed in the Gate View window as follows:

- Green lines labeled GATE START and GATE STOP are displayed at the gate edges as follows: in Edge Gate, a line is shown for Delay and one for the end of the Gate period, defined by Length. In Level Gate a line is shown only for Delay. You can adjust the position of the green lines by adjusting the gate length and the gate delay or by dragging them with your finger or the mouse.. These lines update in the Gate View window as the active function changes, even if the window is not being updated. In Gated LO and Gated Video, these lines are positioned relative to the delay reference line (not relative to 0 time). In Gated FFT, their location is relative to the left edge of the screen.

- A blue line is displayed showing the delay reference, that is, the reference point for the Gate Delay within the Zero Span window. The blue line represents where (in time) the effective location of the gate start would be if the gate were programmed to zero delay.
- A second blue line is displayed at the location that represents the boundary between "compensated IF" and "compensated LO" operating modes.
- The second blue line is labeled "MIN FAST" because it represents the minimum Gate Delay for fast Gated LO operation. This line is only displayed in Gated LO. You cannot scroll (knob) or decrement (down key) the Gate Delay to less than that represented by the position of this line, it can only be set below this position manually, although once there it can be moved freely with the knob while below the line.
- A yellow line in the Gated Video case only, is displayed at B_{length}, where B_{length} is the display point (bucket) length for the swept trace, which is given by the Sweep Time (or Acquisition Time) for that trace divided by number of Points - 1. So it is referenced to 0 time, not to the delay reference. This line is labeled NEXT PT (it is not shown in the figure above because the figure above is for Gated LO).
- The yellow line represents the edge of a display point (bucket). Normally in Gated Video, the bucket length must be selected so that it exceeds the off time of the burst. There is another way to use the analyzer in Gated Video measurements, and that is to set the bucket width much shorter than the off time of the burst. Then use the Max Hold trace function to fill in "missing" buckets more slowly. This allows you to see some of the patterns of the Gated Video results earlier, though seeing a completely filled-in spectrum later.

9.3.3 Gate Delay

Controls the length of time from the time the gate condition goes True until the gate is turned on.

Notes	Units of time are required or no units; otherwise an invalid suffix error message will be generated.
Preset	57.7 us WiMAX OFDMA: 71 us GSM/EDGE: 600 us WLAN: 500 us 5G NR: 5 ms
State Saved	Saved in instrument state
Min	0.0 us
Max	100 s
Backwards	`[:SENSe]:SWEep:TIME:GATE:DELay ESA compatibility`

Compatibility SCPI	

9.3.4 Gate Length

Controls the acquisition length when Gate Type is true.

Remote Command	[:SENSe]:ACQuire:SEGMented:FIX:LENGth <time> [:SENSe]:ACQuire:SEGMented:FIX:LENGth?
Example	:ACQ:SEGM:FIX:LENG 10 us :ACQ:SEGM:FIX:LENG?
Notes	Available when all of the following options are installed: - N9067C-2FP/2TP or N9067EM0E - B85, B1A, B1X, B2X, or B5X - DP4
Dependencies	Grayed out when Gate Type is Variable
Preset	OFF 10 us
State Saved	Saved in instrument state
Min	0 s
Max	1 s

9.3.5 Gate Method

This lets you choose one of the three different types of gating. Not all types of gating are available for all measurements.

For more information see "LO" on page 588, "Video" on page 588 or "FFT" on page 588

Dependencies	This function is only available in the Swept SA measurement in Spectrum Analyzer Mode. This control is unavailable when Gate is On and FFT Sweep Type manually selected. When selected, Sweep Type is forced to Swept and the FFT selection in Sweep Type is grayed out Only the FFT method is supported in the non-SA products
Preset	LO
State Saved	Saved in instrument state
Range	Video|LO|FFT
Annunciation	in Meas Bar

LO

In LO gating, when Gate is set to On, the LO sweeps whenever the gate conditions as specified in the Gate menu are satisfied by the signal at the Gate Source.

This form of gating is more sophisticated, and results in faster measurements. With Gated LO, the analyzer only sweeps while the gate conditions are satisfied. This means that a sweep could take place over several gate events. It would start when the gate signal goes true and stop when it goes false, and then continue when it goes true again. But since the LO is sweeping as long as the gate conditions are satisfied, the sweep typically finishes much more quickly than with Gated Video.

When in zero span, there is no actual sweep performed. But data is only taken while the gate conditions are satisfied. So even though there is no sweep, the gate settings will impact when data is acquired.

Video

In Video gating, when Gate is set to On, the video signal is allowed to pass through whenever the gate conditions as specified in the Gate menu are satisfied by the signal at the Gate Source.

This form of gating may be thought of as a simple switch, which connects the signal to the input of the spectrum analyzer. When the gate conditions are satisfied, the switch is closed, and when the gate conditions are not satisfied, the switch is open. So we only look at the signal while the gate conditions are satisfied.

With this type of gating, you usually set the analyzer to sweep very slowly. In fact, a general rule is to sweep slowly enough that the gate is guaranteed to be closed at least once per data measurement interval (bucket). Then if the peak detector is used, each bucket will represent the peak signal as it looks with the gate closed.

FFT

In FFT gating, when Gate is set to On, an FFT is performed whenever the gate conditions as specified in the Gate menu are satisfied by the signal at the Gate Source. This is an FFT measurement which begins when the gate conditions are satisfied. Since the time period of an FFT is approximately 1.83/RBW, you get a measurement that starts under predefined conditions and takes place over a predefined period. So, in essence, this is a gated measurement. You have limited control over the gate length but it works in FFT sweeps, which the other two methods do not.

Gated FFT cannot be done in zero span since the instrument is not sweeping. So in zero span the Gated LO method is used. Data is still only taken while the gate conditions are satisfied, so the gate settings do impact when data is acquired.

The Gate Length will be 1.83/RBW.

This is a convenient way to make a triggered FFT measurement under control of an external gating signal.

9.3.6 Control Edge/Level

Sets the method of controlling the gating function from the gating signal.

Edge

In Edge triggering, the gate opens (after the Delay) on the selected edge (for example, positive) of the gate signal and closes on the alternate edge (for example, negative).

Level

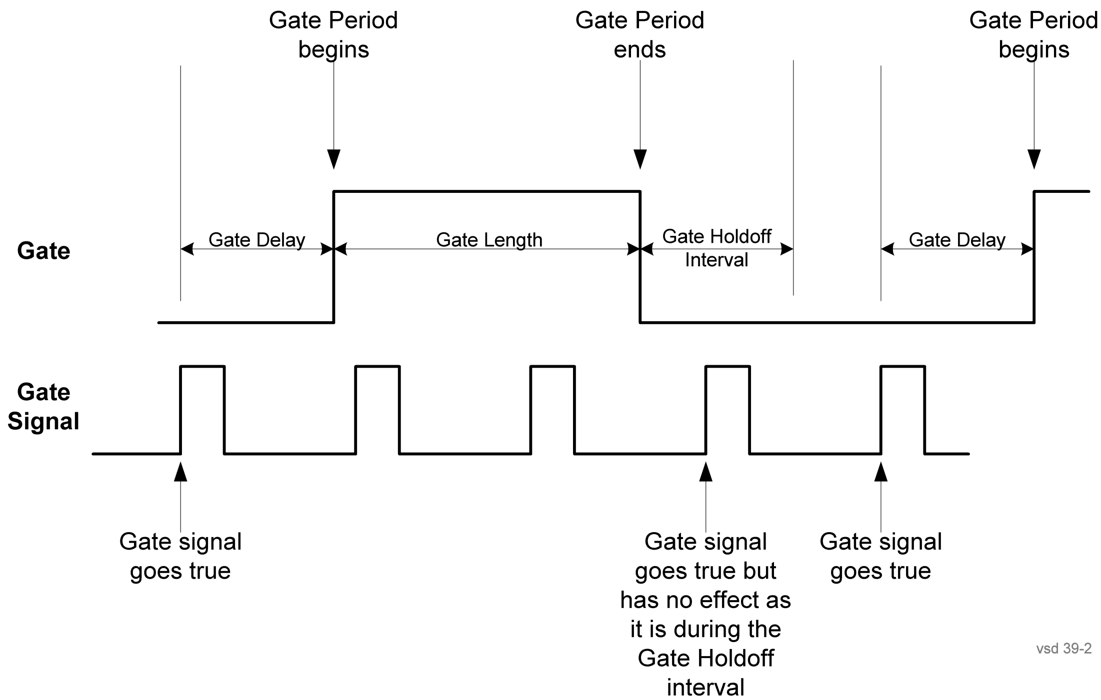
In Level triggering, the gate opens (after the Delay) when the gate signal has achieved a certain level and stays open as long as that level is maintained.

Dependencies	If the Gate Method is FFT, Control is grayed out and Edge is selected. If the Gate Source is TV, Frame, or Line, Control is grayed out and Edge is selected.
Preset	EDGE
State Saved	Saved in instrument state
Backwards Compatibility SCPI	`[:SENSe]:SWEep:TIME:GATE:TYPE` ESA Compatibility

9.3.7 Gate Holdoff

Enables you to increase or decrease the wait time after a gate event ends before the analyzer will respond to the next gate signal.

After any Gate event finishes, the analyzer must wait for the sweep system to settle before it can respond to another Gate signal. The analyzer calculates a "wait time," taking into account a number of factors, including RBW and Phase Noise Optimization settings. The goal is to achieve the same accuracy when gated as in ungated operation. The figure below illustrates this concept:



When Gate Holdoff is in Auto, the wait time calculated by the analyzer is used. When Gate Time is in Manual, the user may adjust the wait time, usually decreasing it in order to achieve greater speed, but at the risk of decreasing accuracy.

When the **Method** control is set to **Video** or **FFT**, the Gate Holdoff function has no effect.

In measurements that do not support Auto, the value shown when Auto is selected is "---" and the manually set holdoff is returned to a query.

Remote Command	`[:SENSe]:SWEep:EGATe:HOLDoff <time>`
	`[:SENSe]:SWEep:EGATe:HOLDoff?`
	`[:SENSe]:SWEep:EGATe:HOLDoff:AUTO OFF | ON | 0 | 1`
	`[:SENSe]:SWEep:EGATe:HOLDoff:AUTO?`

Example	`:SWE:EGAT:HOLD 0.0002`
	`:SWE:EGAT:HOLD?`
	`:SWE:EGAT:HOLD:AUTO ON`
	`:SWE:EGAT:HOLD:AUTO?`

Couplings	When **Gate Holdoff** is **Auto**, the **Gate Holdoff** control shows the value calculated by the analyzer for the wait time. Pressing the **Gate Holdoff** control while it is in **Auto** and not selected, causes the control to become selected and allows the user to adjust the value. If the value is adjusted, the setting changes to **Man.** Pressing the **Gate Holdoff** key, while it is in **Auto** and selected, does not change the value of **Gate Holdoff**, but causes the setting to change to **Man.** Now the user can adjust the value.

	Pressing the control while it is in **Man** and selected, cause the value to change back to **Auto**. Pressing the control while it is in **Man** and not selected, causes the control to become selected and allows the user to adjust the value. When **Method** is set to **Video** or **FFT**, the **Gate Holdoff** function has no effect.
Preset	Auto Auto/On
State Saved	Saved in instrument state
Range	Auto|Man
Min	1 µsec
Max	1 sec

9.3.8 Gate View Sweep Time

Controls the Sweep Time in the Gate View window. To provide an optimal view of the gate signal, the analyzer initializes Gate View Sweep Time based on the current settings of Gate Delay and Gate Length.

Note: Since Gate View Sweep Time is used to calculate Gate Delay and Gate Length increments, it is maintained even when not in Gate View.

NOTE: In analyzers without sweeping hardware such as some modular analyzers, this control may be labeled “Gate View Acquisition Time”

Dependencies	Gate View Sweep Time is initialized: – On Preset (after initializing delay and length). – Every time the Gate Method is set/changed. Additionally, in the Swept SA measurement, whenever you do a Preset, or leave Gate View, the analyzer remembers the Gate Delay and Gate Length settings. Then, when returning to Gate View, if the current Gate Delay and/or Gate Length do not match the remembered values Gate View Sweep Time is re-initialized.
Preset	800 µs WiMAX OFDMA: 5 ms GSM/EDGE: 1 ms 5G NR: 10 ms
State Saved	Saved in instrument state
Min	1 µs
Max	6000 s
Annotation	The gate view Sweep Time is displayed in the lower-right corner of the gate view window

9.3.9 Gate View Start Time

Controls the time at the left edge of the Gate View.

Notes	Units of time are required or no units; otherwise an invalid suffix error message will be generated. See error -131.
Preset	0 ms
State Saved	Saved in instrument state
Min	0
Max	500 ms

9.3.10 Gate Delay Compensation

This function allows you to select an RBW-dependent value by which to adjust the gate delay, to compensate for changes in the delay caused by RBW effects.

Youcan select between uncompensated operation and two types of compensation, **Delay Until RBW Settled** and **Compensate for RBW Group Delay**.

See "More Information" on page 592

Notes	Although this function is Meas Global, there are some measurements that do not support this function. In those measurements the control is not displayed, and the operation will be Uncompensated. If some but not all measurements in a Mode support this function, then going into a measurement that does not support it will not change the Meas Global selection; it will simply be "Uncompensated" while in that measurement. The SCPI command is still accepted while in that measurement. If Gate Delay Compensation is not supported at all within a particular mode, the control is not displayed, and if the SCPI command is sent while in a measurement within that mode, an "Undefined Header" message is generated. NOTE: For modular products such as EXM and VXT, this function is not supported. In those products the control is not displayed and the SCPI is ignored, although it is accepted without error.
Preset	TD-SCDMA mode: Compensate for RBW Group Delay All other modes: Delay Until RBW Settled
State Saved	Saved in instrument state
Range	Uncompensated|Delay Until RBW Settled|Compensate for RBW Group Delay

More Information

Selecting **Uncompensated** means that the actual gate delay is as you set it.

Selecting **Delay Until RBW Settled** causes the gate delay to be increased above the user setting by an amount equal to 3.06/RBW. This compensated delay causes the

GATE START and GATE STOP lines on the display to move by the compensation amount, and the actual hardware gate delay to be increased by the same amount. All the other gate lines (for example, MIN FAST) are unaffected. If the RBW subsequently changes, the compensation is readjusted for the new RBW. The value shown on the **Gate Delay** control does NOT change.

Delay Until RBW Settled allows excellent measurements of gated signals, by allowing the IF to settle following any transient that affects the burst. Excellent measurements also require that the analysis region not extend into the region affected by the falling edge of the burst. Thus, excellent measurements can only be made over a width that declines with narrowing RBWs, which is achieved by decreasing the gate length below the user setting by an amount equal to 2.53/RBW. Therefore, for general purpose compensation, you will still want to change the gate length with changes in RBW even if the gate delay is compensated. The compensated Gate Length is limited by the analyzer so that it will never go below 10% of the value shown on the Gate Length key, as otherwise the sweep times could get very long. Anytime the **Gate Length** and **RBW** values combine in such a way that this limiting takes place, a warning is displayed . For measurements which contain multiple sweeps with different RBW like SEM and SPUR, the smallest RBW is used for this limiting.

Selecting **Compensate for RBW Group Delay** causes the gate delay to be increased above the user setting by an amount equal to 1.81/RBW. This compensated delay causes the GATE START, GATE STOP lines on the display to move by the compensation amount, and the actual hardware gate delay to be increased by the same amount. All the other gate lines (for example, MIN FAST) are unaffected. If the RBW subsequently changes, the compensation is readjusted for the new RBW. The value shown on the **Gate Delay** control does NOT change. **Compensate for RBW Group Delay** also includes gate length compensation; the gate length itself is adjusted as necessary to attempt to compensate for delay effects imposed by the RBW.

Compensate for RBW Group Delay is similar to **Delay Until RBW Settled**, but compensates for the group delay of the RBW filter, rather than the filter settling time. As the RBW gets narrow, this can allow the settling tail of the RBW to affect the beginning part of the gated measurement, and allow the beginning of the RBW settling transient to affect the end of the gated measurement. These two effects are symmetric because the RBW response is symmetric. Because the gate length is not automatically compensated, some users might find this compensation to be more intuitive than compensation for RBW settling.

9.3.11 Min Fast Position Query (Remote Command Only)

This command queries the position of the MIN FAST line, relative to the delay reference (REF) line. See section Gate View On/Off. If this query is sent while not in gate view, the MinFast calculation is performed based on the current values of the appropriate parameters and the result is returned. Knowing this value lets you set an optimal gate delay value for the current measurement setup.

Remote Command	[:SENSe]:SWEep:EGATe:MINFast?
Example	:SWE:EGAT:MIN?

9.3.12 Gate Preset (Remote Command Only)

Presets the time-gated spectrum analysis capability.

This command sets gate parameter values to the ESA preset values, as follows:

– Gate trigger type = edge

– Gate polarity = positive

– Gate delay = 1 us

– Gate length = 1 us

Remote Command	[:SENSe]:SWEep:TIME:GATE:PRESet ESA Compatibility

9.3.13 Gate Level (Remote Command Only)

Sets the gate input transition point level for the external TRIGGER inputs on the front and rear panel. This is a legacy command for PSA compatibility. It is simply an alias to the equivalent trigger level command.

Remote Command	[:SENSe]:SWEep:EGATe:EXTernal[1]|2:LEVel <voltage> [:SENSe]:SWEep:EGATe:EXTernal[1]|2:LEVel?
Notes	This command is simply an alias to :TRIGger[:SEQuence]:EXTernal[1]|2:LEVel

9.3.14 Gate Polarity (Remote Command Only)

Sets the polarity for the gate signal. This setup is now done using the gate trigger's slope setting.

When Positive (Pos) is selected, a positive-going edge (Edge) or a high voltage (Level) will satisfy the gate condition, after the delay set with the Gate Delay key. When Negative (Neg) is selected, a negative-going edge (Edge) or a low voltage (Level) will satisfy the gate condition after the delay.

Remote Command	[:SENSe]:SWEep:EGATe:POLarity NEGative | POSitive [:SENSe]:SWEep:EGATe:POLarity?

Example	`:SWE:EGAT:POL NEG` `:SWE:EGAT:POL?`
Preset	POSitive
State Saved	Saved in instrument state
Backwards Compatibility SCPI	`[:SENSe]:SWEep:TIME:GATE:POLarity` ESA compatibility

Remote Command	`[:SENSe]:SWEep:TIME:GATE:LEVel HIGH | LOW`
	`[:SENSe]:SWEep:TIME:GATE:LEVel?`
	ESA compatibility

Preset	HIGH

9.4 Periodic Sync Src

The Periodic Sync Source tab contains controls which let you select and configure the sync signal for the Periodic Timer Trigger.

For convenience controls for adjusting the level and slope of the selected sync source are provided here. Note that these settings match those in the **Trigger** and **Gate Source** menus; that is, each trigger source has only one value of level and slope, regardless of which menu it is accessed from.

9.4.1 Select Periodic Timer Sync Source

Selects a signal source for you to synchronize your periodic timer trigger to, otherwise you are triggering at some arbitrary location in the frame. Synchronization reduces the precision requirements on the setting of the period.

One of the choices is Off. With the sync source off, the timing will drift unless the signal source frequency is locked to the analyzer frequency reference.

Remote Command	`:TRIGger[:SEQuence]:FRAMe:SYNC EXTernal1 | EXTernal2 | RFBurst | PXI | INTernal | OFF` `:TRIGger[:SEQuence]:FRAMe:SYNC?`

Example	`:TRIG:FRAM:SYNC EXT1`
	`:TRIG:FRAM:SYNC EXT2`
	`:TRIG:FRAM:SYNC RFB`
	`:TRIG:FRAM:SYNC OFF`

Dependencies	`PXI` and `INTernal` triggers are only found in modular analyzers such as VXT. This control is not available in the E7760 or UXM. In some models, there is no second External input. In these models, the External 2 selection is not shown, and the `EXTernal2` parameter generates a “Hardware missing; Not available for this model number” message. Forceful message -241.02
Preset	Off GSM/EDGE, LTE, LTETDD, 5G NR: RFBurst
State Saved	Saved in instrument state
Backwards Compatibility SCPI	`:TRIGger[:SEQuence]:FRAMe:SYNC EXTernal` For backward compatibility, the parameter EXTernal is mapped to EXTernal1

9.5 Auto/Holdoff

The Auto/Holdoff tab contains controls which let you adjust Auto Trigger and Trigger Holdoff parameters

This tab does not appear in Spectrum Analyzer Mode in VXT models M9420A/21A.

9.5.1 Auto Trig

Sets the time that the analyzer will wait for the trigger conditions to be met. If they are not met after that much time, then the analyzer is triggered anyway.

Remote Command	`:TRIGger[:SEQuence]:ATRigger <time>`
	`:TRIGger[:SEQuence]:ATRigger?`
	`:TRIGger[:SEQuence]:ATRigger:STATe OFF | ON | 0 | 1`
	`:TRIGger[:SEQuence]:ATRigger:STATe?`

Example	`:TRIG:ATR:STAT ON` `:TRIG:ATR 100 ms`
Notes	The "time that the analyzer will wait" starts when the analyzer is ready for a trigger, which may be hundreds of ms after the data acquisition for a sweep is done. The "time" ends when the trigger condition is satisfied, not when the delay ends.
Dependencies	Not available in Real Time Spectrum Analyzer
Preset	Off, 100 ms OFF
State Saved	Saved in instrument state
Min	1 ms
Max	100 s

9.5.2 Trig Holdoff

Sets the holdoff time between triggers. When the trigger condition is satisfied, the trigger occurs, the delay begins, and the holdoff time begins. New trigger conditions will be ignored until the holdoff time expires. For a free-running trigger, the holdoff value is the minimum time between triggers.

Remote Command	`:TRIGger[:SEQuence]:HOLDoff <time>`
	`:TRIGger[:SEQuence]:HOLDoff?`
	`:TRIGger[:SEQuence]:HOLDoff:STATe OFF | ON | 0 | 1`
	`:TRIGger[:SEQuence]:HOLDoff:STATe?`

Example	`:TRIG:HOLD:STAT ON`

	`:TRIG:HOLD 100 ms`
Dependencies	Unavailable if the selected Input is BBIQ. If this is the case, the control is grayed out if it is pressed the informational message “Feature not supported for this Input” is displayed. If the SCPI command is sent, the error “Settings conflict; Feature not supported for this Input” is generated.
Preset	Off, 100 ms All modes but GSM/EDGE: OFF GSM/EDGE: ON OFF
State Saved	Saved in instrument state
Min	0 s
Max	0.5 s VXT models M9410A/11A: 2.86 s

10 Programming the Instrument

This section provides information about the instrument's SCPI programming interface.

You can also operate the instrument remotely using some legacy programming languages, by running either the N9061C Remote Language Compatibility measurement application, or the N9062C SCPI Language Compatibility measurement application.

10.1 List of Supported SCPI Commands

When the SCPI LC Mode application has been selected, the instrument supports only a subset of SCPI commands, as listed below.

To find a command in the list, search according to its first alphanumeric character, ignoring any leading ":" or "[" characters. The sole exception to this is the asterisk [*] prefix, identifying IEEE 488.2 Common commands and queries; all these appear at the start of the list.

*

```
*IDN?
*OPT?
*RST
*TRG
*WAI
```

A

```
ABORt
```

C

```
CALCulate:DELTamarker:AOFF
CALCulate:DELTamarker:FUNCtion:FIXed:RPOint:MAXimum[:PEAK]
CALCulate:DELTamarker:FUNCtion:FIXed:RPOint:X
CALCulate:DELTamarker:FUNCtion:FIXed:RPOint:X?
CALCulate:DELTamarker:FUNCtion:FIXed:RPOint:Y
CALCulate:DELTamarker:FUNCtion:FIXed:RPOint:Y?
CALCulate:DELTamarker:FUNCtion:FIXed:RPOint:Y:OFFSet
CALCulate:DELTamarker:FUNCtion:FIXed:RPOint:Y:OFFSet?
CALCulate:DELTamarker:FUNCtion:FIXed[:STATe]
CALCulate:DELTamarker:FUNCtion:FIXed[:STATe]?
CALCulate:DELTamarker:FUNCtion:NOISe[:STATe]?
CALCulate:DELTamarker:FUNCtion:PNOise:AUTO
CALCulate:DELTamarker:FUNCtion:PNOise:AUTO?
CALCulate:DELTamarker:FUNCtion:PNOise:RESult?
CALCulate:DELTamarker:FUNCtion:PNOise[:STATe]
CALCulate:DELTamarker:FUNCtion:PNOise[:STATe]?
CALCulate:DELTamarker:LINK
CALCulate:DELTamarker:LINK?
CALCulate:DELTamarker:MAXimum:LEFT
CALCulate:DELTamarker:MAXimum:NEXT
CALCulate:DELTamarker:MAXimum[:PEAK]
CALCulate:DELTamarker:MAXimum:RIGHt
CALCulate:DELTamarker:MINimum:LEFT
CALCulate:DELTamarker:MINimum:NEXT
```

```
CALCulate:DELTamarker:MINimum[:PEAK]
CALCulate:DELTamarker:MINimum:RIGHt
CALCulate:DELTamarker:MODE
CALCulate:DELTamarker:MODE?
CALCulate:DELTamarker[:STATe]
CALCulate:DELTamarker[:STATe]?
CALCulate:DELTamarker:TRACe
CALCulate:DELTamarker:X
CALCulate:DELTamarker:X?
CALCulate:DELTamarker:X:RELative?
CALCulate:DELTamarker:Y?
CALCulate:DLINe
CALCulate:DLINe?
CALCulate:DLINe:STATe
CALCulate:DLINe:STATe?
CALCulate:FLINe
CALCulate:FLINe?
CALCulate:FLINe:STATe
CALCulate:FLINe:STATe?
CALCulate:LIMit:ACPower:ACHannel:ABSolute
CALCulate:LIMit:ACPower:ACHannel:ABSolute?
CALCulate:LIMit:ACPower:ACHannel:ABSolute:STATe
CALCulate:LIMit:ACPower:ACHannel:ABSolute:STATe?
CALCulate:LIMit:ACPower:ACHannel[:RELative]
CALCulate:LIMit:ACPower:ACHannel[:RELative]?
CALCulate:LIMit:ACPower:ACHannel[:RELative]:STATe
CALCulate:LIMit:ACPower:ACHannel[:RELative]:STATe?
CALCulate:LIMit:ACPower:ACHannel:RESult?
CALCulate:LIMit:ACPower:ALTernate:ABSolute
CALCulate:LIMit:ACPower:ALTernate:ABSolute?
CALCulate:LIMit:ACPower:ALTernate:ABSolute:STATe
CALCulate:LIMit:ACPower:ALTernate:ABSolute:STATe?
CALCulate:LIMit:ACPower:ALTernate[:RELative]
CALCulate:LIMit:ACPower:ALTernate[:RELative]?
CALCulate:LIMit:ACPower:ALTernate[:RELative]:STATe
CALCulate:LIMit:ACPower:ALTernate[:RELative]:STATe?
CALCulate:LIMit:ACPower:ALTernate:RESult?
CALCulate:LIMit:ACPower[:STATe]
CALCulate:LIMit:ACPower[:STATe]?
CALCulate:LIMit:ACTive?
CALCulate:LIMit:CLEar[:IMMediate]
CALCulate:LIMit:COMMent
CALCulate:LIMit:COMMent?
CALCulate:LIMit:CONTrol[:DATA]
CALCulate:LIMit:CONTrol[:DATA]?
CALCulate:LIMit:CONTrol:DOMain
CALCulate:LIMit:CONTrol:DOMain?
CALCulate:LIMit:CONTrol:MODE
CALCulate:LIMit:CONTrol:MODE?
CALCulate:LIMit:CONTrol:OFFSet
CALCulate:LIMit:CONTrol:OFFSet?
CALCulate:LIMit:CONTrol:SHIFt
CALCulate:LIMit:CONTrol:SHIFt?
```

```
CALCulate:LIMit:CONTrol:SPACing
CALCulate:LIMit:CONTrol:SPACing?
CALCulate:LIMit:COPY
CALCulate:LIMit:DELete
CALCulate:LIMit:ESPectrum:MODE
CALCulate:LIMit:ESPectrum:MODE?
CALCulate:LIMit:ESPectrum:RESTore
CALCulate:LIMit:ESPectrum:VALue
CALCulate:LIMit:ESPectrum:VALue?
CALCulate:LIMit:FAIL?
CALCulate:LIMit:LOWer[:DATA]
CALCulate:LIMit:LOWer[:DATA]?
CALCulate:LIMit:LOWer:MARGin
CALCulate:LIMit:LOWer:MARGin?
CALCulate:LIMit:LOWer:MODE
CALCulate:LIMit:LOWer:MODE?
CALCulate:LIMit:LOWer:OFFSet
CALCulate:LIMit:LOWer:OFFSet?
CALCulate:LIMit:LOWer:SHIFt
CALCulate:LIMit:LOWer:SHIFt?
CALCulate:LIMit:LOWer:SPACing
CALCulate:LIMit:LOWer:SPACing?
CALCulate:LIMit:LOWer:STATe
CALCulate:LIMit:LOWer:STATe?
CALCulate:LIMit:LOWer:THReshold
CALCulate:LIMit:LOWer:THReshold?
CALCulate:LIMit:NAME
CALCulate:LIMit:NAME?
CALCulate:LIMit:STATe
CALCulate:LIMit:STATe?
CALCulate:LIMit:TRACe
CALCulate:LIMit:TRACe?
CALCulate:LIMit:UNIT
CALCulate:LIMit:UNIT?
CALCulate:LIMit:UPPer[:DATA]
CALCulate:LIMit:UPPer[:DATA]?
CALCulate:LIMit:UPPer:MARGin
CALCulate:LIMit:Upper:MARGin?
CALCulate:LIMit:UPPer:MODE
CALCulate:LIMit:UPPer:MODE?
CALCulate:LIMit:UPPer:OFFSet
CALCulate:LIMit:UPPer:OFFSet?
CALCulate:LIMit:UPPer:SHIFt
CALCulate:LIMit:UPPer:SHIFt?
CALCulate:LIMit:UPPer:SPACing
CALCulate:LIMit:UPPer:SPACing?
CALCulate:LIMit:UPPer:STATe
CALCulate:LIMit:UPPer:STATe?
CALCulate:LIMit:UPPer:THReshold
CALCulate:LIMit:UPPer:THReshold?
CALCulate:MARKer:AOFF
CALCulate:MARKer:COUNt
CALCulate:MARKer:COUNt?
```

```
CALCulate:MARKer:COUNt:FREQuency?
CALCulate:MARKer:COUNt:RESolution
CALCulate:MARKer:COUNt:RESolution?
CALCulate:MARKer:FUNCtion:CENTer
CALCulate:MARKer:FUNCtion:CSTep
CALCulate:MARKer:FUNCtion:FPEaks:COUNt?
CALCulate:MARKer:FUNCtion:FPEaks[:IMMediate]
CALCulate:MARKer:FUNCtion:FPEaks[:IMMediate]?
CALCulate:MARKer:FUNCtion:FPEaks:SORT
CALCulate:MARKer:FUNCtion:FPEaks:SORT?
CALCulate:MARKer:FUNCtion:FPEaks:X?
CALCulate:MARKer:FUNCtion:FPEaks:Y?
CALCulate:MARKer:FUNCtion:NOISe:RESult?
CALCulate:MARKer:FUNCtion:NOISe[:STATe]
CALCulate:MARKer:FUNCtion:POWer:RESult?
CALCulate:MARKer:FUNCtion:POWer:RESult:PHZ
CALCulate:MARKer:FUNCtion:POWer:RESult:PHZ?
CALCulate:MARKer:FUNCtion:POWer:SELect
CALCulate:MARKer:FUNCtion:REFerence
CALCulate:MARKer:FUNCtion:SUMMary:RMS:RESult?
CALCulate:MARKer:FUNCtion:SUMMary:RMS[:STATe]
CALCulate:MARKer:FUNCtion:SUMMary:RMS[:STATe]?
CALCulate:MARKer:LOEXclude
CALCulate:MARKer:LOEXclude?
CALCulate:MARKer:MAXimum:AUTO
CALCulate:MARKer:MAXimum:AUTO?
CALCulate:MARKer:MAXimum:LEFT
CALCulate:MARKer:MAXimum:NEXT
CALCulate:MARKer:MAXimum[:PEAK]
CALCulate:MARKer:MAXimum:RIGHt
CALCulate:MARKer:MINimum
CALCulate:MARKer:MINimum:AUTO
CALCulate:MARKer:MINimum:AUTO?
CALCulate:MARKer:MINimum:LEFT
CALCulate:MARKer:MINimum:NEXT
CALCulate:MARKer:MINimum:RIGHt
CALCulate:MARKer:PEXCursion
CALCulate:MARKer:PEXCursion?
CALCulate:MARKer:STATe
CALCulate:MARKer:STATe?
CALCulate:MARKer:TRACe
CALCulate:MARKer:TRACe?
CALCulate:MARKer:X
CALCulate:MARKer:X?
CALCulate:MARKer:X:SLIMits:LEFT
CALCulate:MARKer:X:SLIMits:LEFT?
CALCulate:MARKer:X:SLIMits:RIGHt
CALCulate:MARKer:X:SLIMits:RIGHt?
CALCulate:MARKer:X:SLIMits[:STATe]
CALCulate:MARKer:X:SLIMits[:STATe]?
CALCulate:MARKer:Y?
CALCulate:MARKer:Y:PERCent
CALCulate:MARKer:Y:PERCent?
```

```
CALCulate:STATistics:NSAMples
CALCulate:STATistics:NSAMples?
CALCulate:STATistics:PRESet
CALCulate:STATistics:SCALe:AUTO
CALCulate:STATistics:SCALe:X:RANGe
CALCulate:STATistics:SCALe:X:RANGe?
CALCulate:STATistics:SCALe:X:RLEVel
CALCulate:STATistics:SCALe:X:RLEVel?
CALCulate:STATistics:SCALe:Y:LOWer
CALCulate:STATistics:SCALe:Y:LOWer?
CALCulate:STATistics:SCALe:Y:UPPer
CALCulate:STATistics:SCALe:Y:UPPer?
CALCulate:THReshold
CALCulate:THReshold?
CALCulate:THReshold:STATe
CALCulate:THReshold:STATe?
CALCulate:TLINe
CALCulate:TLINe?
CALCulate:TLINe:STATe
CALCulate:TLINe:STATe?
CALCulate:UNIT:POWer
CALCulate:UNIT:POWer?
CALCulate:STATistics:APD:STATe
CALCulate:STATistics:APD:STATe?
CALCulate:STATistics:CCDF:STATe
CALCulate:STATistics:CCDF:STATe?
CALCulate:STATistics:CCDF:X?
CALCulate:STATistics:RESult?
CALibration[:ALL]?
CALibration:STATe
CONFigure?
CONFigure:<measurement>[:NDEFault]
CONFigure:CATalog?
```

D

```
DISPlay:WINDow:TRACe[:STATe]
DISPlay:WINDow:TRACe[:STATe]?
DISPlay:ANNotation:FREQuency
DISPlay:ANNotation:FREQuency?
DISPlay:CMAP:DEFault
DISPlay:CMAP:HSL
DISPlay:CMAP:HSL?
DISPlay:CMAP:PDEFined
DISPlay:CMAP:PDEFined?
DISPlay:FORMat
DISPlay:FORMat?
DISPlay:FSCReen[:STATe]
DISPlay:FSCReen[:STATe]?
DISPlay:LOGO
DISPlay:LOGO?
DISPlay:PSAVe:HOLDoff
```

```
DISPlay:PSAVe:HOLDoff?
DISPlay:PSAVe[:STATe]
DISPlay:PSAVe[:STATe]?
DISPlay:WINDow:SELect
DISPlay:WINDow:SIZE
DISPlay:WINDow:TEXT
DISPlay:WINDow:TEXT
DISPlay:WINDow:TEXT[:DATA]
DISPlay:WINDow:TEXT[:DATA]?
DISPlay:WINDow:TIME
DISPlay:WINDow:TIME?
DISPlay:WINDow:TRACe:MODE
DISPlay:WINDow:TRACe:MODE?
DISPlay:WINDow:TRACe:MODE?
DISPlay:WINDow:TRACe:Y[:SCALe]
DISPlay:WINDow:TRACe:Y[:SCALe]?
DISPlay:WINDow:TRACe:Y[:SCALe]:RLEVel
DISPlay:WINDow:TRACe:Y[:SCALe]:RLEVel?
DISPlay:WINDow:TRACe:Y[:SCALe]:RLEVel:OFFSet
DISPlay:WINDow:TRACe:Y[:SCALe]:RLEVel:OFFSet?
DISPlay:WINDow:TRACe:Y:SPACing
DISPlay:WINDow:TRACe:Y:SPACing?
DISPlay:WINDow:TRACe:Y[:SCALe]:MODE
DISPlay:WINDow:TRACe:Y[:SCALe]:MODE?
DISPlay:WINDow:TRACe:Y[:SCALe]:PDIVision
DISPlay:WINDow:TRACe:Y[:SCALe]:PDIVision?
DISPlay:WINDow:MAMarker[:STATe]
DISPlay:WINDow:MAMarker[:STATe]?
```

F

```
FETCh:<measurement>[n]?
FORMat[:DATA]
FORMat[:DATA]?
```

H

```
HCOPy:ABORt
HCOPy:CMAP:DEFault
HCOPy:CMAP:HSL
HCOPy:CMAP:HSL?
HCOPy:CMAP:PDEFined
HCOPy:CMAP:PDEFined?
HCOPy:DESTination
HCOPy:DESTination?
HCOPy:DEVice:COLor
HCOPy:DEVice:COLor?
HCOPy:DEVice:LANGuage?
HCOPy:DEVice:LANGuage
HCOPy[:IMMediate]
HCOPy:ITEM:ALL
```

```
HCOPy:ITEM:WINDow:TABLe:STATe
HCOPy:ITEM:WINDow:TABLe:STATe?
HCOPy:ITEM:WINDow:TEXT
HCOPy:ITEM:WINDow:TEXT?
HCOPy:ITEM:WINDow:TRACe:STATe
HCOPy:ITEM:WINDow:TRACe:STATe?
HCOPy:PAGE:ORIentation
HCOPy:PAGE:ORIentation?
```

I

```
INITiate:<measurement>
INITiate:CONMeas
INITiate:CONTinuous
INITiate:CONTinuous?
INITiate[:IMMediate]
INITiate:SEQuencer:IMMediate
INPut:ATTenuation
INPut:ATTenuation?
INPut:ATTenuation:AUTO
INPut:ATTenuation:AUTO?
INPut:EATT
INPut:EATT?
INPut:EATT:AUTO
INPut:EATT:AUTO?
INPut:EATT:STATe
INPut:EATT:STATe?
INPut:GAIN:STATe
INPut:GAIN:STATe?
INPut:IMPedance
INPut:IMPedance?
INPut:MIXer:AUTO
INPut:MIXer:AUTO?
INPut:MIXer[:POWer]
INPut:MIXer[:POWer]?
INPut:COUPling
INPut:COUPling?
INSTrument:CATalog?
INSTrument:CONFigure:<mode>:<meas>
INSTrument:DEFault
INSTrument:NSELect
INSTrument:NSELect
INSTrument:NSELect?
INSTrument:NSELect?
INSTrument:SCReen:CATalog?
INSTrument:SCReen:CREate
INSTrument:SCReen:DELete
INSTrument:SCReen:DELete:ALL
INSTrument:SCReen:MULTiple?
INSTrument:SCReen:MULTiple[:STATe]
INSTrument:SCReen:REName
INSTrument:SCReen:SELect
```

```
INSTrument:SCReen:SELect?
INSTrument[:SELect]
INSTrument[:SELect]
INSTrument[:SELect]
INSTrument[:SELect]
INSTrument[:SELect]
INSTrument[:SELect]
INSTrument[:SELect]
INSTrument[:SELect]?
INSTrument[:SELect]?
```

M

```
MEASure:<measurement>[n]?
MMEMory:CATalog
MMEMory:CATalog?
MMEMory:CDIRectory
MMEMory:CDIRectory?
MMEMory:CLEar:ALL
MMEMory:CLEar:STATe
MMEMory:COMMent
MMEMory:COMMent?
MMEMory:COPY
MMEMory:DATA
MMEMory:DATA?
MMEMory:DELete
MMEMory:INITialize
MMEMory:LOAD:AUTO
MMEMory:LOAD:STATe
MMEMory:MDIRectory
MMEMory:MOVE
MMEMory:MSIS
MMEMory:MSIS?
MMEMory:NAME
MMEMory:NAME?
MMEMory:RDIRectory
MMEMory:SELect[:ITEM]:ALL
MMEMory:SELect[:ITEM]:DEFault
MMEMory:SELect[:ITEM]:HWSettings
MMEMory:SELect[:ITEM]:HWSettings?
MMEMory:SELect[:ITEM]:LINes:ALL
MMEMory:SELect[:ITEM]:LINes:ALL?
MMEMory:SELect[:ITEM]:NONE
MMEMory:SELect[:ITEM]:SCData
MMEMory:SELect[:ITEM]:SCData?
MMEMory:SELect[:ITEM]:TRACe[:ACTive]
MMEMory:SELect[:ITEM]:TRACe[:ACTive]?
MMEMory:SELect[:ITEM]:TRANsducer:ALL
MMEMory:SELect[:ITEM]:TRANsducer:ALL?
MMEMory:STORe:STATe
MMEMory:STORe:TRACe
```

R

```
READ:<measurement>[n]?
```

S

```
[:SENSe]:AVERage?
[:SENSe]:AVERage:COUNt
[:SENSe]:AVERage:COUNt?
[:SENSe]:AVERage:STATe
[:SENSe]:AVERage:STATe?
[:SENSe]:AVERage:TYPE
[:SENSe]:BANDwidth|BWIDth[:RESolution]
[:SENSe]:BANDwidth|BWIDth[:RESolution]?
[:SENSe]:BANDwidth|BWIDth[:RESolution]:AUTO
[:SENSe]:BANDwidth|BWIDth[:RESolution]:AUTO?
[:SENSe]:BANDwidth|BWIDth[:RESolution]:RATio
[:SENSe]:BANDwidth|BWIDth[:RESolution]:RATio?
[:SENSe]:BANDwidth|BWIDth[:RESolution]:TYPE
[:SENSe]:BANDwidth|BWIDth[:RESolution]:TYPE?
[:SENSe]:BANDwidth|BWIDth:VIDeo
[:SENSe]:BANDwidth|BWIDth:VIDeo?
[:SENSe]:BANDwidth|BWIDth:VIDeo:AUTO
[:SENSe]:BANDwidth|BWIDth:VIDeo:RATio
[:SENSe]:BANDwidth|BWIDth:VIDeo:RATio?
[:SENSe]:CORRection:EGAin:INPut[:MAGNitude]
[:SENSe]:CORRection:EGAin:INPut[:MAGNitude]?
[:SENSe]:CORRection:TRANsducer:COMMent
[:SENSe]:CORRection:TRANsducer:COMMent?
[:SENSe]:CORRection:TRANsducer:DATA
[:SENSe]:CORRection:TRANsducer:DATA?
[:SENSe]:CORRection:TRANsducer:DELete
[:SENSe]:CORRection:TRANsducer:SCALing
[:SENSe]:CORRection:TRANsducer:SCALing?
[:SENSe]:CORRection:TRANsducer:SELect
[:SENSe]:CORRection:TRANsducer:SELect?
[:SENSe]:CORRection:TRANsducer:STATe
[:SENSe]:CORRection:TRANsducer:STATe?
[:SENSe]:CORRection:TRANsducer:UNIT
[:SENSe]:CORRection:TRANsducer:UNIT?
[:SENSe]:CORRection:TRANsducer:VIEW
[:SENSe]:CORRection:TRANsducer:VIEW?
[:SENSe]:DETector[:FUNCtion]
[:SENSe]:DETector[:FUNCtion]?
[:SENSe]:DETector[:FUNCtion]:AUTO
[:SENSe]:DETector[:FUNCtion]:AUTO?
[:SENSe]:FREQuency:CENTer
[:SENSe]:FREQuency:CENTer?
[:SENSe]:FREQuency:CENTer:STEP
[:SENSe]:FREQuency:CENTer:STEP?
```

[:SENSe]:FREQuency:CENTer:STEP:LINK
[:SENSe]:FREQuency:CENTer:STEP:LINK?
[:SENSe]:FREQuency:CENTer:STEP:LINK:FACTor
[:SENSe]:FREQuency:CENTer:STEP:LINK:FACTor?
[:SENSe]:FREQuency:MODE
[:SENSe]:FREQuency:MODE?
[:SENSe]:FREQuency:OFFSet
[:SENSe]:FREQuency:OFFSet?
[:SENSe]:FREQuency:SPAN
[:SENSe]:FREQuency:SPAN?
[:SENSe]:FREQuency:SPAN:FULL
[:SENSe]:FREQuency:STARt
[:SENSe]:FREQuency:STARt?
[:SENSe]:FREQuency:STOP
[:SENSe]:FREQuency:STOP?
[:SENSe]:POWer:ACHannel:ACPairs
[:SENSe]:POWer:ACHannel:ACPairs?
[:SENSe]:POWer:ACHannel:BANDwidth|BWIDth:ACHannel
[:SENSe]:POWer:ACHannel:BANDwidth|BWIDth:ACHannel?
[:SENSe]:POWer:ACHannel:BANDwidth|BWIDth:ALTernate
[:SENSe]:POWer:ACHannel:BANDwidth|BWIDth:ALTernate?
[:SENSe]:POWer:ACHannel:BANDwidth|BWIDth[:CHANnel]
[:SENSe]:POWer:ACHannel:BANDwidth|BWIDth[:CHANnel]?
[:SENSe]:POWer:ACHannel:MODE
[:SENSe]:POWer:ACHannel:MODE?
[:SENSe]:POWer:ACHannel:PRESet
[:SENSe]:POWer:ACHannel:PRESet:RLEVel
[:SENSe]:POWer:ACHannel:REFerence:AUTO
[:SENSe]:POWer:ACHannel:REFerence:TXCHannel:AUTO
[:SENSe]:POWer:ACHannel:REFerence:TXCHannel:AUTO?
[:SENSe]:POWer:ACHannel:REFerence:TXCHannel:MANual
[:SENSe]:POWer:ACHannel:REFerence:TXCHannel:MANual?
[:SENSe]:POWer:ACHannel:SPACing:ACHannel
[:SENSe]:POWer:ACHannel:SPACing:ACHannel?
[:SENSe]:POWer:ACHannel:SPACing:ALTernate
[:SENSe]:POWer:ACHannel:SPACing:ALTernate?
[:SENSe]:POWer:ACHannel:SPACing:CHANnel
[:SENSe]:POWer:ACHannel:SPACing:CHANnel
[:SENSe]:POWer:ACHannel:TXCHannel:COUNt
[:SENSe]:POWer:ACHannel:TXCHannel:COUNt?
[:SENSe]:POWer:BANDwidth|BWIDth
[:SENSe]:POWer:BANDwidth|BWIDth?
[:SENSe]:POWer:HSPeed
[:SENSe]:POWer:HSPeed?
[:SENSe]:POWer:NCORrection
[:SENSe]:POWer:NCORrection?
[:SENSe]:POWer:TRACe
[:SENSe]:POWer:TRACe?
[:SENSe]:RLC:IDN:TYPE
[:SENSe]:RLC:IDN:TYPE?
[:SENSe]:RLC:IDN:USER
[:SENSe]:RLC:IDN:USER?
[:SENSe]:ROSCillator:SOURce

```
[:SENSe]:ROSCillator:SOURce?
[:SENSe]:SWEep:COUNt
[:SENSe]:SWEep:COUNt?
[:SENSe]:SWEep:EGATe
[:SENSe]:SWEep:EGATe?
[:SENSe]:SWEep:EGATe:HOLDoff
[:SENSe]:SWEep:EGATe:HOLDoff
[:SENSe]:SWEep:EGATe:LENGth
[:SENSe]:SWEep:EGATe:LENGth?
[:SENSe]:SWEep:EGATe:POLarity
[:SENSe]:SWEep:EGATe:POLarity?
[:SENSe]:SWEep:EGATe:SOURce
[:SENSe]:SWEep:EGATe:SOURce?
[:SENSe]:SWEep:EGATe:TYPE
[:SENSe]:SWEep:EGATe:TYPE?
[:SENSe]:SWEep:POINts
[:SENSe]:SWEep:POINts?
[:SENSe]:SWEep:TIME
[:SENSe]:SWEep:TIME?
[:SENSe]:SWEep:TIME:AUTO
[:SENSe]:SWEep:TIME:AUTO?
STATus:OPERation:CONDition
STATus:OPERation:CONDition?
STATus:OPERation:ENABle
STATus:OPERation:ENABle
STATus:OPERation:ENABle
STATus:OPERation:ENABle?
STATus:OPERation:ENABle?
STATus:OPERation:ENABle?
STATus:OPERation[:EVENt]?
STATus:OPERation[:EVENt]?
STATus:OPERation:NTRansition
STATus:OPERation:NTRansition
STATus:OPERation:NTRansition?
STATus:OPERation:NTRansition?
STATus:OPERation:PTRansition
STATus:OPERation:PTRansition
STATus:OPERation:PTRansition?
STATus:OPERation:PTRansition?
STATus:PRESet
STATus:PRESet
STATus:QUEStionable:CALibration:CONDition?
STATus:QUEStionable:CALibration:ENABle
STATus:QUEStionable:CALibration:ENABle?
STATus:QUEStionable:CALibration[:EVENt]?
STATus:QUEStionable:CALibration:EXTended:FAILure:CONDition?
STATus:QUEStionable:CALibration:EXTended:FAILure:ENABle
STATus:QUEStionable:CALibration:EXTended:FAILure:ENABle?
STATus:QUEStionable:CALibration:EXTended:FAILure[:EVENt]?
STATus:QUEStionable:CALibration:EXTended:FAILure:NTRansition
STATus:QUEStionable:CALibration:EXTended:FAILure:NTRansition?
STATus:QUEStionable:CALibration:EXTended:FAILure:PTRansition
STATus:QUEStionable:CALibration:EXTended:FAILure:PTRansition?
```

```
STATus:QUEStionable:CALibration:EXTended:NEEDed:CONDition?
STATus:QUEStionable:CALibration:EXTended:NEEDed:ENABle
STATus:QUEStionable:CALibration:EXTended:NEEDed:ENABle?
STATus:QUEStionable:CALibration:EXTended:NEEDed[:EVENt]?
STATus:QUEStionable:CALibration:EXTended:NEEDed:NTRansition
STATus:QUEStionable:CALibration:EXTended:NEEDed:NTRansition?
STATus:QUEStionable:CALibration:EXTended:NEEDed:PTRansition
STATus:QUEStionable:CALibration:EXTended:NEEDed:PTRansition?
STATus:QUEStionable:CALibration:NTRansition
STATus:QUEStionable:CALibration:NTRansition?
STATus:QUEStionable:CALibration:PTRansition
STATus:QUEStionable:CALibration:PTRansition?
STATus:QUEStionable:CALibration:SKIPped:CONDition?
STATus:QUEStionable:CALibration:SKIPped:ENABle
STATus:QUEStionable:CALibration:SKIPped:ENABle?
STATus:QUEStionable:CALibration:SKIPped[:EVENt]?
STATus:QUEStionable:CALibration:SKIPped:NTRansition
STATus:QUEStionable:CALibration:SKIPped:NTRansition?
STATus:QUEStionable:CALibration:SKIPped:PTRansition
STATus:QUEStionable:CALibration:SKIPped:PTRansition?
STATus:QUEStionable:CONDition?
STATus:QUEStionable:CONDition?
STATus:QUEStionable:ENABle
STATus:QUEStionable:ENABle
STATus:QUEStionable:ENABle?
STATus:QUEStionable:ENABle?
STATus:QUEStionable[:EVENt]?
STATus:QUEStionable[:EVENt]?
STATus:QUEStionable:FREQuency:CONDition?
STATus:QUEStionable:FREQuency:CONDition?
STATus:QUEStionable:FREQuency:ENABle
STATus:QUEStionable:FREQuency:ENABle
STATus:QUEStionable:FREQuency:ENABle?
STATus:QUEStionable:FREQuency:ENABle?
STATus:QUEStionable:FREQuency[:EVENt]?
STATus:QUEStionable:FREQuency[:EVENt]?
STATus:QUEStionable:FREQuency:NTRansition
STATus:QUEStionable:FREQuency:NTRansition
STATus:QUEStionable:FREQuency:NTRansition?
STATus:QUEStionable:FREQuency:NTRansition?
STATus:QUEStionable:FREQuency:PTRansition
STATus:QUEStionable:FREQuency:PTRansition
STATus:QUEStionable:FREQuency:PTRansition?
STATus:QUEStionable:FREQuency:PTRansition?
STATus:QUEStionable:INTegrity:CONDition?
STATus:QUEStionable:INTegrity:ENABle
STATus:QUEStionable:INTegrity:ENABle?
STATus:QUEStionable:INTegrity[:EVENt]?
STATus:QUEStionable:INTegrity:NTRansition
STATus:QUEStionable:INTegrity:NTRansition?
STATus:QUEStionable:INTegrity:PTRansition
STATus:QUEStionable:INTegrity:PTRansition?
STATus:QUEStionable:INTegrity:SIGNal:CONDition?
```

```
STATus:QUEStionable:INTegrity:SIGNal:ENABle
STATus:QUEStionable:INTegrity:SIGNal:ENABle?
STATus:QUEStionable:INTegrity:SIGNal[:EVENt]?
STATus:QUEStionable:INTegrity:SIGNal:NTRansition
STATus:QUEStionable:INTegrity:SIGNal:NTRansition?
STATus:QUEStionable:INTegrity:SIGNal:PTRansition
STATus:QUEStionable:INTegrity:SIGNal:PTRansition?
STATus:QUEStionable:INTegrity:UNCalibrated:CONDition?
STATus:QUEStionable:INTegrity:UNCalibrated:ENABle
STATus:QUEStionable:INTegrity:UNCalibrated:ENABle?
STATus:QUEStionable:INTegrity:UNCalibrated[:EVENt]?
STATus:QUEStionable:INTegrity:UNCalibrated:NTRansition
STATus:QUEStionable:INTegrity:UNCalibrated:NTRansition?
STATus:QUEStionable:INTegrity:UNCalibrated:PTRansition
STATus:QUEStionable:INTegrity:UNCalibrated:PTRansition?
STATus:QUEStionable:NTRansition
STATus:QUEStionable:NTRansition
STATus:QUEStionable:NTRansition?
STATus:QUEStionable:NTRansition?
STATus:QUEStionable:POWer:CONDition?
STATus:QUEStionable:POWer:ENABle
STATus:QUEStionable:POWer:ENABle?
STATus:QUEStionable:POWer[:EVENt]?
STATus:QUEStionable:POWer:NTRansition
STATus:QUEStionable:POWer:NTRansition?
STATus:QUEStionable:POWer:PTRansition
STATus:QUEStionable:POWer:PTRansition?>
STATus:QUEStionable:PTRansition
STATus:QUEStionable:PTRansition
STATus:QUEStionable:PTRansition?
STATus:QUEStionable:PTRansition?
STATus:QUEStionable:TEMPerature:CONDition?
STATus:QUEStionable:TEMPerature:ENABle
STATus:QUEStionable:TEMPerature:ENABle?
STATus:QUEStionable:TEMPerature[:EVENt]?
STATus:QUEStionable:TEMPerature:NTRansition
STATus:QUEStionable:TEMPerature:NTRansition?
STATus:QUEStionable:TEMPerature:PTRansition
STATus:QUEStionable:TEMPerature:PTRansition?
STATus:QUEue[:NEXT]?
SYSTem:APPLication:CATalog[:NAME]?
SYSTem:APPLication:CATalog[:NAME]:COUNt?
SYSTem:APPLication:CATalog:OPTion?
SYSTem:APPLication:CATalog:REVision?
SYSTem:APPLication[:CURRent][:NAME]?
SYSTem:APPLication[:CURRent]:OPTion?
SYSTem:APPLication[:CURRent]:REVision?
SYSTem:COMMunicate:GPIB[:SELF]:ADDRess
SYSTem:COMMunicate:GPIB[:SELF]:ADDRess?
SYSTem:COMMunicate:GPIB[:SELF]:RTERminator
SYSTem:COMMunicate:GPIB[:SELF]:RTERminator?
SYSTem:DATE
SYSTem:DATE?
```

SYSTem:DISPlay:FPANel:STATe
SYSTem:DISPlay:FPANel:STATe?
SYSTem:DISPlay:UPDate
SYSTem:DISPlay:UPDate?
SYSTem:ERRor:CLEar:ALL
SYSTem:ERRor:LIST?
SYSTem:ERRor[:NEXT]?
SYSTem:OPTions?
SYSTem:PRESet
SYSTem:PRESet
SYSTem:PRESet:FULL
SYSTem:PRESet:USER
SYSTem:PRESet:USER:ALL
SYSTem:PRESet:USER:SAVE
SYSTem:SEQuencer
SYSTem:SEQuencer?
SYSTem:TIME
SYSTem:TIME?
SYSTem:VERSion?

T

TRACe[:DATA]
TRACe[:DATA]?
TRACe:IQ:DATA?
TRACe:IQ:SET
TRACe:IQ:SRATe
TRACe:IQ:SRATe?
TRACe:IQ[:STATe]
TRACe:IQ[:STATe]?
TRIGger[:SEQuence]:HOLDoff
TRIGger[:SEQuence]:HOLDoff?
TRIGger[:SEQuence]:LEVel:IFPower
TRIGger[:SEQuence]:LEVel:IFPower?
TRIGger[:SEQuence]:LEVel:RFPower
TRIGger[:SEQuence]:LEVel:RFPower?
TRIGger[:SEQuence]:LEVel:VIDeo
TRIGger[:SEQuence]:LEVel:VIDeo?
TRIGger[:SEQuence]:SLOPe
TRIGger[:SEQuence]:SLOPe?
TRIGger[:SEQuence]:SOURce
TRIGger[:SEQuence]:SOURce?

10.2 IEEE 488.2 Common Commands

The instrument supports the following subset of IEEE 488.2 Common Commands, as defined in Chapter 10 of IEEE Standard 488.2–1992. As indicated below, some of these commands correspond directly to instrument front-panel functionality, while others are available only as remote commands.

– "*CAL? - Calibration Query" on page 614 (Align Now All equivalent)
– "*CLS - Clear Status" on page 615
– "*ESE - Standard Event Status Enable" on page 615
– "*ESR? - Standard Event Status Register Query" on page 616
– "*IDN? - Identification Query" on page 616
– "*OPC? - Operation Complete" on page 617
– "*OPT? - Query Instrument Options" on page 618
– "*RCL - Recall Instrument State" on page 618 (Recall State equivalent)
– "*RST - Reset" on page 619 (Mode Preset equivalent)
– "*SAV - Save Instrument State" on page 619 (Save State equivalent)
– "*SRE - Service Request Enable" on page 620
– "*STB? - Status Byte Query" on page 620
– "*TRG - Trigger" on page 620
– "*TST? - Self Test Query" on page 621
– "*WAI - Wait-to-Continue" on page 621

10.2.1 *CAL? - Calibration Query

`*CAL?` Performs a full alignment and returns a number indicating the success of the alignment. A zero is returned if the alignment is successful. A one is returned if any part of the alignment fails. The equivalent SCPI command is `:CALibrate[:ALL]?`

See "Align Now All" on page 361.

Remote Command	`*CAL`
Example	`*CAL?` Runs a full alignment and returns 0 if no problems encountered

Status Bits/OPC dependencies	See "Align Now All" on page 361

10.2.2 *CLS - Clear Status

Clears the status byte register. It does this by emptying the error queue and clearing all bits in all of the event registers, and consequently all bits in the Status Byte register.

The Status Byte register summarizes the states of the other registers. It is also responsible for generating service requests.

Remote Command	`*CLS`
Example	`*CLS` Clears the error queue and the Status Byte Register
Notes	For related commands, see the `:SYSTem:ERRor[:NEXT]?` command. See also the `:STATus:PRESet` command and all commands in the STATus subsystem
Status Bits/OPC dependencies	Resets all bits in all event registers to 0, which resets all the status byte register bits to 0 also
Backwards Compatibility Notes	In general the status bits used in the X-Series status system are backwards compatible with ESA and PSA. However, unlike ESA and PSA, all conditions generate events that go into the event log, and some will also generate status bits

10.2.3 *ESE - Standard Event Status Enable

Sets the desired bits in the Event Enable Register of the "Standard Event Status Register" on page 795, which enables the corresponding bits in the Standard Event Status register. This register monitors I/O errors and synchronization conditions such as operation complete, request control, query error, device dependent error, status execution error, command error, and power on. The selected bits are OR'd to become a summary bit (bit 5) in the byte register, which can be queried.

The query returns the state of the standard event status enable register.

Numeric values for bit patterns can be entered using decimal or hexadecimal representations (that is, 0 to 32767 is equivalent to #H0 to #H7FFF).

Remote Command	`*ESE <integer>` `*ESE?`

Example	`*ESE 36`
	Enables the Standard Event Status Register to monitor query and command errors (bits 2 and 5)
	`*ESE?`
	Returns a 36 indicating that the query and command status bits are enabled

Notes	For related commands, see the STATus subsystem and `:SYSTem:ERRor[:NEXT]?` commands
Preset	255
State Saved	Not saved in state
Min	0
Max	255

10.2.4 *ESR? - Standard Event Status Register Query

Queries and clears the "Standard Event Status Register" on page 795. (This is a destructive read.) The value returned is a hexadecimal number that reflects the current state (0/1) of all the bits in the register.

Remote Command	`*ESR?`
Example	`*ESR?` Returns a 1 if there is either a query or command error, otherwise it returns a zero
Notes	For related commands, see the `STATus` subsystem commands
Preset	0
Min	0
Max	255
Status Bits/OPC dependencies	Standard Event Status Register (bits 0 – 7)

10.2.5 *IDN? - Identification Query

Returns a string of instrument identification information. The string will contain the model number, serial number, and firmware revision.

The response is organized into four fields separated by commas. The field definitions are as follows:

- Manufacturer
- Model
- Serial number
- Firmware version

Remote Command	`*IDN?`

Example	`*IDN?`
	Returns instrument identification information, such as:
	`Keysight Technologies,N9040B,US01020004,A.15.02`

Remote Command	`:ID?`

Example	`:ID?`
	Returns model number, such as:
	`N9040B`

Notes	ID? Is provided for backwards compatibility When in Remote Language Compatibility mode, the `ID?` query returns the model number of the emulated instrument When in any other mode, the returned model number is that of the actual instrument

10.2.6 *OPC? - Operation Complete

The `*OPC` command sets bit 0 in the standard event status register (SER) to “1” when pending operations have finished, that is when all overlapped commands are complete. It does not hold off subsequent operations. You can determine when the overlapped commands have completed either by polling the OPC bit in SER, or by setting up the status system such that a service request (SRQ) is asserted when the OPC bit is set.

The `*OPC?` query returns a “1” after all the current overlapped commands are complete. So it holds off subsequent commands until the "1" is returned, then the program continues. This query can be used to synchronize events of other instruments on the external bus.

Remote Command	`*OPC` `*OPC?`

Example	Select single sweeping:
	`:INIT:CONT 0`
	Initiate a sweep:
	`:INIT:IMM`
	Hold off any further commands until the sweep is complete:
	`*OPC?`

Notes	Not global to all remote ports or front panel. `*OPC` only considers operation that was initiated on the same port that the `*OPC` command was issued from `*OPC` is an overlapped command, but `*OPC?` is sequential
Backwards Compatibility Notes	1. Commands such as, *`OPC/*OPC?/*WAI/*RST` used to be global. They considered front panel operation in conjunction with the GPIB functionality. Now they are evaluated on a per channel basis. That is, the various rear panel remote ports and the front panel i/o are all considered separately. Only the functionality initiated on the port where the `*OPC` was sent, is considered for its operation 2. `*OPC` used to hold off until the operation bits were cleared. Now it holds off until all overlapping commands are completed. Also, earlier instruments did not wait for completion of all processes, only the ones identified here (in the STATus:OPERation register):

- Calibrating: monitored by PSA, ESA, VSA (E4406A)
- Sweeping: monitored by PSA, ESA, VSA (E4406A)
- Waiting for Trigger: monitored by PSA, ESA, VSA (E4406A)
- Measuring: monitored by PSA and ESA (but not in all Modes)
- Paused: monitored by VSA (E4406A)
- Printing: monitored by VSA (E4406A)
- Mass memory busy: monitored by VSA (E4406A)

10.2.7 *OPT? - Query Instrument Options

Returns a string of all the installed instrument options. It is a comma separated list with quotes, such as:

`“550,B25,B40,BBA,CRP,CRW,EA3,EDP,ESC,EXM,FBP,LNP,MPB,NF2,RTS,EMC,FP2"`

Remote Command	`*OPT?`

10.2.8 *RCL - Recall Instrument State

This command recalls the instrument state from the specified instrument memory register.

- If the state being loaded has a newer firmware revision than the revision of the instrument, no state is recalled and an error is reported
- If the state being loaded has an equal firmware revision than the revision of the instrument, the state will be loaded.
- If the state being loaded has an older firmware revision than the revision of the instrument, the instrument will only load the parts of the state that apply to the older revision.

Remote Command	`*RCL <register #>`
Example	`*RCL 7` Recalls the instrument state that is currently stored in register 7 (register 8 in the UI)
Notes	Registers 0 through 15 are accessible from the front panel in menu keys for Recall Registers. Register 0 is the front panel Register 1
Min	0
Max	127
Status Bits/OPC dependencies	The command is sequential

10.2.9 *RST - Reset

*RST is equivalent to :SYST:PRES;:INIT:CONT OFF, which is a Mode Preset in the Single measurement state. This remote command is preferred over the Mode Preset remote command :SYST:PRES, because optimal remote programming occurs with the instrument in the single measurement state.

*RST clears all pending OPC bits and sets the Status Byte to 0.

Remote Command	*RST
Example	*RST
Notes	Sequential
Couplings	*RST causes the currently running measurement to be aborted and causes the default measurement to be active. *RST gets the mode to a consistent state, with all of the default couplings set
Status Bits/OPC dependencies	Clears all pending OPC bits. The Status Byte is set to 0
Backwards Compatibility Notes	In legacy analyzers, *RST did not set the analyzer to **Single**, but in the X-Series it does, for compliance with the IEEE 488.2 specification. In the Swept SA measurement, you can configure the instrument to be compatible with legacy analyzers in this regard, using the Meas Setup, Legacy Compat, *RST function In the X-Series, *RST does not do a *CLS (clear the status bits and the error queue). In legacy analyzers, *RST used to do the equivalent of :SYSTem:PRESet, *CLS and :INITiate:CONTinuous OFF. But to be 488.2 compliant, *RST in the X-Series does not do a *CLS

10.2.10 *SAV - Save Instrument State

This command saves the current instrument state and mode to the specified instrument memory register.

Remote Command	*SAV <register #>
Example	*SAV 9 Saves the instrument state in register 9 (register 10 in the UI)
Notes	Registers 0 through 15 are accessible from the front panel in menu keys for Save Registers. Register 0 is the front panel Register 1
Min	0
Max	127
Status Bits/OPC dependencies	The command is sequential

10.2.11 *SRE - Service Request Enable

This command enables the desired bits of the "Service Request Enable Register" on page 794.

The query returns the value of the register, indicating which bits are currently enabled.

Numeric values for bit patterns can be entered using decimal or hexadecimal representations (that is, 0 to 32767 is equivalent to #H0 to #H7FFF).

Remote Command	`*SRE <integer>` `*SRE?`
Example	`*SRE 22` Enables bits 1, 2, and 4 in the service request enable register
Notes	For related commands, see the `STATus` subsystem and `:SYSTem:ERRor[:NEXT]?` commands
Preset	0
Min	0
Max	255
Status Bits/OPC dependencies	Service Request Enable Register (all bits, 0 – 7)

10.2.12 *STB? - Status Byte Query

Returns the value of the "Status Byte Register" on page 791 without erasing its contents.

Remote Command	`*STB?`
Example	`*STB?` Returns a decimal value for the bits in the status byte register For example, if a 16 is returned, it indicates that bit 5 is set and one of the conditions monitored in the standard event status register is set
Notes	See related command `*CLS`
Status Bits/OPC dependencies	Status Byte Register (all bits, 0 – 7)

10.2.13 *TRG - Trigger

This command triggers the instrument. Use the `:TRIGger[:SEQuence]:SOURce` command to select the trigger source.

Remote	`*TRG`

Command	
Example	*TRG Triggers the instrument to take a sweep or start a measurement, depending on the current instrument settings
Notes	See related command :INITiate:IMMediate

10.2.14 *TST? - Self Test Query

This query performs the internal self-test routines, and returns a number indicating the success of the testing.

A zero is returned if the test is successful, 1 if it fails.

Remote Command	*TST?
Example	*TST? Runs the self-test routines and returns: 0=passed, 1=some part failed

10.2.15 *WAI - Wait-to-Continue

This command causes the instrument to wait until all overlapped commands are completed before executing any additional commands. There is no query form for the command.

Remote Command	*WAI
Example	:INIT:CONT OFF; INIT;*WAI Sets the instrument to single sweep. Starts a sweep and waits for its completion.
Status Bits/OPC dependencies	Not global to all remote ports or front panel. *OPC only considers operation that was initiated on the same port as the *OPC command was issued from.

10.3 Supported SCPI Command Descriptions

This chapter lists the FSE/FSP/FSU/ESU/FSL/FSV/FSW SCPI commands that are supported by SCPI LC Mode, and provides brief details of the command parameters.

10.3.1 Split-Screen Suffixes

Most FSE/FSP/FSU/ESU/FSL/FSV/FSW SCPI commands have a numeric suffix at the first node, corresponding to the Split Screen A/B feature, for example, CALCulate<1|2>, INITiate<1|2> and so on. However, SCPI LC Mode does **not** support suffix "2". That is, Full Screen is assumed, and all commands are mapped as if to parameter <1>.

The numeric suffix "1" can be omitted, for example, CALCulate1 is equal to CALCulate.

If you send a command with the numeric suffix "2", an error message is displayed in the instrument's message area.

10.3.2 ABORt Subsystem

The ABORt subsystem contains commands for aborting triggered actions. An action may be triggered again immediately after being aborted. All commands trigger events, and therefore have no *RST value.

10.3.2.1 ABORt

Aborts any current measurement and resets the trigger system.

Remote Command	`:ABORt`
Example	`:ABOR`
Remote Command Notes	FSE, FSP, FSU, ESU, FSL, FSV, FSW ABORt

10.3.3 CALCulate:DELTamarker Subsystem

The CALCulate:DELTamarker subsystem controls the delta-marker functions.

NOTE **All delta marker functions are not supported in the CCDF and APD measurements.**

NOTE **FSV/FSW has 16 delta markers while X-series can only support 4 delta markers.**

10.3.3.1 CALCulate:DELTamarker[:STATe]

When delta marker 1 is selected, this command switches the delta marker on and off.

When any one of delta markers 2 through 4 is selected, that marker becomes the delta marker. If the marker was not activated, it becomes activated, and is placed at the maximum of the measurement curve.

If the numeric suffix is omitted, delta marker 1 is automatically selected.

The query returns the current state of this setting.

Remote Command	`:CALCulate[1]:DELTamarker[1]|2|...|4[:STATe] ON|OFF|1|0` `:CALCulate[1]:DELTamarker[1]|2|...|4[:STATe]?`
Example	`CALC:DELT ON`
Remote Command Notes	FSV/FSW has 16 delta markers while X-series can only support 4 delta markers. FSE, FSP, FSU, ESU, FSL CALCulate[1]|2:DELTamarker[1]|2|...|4[:STATe] ON|OFF FSV CALCulate[1]|2:DELTamarker[1]|2|...|16[:STATe] ON|OFF FSW CALCulate[1]|2...|16:DELTamarker[1]|2|...|16[:STATe] ON|OFF
Preset	OFF
State Saved	Saved in instrument state.

10.3.3.2 CALCulate:DELTamarker:MODE

The command switches the frequency input of the delta marker between Absolute and Relative modes.

The query returns the current state of this setting.

Remote Command	`:CALCulate[1]:DELTamarker[1]|2|...|4:MODE ABSolute|RELative` `:CALCulate[1]:DELTamarker[1]|2|...|4:MODE?`

Example	`CALC:DELT:MODE ABS`
	`CALC:DELT:MODE REL`
	`CALC:DELT:MODE?`

Remote Command Notes	FSV/FSW has 16 delta markers while X-series can only support 4 delta markers. FSE, FSP, FSU, ESU, FSL CALCulate[1]|2:DELTamarker[1]|2|...|4:MODE ABSolute|RELative FSV CALCulate[1]|2:DELTamarker[1]|2|...|16:MODE ABSolute|RELative

	FSW CALCulate[1]|2|...|16:DELTamarker[1]|2|...|16:MODE ABSolute|RELative
Preset	RELative
State Saved	Saved in instrument state.
Range	ABSolute | RELative

10.3.3.3 CALCulate:DELTamarker:AOFF

Switches off all active delta markers.

Remote Command	`:CALCulate[1]:DELTamarker[1]|2|...|4:AOFF`
Example	`CALC:DELT:AOFF`
Remote Command Notes	FSV/FSW has 16 delta markers while X-series can only support 4 delta markers. FSE, FSP, FSU, ESU, FSL CALCulate[1]|2:DELTamarker[1]|2|...|4:AOFF FSV CALCulate[1]|2:DELTamarker[1]|2|...|16:AOFF FSW CALCulate[1]|2|...|16:DELTamarker[1]|2|...|16:AOFF

10.3.3.4 CALCulate:DELTamarker:TRACe

Assigns the specified delta marker to the specified trace.

Remote Command	`:CALCulate[1]:DELTamarker[1]|2|...|4:TRACe 1|2|3|4|5|6`
Example	`CALC:DELT:TRAC 1`
Remote Command Notes	FSV/FSW has 16 delta markers while X-series can only support 4 delta markers. FSE CALCulate[1]|2:DELTamarker[1]|2|...|4:TRACe 1|2|3|4 FSP, FSU, ESU CALCulate[1]|2:DELTamarker[1]|2|...|4:TRACe 1|2|3 FSL CALCulate[1]|2:DELTamarker[1]|2|...|4:TRACe 1|2|3|4|5|6 FSV CALCulate[1]|2:DELTamarker[1]|2|...|16:TRACe 1|2|3|4|5|6 FSW CALCulate[1]|2|...|16:DELTamarker[1]|2|...|16:TRACe 1|2|3|4|5|6
Preset	1
State Saved	Saved in instrument state.

Min	1
Max	3

10.3.3.5 CALCulate:DELTamarker:X

The command positions the specified delta marker at the indicated frequency (span > 0) or time (span = 0).

The query returns the current value of this parameter.

Remote Command	`:CALCulate[1]:DELTamarker[1]|2|...|4:X <freq>|<time>` `:CALCulate[1]:DELTamarker[1]|2|...|4:X?`
Example	`CALC:DELT:X 10.7MHz` `CALC:DELT:X?`
Remote Command Notes	FSV/FSW has 16 delta markers while X-series can only support 4 delta markers. FSE :CALCulate[1]|2:DELTamarker[1]|2|...|4:X 0 to MAX (frequency | sweep time | symbols) FSP, FSU, ESU, FSL CALCulate[1]|2:DELTamarker[1]|2|...|4:X 0 to MAX (frequency | sweep time) FSV CALCulate[1]|2:DELTamarker[1]|2|...|16:X 0 to MAX (frequency | sweep time) FSW CALCulate[1]|2|...|16:DELTamarker[1]|2|...|16:X <position>

10.3.3.6 CALCulate:DELTamarker:X:RELative?

Queries the frequency or time value of the specified delta marker, relative to marker 1, or to the reference position (for CALCulate:DELTamarker:FUNCtion:FIXed:STATe ON). If required, the corresponding delta marker is activated.

This command is not supported in the CCDF and APD measurements.

Remote Command	`:CALCulate[1]:DELTamarker[1]|2|...|4:X:RELative?`
Example	`CALC:DELT:X:REL?`
Remote Command Notes	FSV/FSW has 16 delta markers while X-series can only support 4 delta markers. FSE, FSP, FSU, ESU, FSL CALCulate[1]|2:DELTamarker[1]|2|...|4:X:RELative? FSV CALCulate[1]|2:DELTamarker[1]|2|...|16:X:RELative? FSW CALCulate[1]|2|...|16:DELTamarker[1]|2|...|16:X:RELative?

10.3.3.7 CALCulate:DELTamarker:Y?

Queries the measured value of the specified delta marker. If required, the specified delta marker is activated. The returned result is a value relative to marker 1, or to the reference position if the reference is fixed.

To obtain a valid query result, a complete sweep with synchronization to the sweep end must be performed between the activation of the delta marker and the query of the y value. This is only possible in single sweep mode.

Depending on the unit defined with CALCulate:UNIT:POWer or on the activated measuring functions, the query result is output in the units below:

Parameter or measuring functions	Output unit
DBM | DBPW | DBUV | DBMV | DBUA	dB (lin/log)
WATT | VOLT | AMPere	dB (lin), % (log)
Statistics function (APD or CCDF) on	dimensionless output
(FSP) Result display FM (FS-K7)	HA
(FSP) Result display RF POWER (FS-K7)	dB
(FSP) Result display SPECTRUM (FS-K7)	dB

The only unit supported is dB.

Remote Command	`:CALCulate[1]:DELTamarker[1]|2|...|4:Y?`
Example	`CALC:DELT:Y?`
Remote Command Notes	FSV/FSW has 16 delta markers while X-series can only support 4 delta markers. FSE, FSP, FSU, ESU, FSL CALCulate[1]|2:DELTamarker[1]|2|...|4:Y? FSV CALCulate[1]|2:DELTamarker[1]|2|...|16:Y? FSW CALCulate[1]|2|...|16:DELTamarker[1]|2|...|16:Y?

10.3.3.8 CALCulate:DELTamarker:MAXimum[:PEAK]

Places the delta marker at the current maximum value of the trace. If required, the specified delta marker is first activated.

Remote Command	`:CALCulate[1]:DELTamarker[1]|2|...|4:MAXimum[:PEAK]`
Example	`CALC:DELT:MAX`
Remote Command Notes	FSV/FSW has 16 delta markers while X-series can only support 4 delta markers. FSE, FSP, FSU, ESU, FSL CALCulate[1]|2:DELTamarker[1]|2|...|4:MAXimum[:PEAK]

	FSV CALCulate[1]|2:DELTamarker[1]|2|...|16:MAXimum[:PEAK] FSW CALCulate[1]|2|...|16:DELTamarker[1]|2|...|16:MAXimum[:PEAK]

10.3.3.9 CALCulate:DELTamarker:MAXimum:LEFT

Places the delta marker at the next smaller maximum to the left of the current value (that is, in order of decreasing X values). If required, the specified delta marker is first activated.

Remote Command	`:CALCulate[1]:DELTamarker[1]|2|...|4:MAXimum:LEFT`
Example	`CALC:DELT:MAX:LEFT`
Remote Command Notes	FSV/FSW has 16 delta markers while X-series can only support 4 delta markers. FSE, FSP, FSU, ESU, FSL CALCulate[1]|2:DELTamarker[1]|2|...|4:MAXimum:LEFT FSV CALCulate[1]|2:DELTamarker[1]|2|...|16:MAXimum:LEFT FSW CALCulate[1]|2|...|16:DELTamarker[1]|2|...|16:MAXimum:LEFT

10.3.3.10 CALCulate:DELTamarker:MAXimum:NEXT

Places the delta marker at the next smaller maximum on the trace. If required, the specified delta marker is first activated.

Remote Command	`:CALCulate[1]:DELTamarker[1]|2|...|4:MAXimum:NEXT`
Example	`CALC:DELT:MAX:NEXT`
Remote Command Notes	FSV/FSW has 16 delta markers while X-series can only support 4 delta markers. FSE, FSP, FSU, ESU, FSL CALCulate[1]|2:DELTamarker[1]|2|...|4:MAXimum:NEXT FSV CALCulate[1]|2:DELTamarker[1]|2|...|16:MAXimum:NEXT FSW CALCulate[1]|2|...|16:DELTamarker[1]|2|...|16:MAXimum:NEXT

10.3.3.11 CALCulate:DELTamarker:MAXimum:RIGHt

Places the delta marker at the next smaller maximum to the right of the current value (that is, in order of increasing X values). If required, the specified delta marker is first activated.

Remote Command	:CALCulate[1]:DELTamarker[1]|2|...|4:MAXimum:RIGHt
Example	CALC:DELT:MAX:RIGH
Remote Command Notes	FSV/FSW has 16 delta markers while X-series can only support 4 delta markers. FSE, FSP, FSU, ESU, FSL CALCulate[1]|2:DELTamarker[1]|2|...|4:MAXimum:RIGHt FSV CALCulate[1]|2:DELTamarker[1]|2|...|16:MAXimum:RIGHt FSW CALCulate[1]|2|...|16:DELTamarker[1]|2|...|16:MAXimum:RIGHt

10.3.3.12 CALCulate:DELTamarker:MINimum[:PEAK]

Places the delta marker at the current minimum on the trace. If required, the specified delta marker is first activated.

Remote Command	:CALCulate[1]:DELTamarker[1]|2|...|4:MINimum[:PEAK]
Example	CALC:DELT:MIN
Remote Command Notes	FSV/FSW has 16 delta markers while X-series can only support 4 delta markers. FSE, FSP, FSU, ESU, FSL CALCulate[1]|2:DELTamarker[1]|2|...|4:MINimum[:PEAK] FSV CALCulate[1]|2:DELTamarker[1]|2|...|16:MINimum[:PEAK] FSW CALCulate[1]|2|...|16:DELTamarker[1]|2|...|16:MINimum[:PEAK]

10.3.3.13 CALCulate:DELTamarker:MINimum:LEFT

Places the delta marker at the next higher minimum to the left of the current value (that is, in order of decreasing X values). If required, the specified delta marker is first activated.

Remote Command	:CALCulate[1]:DELTamarker[1]|2|...|4:MINimum:LEFT
Example	CALC:DELT:MIN:LEFT
Remote Command Notes	FSV/FSW has 16 delta markers while X-series can only support 4 delta markers. FSE, FSP, FSU, ESU, FSL CALCulate[1]|2:DELTamarker[1]|2|...|4:MINimum:LEFT FSV CALCulate[1]|2:DELTamarker[1]|2|...|16:MINimum:LEFT FSW

CALCulate[1]|2|...|16:DELTamarker[1]|2|...|16:MINimum:LEFT

10.3.3.14 CALCulate:DELTamarker:MINimum:NEXT

Places the delta marker at the next higher minimum of the trace. If required, the specified delta marker is first activated.

Remote Command	`:CALCulate[1]:DELTamarker[1]|2|...|4:MINimum:NEXT`
Example	`CALC:DELT:MIN:NEXT`
Remote Command Notes	FSV/FSW has 16 delta markers while X-series can only support 4 delta markers. FSE, FSP, FSU, ESU, FSL CALCulate[1]|2:DELTamarker[1]|2|...|4:MINimum:NEXT FSV CALCulate[1]|2:DELTamarker[1]|2|...|16:MINimum:NEXT FSW CALCulate[1]|2|...|16:DELTamarker[1]|2|...|16:MINimum:NEXT

10.3.3.15 CALCulate:DELTamarker:MINimum:RIGHt

Places the delta marker at the next higher minimum to the right of the current value (that is, in order of increasing X values). If required, the specified delta marker is first activated.

Remote Command	`:CALCulate[1]:DELTamarker[1]|2|...|4:MINimum:RIGHt`
Example	`CALC:DELT:MIN:RIGH`
Remote Command Notes	FSV/FSW has 16 delta markers while X-series can only support 4 delta markers. FSE, FSP, FSU, ESU, FSL CALCulate[1]|2:DELTamarker[1]|2|...|4:MINimum:RIGHt FSV CALCulate[1]|2:DELTamarker[1]|2|...|16:MINimum:RIGHt FSW CALCulate[1]|2|...|16:DELTamarker[1]|2|...|16:MINimum:RIGHt

10.3.3.16 CALCulate:DELTamarker:LINK ON | OFF

The command switches the link between delta marker 1 and marker 1 on or off.

If the link is “on”, and the X-axis value of marker 1 is changed, then delta marker 1 will change by the same amount.

The numeric suffix of DELTamarker may only be 1, or be omitted, because this functionality is only available for marker 1 and delta marker 1.

The query returns the current state of this setting.

Remote Command	`:CALCulate[1]:DELTamarker[1]|2|...|4:LINK ON|OFF|1|0` `:CALCulate[1]:DELTamarker[1]|2|...|4:LINK?`
Example	`CALC:DELT:LINK ON`
Remote Command Notes	FSV/FSW has 16 delta markers while X-series can only support 4 delta markers. FSU, ESU CALCulate[1]|2:DELTamarker[1]|2|...|4:LINK ON|OFF FSV CALCulate[1]|2:DELTamarker[1]|2|...|16:LINK ON|OFF FSW CALCulate[1]|2|...|16:DELTamarker[1]|2|...|16:LINK ON|OFF
Preset	OFF
State Saved	Saved in instrument state.

10.3.3.17 CALCulate:DELTamarker:FUNCtion:FIXed[:STATe]

The command switches between relative measurement, and measurement relative to a fixed reference.

If required, marker 1 is activated and a peak search is performed.

If marker 1 is activated, its position becomes the reference point for the measurement. The reference point can then be changed, using commands CALCulate:DELTamarker:FUNCtion:FIXed:RPOint:X and :RPOint:Y, independently of the position of marker 1 and of any trace.

The query returns the current state of this setting.

Remote Command	`:CALCulate[1]:DELTamarker[1]|2|...|4:FUNCtion:FIXed[:STATe] ON | OFF | 1 | 0` `:CALCulate[1]:DELTamarker[1]|2|...|4:FUNCtion:FIXed[:STATe]?`
Example	`CALC:DELT:FUNC:FIX ON`
Remote Command Notes	FSV/FSW has 16 delta markers while X-series can only support 4 delta markers. FSE, FSP, FSU, ESU, FSL CALCulate[1]|2:DELTamarker[1]|2|...|4:FUNCtion:FIXed[:STATe] ON|OFF FSV CALCulate[1]|2:DELTamarker[1]|2|...|16:FUNCtion:FIXed[:STATe] ON|OFF FSW CALCulate[1]|2|...|16:DELTamarker[1]|2|...|16:FUNCtion:FIXed[:STATe] ON|OFF
Preset	OFF
State Saved	Saved in instrument state.

10.3.3.18 CALCulate:DELTamarker:FUNCtion:FIXed:RPOint:MAXimum[:PEAK]

Sets the reference point for all delta markers when you are making measurements using a fixed reference point (enabled by the command CALC:DELT:FUNC:FIX:STAT ON). You can specify a value using the parameter, or specify the peak of the selected trace [:PEAK].

For phase-noise measurements (selected via CALCulate:DELTamarker:FUNCtion:PNOise:STATe ON), the command specifies a new reference point for delta marker 2.

Remote Command	`:CALCulate[1]:DELTamarker[1]|2|...|4:FUNCtion:FIXed:RPOint:MAXimum[:PEAK]`
Example	`CALC:DELT:FUNC:FIX:RPO:MAX`
Remote Command Notes	FSV/FSW has 16 delta markers while X-series can only support 4 delta markers. FSP, FSU, ESU, FSL CALCulate[1]|2:DELTamarker[1]|2|...|4:FUNCtion:FIXed:RPOint:MAXimum[:PEAK] FSV CALCulate[1]|2:DELTamarker[1]|2|...|16:FUNCtion:FIXed:RPOint:MAXimum[:PEAK] FSW CALCulate[1]|2|...|16:DELTamarker[1]|2|...|16:FUNCtion:FIXed:RPOint:MAXimum[:PEAK]

10.3.3.19 CALCulate:DELTamarker:FUNCtion:FIXed:RPOint:Y

Sets or queries a Y-axis reference point for all delta markers when you are making measurements using a fixed reference point (enabled by CALCulate:DELTamarker:FUNCtion:FIXed:STATe ON).

For phase-noise measurements (selected via CALCulate:DELTamarker:FUNCtion:PNOise:STATe ON), the command specifies a new reference point level for delta marker 2.

Remote Command	`:CALCulate[1]:DELTamarker[1]|2|...|4:FUNCtion:FIXed:RPOint:Y <ampl>` `:CALCulate[1]:DELTamarker[1]|2|...|4:FUNCtion:FIXed:RPOint:Y?`
Example	`CALC:DELT2:FUNC:FIX:RPO:Y -10DBM` `CALC:DELT2:FUNC:FIX:RPO:Y?`
Remote Command Notes	FSV/FSW has 16 delta markers while X-series can only support 4 delta markers. FSE, FSP, FSU, ESU, FSL CALCulate[1]|2:DELTamarker[1]|2|...|4:FUNCtion:FIXed:RPOint:Y <numeric_value> FSV CALCulate[1]|2:DELTamarker[1]|2|...|16:FUNCtion:FIXed:RPOint:Y <numeric_value> FSW CALCulate[1]|2|...|16:DELTamarker[1]|2|...|16:FUNCtion:FIXed:RPOint:Y <numeric_value>

10.3.3.20 CALCulate:DELTamarker:FUNCtion:FIXed:RPOint:Y:OFFSet

Sets or queries the additional offset for all delta markers when you are making measurements using a fixed reference value (enabled by CALCulate:DELTamarker:FUNCtion:FIXed:STATe ON).

For phase-noise measurements (selected via CALCulate:DELTamarker:FUNCtion:PNOise:STATe ON), specifies an additional offset that is included in the display of delta marker 2.

Remote Command	`:CALCulate[1]:DELTamarker[1]|2|...|4:FUNCtion:FIXed:RPOint:Y:OFFSet <rel_ampl>` `:CALCulate[1]:DELTamarker[1]|2|...|4:FUNCtion:FIXed:RPOint:Y:OFFSet?`
Example	`CALC:DELT2:FUNC:FIX:RPO:Y:OFFS 10DB` `CALC:DELT2:FUNC:FIX:RPO:Y:OFFS?`
Remote Command Notes	FSV/FSW has 16 delta markers while X-series can only support 4 delta markers. FSE, FSP, FSU, ESU, FSL CALCulate[1]|2:DELTamarker[1]|2|...|4:FUNCtion:FIXed:RPOint:Y:OFFSet <numeric_value> FSV CALCulate[1]|2:DELTamarker[1]|2|...|16:FUNCtion:FIXed:RPOint:Y:OFFSet <numeric_value> FSW CALCulate[1]|2|...|16:DELTamarker[1]|2|...|16:FUNCtion:FIXed:RPOint:Y:OFFSet <numeric_value>
Preset	0

10.3.3.21 CALCulate:DELTamarker:FUNCtion:FIXed:RPOint:X

Sets or queries the reference frequency or time for all delta markers when you are making measurements using a fixed reference value (enabled by CALCulate:DELTamarker:FUNCtion:FIXed:STATe ON).

For phase-noise measurements (selected via CALCulate:DELTamarker:FUNCtion:PNOise:STATe ON), specifies a reference frequency or time for delta marker 2.

Remote Command	`:CALCulate[1]:DELTamarker[1]|2|...|4:FUNCtion:FIXed:RPOint:X <freq> | <time>` `:CALCulate[1]:DELTamarker[1]|2|...|4:FUNCtion:FIXed:RPOint:X?`
Example	`CALC:DELT2:FUNC:FIX:RPO:X 10MHz` `CALC1:DELT:FUNC:FIX:RPO:X?`
Remote Command Notes	FSV/FSW has 16 delta markers while X-series can only support 4 delta markers. FSE, FSP, FSU, ESU, FSL CALCulate[1]|2:DELTamarker[1]|2|...|4:FUNCtion:FIXed:RPOint:X <numeric_value> FSV

	CALCulate[1]|2:DELTamarker[1]|2|...|16:FUNCtion:FIXed:RPOint:X <numeric_value> FSW CALCulate[1]|2|...|16:DELTamarker[1]|2|...|16:FUNCtion:FIXed:RPOint:X <RefPoint>

10.3.3.22 CALCulate:DELTamarker:FUNCtion:PNOise[:STATe]

The command switches phase-noise measurement on or off for all active delta markers. All correction values are included.

If required, marker 1 is activated, and a peak search is performed. If marker 1 is activated, its position becomes the measurement's reference point.

The measurement's reference point can be modified with commands CALCulate:DELTamarker:FUNCtion:FIXed:RPOint:X and ...:RPOint:Y, independently of the position of marker 1 and of any trace.

The DELTamarker numeric suffix [1]|2|3|4 is not required for this command.

The query returns the current state of this setting.

Remote Command	`:CALCulate[1]:DELTamarker[1]|2|...|4:FUNCtion:PNOise[:STATe] ON	OFF	1	0` `:CALCulate[1]:DELTamarker[1]|2|...|4:FUNCtion:PNOise[:STATe]?`
Example	`CALC:DELT:FUNC:PNO ON`
Remote Command Notes	FSV/FSW has 16 delta markers while X-series can only support 4 delta markers. FSE, FSP, FSU, ESU, FSL CALCulate[1]|2:DELTamarker[1]|2|...|4:FUNCtion:PNOise[:STATe] ON|OFF FSV CALCulate[1]|2:DELTamarker[1]|2|...|16:FUNCtion:PNOise[:STATe] FSW CALCulate[1]|2|...|16:DELTamarker[1]|2|...|16:FUNCtion:PNOise[:STATe] ON|OFF
Preset	OFF
State Saved	Saved in instrument state.

10.3.3.23 CALCulate:DELTamarker:FUNCtion:PNOise:AUTO

The command switches on or off automatic peak search action for fixed reference marker 1. When activated, this search occurs at the end of each sweep.

You can use this functionality to track a drifting source during a phase noise measurement. Delta marker 2, which shows the phase noise measurement result, retains the delta frequency value. Therefore the results of phase noise measurement with a specified offset remain valid.

When marker 2 reaches the limit of the span, the delta marker value is automatically adjusted to be within the span. In such cases, select a wider span.

The query returns the current state of this setting.

Remote Command	`:CALCulate[1]:DELTamarker[1]|2|...|4:FUNCtion:PNOise:AUTO ON	OFF	1	0` `:CALCulate[1]:DELTamarker[1]|2|...|4:FUNCtion:PNOise:AUTO?`
Example	`CALC:DELT:FUNC:PNO:AUTO ON`
Remote Command Notes	FSV/FSW has 16 delta markers while X-series can only support 4 delta markers. FSU, ESU CALCulate[1]|2:DELTamarker[1]|2|...|4:FUNCtion:PNOise:AUTO ON|OFF FSV CALCulate[1]|2:DELTamarker[1]|2|...|16:FUNCtion:PNOise:AUTO ON|OFF FSW CALCulate[1]|2|...|16:DELTamarker[1]|2|...|16:FUNCtion:PNOise:AUTO ON|OFF
Preset	OFF
State Saved	Saved in instrument state.

10.3.3.24 CALCulate:DELTamarker:FUNCtion:PNOise:RESult?

Queries the result of a phase noise measurement. If required, the measurement is switched on.

Remote Command	`:CALCulate[1]:DELTamarker[1]|2|...|4:FUNCtion:PNOise:RESult?`
Example	`CALC:DELT:FUNC:PNO:RES?`
Remote Command Notes	FSE, FSP, FSU, ESU, FSL CALCulate[1]|2:DELTamarker[1]|2|...|4:FUNCtion:PNOise:RESult? FSV CALCulate[1]|2:DELTamarker[1]|2|...|16:FUNCtion:PNOise:RESult? FSW CALCulate[1]|2|...|16:DELTamarker[1]|2|...|16:FUNCtion:PNOise:RESult?

10.3.4 CALCulate:LIMit Subsystem

The CALCulate:LIMit subsystem includes the limit lines and limit checks. Limit lines may be defined as upper or lower. The limit line Y-values correspond to the X-axis values. The number of x and y values must be identical.

X Series Analyzers support up to 6 active limit lines at the same time (marked by LIMit1 to LIMit6).

10.3.4.1 CALCulate:LIMit:ACTive?

Queries the names of all active limit lines. For this command, all the numeric suffixes are ignored.

The return values are sorted alphabetically. If there are no active limit lines, an empty string is returned.

Remote Command	`:CALCulate[1]:LIMit[1]|2|...|6:ACTive?`
Example	`CALC:LIM:ACT?`
Remote Command Notes	FSE, FSU, ESU, FSL, FSV CALCulate[1]|2:LIMit[1]|2|...|8:ACTive? FSW CALCulate[1]|2|...|16:LIMit[1]|2|...|8:ACTive?
Preset	“”
State Saved	Saved in instrument state.

10.3.4.2 CALCulate:LIMit:TRACe

The command assigns a limit line to a trace.

The query returns the current assignment.

Remote Command	`:CALCulate[1]:LIMit[1]|2|...|6:TRACe 1|2|3|4|5|6` `:CALCulate[1]:LIMit[1]|2|...|6:TRACe?`
Example	`CALC:LIM:TRAC 1`
Remote Command Notes	FSE CALCulate[1]|2:LIMit[1]|2|...|8:TRACe 1|2|3|4 FSP, FSU, ESU CALCulate[1]|2:LIMit[1]|2|...|8:TRACe 1|2|3 FSL, FSV CALCulate[1]|2:LIMit[1]|2|...|8:TRACe 1|2|3|4|5|6 FSW CALCulate[1]|2|...|16:LIMit[1]|2|...|8:TRACe 1|2|3|4|5|6
Preset	1
State Saved	Saved in instrument state.
Min	1
Max	6

10.3.4.3 CALCulate:LIMit:STATe

The command switches the limit check for the specified limit line on or off.

The limit check result may be queried using CALCulate:LIMit:FAIL?.

The query returns the current state of this setting.

Remote Command	`:CALCulate[1]:LIMit[1]|2|...|6:STATe ON|OFF|1|0`

	:CALCulate[1]:LIMit[1]|2|...|6:STATe?
Example	CALC:LIM:STAT ON
Remote Command Notes	FSE, FSP, FSU, ESU, FSL, FSV CALCulate[1]|2:LIMit[1]|2|...|8:STATe ON|OFF FSW CALCulate[1]|2|...|16:LIMit[1]|2|...|8:STATe ON|OFF
Preset	OFF
State Saved	Saved in instrument state.

10.3.4.4 CALCulate:LIMit:UNIT

The command specifies the unit for all limit lines.

This mode supports only the following amplitude units: DBM, DBPW, WATT, DBUV, DBMV, VOLT, DBUA and DB.

The command ignores the numeric suffix of LIMit, and sets all limit lines to the same unit.

The query returns the current state of this setting.

Remote Command	:CALCulate[1]:LIMit[1]|2|...|6:UNIT DBM|DBUV|DBMV|DBUA|A|V|W :CALCulate[1]:LIMit[1]|2|...|6:UNIT?
Example	CALC:LIM:UNIT DBM CALC:LIM:UNIT?
Remote Command Notes	FSE CALCulate[1]|2:LIMit[1]|2|...|8:UNIT DBM|DBPW|DBPT|WATT|DBUV|DBMV|VOLT|DBUA|AMPere|DB|DBUV_MHZ|DBMV_MHZ|DBUA_MHZ|DBUV_M|DBUA_M|DBUV_MMHZ|DBUA_MMHZ|UNITLESS FSP CALCulate[1]|2:LIMit[1]|2|...|8:UNIT DBM|DBPW|WATT|DBUV|DBMV|VOLT|DBUA|AMPere|DB|DEG|RAD|S|HZ|PCT|UNITLESS FSU, ESU CALCulate[1]|2:LIMit[1]|2|...|8:UNIT DBM|DBPW|WATT|DBUV|DBMV|VOLT|DBUA|AMPere|DB|UNITLESS FSL CALCulate[1]|2:LIMit[1]|2|...|8:UNIT DBM|DBPW|WATT|DBUV|DBMV|VOLT|DBUA|AMPere|DB|DEG|RAD|HZ|PCT FSV CALCulate[1]|2:LIMit[1]|2|...|8:UNIT DBM|DBPW|WATT|DBUV|DBMV|VOLT|DBUA|AMPere|DB|DBUV_M|DBUA_M|DEG|RAD|S|HZ|PCT|(unitless) FSW CALCulate[1]|2|...|16:LIMit[1]|2|...|8:UNIT DBM|DBPW|WATT|DBUV|DBMV|VOLT|DBUA|AMPere|DB|DBUV_M|DBUA_M|UNITLESS

Preset	DBM
State Saved	Saved in instrument state.
Range	DBM | DBUV | DBMV | DBUA | A | V | W

10.3.4.5 CALCulate:LIMit:FAIL?

Returns the limit check result for the specified limit line.

To obtain a valid result, you must perform a complete sweep. A synchronization with *OPC, *OPC? or *WAI should therefore be provided.

The numeric value returned has the following meaning:

0	PASS
1	FAIL
2	MARGIN

Remote Command	`:CALCulate[1]:LIMit[1]|2|...|6:FAIL?`
Example	`CALC:LIM:FAIL?`
Remote Command Notes	FSE, FSP, FSU, ESU, FSL, FSV CALCulate[1]|2:LIMit[1]|2|...|8:FAIL? FSW CALCulate[1]|2|...|16:LIMit[1]|2|...|8:FAIL?
Min	0
Max	1

10.3.4.6 CALCulate:LIMit:CLEar[:IMMediate]

Deletes the current limit check result for all limit lines.

Remote Command	`:CALCulate[1]:LIMit[1]|2|...|6:CLEar[:IMMediate]`
Example	`CALC:LIM:CLE`
Remote Command Notes	FSE, FSP, FSU, ESU, FSL, FSV CALCulate[1]|2:LIMit[1]|2|...|8:CLEar[:IMMediate] FSW CALCulate[1]|2|...|16:LIMit[1]|2|...|8:CLEar[:IMMediate]

10.3.4.7 CALCulate:LIMit:COMMent <string>

The command defines a comment for the specified limit line. The comment string may have a maximum length of 40 characters.

The query returns the current value of this string.

Remote Command	`:CALCulate[1]:LIMit[1]|2|...|6:COMMent <string>` `:CALCulate[1]:LIMit[1]|2|...|6:COMMent?`
Example	`CALC:LIM:COMM 'GSM2'` `CALC:LIM:COMM?`
Remote Command Notes	FSE, FSP, FSU, ESU, FSL, FSV CALCulate[1]|2:LIMit[1]|2|...|8:COMMent <string>, max. 40 characters FSW CALCulate[1]|2|...|16:LIMit[1]|2|...|8:COMMent <string>, max. 40 characters
Preset	""
State Saved	Saved in instrument state.

10.3.4.8 CALCulate:LIMit:COPY 1|2|3|4|5|6 | <name>

Copies the limit line specified by the numeric suffix of LIMit onto the limit line specified by the command's parameter.

This mode does not support the parameter option <name>.

Remote Command	`:CALCulate[1]:LIMit[1]|2|...|6:COPY <int>`
Example	`CALC:LIM:COPY 2`
Remote Command Notes	FSE, FSP, FSU, ESU, FSL, FSV CALCulate[1]|2:LIMit[1]|2|...|8:COPY 1 to 8|<name> FSW CALCulate[1]|2|...|16:LIMit[1]|2|...|8:COPY 1 to 8|<name>
Min	1
Max	6

10.3.4.9 CALCulate:LIMit:NAME <name of limit line>

The command assigns a name to the limit line specified by the numeric suffix of LIMit. A limit line with this name is created, if it does not already exist.

The query returns the current value of this string.

Remote Command	`:CALCulate[1]:LIMit[1]|2|...|6:NAME <string>` `:CALCulate[1]:LIMit[1]|2|...|6:NAME?`
Example	`CALC:LIM:NAME 'test'` `CALC:LIM:NAME?`
Remote Command Notes	FSE, FSP, FSU, ESU, FSL, FSV CALCulate[1]|2:LIMit[1]|2|...|8:NAME <name of limit line> FSW

	CALCulate[1]|2|...|16:LIMit[1]|2|...|8:NAME <name of limit line>
Preset	'REM1' to 'REM6' for lines 1|2|3|4|5|6
State Saved	Saved in instrument state.

10.3.4.10 CALCulate:LIMit:DELete

Deletes the specified limit line.

Remote Command	`:CALCulate[1]:LIMit[1]|2|...|6:DELete`
Example	`CALC:LIM:DEL`
Remote Command Notes	FSE, FSP, FSU, ESU, FSL, FSV CALCulate[1]|2:LIMit[1]|2|...|8:DELete FSW CALCulate[1]|2|...|16:LIMit[1]|2|...|8:DELete

10.3.5 CALCulate:LIMit:ESPectrum Subsystem

The CALCulate:LIMit:SPECtrum subsystem defines the limit check for spectrum emission measurements.

The following SCPI commands of this subsystem are accepted by the analyzer, but result in no action, and report no error.

10.3.5.1 CALCulate:LIMit:ESPectrum:MODE AUTO | MANual | USER

This command is accepted, but takes no action and reports no error.

Remote Command	`:CALCulate[1]:LIMit[1]|2|...|6:ESPectrum:MODE AUTO | MANual | USER` `:CALCulate[1]:LIMit[1]|2|...|6:ESPectrum:MODE?`
Example	`CALC:LIM:ESP:MODE AUTO` `CALC:LIM:ESP:MODE`
Remote Command Notes	FSP CALCulate[1]|2:LIMit[1]|2|...|8:ESPectrum:MODE AUTO|MANual|USER FSV CALCulate[1]|2:LIMit[1]|2|...|8:ESPectrum:MODE AUTO|MANual FSW CALCulate[1]|2|...|16:LIMit[1]|2|...|8:ESPectrum[1]|2|3:MODE AUTO|MANual
Preset	AUTO
State Saved	Saved in instrument state.
Range	AUTO | MANual | USER

10.3.5.2 CALCulate:LIMit:ESPectrum:VALue

Sets manual limit line selection. The limit line is selected by specifying the expected dBm power.

This command is accepted, but takes no action and reports no error.

Remote Command	`:CALCulate[1]:LIMit[1]|2|...|6:ESPectrum:VALue <integer>` `:CALCulate[1]:LIMit[1]|2|...|6:ESPectrum:VALue?`
Example	`CALC:LIM:ESP:VAL 39` `CALC:LIM:ESP:VAL?`
Remote Command Notes	FSP, FSV CALCulate[1]|2:LIMit[1]|2|...|8:ESPectrum:VALue <numeric_value> FSW CALCulate[1]|2|...|16:LIMit[1]|2|...|8:ESPectrum[1]|2|3:VALue <power>
Preset	0

10.3.5.3 CALCulate:LIMit:ESPectrum:RESTore

Restores the standard limit lines for the spectrum emission mask measurement. Any modifications that were made to the standard limit lines are lost, and the default setting is restored.

This command is accepted, but takes no action and reports no error.

Remote Command	`:CALCulate[1]:LIMit[1]|2|...|6:ESPectrum:RESTore`
Example	`CALC:LIM:ESP:REST`
Remote Command Notes	FSP, FSV CALCulate[1]|2:LIMit[1]|2|...|8:ESPectrum:RESTore FSW CALCulate[1]|2|...|16:LIMit[1]|2|...|8:ESPectrum[1]|2|3:RESTore

10.3.6 CALCulate:LIMit:ACPower Subsystem

The CALCulate:LIMit:ACPower subsystem defines the limit check for adjacent channel power measurement.

10.3.6.1 CALCulate:LIMit:ACPower[:STATe]

This command switches on and off the limit check for adjacent channel power measurements in the selected measurement window. The commands CALCulate:LIMit:ACPower:ACHannel:STATe or CALCulate:LIMit:ACPower:ALTernate:STATe must be used in addition to specify whether the limit check is to be performed for the upper/lower adjacent channel or for the alternate adjacent channels.

The numeric suffixes after LIMit are irrelevant for this command.

Remote Command	`:CALCulate[1]:LIMit[1]|2|...|6:ACPower[:STATe] ON|OFF|1|0` `:CALCulate[1]:LIMit[1]|2|...|6:ACPower[:STATe]?`
Example	`CALC:LIM:ACP ON` `CALC:LIM:ACP?`
Remote Command Notes	FSE, FSP, FSU, ESU, FSL, FSV CALCulate[1]|2:LIMit[1]|2|...|8:ACPower[:STATe] ON|OFF FSW CALCulate[1]|2|...|16:LIMit[1]|2|...|8:ACPower[:STATe] ON|OFF
Preset	OFF
State Saved	Saved in instrument state.

10.3.6.2 CALCulate:LIMit:ACPower:ACHannel[:RELative]

This command defines the relative limit of the upper/lower adjacent channel for adjacent channel

power measurements in the selected measurement window. The reference value for the relative limit value is the measured channel power.

It should be noted that the relative limit value has no effect on the limit check as soon as it is below the absolute limit value defined with CALCulate:LIMit:ACPower:ACHannel:ABSolute. This mechanism allows automatic checking of the absolute basic values of adjacent channel power as defined in mobile radio standards.

The numeric suffixes after LIMit are irrelevant for this command.

Parameter: The first numeric value is the limit for the upper (lower) adjacent channel. The

second value is ignored but must be indicated for reasons of compatibility with the

FSE family.

Remote Command	`:CALCulate[1]:LIMit[1]|2|...|6:ACPower:ACHannel[:RELative] <rel_ampl>,<rel_ampl>` `:CALCulate[1]:LIMit[1]|2|...|6:ACPower:ACHannel[:RELative]?`

Example	`CALC:LIM:ACP:ACH 30DB, 30DB`
	`CALC:LIM:ACP:ACH:REL 30DB, 30DB`
	`CALC:LIM:ACP:ACH?`
	`CALC:LIM:ACP:ACH:REL?`

Remote Command Notes	FSE, FSP, FSU, ESU, FSL, FSV CALCulate[1]|2:LIMit[1]|2|...|8:ACPower:ACHannel[:RELative] <0 to 100dB>,<0 to 100dB> FSW CALCulate[1]|2|...|16:LIMit[1]|2|...|8:ACPower:ACHannel[:RELative] <0 to 100dB>,<0 to 100dB>
Preset	0dB, 0dB
State Saved	Saved in instrument state.

10.3.6.3 CALCulate:LIMit:ACPower:ACHannel[:RELative]:STATe

This command activates the limit check for the relative limit value of the adjacent channel when

adjacent channel power measurement is performed. Before the command, the limit check must be activated using CALCulate:LIMit:ACPower:STATe ON.

The result can be queried with CALCulate:LIMit:ACPower:ACHannel:RESult?. It should be noted that a complete measurement must be performed between switching on the limit check and the result query, since otherwise no valid results are available.

The numeric suffixes after LIMit are irrelevant for this command.

Remote Command	`:CALCulate[1]:LIMit[1]|2|...|6:ACPower:ACHannel[:RELative]:STATe ON | OFF | 1 | 0` `:CALCulate[1]:LIMit[1]|2|...|6:ACPower:ACHannel[:RELative]:STATe?`

Example	`CALC:LIM:ACP:ACH:STAT ON`
	`CALC:LIM:ACP:ACH:REL:STAT ON`
	`CALC:LIM:ACP:ACH:STAT?`
	`CALC:LIM:ACP:ACH:REL:STAT?`

Remote Command Notes	FSE, FSP, FSU, ESU, FSL, FSV CALCulate[1]|2:LIMit[1]|2|...|8:ACPower:ACHannel[:RELative]:STATe ON|OFF FSW CALCulate[1]|2|...|16:LIMit[1]|2|...|8:ACPower:ACHannel[:RELative]:STATe ON|OFF
Preset	OFF
State Saved	Saved in instrument state.

10.3.6.4 CALCulate:LIMit:ACPower:ACHannel:ABSolute

This command defines the absolute limit value for the lower/upper adjacent channel during adjacentchannel power measurement (Adjacent Channel Power) in the selected measurement window.

It should be noted that the absolute limit value has no effect on the limit check as soon as it is below the relative limit value defined with

CALCulate:LIMit:ACPower:ACHannel:RELative. This mechanism allows automatic checking of the absolute basic values of adjacent channel power as defined in mobile radio standards.

The numeric suffixes after LIMIt are irrelevant for this command.

Parameter: The first value is the limit for the lower and the upper adjacent channel. The second limit value is ignored.

Remote Command	`:CALCulate[1]:LIMit[1]|2|...|6:ACPower:ACHannel:ABSolute <ampl>,<ampl>` `:CALCulate[1]:LIMit[1]|2|...|6:ACPower:ACHannel:ABSolute?`
Example	`CALC:LIM:ACP:ACH:ABS 30DBM, 30DBM` `CALC:LIM:ACP:ACH:ABS?`
Remote Command Notes	FSP, FSU, ESU, FSL, FSV CALCulate[1]|2:LIMit[1]|2|...|8:ACPower:ACHannel:ABSolute <-200dBm to 200dBm>,<-200dBm to 200dBm> FSW CALCulate[1]|2|...|16:LIMit[1]|2|...|8:ACPower:ACHannel:ABSolute <-200dBm to 200dBm>,<-200dBm to 200dBm>
Preset	-200dBm, -200dBm
State Saved	Saved in instrument state.

10.3.6.5 CALCulate:LIMit:ACPower:ACHannel:ABSolute:STATe

This command activates the limit check for the adjacent channel when adjacent-channel power measurement (Adjacent Channel Power) is performed. Before the command, the limit check for the channel/adjacent-channel measurement must be globally switched on using CALC:LIM:ACP ON.

The result can be queried with CALCulate:LIMit:ACPower:ACHannel:RESult?. It should be noted that a complete measurement must be performed between switching on the limit check and the result query, since otherwise no valid results are available.

The numeric suffixes after LIMIt are irrelevant for this command.

Remote Command	`:CALCulate[1]:LIMit[1]|2|...|6:ACPower:ACHannel:ABSolute:STATe ON | OFF | 1 | 0` `:CALCulate[1]:LIMit[1]|2|...|6:ACPower:ACHannel:ABSolute:STATe?`
Example	`CALC:LIM:ACP:ACH:ABS:STAT ON` `CALC:LIM:ACP:ACH:ABS:STAT?`
Remote Command Notes	FSP, FSU, ESU, FSL, FSV CALCulate[1]|2:LIMit[1]|2|...|8:ACPower:ACHannel:ABSolute:STATe ON|OFF FSW CALCulate[1]|2|...|16:LIMit[1]|2|...|8:ACPower:ACHannel:ABSolute:STATe ON|OFF

Preset	OFF
State Saved	Saved in instrument state.

10.3.6.6 CALCulate:LIMit:ACPower:ACHannel:RESult?

This command queries the result of the limit check for the upper/lower adjacent channel in the selected measurement window when adjacent channel power measurement is performed.

If the power measurement of the adjacent channel is switched off, the command produces a query error.

The numeric suffixes after LIMit are irrelevant for this command.

Parameter: The result is returned in the form <result>, <result> where <result> = PASSED | FAILED, and where the first returned value denotes the lower, the second denotes the upper adjacent channel.

Remote Command	`:CALCulate[1]:LIMit[1]|2|...|6:ACPower:ACHannel:RESult?`
Example	`CALC:LIM:ACP:ACH:RES?`
Remote Command Notes	FSE, FSP, FSU, ESU, FSL, FSV CALCulate[1]|2:LIMit[1]|2|...|8:ACPower:ACHannel:RESult? FSW CALCulate[1]|2|...|16:LIMit[1]|2|...|8:ACPower:ACHannel:RESult?

10.3.6.7 CALCulate:LIMit:ACPower:ALTernate[:RELative]

This command defines the limit for the first/second alternate adjacent channel in the selected measurement window for adjacent channel power measurements. The reference value for the relative limit value is the measured channel power.

The numeric suffix after ALTernate denotes the first or the second alternate channel. The numeric suffixes after LIMit are irrelevant for this command.

It should be noted that the relative limit value has no effect on the limit check as soon as it is below the absolute limit defined with CALCulate:LIMit:ACPower:ALTernate:ABSolute. This mechanism allows automatic checking of the absolute basic values of adjacent channel power as defined in mobile radio standards.

Parameter: The first value is the limit for the lower and the upper alternate adjacent channel. The second limit value is ignored.

Remote Command	`:CALCulate[1]:LIMit[1]|2|...|6:ACPower:ALTernate[1]|2[:RELative] <rel_ampl>,<rel_ampl>` `:CALCulate[1]:LIMit[1]|2|...|6:ACPower:ALTernate[1]|2[:RELative]?`

Example	`CALC:LIM:ACP:ALT 30DB, 30DB`
	`CALC:LIM:ACP:ALT2:REL 30DB, 30DB`
	`CALC:LIM:ACP:ALT?`
	`CALC:LIM:ACP:ALT2:REL?`

Remote Command Notes	FSE, FSP CALCulate[1]|2:LIMit[1]|2|...|8:ACPower:ALTernate<1 to 2>[:RELative] <0 to 100dB>,<0 to 100dB> FSU, ESU, FSL, FSV CALCulate[1]|2:LIMit[1]|2|...|8:ACPower:ALTernate[1]|2|...|11[:RELative] <0 to 100dB>,<0 to 100dB> FSW CALCulate[1]|2|...|16:LIMit[1]|2|...|8:ACPower:ALTernate[1]|2|...|11[:RELative] <0 to 100dB>,<0 to 100dB>
Preset	0dB, 0dB
State Saved	Saved in instrument state.

10.3.6.8 CALCulate:LIMit:ACPower:ALTernate[:RELative]:STATe

This command activates the limit check for the first/second alternate adjacent channel in the selected measurement window for adjacent channel power measurements. Before the command, the limit check must be activated using CALCulate:LIMit:ACPower:STATe ON.

The numeric suffix after ALTernate denotes the first or the second alternate channel. The numeric suffixes after LIMit are irrelevant for this command.

The result can be queried with CALCulate:LIMit:ACPower:ALTernate:RESult?. It should be noted that a complete measurement must be performed between switching on the limit check and the result query, since otherwise no valid results are obtained.

Remote Command	`:CALCulate[1]:LIMit[1]|2|...|6:ACPower:ALTernate[1]|2[:RELative]:STATe ON | OFF | 1 | 0` `:CALCulate[1]:LIMit[1]|2|...|6:ACPower:ALTernate[1]|2[:RELative]:STATe?`

Example	`CALC:LIM:ACP:ALT:STAT ON`
	`CALC:LIM:ACP:ALT2:REL:STAT ON`
	`CALC:LIM:ACP:ALT:STAT?`
	`CALC:LIM:ACP:ALT2:REL:STAT?`

Remote Command Notes	FSE, FSP, FSU, ESU CALCulate[1]|2:LIMit[1]|2|...|8:ACPower:ALTernate[1]|2:STATe ON | OFF FSU, ESU, FSL, FSV CALCulate[1]|2:LIMit[1]|2|...|8:ACPower:ALTernate[1]|2|...|11[:RELative]:STATe ON | OFF FSW CALCulate[1]|2|...|16:LIMit[1]|2|...|8:ACPower:ALTernate[1]|2|...|11[:RELative]:STATe ON | OFF

Preset	OFF
State Saved	Saved in instrument state.

10.3.6.9 CALCulate:LIMit:ACPower:ALTernate:ABSolute

This command defines the absolute limit value for the lower/upper alternate adjacent channel power measurement (Adjacent Channel Power) in the selected measurement window.

The numeric suffix after ALTernate denotes the first or the second alternate channel. The numeric suffixes after LIMit are irrelevant for this command.

It should be noted that the absolute limit value for the limit check has no effect as soon as it is below the relative limit value defined with CALCulate:LIMit:ACPower:ALTernate:RELative. This mechanism allows automatic checking of the absolute basic values defined in mobile radio standards for the power in adjacent channels.

Parameter: The first value is the limit for the lower and the upper alternate adjacent channel. The second limit value is ignored.

Remote Command	`:CALCulate[1]:LIMit[1]|2|...|6:ACPower:ALTernate[1]|2:ABSolute <ampl>,<ampl>`
	
	`:CALCulate[1]:LIMit[1]|2|...|6:ACPower:ALTernate[1]|2:ABSolute?`

Example	`CALC:LIM:ACP:ALT:ABS 30DBM, 30DBM`
	
	`CALC:LIM:ACP:ALT:ABS?`

Remote Command Notes	FSP CALCulate[1]|2:LIMit[1]|2|...|8:ACPower:ALTernate<1|2 >:ABSolute <-200DBM to 200DBM>,<-200DBM to 200DBM> FSU, ESU, FSL, FSV CALCulate[1]|2:LIMit[1]|2|...|8:ACPower:ALTernate<1...11>:ABSolute <-200DBM to 200DBM>,<-200DBM to 200DBM> FSW CALCulate[1]|2|...|16:LIMit[1]|2|...|8:ACPower:ALTernate<1...11>:ABSolute <-200DBM to 200DBM>,<-200DBM to 200DBM>
Preset	-200dBm, -200dBm
State Saved	Saved in instrument state.

10.3.6.10 CALCulate:LIMit:ACPower:ALTernate:ABSolute:STATe

This command activates the limit check for the first/second alternate adjacent channel in the selected measurement window for adjacent channel power measurement (Adjacent Channel Power).

Before the command, the limit check must be globally switched on for the channel/adjacent channel power with the command CALCulate:LIMit:ACPower:STATe ON.

The numeric suffix after ALTernate denotes the first or the second alternate channel. The numeric suffixes after LIMit are irrelevant for this command.

The result can be queried with CALCulate:LIMit:ACPower:ALTernate:RESult?. It should be noted that a complete measurement must be performed between switching on the limit check and the result query, since otherwise no valid results are available.

Remote Command	`:CALCulate[1]:LIMit[1]|2|...|6:ACPower:ALTernate[1]|2:ABSolute:STATe ON	OFF	1	0` `:CALCulate[1]:LIMit[1]|2|...|6:ACPower:ALTernate[1]|2:ABSolute:STATe?`
Example	`CALC:LIM:ACP:ALT:ABS:STAT ON` `CALC:LIM:ACP:ALT:ABS:STAT?`
Remote Command Notes	FSP CALCulate[1]|2:LIMit[1]|2|...|8:ACPower:ALTernate[1]|2:ABSolute:STATe ON | OFF FSU, ESU, FSL, FSV CALCulate[1]|2:LIMit[1]|2|...|8:ACPower:ALTernate[1]|2|...|11:ABSolute:STATe ON | OFF FSW CALCulate[1]|2|...|16:LIMit[1]|2|...|8:ACPower:ALTernate[1]|2|...|11:ABSolute:STATe ON | OFF
Preset	OFF
State Saved	Saved in instrument state.

10.3.6.11 CALCulate:LIMit:ACPower:ALTernate:RESult?

This command queries the result of the limit check for the first/second alternate adjacent channel in the selected measurement window for adjacent channel power measurements.

The numeric suffix after ALTernate denotes the first or the second alternate channel. The numeric suffixes after LIMit are irrelevant for this command.

If the power measurement of the adjacent channel is switched off, the command produces a query error.

Parameter: The result is returned in the form <result>, <result> where <result> = PASSED | FAILED and where the first (second) returned value denotes the lower (upper) alternate adjacent channel.

Remote Command	`:CALCulate[1]:LIMit[1]|2|...|6:ACPower:ALTernate[1]|2:RESult?`
Example	`CALC:LIM:ACP:ALT:RES?` `CALC:LIM:ACP:ALT2:RES?`

Remote Command Notes	FSE, FSP CALCulate[1]|2:LIMit[1]|2|...|8:ACPower:ALTernate[1]|2:RESult? FSU, ESU, FSL, FSV CALCulate[1]|2:LIMit[1]|2|...|8:ACPower:ALTernate<1...11>:RESult? FSW CALCulate[1]|2|...|16:LIMit[1]|2|...|8:ACPower:ALTernate<1...11>:RESult?

10.3.7 CALCulate:LIMit:CONTrol Subsystem

The CALCulate:LIMit:CONTrol subsystem controls the X-axis..

NOTE: All limit functions are not supported in the CCDF and APD measurements.

10.3.7.1 CALCulate:LIMit:CONTrol[:DATA]

The command specifies the X-axis values (frequencies or times) of the upper or lower limit lines.

The query returns the current values of these settings.

Remote Command	`:CALCulate[1]:LIMit[1]|2|...|6:CONTrol[:DATA] <freq>,<freq>… | <time>,<time>,…` `:CALCulate[1]:LIMit[1]|2|...|6:CONTrol[:DATA]?`
Example	`CALC:LIM:CONT:DATA 1.0e7, 2.0e7, 1.0e8, 3.0e8, 1.0e9` `CALC:LIM:CONT:DATA?`
Remote Command Notes	FSE, FSP, FSU, ESU, FSL, FSV CALCulate[1]|2:LIMit[1]|2|...|8:CONTrol[:DATA] <numeric_value>,<numeric_value>.. FSW CALCulate[1]|2|...|16:LIMit[1]|2|...|8:CONTrol[:DATA] <numeric_value>,<numeric_value>..
State Saved	Saved in instrument state.

10.3.7.2 CALCulate:LIMit:CONTrol:DOMain FREQuency | TIME

The command switches between frequency or time domain for the X-axis.

The query returns the current state of this setting.

Remote Command	`:CALCulate[1]:LIMit[1]|2|...|6:CONTrol:DOMain FREQuency|TIME` `:CALCulate[1]:LIMit[1]|2|...|6:CONTrol:DOMain?`
Example	`CALC:LIM:CONT:DOM FREQ` `CALC:LIM:CONT:DOM?`

Remote Command Notes	FSE, FSP, FSU, ESU, FSL, FSV CALCulate[1]|2:LIMit[1]|2|...|8:CONTrol:DOMain FREQuency | TIME FSW CALCulate[1]|2|...|16:LIMit[1]|2|...|8:CONTrol:DOMain FREQuency | TIME
Preset	FREQuency
State Saved	Saved in instrument state.
Range	FREQuency | TIME

10.3.7.3 CALCulate:LIMit:CONTrol:OFFSet

The command defines an offset for the X-axis value of the specified relative limit line, in the frequency or time domain.

The query returns the current value of this setting.

Remote Command	`:CALCulate[1]:LIMit[1]|2|...|6:CONTrol:OFFSet <freq>|<time>` `:CALCulate[1]:LIMit[1]|2|...|6:CONTrol:OFFSet?`
Example	`CALC:LIM:CONT:OFFS 1` `CALC:LIM:CONT:OFFS?`
Remote Command Notes	FSE, FSP, FSU, ESU, FSL, FSV CALCulate[1]|2:LIMit[1]|2|...|8:CONTrol:OFFSet <numeric_value> FSW CALCulate[1]|2|...|16:LIMit[1]|2|...|8:CONTrol:OFFSet <numeric_value>
Preset	0

10.3.7.4 CALCulate:LIMit:CONTrol:MODE RELative | ABSolute

The command switches between relative or absolute scaling for the X-axis of the specified limit line.

The query returns the current state of this setting.

Remote Command	`:CALCulate[1]:LIMit[1]|2|...|6:CONTrol:MODE RELative | ABSolute` `:CALCulate[1]:LIMit[1]|2|...|6:CONTrol:MODE?`
Example	`CALC:LIM:CONT:MODE ABS` `CALC:LIM:CONT:MODE`
Remote Command Notes	FSE, FSP, FSU, ESU, FSL, FSV CALCulate[1]|2:LIMit[1]|2|...|8:CONTrol:MODE RELative | ABSolute FSW CALCulate[1]|2|...|16:LIMit[1]|2|...|8:CONTrol:MODE RELative | ABSolute

Preset	ABS
State Saved	Saved in instrument state.
Range	RELative | ABSolute

10.3.7.5 CALCulate:LIMit:CONTrol:SHIFt

The command shifts the specified limit line in the X-direction, by the specified value.

The query returns the current value of this setting for the specified limit line.

Remote Command	`:CALCulate[1]:LIMit[1]|2|...|6:CONTrol:SHIFt <freq>|<time>` `:CALCulate[1]:LIMit[1]|2|...|6:CONTrol:SHIFt?`
Preset	0

10.3.7.6 CALCulate:LIMit:CONTrol:SPACing LINear | LOGarithmic

The command switches between linear or logarithmic interpolation for calculation of limit lines from frequency points.

The query returns the current state of this setting.

Remote Command	`:CALCulate[1]:LIMit[1]|2|...|6:CONTrol:SPACing LINear | LOGarithmic` `:CALCulate[1]:LIMit[1]|2|...|6:CONTrol:SPACing?`
Example	`CALC:LIM:CONT:SPAC LOG` `CALC:LIM:CONT:SPAC`
Remote Command Notes	FSE, FSP, FSU, ESU, FSL, FSV CALCulate[1]|2:LIMit[1]|2|...|8:CONTrol:SPACing LINear | LOGarithmic FSW CALCulate[1]|2|...|16:LIMit[1]|2|...|8:CONTrol:SPACing LINear | LOGarithmic
Preset	LIN
State Saved	Saved in instrument state.
Range	LINear | LOGarithmic

10.3.8 CALCulate:LIMit:LOWer Subsystem

The CALCulate:LIMit:LOWer subsystem controls the lower limit line.

NOTE	All limit functions are not supported in the CCDF and APD measurements.

10.3.8.1 CALCulate:LIMit:LOWer[:DATA]

The command defines a set of values for the specified lower limit line.

The query returns the current value set.

Remote Command	`CALCulate[1]:LIMit[1]|2|...|6:LOWer[:DATA] <real>,<real>…` `CALCulate[1]:LIMit[1]|2|...|6:LOWer[:DATA]?`
Example	`CALC:LIM:LOW:DATA 1,20,100,300,1` `CALC:LIM:LOW:DATA?`
Remote Command Notes	FSE, FSP, FSU, ESU, FSL, FSV CALCulate[1]|2:LIMit[1]|2|...|8:LOWer[:DATA] <numeric_value>,<numeric_value>.. FSW CALCulate[1]|2|...|16:LIMit[1]|2|...|8:LOWer[:DATA] <numeric_value>,<numeric_value>..
State Saved	Saved in instrument state.

10.3.8.2 CALCulate:LIMit:LOWer:STATe

The command activates or deactivates the specified lower limit line. Limit check is activated separately, using CALC:LIM:STAT ON.

The query returns the current state of this setting.

Remote Command	`:CALCulate[1]:LIMit[1]|2|...|6:LOWer:STATe ON|OFF|1|0` `:CALCulate[1]:LIMit[1]|2|...|6:LOWer:STATe?`
Example	`CALC:LIM:LOW:STAT OFF` `CALC:LIM:LOW:STAT?`
Remote Command Notes	FSE, FSP, FSU, ESU, FSL, FSV CALCulate[1]|2:LIMit[1]|2|...|8:LOWer:STATe ON | OFF FSW CALCulate[1]|2|...|16:LIMit[1]|2|...|8:LOWer:STATe ON | OFF
Preset	OFF
State Saved	Saved in instrument state.

10.3.8.3 CALCulate:LIMit:LOWer:OFFSet

The command defines an offset for the Y axis of the specified relative lower limit line.

The query returns the current value of this setting.

Remote Command	`:CALCulate[1]:LIMit[1]|2|...|6:LOWer:OFFSet <rel_ampl>`

	`:CALCulate[1]:LIMit[1]|2|...|6:LOWer:OFFSet?`
Example	`CALC:LIM:LOW:OFFS 1DB` `CALC:LIM:LOW:OFFS?`
Remote Command Notes	FSE, FSP, FSU, ESU, FSL, FSV CALCulate[1]|2:LIMit[1]|2|...|8:LOWer:OFFSet <numeric_value> FSW CALCulate[1]|2|...|16:LIMit[1]|2|...|8:LOWer:OFFSet <numeric_value>
Preset	0

10.3.8.4 CALCulate:LIMit:LOWer:MARGin

The command defines a margin for the specified lower limit line. At the margin level, out-of-limit values are signaled (if the limit check is active), but are not treated as violations of the limit value.

The query returns the current value of this setting.

Remote Command	`:CALCulate[1]:LIMit[1]|2|...|6:LOWer:MARGin <rel_ampl>` `:CALCulate[1]:LIMit[1]|2|...|6:LOWer:MARGin?`
Example	`CALC:LIM:LOW:MARG 10DB` `CALC:LIM:LOW:MARG?`
Remote Command Notes	FSE, FSP, FSU, ESU, FSL, FSV CALCulate[1]|2:LIMit[1]|2|...|8:LOWer:MARGin <numeric_value> FSW CALCulate[1]|2|...|16:LIMit[1]|2|...|8:LOWer:MARGin <numeric_value>
Preset	0

10.3.8.5 CALCulate:LIMit:LOWer:MODE

The command switches between relative or absolute scaling for the Y-axis of the specified lower limit line.

Selecting RELative causes the unit to be switched to dB.

The query returns the current state of this setting.

Remote Command	`:CALCulate[1]:LIMit[1]|2|...|6:LOWer:MODE RELative|ABSolute` `:CALCulate[1]:LIMit[1]|2|...|6:LOWer:MODE?`
Example	`CALC:LIM:LOW:MODE ABS` `CALC:LIM:LOW:MODE?`
Remote Command Notes	FSE, FSP, FSU, ESU, FSL, FSV CALCulate[1]|2:LIMit[1]|2|...|8:LOWer:MODE RELative | ABSolute

	FSW CALCulate[1]|2|...|16:LIMit[1]|2|...|8:LOWer:MODE RELative | ABSolute
Preset	ABS
State Saved	Saved in instrument state.
Range	RELative | ABSolute

10.3.8.6 CALCulate:LIMit:LOWer:SHIFt

The command shifts the specified limit line in the Y-direction, by the specified amount.

The query returns the current value of this setting.

Remote Command	`:CALCulate[1]:LIMit[1]|2|...|6:LOWer:SHIFt <rel_ampl>` `:CALCulate[1]:LIMit[1]|2|...|6:LOWer:SHIFt?`
Example	`CALC:LIM:LOW:SHIF 1` `CALC:LIM:LOW:SHIF?`
Remote Command Notes	FSE, FSP, FSU, ESU, FSL, FSV CALCulate[1]|2:LIMit[1]|2|...|8:LOWer:SHIFt <numeric_value> FSW CALCulate[1]|2|...|16:LIMit[1]|2|...|8:LOWer:SHIFt <numeric_value>
Preset	0

10.3.8.7 CALCulate:LIMit:LOWer:SPACing

The command switches between linear or logarithmic interpolation for the lower limit line.

The query returns the current state of this setting.

Remote Command	`:CALCulate[1]:LIMit[1]|2|...|6:LOWer:SPACing LINear | LOGarithmic` `:CALCulate[1]:LIMit[1]|2|...|6:LOWer:SPACing?`
Example	`CALC:LIM:LOW:SPAC LIN` `CALC:LIM:LOW:SPAC?`
Remote Command Notes	FSE, FSP, FSU, ESU, FSL, FSV CALCulate[1]|2:LIMit[1]|2|...|8:LOWer:SPACing LINear | LOGarithmic FSW CALCulate[1]|2|...|16:LIMit[1]|2|...|8:LOWer:SPACing LINear | LOGarithmic
Preset	LIN
State Saved	Saved in instrument state.
Range	LINear | LOGarithmic

10.3.8.8 CALCulate:LIMit:LOWer:THReshold

The command defines an absolute threshold value for limit lines with relative Y-axis scaling.

The absolute threshold value is used for the limit check when it exceeds the relative limit value.

This mode supports only dBm units.

The query returns the current value of this setting.

Remote Command	`CALCulate[1]:LIMit[1]|2|...|6:LOWer:THReshold <ampl>` `CALCulate[1]:LIMit[1]|2|...|6:LOWer:THReshold?`
Example	`CALC:LIM:LOW:THR 1DBM` `CALC:LIM:LOW:THR?`
Remote Command Notes	FSP, FSU, ESU, FSL, FSV CALCulate[1]|2:LIMit[1]|2|...|8:LOWer:THReshold <numeric_value> FSW CALCulate[1]|2|...|16:LIMit[1]|2|...|8:LOWer:THReshold <numeric_value>
Preset	-200dBm

10.3.9 CALCulate:LIMit:UPPer Subsystem

The CALCulate:LIMit:UPPer subsystem controls the upper limit line.

NOTE **All limit functions are not supported in the CCDF and APD measurements.**

10.3.9.1 CALCulate:LIMit:UPPer[:DATA]

The command defines a set of values for the specified upper limit line.

The query returns the current value set.

Remote Command	`:CALCulate[1]:LIMit[1]|2|...|6:UPPer[:DATA] <real>,<real>…` `:CALCulate[1]:LIMit[1]|2|...|6:UPPer[:DATA]?`
Example	`CALC:LIM:UPP:DATA -10,0,0,-10,-5` `CALC:LIM:UPP:DATA?`
Remote Command Notes	FSE, FSP, FSU, ESU, FSL, FSV CALCulate[1]|2:LIMit[1]|2|...|8:UPPer[:DATA] <numeric_value>,<numeric_value> FSW CALCulate[1]|2|...|16:LIMit[1]|2|...|8:UPPer[:DATA] <numeric_value>,<numeric_value>
State Saved	Saved in instrument state.

10.3.9.2 CALCulate:LIMit:UPPer:STATe

The command activates or deactivates the specified upper limit line. Limit check is activated separately, using CALC:LIM:STAT ON.

The query returns the current state of this setting.

Remote Command	`:CALCulate[1]:LIMit[1]|2|...|6:UPPer:STATe ON|OFF|1|0` `:CALCulate[1]:LIMit[1]|2|...|6:UPPer:STATe?`
Example	`CALC:LIM:UPP:STAT OFF` `CALC:LIM:UPP:STAT?`
Remote Command Notes	FSE, FSP, FSU, ESU, FSL, FSV CALCulate[1]|2:LIMit[1]|2|...|8:UPPer:STATe ON | OFF FSW CALCulate[1]|2|...|16:LIMit[1]|2|...|8:UPPer:STATe ON | OFF
Preset	OFF
State Saved	Saved in instrument state.

10.3.9.3 CALCulate:LIMit:UPPer:OFFSet

The command defines an offset for the Y-axis of the specified relative upper limit line.

The query returns the current value of this setting.

Remote Command	`CALCulate[1]:LIMit[1]|2|...|6:UPPer:OFFSet <rel_ampl>` `CALCulate[1]:LIMit[1]|2|...|6:UPPer:OFFSet?`
Example	`CALC:LIM:UPP:OFFS 1` `CALC:LIM:UPP:OFFS?`
Remote Command Notes	FSE, FSP, FSU, ESU, FSL, FSV CALCulate[1]|2:LIMit[1]|2|...|8:LOWer:SHIFt <numeric_value> FSW CALCulate[1]|2|...|16:LIMit[1]|2|...|8:LOWer:SHIFt <numeric_value>
Preset	0

10.3.9.4 CALCulate:LIMit:UPPer:MARGin

The command defines a margin for the specified upper limit line. At the margin level, out-of-limit values are signaled (if the limit check is active), but are not treated as violations of the limit value.

The query returns the current value of this setting.

Remote Command	`:CALCulate[1]:LIMit[1]|2|...|6:UPPer:MARGin <rel_ampl>` `:CALCulate[1]:LIMit[1]|2|...|6:Upper:MARGin?`
Example	`CALC:LIM:UPP:MARG 10` `CALC:LIM:UPP:MARG?`
Remote Command Notes	FSE, FSP, FSU, ESU, FSL, FSV CALCulate[1]|2:LIMit[1]|2|...|8:UPPer:MARGin <numeric_value> FSW CALCulate[1]|2|...|16:LIMit[1]|2|...|8:UPPer:MARGin <numeric_value>
Preset	0

10.3.9.5 CALCulate:LIMit:UPPer:MODE

The command switches between relative or absolute scaling for the Y-axis of the specified upper limit line.

Selecting RELative causes the unit to be switched to dB.

The query returns the current state of this setting.

Remote Command	`:CALCulate[1]:LIMit[1]|2|...|6:UPPer:MODE RELative|ABSolute` `:CALCulate[1]:LIMit[1]|2|...|6:UPPer:MODE?`
Example	`CALC:LIM:UPP:MODE ABS` `CALC:LIM:UPP:MODE?`
Remote Command Notes	FSE, FSP, FSU, ESU, FSL, FSV CALCulate[1]|2:LIMit[1]|2|...|8:UPPer:MODE RELative | ABSolute FSW CALCulate[1]|2|...|16:LIMit[1]|2|...|8:UPPer:MODE RELative | ABSolute
Preset	ABS
State Saved	Saved in instrument state.
Range	RELative | ABSolute

10.3.9.6 CALCulate:LIMit:UPPer:SHIFt

The command shifts the specified limit line in the Y-direction by the specified amount.

The query returns the current value of this setting.

Remote Command	`CALCulate[1]:LIMit[1]|2|...|6:UPPer:SHIFt <rel_ampl>` `CALCulate[1]:LIMit[1]|2|...|6:UPPer:SHIFt?`
Example	`CALC:LIM:UPP:SHIF 1` `CALC:LIM:UPP:SHIF?`

Remote Command Notes	FSE, FSP, FSU, ESU, FSL, FSV CALCulate[1]|2:LIMit[1]|2|...|8:UPPer:SHIFt <numeric_value> FSW CALCulate[1]|2|...|16:LIMit[1]|2|...|8:UPPer:SHIFt <numeric_value>
Preset	0

10.3.9.7 CALCulate:LIMit:UPPer:SPACing

The command switches between linear or logarithmic interpolation for the upper limit line.

The query returns the current state of this setting.

Remote Command	`:CALCulate[1]:LIMit[1]|2|...|6:UPPer:SPACing LINear | LOGarithmic` `:CALCulate[1]:LIMit[1]|2|...|6:UPPer:SPACing?`
Example	`CALC:LIM:UPP:SPAC LIN` `CALC:LIM:UPP:SPAC?`
Remote Command Notes	FSE, FSP, FSU, ESU, FSL, FSV CALCulate[1]|2:LIMit[1]|2|...|8:UPPer:SPACing LINear | LOGarithmic FSW CALCulate[1]|2|...|16:LIMit[1]|2|...|8:UPPer:SPACing LINear | LOGarithmic
Preset	LIN
State Saved	Saved in instrument state.
Range	LINear | LOGarithmic

10.3.9.8 CALCulate:LIMit:UPPer:THReshold

The command specifies an absolute threshold value for limit lines with relative Y-axis scaling. The absolute threshold value is used for the limit check when it exceeds the relative limit value.

This mode supports only dBm units.

The query returns the current value of this setting.

Remote Command	`:CALCulate[1]:LIMit[1]|2|...|6:UPPer:THReshold <ampl>` `:CALCulate[1]:LIMit[1]|2|...|6:UPPer:THReshold?`
Example	`CALC:LIM:UPP:THR 1DBM` `CALC:LIM:UPP:THR?`
Remote Command Notes	FSP, FSU, ESU, FSL, FSV CALCulate[1]|2:LIMit[1]|2|...|8:UPPer:THReshold <numeric_value> FSW

	CALCulate[1]|2|...|16:LIMit[1]|2|...|8:UPPer:THReshold <numeric_value>
Preset	-200dBm

10.3.10 CALCulate:MARKer Subsystem

The CALCulate:MARKer subsystem controls marker functions in the instrument.

NOTE **All marker functions are not supported in the CCDF and APD measurements.**

10.3.10.1 CALCulate:MARKer[:STATe]

The command switches the specified marker on or off.

If no numeric suffix is supplied, marker 1 is selected automatically.

If marker 2, 3 or 4 is selected and used as a delta marker, it is switched to marker mode.

The query returns the current state of this setting.

Remote Command	`:CALCulate[1]:MARKer[1]|2|...|4:STATe ON|OFF|1|0` `:CALCulate[1]:MARKer[1]|2|...|4:STATe?`
Example	`CALC:MARK3:STAT ON`
Remote Command Notes	FSE, FSP, FSU, ESU, FSL CALCulate[1]|2:MARKer[1]|2|...|4[:STATe] ON | OFF FSV CALCulate[1]|2:MARKer[1]|2|...|16[:STATe] ON | OFF FSW CALCulate[1]|2|...|16:MARKer[1]|2|...|16[:STATe] ON | OFF
Preset	OFF
State Saved	Saved in instrument state.

10.3.10.2 CALCulate:MARKer:AOFF

Turns off all active markers.

All delta markers are turned off.

All active marker and delta marker measurement functions are turned off.

Remote Command	`:CALCulate[1]:MARKer[1]|2|...|4:AOFF`
Example	`CALC:MARK:AOFF`
Remote Command Notes	FSE, FSP, FSU, ESU, FSL CALCulate[1]|2:MARKer[1]|2|...|4:AOFF

	FSV CALCulate[1]|2:MARKer[1]|2|...|16:AOFF FSW CALCulate[1]|2|...|16:MARKer[1]|2|...|16:AOFF

10.3.10.3 CALCulate:MARKer:TRACe

The command assigns the specified marker to the trace defined by the command parameter.

If required, the corresponding marker is turned on.

The query returns the current assignment.

Remote Command	`:CALCulate[1]:MARKer[1]|2|...|4:TRACe 1|2|3` `:CALCulate[1]:MARKer[1]|2|...|4:TRACe?`
Example	`CALC:MARK:TRAC 2`
Remote Command Notes	FSE CALCulate[1]|2:MARKer[1]|2|...|4:TRACe 1|2|3|4 FSP, FSU, ESU CALCulate[1]|2:MARKer[1]|2|...|4:TRACe 1|2|3 FSL CALCulate[1]|2:MARKer[1]|2|...|4:TRACe 1|2|3|4|5|6 FSV CALCulate[1]|2:MARKer[1]|2|...|16:TRACe 1|2|3|4|5|6 FSW CALCulate[1]|2|...|16:MARKer[1]|2|...|16:TRACe 1|2|3|4|5|6
Preset	1
Min	1
Max	3

10.3.10.4 CALCulate:MARKer:X

The command places the selected marker at the indicated frequency, time, or level (for APD or CCDF measurements).

If marker 2, 3 or 4 is selected and used as delta marker, it is switched to marker mode.

The query returns the current value of this setting.

Remote Command	`:CALCulate[1]:MARKer[1]|2|...|4:X <freq>|<time>` `:CALCulate[1]:MARKer[1]|2|...|4:X?`

Example	`CALC:MARK:X 1000000000` `CALC:MARK:X?`
Remote Command Notes	FSE, FSP, FSU, ESU, FSL CALCulate[1]|2:MARKer[1]|2|...|4:X 0 to MAX (frequency | sweep time) FSV CALCulate[1]|2:MARKer[1]|2|...|16:X 0 to MAX (frequency | sweep time) FSW CALCulate[1]|2|...|16:MARKer[1]|2|...|16:X <numeric_value>

10.3.10.5 CALCulate:MARKer:X:SLIMits[:STATe]

The command switches the search range limits on or off.

For this command, the numeric suffix after MARKer is ignored.

If time domain power measurement is active, this command limits the evaluation range on the trace.

The query returns the current state of this setting.

Remote Command	`:CALCulate[1]:MARKer[1]|2|...|4:X:SLIMits[:STATe] ON|OFF|1|0` `:CALCulate[1]:MARKer[1]|2|...|4:X:SLIMits[:STATe]?`
Example	`CALC:MARK:X:SLIM:STAT ON`
Remote Command Notes	FSE, FSP, FSU, ESU, FSL CALCulate[1]|2:MARKer[1]|2|...|4:X:SLIMits[:STATe] ON | OFF FSV CALCulate[1]|2:MARKer[1]|2|...|16:X:SLIMits[:STATe] ON | OFF FSW CALCulate[1]|2|...|16:MARKer[1]|2|...|16:X:SLIMits[:STATe] ON | OFF
Preset	OFF
State Saved	Saved in instrument state.

10.3.10.6 CALCulate:MARKer:X:SLIMits:LEFT

The command sets the left limit of the search range for markers and delta markers.

The query returns the current value of this setting.

Remote Command	`:CALCulate[1]:MARKer[1]|2|...|4:X:SLIMits:LEFT <freq>|<time>` `:CALCulate[1]:MARKer[1]|2|...|4:X:SLIMits:LEFT?`
Example	`CALC:MARK:X:SLIM:LEFT 1MHZ` `CALC:MARK:X:SLIM:LEFT?`
Remote	FSP, FSU, ESU, FSL

Command Notes	CALCulate[1]|2:MARKer[1]|2|...|4:X:SLIMits:LEFT 0 to MAX (frequency | sweep time) FSV CALCulate[1]|2:MARKer[1]|2|...|16:X:SLIMits:LEFT 0 to MAX (frequency | sweep time) FSW CALCulate[1]|2|...|16:MARKer[1]|2|...|16:X:SLIMits:LEFT 0 to MAX (frequency | sweep time)

10.3.10.7 CALCulate:MARKer:X:SLIMits:RIGHT

The command sets the right limit of the search range for markers and delta markers.

The query returns the current value of this setting.

Remote Command	`:CALCulate[1]:MARKer[1]|2|...|4:X:SLIMits:RIGHt <freq> | <time>` `:CALCulate[1]:MARKer[1]|2|...|4:X:SLIMits:RIGHt?`
Example	`CALC:MARK:X:SLIM:RIGH 1MHZ` `CALC:MARK:X:SLIM:RIGH?`
Remote Command Notes	FSP, FSU, ESU, FSL CALCulate[1]|2:MARKer[1]|2|...|4:X:SLIMits:RIGHT 0 to MAX (frequency | sweep time) FSV CALCulate[1]|2:MARKer[1]|2|...|16:X:SLIMits:RIGHT 0 to MAX (frequency | sweep time) FSW CALCulate[1]|2|...|16:MARKer[1]|2|...|16:X:SLIMits:RIGHT 0 to MAX (frequency | sweep time)

10.3.10.8 CALCulate:MARKer:COUNt

The command switches on or off operation of the frequency counter at the marker position.

The query returns the current state of this setting.

Remote Command	`:CALCulate[1]:MARKer[1]|2|...|4:COUNt ON|OFF|1|0` `:CALCulate[1]:MARKer[1]|2|...|4:COUNt?`
Example	`CALC:MARK:COUN ON`
Remote Command Notes	FSE, FSP, FSU, ESU, FSL CALCulate[1]|2:MARKer[1]|2|...|4:COUNt ON | OFF FSV CALCulate[1]|2:MARKer[1]|2|...|16:COUNt ON | OFF FSW CALCulate[1]|2|...|16:MARKer[1]|2|...|16:COUNt ON | OFF
Preset	OFF

10.3.10.9 CALCulate:MARKer:COUNt:RESolution

The command specifies the resolution of the frequency counter.

This mode supports the following resolutions: 1 | 10 | 100 | 1000| 10000 | 100000 | 1000000 Hz.

The query returns the current value of this setting.

Remote Command	`:CALCulate[1]:MARKer[1]|2|...|4:COUNt:RESolution <freq>` `:CALCulate[1]:MARKer[1]|2|...|4:COUNt:RESolution?`
Example	`CALC:MARK:COUN:RES 1kHZ` `CALC:MARK:COUN:RES?`
Remote Command Notes	FSE, FSP, FSU, ESU, FSL CALCulate[1]|2:MARKer[1]|2|...|4:COUNt:RESolution 0.1 | 1 | 10 | 100 | 1000 | 10000 Hz FSV CALCulate[1]|2:MARKer[1]|2|...|16:COUNt:RESolution 0.001 | 0.01 | 0.1 | 1 | 10 | 100 | 1000 | 10000 Hz FSW CALCulate[1]|2|...|16:MARKer[1]|2|...|16:COUNt:RESolution 0.001 | 0.01 | 0.1 | 1 | 10 | 100 | 1000 | 10000 Hz
Preset	1KHZ
Min	1
Max	1MHz

10.3.10.10 CALCulate:MARKer:COUNt:FREQuency?

Queries the frequency counter result for the specified marker.

Remote Command	`:CALCulate[1]:MARKer[1]|2|...|4:COUNt:FREQuency?`
Example	`CALC:MARK:COUN:FREQ?`
Remote Command Notes	FSE, FSP, FSU, ESU, FSL :CALCulate[1]|2:MARKer[1]|2|...|4:COUNt:FREQuency? FSV :CALCulate[1]|2:MARKer[1]|2|...|16:COUNt:FREQuency? FSW :CALCulate[1]|2|...|16:MARKer[1]|2|...|16:COUNt:FREQuency?

10.3.10.11 CALCulate:MARKer:LOEXclude

The command switches local oscillator suppression for peak search on or off.

This setting is valid for all markers and delta markers.

The query returns the current state of this setting.

The numeric suffix after MARKer is irrelevant.

Remote Command	:CALCulate[1]:MARKer[1]|2|...|4:LOEXclude ON|OFF|1|0 :CALCulate[1]:MARKer[1]|2|...|4:LOEXclude?
Example	CALC:MARK:LOEX ON
Remote Command Notes	FSE, FSP, FSU, ESU, FSL CALCulate[1]|2:MARKer[1]|2|...|4:LOEXclude ON | OFF FSV CALCulate[1]|2:MARKer[1]|2|...|16:LOEXclude ON | OFF FSW CALCulate[1]|2|...|16:MARKer[1]|2|...|16:LOEXclude ON | OFF
Preset	ON
State Saved	Saved in instrument state.

10.3.10.12 CALCulate:MARKer:Y?

Queries the measured value of the specified marker.

If required, the marker is activated, or switched to marker mode.

Remote Command	:CALCulate[1]:MARKer[1]|2|...|4:Y?
Example	CALC:MARK2:Y 1
Remote Command Notes	FSE, FSP, FSU, ESU, FSL CALCulate[1]|2:MARKer[1]|2|...|4:Y? FSV CALCulate[1]|2:MARKer[1]|2|...|16:Y? FSW CALCulate[1]|2|...|16:MARKer[1]|2|...|16:Y?

10.3.10.13 CALCulate:MARKer:Y:PERCent

This command positions the selected marker in the selected window to the given probability. If marker 2, 3 or 4 is selected and used as a delta marker, it is switched to marker mode.

This command is accepted, but takes no action and reports no error.

Remote Command	:CALCulate[1]:MARKer[1]|2|...|4:Y:PERCent <float> :CALCulate[1]:MARKer[1]|2|...|4:Y:PERCent?
Example	CALC:MARK2:Y:PERC 95PCT
Remote Command Notes	FSP, FSU, ESU, FSL CALCulate[1]|2:MARKer[1]|2|...|4:Y:PERCent 0 to100 FSV

	CALCulate[1]|2:MARKer[1]|2|...|16:Y:PERCent 0 to100 FSW CALCulate[1]|2|...|16:MARKer[1]|2|...|16:Y:PERCent 0 to100
Min	0
Max	100

10.3.10.14 CALCulate:MARKer:MAXimum[:PEAK]

Places the delta marker at the current maximum on the measured curve. If required, the delta marker is first activated.

This command is an event, and therefore has no *RST value and no query.

Remote Command	`:CALCulate[1]:MARKer[1]|2|...|4:MAXimum[:PEAK]`
Example	`CALC:MARK:MAX`
Remote Command Notes	FSE, FSP, FSU, ESU, FSL CALCulate[1]|2:MARKer[1]|2|...|4:MAXimum[:PEAK] FSV CALCulate[1]|2:MARKer[1]|2|...|16:MAXimum[:PEAK] FSW CALCulate[1]|2|...|16:MARKer[1]|2|...|16:MAXimum[:PEAK]

10.3.10.15 CALCulate:MARKer:MAXimum:NEXT

Places the marker at the next smaller maximum value of the corresponding trace.

Remote Command	`:CALCulate[1]:MARKer[1]|2|...|4:MAXimum:NEXT`
Example	`CALC:MARK:MAX:NEXT`
Remote Command Notes	FSE, FSP, FSU, ESU, FSL CALCulate[1]|2:MARKer[1]|2|...|4:MAXimum:NEXT FSV CALCulate[1]|2:MARKer[1]|2|...|16:MAXimum:NEXT FSW CALCulate[1]|2|...|16:MARKer[1]|2|...|16:MAXimum:NEXT

10.3.10.16 CALCulate:MARKer:MAXimum:LEFT

Places the marker at the next smaller maximum to the left of the current value (that is, in order of decreasing X values) on the trace.

Remote Command	`:CALCulate[1]:MARKer[1]|2|...|4:MAXimum:LEFT`
Example	`CALC:MARK:MAX:LEFT`

Remote Command Notes	FSE, FSP, FSU, ESU, FSL CALCulate[1]|2:MARKer[1]|2|...|4:MAXimum:LEFT FSV CALCulate[1]|2:MARKer[1]|2|...|16:MAXimum:LEFT FSW CALCulate[1]|2|...|16:MARKer[1]|2|...|16:MAXimum:LEFT

10.3.10.17 CALCulate:MARKer:MAXimum:RIGHt

Places the delta marker at the next smaller maximum to the right of the current value (that is, in order of increasing X values). If required, the corresponding delta marker is first activated.

This command is an event, and therefore has no *RST value and no query.

Remote Command	`CALCulate[1]:MARKer[1]|2|...|4:MINimum:RIGHt`
Example	`CALC:MARK:MIN:RIGH`
Remote Command Notes	FSE, FSP, FSU, ESU, FSL CALCulate[1]|2:MARKer[1]|2|...|4:MAXimum:RIGHt FSV CALCulate[1]|2:MARKer[1]|2|...|16:MAXimum:RIGHt FSW CALCulate[1]|2|...|16:MARKer[1]|2|...|16:MAXimum:RIGHt

10.3.10.18 CALCulate:MARKer:MAXimum:AUTO

For marker 1, the command switches on or off operation of automatic maximum peak search at the end of each sweep.

The marker search limit settings are taken into account.

For this command, the numeric suffix of MARKer is ignored.

The query returns the current state of this setting.

Remote Command	`:CALCulate[1]:MARKer[1]|2|...|4:MAXimum:AUTO ON|OFF|1|0` `:CALCulate[1]:MARKer[1]|2|...|4:MAXimum:AUTO?`
Example	`CALC:MARK:MAX:AUTO ON` `CALC:MARK:MAX:AUTO?`
Remote Command Notes	FSU, ESU, FSL CALCulate[1]|2:MARKer[1]|2|...|4:MAXimum:AUTO ON | OFF FSV CALCulate[1]|2:MARKer[1]|2|...|16:MAXimum:AUTO ON | OFF

	FSW CALCulate[1]|2|...|16:MARKer[1]|2|...|16:MAXimum:AUTO ON | OFF
Preset	OFF
State Saved	Saved in instrument state.

10.3.10.19 CALCulate:MARKer:MINimum:AUTO

For marker 1, the command switches on or off operation of automatic minimum peak search at the end of each sweep.

The marker search limit settings are taken into account.

For this command, the numeric suffix of MARKer is ignored.

The query returns the current state of this setting.

Remote Command	`:CALCulate[1]:MARKer[1]|2|...|4:MINimum:AUTO ON|OFF|1|0` `:CALCulate[1]:MARKer[1]|2|...|4:MINimum:AUTO?`
Example	`CALC:MARK:MIN:AUTO ON` `CALC:MARK:MIN:AUTO?`
Remote Command Notes	FSU, ESU, FSL CALCulate[1]|2:MARKer[1]|2|...|4:MINimum:AUTO ON | OFF FSV CALCulate[1]|2:MARKer[1]|2|...|16:MINimum:AUTO ON | OFF FSW CALCulate[1]|2|...|16:MARKer[1]|2|...|16:MINimum:AUTO ON | OFF
Preset	OFF
State Saved	Saved in instrument state.

10.3.10.20 CALCulate:MARKer:MINimum[:PEAK]

Places the delta marker at the current maximum on the trace.

If required, the corresponding delta marker is first activated.

This command is an event, and therefore has no *RST value and no query.

Remote Command	`:CALCulate[1]:MARKer[1]|2|...|4:MINimum [:PEAK]`
Example	`CALC:MARK:MIN`
Remote Command Notes	FSE, FSP, FSU, ESU, FSL CALCulate[1]|2:MARKer[1]|2|...|4:MINimum[:PEAK] FSV CALCulate[1]|2:MARKer[1]|2|...|16:MINimum[:PEAK] FSW CALCulate[1]|2|...|16:MARKer[1]|2|...|16:MINimum[:PEAK]

10.3.10.21 CALCulate:MARKer:MINimum:NEXT

Places the marker at the next smaller maximum of the corresponding trace.

Remote Command	`:CALCulate[1]:MARKer[1]|2|...|4:MINimum:NEXT`
Example	`CALC:MARK:MIN:NEXT`
Remote Command Notes	FSE, FSP, FSU, ESU, FSL CALCulate[1]|2:MARKer[1]|2|...|4:MINimum:NEXT FSV CALCulate[1]|2:MARKer[1]|2|...|16:MINimum:NEXT FSW CALCulate[1]|2|...|16:MARKer[1]|2|...|16:MINimum:NEXT

10.3.10.22 CALCulate:MARKer:MINimum:RIGHt

Places the delta marker at the next smaller maximum to the right of the current value (that is, in order of increasing X values).

If required, the corresponding delta marker is first activated.

This command is an event, and therefore has no *RST value and no query.

Remote Command	`CALCulate[1]:MARKer[1]|2|...|4:MAXimum:RIGHt`
Example	`CALC:MARK:MAX:RIGH`
Remote Command Notes	FSE, FSP, FSU, ESU, FSL CALCulate[1]|2:MARKer[1]|2|...|4:MINimum:RIGHt FSV CALCulate[1]|2:MARKer[1]|2|...|16:MINimum:RIGHt FSW CALCulate[1]|2|...|16:MARKer[1]|2|...|16:MINimum:RIGHt

10.3.10.23 CALCulate:MARKer:MINimum:LEFT

Places the marker at the next smaller maximum to the left of the current value (that is, in order of decreasing X values) on the trace.

Remote Command	`:CALCulate[1]:MARKer[1]|2|...|4:MINimum:LEFT`
Example	`CALC:MARK:MIN:LEFT`
Remote Command Notes	FSE, FSP, FSU, ESU, FSL CALCulate[1]|2:MARKer[1]|2|...|4:MINimum:LEFT FSV CALCulate[1]|2:MARKer[1]|2|...|16:MINimum:LEFT

	FSW CALCulate[1]|2|...|16:MARKer[1]|2|...|16:MINimum:LEFT

10.3.10.24 CALCulate:MARKer:PEXCursion

The command specifies the peak excursion.

This mode supports only dB units.

The query returns the current value of this setting.

Remote Command	`:CALCulate[1]:MARKer[1]|2|...|4:PEXCursion <rel_ampl>` `:CALCulate[1]:MARKer[1]|2|...|4:PEXCursion?`
Example	`CALC:MARK:PEXC 10dB`
Remote Command Notes	FSE, FSP, FSU, ESU, FSL CALCulate[1]|2:MARKer[1]|2|...|4:PEXCursion <numeric_value> FSV CALCulate[1]|2:MARKer[1]|2|...|16:PEXCursion <numeric_value> FSW CALCulate[1]|2|...|16:MARKer[1]|2|...|16:PEXCursion <numeric_value>
Preset	6dB
State Saved	Saved in instrument state.

10.3.11 CALCulate:MARKer:FUNCtion Subsystem

10.3.11.1 CALCulate:MARKer:FUNCtion Subsystem

10.3.11.2 CALCulate:MARKer:FUNCtion:CENTer

This command sets the center frequency of the selected measurement window equal to the frequency of the indicated marker.

If marker 2, 3 or 4 is selected and used as delta marker, it is switched to the marker mode.

Remote Command	`:CALCulate[1]:MARKer[1]|2|...|4:FUNCtion:CENTer`
Example	`CALC:MARK:FUNC:CENT`
Remote Command Notes	FSE, FSP, FSU, ESU, FSL CALCulate[1]|2:MARKer[1]|2|...|4:FUNCtion:CENTer FSV CALCulate[1]|2:MARKer[1]|2|...|16:FUNCtion:CENTer FSW CALCulate[1]|2|...|16:MARKer[1]|2|...|16:FUNCtion:CENTer

10.3.11.3 CALCulate:MARKer:FUNCtion:CSTep

This command sets the step width of the center frequency in the selected measurement window to the X value of the current marker. If marker 2, 3 or 4 is selected and used as delta marker, it is

switched to the marker mode.

Remote Command	`:CALCulate[1]:MARKer[1]|2|...|4:FUNCtion:CSTep`
Example	`CALC:MARK:FUNC:CST`
Remote Command Notes	FSE, FSP, FSU, ESU, FSL CALCulate[1]|2:MARKer[1]|2|...|4:FUNCtion:CSTep FSV CALCulate[1]|2:MARKer[1]|2|...|16:FUNCtion:CSTep FSW CALCulate[1]|2|...|16:MARKer[1]|2|...|16:FUNCtion:CSTep

10.3.11.4 CALCulate:MARKer:FUNCtion:FPEaks[:IMMediate]

This command searches the selected trace for the indicated number of maxima. The results are entered in a list and can be queried with commands CALC:MARK:FUNC:FPEaks:X? and CALC:MARK:FUNC:FPEaks:Y?. The number of maxima foand can be queried with CALC:MARK:FUNC:FPEaks:COUNt?. The trace to be examined is selected with CALC:MARK:TRACe. The order of the results in the list can be defined with CALC:MARK:FUNC:FPEaks:SORT.

NOTE

The number of maxima foand depends on the waveform and value set for the Peak Excursion parameter (CALC:MARK:PEXC), however, a maximum number of 50 maxima are determined. Only the signals which exceed their surroanding values at least by the value indicated by the peak excursion parameter will be recognized as maxima. Therefore, the number of maxima foand is not automatically the same as the number of maxima desired.

Remote Command	`:CALCulate[1]:MARKer[1]|2|...|4:FUNCtion:FPEaks[:IMMediate] <int>` `:CALCulate[1]:MARKer[1]|2|...|4:FUNCtion:FPEaks[:IMMediate]?`
Example	`CALC:MARK:FUNC:FPE 5`
Remote Command Notes	FSP, FSU, ESU CALCulate[1]|2:MARKer[1]|2|...|4:FUNCtion:FPEaks[:IMMediate] 0 to 50 FSL CALCulate[1]|2:MARKer[1]|2|...|4:FUNCtion:FPEaks[:IMMediate] 0 to 200 FSV CALCulate[1]|2:MARKer[1]|2|...|16:FUNCtion:FPEaks[:IMMediate] 0 to 200

	FSW CALCulate[1]|2|...|16:MARKer[1]|2|...|16:FUNCtion:FPEaks[:IMMediate] 0 to 200
Preset	0

10.3.11.5 CALCulate:MARKer:FUNCtion:FPEaks:COUNt?

This query reads out the number of maxima foand during the search. If no search for maxima has been performed, 0 is returned.

Remote Command	`:CALCulate[1]:MARKer[1]|2|...|4:FUNCtion:FPEaks:COUNt?`
Example	`CALC:MARK:FUNC:FPE:COUN?`
Remote Command Notes	FSP, FSU, ESU, FSL CALCulate[1]|2:MARKer[1]|2|...|4:FUNCtion:FPEaks:COUNt? FSV CALCulate[1]|2:MARKer[1]|2|...|16:FUNCtion:FPEaks:COUNt? FSW CALCulate[1]|2|...\16:MARKer[1]|2|...|16:FUNCtion:FPEaks:COUNt?

10.3.11.6 CALCulate:MARKer:FUNCtion:FPEaks:X?

This query reads out the list of X values of the maxima foand. The number of available values can be queried with CALC:MARK:FUNC:FPEaks:COUNt?.

With sort mode X, the X values are in increasing order; with sort mode Y the order corresponds to the decreasing order of the Y values.

Remote Command	`:CALCulate[1]:MARKer[1]|2|...|4:FUNCtion:FPEaks:X?`
Example	`CALC:MARK:FUNC:FPE:X?`
Remote Command Notes	FSP, FSU, ESU, FSL CALCulate[1]|2:MARKer[1]|2|...|4:FUNCtion:FPEaks:X? FSV CALCulate[1]|2:MARKer[1]|2|...|16:FUNCtion:FPEaks:X? FSW CALCulate[1]|2|...\16:MARKer[1]|2|...|16:FUNCtion:FPEaks:X?

10.3.11.7 CALCulate:MARKer:FUNCtion:FPEaks:Y?

This query reads out the list of X values of the maxima foand. The number of available values can be queried with CALC:MARK:FUNC:FPEaks:COUNt?.

With sort mode X, the X values are in increasing order; with sort mode Y the order corresponds to the decreasing order of the Y values.

Remote Command	`:CALCulate[1]:MARKer[1]|2|...|4:FUNCtion:FPEaks:Y?`
Example	`CALC:MARK:FUNC:FPE:Y?`
Remote Command Notes	FSP, FSU, ESU, FSL CALCulate[1]|2:MARKer[1]|2|...|4:FUNCtion:FPEaks:Y? FSV CALCulate[1]|2:MARKer[1]|2|...|16:FUNCtion:FPEaks:Y? FSW CALCulate[1]|2|...|16:MARKer[1]|2|...|16:FUNCtion:FPEaks:Y?

10.3.11.8 CALCulate:MARKer:FUNCtion:FPEaks:SORT

This command sets the sort mode for the search for maxima:

X the maxima are sorted in the list of responses according to increasing X values

Y the maxima are sorted in the list of responses according to decreasing Y values

Remote Command	`:CALCulate[1]:MARKer[1]|2|...|4:FUNCtion:FPEaks:SORT X|Y` `:CALCulate[1]:MARKer[1]|2|...|4:FUNCtion:FPEaks:SORT?`
Example	`CALC:MARK:FUNC:FPE:SORT X` `CALC:MARK:FUNC:FPE:SORT?`
Remote Command Notes	FSP, FSU, ESU, FSL CALCulate[1]|2:MARKer[1]|2|...|4:FUNCtion:FPEaks:SORT X | Y FSV CALCulate[1]|2:MARKer[1]|2|...|16:FUNCtion:FPEaks:SORT X | Y FSW CALCulate[1]|2|...|16:MARKer[1]|2|...|16:FUNCtion:FPEaks:SORT X | Y

10.3.11.9 CALCulate:MARKer:FUNCtion:SUMMary:RMS[:STATe]

This command switches on or off the measurement of the effective (RMS) power in the selected measurement window. If necessary the function is switched on previously.

The function is independent of the marker selection, i.e. the numeric suffix of MARKer is irrelevant. It is only available in the time domain (span = 0).

Remote Command	`:CALCulate[1]:MARKer[1]|2|...|4:FUNCtion:SUMMary:RMS[:STATe] ON | OFF | 1 | 0` `:CALCulate[1]:MARKer[1]|2|...|4:FUNCtion:SUMMary:RMS[:STATe]?`
Example	`CALC:MARK:FUNC:SUMM:RMS ON` `CALC:MARK:FUNC:SUMM:RMS?`

Remote Command Notes	FSE, FSP, FSU, ESU, FSL CALCulate[1]|2:MARKer[1]|2|...|4:FUNCtion:SUMMary:RMS[:STATe] ON | OFF FSV CALCulate[1]|2:MARKer[1]|2|...|4:FUNCtion:SUMMary:RMS[:STATe] ON | OFF FSW CALCulate[1]|2|...|16:MARKer[1]|2|...|4:FUNCtion:SUMMary:RMS[:STATe] ON | OFF
Preset	OFF
State Saved	Saved in instrument state.

10.3.11.10 CALCulate:MARKer:FUNCtion:SUMMary:RMS:RESult?

This command queries the result of the measurement of the RMS power value in the selected measurement window.

The function is independent of the marker selection, i.e. the numeric suffix of :MARKer is irrelevant. It is only available in the time domain (span = 0).

A complete sweep with synchronization to sweep end must be performed between switching on the function and querying the measured value to obtain a valid query result. This is only possible in single sweep mode.

Remote Command	`:CALCulate[1]:MARKer[1]|2|...|4:FUNCtion:SUMMary:RMS:RESult?`
Example	`CALC:MARK:FUNC:SUMM:RMS:RES?`
Remote Command Notes	FSE, FSP, FSU, ESU, FSL CALCulate[1]|2:MARKer[1]|2|...|4:FUNCtion:SUMMary:RMS:RESult? FSV CALCulate[1]|2:MARKer[1]|2|...|16:FUNCtion:SUMMary:RMS:RESult? FSW CALCulate[1]|2|...|16:MARKer[1]|2|...|16:FUNCtion:SUMMary:RMS:RESult?

10.3.11.11 CALCulate:MARKer:FUNCtion:NOISe[:STATe]

The command switches noise measurement on or off for all markers.

The noise power density is measured at the marker positions. The result may be queried using CALCulate:MARKer:FUNCtion:NOISe:RESult?.

The query returns the current state of this setting.

Remote Command	`:CALCulate[1]:MARKer[1]|2|...|4:FUNCtion:NOISe[:STATe] ON | OFF | 1 | 0` `:CALCulate[1]:DELTamarker[1]|2|...|4:FUNCtion:NOISe[:STATe]?`
Example	`CALC:MARK:FUNC:NOIS ON`
Remote Command Notes	FSE, FSP, FSU, ESU, FSL CALCulate[1]|2:MARKer[1]|2|...|4:FUNCtion:NOISe[:STATe] ON | OFF

	FSV CALCulate[1]|2:MARKer[1]|2|...|16:FUNCtion:NOISe[:STATe] ON | OFF FSW CALCulate[1]|2|...|16:MARKer[1]|2|...|16:FUNCtion:NOISe[:STATe] ON | OFF
Preset	OFF
State Saved	Saved in instrument state.

10.3.11.12 CALCulate:MARKer:FUNCtion:NOISe:RESult?

Queries the noise measurement result.

To obtain a valid result, a complete sweep must be performed after switching on the function, but before querying the measured value. This is possible only in Single sweep mode.

Remote Command	`:CALCulate[1]:MARKer[1]|2|...|4:FUNCtion:NOISe:RESult?`
Example	`CALC:MARK:FUNC:NOIS:RES?`
Remote Command Notes	FSE, FSP, FSU, ESU, FSL CALCulate[1]|2:MARKer[1]|2|...|4:FUNCtion:NOISe:RESult? FSV CALCulate[1]|2:MARKer[1]|2|...|16:FUNCtion:NOISe:RESult? FSW CALCulate[1]|2|...\16:MARKer[1]|2|...|16:FUNCtion:NOISe:RESult?

10.3.12 CALCulate:MARKer:FUNCtion:REFerence

Sets the reference level to the power measured by the specified marker.

If marker 2, 3 or 4 is selected, and used as delta marker, it is switched to marker mode.

This command is an event, and therefore has neither *RST value nor query.

The value of the numeric suffix [1]|2|3|4 is ignored.

Remote Command	`:CALCulate[1]:MARKer[1]|2|...|4:FUNCtion:REFerence`
Example	`CALC:MARK:FUNC:REF`
Remote Command Notes	FSE, FSP, FSU, ESU, FSL CALCulate[1]|2:MARKer[1]|2|...|4:FUNCtion:REFerence FSV CALCulate[1]|2:MARKer[1]|2|...|16:FUNCtion:REFerence FSW CALCulate[1]|2|...\16:MARKer[1]|2|...|16:FUNCtion:REFerence

10.3.12.1 CALCulate:MARKer:FUNCtion:POWer Subsystem

The CALCulate:MARKer:FUNCtion:POWER subsystem includes commands for control of power measurement.

10.3.12.2 CALCulate:MARKer:FUNCtion:POWer:SELect

Selects and activates the specified power measurement type.

This mode supports: ACPower, MCACpower, CPOWer, OBANdwidth and OBWidth.

Remote Command	`CALCulate[1]:MARKer[1]|2|...|4:FUNCtion:POWer:SELect ACPower | CPOWer | MCACpower | OBANdwidth | OBWidth | CN | CN0`
Example	`CALC:MARK:FUNC:POW:SEL OBW`
Remote Command Notes	FSE, FSP, FSU, ESU, FSL CALCulate[1]|2:MARKer[1]|2|...|4:FUNCtion:POWer:SELect ACPower | CPOWer | MCACpower | OBANdwidth | OBWidth | CN | CN0 FSV CALCulate[1]|2:MARKer[1]|2|...|16:FUNCtion:POWer:SELect ACPower | CPOWer | MCACpower | OBANdwidth | OBWidth | CN | CN0 FSW CALCulate[1]|2|...|16:MARKer[1]|2|...|16:FUNCtion:POWer:SELect ACPower | CPOWer | MCACpower | OBANdwidth | OBWidth | CN | CN0

10.3.12.3 CALCulate:MARKer:FUNCtion:POWer:RESult:PHZ

The command switches the query response for power measurement results between absolute values (OFF) and output referred to measurement bandwidth (ON).

The query returns the current state of this setting.

Remote Command	`:CALCulate[1]:MARKer[1]|2|...|4:FUNCtion:POWer:RESult:PHZ ON | OFF | 1 | 0` `:CALCulate[1]:MARKer[1]|2|...|4:FUNCtion:POWer:RESult:PHZ?`
Example	`CALC:MARK:FUNC:POW:RES:PHZ OFF` `CALC:MARK:FUNC:POW:RES:PHZ?`
Remote Command Notes	FSP, FSU, ESU, FSL CALCulate[1]|2:MARKer[1]|2|...|4:FUNCtion:POWer:RESult:PHZ ON | OFF FSV CALCulate[1]|2:MARKer[1]|2|...|16:FUNCtion:POWer:RESult:PHZ ON | OFF FSW CALCulate[1]|2|...|16:MARKer[1]|2|...|16:FUNCtion:POWer:RESult:PHZ ON | OFF

Preset	OFF
State Saved	Saved in instrument state.

10.3.13 CALCulate:STATistics Subsystem

The CALCulate:STATistics subsystem controls the statistical measurement functionality.

10.3.13.1 CALCulate:STATistics:APD[:STATe]

This command is accepted, but takes no action and reports no error.

Remote Command	`:CALCulate:STATistics:APD:STATe ON|OFF|1|0` `:CALCulate:STATistics:APD:STATe?`
Example	`CALC:STAT:APD:STAT ON`
Remote Command Notes	FSP, FSU, ESU, FSL, FSV CALCulate[1]|2:STATistics:APD[:STATe] ON | OFF FSW CALCulate[1]|2|...|16:STATistics:APD[:STATe] ON | OFF
Preset	OFF
State Saved	Saved in instrument state.

10.3.13.2 CALCulate:STATistics:CCDF[:STATe]

The command activates or deactivates measurement of the complementary cumulative distribution function (CCDF).

When this function is activated, the APD measurement is turned off.

The query returns the current state of this setting.

Remote Command	`:CALCulate:STATistics:CCDF:STATe ON|OFF|1|0` `:CALCulate:STATistics:CCDF:STATe?`
Example	`CALC:STAT:CCDF:STAT ON`
Remote Command Notes	FSP, FSU, ESU, FSL, FSV CALCulate[1]|2:STATistics:CCDF[:STATe] ON | OFF FSW CALCulate[1]|2|...|16:STATistics:CCDF[:STATe] ON | OFF
Preset	OFF
State Saved	Saved in instrument state.

10.3.13.3 CALCulate:STATistics:CCDF:X?

Queries the level values for the probabilities 0.01%, 0.1%, 1% and 10%.

Remote Command	`CALCulate:STATistics:CCDF:X[1]|2|3? P0_01|P0_1|P1|P10`
Example	`CALC:STAT:CCDF:X? P10`
Remote Command Notes	FSU, ESU CALCulate[1]|2:STATistics:CCDF:X[1]|2|3? P0_01 | P0_1 | P1 | P10 FSV CALCulate[1]|2:STATistics:CCDF:X[1]|2|...|6? P0_01 | P0_1 | P1 | P10 FSW CALCulate[1]|2|...\16:STATistics:CCDF:X[1]|2|...|6? P0_01 | P0_1 | P1 | P10

10.3.13.4 CALCulate:STATistics:NSAMples

The command specifies the number of measurement points to be acquired for the statistical measurement functions.

The minimum value supported by this mode is 1000.

The query returns the current value of this setting.

Remote Command	`:CALCulate[1]:STATistics:NSAMples <int>` `:CALCulate[1]:STATistics:NSAMples?`
Example	`CALC:STAT:NSAM 100000` `CALC:STAT:NSAM?`
Remote Command Notes	FSP, FSU, ESU, FSL, FSV CALCulate[1]|2:STATistics:NSAMples 100 to 1E9 FSW CALCulate[1]|2|...|16:STATistics:NSAMples 100 to 1E9
Preset	100000
State Saved	Saved in instrument state.
Min	1000
Max	1E9

10.3.13.5 CALCulate:STATistics:SCALe:AUTO

This command is accepted, but takes no action and reports no error.

Remote Command	`:CALCulate[1]:STATistics:SCALe:AUTO ONCE`
Example	`CALC:STAT:SCAL:AUTO ONCE`

Remote Command Notes	FSP, FSU, ESU, FSL, FSV CALCulate[1]|2:STATistics:SCALe:AUTO ONCE FSW CALCulate[1]|2|...|16:STATistics:SCALe:AUTO ONCE

10.3.13.6 CALCulate:STATistics:SCALe:X:RLEVel

Specifies the reference level for the X-axis of the measurement display. The setting is identical to the reference level setting using the command DISPlay:WINDow:TRACe:Y: RLEVel.

This command is accepted, but takes no action and reports no error.

Remote Command	`:CALCulate[1]:STATistics:SCALe:X:RLEVel < ampl>` `:CALCulate[1]:STATistics:SCALe:X:RLEVel?`
Example	`CALC:STAT:SCAL:X:RLEV -60dBm` `CALC:STAT:SCAL:X:RLEV?`
Remote Command Notes	FSP, FSU, ESU CALCulate[1]|2:STATistics:SCALe:X:RLEVel -130dBm to 30dBm FSL, FSV CALCulate[1]|2:STATistics:SCALe:X:RLEVel -120dBm to 20dBm FSW CALCulate[1]|2|...|16:STATistics:SCALe:X:RLEVel -130dBm to 30dBm
Preset	-20dBm
State Saved	Saved in instrument state.
Min	-130
Max	30

10.3.13.7 CALCulate:STATistics:SCALe:X:RANGe

Specifies the level range for the X-axis of the measurement display. The setting is identical to the level range setting defined with the command DISPlay:WINDow:TRACe:Y:SCALe.

This command is accepted, but takes no action and reports no error.

Remote Command	`:CALCulate[1]:STATistics:SCALe:X:RANGe <rel_ampl>` `:CALCulate[1]:STATistics:SCALe:X:RANGe?`
Example	`CALC:STAT:SCAL:X:RANG 20dB` `CALC:STAT:SCAL:X:RANG?`
Remote Command Notes	FSP, FSL, FSV

	CALCulate[1]|2:STATistics:SCALe:X:RANGe 10dB to 200dB FSU, ESU CALCulate[1]|2:STATistics:SCALe:X:RANGe 1dB to 200dB FSW CALCulate[1]|2|...|16:STATistics:SCALe:X:RANGe 1dB to 200dB
Preset	100dB
State Saved	Saved in instrument state.
Min	10
Max	200

10.3.13.8 CALCulate:STATistics:SCALe:Y:UPPer

Specifies the upper limit for the Y-axis of the display, in statistical measurements. Since probabilities are specified on the Y axis, the entered numerical values are dimensionless.

This command is accepted, but takes no action and reports no error.

Remote Command	`:CALCulate[1]:STATistics:SCALe:Y:UPPer <real>` `:CALCulate[1]:STATistics:SCALe:Y:UPPer?`
Example	`CALC:STAT:SCAL:Y:UPP 0.01` `CALC:STAT:SCAL:Y:UPP?`
Remote Command Notes	FSP, FSU, ESU, FSL, FSV CALCulate[1]|2:STATistics:SCALe:Y:UPPer 1E-8 to 1.0 FSW CALCulate[1]|2|...|16:STATistics:SCALe:Y:UPPer 1E-5 to 1.0
Preset	1.0
State Saved	Saved in instrument state.
Min	1e-8
Max	1.0

10.3.13.9 CALCulate:STATistics:SCALe:Y:LOWer

Specifies the lower limit for the Y-axis of the display, in statistical measurements. Since probabilities are specified on the Y axis, the entered numerical values are dimensionless.

This command is accepted, but takes no action and reports no error.

Remote Command	`:CALCulate[1]:STATistics:SCALe:Y:LOWer <real>` `:CALCulate[1]:STATistics:SCALe:Y:LOWer?`
Example	`CALC:STAT:SCAL:Y:LOW 0.001`

	CALC:STAT:SCAL:Y:LOW?
Remote Command Notes	FSP, FSU, ESU, FSL, FSV CALCulate[1]|2:STATistics:SCALe:Y:LOWer 1E-9 to 0.1 FSW CALCulate[1]|2|...|16:STATistics:SCALe:Y:LOWer 1E-9 to 0.1
Preset	1e-6
State Saved	Saved in instrument state.
Min	1e-9
Max	0.1

10.3.13.10 CALCulate:STATistics:PRESet

Resets the scaling of the X- and Y-axes in a statistical measurement. The following values are set:

This command is accepted, but takes no action and reports no error.

Remote Command	:CALCulate[1]:STATistics:PRESet
Example	CALC:STAT:PRES
Remote Command Notes	FSP, FSU, ESU, FSL, FSV CALCulate[1]|2:STATistics:PRESet FSW CALCulate[1]|2|...|16:STATistics:PRESet

10.3.13.11 CALCulate:STATistics:RESult?

Queries the results of statistical measurements of a recorded trace.

Currently, only TRACE1 is valid for CCDF measurements.

Remote Command	CALCulate:STATistics:RESult? MEAN|PEAK|CFACtor|ALL
Example	CALC:STAT:RES? ALL
Remote Command Notes	FSP, FSU, ESU, FSL CALCulate[1]|2:STATistics:RESult[1]|2|3? MEAN | PEAK | CFACtor | ALL FSV CALCulate[1]|2:STATistics:RESult[1]|2|...|6? MEAN | PEAK | CFACtor | ALL FSW CALCulate[1]|2|...|16:STATistics:RESult[1]|2|...|6? MEAN | PEAK | CFACtor | ALL

10.3.14 CALCulate:THReshold Subsystem

The CALCulate:THReshold subsystem controls the threshold value for maximum/minimum marker searches.

10.3.14.1 CALCulate:DLINe

Specifies the position of Display Line 1 or 2. These lines enable the user to mark any levels in the diagram. The unit depends on the setting made with CALC:UNIT.

This command is accepted, but takes no action and reports no error.

Remote Command	`:CALCulate[1]:DLINe[1]|2 <ampl>` `:CALCulate[1]:DLINe[1]|2?`
Example	`CALC:DLIN -20DBM`
Remote Command Notes	FSE, FSP, FSU, ESU, FSL, FSV CALCulate[1]|2:DLINe[1]|2 MINimum to MAXimum (depending on current unit) FSW CALCulate[1]|2|...|16:DLINe[1]|2 MINimum to MAXimum (depending on current unit)
State Saved	Saved in instrument state.

10.3.14.2 CALCulate:DLINe:STATe

The command turns Display Line 1 or 2 (level lines) on or off.

The query returns the current state of this setting.

Remote Command	`:CALCulate[1]:DLINe[1]|2:STATe ON|OFF|1|0` `:CALCulate[1]:DLINe[1]|2:STATe?`
Example	`CALC:DLIN:STAT ON`
Remote Command Notes	FSE, FSP, FSU, ESU, FSL, FSV CALCulate[1]|2:DLINe[1]|2:STATe ON | OFF FSW CALCulate[1]|2|...|16:DLINe[1]|2:STATe ON | OFF
Preset	OFF
State Saved	Saved in instrument state.

10.3.14.3 CALCulate:THReshold

The command specifies the threshold value for the maximum/minimum search of markers with marker search functions MAX PEAK, NEXT PEAK, etc.

The associated display line is automatically turned on.

The query returns the current value of this setting.

Remote Command	`:CALCulate[1]:THReshold <ampl>` `:CALCulate[1]:THReshold?`
Example	`CALC:THR -82DBM`
Remote Command Notes	FSE, FSP, FSU, ESU, FSL, FSV CALCulate[1]|2:THReshold MINimum to MAXimum (depending on current unit) FSW CALCulate[1]|2|...|16:THReshold MINimum to MAXimum (depending on current unit)
State Saved	Saved in instrument state.

10.3.14.4 CALCulate:THReshold:STATe

The command turns the threshold line on or off.

The unit depends on the setting performed by CALC:UNIT.

The query returns the current state of this setting.

Remote Command	`:CALCulate[1]:THReshold:STATe ON|OFF|1|0` `:CALCulate[1]:THReshold:STATe?`
Example	`CALC:THR:STAT ON`
Remote Command Notes	FSE, FSP, FSU, ESU, FSL, FSV CALCulate[1]|2:THReshold:STATe ON | OFF FSW CALCulate[1]|2|...|16:THReshold:STATe ON | OFF
Preset	OFF
State Saved	Saved in instrument state.

10.3.14.5 CALCulate:FLINe

Specifies the position of the frequency lines.

This command is accepted, but takes no action and reports no error.

Remote Command	`:CALCulate[1]:FLINe[1]|2 <freq>` `:CALCulate[1]:FLINe[1]|2?`
Example	`CALC:FLIN 120MHz`
Remote Command Notes	FSE, FSP, FSU, ESU, FSL, FSV CALCulate[1]|2:FLINe[1]|2 0 to fmax FSW CALCulate[1]|2|...|16:FLINe[1]|2 0 to fmax
State Saved	Saved in instrument state.

10.3.14.6 CALCulate:FLINe:STATe

Switches the frequency line on or off.

This command is accepted, but takes no action and reports no error.

Remote Command	`:CALCulate[1]:FLINe[1]|2:STATe ON|OFF|1|0` `:CALCulate[1]:FLINe[1]|2:STATe?`
Example	`CALC:FLIN:STAT ON`
Remote Command Notes	FSE, FSP, FSU, ESU, FSL, FSV CALCulate[1]|2:FLINe[1]|2:STATe ON | OFF FSW CALCulate[1]|2|...|16:FLINe[1]|2:STATe ON | OFF
Preset	OFF
State Saved	Saved in instrument state.

10.3.14.7 CALCulate:TLINe

Specifies the position of the time lines.

This command is accepted, but takes no action and reports no error.

Remote Command	`:CALCulate[1]:TLINe[1]|2 <time>` `:CALCulate[1]:TLINe[1]|2?`
Example	`CALC:TLIN 10ms`
Remote Command Notes	FSE, FSP, FSU, ESU, FSL CALCulate[1]|2:TLINe[1]|2 0 to 1000s FSV CALCulate[1]|2:TLINe[1]|2 0 to 30000000000s FSW CALCulate[1]|2|...|16:TLINe[1]|2 0 to 1600s
State Saved	Saved in instrument state.

10.3.14.8 CALCulate:TLINe:STATe

Switches the time line on or off.

This command is accepted, but takes no action and reports no error.

Remote Command	`:CALCulate[1]:TLINe[1]|2:STATe ON|OFF|1|0` `:CALCulate[1]:TLINe[1]|2:STATe?`
Example	`CALC:TLIN:STAT ON`

Remote Command Notes	FSE, FSP, FSU, ESU, FSL, FSV CALCulate[1]|2:TLINe[1]|2:STATe ON | OFF FSW CALCulate[1]|2|…|16:TLINe[1]|2:STATe ON | OFF
Preset	OFF
State Saved	Saved in instrument state.

10.3.15 CALCulate:UNIT Subsystem

The CALCulate:UNIT subsystem specifies the units for power measurement settings.

10.3.15.1 CALCulate:UNIT:POWer

The command selects the power units.

This mode supports the following unit parameters: DBM | DBUV | DBMV | DBPW | DBUA | V | A | W.

The query returns the current unit selection.

Remote Command	`:CALCulate[1]:UNIT:POWer DBM|DBUV|DBMV|DBPW|DBUA|V|A|W` `:CALCulate[1]:UNIT:POWer?`
Example	`CALC:UNIT:POW DBM`
Remote Command Notes	FSE CALCulate[1]|2:UNIT:POWer DBM | V | W | DB | PCT | DBPT | UNITLESS | DBPW | WATT | DBUV | DBMV | VOLT | DBUA | AMPere | DBUV_MHZ |DBMV_MHZ| DBUA_MHZ | DBUV_M | DBUA_M |DBUV_MMHZ | DBUA_MMHZ FSP CALCulate[1]|2:UNIT:POWer DBM | V | A | W | DB | PCT | UNITLESS | DBPW | WATT | DBUV | DBMV | VOLT | DBUA | AMPere FSU, ESU CALCulate[1]|2:UNIT:POWer DBM | V | A | W | DBPW | WATT | DBUV | DBMV | VOLT | DBUA | AMPere | DBPT | DBUV_M | DBUA_M FSL CALCulate[1]|2:UNIT:POWer DBM | V | A | W | DBPW | WATT | DBPT | DBUV | DBMV | VOLT | DBUA | AMPere FSV CALCulate[1]|2:UNIT:POWer DBM | V | A | W | DBPW | WATT | DBUV | DBMV | VOLT | DBUA | AMPere FSW CALCulate[1]|2|…|16:UNIT:POWer DBM | V | A | W | DBPW | WATT | DBUV | DBMV | VOLT | DBUA | AMPere

Preset	DBM
State Saved	Saved in instrument state.
Range	DBM | DBUV | DBMV | DBPW | DBUA | V | A | W

dBm

Sets the unit for the selected amplitude scale (log/lin) to dBm.

dBpW

Sets the unit for the selected amplitude scale (log/lin) to dBpW.

dBmV

Sets the unit for the selected amplitude scale (log/lin) to dBmV.

W

Sets the unit for the selected amplitude scale (log/lin) to Watt.

V

Sets the unit for the selected amplitude scale (log/lin) to Volt.

A

Sets the unit for the selected amplitude scale (log/lin) to Ampere.

dBμV

Sets the unit for the selected amplitude scale (log/lin) to dBμV.

dBμA

Sets the unit for the selected amplitude scale (log/lin) to dBμA.

10.3.16 CALibration Subsystem

The CALibration subsystem specifies the data for system error correction.

10.3.16.1 CALibration[:ALL]?

Initiates the acquisition of system error correction data.

If the acquisition was successful, "0" is returned.

Remote Command	`:CALibration[:ALL]?`
Example	`:CAL?`
Remote Command Notes	FSE, FSP, FSU, ESU, FSL, FSV, FSW CALibration[:ALL]?

10.3.16.2 CALibration:STATe

Specifies whether the current calibration data is to be taken into account by the instrument (ON) or not (OFF).

Remote Command	`:CALibration:STATe ON|OFF|1|0`
Example	`CAL:STAT OFF`
Remote Command Notes	FSE, FSP, FSU, ESU, FSL, FSV, FSW CALibration:STATe ON | OFF
Preset	ON
State Saved	No

10.3.17 DISPlay Subsystem

The DISPLay subsystem commands control the selection and presentation of textual and graphical information and measurement data.

This mode does not support the screen display function. All DISPlay-related SCPI commands are accepted, but take no action and report no error.

10.3.17.1 DISPlay:FORMat

Switches the measurement result display between FULL SCREEN and SPLIT SCREEN.

This command is accepted, but takes no action and reports no error.

Remote Command	`:DISPlay:FORMat SINGle|SPLit` `:DISPlay:FORMat?`
Example	`DISP:FORM SING`
Remote Command Notes	FSE, FSP, FSU, ESU, FSL, FSV, FSW DISPlay:FORMat SINGle | SPLit

Preset	SINGle
State Saved	Saved in instrument state.
Range	SINGle|SPLit

10.3.17.2 DISPlay:ANNotation:FREQuency

Switches X-axis annotation on or off.

This command is accepted, but takes no action and reports no error.

Remote Command	`:DISPlay:ANNotation:FREQuency ON|OFF|1|0` `:DISPlay:ANNotation:FREQuency?`
Example	`DISP:ANN:FREQ OFF` `DISP:ANN:FREQ?`
Remote Command Notes	FSE, FSP, FSU, ESU, FSL, FSV, FSW DISPlay:ANNotation:FREQuency ON | OFF
Preset	ON
State Saved	Saved in instrument state.

10.3.17.3 DISPlay:LOGO

Switches the on-screen company logo on or off.

This command is accepted, but takes no action and reports no error.

Remote Command	`:DISPlay:LOGO ON|OFF|1|0` `:DISPlay:LOGO?`
Example	`DISP:LOGO OFF` `DISP:LOGO?`
Remote Command Notes	FSE, FSP, FSU, ESU, FSL, FSV, FSW DISPlay:LOGO ON | OFF
Preset	ON
State Saved	Saved in instrument state.

10.3.17.4 DISPlay:PSAVe[:STATe]

Switches the display power-save mode on or off.

This command is accepted, but takes no action and reports no error.

Remote Command	`:DISPlay:PSAVe[:STATe] ON|OFF|1|0` `:DISPlay:PSAVe[:STATe]?`

Example	`DISP:PSAV OFF` `DISP:PSAV?`
Remote Command Notes	FSE, FSP, FSU, ESU, FSL, FSV, FSW DISPlay:PSAVe[:STATe] ON | OFF
Preset	OFF
State Saved	Saved in instrument state.

10.3.17.5 DISPlay:PSAVe:HOLDoff

Specifies the holdoff time for the display's power-save mode.

This command is accepted, but takes no action and reports no error.

Remote Command	`:DISPlay:PSAVe:HOLDoff <int>` `:DISPlay:PSAVe:HOLDoff?`
Example	`DISP:PSAV:HOLD 30` `DISP:PSAV:HOLD?`
Remote Command Notes	FSE DISPlay: PSAVe:HOLDoff <1|...|100> FSP, FSU, ESU, FSL, FSV DISPlay: PSAVe:HOLDoff <1|...|60>
Preset	FSE 1 FSP, FSU, ESU, FSL, FSV 15
Min	1
Max	60

10.3.17.6 DISPlay:CMAP:DEFault

Resets the display's screen colors to their defaults.

This command is accepted, but takes no action and reports no error.

Remote Command	`:DISPlay:CMAP [1]|2|...|12|13|14|15|16|17|18|19|20|21|22|23|24|25|26:DEFault[1] | 2`
Example	`DISP:CMAP:DEF`
Remote Command Notes	FSE DISPlay:CMAP[1]|2|...|13:DEFault FSP, FSU, ESU, FSL DISPlay:CMAP[1]|2|...|26:DEFault[1]|2

	FSV DISPlay:CMAP[1]|2|...|41:DEFault[1]|2 FSW DISPlay:CMAP[1]|2|...|41:DEFault[1]|2|...|4

10.3.17.7 DISPlay:CMAP:HSL

Defines the instrument’s color map.

This command is accepted, but takes no action and reports no error.

Remote Command	`:DISPlay:CMAP[1]|2|...|12|13|14|15|16|17|18|19|20|21|22|23|24|25|26:HSL <real>,<real>,<real>` `:DISPlay:CMAP[1]|2|...|12|13|14|15|16|17|18|19|20|21|22|23|24|25|26:HSL?`
Example	`DISP:CMAP:HSL 0.3,0.8,1.0` `DISP:CMAP:HSL?`
Remote Command Notes	FSE DISPlay:CMAP[1]|2|...|13:HSL < 0.0 to 1.0>,< 0.0 to 1.0>,< 0.0 to 1.0> FSP, FSU, ESU, FSL DISPlay:CMAP[1]|2|...|26:HSL < 0.0 to 1.0>,< 0.0 to 1.0>,< 0.0 to 1.0> FSV, FSW DISPlay:CMAP[1]|2|...|41:HSL < 0.0 to 1.0>,< 0.0 to 1.0>,< 0.0 to 1.0>
State Saved	Saved in instrument state.

10.3.17.8 DISPlay:CMAP:PDEFined

Specifies predefined color values for the instrument’s color map.

This command is accepted, but takes no action and reports no error.

Remote Command	`:DISPlay:CMAP [1]|2|...|12|13|14|15|16|17|18|19|20|21|22|23|24|25|26:PDEFined BLACk | BLUE | BROWn | GREen | CYAN | RED | MAGenta | YELLow | WHITe | DGRAy | LGRAy | LBLUe | LGREen | LCYan | LRED | LMAGenta` `:DISPlay:CMAP [1]|2|...|12|13|14|15|16|17|18|19|20|21|22|23|24|25|26:PDEFined?`
Example	`DISP:CMAP:PDEF BLAC` `DISP:CMAP:PDEF?`
Remote Command Notes	FSE, DISPlay:CMAP[1]|2|...|13:PDEFined BLACk | BLUE | BROWn | GREen | CYAN | RED | MAGenta | YELLow |WHITe | DGRay | LGRay | LBLue | LGReen | LCYan |LRED | LMAGenta FSP, FSU, ESU, FSL DISPlay:CMAP[1]|2|...|26:PDEFined BLACk | BLUE | BROWn | GREen | CYAN | RED | MAGenta | YELLow |

	WHITe | DGRAy | LGRAy | LBLUe | LGREen | LCYan | LRED | LMAGenta FSV, FSW DISPlay:CMAP[1]|2|…|41:PDEFined BLACk | BLUE | BROWn | GREen | CYAN | RED | MAGenta | YELLow | WHITe | DGRAy | LGRAy | LBLUe | LGREen | LCYan | LRED | LMAGenta
State Saved	Saved in instrument state.
Range	BLACk | BLUE | BROWn | GREen | CYAN | RED | MAGenta | YELLow | WHITe | DGRAy | LGRAy | LBLUe | LGREen | LCYan | LRED | LMAGenta

10.3.17.9 DISPlay[:WINDow]:SELect

This command is accepted, but takes no action and reports no error.

Remote Command	`:DISPlay:WINDow[1]:SELect`
Example	`DISP:WIND:SEL`
Remote Command Notes	FSE, FSP, FSU, ESU DISPlay[:WINDow[1]|2]:SELect FSV DISPlay[:WINDow[1]|2|…|4]:SELect FSW DISPlay[:WINDow[1]|2|…|16]:SELect
Backwards Compatibility SCPI	`:DISPlay:SELect`

10.3.17.10 DISPlay[:WINDow]:SIZE

Switches the measurement window between full screen and half screen.

This command is accepted, but takes no action and reports no error.

Remote Command	`:DISPlay:WINDow[1]:SIZE LARGe|SMALl` `:DISPlay:WINDow[1]:TRACe[1]|2|3:MODE?`
Example	`DISP:WIND:SIZE LARG` `DISP:WIND:SIZE?`
Remote Command Notes	FSU, ESU, FSL, FSV DISPlay[:WINDow[1]|2]:SIZE LARGe | SMALl FSW DISPlay[:WINDow[1]|2|…|16]:SIZE LARGe | SMALl
Preset	SMALl
State Saved	Saved in instrument state.
Range	LARGe | SMALl
Backwards Compatibility SCPI	`:DISPlay:SIZE`

10.3.17.11 DISPlay[:WINDow]:TEXT[:DATA]

Specifies a comment (max. 20 characters) that can be displayed on the screen.

This command is accepted, but takes no action and reports no error.

Remote Command	`:DISPlay:WINDow[1]:TEXT[:DATA] <string>` `:DISPlay:WINDow[1]:TEXT[:DATA]?`
Example	`DISP:WIND:TEXT:DATA "123"` `DISP:WIND:TEXT:DATA?`
Remote Command Notes	FSE, FSP, FSU, ESU, FSL, FSV DISPlay[:WINDow[1]|2]:TEXT[:DATA] <string>
Preset	""
State Saved	Saved in instrument state.
Backwards Compatibility SCPI	`:DISPlay:TEXT[:DATA]`

10.3.17.12 DISPlay[:WINDow]:TEXT:STATe

Switches display of the comment (screen title) on or off.

This command is accepted, but takes no action and reports no error.

Remote Command	`:DISPlay:WINDow[1]:TEXT :STATe ON|OFF|1|0` `:DISPlay:WINDow[1]:TEXT :STATe?`
Example	`DISP:WIND:TEXT:STAT ON` `DISP:WIND:TEXT:STAT?`
Remote Command Notes	FSE, FSP, FSU, ESU, FSL, FSV DISPlay[:WINDow[1]|2]:TEXT:STATe ON | OFF
Preset	OFF
State Saved	Saved in instrument state.
Backwards Compatibility SCPI	`:DISPlay:TEXT:STATe`

10.3.17.13 DISPlay[:WINDow]:TIME

Switches on-screen display of date and time on or off.

This command is accepted, but takes no action and reports no error.

Remote Command	`:DISPlay:WINDow[1]:TIME ON|OFF|1|0`

	`:DISPlay:WINDow[1]:TIME?`
Example	`DISP:WIND:TIME ON` `DISP:WIND:TIME?`
Remote Command Notes	FSE, FSP, FSU, ESU, FSL, FSV DISPlay[:WINDow[1]|2]:TIME ON | OFF
Preset	OFF
State Saved	Saved in instrument state.
Backwards Compatibility SCPI	`:DISPlay:TIME`

10.3.17.14 DISPlay[:WINDow]:TRACe:Y[:SCALe]

The command specifies the display range of the Y-axis (level axis) with logarithmic scaling (DISP:TRAC:Y:SPAC LOG).

The query returns the current value of this setting.

Remote Command	`DISPlay:WINDow[1]:TRACe[1]|2|3:Y[:SCALe] <rel_ampl>` `DISPlay:WINDow[1]:TRACe[1]|2|3:Y[:SCALe]?`
Example	`DISP:WIND:TRAC:Y 20dB` `DISP:WIND:TRAC:Y?`
Remote Command Notes	FSE, DISPlay[:WINDow[1]|2]:TRACe[1]|2|...|4:Y[:SCALe] 10dB to 200dB FSP, FSU, ESU DISPlay[:WINDow[1]|2]:TRACe[1]|2|3:Y[:SCALe] 10dB to 200dB FSL, FSV DISPlay[:WINDow[1]|2]:TRACe[1]|2|...|6:Y[:SCALe] 10dB to 200dB FSW DISPlay[:WINDow[1]|2|...|16]:TRACe[1]|2|...|6:Y[:SCALe] 1dB to 200dB
Preset	100dB
Min	10dB
Max	200dB
Backwards Compatibility SCPI	`:DISPlay[1]:TRACe[1]|2|3:Y[:SCALe]`

10.3.17.15 DISPlay[:WINDow]:TRACe:Y[:SCALe]:MODE

Specifies the scale type of the Y-axis (absolute or relative).

This command is accepted, but takes no action and reports no error.

Remote Command	:DISPlay:WINDow[1]:TRACe:Y[:SCALe]:MODE ABSolute|RELative :DISPlay:WINDow[1]:TRACe:Y[:SCALe]:MODE?
Example	DISP:WIND:TRAC:Y:MODE ABS DISP:WIND:TRAC:Y:MODE?
Remote Command Notes	FSE, DISPlay[:WINDow[1]|2]:TRACe[1]|2|...|4:Y[:SCALe]:MODE ABSolute | RELative FSP, FSU, ESU DISPlay[:WINDow[1]|2]:TRACe[1]|2|3:Y[:SCALe]:MODE ABSolute | RELative FSL, FSV DISPlay[:WINDow[1]|2]:TRACe[1]|2|...|6:Y[:SCALe]:MODE ABSolute | RELative FSW DISPlay[:WINDow[1]|2|..|16]:TRACe[1]|2|...|6:Y[:SCALe]:MODE ABSolute | RELative
Preset	ABS
State Saved	Saved in instrument state.
Range	ABSolute | RELative
Backwards Compatibility SCPI	:DISPlay[1]:TRACe[1]|2|3:Y[:SCALe]:MODE

10.3.17.16 DISPlay[:WINDow]:TRACe:Y[:SCALe]:RLEVel

The command specifies the reference level.

The query returns the current value of this setting.

Remote Command	:DISPlay:WINDow[1]:TRACe[1]|2|3:Y[:SCALe]:RLEVel <ampl> :DISPlay:WINDow[1]:TRACe[1]|2|3:Y[:SCALe]:RLEVel?
Example	DISP:TRAC:Y:RLEV 20dBm
Remote Command Notes	FSE DISPlay[:WINDow[1]|2]:TRACe[1]|2|...|4:Y[:SCALe]:RLEVel -200dBm to 200dBm FSP, FSU, ESU DISPlay[:WINDow[1]|2]:TRACe[1]|2|3:Y[:SCALe]:RLEVel -130dBm to 30dBm FSL, FSV DISPlay[:WINDow[1]|2]:TRACe[1]|2|...|6:Y[:SCALe]:RLEVel <numeric_value> in dBm FSW DISPlay[:WINDow[1]|2|...|16]:TRACe[1]|2|...|6:Y[:SCALe]:RLEVel <numeric_value> in dBm
Preset	FSE, FSP,FSU, ESU, FSL -20 dBm FSV -10dBm

State Saved	Saved in instrument state.
Min	-130 dBm
Max	30 dBm
Backwards Compatibility SCPI	`:DISPlay:TRACe[1]|2|3:Y[:SCALe]:RLEVel`

10.3.17.17 DISPlay[:WINDow]:TRACe:Y[:SCALe]:RLEVel:OFFSet

The command specifies the offset of the reference level.

The query returns the current value of this setting.

Remote Command	`:DISPlay:WINDow[1]:TRACe[1]|2|3:Y[:SCALe]:RLEVel:OFFSet <rel_ampl>` `:DISPlay:WINDow[1]:TRACe[1]|2|3:Y[:SCALe]:RLEVel:OFFSet?`
Example	`DISP:TRAC:Y:RLEV:OFFS -10dB`
Remote Command Notes	FSE, DISPlay[:WINDow[1]|2]:TRACe[1]|2|...|4:Y[:SCALe]:RLEVel:OFFSet -200dB to 200dB FSP, FSU, ESU DISPlay[:WINDow[1]|2]:TRACe[1]|2|3:Y[:SCALe]:RLEVel:OFFSet -200dB to 200dB FSL, FSV DISPlay[:WINDow[1]|2]:TRACe[1]|2|...|6:Y[:SCALe]:RLEVel:OFFSet -200dB to 200dB FSW DISPlay[:WINDow[1]|2|...|16]:TRACe[1]|2|...|6:Y[:SCALe]:RLEVel:OFFSet -200dB to 200dB
Preset	0 dB
State Saved	Saved in instrument state.
Min	-200.0 dB
Max	200 dB
Backwards Compatibility SCPI	`:DISPlay:TRACe[1]|2|3:Y[:SCALe]:RLEVel:OFFSet`

DISPlay[:WINDow]:TRACe:Y[:SCALe]:PDIVision

The command specifies the scaling of the Y-axis, using the currently-selected unit.

This mode supports only dB units.

The query returns the current value of this setting.

Remote Command	`DISPlay:WINDow[1]:TRACe:Y[:SCALe]:PDIVision <rel_ampl>` `DISPlay:WINDow[1]:TRACe:Y[:SCALe]:PDIVision?`
Example	`DISP:WIND:TRAC:Y:PDIV 5` `DISP:WIND:TRAC:Y:PDIV?`

Remote Command Notes	FSE DISPlay[:WINDow[1]|2]:TRACe[1]|2|...|4:Y[:SCALe]:PDIVision <numeric_value> FSP DISPlay[:WINDow[1]|2]:TRACe[1]|2|3:Y[:SCALe]:PDIVision <numeric_value> FSW DISPlay[:WINDow[1]|2|...|16]:TRACe[1]|2|...|16:Y[:SCALe]:PDIVision <numeric_value>
State Saved	Saved in instrument state.
Backwards Compatibility SCPI	`:DISPlay[1]:TRACe[1]|2|3:Y[:SCALe]:PDIVision`

10.3.17.18 DISPlay[:WINDow]:TRACe:Y:SPACing

The command switches between linear and logarithmic display.

This mode does not support the parameter option LDB.

The query returns the current state of this setting.

Remote Command	`:DISPlay:WINDow[1]:TRACe[1]|2|3:Y:SPACing LINear|LOGarithmic` `:DISPlay:WINDow[1]:TRACe[1]|2|3:Y:SPACing?`
Example	`DISP:WIND:TRAC:Y:SPAC LOG` `DISP:WIND:TRAC:Y:SPAC?`
Remote Command Notes	FSE, DISPlay[:WINDow[1]|2]:TRACe[1]|2|...|4:Y:SPACing LINear | LOGarithmic | PERCent FSP DISPlay[:WINDow[1]|2]:TRACe[1]|2|3:Y:SPACing LINear | LOGarithmic FSU, ESU DISPlay[:WINDow[1]|2]:TRACe[1]|2|3:Y:SPACing LINear | LOGarithmic | LDB FSL, FSV DISPlay[:WINDow[1]|2]:TRACe[1]|2|...|6:Y:SPACing LINear | LOGarithmic | LDB FSW DISPlay[:WINDow[1]|2|...|16]:TRACe[1]|2|...|6:Y:SPACing LINear | LOGarithmic | LDB | PERCent
Preset	LOG
State Saved	Saved in instrument state.
Backwards Compatibility SCPI	`:DISPlay[1]:TRACe[1]|2|3:Y:SPACing`

10.3.17.19 DISPlay[:WINDow]:TRACe:MODE

The command specifies the display type and evaluation mode for the specified trace.

The query returns the current state of this setting for the specified trace.

Remote Command	`:DISPlay:WINDow[1]:TRACe[1]|2|3:MODE WRITe | VIEW | AVERage | MAXHold | MINHold` `:DISPlay:WINDow[1]:TRACe[1]|2|3:MODE?`
Example	`DISP:WIND1:TRAC:MODE WRIT`
Remote Command Notes	FSE DISPlay[:WINDow[1]|2]:TRACe[1]|2|...|4:MODE WRITe | VIEW | AVERage | MAXHold | MINHold FSP, FSU, ESU DISPlay[:WINDow[1]|2]:TRACe[1]|2|3:MODE WRITe | VIEW | AVERage | MAXHold | MINHold FSL, FSV DISPlay[:WINDow[1]|2]:TRACe[1]|2|...|6:MODE WRITe | VIEW | AVERage | MAXHold | MINHold | RMS FSW DISPlay[:WINDow[1]|2|...|16]:TRACe[1]|2|...|6:MODE WRITe | VIEW | AVERage | MAXHold | MINHold | BLANk
Preset	WRITe
State Saved	Saved in instrument state.
Range	WRITe | VIEW | AVERage | MAXHold | MINHold
Backwards Compatibility SCPI	`:DISPlay:TRACe[1]|2|3:MODE`

10.3.17.20 DISPlay[:WINDow]:TRACe[:STATe]

The command switches on or off display of the corresponding trace.

The query returns the current state of this setting.

Remote Command	`:DISPlay[1]:WINDow[1]:TRACe[1]|2|3[:STATe] ON|OFF|1|0` `:DISPlay[1]:WINDow[1]:TRACe[1]|2|3[:STATe]?`
Example	`DISP:TRAC1 ON`
Remote Command Notes	FSE, DISPlay[:WINDow[1]|2]:TRACe[1]|2|...|4[:STATe] ON | OFF FSP, FSU, ESU DISPlay[:WINDow[1]|2]:TRACe[1]|2|3[:STATe] ON | OFF FSL, FSV DISPlay[:WINDow[1]|2]:TRACe[1]|2|...|6[:STATe] ON | OFF FSW DISPlay[:WINDow[1]|2|...|16]:TRACe[1]|2|...|6[:STATe] ON | OFF
Preset	ON for Trace 1, OFF for the others
State Saved	Saved in instrument state.
Backwards Compatibility SCPI	`:DISPlay[1]:TRACe[1]|2|3[:STATe]`

10.3.18 FORMat Subsystem

The FORMat subsystem specifies the format of data transmitted from and received by the instrument.

10.3.18.1 FORMat[:DATA]

The command specifies the format for data transmitted from the instrument to a control PC.

This command is specific to X-Series analyzers.

The query returns the current state of this setting.

Remote Command	`:FORMat[:DATA] ASCii|INTeger,32|REAL,32|REAL|64` `:FORMat[:DATA]?`
Example	`FORM REAL,32` `FORM ASC`
Remote Command Notes	FSE FORMat[:DATA] ASCii | REAL | UINT[,32] FSP, FSU, ESU FORMat[:DATA] ASCii | REAL| UINT[,8|32] FSL FORMat[:DATA] ASCii | REAL| UINT | MATLAB[,8|32] FSV FORMat[:DATA] ASCii | REAL,32 FSW FORMat[:DATA] ASCii | REAL,16|32|64
Preset	ASCii

10.3.19 HCOPy Subsystem

The HCOPy subsystem controls the rendering of display information on output devices or to files.

Most of the HCOPy subsystem SCPI commands are accepted, but take no action and report no error. There are two exceptions: HCOPy:ABORt and HCOPy[:IMMediate].

10.3.19.1 HCOPy:ABORt

Aborts hardcopy output.

Remote Command	`:HCOPy:ABORt`
Example	`HCOP:ABOR`
Remote Command Notes	FSE, FSP, FSU, ESU, FSL, FSV, FSW HCOPy:ABORt

10.3.19.2 HCOPy:CMAP:DEFault

This command is accepted, but takes no action and reports no error.

Remote Command	`:HCOPy:CMAP[1]|2|...|12|13|14|15|16|17|18|19|20|21|22|23|24|25|26:DEFault [1] | 2 | 3`
Example	`HCOP:CMAP:DEF`
Remote Command Notes	FSP, FSU, ESU, FSL HCOPy:CMAP[1]|2|...|26:DEFault1|2|3 FSL HCOPy:CMAP[1]|2|...|26:DEFault1|2|3|4 FSV, FSW HCOPy:CMAP[1]|2|...|41:DEFault1|2|3|4

10.3.19.3 HCOPy:CMAP:HSL

This command is accepted, but takes no action and reports no error.

Remote Command	`:HCOPy:CMAP[1]|2|...|12|13|14|15|16|17|18|19|20|21|22|23|24|25|26:HSL <real>,<real>,<real>` `:HCOPy:CMAP[1]|2|...|12|13|14|15|16|17|18|19|20|21|22|23|24|25|26:HSL?`
Example	`HCOP:CMAP:HSL 0.3,0.8,1.0` `HCOP:CMAP:HSL?`
Remote Command Notes	FSP, FSU, ESU, FSL HCOPy:CMAP[1]|2|...|26:HSL <0.0 to 1.0>,<0.0 to 1.0>,<0.0 to 1.0> FSV, FSW HCOPy:CMAP[1]|2|...|41:HSL <0.0 to 1.0>,<0.0 to 1.0>,<0.0 to 1.0>
State Saved	Saved in instrument state.

10.3.19.4 HCOPy:CMAP:PDEFined

This command is accepted, but takes no action and reports no error.

Remote Command	`:HCOPy:CMAP [1]|2|...|12|13|14|15|16|17|18|19|20|21|22|23|24|25|26:PDEFined BLACk | BLUE | BROWn | GREen | CYAN | RED | MAGenta | YELLow | WHITe | DGRAy |`

	`LGRAy | LBLUe | LGREen | LCYan | LRED | LMAGenta` `:HCOPy:CMAP [1]|2|...|12|13|14|15|16|17|18|19|20|21|22|23|24|25|26:PDEFined?`
Example	`HCOP:CMAP:PDEF BLAC` `HCOP:CMAP:PDEF?`
Remote Command Notes	FSP, FSU, ESU, FSL HCOPy:CMAP[1]|2|...|26:PDEFined BLACk | BLUE | BROWn | GREen | CYAN | RED | MAGenta | YELLow | WHITe | DGRAy | LGRAy | LBLUe | LGREen | LCYan | LRED | LMAGenta FSV, FSW HCOPy:CMAP[1]|2|...|41:PDEFined BLACk | BLUE | BROWn | GREen | CYAN | RED | MAGenta | YELLow | WHITe | DGRAy | LGRAy | LBLUe | LGREen | LCYan | LRED | LMAGenta
State Saved	Saved in instrument state.
Range	BLACk | BLUE | BROWn | GREen | CYAN | RED | MAGenta | YELLow | WHITe | DGRAy | LGRAy | LBLUe | LGREen | LCYan | LRED | LMAGenta

10.3.19.5 HCOPy:DESTination

This command is accepted, but takes no action and reports no error.

Remote Command	`:HCOPy:DESTination[1]|2 <string>` `:HCOPy:DESTination[1]|2?`
Example	`HCOP:DEST 'MMEM'` `HCOP:DEST?`
Remote Command Notes	FSE, FSP, FSU, ESU, FSL, FSV, FSW HCOPy:DESTination[1]|2 <string>
State Saved	Saved in instrument state.

10.3.19.6 HCOPy:DEVice:COLor

This command is accepted, but takes no action and reports no error.

Remote Command	`:HCOPy:DEVice:COLor ON|OFF|1|0` `:HCOPy:DEVice:COLor?`
Example	`HCOP:DEV:COL OFF` `HCOP:DEV:COL?`
Remote Command Notes	FSE, FSP, FSU, ESU, FSL, FSV, FSW HCOPy:DEVice:COLor ON | OFF
Preset	OFF
State Saved	Saved in instrument state.

10.3.19.7 HCOPy:DEVice:LANGuage

This command is accepted, but takes no action and reports no error.

Remote Command	`:HCOPy:DEVice:LANGuage[1]|2 GDI|WMF|EWMF|BMP` `:HCOPy:DEVice:LANGuage?`
Example	`HCOP:DEV:LANG GDI` `HCOP:DEV:LANG?`
Remote Command Notes	FSE :HCOPy:DEVice:LANGuage[1]|2 WMF| EWMF | GDI | BMP (FSE with NT controller) :HCOPy:DEVice:LANGuage[1]|2 HPGL | PCL4 | PCL5 | POSTscript | ESCP | WMF| PCX | HP7470 | EPSON24| EPSON24C | PCL4_C | PCL4_C3 | LASERJ | DESKJ | DESKJ_C | DESKJ_C3 | HPGL_LS | HP7470LS FSP, FSU, ESU HCOPy:DEVice:LANGuage[1]|2 GDI | WMF | EWMF | BMP FSL, FSV, FSW HCOPy:DEVice:LANGuage[1]|2 GDI | WMF | EWMF | BMP | JPG | PNG
State Saved	Saved in instrument state.
Range	GDI | WMF | EWMF | BMP

10.3.19.8 HCOPy[:IMMediate]

Initiates hard copy output. The numeric suffix specifies which printer configuration should be used for the output. If there is no suffix, configuration 1 is selected.

Remote Command	`:HCOPy[:IMMediate]`
Example	`HCOP:IMM`
Remote Command Notes	FSE, FSP, FSU, ESU, FSL, FSV, FSW HCOPy[:IMMediate[1]|2]

10.3.19.9 HCOPy:ITEM:ALL

This command is accepted, but takes no action and reports no error.

Remote Command	`:HCOPy:ITEM:ALL`
Example	`HCOP:ITEM:ALL`
Remote Command Notes	FSE, FSP, FSU, ESU, FSL, FSV, FSW HCOPy:ITEM:ALL

10.3.19.10 HCOPy:ITEM:WINDow:TABle:STATe

This command is accepted, but takes no action and reports no error.

Remote Command	`:HCOPy:ITEM:WINDow[1]|2:TABLe:STATe ON|OFF|1|0` `:HCOPy:ITEM:WINDow[1]|2:TABLe:STATe?`
Example	`HCOP:ITEM:WIND:TABL:STAT OFF` `HCOP:ITEM:WIND:TABL:STAT?`
Remote Command Notes	FSE, FSP, FSU, ESU, FSV HCOPy:ITEM:WINDow[1]|2:TABLe:STATe ON | OFF
Preset	OFF
State Saved	Saved in instrument state.

10.3.19.11 HCOPy:ITEM:WINDow:TEXT

This command is accepted, but takes no action and reports no error.

Remote Command	`:HCOPy:ITEM:WINDow[1]|2:TEXT <string>` `:HCOPy:ITEM:WINDow[1]|2:TEXT?`
Example	`HCOP:ITEM:WIND:TEXT 'comment'` `HCOP:ITEM:WIND:TEXT?`
Remote Command Notes	FSE, FSP, FSU, ESU, FSL, FSV, FSW HCOPy:ITEM:WINDow[1]|2:TEXT <string>
State Saved	Saved in instrument state.

10.3.19.12 HCOPy:ITEM:WINDow:TRACe:STATe

This command is accepted, but takes no action and reports no error.

Remote Command	`:HCOPy:ITEM:WINDow[1]|2:TRACe:STATe ON|OFF|1|0` `:HCOPy:ITEM:WINDow[1]|2:TRACe:STATe?`
Example	`HCOP:ITEM:WIND:TRAC:STAT OFF` `HCOP:ITEM:WIND:TRAC:STAT?`
Remote Command Notes	FSE, FSP, FSU, ESU, FSL HCOPy:ITEM:WINDow[1]|2:TRACe:STATe ON | OFF
Preset	OFF
State Saved	Saved in instrument state.

10.3.19.13 HCOPy:PAGE:ORIentation

This command is accepted, but takes no action and reports no error.

Remote Command	`:HCOPy:PAGE:ORIentation[1]|2 LANDscape|PORTrait` `:HCOPy:PAGE:ORIentation[1]|2?`
Example	`HCOP:PAGE:ORI LAND` `HCOP:PAGE:ORI?`
Remote Command Notes	FSE, FSP, FSU, ESU, FSL, FSV HCOPy:PAGE:ORIentation[1]|2 LANDscape | PORTrait
Preset	PORT
State Saved	Saved in instrument state.
Range	LANDscape | PORTrait

10.3.20 INITiate Subsystem

The INITiate subsystem controls the init-measurement function.

10.3.20.1 INITiate:CONTinuous

The command switches the trigger system between the continuously-initiated mode (Continuous) or single measurement mode (Single).

The query returns the current state of this setting.

Remote Command	`:INITiate[1]:CONTinuous ON|OFF|1|0` `:INITiate[1]:CONTinuous?`
Example	`:INIT:CONT 0` `:INIT:CONT 1`
Remote Command Notes	FSE, FSP, FSU, ESU, FSL, FSV INITiate[1]|2:CONTinuous ON | OFF FSW INITiate[1]|2|...|16:CONTinuous ON | OFF
Preset	ON
State Saved	Saved in instrument state.

10.3.20.2 INITiate:CONMeas

In Single sweep mode, this command resumes a stopped measurement from the current position.

Remote Command	`:INITiate[1]:CONMeas`
Example	`INIT:CONM`
Remote Command Notes	FSE, FSP, FSU, ESU, FSL, FSV INITiate[1]|2:CONMeas FSW INITiate[1]|2|...|16:CONMeas

10.3.20.3 INITiate[:IMMediate]

Initiates a new sweep.

Remote Command	`:INITiate[1][:IMMediate]`
Example	`INIT`
Remote Command Notes	FSE, FSP, FSU, ESU, FSL, FSV INITiate[1]|2[:IMMediate] FSW INITiate[1]|2|...|16[:IMMediate]

10.3.21 INPut Subsystem

The INPut subsystem controls the input characteristics of the instrument's RF inputs.

10.3.21.1 INPut:ATTenuation

The command specifies the input attenuator setting.

With the Electronic Attenuator Option, this mode supports 2 dB steps.

The query returns the current value of this setting.

Remote Command	`:INPut[1]:ATTenuation <rel_ampl>` `:INPut[1]:ATTenuation?`
Example	`INP:ATT 40dB`
Remote Command Notes	FSE INPut[1]|2:ATTenuation 0 to 70 dB FSP, FSU, ESU INPut[1]|2:ATTenuation 0 to 70/75 dB FSL, FSV, FSW INPut[1]|2:ATTenuation <numeric_value> in dB
Preset	FSE NA FSP, FSU, ESU, FSV, FSW

	10dB FSL 0dB
State Saved	Saved in instrument state.
Min	0
Max	70

10.3.21.2 INPut:ATTenuation:AUTO

The command switches between coupling of the input attenuation to the reference level (state ON), and manual input attenuation (state OFF).

The query returns the current state of this setting.

Remote Command	`:INPut[1]:ATTenuation:AUTO ON|OFF|1|0` `:INPut[1]:ATTenuation:AUTO?`
Example	`INP:ATT:AUTO ON`
Remote Command Notes	FSE, FSP, FSU, ESU, FSL, FSV, FSW INPut[1]|2:ATTenuation:AUTO ON | OFF
Preset	ON
State Saved	Saved in instrument state.

10.3.21.3 INPut:EATT

The command specifies the setting of the electronic input attenuator.

This mode supports a maximum value of 24 dB.

The query returns the current value of this setting.

Remote Command	`:INPut[1]:EATT <rel_ampl>` `:INPut[1]:EATT?`
Example	`INP:EATT 15dB`
Remote Command Notes	FSP, FSU, ESU INPut[1]|2:EATT 0 to 30dB FSV INPut[1]|2:EATT 0 to 25dB FSW INPut[1]|2:EATT <Attenuation>
Preset	0
State Saved	Saved in instrument state.

Min	0
Max	24

10.3.21.4 INPut:EATT:AUTO

The command switches between coupling of the electronic input attenuation to the reference level (state ON), and manual input attenuation (state OFF).

The query returns the current state of this setting.

Remote Command	`:INPut[1]:EATT:AUTO ON|OFF|1|0` `:INPut[1]:EATT:AUTO?`
Example	`INP:EATT:AUTO ON`
Remote Command Notes	FSP, FSU, ESU, FSV, FSW INPut[1]|2:EATT:AUTO ON | OFF
Preset	ON
State Saved	Saved in instrument state.

10.3.21.5 INPut:EATT:STATe

The command switches electronic input attenuation on or off.

The query returns the current state of this setting.

Remote Command	`:INPut[1]:EATT:STATe ON|OFF|1|0` `:INPut[1]:EATT:STATe?`
Example	`INP:EATT:STAT ON`
Remote Command Notes	FSP, FSU, ESU, FSV, FSW INPut[1]|2:EATT:STATe ON | OFF
Preset	OFF
State Saved	Saved in instrument state.

10.3.21.6 INPut:IMPedance

The command sets the instrument's nominal input impedance.

The query returns the current state of this setting.

Remote Command	`:INPut[1]:IMPedance 50|75` `:INPut[1]:IMPedance?`
Example	`INP:IMP 75` `INP:IMP?`

Remote Command Notes	FSE, FSP, FSU, ESU, FSL, FSV, FSW INPut[1]|2:IMPedance 50 | 75
Preset	50
State Saved	Saved in instrument state.
Range	50 | 75

10.3.21.7 INPut:GAIN:STATe

The command switches the instrument's preamplifier on or off.

The query returns the current state of this setting.

Remote Command	`:INPut[1]:GAIN:STATe ON|OFF|1|0` `:INPut[1]:GAIN:STATe?`
Example	`INP:GAIN:STAT ON`
Remote Command Notes	FSP, FSU, ESU, FSL, FSV, FSW INPut[1]|2:GAIN:STATe ON | OFF
Preset	OFF
State Saved	Saved in instrument state.

10.3.21.8 INPut:MIXer[:POWer]

This command defines the desired power at the input mixer of the R&S FSU/ESU. On any change to the reference level the RF attenuation will be adjusted in a way that makes the difference between reference level and RF attenuation come as close to the desired mixer level as possible.

Currently, this command won't invoke any action.

Remote Command	`:INPut[1]:MIXer[:POWer] <real>` `:INPut[1]:MIXer[:POWer]?`
Example	`INP:MIX -30` `INP:MIX?`
Remote Command Notes	FSU, ESU INPut[1]|2:MIXer[:POWer] <numeric value> Currently, this command won't invoke any action.
Preset	-25 dBm
Min	-100 dBm
Max	5 dBm

10.3.21.9 INPut:MIXer:AUTO

This command enables/disables the automatic setup of the mixer level.

Currently, this command won't invoke any action.

Remote Command	`:INPut[1]:MIXer:AUTO ON|OFF|1|0` `:INPut[1]:MIXer:AUTO?`
Example	`INP:MIX:AUTO ON` `INP:MIX:AUTO?`
Remote Command Notes	FSU, ESU INPut[1]|2:MIXer:AUTO ON | OFF Currently, this command won't invoke any action.
Preset	ON
State Saved	Saved in instrument state.

10.3.22 INSTrument Subsystem

The INSTrument subsystem allows you to select the analyzer's operating mode.

10.3.22.1 INSTrument[:SELect]

The command selects the analyzer's mode according to the value of a text parameter.

This mode supports a parameter set that differs from that listed above. For details, see the table of available parameter values in the section "INSTrument:NSELect" on page 707.

The query returns the current state of this setting.

Remote Command	`:INSTrument[:SELect] <string>` `:INSTrument[:SELect]?`
Example	`:INST:SEL SA`
Remote Command Notes	FSE, FSP, FSU, ESU, FSL, FSV INSTrument[1]|2[:SELect] SANalyzer | ... FSW INSTrument[:SELect] <ChannelType> | <ChannelName>
State Saved	Saved in instrument state.

10.3.22.2 INSTrument:NSELect

The command selects the analyzer's mode according to the value of a numeric parameter.

This mode supports the parameter values listed in the table below.

Mode Identification Numbers and Strings for X-Series Analyzers:

Mode	:INSTrument:NSELect <integer>	:INSTrument[:SELect] <parameter>
Spectrum Analyzer	1	SA
GSM	3	GSM
cdmaOne	4	CDMA
NADC	5	NADC
PDC	6	PDC
I/Q Analyzer (Basic)	8	BASIC
WCDMA with HSDPA/HSUPA	9	WCDMA
cdma2000	10	CDMA2K
GSM/EDGE/EDGE Evo	13	EDGEGSM
Phase Noise	14	PNOISE
1xEV-DO	15	CDMA1XEV
Combined WLAN	19	CWLAN
802.16 OFDMA (WiMAX/WiBro)	75	WIMAXOFDMA
Combined Fixed WiMAX	81	CWIMAXOFDM
Vector Signal Analyzer (VXA)	100	VSA
89601 VSA	101	VSA89601
LTE	102	LTE
iDEN/WiDEN/MotoTalk	103	IDEN
802.16 OFDM (Fixed WiMAX)	104	WIMAXFIXED
LTE TDD	105	LTETDD
TD-SCDMA with HSPA/8PSK	211	TDSCDMA
Noise Figure	219	NFIGURE
Bluetooth	228	BLUETOOTH
Measuring Receiver	233	MRECEIVE
Analog Demod	234	ADEMOD
DVB-T/H	235	DVB
DTMB	236	DTMB
ISDB-T	239	ISDBT
CMMB	240	CMMB

Remote Language Compatibility	266	RLC
SCPI Language Compatibility	270	SCPILC

The query returns the current value of this setting.

Remote Command	`:INSTrument:NSELect <integer>` `:INSTrument:NSELect?`
Example	`:INST:NSEL 1`
Remote Command Notes	FSE, FSP, FSU, ESU, FSL, FSV INSTrument:NSELect <numeric value>
State Saved	Saved in instrument state.

10.3.23 MMEMory Subsystem

The MMEMory (mass memory) subsystem allows access to the analyzer’s storage media, and permits storage of various settings.

10.3.23.1 MMEMory:CATalog?

Reads the content of the specified directory.

Remote Command	`:MMEMory:CATalog <string>` `:MMEMory:CATalog?`
Example	`:MMEM:CAT ‘C:’` `:MMEM:CAT?`
Remote Command Notes	FSE, FSP, FSU, ESU, FSL, FSV,FSW MMEMory:CATalog? <path>
State Saved	Saved in instrument state.

10.3.23.2 MMEMory:CDIRectory

The command changes the current directory to that specified by <directory_name>.

The query returns the current directory setting.

Remote Command	`:MMEMory:CDIRectory <string>` `:MMEMory:CDIRectory?`
Example	`:MMEM:CDIR ‘C:\Temp’` `:MMEM:CDIR?`
Remote Command Notes	FSE, FSP, FSU, ESU, FSL, FSV, FSW MMEMory:CDIRectory <directory_name>

State Saved	Saved in instrument state.

10.3.23.3 MMEMory:COPY

If <file_source> specifies a single file, copies the file to <file_destination>.

If <file_source> lists more than one file, copies the files to the destination directory specified by <file_destination>.

Remote Command	`:MMEMory:COPY <string>,<string>`
Example	`:MMEM:COPY 'C:\test.txt' 'D:'`
Remote Command Notes	FSE, FSP, FSU, ESU, FSL, FSV, FSW MMEMory:COPY <file_source>,<file_destination>

10.3.23.4 MMEMory:DATA

The command writes the data block <block_data> from the control computer into the file specified by (in the analyzer).

The query transfers the file specified by from the analyzer to the control computer.

Remote Command	`:MMEMory:DATA <string>[,<block_data>]` `:MMEMory:DATA? <string>`
Example	`:MMEM:DATA 'TEST.CFG', #217This is the file` `:MMEM:DATA? 'TEST.CFG'`
Remote Command Notes	FSE, FSP, FSU, ESU, FSL, FSV, FSW MMEMory:DATA <file_name>[,<block data>]
State Saved	Saved in instrument state.

10.3.23.5 MMEMory:DELete

Deletes the file specified by .

Remote Command	`:MMEMory:DELete <string >`
Example	`:MMEM:DEL 'C:\test.txt'`
Remote Command Notes	FSE, FSP, FSU, ESU, FSL, FSV, FSW MMEMory:DELete <file_name>

10.3.23.6 MMEMory:INITialize

This command is accepted, but takes no action and reports no error.

Remote Command	`:MMEMory:INITialize <string >`
Example	`:MMEM:INIT 'A:'`
Remote Command Notes	FSE, FSP, FSU, ESU MMEMory:INITialize 'A:'

10.3.23.7 MMEMory:LOAD:STATe

Loads device settings from the file specified by . The file contents are set as the new analyzer state.

Remote Command	`:MMEMory:LOAD:STATe 1,<string>`
Example	`:MMEM:LOAD:STAT 1,'myState.state'`
Remote Command Notes	FSE, FSP, FSU, ESU, FSL, FSV, FSW MMEMory:LOAD:STATe 1,<file_name>

10.3.23.8 MMEMory:LOAD:AUTO

Specifies a settings file, the contents of which will automatically be loaded (and set as the analyzer state) when the analyzer is switched on.

Remote Command	`:MMEMory:LOAD:AUTO 1,<string>`
Example	`:MMEM:LOAD:AUTO 1,'myState.state'`
Remote Command Notes	FSE, FSP, FSU, ESU, FSL, FSV, FSW MMEMory:LOAD:AUTO 1,<file_name>

10.3.23.9 MMEMory:MDIRectory

Creates the new directory specified by <directory_name>.

Remote Command	`:MMEMory:MDIRectory <string >`
Example	`:MMEM:MDIR 'C:\T1'`
Remote Command Notes	FSE, FSP, FSU, ESU, FSL, FSV, FSW MMEMory:MDIRectory <directory_name>

10.3.23.10 MMEMory:MOVE

If <file_destination> contains no path information, then <file_source> is renamed to <file_destination>.

If <file_destination> contains path information, <file_source> is moved to the specified path, and renamed if <file_destination> also includes a file name.

Remote Command	`:MMEMory:MOVE <string>,<string>`
Example	`:MMEM:MOVE 'C:\test.txt' 'D:'`
Remote Command Notes	FSE, FSP, FSU, ESU, FSL, FSV, FSW MMEMory:MOVE <file_source>,<file_destination>

10.3.23.11 MMEMory:MSIS

This command is accepted, but takes no action and reports no error.

Remote Command	`:MMEMory:MSIS <string >` `:MMEMory:MSIS?`
Example	`:MMEM:MSIS 'A:'`
Remote Command Notes	FSE, FSL, FSP, FSU, ESU, FSV, FSW MMEMory:MSIS 'A:' | ... | 'Z:'

10.3.23.12 MMEMory:NAME

The command specifies the path and name of the destination file, for use when a print-to-file operation is initiated using the command HCOPy:IMMediate.

The specified destination file type must be PNG.

The query returns the current value of this setting.

Remote Command	`:MMEMory:NAME <string >` `:MMEMory:NAME?`
Example	`:MMEM:NAME '1.PNG'` `:MMEM:NAME?`
Remote Command Notes	FSE, FSP, FSU, ESU, FSL, FSV, FSW MMEMory:NAME <file_name>

10.3.23.13 MMEMory:RDIRectory

Deletes the directory specified by <directory_name>.

Remote Command	`:MMEMory:RDIRectory <string>`
Example	`:MMEM:RDIR 'C:\Test'`
Remote Command Notes	FSE, FSP, FSU, ESU, FSL, FSV, FSW MMEMory:RDIRectory <directory_name>

10.3.23.14 MMEMory:STORe:STATe

Stores the current analyzer state settings in a set of files. The files use the specified file name, but have differing extensions.

Remote Command	`:MMEMory:STORe:STATe 1,<string>`
Example	`:MMEM:STORe:STAT 1,'myState.state'`
Remote Command Notes	FSE MMEMory:STORe:STATe 1,<file_name> FSP, FSU, ESU, FSL, FSV, FSW MMEMory:STORe[1]|2:STATe 1,<file_name>

10.3.23.15 MMEMory:STORe:TRACe

Stores the specified trace (1…6) in an ASCII-format file specified by .

Remote Command	`:MMEMory:STORe:TRACe TRACE1 | TRACE2 | TRACE3 | TRACE4 | TRACE5 | TRACE6 | ALL,<string>`
Example	`:MMEM:STORe:TRACe TRACe1,'Trace1.trace'`
Remote Command Notes	FSE, MMEMory:STORe:TRACe 1|2|3|4,<file_name> FSP, FSU, ESU MMEMory:STORe[1]|2:TRACe 1|2|3,<file_name> FSL, FSV, FSW MMEMory:STORe[1]|2:TRACe 1|2|3|4|5|6,<file_name>

10.3.23.16 MMEMory:CLEar:STATe

Clears the analyzer setting specified by .

This command is accepted, but takes no action and reports no error.

Remote Command	`:MMEMory:CLEar:STATe 1,<string>`
Example	`:MMEM:CLE:STAT 1,'Trace1.trace'`
Remote Command Notes	FSE, FSP, FSU, ESU, FSL, FSV, FSW MMEMory:CLEar:STATe 1,<file_name>

10.3.23.17 MMEMory:CLEar:ALL

Clears all analyzer settings in the current directory.

This command is accepted, but takes no action and reports no error.

Remote Command	`:MMEMory:CLEar:ALL`
Example	`:MMEM:CLE:ALL`
Remote Command Notes	FSE, FSP, FSU, ESU, FSL, FSV, FSW MMEMory:CLEar:ALL

10.3.23.18 MMEMory:SELect[:ITEM]:HWSettings

This command is accepted, but takes no action and reports no error.

Remote Command	`:MMEMory:SELect[:ITEM]:HWSettings ON|OFF|1|0` `:MMEMory:SELect[:ITEM]:HWSettings?`
Example	`MMEM:SEL:HWS OFF` `MMEM:SEL:HWS?`
Remote Command Notes	FSE, FSP, FSU, ESU, FSL, FSV, FSW MMEMory:SELect[:ITEM]:HWSettings ON | OFF
Preset	ON
State Saved	Saved in instrument state.

10.3.23.19 MMEMory:SELect[:ITEM]:TRACe[:ACTive]

This command is accepted, but takes no action and reports no error.

Remote Command	`:MMEMory:SELect[:ITEM]:TRACe[:ACTive] ON|OFF|1|0` `:MMEMory:SELect[:ITEM]:TRACe[:ACTive]?`
Example	`MMEM:SEL:TRAC OFF` `MMEM:SEL:TRAC?`
Remote Command Notes	FSE, FSP, FSU, ESU, FSL MMEMory:SELect[:ITEM]:TRACe[1]|2|...|4 ON | OFF FSV, FSW MMEMory:SELect[:ITEM]:TRACe[1]|2|...|6 ON | OFF
Preset	OFF
State Saved	Saved in instrument state.

10.3.23.20 MMEMory:SELect[:ITEM]:LINes:ALL

This command is accepted, but takes no action and reports no error.

Remote Command	`:MMEMory:SELect[:ITEM]:LINes:ALL ON|OFF|1|0` `:MMEMory:SELect[:ITEM]:LINes:ALL?`

Example	`MMEM:SEL:LIN:ALL OFF` `MMEM:SEL:LIN:ALL?`
Remote Command Notes	FSE, FSP, FSU, ESU, FSL, FSV, FSW MMEMory:SELect[:ITEM]:LINes:ALL ON | OFF
Preset	FSE, FSP, FSU, ESU, FSL ON FSV, FSW OFF
State Saved	Saved in instrument state.

10.3.23.21 MMEMory:SELect[:ITEM]:SCData

This command is accepted, but takes no action and reports no error.

Remote Command	`:MMEMory:SELect[:ITEM]:SCData ON|OFF|1|0` `:MMEMory:SELect[:ITEM]:SCData?`
Example	`MMEM:SEL:SCD OFF` `MMEM:SEL:SCD?`
Remote Command Notes	FSE, FSP, FSU, ESU, FSL MMEMory:SELect[:ITEM]:SCData ON | OFF
Preset	OFF
State Saved	Saved in instrument state.

10.3.23.22 MMEMory:SELect[:ITEM]:TRANsducer:ALL

This command is accepted, but takes no action and reports no error.

Remote Command	`:MMEMory:SELect[:ITEM]:TRANsducer:ALL ON|OFF|1|0` `:MMEMory:SELect[:ITEM]:TRANsducer:ALL?`
Example	`MMEM:SEL:TRAN:ALL OFF` `MMEM:SEL:TRAN:ALL?`
Remote Command Notes	FSE, FSP, FSU, ESU, FSL, FSV, FSW MMEMory:SELect[:ITEM]:TRANsducer:ALL ON | OFF
Preset	FSE, FSP, FSU, ESU, FSL ON FSV OFF
State Saved	Saved in instrument state.

10.3.23.23 MMEMory:SELect[:ITEM]:ALL

This command is accepted, but takes no action and reports no error.

Remote Command	:MMEMory:SELect[:ITEM]:ALL
Example	MMEM:SEL:ALL
Remote Command Notes	FSE, FSP, FSU, ESU, FSL, FSV, FSW MMEMory:SELect[:ITEM]:ALL

10.3.23.24 MMEMory:SELect[:ITEM]:NONE

This command is accepted, but takes no action and reports no error.

Remote Command	:MMEMory:SELect[:ITEM]:NONE
Example	MMEM:SEL:NONE
Remote Command Notes	FSE, FSP, FSU, ESU, FSL, FSV, FSW MMEMory:SELect[:ITEM]:NONE

10.3.23.25 MMEMory:SELect[:ITEM]:DEFault

This command is accepted, but takes no action and reports no error.

Remote Command	:MMEMory:SELect[:ITEM]:DEFault
Example	MMEM:SEL: DEF
Remote Command Notes	FSE, FSP, FSU, ESU, FSL, FSV, FSW MMEMory:SELect[:ITEM]:DEFault

10.3.23.26 MMEMory:COMMent

Specifies a comment (max. 60 characters), to be associated with a stored analyzer setting.

This command is accepted, but takes no action and reports no error.

Remote Command	:MMEMory:COMMent <string> :MMEMory:COMMent?
Example	MMEM:COMM ‘Unknown Trace’ MMEM:COMM?
Remote Command Notes	FSE, FSP, FSU, ESU, FSL, FSV, FSW MMEMory:COMMent <string>
State Saved	Saved in instrument state.

10.3.24 SENSe:AVERage Subsystem

The SENSe:AVERage subsystem calculates the acquired data average. After several successive measurements, a new test result is obtained.

10.3.24.1 [SENSe]:AVERage:COUNt

Specifies the number of measurements that contribute to the average value.

In the SCPILC mode, the maximum value is 10000 and not 32767 as in FSx.

Remote Command	`[:SENSe]:AVERage:COUNt <integer>` `[:SENSe]:AVERage:COUNt?`
Example	`SENS:AVER:COUN 10` `SENS:AVER:COUN?`
Remote Command Notes	FSE, FSP, FSU, ESU, FSL, FSV [SENSe[1]|2]:AVERage:COUNt 0 to 32767 FSW [SENSe]:AVERage[1]|2|...|16:COUNt 0 to 200000
Preset	0
State Saved	Saved in instrument state.
Min	0
Max	10000

10.3.24.2 [SENSe]:AVERage[:STATe]

Switches on or off the selected trace's average calculation (STATe) within the measurement window.

Remote Command	`[:SENSe]:AVERage:STATe[1]|2|...|6 ON|OFF|1|0` `[:SENSe]:AVERage:STATe[1]|2|...|6?`
Example	`AVER:STAT1 OFF` `SENS:AVER:STAT3 ON`
Remote Command Notes	FSE :[SENSe[1]|2]:AVERage[:STATe] ON | OFF FSP, FSU, ESU [SENSe[1]|2]:AVERage[:STATe[1]|2|3] ON | OFF FSL, FSV [SENSe[1]|2]:AVERage[:STATe[1]|2|...|6] ON | OFF FSV

	[SENSe]:AVERage[1]|2|...|16[:STATe[1]|2|...|6] ON | OFF
Preset	OFF
State Saved	Yes.
Backwards Compatibility SCPI	`:SENSe1:AVERage[:STATe]`

10.3.24.3 [SENSe]:AVERage:TYPE

Specifies the average function type.

Remote Command	`[:SENSe]:AVERage:TYPE VIDeo|LINear` `[:SENSe]:AVERage?`
Example	`AVER:TYPE LIN` `AVER:TYPE?`
Remote Command Notes	FSE :[SENSe[1]|2]:AVERage:TYPE MAXimum | MINimum | SCALar FSP, FSU, ESU, FSL [SENSe[1]|2]:AVERage:TYPE VIDeo | LINear FSV [SENSe[1]|2]:AVERage:TYPE VIDeo | LINear | POWer FSW [SENSe]:AVERage[1|2|...|16]:TYPE VIDeo | LINear | POWer
Preset	VIDeo
Range	VIDeo | LINear
Backwards Compatibility SCPI	`:SENSe1:AVERage:TYPE`

10.3.25 SENSe:BANDwidth Subsystem

The SENSe:BANDwidth subsystem specifies the instrument's filter bandwidths. Both BANDwidth and BWIDth perform the same functions.

10.3.25.1 [SENSe]:BANDwidth|BWIDth[:RESolution]

Specifies the instrument's resolution bandwidth.

In the SCPILC mode, the maximum resolution bandwidth is 8 MHz (not 10 MHz as in FSx) and the minimum resolution bandwidth is 1 Hz (not 10 Hz as in FSx).

Remote Command	`[:SENSe]:BANDwidth|BWIDth[:RESolution] <freq>` `[:SENSe]:BANDwidth|BWIDth[:RESolution]?`

Example	BAND 1 KHZ BAND?
Remote Command Notes	The setting and querying of values depends on the current bandwidth type. FSE, FSL [SENSe[1]|2]:BANDwidth|BWIDth[:RESolution] <numeric_value> FSP [SENSe[1]|2]:BANDwidth|BWIDth[:RESolution] 10Hz to 10MHz FSU, ESU [SENSe[1]|2]:BANDwidth|BWIDth[:RESolution] 10 Hz to 20MHz FSV [SENSe[1]|2]:BANDwidth|BWIDth[:RESolution] 10 Hz to 40MHz FSW [SENSe]:BANDwidth|BWIDth[:RESolution] <bw>
Preset	3 MHz
State Saved	Saved in instrument state.
Min	1 Hz
Max	8 MHz
Backwards Compatibility SCPI	:SENSe1:BANDwidth|BWIDth[:RESolution]

10.3.25.2 [SENSe]:BANDwidth|BWIDth[:RESolution]:AUTO

Automatically couples the instrument's resolution bandwidth to the span or it cancels the coupling.

Remote Command	[:SENSe]:BANDwidth|BWIDth[:RESolution]:AUTO OFF|ON|0|1 [:SENSe]:BANDwidth|BWIDth[:RESolution]:AUTO?
Example	BWID:AUTO ON BWID:AUTO?
Remote Command Notes	FSE, FSP, FSU, ESU, FSL, FSV [SENSe[1]|2]:BANDwidth|BWIDth[:RESolution]:AUTO ON | OFF FSW [SENSe]:BANDwidth|BWIDth[:RESolution]:AUTO ON | OFF
Preset	ON
Backwards Compatibility SCPI	:SENSe1:BANDwidth|BWIDth[:RESolution]:AUTO

10.3.25.3 [SENSe]:BANDwidth|BWIDth[:RESolution]:RATio

Specifies the resolution bandwidth (Hz) / span (Hz) ratio.

Remote Command	`[:SENSe]:BANDwidth|BWIDth[:RESolution]:RATio <real>` `[:SENSe]:BANDwidth|BWIDth[:RESolution]:RATio?`
Example	`BAND:RAT 0.1`
Remote Command Notes	FSE, FSP, FSU, ESU, FSL, FSV [SENSe[1]|2]:BANDwidth|BWIDth[:RESolution]:RATio 0.0001 to 1 FSW [SENSe]:BANDwidth|BWIDth[:RESolution]:RATio 0.0001 to 1
Preset	FSE: NA FSP, FSE, FSU, FSL: 0.02 with BAND:TYPE NORMal or RBW > 30 kHz; 0.01 with BAND:TYPE FFT for RBW ≤ 30 kHz FSV: 0.01
State Saved	Saved in instrument state.
Min	0.0001
Max	1
Backwards Compatibility SCPI	`:SENSe1:BANDwidth|BWIDth[:RESolution]:RATio`

Preset detail:

FSE	FSP, FSE, FSU, FSL	FSV
NA	0.02 with BAND:TYPE NORMal or RBW > 30 kHz 0.01 with BAND:TYPE FFT for RBW ≤ 30 kHz	0.01

10.3.25.4 [SENSe]:BANDwidth|BWIDth[:RESolution]:TYPE

Sets the resolution bandwidth filter type to "normal" analog, FIR in 1, 3, 10 steps, or FFT for bandwidths less than 100 kHz.

[NOTE] CFILter and RRC are not supported in the current version.

Remote Command	`[:SENSe]:BANDwidth|BWIDth[:RESolution]:TYPE NORMal | FFT | CFILter | RRC | PULSe | NOISe` `[:SENSe]:BANDwidth|BWIDth[:RESolution]:TYPE?`
Example	`BAND:TYPE RRC` `BAND:TYPE?`
Remote Command Notes	FSP [SENSe[1]|2]:BANDwidth|BWIDth[:RESolution]:TYPE NORMal | FFT | CFILter | RRC FSU, ESU, FSL [SENSe[1]|2]:BANDwidth|BWIDth[:RESolution]:TYPE NORMal | FFT | CFILter | RRC | PULSe FSV

	[SENSe[1]|2]:BANDwidth|BWIDth[:RESolution]:TYPE NORMal | CFILter | RRC | P5 FSW [SENSe]:BANDwidth|BWIDth[:RESolution]:TYPE NORMal | CFILter | RRC | P5 | CISPr | PULSe | MIL
Preset	NORMal
State Saved	Saved in instrument state.
Range	NORMal | FFT | CFILter | RRC | PULSe | NOISe
Backwards Compatibility SCPI	:SENSe1:BANDwidth|BWIDth[:RESolution]:TYPE

10.3.25.5 [SENSe]:BANDwidth|BWIDth:VIDeo

Sets the instrument's video bandwidth to between10 Hz and 10 MHz in 1, 3, 10 steps.

In the SCPILC mode, the maximum video bandwidth is 50 MHz and not 10 MHz as in FSx.

Remote Command	[:SENSe]:BANDwidth|BWIDth:VIDeo <freq> [:SENSe]:BANDwidth|BWIDth:VIDeo?
Example	BAND:VID 1KHZ BAND:VID?
Remote Command Notes	FSE, FSP, FSU, ESU [SENSe[1]|2]:BANDwidth|BWIDth:VIDeo 1Hz to 10MHz FSL, FSV [SENSe[1]|2]:BANDwidth|BWIDth:VIDeo <numeric_value> FSW [SENSe]:BANDwidth|BWIDth:VIDeo <numeric_value>
Preset	10 MHz
State Saved	Saved in instrument state.
Min	1 Hz
Max	50 MHz
Backwards Compatibility SCPI	:SENSe1:BANDwidth|BWIDth[:RESolution]:VIDeo

10.3.25.6 [SENSe]:BANDwidth|BWIDth:VIDeo:AUTO

Automatically couples the instrument's video bandwidth to its resolution bandwidth or cancels the coupling.

Remote Command	[:SENSe]:BANDwidth|BWIDth:VIDeo:AUTO ON|OFF|1|0 [:SENSe]:BANDwidth|BWIDth:VIDeo:AUTO?

Example	BAND:VID:AUTO OFF
Remote Command Notes	FSE, FSP, FSU, ESU, FSL, FSV [SENSe[1]|2]:BANDwidth|BWIDth:VIDeo:AUTO ON | OFF FSW [SENSe]:BANDwidth|BWIDth:VIDeo:AUTO ON | OFF
Preset	ON
State Saved	Saved in instrument state.
Backwards Compatibility SCPI	:SENSe1:BANDwidth|BWIDth[:RESolution]:VIDeo:AUTO

10.3.25.7 [SENSe]:BANDwidth|BWIDth:VIDeo:RATio

Specifies the video bandwidth (Hz) / resolution bandwidth (Hz) ratio.

Remote Command	[:SENSe]:BANDwidth|BWIDth:VIDeo:RATio <real> [:SENSe]:BANDwidth|BWIDth:VIDeo:RATio?
Example	BAND:VID:RAT 2 BAND:VID:RAT?
Remote Command Notes	FSE [SENSe[1]|2]:BANDwidth|BWIDth:VIDeo:RATIO 0.001 to 1000 | SINe | PULSe | NOISe FSP, FSU, ESU, FSL, FSV [SENSe[1]|2]:BANDwidth|BWIDth:VIDeo:RATio 0.01 to 1000 FSV [SENSe]:BANDwidth|BWIDth:VIDeo:RATio 0.01 to 1000
Preset	3
State Saved	Saved in instrument state.
Min	0.00001
Max	3000000
Backwards Compatibility SCPI	:SENSe1:BANDwidth|BWIDth[:RESolution]:VIDeo:RATio

10.3.26 SENSe:DETector Subsystem

The SENSe:DETector subsystem controls measurement data acquisition via selection of the detector for the corresponding trace.

10.3.26.1 [SENSe]:DETector[:FUNCtion]

Switches on the data acquisition detector in the selected trace.

Remote Command	[:SENSe]:DETector[1]|2|3[:FUNCtion] APEak | NEGative | POSitive | SAMPle | RMS | AVERage | QPEak [:SENSe]:DETector[1]|2|3[:FUNCtion]?
Example	DET POS
Remote Command Notes	FSE [SENSe[1]|2]:DETector[1]|2|...|4[:FUNCtion] APEak | NEGative | POSitive | SAMPle | RMS | AVERage FSP, FSL [SENSe[1]|2]:DETector[1]|2|3[:FUNCtion] APEak | NEGative | POSitive | SAMPle | RMS | AVERage | QPEak FSU, ESU [SENSe[1]|2]:DETector[1]|2|3[:FUNCtion] APEak | NEGative | POSitive | SAMPle | RMS | AVERage | QPEak | CAVerage | CRMS FSL [SENSe[1]|2]:DETector[1]|2|...|6[:FUNCtion] APEak | NEGative | POSitive | SAMPle | RMS | AVERage | QPEak FSV [SENSe[1]|2][:WINDow]:DETector[1]|2|...|6[:FUNCtion] APEak | NEGative | POSitive | SAMPle | RMS | AVERage | QPEak FSW [SENSe][:WINDow[1]|2|...|16]:DETector[1]|2|...|6[:FUNCtion] APEak | NEGative | POSitive | SAMPle | RMS | AVERage | QPEak | CRMS | CAVerage
Preset	APEak
State Saved	Saved in instrument state.
Range	APEak | NEGative | POSitive | SAMPle | RMS | AVERage | QPEak
Backwards Compatibility SCPI	:SENSe1:DETector[1]|2|3[:FUNCtion]

10.3.26.2 [SENSe]:DETector[:FUNCtion]:AUTO

Either couples the detector to the current trace setting or turns coupling off.

Remote Command	[:SENSe]:DETector[1]|2|3[:FUNCtion]:AUTO ON|OFF|1|0 [:SENSe]:DETector[1]|2|3[:FUNCtion]:AUTO?
Example	DET:AUTO OFF
Remote Command Notes	FSE [SENSe[1]|2]:DETector[1]|2|...|4[:FUNCtion]:AUTO ON | OFF FSP, FSU, ESU [SENSe[1]|2]:DETector[1]|2|3[:FUNCtion]:AUTO ON | OFF FSL [SENSe[1]|2]:DETector[1]|2|...|6[:FUNCtion]:AUTO ON | OFF FSV [SENSe[1]|2][:WINDow]:DETector[1]|2|...|6[:FUNCtion]:AUTO ON | OFF

	FSW [SENSe][:WINDow[1]|2|...|16]:DETector[1]|2|...|6[:FUNCtion]:AUTO ON | OFF
Preset	ON
State Saved	Saved in instrument state.
Backwards Compatibility SCPI	`:SENSe1:DETector[1]|2|3[:FUNCtion]:AUTO`

10.3.27 SENSe:CORRection Subsystem

This subsystem controls calibration and normalization during operation. The SENSe:CORRection subsystem controls calibration and normalization

10.3.27.1 [SENSe]:CORRection:EGAin:INPut[:MAGNitude]

Informs the analyzer of an external gain.

SCPILC mode supports the range of -120 to 120 dB, not -200 to 200 dB as FSP.

Remote Command	`[:SENSe]:CORRection:EGAin:INPut[:MAGNitude] <rel_ampl>` `[:SENSe]:CORRection:EGAin:INPut[:MAGNitude]?`
Example	`CORR:EGA:INP 10DB`
Remote Command Notes	FSP, FSV [SENSe[1]|2]:CORRection:EGAin:INPut[:MAGNitude] -200...200dB
Preset	0 dB
State Saved	Saved in instrument state.
Min	-120 dB
Max	120 dB
Backwards Compatibility SCPI	`:SENSe1:CORRection:EGAin:INPut[:MAGNitude]`

10.3.27.2 [SENSe]:CORRection:TRANsducer:SELect

This command selects the transducer factor designated by <name>. If <name> does not exist yet, a new transducer factor is created.

NOTE **This command must be sent prior to the subsequent commands for modifying/activating transducer factors.**

Parameter: <name>::= Name of the transducer factor in string data form with a maximum of 8 characters.

Currently, this command support 6 correction settings.

Remote Command	`[:SENSe]:CORRection:TRANsducer:SELect <string>` `[:SENSe]:CORRection:TRANsducer:SELect?`
Example	`CORR:TRAN:SEL “A”` `CORR:TRAN:SEL?`
Notes	Altogether there are only 6 different transducers can be selected. If there is a new transducer, the most old one will be replaced by the new one.
Remote Command Notes	FSE, FSP, FSU, ESU, FSL, FSV [SENSe[1]|2]:CORRection:TRANsducer:SELect <name> FSW [SENSe]:CORRection:TRANsducer:SELect <name> Currently, this command support 6 correction settings.
State Saved	Saved in instrument state.

10.3.27.3 [SENSe]:CORRection:TRANsducer:UNIT

This command defines the unit of the transducer factor selected.

NOTE **Prior to this command, the command SENS:CORR:TRAN:SEL must be sent.**

Parameter: <string>::= 'DB' | 'DBM' | 'DBMV' | 'DBUV' | 'DBUV/M' | 'DBUA' | 'DBUA/M' | 'DBPW' | 'DBPT'

Currently, this command support 6 correction settings.

This command won’t invoke any action and the default value in the system si always be “DB”.

Remote Command	`[:SENSe]:CORRection:TRANsducer:UNIT <string>` `[:SENSe]:CORRection:TRANsducer:UNIT?`
Example	`CORR:TRAN:UNIT “DB”` `CORR:TRAN:UNIT?`
Notes	This command won’t invoke any action and the default value in the system is always be “DB”.
Remote Command Notes	FSE, FSP, FSU, ESU, FSL, FSV [SENSe[1]|2]:CORRection:TRANsducer:UNIT ’DB’ | ’DBM’ | ’DBMV’ | ’DBUV’ | ’DBUV/M’ | ’DBUA’ | ’DBUA/M’ | ’DBPW’ | ’DBPT’ FSW [SENSe]:CORRection:TRANsducer:UNIT ’DB’ | ’DBM’ | ’DBMV’ | ’DBUV’ | ’DBUV/M’ | ’DBUA’ | ’DBUA/M’ | ’DBPW’ | ’DBPT’ Currently, this command support 6 correction settings.
State Saved	Saved in instrument state.

10.3.27.4 [SENSe]:CORRection:TRANsducer:SCALing

This command defines whether the frequency scaling of the transducer factor is linear or logarithmic.

NOTE Prior to this command, the command SENS:CORR:TRAN:SEL must be sent.

Currently, this command support 6 correction settings.

Remote Command	`[:SENSe]:CORRection:TRANsducer:SCALing LINear|LOGarithmic` `[:SENSe]:CORRection:TRANsducer:SCALing?`
Example	`CORR:TRAN:SCAL LIN` `CORR:TRAN:SCAL?`
Remote Command Notes	FSE, FSP, FSU, ESU, FSL, FSV [SENSe[1]|2]:CORRection:TRANsducer:SCALing LINear | LOGarithmic FSW [SENSe]:CORRection:TRANsducer:SCALing LINear | LOGarithmic Currently, this command support 6 correction settings.
State Saved	Saved in instrument state.

10.3.27.5 [SENSe]:CORRection:TRANsducer:COMMent

This command defines the comment for the selected transducer factor.

NOTE Prior to this command, the command SENS:CORR:TRAN:SEL must be sent.

Currently, this command support 6 correction settings.

Remote Command	`[:SENSe]:CORRection:TRANsducer:COMMent <string>` `[:SENSe]:CORRection:TRANsducer:COMMent?`
Example	`CORR:TRAN:COMM “NA”` `CORR:TRAN:COMM?`
Remote Command Notes	FSE, FSP, FSU, ESU, FSL, FSV [SENSe[1]|2]:CORRection:TRANsducer:COMMent <string> FSW [SENSe]:CORRection:TRANsducer:COMMent <string> Currently, this command support 6 correction settings.
State Saved	Saved in instrument state.

10.3.27.6 [SENSe]:CORRection:TRANsducer:DATA

This command defines the reference values of the transducer factor selected. These values are entered as a sequence of frequency/level pairs. The frequencies must be sent in ascending order.

NOTE **Prior to this command, the command SENS:CORR:TRAN:SEL must be sent. The level values are sent as dimensionless numbers; the unit is specified by means of the command: SENS:CORR:TRAN:UNIT.**

Currently, this command support 6 correction settings.

All parameters have no unit, which is different from the R&S box.

Remote Command	`[:SENSe]:CORRection:TRANsducer:DATA <freq_real>,<level_real>,…` `[:SENSe]:CORRection:TRANsducer:DATA?`
Example	`CORR:TRAN:DATA 1,2,3,4,5,6,7,8,9,0` `CORR:TRAN:DATA?`
Notes	All parameters have no unit, which is different from the R&S box.
Remote Command Notes	FSE, FSP, FSU, ESU, FSL, FSV [SENSe[1]|2]:CORRection:TRANsducer:DATA <freq>,<level>... FSW [SENSe]:CORRection:TRANsducer:DATA <freq>,<level>... Currently, this command support 6 correction settings.
State Saved	Saved in instrument state.

10.3.27.7 [SENSe]:CORRection:TRANsducer[:STATe]

This command switches the selected transducer factor on or off.

NOTE **Prior to this command, the command SENS:CORR:TRAN:SEL must be sent.**

Currently, this command support 6 correction settings.

Remote Command	`[:SENSe]:CORRection:TRANsducer:STATe ON|OFF|1|0` `[:SENSe]:CORRection:TRANsducer:STATe?`
Example	`CORR:TRAN:STAT OFF` `CORR:TRAN:STAT?`
Remote Command Notes	FSE, FSP, FSU, ESU, FSL, FSV [SENSe[1]|2]:CORRection:TRANsducer[:STATe] ON | OFF FSW [SENSe]:CORRection:TRANsducer[:STATe] ON | OFF

	Currently, this command support 6 correction settings.
Preset	OFF
State Saved	Saved in instrument state.

10.3.27.8 [SENSe]:CORRection:TRANsducer:DELete

This command deletes the selected transducer factor.

NOTE **Prior to this command, the command SENS:CORR:TRAN:SEL must be sent.**

Currently, this command support 6 correction settings.

Remote Command	`[:SENSe]:CORRection:TRANsducer:DELete`
Example	`CORR:TRAN:DEL`
Remote Command Notes	FSE, FSP, FSU, ESU, FSL, FSV [SENSe[1]|2]:CORRection:TRANsducer:DELete FSW [SENSe]:CORRection:TRANsducer:DELete
Remote Command Notes	Currently, this command support 6 correction settings.
State Saved	Saved in instrument state.

10.3.27.9 [SENSe]:CORRection:TRANsducer:VIEW

This command switches on the display of the active transducer factor or set.

NOTE **Prior to this command, the command SENS:CORR:TRAN:SEL must be sent.**

Currently, this command support 6 correction settings.

Remote Command	`[:SENSe]:CORRection:TRANsducer:VIEW ON|OFF|1|0` `[:SENSe]:CORRection:TRANsducer:VIEW?`
Example	`CORR:TRAN:VIEW OFF` `CORR:TRAN:VIEW?`
Remote Command Notes	FSP, FSL, FSV [SENSe[1]|2]:CORRection:TRANsducer:VIEW ON | OFF Currently, this command support 6 correction settings.
Preset	OFF
State Saved	Saved in instrument state.

10.3.28 SENSe:FREQuency Subsystem

The SENSe:FREQuency subsystem specifies the active display's frequency axis. The frequency axis can either be set via the center frequency and span, or via the start and stop frequency.

10.3.28.1 [SENSe]:FREQuency:CENTer

Specifies the analyzer's center frequency or the measuring frequency for span = 0.

Remote Command	`[:SENSe]:FREQuency:CENTer <freq>` `[:SENSe]:FREQuency:CENTer?`
Example	`FREQ:CENT 50MHz` `FREQ:CENT?`
Remote Command Notes	FSE, FSP, FSU, ESU, FSL, FSV [SENSe[1]|2]:FREQuency:CENTer 0 GHz to fmax FSW [SENSe]:FREQuency:CENTer 0 GHz to fmax
Preset	fmax /2 with fmax = maximum frequency
State Saved	Saved in instrument state.
Min	Depends on instrument minimum frequency
Max	Depends on instrument maximum frequency
Backwards Compatibility SCPI	`:SENSe1:FREQuency:CENTer`

10.3.28.2 [SENSe]:FREQuency:CENTer:STEP

Specifies the center frequency's step width.

Remote Command	`[:SENSe]:FREQuency:CENTer:STEP <freq>` `[:SENSe]:FREQuency:CENTer:STEP?`
Example	`FREQ:CENT:STEP 120MHz`
Remote Command Notes	FSE, FSP, FSU, ESU, FSL, FSV [SENSe[1]|2]:FREQuency:CENTer:STEP 0 to fmax FSW [SENSe]:FREQuency:CENTer:STEP 0 to fmax
Preset	1MHz
State Saved	Saved in instrument state.
Min	1 Hz

Max	27.0 GHz
Backwards Compatibility SCPI	`:SENSe1:FREQuency:CENTer:STEP`

10.3.28.3 [SENSe]:FREQuency:CENTer:STEP:LINK

Couples the center frequency's step width to the span (span >0) or to the resolution bandwidth (span = 0), or cancels the coupling.

Remote Command	`[:SENSe]:FREQuency:CENTer:STEP:LINK SPAN | RBW | OFF` `[:SENSe]:FREQuency:CENTer:STEP:LINK?`
Example	`FREQ:CENT:STEP:LINK RBW` `FREQ:CENT:STEP:LINK?`
Remote Command Notes	FSE, FSP, FSU, ESU, FSL, FSV [SENSe[1]|2]:FREQuency:CENTer:STEP:LINK SPAN | RBW | OFF FSW [SENSe]:FREQuency:CENTer:STEP:LINK SPAN | RBW | OFF
Preset	SPAN
State Saved	Saved in instrument state.
Backwards Compatibility SCPI	`:SENSe1:FREQuency:CENTer:STEP:LINK`

10.3.28.4 [SENSe]:FREQuency:CENTer:STEP:LINK:FACTor

Couples the center frequency's step width to a factor of the span (span >0) or to the resolution bandwidth (span = 0).

Remote Command	`[:SENSe]:FREQuency:CENTer:STEP:LINK:FACTor <int>` `[:SENSe]:FREQuency:CENTer:STEP:LINK:FACTor?`
Example	`FREQ:CENT:STEP:LINK:FACTor 20PCT`
Remote Command Notes	FSE, FSP, FSU, ESU, FSL, FSV [SENSe[1]|2]:FREQuency:CENTer:STEP:LINK:FACTor 1 to 100 PCT FSW [SENSe]:FREQuency:CENTer:STEP:LINK:FACTor 1 to 100 PCT
State Saved	Saved in instrument state.
Min	1
Max	100
Backwards Compatibility SCPI	`:SENSe1:FREQuency:CENTer:STEP:LINK:FACTor`

10.3.28.5 [SENSe]:FREQuency:SPAN

Specifies the frequency span.

Remote Command	`[:SENSe]:FREQuency:SPAN <freq>` `[:SENSe]:FREQuency:SPAN?`
Example	`FREQ:SPAN 10MHz`
Remote Command Notes	FSE, FSP, FSU, ESU, FSL, FSV [SENSe[1]|2]:FREQuency:SPAN 0Hz to fmax FSW [SENSe]:FREQuency:SPAN 10Hz to fmax
Preset	3 GHz
State Saved	Saved in instrument state.
Max	26.5 GHz
Backwards Compatibility SCPI	`:SENSe1:FREQuency:SPAN`

10.3.28.6 [SENSe]:FREQuency:SPAN:FULL

Sets the frequency span to maximum.

Remote Command	`[:SENSe]:FREQuency:SPAN:FULL`
Example	`FREQ:SPAN:FULL`
Remote Command Notes	FSE, FSP, FSU, ESU, FSL, FSV [SENSe[1]|2]:FREQuency:SPAN:FULL FSW [SENSe]:FREQuency:SPAN:FULL
Backwards Compatibility SCPI	`:SENSe1:FREQuency:SPAN:FULL`

10.3.28.7 [SENSe]:FREQuency:STARt

Specifies the analyzer’s start frequency. This command is available only in the frequency domain (span > 0).

Remote Command	`[:SENSe]:FREQuency:STARt <freq>` `[:SENSe]:FREQuency:STARt?`
Example	`FREQ:STAR 200MHz` `FREQ:STAR?`
Remote Command Notes	FSE, FSP, FSU, ESU, FSL, FSV [SENSe[1]|2]:FREQuency:STARt 0Hz to fmax

	FSW [SENSe]:FREQuency:STARt 0Hz to fmax-min span
Preset	0 Hz
State Saved	Saved in instrument state.
Min	0Hz
Max	Depends on the instrument maximum frequency

10.3.28.8 [SENSe]:FREQuency:STOP

Specifies the analyzer's stop frequency. This command is available only in the frequency domain (span > 0).

Remote Command	`[:SENSe]:FREQuency:STOP <freq>` `[:SENSe]:FREQuency:STOP?`
Example	`FREQ:STOP 220MHz` `FREQ:STOP?`
Remote Command Notes	FSE, FSP, FSU, ESU, FSL, FSV [SENSe[1]|2]:FREQuency:STOP 0Hz to fmax FSW [SENSe]:FREQuency:STOP min span to fmax
Preset	3GHZ
State Saved	Saved in instrument state.
Min	0Hz
Max	27.0 GHz

10.3.28.9 [SENSe]:FREQuency:MODE

This command switches between time domain (CW | FIXed) and frequency domain (SWEep).

Remote Command	`[:SENSe]:FREQuency:MODE CW|FIXed|SWEep` `[:SENSe]:FREQuency:MODE?`
Example	`FREQ:MODE CW`
Remote Command Notes	FSE, FSP, FSU, ESU, FSV [SENSe[1]|2]:FREQuency:MODE CW | FIXed | SWEep FSL [SENSe[1]|2]:FREQuency:MODE CW | FIXed | SWEep | SCAN
Preset	SWEep
Range	CW | FIXed | SWEep

Backwards Compatibility SCPI	`:SENSe1:FREQuency:MODE`

10.3.28.10 [SENSe]:FREQuency:OFFSet

Specifies the instrument’s frequency offset.

Remote Command	`[:SENSe]:FREQuency:OFFSet <freq>` `[:SENSe]:FREQuency:OFFSet?`
Example	`FREQ:OFFS 10MHz`
Remote Command Notes	FSE, FSP, FSU, ESU [SENSe[1]|2]:FREQuency:OFFSet <numeric_value> FSL, FSV [SENSe[1]|2]:FREQuency:OFFSet -100GHz...100GHz FSW [SENSe]:FREQuency:OFFSet -100GHz...100GHz
Preset	0 Hz
State Saved	Saved in instrument state.
Min	-500 GHz
Max	500 GHz
Backwards Compatibility SCPI	`:SENSe1:FREQuency:OFFSet`

10.3.29 SENSe:POWer Subsystem

The SENSe:POWer subsystem controls the instrument's channel and adjacent channel power measurements.

10.3.29.1 [SENSe]:POWer:ACHannel:SPACing:CHANnel

Specifies the channel spacing for the carrier signals. This command is available only for measurements in the frequency domain (span > 0).

Remote Command	`[:SENSe]:POWer:ACHannel:SPACing:CHANnel 1000` `[:SENSe]:POWer:ACHannel:SPACing:CHANnel`
Example	`POW:ACH:SPAC:CHAN 2000` `POW:ACH:SPAC:CHAN?`
Remote Command Notes	FSP [SENSe[1]|2]:POWer:ACHannel:SPACing:CHANnel 100 Hz to 2000 MHz FSU, ESU [SENSe[1]|2]:POWer:ACHannel:SPACing:CHANnel[1]|2|...|11 100 Hz to 2000 MHz

	FSL [SENSe[1]|2]:POWer:ACHannel:SPACing:CHANnel[1]|2|...|11 14kHz to 2000 MHz FSV [SENSe[1]|2]:POWer:ACHannel:SPACing:CHANnel[1]|2|...|11 14kHz to 20 GHz FSW [SENSe]:POWer:ACHannel:SPACing:CHANnel[1]|2|...|18 14kHz to 2 GHz
Preset	20 kHz
State Saved	Saved in instrument state.
Min	100 Hz
Max	2 GHz

10.3.29.2 [SENSe]:POWer:ACHannel:SPACing:ACHannel

Specifies the channel spacing of the adjacent channel to the TX channel. At the same time, the spacing of alternate adjacent channels 1 and 2 is set to double or triple the entered value.

This command is available only in the frequency domain (span > 0).

Remote Command	`[:SENSe]:POWer:ACHannel:SPACing:ACHannel <freq>` `[:SENSe]:POWer:ACHannel:SPACing:ACHannel?`
Example	`POW:ACH:SPAC:ACH 33kHz`
Remote Command Notes	FSE, FSU, ESU [SENSe[1]|2]:POWer:ACHannel:SPACing:ACHannel 0 Hz to 1000 MHz FSP [SENSe[1]|2]:POWer:ACHannel:SPACing:ACHannel 100 Hz to 2000 MHz FSL [SENSe[1]|2]:POWer:ACHannel:SPACing[:ACHannel] 100 Hz to 2000 MHz FSV [SENSe[1]|2]:POWer:ACHannel:SPACing[:ACHannel] 100 Hz to 20 GHz FSW [SENSe]:POWer:ACHannel:SPACing[:ACHannel] 100 Hz to 2 GHz
Preset	FSE 24kHz FSP, FSU, ESU, FSL, FSV, FSW 14kHz
State Saved	Saved in instrument state.
Min	100Hz
Max	2000MHz

10.3.29.3 [SENSe]:POWer:ACHannel:SPACing:ALTernate

Specifies the spacing between the first (ALTernate1) or second alternate adjacent channel (ALTernate2) and the TX channel.

Remote Command	`[:SENSe]:POWer:ACHannel:SPACing:ALTernate[1]|2 <freq>` `[:SENSe]:POWer:ACHannel:SPACing:ALTernate[1]|2?`
Example	`POW:ACH:SPAC:ALT1 100kHz`
Remote Command Notes	FSE [SENSe[1]|2]:POWer:ACHannel:SPACing:ACHannel 0 Hz to 1000 MHz FSP [SENSe[1]|2]:POWer:ACHannel:SPACing:ALTernate[1]|2 100 Hz to 2000 MHz FSU, ESU, FSL [SENSe[1]|2]:POWer:ACHannel:SPACing:ALTernate[1]|2|...|11 100 Hz to 2000 MHz FSV [SENSe[1]|2]:POWer:ACHannel:SPACing:ALTernate[1]|2|...|11 100 Hz to 20 GHz FSW [SENSe]:POWer:ACHannel:SPACing:ALTernate[1]|2|...|11 100 Hz to 2 GHz
Preset	FSE 24kHz FSP 40000|60000 FSU, ESU, FSL 40 kHz (ALT1) | 60 kHz (ALT2) | 80 kHz (ALT3) | 100 kHz (ALT4) | 120 kHz (ALT5) | 140 kHz (ALT6) | 160 kHz (ALT7) | 180 kHz (ALT8) | 200 kHz (ALT9) | 220 kHz (ALT10) | 240 kHz (ALT11)
State Saved	Saved in instrument state.
Min	100Hz
Max	2000MHz

10.3.29.4 [SENSe]:POWer:ACHannel:TXCHannel:COUNt

Specifies the number of carrier signals. This command is only available for multicarrier channel and adjacent-channel power measurements.

Remote Command	`[:SENSe]:POWer:ACHannel:TXCHannel:COUNt <int>` `[:SENSe]:POWer:ACHannel:TXCHannel:COUNt?`
Example	`POW:ACH:TXCH:COUN 1` `POW:ACH:TXCH:COUN?`
Remote Command Notes	FSP [SENSe[1]|2]:POWer:ACHannel:TXCHannel:COUNt 1 | 2 | 3 | 4 FSU, ESU, FSL

	[SENSe[1]|2]:POWer:ACHannel:TXCHannel:COUNt 1 to 12 FSV [SENSe[1]|2]:POWer:ACHannel:TXCHannel:COUNt 1 to 18 FSW [SENSe]:POWer:ACHannel:TXCHannel:COUNt 1 to 18
Preset	FSP, FSU, ESU 4 FSL 1
State Saved	Saved in instrument state.
Min	1
Max	4

10.3.29.5 [SENSe]:POWer:ACHannel:ACPairs

Specifies the number of adjacent channels (upper and lower channel in pairs).The number 0 represents a pure channel power measurement.

Remote Command	`[:SENSe]:POWer:ACHannel:ACPairs` `[:SENSe]:POWer:ACHannel:ACPairs?`
Example	`POW:ACH:ACP 3`
Remote Command Notes	FSE, FSP [SENSe[1]|2]:POWer:ACHannel:ACPairs 1 | 2 | 3 FSU, ESU, FSL, FSV [SENSe[1]|2]:POWer:ACHannel:ACPairs 0 to 12 FSW [SENSe]:POWer:ACHannel:ACPairs 0 to 12
Preset	1
Range	0|1|2|3

10.3.29.6 [SENSe]:POWer:ACHannel:BANDwidth|BWIDth[:CHANnel]

Specifies the radio communication system’s channel bandwidth.

Remote Command	`[:SENSe]:POWer:ACHannel:BANDwidth|BWIDth[:CHANnel] <freq>` `[:SENSe]:POWer:ACHannel:BANDwidth|BWIDth[:CHANnel]?`
Example	`POW:ACH:BWID 30kHz`
Remote Command Notes	FSE [SENSe[1]|2]:POWer:ACHannel:BANDwidth|BWIDth[:CHANnel] 0 Hz to 1000 MHz FSP, FSU, ESU, FSL

	[SENSe[1]|2]:POWer:ACHannel:BANDwidth|BWIDth[:CHANnel] 100 Hz to 1000 MHz FSV [SENSe[1]|2]:POWer:ACHannel:BANDwidth|BWIDth[:CHANnel[1]|2|...|11] 100 Hz to 40 GHz FSW [SENSe]:POWer:ACHannel:BANDwidth|BWIDth[:CHANnel[1]|2|...|18] 100 Hz to 1 GHz
Preset	XA, FSP, FSU, ESU, FSL, FSV, FSW 14kHz FSE 24kHz
State Saved	Saved in instrument state.
Min	100Hz
Max	1000MHz

10.3.29.7 [SENSe]:POWer:ACHannel:BANDwidth|BWIDth:ACHannel

Specifies the radio transmission system’s adjacent channel bandwidth. If the adjacent channel bandwidth is changed, all alternate adjacent channel’s bandwidths are automatically set to the same value.

Remote Command	`[:SENSe]:POWer:ACHannel:BANDwidth|BWIDth:ACHannel <freq>` `[:SENSe]:POWer:ACHannel:BANDwidth|BWIDth:ACHannel?`
Example	`POW:ACH:BWID:ACH 30kHz`
Remote Command Notes	FSE [SENSe[1]|2]:POWer:ACHannel:BANDwidth|BWIDth:ACHannel 0 Hz to 1000 MHz FSP, FSU, ESU, FSL [SENSe[1]|2]:POWer:ACHannel:BANDwidth|BWIDth:ACHannel 100 Hz to 1000 MHz FSV [SENSe[1]|2]:POWer:ACHannel:BANDwidth|BWIDth:ACHannel 100 Hz to 40 GHz FSW [SENSe]:POWer:ACHannel:BANDwidth|BWIDth:ACHannel 100 Hz to 1 GHz
Preset	XA, FSP, FSU, ESU, FSL, FSV, FSW 14kHz FSE 24kHz
State Saved	Saved in instrument state.
Min	100Hz
Max	1000MHz

10.3.29.8 [SENSe]:POWer:ACHannel:BANDwidth|BWIDth:ALTernate

Specifies the radio transmission system's channel bandwidth for the first and second alternate adjacent channel. If alternate adjacent channel 1's bandwidth is changed, then alternate adjacent channel 2's bandwidth is automatically set to the same value.

Remote Command	`[:SENSe]:POWer:ACHannel:BANDwidth|BWIDth:ALTernate[1]	2 <freq>` `[:SENSe]:POWer:ACHannel:BANDwidth|BWIDth:ALTernate[1]|2?`
Example	`POW:ACH:BWID:ALT2 30kHz`
Remote Command Notes	FSE [SENSe[1]|2]:POWer:ACHannel:BANDwidth|BWIDth:ALTernate[1]|2 0 Hz to 1000 MHz FSP [SENSe[1]|2]:POWer:ACHannel:BANDwidth|BWIDth:ALTernate[1]|2 100 Hz to 1000 MHz FSU, ESU, FSL [SENSe[1]|2]:POWer:ACHannel:BANDwidth|BWIDth:ALTernate[1]|2|...|11 100 Hz to 1000 MHz FSV [SENSe[1]|2]:POWer:ACHannel:BANDwidth|BWIDth:ALTernate[1]|2|...|11 100 Hz to 40 GHz FSW [SENSe]:POWer:ACHannel:BANDwidth|BWIDth:ALTernate[1]|2|...|11 100 Hz to 1 GHz
Preset	XA, FSP, FSU, ESU, FSL, FSV, FSW 14kHz FSE 24kHz
State Saved	Saved in instrument state.
Min	100Hz
Max	1000MHz

10.3.29.9 [SENSe]:POWer:ACHannel:MODE

Switches between absolute and relative adjacent channel measurements.

Remote Command	`[:SENSe]:POWer:ACHannel:MODE ABSolute|RELative` `[:SENSe]:POWer:ACHannel:MODE?`
Example	`POW:ACH:MODE REL`
Remote Command Notes	FSE, FSP, FSU, ESU, FSL, FSV [SENSe[1]|2]:POWer:ACHannel:MODE ABSolute | RELative FSW [SENSe]:POWer:ACHannel:MODE ABSolute | RELative
Preset	ABSolute

State Saved	Saved in instrument state.
Range	ABSolute|RELative

10.3.29.10 [SENSe]:POWer:ACHannel:REFerence:AUTO ONCE

Sets the relative measurement's reference value to the currently measured channel power.

This command is accepted, but takes no action and reports no error.

Remote Command	`[:SENSe]:POWer:ACHannel:REFerence:AUTO ONCE`
Example	`POW:ACH:REF:AUTO ONCE`
Remote Command Notes	FSE, FSP, FSU, ESU, FSL, FSV [SENSe[1]|2]:POWer:ACHannel:REFerence:AUTO ONCE FSW [SENSe]:POWer:ACHannel:REFerence:AUTO ONCE
State Saved	Saved in instrument state.

10.3.29.11 [SENSe]:POWer:ACHannel:REFerence:TXCHannel:AUTO

Activates the automatic selection of the transmission channel that is used as a reference channel in relative adjacent-channel power measurements.

Remote Command	`[:SENSe]:POWer:ACHannel:REFerence:TXCHannel:AUTO MINimum | MAXimum | LHIGhest` `[:SENSe]:POWer:ACHannel:REFerence:TXCHannel:AUTO?`
Example	`SENS:POW:ACH:REF:TXCH:AUTO MIN`
Remote Command Notes	FSP, FSL, FSV [SENSe[1]|2]:POWer:ACHannel:REFerence:TXCHannel:AUTO MINimum | MAXimum | LHIGhest FSU, ESU [SENSe[1]|2]:POWer:ACHannel:REFerence:TXCHannel:AUTO MINimum | MAXimum | LHIGhest | OFF FSW [SENSe]:POWer:ACHannel:REFerence:TXCHannel:AUTO MINimum | MAXimum | LHIGhest
State Saved	Saved in instrument state.
Range	MINimum | MAXimum | LHIGhest

10.3.29.12 [SENSe]:POWer:ACHannel:REFerence:TXCHannel:MANual

Selects the transmission channel to use as a reference channel in relative adjacent-channel power measurements.

The command is only available for multicarrier and adjacent-channel power measurements.

Remote Command	[:SENSe]:POWer:ACHannel:REFerence:TXCHannel:MANual 1 | 2 [:SENSe]:POWer:ACHannel:REFerence:TXCHannel:MANual?
Example	POW:ACH:REF:TXCH:MAN 2 POW:ACH:REF:TXCH:MAN?
Remote Command Notes	FSP [SENSe[1]|2]:POWer:ACHannel:REFerence:TXCHannel:MANual 1 | 2 | 3 | 4 FSU, ESU, FSL [SENSe[1]|2]:POWer:ACHannel:REFerence:TXCHannel:MANual 1 to 12 FSV [SENSe[1]|2]:POWer:ACHannel:REFerence:TXCHannel:MANual 1 to 18 FSW [SENSe]:POWer:ACHannel:REFerence:TXCHannel:MANual 1 to 18
Preset	1
State Saved	Saved in instrument state.
Min	1
Max	2

10.3.29.13 [SENSe]:POWer:ACHannel:PRESet

Adjusts the frequency span, the measurement bandwidths including the required detector for the number of channels, the channel bandwidths, and the channel spacings selected in the active power measurement. If required, switches on the adjacent-channel power measurement prior to the adjustment.

Remote Command	[:SENSe]:POWer:ACHannel:PRESet ACPower | CPOWer | MCACpower | OBANdwidth | OBWidth | CN | CN0
Example	SENS:POW:ACH:PRES ACP
Remote Command Notes	FSE [SENSe[1]|2]:POWer:ACHannel:PRESet ACPower | CPOWer | OBANdwidth|OBWidth | CN | CN0 | ADJust FSP, FSU, ESU, FSL, FSV [SENSe[1]|2]:POWer:ACHannel:PRESet ACPower | CPOWer | MCACpower | OBANdwidth | OBWidth | CN | CN0 FSW [SENSe]:POWer:ACHannel:PRESet ACPower | CPOWer | MCACpower | OBANdwidth | OBWidth | CN | CN0
State Saved	No
Range	ACPower | CPOWer | MCACpower | OBANdwidth | OBWidth | CN | CN0

10.3.29.14 [SENSe]:POWer:ACHannel:PRESet:RLEVel

Adjusts the reference level to the measured channel power. If required, switches on the adjacent channel power measurement.

This command is accepted, but takes no action and reports no error.

Remote Command	`[:SENSe]:POWer:ACHannel:PRESet:RLEVel`
Example	`SENS:POW:ACH:PRES:RLEV`
Remote Command Notes	FSP, FSU, ESU, FSL, FSV [SENSe[1]|2]:POWer:ACHannel:PRESet:RLEVel FSW [SENSe]:POWer:ACHannel:PRESet:RLEVel

10.3.29.15 [SENSe]:POWer:BANDwidth|BWIDth

Specifies the power percentage with respect to the total power.

Remote Command	`[:SENSe]:POWer:BANDwidth|BWIDth <real>` `[:SENSe]:POWer:BANDwidth|BWIDth?`
Example	`POW:BAND 99.0` `POW:BAND?`
Remote Command Notes	FSE [SENSe[1]|2]:POWer:BANDwidth|BWIDth 0 to 100PCT FSP, FSU, ESU, FSL, FSV [SENSe[1]|2]:POWer:BANDwidth|BWIDth 10 to 99.9PCT FSW [SENSe]:POWer:BANDwidth|BWIDth 10 to 99.9PCT
Preset	99PCT
State Saved	Saved in instrument state.
Min	10
Max	99.99

10.3.29.16 [SENSe]:POWer:HSPeed

Switches on or off the high-speed channel or adjacent channel power measurement.

Remote Command	`[:SENSe]:POWer:HSPeed ON|OFF|1|0` `[:SENSe]:POWer:HSPeed?`
Example	`POW:HSP ON`

	POW:HSP?
Remote Command Notes	FSP, FSU, ESU, FSL, FSV [SENSe[1]|2]:POWer:HSPeed ON | OFF FSW [SENSe]:POWer:HSPeed ON | OFF
Preset	OFF
State Saved	Saved in instrument state.

10.3.29.17 [SENSe]:POWer:NCORrection

Switches on or off the instrument inherent noise correction for channel power measurement.

Remote Command	[:SENSe]:POWer:NCORrection ON|OFF|1|0 [:SENSe]:POWer:NCORrection?
Example	POW:NCOR ON POW:NCOR?
Remote Command Notes	FSP, FSU, ESU [SENSe[1]|2]:POWer:NCORrection ON | OFF FSV [SENSe[1]|2]:POWer:NCORrection ON | OFF | AUTO FSW [SENSe]:POWer:NCORrection ON | OFF
Preset	OFF
State Saved	Saved in instrument state.

10.3.29.18 [SENSe]:POWer:TRACe

Assigns the channel or adjacent channel power measurement to the indicated trace in the selected measurement window.

This command is accepted, but takes no action and reports no error.

Remote Command	[:SENSe]:POWer:TRACe <int> [:SENSe]:POWer:TRACe?
Example	SENS:POW:TRAC 1 SENS:POW:TRAC?
Remote Command Notes	FSP, FSU, ESU [SENSe[1]|2]:POWer:TRACe 1|2|3 FSL, FSV

	[SENSe[1]|2]:POWer:TRACe 1|2|3|4|5|6 FSW [SENSe]:POWer:TRACe 1|2|3|4|5|6
State Saved	Saved in instrument state.
Min	1
Max	3

10.3.30 SENSe:ROSCillator Subsystem

The SENSe:ROSCillator subsystem controls the reference oscillator. The numeric suffix in SENSe is irrelevant for the commands in this subsystem.

10.3.30.1 [SENSe]:ROSCillator:SOURce

Switches between an external or internal reference oscillator for frequency processing of external generators 1 and 2.

Remote Command	`[:SENSe]:ROSCillator:SOURce INTernal|EXTernal` `[:SENSe]:ROSCillator:SOURce?`
Example	`ROSC:SOUR EXT`
Remote Command Notes	FSE, FSP, FSU, ESU, FSL, FSV [SENSe[1]|2]:ROSCillator:SOURce INTernal | EXTernal FSW [SENSe]:ROSCillator:SOURce INTernal | EXTernal[1] | E10 | E100 | EAUTo | SYNC
Preset	INT
State Saved	Yes.
Range	INTernal|EXTernal

10.3.31 SENSe:SWEep Subsystem

The SENSe:SWEep subsystem controls the sweep parameters.

10.3.31.1 [SENSe]:SWEep:TIME

Specifies sweep time.

Remote Command	`[:SENSe]:SWEep:TIME <time>` `[:SENSe]:SWEep:TIME?`
Example	`SWE:TIME 500ms`
Remote	FSE, FSL, FSV

Command Notes	[SENSe[1]|2]:SWEep:TIME <numeric_value> FSP, FSU, ESU [SENSe[1]|2]:SWEep:TIME 2,5ms to 16000s (frequency domain) | 1µs to 16000s (time domain) FSW [SENSe]:SWEep:TIME <numeric_value>
Preset	1ms
State Saved	Saved in instrument state.
Min	1 ms
Max	4000 s

10.3.31.2 [SENSe]:SWEep:TIME:AUTO

Automatically couples sweep time to the frequency span and bandwidth settings.

Remote Command	`[:SENSe]:SWEep:TIME:AUTO OFF|ON|0|1` `[:SENSe]:SWEep:TIME:AUTO?`
Example	`SWE:TIME:AUTO OFF`
Remote Command Notes	FSE, FSP, FSU, ESU, FSL, FSV [SENSe[1]|2]:SWEep:TIME:AUTO ON | OFF FSW [SENSe]:SWEep:TIME:AUTO ON | OFF
Preset	ON
State Saved	Saved in instrument state.

10.3.31.3 [SENSe]:SWEep:COUNt

Specifies the number of single sweeps that are used to calculate the average or maximum value.

SCPILC mode supports the maximum value of 10000, not 32767 as in FSx.

Remote Command	`[:SENSe]:SWEep:COUNt <int>` `[:SENSe]:SWEep:COUNt?`
Example	`SENS:SWE:COUN 1000` `SENS:SWE:COUN?`
Remote Command Notes	FSE, FSP, FSU, ESU, FSL, FSV [SENSe[1]|2]:SWEep:COUNt 0 to 32767 FSW [SENSe]:SWEep:COUNt 0 to 200000
Preset	0

State Saved	Saved in instrument state.
Min	0
Max	40000

10.3.31.4 [SENSe]:SWEep:EGATe

Switches on or off sweep control by an external gate signal.

Remote Command	`[:SENSe]:SWEep:EGATe ON|OFF|1|0` `[:SENSe]:SWEep:EGATe?`
Example	`SWE:EGAT ON` `SWE:EGAT?`
Remote Command Notes	FSE, FSP, FSU, ESU, FSL, FSV [SENSe[1]|2]:SWEep:EGATe ON | OFF FSW [SENSe]:SWEep:EGATe ON | OFF
Preset	OFF
State Saved	Saved in instrument state.

10.3.31.5 [SENSe]:SWEep:EGATe:TYPE

Specifies the external gate signal's triggering type (level or edge).

Remote Command	`[:SENSe]:SWEep:EGATe:TYPE LEVel|EDGE` `[:SENSe]:SWEep:EGATe:TYPE?`
Example	`SWE:EGAT:TYPE LEVel` `SWE:EGAT:TYPE?`
Remote Command Notes	FSE, FSP, FSU, ESU, FSL, FSV [SENSe[1]|2]:SWEep:EGATe:TYPE LEVel | EDGE FSW [SENSe]:SWEep:EGATe:TYPE LEVel | EDGE
Preset	EDGE
State Saved	Saved in instrument state.
Range	LEVel | EDGE

10.3.31.6 [SENSe]:SWEep:EGATe:POLarity

Specifies the external gate signal's polarity.

Remote Command	`[:SENSe]:SWEep:EGATe:POLarity POSitive|NEGative`

	[:SENSe]:SWEep:EGATe:POLarity?
Example	SWE:EGAT:POL NEG SWE:EGAT:POL?
Remote Command Notes	FSE, FSP, FSU, ESU, FSL, FSV [SENSe[1]|2]:SWEep:EGATe:POLarity POSitive | NEGative FSW [SENSe]:SWEep:EGATe:POLarity POSitive | NEGative
Preset	POSitive
State Saved	Saved in instrument state.
Range	POSitive | NEGative

10.3.31.7 [SENSe]:SWEep:EGATe:HOLDoff

For edge triggering, specifies the instrument's holdoff time.

Remote Command	[:SENSe]:SWEep:EGATe:HOLDoff <time> [:SENSe]:SWEep:EGATe:HOLDoff ?
Example	SWE:EGAT:HOLD 0.0002 SWE:EGAT:HOLD?
Remote Command Notes	FSE, [SENSe[1]|2]:SWEep:EGATe:HOLDoff 0 to 100s FSP, FSU, ESU, FSL [SENSe[1]|2]:SWEep:EGATe:HOLDoff 125 ns to 100 s FSV [SENSe[1]|2]:SWEep:EGATe:HOLDoff 125 ns to 30 s
Preset	0
State Saved	Saved in instrument state.
Min	125ns
Max	100s

10.3.31.8 [SENSe]:SWEep:EGATe:LENGth

For edge triggering, specifies the time interval during which the instrument sweeps.

Remote Command	[:SENSe]:SWEep:EGATe:LENGth <time> [:SENSe]:SWEep:EGATe:LENGth?
Example	SWE:EGAT:LENG 1 SWE:EGAT:LENG?
Remote Command	FSE, FSP, FSU, ESU, FSL

Notes	[SENSe[1]|2]:SWEep:EGATe:LENGth 0 to 100s FSV [SENSe[1]|2]:SWEep:EGATe:LENGth 125ns to 30s FSW [SENSe]:SWEep:EGATe:LENGth 0 to 30s
Preset	XA 1.25e-7 FSE, FSU, ESU, FSL, FSP, FSW 0 FSV 400US
State Saved	Saved in instrument state.
Min	0
Max	100s

10.3.31.9 [SENSe]:SWEep:EGATe:SOURce

Switches between an external gate signal and an IF power signal as the signal source for the gate mode.

Remote Command	`[:SENSe]:SWEep:EGATe:SOURce EXTernal|IFPower|RFPower` `[:SENSe]:SWEep:EGATe:SOURce?`
Example	`SENS:SWE:EGAT:SOUR EXT` `SENS:SWE:EGAT:SOUR?`
Remote Command Notes	FSE [SENSe[1]|2]:SWEep:EGATe:SOURce EXTernal | RFPower FSP [SENSe[1]|2]:SWEep:EGATe:SOURce EXTernal | IFPower | RFPower FSU, ESU [SENSe[1]|2]:SWEep:EGATe:SOURce EXTernal | IFPower FSL [SENSe[1]|2]:SWEep:EGATe:SOURce EXTernal | IFPower | VIDeo FSV [SENSe[1]|2]:SWEep:EGATe:SOURce EXTernal | IFPower | VIDeo | RFPower | PSEN FSW [SENSe]:SWEep:EGATe:SOURce EXTernal | EXT2 | EXT3 | IFPower | IQPower | VIDeo | RFPower | PSEN
Preset	FSEEXTernalFSP, FSU, ESU, FSL, FSV, FSWIFPower
Range	EXTernal | IFPower | RFPower

10.3.31.10 [SENSe]:SWEep:POINts

Specifies the number of measurement points for one sweep run.

Remote Command	`[:SENSe]:SWEep:POINts <integer>` `[:SENSe]:SWEep:POINts?`
Example	`SWE:POIN 251` `SWE:POIN?`
Remote Command Notes	FSP [SENSe[1]|2]:SWEep:POINts 125 to 8001 FSU, ESU [SENSe[1]|2]:SWEep:POINts 155, 313, 625, 1251, 1999, 2501, 5001, 10001, 20001, 30001 FSL, FSV [SENSe[1]|2]:SWEep:POINts 101…32001 FSW [SENSe]:SWEep:POINts 101…100001
Preset	FSP, FSL: 501; FSU, ESU: 625; FSV: 691; FSW: 1001
State Saved	Saved in instrument state.
Min	1
Max	40001

Preset:

FSP, FSL	FSU, ESU	FSV	FSW
501	625	691	1001

10.3.32 STATus Subsystem

The STATus subsystem provides the status reporting system commands. The status registers are not influenced by *RST.

10.3.32.1 STATus:OPERation[:EVENt]?

Queries the contents of the EVENt section in the STATus:OPERation register. After the readout, the contents of the EVENt section are deleted.

Remote Command	`:STATus:OPERation[:EVENt]?`
Example	`STAT:OPER?`
Remote Command Notes	FSE, FSP, FSU, ESU, FSL, FSV, FSW STATus:OPERation[:EVENt]?
Preset	0

10.3.32.2 STATus:OPERation:CONDition?

Queries the CONDition section in the STATus:OPERation register. The current hardware status is reflected in the value returned. The contents of the CONDition section are not deleted after the readout.

Remote Command	`:STATus:OPERation:CONDition`
Example	`STAT:OPER:COND?`
Remote Command Notes	FSE, FSP, FSU, ESU, FSL, FSV, FSW STATus:OPERation:CONDition?
Preset	0

10.3.32.3 STATus:OPERation:ENABle

Specifies the bits of the ENABle section in the STATus:OPERation register.

This mode supports the maximum value of 32767, not 65535 as in FSx.

Remote Command	`:STATus:OPERation:ENABle <integer>` `:STATus:OPERation:ENABle?`
Example	`STAT:OPER:ENAB 1`
Remote Command Notes	FSE, FSP, FSU, ESU, FSL, FSV, fSW STATus:OPERation:ENABle 0 to 65535
Preset	0
Min	0
Max	32767

10.3.32.4 STATus:OPERation:PTRansition

Specifies the edge detectors of all bits in the STATus:OPERation register from 0 to 1 for the transitions of the CONDition bit.

This mode supports the maximum value of 32767, not 65535 as FSx.

Remote Command	`:STATus:OPERation:PTRansition <integer>` `:STATus:OPERation:PTRansition?`
Example	`STAT:OPER:PTR 1`
Remote Command Notes	FSE, FSP, FSU, ESU, FSL, FSV, FSW STATus:OPERation:PTRansition 0 to 65535
Preset	32767
Min	0
Max	32767

10.3.32.5 STATus:OPERation:NTRansition

Specifies the edge detectors of all bits in the STATus:OPERation register from 1 to 0 for the transitions of the CONDition bit.

This mode supports the maximum value of 32767, not 65535 as in FSx.

Remote Command	`:STATus:OPERation:NTRansition <integer>` `:STATus:OPERation:NTRansition?`
Example	`STAT:OPER:NTR 1`
Remote Command Notes	FSE, FSP, FSU, ESU, FSL, FSV, FSW STATus:OPERation:NTRansition 0 to 65535
Preset	0
Min	0
Max	32767

10.3.32.6 STATus:PRESet

Resets the edge detectors and ENABle parts of all registers to a defined value.

Remote Command	`:STATus:PRESet`
Example	`STAT:PRES`
Remote Command Notes	FSE, FSP, FSU, ESU, FSL, FSV, FSW STATus:PRESet

10.3.32.7 STATus:QUEStionable[:EVENt]

Queries the contents of the EVENt section in the STATus:QUEStionable register. After the readout, the contents of the EVENt section are deleted.

Remote Command	`:STATus:QUEStionable[:EVENt]?`
Example	`STAT:QUES?`
Remote Command Notes	FSE, FSP, FSU, ESU, FSL, FSV, FSW STATus:QUEStionable[:EVENt]?
Preset	0

10.3.32.8 STATus:QUEStionable:CONDition

Queries the CONDition section in the STATus:QUEStionable register. The contents of the CONDition section are not deleted after a readout.

Remote Command	:STATus:QUEStionable:CONDition?
Example	STAT:QUES:COND?
Remote Command Notes	FSE, FSP, FSU, ESU, FSL, FSV, FSW STATus:QUEStionable:CONDition?
Preset	0

10.3.32.9 STATus:QUEStionable:ENABle

Specifies the bits of the ENABle section in the STATus-QUEStionable register. The

ENABle register selectively enables individual events in the associated EVENt section for the summary bit in the status byte.

This mode supports the maximum value of 32767, not 65535 as FSx.

Remote Command	:STATus:QUEStionable:ENABle <integer> :STATus:QUEStionable:ENABle?
Example	:STATus:QUEStionable:ENABle 16
Remote Command Notes	FSE, FSP, FSU, ESU, FSL, FSV, FSW STATus:QUEStionable:ENABle 0 to 65535
Preset	0
Min	0
Max	32767

10.3.32.10 STATus:QUEStionable:PTRansition

This mode supports the maximum value of 32767, not 65535 as in FSx.

Remote Command	:STATus:QUEStionable:PTRansition <integer>. :STATus:QUEStionable:PTRansition?
Example	STAT:QUES:PNTR 16
Remote Command Notes	FSE, FSP, FSU, ESU, FSL, FSV, FSW STATus:QUEStionable:PTRansition 0 to 65535
Preset	0
Min	0
Max	32767

10.3.32.11 STATus:QUEStionable:NTRansition

Specifies the edge detectors of all bits in the STATus:OPERation register from 1 to 0 for the transitions of the CONDition bit.

This mode supports the maximum value of 32767, not 65535 as FSx.

Remote Command	`:STATus:QUEStionable:NTRansition <integer>.` `:STATus:QUEStionable:NTRansition?`
Example	`STAT:QUES:NTR 16`
Remote Command Notes	FSE, FSP, FSU, ESU, FSL, FSV, FSW STATus:QUEStionable:NTRansition 0 to 65535
Preset	0
Min	0
Max	32767

10.3.32.12 STATus:QUEStionable:FREQuency[:EVENt]

Queries the contents of the EVENt section in the STATus:QUEStionable: FREQuency register.

Remote Command	`:STATus:QUEStionable:FREQuency[:EVENt]?`
Example	`STAT:QUES:FREQ?`
Remote Command Notes	FSE, FSP, FSU, ESU, FSL, FSV, FSW STATus:QUEStionable:FREQuency[:EVENt]?
Preset	0

10.3.32.13 STATus:QUEStionable:FREQuency:CONDition

Queries the contents of the CONDition section in the

STATus:QUEStionable:FREQuency register. The contents of the CONDition section are not deleted after a readout.

Remote Command	`:STATus:QUEStionable:FREQuency:CONDition?`
Example	`STAT:QUES:FREQ:COND?`
Remote Command Notes	FSE, FSP, FSU, ESU, FSL, FSV, FSW STATus:QUEStionable:FREQuency:CONDition?
Preset	0

10.3.32.14 STATus:QUEStionable:FREQuency:ENABle

Specifies the bits of the ENABle section in the STATus:QUEStionable:FREQuency register.

This mode supports the maximum value of 32767, not 65535 as FSx.

Remote Command	`:STATus:QUEStionable:FREQuency:ENABle <integer>` `:STATus:QUEStionable:FREQuency:ENABle?`

Example	STAT:QUES:FREQ:ENAB 2
Remote Command Notes	FSE, FSP, FSU, ESU, FSL, FSV, FSW STATus:QUEStionable:FREQuency:ENABle 0 to 65535
Preset	32767
Min	0
Max	32767

10.3.32.15 STATus:QUEStionable:FREQuency:PTRansition

Specifies the edge detectors of all bits in the STATus:QUEStionable:FREQuency register from 0 to 1 for the transitions of the CONDition bit.

This mode supports the maximum value of 32767, not 65535 as in FSx.

Remote Command	:STATus:QUEStionable:FREQuency:PTRansition <integer> :STATus:QUEStionable:FREQuency:PTRansition?
Example	STAT:QUES:FREQ:PTR 2
Remote Command Notes	FSE, FSP, FSU, ESU, FSL, FSV, FSW STATus:QUEStionable:FREQuency:PTRansition 0 to 65535
Preset	32767
Min	0
Max	32767

10.3.32.16 STATus:QUEStionable:FREQuency:NTRansition

Specifies the edge detectors of all bits in the STATus:QUEStionable:FREQuency register from 1 to 0 for the transitions of the CONDition bit.

This mode supports the maximum value of 32767, not 65535 as in FSx.

Remote Command	:STATus:QUEStionable:FREQuency:NTRansition <integer> :STATus:QUEStionable:FREQuency:NTRansition?
Example	STAT:QUES:FREQ:NTR 2
Remote Command Notes	FSE, FSP, FSU, ESU, FSL, FSV, FSW STATus:QUEStionable:FREQuency:NTRansition 0 to 65535
Preset	0
Min	0
Max	32767

10.3.32.17 STATus:QUEue[:NEXT]?

Returns the earliest entry to the error queue then deletes it.

Remote Command	:STATus:QUEue[:NEXT]?
Example	STAT:QUE?
Remote Command Notes	FSE, FSP, FSU, ESU, FSL, FSV, FSW STATus:QUEue[:NEXT]?

10.3.33 SYSTem Subsystem

This subsystem includes commands for general functions.

10.3.33.1 SYSTem:COMMunicate:GPIB[:SELF]:ADDRess

Changes the analyzer's IEC/IEEE-bus address.

Changing this address may require further communication to use the new address.

Remote Command	:SYSTem:COMMunicate:GPIB[:SELF]:ADDRess <integer> :SYSTem:COMMunicate:GPIB[:SELF]:ADDRess?
Example	:SYST:COMM:GPIB:ADDR 17
Remote Command Notes	Note: Changing the Address on the GPIB port requires all further communication to use the new address. FSE, FSP, FSU, ESU, FSL, FSV, FSW SYSTem:COMMunicate:GPIB[:SELF]:ADDRess 0 to 30
State Saved	No
Range	0 to 30
Min	0
Max	30

10.3.33.2 SYSTem:COMMunicate:GPIB[:SELF]:RTERminator

This command changes the GPIB receive terminator.

According to the standard the terminator in ASCII is <LF> and/or <EOI>. For binary data transfers

(e.g. trace data) from the control computer to the instrument, the binary code (0AH) used for <LF> might be included in the binary data block, and therefore should not be interpreted as a terminator in this particular case. This can be avoided by changing the receive terminator to EOI.

Output of binary data from the instrument to the control computer does not require such a terminator change.

Currently, this command won't invoke any action.

Remote Command	:SYSTem:COMMunicate:GPIB[:SELF]:RTERminator LFEOI | EOI :SYSTem:COMMunicate:GPIB[:SELF]:RTERminator?
Example	SYST:COMM:GPIB:RTER LFEOI SYST:COMM:GPIB:RTER?
Remote Command Notes	FSE, FSP, FSU, ESU, FSL, FSV, FSW SYSTem:COMMunicate:GPIB[:SELF]:RTERminator LFEOI | EOI Currently, this command won't invoke any action.
Preset	LFEOI

10.3.33.3 SYSTem:DATE

Sets or queries the date portion of the analyzer's internal clock.

Remote Command	:SYSTem:DATE <year>,<month>,<day> :SYSTem:DATE?
Example	:SYST:DATE 2006,05,26
Remote Command Notes	FSE, FSP, FSU, ESU, FSL, FSV SYSTem:DATE 1980 to 2099, 1 to 12, 1|2|31

10.3.33.4 SYSTem:DISPlay:FPANel[:STATe]

Turns the on-screen display of front panel keys on or off.

Remote Command	SYSTem:DISPlay:FPANel[:STATe] SYSTem:DISPlay:FPANel[:STATe]?
Example	:SYST:DISP:FPAN ON :SYST:DISP:FPAN?
Remote Command Notes	FSP, FSU, ESU, FSL, FSV, FSW SYSTem:DISPlay:FPANel[:STATe] ON | OFF
Preset	ON
State Saved	No

10.3.33.5 SYSTem:DISPlay:UPDate

This command is accepted, but takes no action and reports no error.

Remote Command	:SYSTem:DISPlay:UPDate ON|OFF|1|0 :SYSTem:DISPlay:UPDate?
Example	SYST:DISP:UPD ON
Remote Command	FSE, FSP, FSU, ESU, FSL, FSV, FSW

Notes	SYSTem:DISPlay:UPDate ON | OFF
Preset	ON

10.3.33.6 SYSTem:ERRor?

Queries the first (oldest) entry in the error queue, then deletes that entry.

Remote Command	`:SYSTem:ERRor[:NEXT]?`
Example	`:SYST:ERR?`
Remote Command Notes	FSE, FSP, FSU, ESU SYSTem:ERRor? FSL, FSV, FSW SYSTem:ERRor[:NEXT]?

10.3.33.7 SYSTem:ERRor:LIST?

This command is accepted, but takes no action and reports no error.

Remote Command	`:SYSTem:ERRor:LIST?`
Example	`:SYST:ERR:LIST?`
Remote Command Notes	FSP, FSU, ESU, FSL, FSV, FSW SYSTem:ERRor:LIST?

10.3.33.8 SYSTem:ERRor:CLEar:ALL

This command is accepted, but takes no action and reports no error.

Remote Command	`:SYSTem:ERRor:CLEar:ALL`
Example	`:MMEM:CLE:ALL`
Remote Command Notes	FSP, FSU, ESU, FSL, FSV, FSW SYSTem:ERRor:CLEar:ALL

10.3.33.9 SYSTem:PRESet

Initiates a reset of the analyzer.

Remote Command	`:SYSTem:PRESet`
Example	`:SYST:PRES`
Remote Command Notes	FSE, FSP, FSU, ESU, FSL, FSV, FSW SYSTem:PRESet

10.3.33.10 SYSTem:TIME

Sets or queries the time portion of the analyzer's internal clock. The sequence of entry is hour, minute, second.

Remote Command	`:SYSTem:TIME <hour>,<minute>,<second>` `:SYSTem:TIME?`
Example	`:SYST:TIME 13,05,26`
Remote Command Notes	FSE, FSP, FSU, ESU, FSL, FSV SYSTem:TIME 0 to 23, 0 to 59, 0 to 59

10.3.33.11 SYSTem:VERSion

Queries the analyzer's SCPI version number.

This command is a query and therefore has no *RST value.

Remote Command	`:SYSTem:VERSion?`
Example	`:SYST:VERS?`
Remote Command Notes	FSE, FSP, FSU, ESU, FSL, FSV SYSTem:VERSion?

10.3.34 TRACe Subsystem

10.3.34.1 TRACe[:DATA]

The command writes trace data from the control computer to the specified trace of the analyzer.

The TRACe[:DATA] command is of the form:

:TRACe:DATA <trace>,<data>

where <trace> may be one of the following parameters:

TRACE1, TRACE2, TRACE3, TRACE4, TRACE5, TRACE6

and where <data> may be either:

- ASCII data, consisting of a set of comma-separated values, or,

- REAL or INTeger, sent as a definite length block, with a header describing the data to follow.

The query reads the specified trace data from the analyzer to the control computer.

Remote	`:TRACe[1][:DATA] TRACE1	TRACE2	TRACE3	TRACE4	TRACE5 |`

Command	`TRACE6,<data>` `:TRACe[1][:DATA]? TRACE1|TRACE2|TRACE3|TRACE4|TRACE5|TRACE6`
Example	`TRAC? TRACE1`
Remote Command Notes	FSE TRACe[:DATA] TRACE1| TRACE2| TRACE3| TRACE4, <block> | <numeric_value> FSP TRACe[1]|2[:DATA] TRACE1| TRACE2| TRACE3, | PWCDp | CTABle | SPURious, <block> | <numeric_value> FSU, ESU TRACe[1]|2[:DATA] TRACE1 | TRACE2 | TRACE3 | LIST | SPURious | ABITstream | PWCDp | CTABle, <block> | <numeric_value> FSL TRACe[1]|2[:DATA] TRACE1 | TRACE2 | TRACE3 | TRACE4 | TRACE5 | TRACE6 | LIST | SPURious,<block> | <numeric_value> FSV(query only) TRACe[1]|2[:DATA]? TRACE1 | TRACE2 | TRACE3 | TRACE4 | TRACE5 | TRACE6 | LIST | SPURious | SPECtrogram | SGRam FSW TRACe[1]|2|...|16[:DATA] TRACE1 | TRACE2 | TRACE3 | TRACE4 | TRACE5 | TRACE6 | LIST | SPURious | SPECtrogram | SGRam, <data> TRACe[1]|2|...|16[:DATA]? TRACE1 | TRACE2 | TRACE3 | TRACE4 | TRACE5 | TRACE6 | LIST | SPURious | SPECtrogram | SGRam

10.3.35 TRACe:IQ Subsystem

This subsystem includes commands for handling measured I/Q data.

10.3.35.1 TRACe:IQ:DATA

This query causes a measurement to be performed, then returns a list of measurement results. The results are corrected for frequency response before being returned.

Before sending this query, specify the measurement settings using "TRACe:IQ:SET" on page 757.

Remote Command	`:TRACe[1]:IQ:DATA?`
Example	`TRAC:IQ:DATA?`
Remote Command Notes	FSP, FSU, ESU, FSL, FSV TRACe[1]|2:IQ:DATA?

10.3.35.2 TRACe:IQ:SET

Specifies the analyzer settings for measurement of I/Q data.

Remote Command	`TRACe[1]:IQ:SET <filter type>,<rbw>,<sample rate>,<trigger source>,<trigger slope>,<pretrigger samples>,<# of samples>`
Example	`TRAC:IQ:SET NORM, 10MHz, 32MHz, EXT, POS, 0, 2048` `TRAC:IQ:SET NORM, 1MHz, 4MHz, EXT, POS, 1024, 512`
Remote Command Notes	FSP, FSU, ESU, FSL, FSV TRACe[1]|2:IQ:SET <filter type>,<rbw>,<sample rate>,<trigger source>,<trigger slope>,<pretrigger samples>,<# of samples>

10.3.35.3 TRACe:IQ:SRATe

Specifies the sampling rate for I/Q data acquisition.

Remote Command	`TRACe[1]:IQ:SRATe <freq>` `TRACe[1]:IQ:SRATe?`
Example	`TRAC:IQ:SRAT 4MHZ` `TRAC:IQ:SRAT?`
Remote Command Notes	FSP, FSU, ESU TRACe[1]|2:IQ:SRATe 15.625kHz to 32MHz FSL TRACe[1]|2:IQ:SRATe 10 kHz to 65.83 MHz FSV TRACe[1]|2:IQ:SRATe 100 Hz to 45 MHz
Preset	32MHz
State Saved	Saved in instrument state.
Min	15.625kHz
Max	32MHz

10.3.35.4 TRACe:IQ[:STATe]

Switches the current measurement between SWEEP mode and I/Q mode.

Remote Command	`:TRACe:IQ[:STATe] ON|OFF|1|0` `:TRACe:IQ[:STATe]?`
Example	`TRAC:IQ:STAT ON`
Remote Command Notes	FSP, FSU, ESU, FSL, FSV TRACe[1]|2:IQ[:STATe] ON | OFF
Preset	OFF
State Saved	Saved in instrument state.

10.3.36 TRIGger Subsystem

This subsystem includes commands that control and synchronize the start of a sweep.

An external trigger signal can be supplied via the connector on the analyzer’s rear panel.

10.3.36.1 TRIGger[:SEQuence]:SOURce

Selects the trigger source.

This mode supports only parameter options: IMMediate, EXTernal, VIDeo, RFPower.

It does not support parameter options: IFPower, TV, AF, FM, AM and PM.

Remote Command	`:TRIGger[1][:SEQuence]:SOURce IMMediate | EXTernal | VIDeo | IFPower | RFPower | TV | AF | FM | AM | PM` `:TRIGger[1][:SEQuence]:SOURce?`
Example	`TRIG:SOUR EXT`
Remote Command Notes	FSE TRIGger[1]|2[:SEQuence]:SOURce IMMediate | LINE | EXTernal | VIDeo | RFPower | TV | AF FSP TRIGger[1]|2[:SEQuence]:SOURce IMMediate | EXTernal | VIDeo | IFPower | RFPower | TV | AF | FM | AM | PM FSU, ESU TRIGger[1]|2[:SEQuence]:SOURce IMMediate | EXTernal | VIDeo | IFPower FSL TRIGger[1]|2[:SEQuence]:SOURce IMMediate (Free Run) | EXTern | IFPower | VIDeo | TIME | TV FSV TRIGger[1]|2[:SEQuence]:SOURce IMMediate (Free Run) | EXTern | IFPower | RFPower | VIDeo | BBPower | PSEN | GP0...GP5 FSW TRIGger[:SEQuence]:SOURce IMMediate (Free Run) | EXTernal | EXT2 | EXT3 | IFPower | RFPower | VIDeo | PSEN
Preset	`IMMediate`
Range	IMMediate | EXTernal | VIDeo | IFPower | RFPower | TV | AF | FM | AM | PM

10.3.36.2 TRIGger[:SEQuence]:LEVel:IFPower

This command sets the level of the IF power trigger source.

This command is accepted, but takes no action and reports no error.

Remote Command	:TRIGger[1][:SEQuence]:LEVel:IFPower <ampl> :TRIGger[1][:SEQuence]:LEVel:IFPower?
Example	TRIG:LEV:IFP -20DBM
Remote Command Notes	FSP TRIGger[1]|2[:SEQuence]:LEVel:IFPower -30 to –10DBM FSU, ESU TRIGger[1]|2[:SEQuence]:LEVel:IFPower -70 to +30 dBm FSL TRIGger[1]|2[:SEQuence]:LEVel:IFPower -50 to -10 dBm FSV TRIGger[1]|2[:SEQuence]:LEVel:IFPower <numeric_value> FSW TRIGger[:SEQuence]:LEVel:IFPower <numeric_value>
Preset	-20dBm FSW -10dBm
State Saved	Saved in instrument state.
Min	30dBm
Max	-70dBm

10.3.36.3 TRIGger[:SEQuence]:LEVel:RFPower

Sets the RF power trigger level.

This mode supports the level range:-200 to 100 dBm.

Remote Command	:TRIGger[1][:SEQuence]:LEVel:RFPower <real> :TRIGger[1][:SEQuence]:LEVel:RFPower?
Example	TRIG:LEV:RFP -20DBM
Remote Command Notes	FSP TRIGger[1]|2[:SEQuence]:LEVel:RFPower -50 to –10DBM FSV TRIGger[1]|2[:SEQuence]:LEVel:RFPower <numeric_value> FSW TRIGger[:SEQuence]:LEVel:RFPower <numeric_value>
Preset	-20dBm
State Saved	Saved in instrument state.
Min	-200dBm
Max	100dBm

10.3.36.4 TRIGger[:SEQuence]:LEVel:VIDeo

Sets the video trigger level.

Remote Command	`TRIGger[1][:SEQuence]:LEVel:VIDeo <real>` `TRIGger[1][:SEQuence]:LEVel:VIDeo?`
Example	`TRIG:LEV:VID 40` `TRIG:LEV:VID?`
Remote Command Notes	FSE, FSP, FSU, ESU, FSL, FSV TRIGger[1]|2[:SEQuence]:LEVel:VIDeo 0 to 100PCT FSW TRIGger[:SEQuence]:LEVel:VIDeo 0 to 100PCT
Preset	50
State Saved	Saved in instrument state.
Min	0
Max	100

10.3.36.5 TRIGger[:SEQuence]:HOLDoff

Specifies the trigger delay period.

Remote Command	`:TRIGger[1][:SEQuence]:HOLDoff <time>` `:TRIGger[1][:SEQuence]:HOLDoff?`
Example	`TRIG:HOLD 100ms`
Remote Command Notes	FSE, FSP, FSU, ESU TRIGger[1]|2[:SEQuence]:HOLDoff -100s to 100s FSL TRIGger[1]|2[:SEQuence]:HOLDoff[:TIME] -100s to 100s FSV TRIGger[1]|2[:SEQuence]:HOLDoff[:TIME] 0s to 100s FSW TRIGger[:SEQuence]:HOLDoff[:TIME] 0s to 30s
Preset	0s
State Saved	Saved in instrument state.
Min	0s
Max	0.5s

10.3.36.6 TRIGger[:SEQuence]:SLOPe

Sets the trigger signal slope to positive or negative.

The trigger slope setting applies to all trigger sources.

Remote Command	`:TRIGger[1][:SEQuence]:SLOPe POSitive|NEGative` `:TRIGger[1][:SEQuence]:SLOPe?`
Example	`TRIG:SLOP NEG`
Remote Command Notes	FSE, FSP, FSU, ESU, FSL, FSV TRIGger[1]|2[:SEQuence]:SLOPe POSitive | NEGative FSW TRIGger[:SEQuence]:SLOPe POSitive | NEGative
Preset	POSitive
State Saved	Saved in instrument state.
Range	POSitive|NEGative

10.3.37 UNIT Subsystem

See the CALC:UNIT subsystem.

10.4 SCPI Operation and Results Query

Remote control of measurements and query of measurement result data is performed using SCPI commands. There are a number of different commands you can use to control the measurement, depending on how you wish to operate the instrument. There are also a number of queries that you can use to extract the measurement data.

In this section “Mode” refers to the Measurement Application, for example, Spectrum Analyzer or 5G NR.

10.4.1 Mode Control

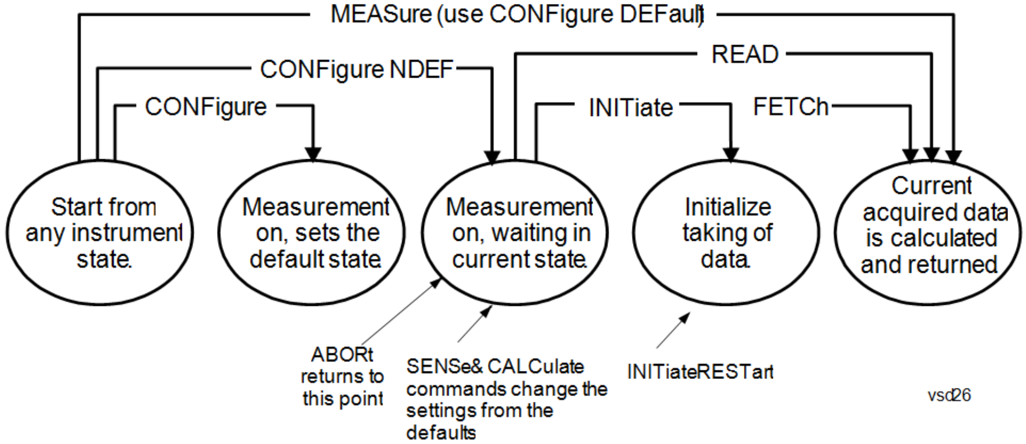
You can use either `INSTrument:SELect` (:INST:SEL) or `INSTrument:NSELect` (:INST:NSEL) to select the instrument's "Mode" on page 48.

The `:INSTrument:CONFigure` command causes a Mode *and* Measurement switch at the same time. This results in faster overall switching than sending the `:INSTrument:SELect` and `CONFigure` commands separately. See "Mode and Measurement Select" on page 49.

10.4.2 Measurement Control

Here are the measurement control commands and their functions, also illustrated in the diagram below. Note that some of these commands also result in data being returned.

"CONFigure" on page 764	Switches to the desired measurement
"INITiate" on page 765	Starts the measurement
"FETCh" on page 765	Queries the data
"READ" on page 766	Starts the measurement and queries the data
"MEASure" on page 767	Switches to the desired measurement, starts the measurement and queries the data



10.4.2.1 CONFigure

This command stops the current measurement (if any) and sets up the instrument for the specified measurement using the factory default instrument settings. It does not initiate the taking of measurement data unless `:INIT:CONTinuous` is `ON`. If you change any measurement settings after using the `:CONFigure` command, the `:READ` command can be used to initiate a measurement without changing the settings back to their defaults.

Normally the `:CONFigure` command presets the measurement after selecting it; however, if sent with the `NDEFault` parameter, it selects it without performing a Preset.

Remote Command	`:CONFigure:<measurement>[:NDEFault]` `:CONFigure?`

Example	Select and preset the Swept SA measurement:
	`:CONF:SAN`
	Select the Swept SA measurement *without* presetting:
	`:CONF:SAN:NDEF`
	Query the current measurement:
	`:CONF?`

Remote Command	`:CONFigure:CATalog?`
Example	`:CONF:CATalog?` Returns a quoted string of all licensed measurement names in the current mode. For example, `"SAN, CHP, OBW, ACP, PST, TXP, SPUR, SEM, LIST”` for the Spectrum Analyzer mode

10.4.2.2 INITiate

Initiates a trigger cycle for the specified measurement, but does not output any data. You must then use the `:FETCh<meas>` command to return data. If a measurement other than the current one is specified, the instrument will switch to that measurement and then initiate it.

Remote Command	`:INITiate:<measurement>`
Example	`:INIT:SAN` Switches to the SANalyzer (Swept SA) measurement if not already there, and starts the measurement

`:INITiate` does not change any of the measurement settings. For example, if you have already run the ACP measurement and you send `:INIT:ACP?`, it will initiate a new ACP measurement using the same instrument settings as the last time ACP was run.

If another measurement is running, `:INIT` will switch to the specified measurement. For example, suppose you are running the Channel Power measurement. If you send `:INIT:ACP?`, it will change from channel power to ACP and will initiate an ACP measurement.

If your selected measurement is currently in the idle state, it triggers the measurement, assuming the trigger conditions are met. Then it completes one trigger cycle. Depending upon the measurement and the number of averages, there may be multiple data acquisitions, with multiple trigger events, for one full trigger cycle.

`:INIT` also holds off additional commands until the acquisition is complete.

10.4.2.3 FETCh

The `:FETCh` command puts selected data from the most recent measurement into the output buffer. Use `:FETCh` if you have already made a good measurement and you want to return data. You can issue `:FETCh` multiple times to get data for different `n` values, for example, both scalars and trace data from a single measurement, without restarting or re-making the measurement.

Remote Command	`:FETCh:<measurement>[n]?`
Example	`:FETCh:SAN2?` Fetches item 2 (Trace 2) from the SAN (Swept SA) measurement when the measurement completes If not in the Swept SA measurement, returns an error

`:FETCh` does not change any of the measurement settings, it simply reads the results of the current measurement. `:FETCh` may be used to return results other than those specified with the original `:READ` or `:MEASure` command that you sent.

You can only `:FETCh` results from the measurement that is currently active, it will not change to a different measurement. An error message is reported if a measurement other than the current one is specified.

If you need to get new measurement data, use the `:READ` command, which is equivalent to `:INITiate` followed by `:FETCh`.

The measurement results for n=1 (usually the scalar result) will be returned if the optional `n` value is not included, or is set to 1. If the `n` value is set to a value other than 1, the selected data results will be returned. See each measurement for details of what types of scalar results or trace data results are available. The binary data formats should be used for handling large blocks of data since they are smaller and transfer faster than the ASCII format. (`:FORMat:DATA`)

Note that the data returned in response to a `:FETCh?` uses the data setting specified by the `:FORMat:BORDer` and `:FORMat:DATA` commands, and can return real or ASCII data. If the format is set to `INT,32`, it returns REAL,32 data.

10.4.2.4 READ

Initiates a trigger cycle for the specified measurement and outputs the requested data. If a measurement other than the current one is specified, the instrument will switch to that measurement before it initiates the measurement and returns results.

Remote Command	`:READ:<measurement>[n]?`
Example	`:READ:SAN2?` Switches to the SANalyzer (Swept SA) measurement if not already there, starts the measurement, and returns item 2 (Trace 2) from the measurement when the measurement completes

`:READ` does not change any of the measurement settings. For example, if have already run the ACP measurement and you send `:READ:ACP?`, it will initiate a new ACP measurement using the same instrument settings as the last time ACP was run.

`:READ` will switch to the specified measurement if the instrument is not already in that measurement. For example, suppose you have already run the ACP measurement, but now you are running the Channel Power measurement. When you send `:READ:ACP?`, it will change from channel power back to ACP and, using the previous ACP settings, will initiate the measurement and return results.

The measurement results for n=1 (usually the scalar result) will be returned if the optional `n` value is not included, or is set to 1. If the `n` value is set to a value other than 1, the selected data results will be returned. See each measurement for details of what types of scalar results or trace data results are available. The binary data formats should be used for handling large blocks of data, since they are smaller and transfer faster than the ASCII format. (`:FORMat:DATA`)

Note that the data returned in response to a `:READ?` query uses the data setting specified by the `:FORMat:BORDer` and `:FORMat:DATA` commands, and can return real or ASCII data. If the format is set to `INT,32`, it returns REAL,32 data

`:READ` holds off additional commands until the acquisition is complete.

10.4.2.5 MEASure

`:MEASure` stops the current measurement (if any) and sets up the instrument for the specified measurement using the factory default instrument settings, initiates a trigger cycle for the specified measurement and outputs the requested data.

Remote Command	`:MEASure:<measurement>[n]?`
Example	`:MEAS:SAN2?` Switches to the SANalyzer (Swept SA) measurement, starts the measurement, and reads back item 2 (Trace 2) when the measurement completes

This is a fast single-command way to make a measurement using the factory default instrument settings. These are the settings and units that conform to the Mode Setup settings (e.g., Radio Standard) that you have currently selected.

- Stops the current measurement (if any) and sets up the instrument for the specified measurement using the factory defaults
- Initiates the data acquisition for the measurement
- Blocks other SCPI communication, waiting until the measurement is complete before returning results.
- If the function does averaging, it is turned on and the number of averages is set to 10.
- After the data is valid it returns the scalar results, or the trace data, for the specified measurement. The type of data returned may be defined by an [n] value that is sent with the command.
- The scalar measurement results will be returned if the optional [n] value is not included, or is set to 1. If the `n` value is set to a value other than 1, the selected trace data results will be returned. See each command for details of what types of scalar results or trace data results are available.
- ASCII is the default format for the data output. (Older versions of Spectrum Analysis and Phase Noise mode measurements only supported ASCII.) The binary data formats should be used for handling large blocks of data, since they are smaller and faster than the ASCII format. Refer to the `:FORMat:DATA` command for more information.

If you need to change some of the measurement parameters from the factory default settings, you can set up the measurement using the `:CONFigure` command. Use the commands in the `:SENSe:<measurement>` and `:CALCulate:<measurement>` subsystems to change the settings. Then you can use the `:READ?` command to initiate the measurement and query the results.

If you need to make a given measurement repeatedly, with settings other than the factory defaults, you can use the commands in the `:SENSe:<measurement>` and

`:CALCulate:<measurement>` subsystems to set up the measurement. Then use the `:READ?` command to initiate the measurement and query the results.

Measurement settings persist if you initiate a different measurement and then return to a previous one. Use `:READ:<measurement>?` if you want to use those persistent settings. If you want to go back to the default settings, use `:MEASure:<measurement>?`

Note that the data returned in response to a `:MEASure?` query uses the data setting specified by the `:FORMat:BORDer` and `:FORMat:DATA` commands and can return real or ASCII data. If the format is set to `INT,32`, it returns REAL,32 data.

10.4.3 Trace Control Commands

The following commands and queries are available to format and manipulate trace data.

10.4.3.1 Clear Trace (Remote Command Only)

Clears the selected trace (from the front panel) or the specified trace (from SCPI). Does not affect the state of any function or variable in the instrument. Loads `mintracevalue` into all of the points in the selected trace, unless the trace is in Min Hold, in which case it loads `maxtracevalue`. It does this even if Update = Off.

Remote Command	`:TRACe:CLEar TRACE1 | TRACE2 | TRACE3 | TRACE4 | TRACE5 | TRACE6`
Example	`:TRAC:CLE TRACE1` Clears trace 1

10.4.3.2 Send/Query Trace Data (Remote Command Only)

This command allows trace data to be sent to the instrument or queried from the instrument.

The response to the query is a list of the amplitude points that comprise the requested trace in the current Y Axis Unit of the instrument. The X Axis Unit is that of the destination trace (for send) or the source trace (for query).

See also:

– "Query Trace Data" on page 769

– "More Information" on page 769

Remote Command	`:TRACe[:DATA] TRACE1 | TRACE2 | TRACE3 | TRACE4 | TRACE5 | TRACE6, <data>`
Notes	The `TRACe[:DATA]` command is of the form: `:TRACe:DATA <trace>,<data>`

	where <trace> can be one of the following parameters: `TRACE1, TRACE2, TRACE3, TRACE4, TRACE5, TRACE6` and where `<data>` can be: - `ASCII` data, which consists of a string of values separated by comma *or* - `REAL` or `INTeger` sent as a definite length block, with a header describing the data to follow
Couplings	Sweep points will affect the amount of data The `:FORMat:DATA` command ("Format Data: Numeric Data (Remote Command Only)" on page 770) describes the different types of data formats that can be used with trace data Use the `:FORMat:BORDer` command to set the byte order ("Format Data: Byte Order (Remote Command Only)" on page 771)

Query Trace Data

Remote Command	`:TRACe[:DATA]? TRACE1 | TRACE2 | TRACE3 | TRACE4 | TRACE5 | TRACE6`

Example	Send five points to Trace 1. Assuming that `:FORMat:DATA` is set to `ASCII`, Y Axis Unit is set to dBm, and sweep points is set to 5, this will result in Trace 1 consisting of the five points: -1 dBm, -2 dBm, -3 dBm, -4 dBm, and -5 dBm:
	`:TRAC TRACE1,-1,-2,-3,-4,-5`
	Query the instrument for the contents of trace 2:
	`:TRAC? TRACE2`

Backwards Compatibility Notes	In the X-Series, the legacy `RAWTRACE`, `LLINE1`, `LLINE2` parameters for trace data query are no longer available

More Information

The format and byte-ordering of the sent or received data will be dependent on the `:FORMat:DATA` and `:FORMat:BORDer` commands. `ASCII` data consists of a string of comma separated values. `REAL` or `INTeger` data is sent as a definite length block, with a header describing the data to follow.

For example, a four point trace might look like this if in ASCII (`:FORMat:DATA ASCIi`):

```
-5.87350E+01, -5.89110E+01, -5.87205E+01, -5.12345E+01<NL><END>
```

and like this if in `INTeger` with 4 bytes per point (`:FORMat:DATA INT,32`):

```
#216<16 bytes of data><NL><END>
```

where the 2 in the #216 means “2 digits of numeric data to follow”, and the 16 is the 2 digits and means “16 binary bytes to follow” (this is the definite length block format).

Note that the data is terminated with `<NL><END>`. (For GPIB, this is newline, or linefeed, followed by EOI set true. For LAN, this is newline only.)

The data format set by `:FORMat:DATA` and `:FORMat:BORDer` is used both for sending data to the instrument and receiving data from the instrument.

When sending data to the instrument, the data block must contain exactly the number of points currently specified in **Sweep, Points** or an error message will be generated and there will be no change to the target trace.

No units terminator (for example, dB or V) is used when sending data; the data is taken as being in the current Y Axis Unit of the instrument.

When a trace is sent to the instrument, it immediately overwrites all of the data in the target trace. Consequently the trace should be inactive in order to achieve predictable results. If you send trace data while a trace is active, and particularly if a sweep or an **Average** or **Max/Min Hold** sequence is already in progress, you may end up with a trace that combines the data you sent with measurement data. Similarly, when querying trace data, it is best if the instrument is *not* sweeping during the query.

Therefore, it is generally advisable to be in **Single** Sweep, or have the trace in View, when sending trace data to the instrument, or querying trace data from the instrument.

10.4.3.3 Format Data: Numeric Data (Remote Command Only)

This command specifies the format of the trace data input and output. It specifies the formats used for trace data during data transfer across any remote port. It affects only the data format for setting and querying trace data for the `:TRACe[:DATA]`, `:TRACe[:DATA]?`, `:CALCulate:DATA[n]?` and `:FETCh:SANalyzer[n]?` commands and queries.

Remote Command	`:FORMat[:TRACe][:DATA] ASCii | INTeger,32 | REAL,32 | REAL,64` `:FORMat[:TRACe][:DATA]?`
Notes	The query response is: – `ASCii`: ASC,8 – `REAL,32`: REAL,32 – `REAL,64`: REAL,64 – `INTeger,32`: INT,32 When the numeric data format is `REAL` or `ASCii`, data is output in the current Y Axis unit. When the data format is `INTeger`, data is output in units of m dBm (.001 dBm) The `INT,32` format returns binary 32-bit integer values in internal units (m dBm), in a definite length block
Dependencies	Sending a data format spec with an invalid number (for example `INT,48`) generates no error. The instrument simply uses the default (8 for `ASCii`, 32 for `INTeger`, 32 for `REAL`)

	Sending data to the analyzer that does not conform to the current FORMat specified results in an error Sending ASCII data when a definite block is expected generates message -161 "Invalid Block Data" Sending a definite block when ASCII data is expected generates message -121 "Invalid Character in Number"
Preset	ASCii
Backwards Compatibility Notes	Note that the INT,32 format applied only to the command, :TRACe:DATA, to preserve backwards compatibility for the Swept SA measurement. For all other commands/queries that honor :FORMat:DATA, if INT,32 is sent, the instrument behaves as though it were set to REAL,32

The specs for each output type are:

- ASCii - Amplitude values are in ASCII, in the current Y Axis Unit, one ASCII character per digit, values separated by commas. Each value is in the form: SX.YYYYYEsZZ, where:
  - S = sign (+ or -)
  - X = one digit to left of decimal point
  - Y = 5 digits to right of decimal point
  - E = E, exponent header
  - s = sign of exponent (+ or -)
  - ZZ = two digit exponent
- REAL,32 - Binary 32-bit real values in the current Y Axis Unit, in a definite length block
- REAL,64 - Binary 64-bit real values in the current Y Axis Unit, in a definite length block

10.4.3.4 Format Data: Byte Order (Remote Command Only)

Selects the binary data byte order for data transfer and other queries. It controls whether binary data is transferred in NORMal or SWAPped mode.

Affects only the byte order for setting and querying trace data for the :TRACe[:DATA], :TRACe[:DATA]? , :CALCulate:DATA[n]? and :FETCh:SANalyzer[n]? commands and queries.

By definition any command that specifies that it uses :FORMat:DATA uses any format supported by :FORMat:DATA.

- NORMal order. The byte sequence begins with the most significant byte (MSB) first, and ends with the least significant byte (LSB) last, in the sequence: 1|2|3|4

– `SWAPped` order. The byte sequence begins with the LSB first, and ends with the MSB last, in the sequence: 4|3|2|1

Remote Command	`:FORMat:BORDer NORMal | SWAPped` `:FORMat:BORDer?`
Preset	`NORMal`

10.4.3.5 Calculate/Compress Trace Data Query (Remote Command Only)

Returns compressed data for the currently selected measurement and sub-opcode `n` where:

`n` = any valid sub-opcode for that measurement. See the `:MEASure:<measurement>?` query description of your specific measurement for information on the data that can be returned.

The data is returned in the current Y Axis Unit of the instrument. The command is used with a sub-opcode <n> (default = 1) to specify the trace. With trace queries, it is best if the instrument is *not* sweeping during the query. Therefore, it is generally advisable to be in **Single** Sweep, or set Update = Off.

This query is used to compress or decimate a long trace, to extract and return only the desired data. A typical example would be to acquire N frames of GSM data and return the mean power of the first burst in each frame. The query can also be used to identify the best curve fit for the data.

Remote Command	`:CALCulate:DATA<n>:COMPress? BLOCk | CFIT | MAXimum | MINimum | MEAN | DMEan | RMS | SAMPle | SDEViation | PPHase [,<soffset>[,<length>[,<roffset>[,<rlimit>]]]]`
Notes	The command supports 5 parameters. Note that the last 4 (`<soffset>`,`<length>`,`<roffset>`,`<rlimit>`) are optional, but these optional parameters must be entered in the specified order. For example, if you want to specify `<length>`, then you must also specify `<soffset>`. See details below for a definition of each of these parameters This command uses the data in the format specified by `:FORMat:DATA`, returning either binary or ASCII data As an example, to query the mean power of a set of GSM bursts: – Supply a signal that is a set of GSM bursts – Select the IQ Waveform measurement (in IQ Analyzer Mode) – Set the sweep time to acquire at least one burst – Set the triggers such that acquisition happens at a known position relative to a burst – Then query the mean burst levels using: `:CALC:DATA2:COMP? MEAN,24e-6,526e-6` These parameter values correspond to GSM signals, where `526e-6` is the length of the burst in the slot and you just want 1 burst

BLOCk or block data

Returns all the data points from the region of the trace data that you specify. For example, it could be used to return the data points of an input signal over several timeslots, excluding the portions of the trace data that you do not want. (This is x,y pairs for trace data, and I,Q pairs for complex data.)

CFIT or curve fit

Applies curve fitting routines to the data.

`<soffset>` and `<length>` are required to define the data that you want.

`<roffset>` is an optional parameter for the desired order of the curve equation.

The query returns the following values: the x-offset (in seconds) and the curve coefficients ((order + 1) values).

`MIN`, `MAX`, `MEAN`, `DME`, `RMS`, `SAMP`, `SDEV` and `PPH` return one data value for each specified region (or `<length>`) of trace data, for as many regions as possible until you run out of trace data (using `<roffset>` to specify regions), or they return the number of regions you specify (using `<rlimit>`), ignoring any data beyond that.

MINimum

Returns the minimum data point (y value) for the specified region(s) of trace data. For I/Q trace data, the minimum magnitude of the I/Q pairs is returned.

MAXimum

Returns the maximum data point (y value) for the specified region(s) of trace data. For I/Q trace data, the maximum magnitude of the I/Q pairs is returned.

MEAN

Returns a single value that is the arithmetic mean of the data point values (in dB/ dBm) for the specified region(s) of trace data. For I/Q trace data, the mean of the magnitudes of the I/Q pairs is returned. See the following equations.

NOTE

If the original trace data is in dB, this function returns the arithmetic mean of those log values, not log of the mean power which is a more useful value. The mean of the log is the better measurement technique when measuring CW signals in the presence of noise. The mean of the power, expressed in dB, is useful in power measurements such as Channel Power. To achieve the mean of the power, use the RMS option.

Equation 1: Mean Value of Data Points for Specified Region(s)

$$\text{MEAN} = \frac{1}{n} \sum_{Xi \in \text{region(s)}} Xi$$

where Xi is a data point value, and n is the number of data points in the specified region(s).

Equation 2: Mean Value of I/Q Data Pairs for Specified Region(s)

$$\text{MEAN} = \frac{1}{n} \sum_{Xi \in \text{region(s)}} |Xi|$$

where |Xi| is the magnitude of an I/Q pair, and n is the number of I/Q pairs in the specified region(s).

DMEan

Returns a single value that is the mean power (in dB/ dBm) of the data point values for the specified region(s) of trace data. See the following equation:

Equation 3: DMEan Value of Data Points for Specified Region(s)

$$\text{DME} = 10 \times \log_{10}\left(\frac{1}{n} \sum_{Xi \in \text{region(s)}} 10^{\frac{Xi}{10}} \right)$$

RMS

Returns a single value that is the average power on a root-mean-squared voltage scale (arithmetic rms) of the data point values for the specified region(s) of trace data. See the following equation.

Equation 4: RMS Value of Data Points for Specified Region(s)

$$\text{RMS} = \sqrt{\frac{1}{n} \sum_{Xi \in \text{region(s)}} Xi^2}$$

where Xi is a data point value, and n is the number of data points in the specified region(s).

For I/Q trace data, the rms of the magnitudes of the I/Q pairs is returned. See the following equation.

NOTE

This function is very useful for I/Q trace data. However, if the original trace data is in dB, this function returns the rms of the log values which is not usually needed.

Equation 5: RMS Value of I/Q Data Pairs for Specified Region(s)

$$\mathrm{RMS} = \sqrt{\frac{1}{n} \sum_{Xi \in \mathrm{region(s)}} Xi\, Xi^*}$$

where Xi is the complex value representation of an I/Q pair, Xi* its conjugate complex number, and n is the number of I/Q pairs in the specified region(s).

Once you have the rms value for a region of trace data (linear or I/Q), you may want to calculate the mean power. You must convert this rms value (peak volts) to power in dBm:

*10 x log[10 * (rms value)2]*

SAMPle

Returns the first data value (x,y pair) for the specified region(s) of trace data. For I/Q trace data, the first I/Q pair is returned.

SDEViation

Returns a single value that is the arithmetic standard deviation for the data point values for the specified region(s) of trace data. See the following equation.

Equation 6: Standard Deviation of Data Point Values for Specified Region(s)

$$\mathrm{SDEV} = \sqrt{\frac{1}{n} \sum_{Xi \in \mathrm{region(s)}} (Xi - \overline{X})^2}$$

where Xi is a data point value, X is the arithmetic mean of the data point values for the specified region(s), and n is the number of data points in the specified region(s).

For I/Q trace data, the standard deviation of the magnitudes of the I/Q pairs is returned. See the following equation.

Equation 7: Standard Deviation of I/Q Data Pair Values for Specified Region(s)

$$\mathrm{SDEV} = \sqrt{\frac{1}{n} \sum_{Xi \in \mathrm{region(s)}} (|Xi| - \overline{X})^2}$$

where |Xi| is the magnitude of an I/Q pair, X is the mean of the magnitudes for the specified region(s), and n is the number of data points in the specified region(s).

PPHase

Returns the x,y pairs of both rms power (dBm) and arithmetic mean phase (radian) for every specified region and frequency offset (Hz). The number of pairs is defined by the specified number of regions. This parameter can be used for I/Q vector (n=0) in Waveform (time domain) measurement and all parameters are specified by data point in `PPHase`.

The rms power of the specified region may be expressed as:

Power = 10 x log [10 x (RMS I/Q value)] + 10

The RMS I/Q value (peak volts) is:

$$\sqrt{\frac{1}{n}\sum_{Xi\,\in\,\text{region}} Xi\,Xi^*}$$

where Xi is the complex value representation of an I/Q pair, Xi* its conjugate complex number, and n is the number of I/Q pairs in the specified region.

The arithmetic mean phase of the specified region may be expressed as:

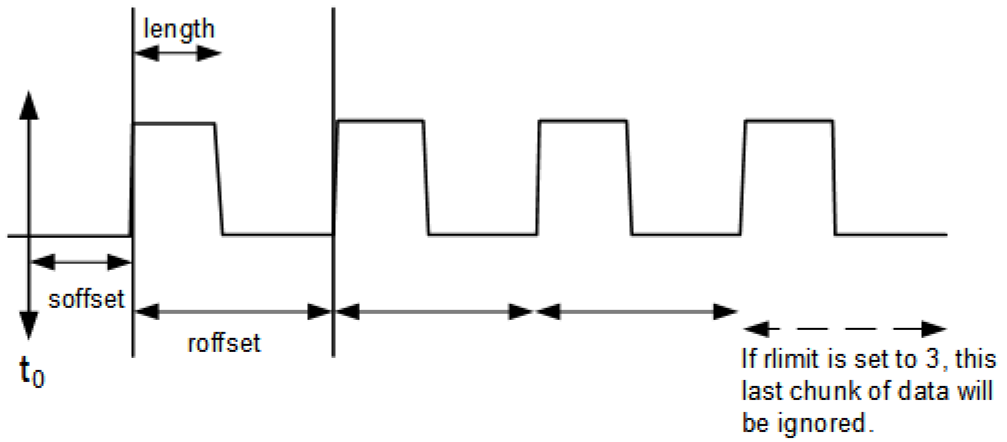
$$\frac{1}{n}\sum_{Yi\,\in\,\text{region}} Yi$$

where Yi is the unwrapped phase of I/Q pair with applying frequency correction and n is the number of I/Q pairs in the specified region.

The frequency correction is made by the frequency offset calculated by the arithmetic mean of every specified region’s frequency offset. Each frequency offset is calculated by the least square method against the unwrapped phase of I/Q pair.

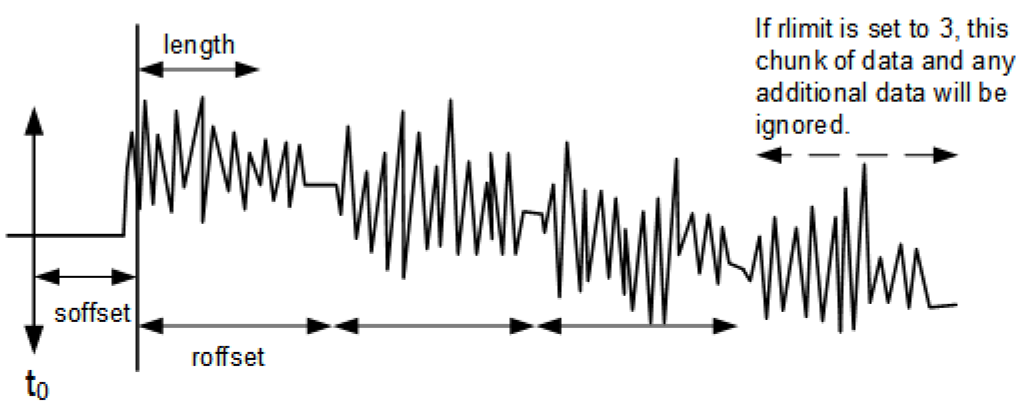
Sample Trace Data - Constant Envelope

(See below for explanation of variables.)



Sample Trace Data - Not Constant Envelope

(See below for explanation of variables.)



`<soffset>` *Start Offset* is an optional real number. (It is in seconds for time-domain traces, and is a dimensionless index 0 to Npoints – 1, for frequency-domain traces)\

It specifies the amount of data at the beginning of the trace that will be ignored before the decimation process starts. It is the time or frequency change from the start of the trace to the point where you want to start using the data

The default value is zero

`<length>` *Length* is an optional real number. (It is in seconds for time-domain traces, and is a dimensionless index 0 to Npoints – 1, for frequency-domain traces)

It defines how much data will be compressed into one value

This parameter has a default value equal to the current trace length

`<roffset>` *Repeat Offset* is an optional real number. (It is in seconds for time-domain traces, and is a dimensionless index 0 to Npoints – 1, for frequency-domain traces)

It defines the beginning of the next field of trace elements to be compressed. This is relative to the beginning of the previous field

This parameter has a default value equal to the `<length>` variable

	Note that this parameter is used for a completely different purpose when curve fitting (see `CFIT` above)
`<rlimit>`	*Repeat Limit* is an optional integer. It specifies the number of data items that you want returned. It will ignore any additional items beyond that number. You can use the Start offset and the Repeat limit to pick out exactly what part of the data you want to use The default value is all the data

10.4.3.6 Calculate Peaks of Trace Data (Remote Command Only)

Returns a list of all the peaks for the currently selected measurement and sub-opcode `n`. The peaks must meet the requirements of the peak threshold and excursion values.

`n` = any valid sub-opcode for the current measurement. See the `:MEASure:<measurement>?` query description for your specific measurement, for information on the data that can be returned.

The command can only be used with specific sub-opcodes with measurement results that are trace data. Both real and complex traces can be searched, but complex traces are converted to magnitude in dBm. In many measurements, the sub-opcode n = 0 is the raw trace data, which cannot be searched for peaks. Sub-opcode n = 1 is often calculated results values, which also cannot be searched for peaks.

This command uses the data setting specified by the `:FORMat:BORDer` and `:FORMat:DATA` commands, and can return real or ASCII data. If the format is set to `INT,32`, it returns `REAL,32` data.

The command has four types of parameters:

- Threshold (in dBm)
- Excursion (in dB)
- Sorting order (amplitude, frequency, time)
- Optional in some measurements: Display line use (all, > display line, < display line)

Remote Command	For Swept SA measurement:
	`:CALCulate:DATA[1]|2|...|6:PEAKs? <threshold>,<excursion>[,AMPLitude | FREQuency | TIME[,ALL | GTDLine | LTDLine]]`
	For most other measurements:
	`:CALCulate:DATA[1]|2|...|6:PEAKs? <threshold>,<excursion>[,AMPLitude | FREQuency | TIME]`

Notes	`<n>` - The trace that will be used `<threshold>` - The level below which trace data peaks are ignored. Note that the threshold value is

required and is always used as a peak criterion. To effectively disable the threshold criterion for this command, provide a substantially low threshold value, such as –200 dBm. Note also that the threshold value used in this command is independent of and has no effect on the threshold value stored under the Peak Criteria menu

`<excursion>` - The minimum amplitude variation (rise and fall) required for a signal to be identified as peak. Note that the excursion value is required and is always used as a peak criterion. To effectively disable the excursion criterion for this command, provide the minimum value of 0.0 dB. Note also that the excursion value used in this command is independent of and has no effect on the excursion value stored under the Peak Criteria menu

Values must be provided for threshold and excursion. The sorting and display line parameters are optional (defaults are `AMPLitude` and `ALL`)

Note that there is always a Y-axis value for the display line, regardless of whether the display line state is on or off. It is the current Y-axis value of the display line which is used by this command to determine whether a peak should be reported

Sorting order:

- `AMPLitude` - lists the peaks in order of descending amplitude, with the highest peak first (default if optional parameter not sent)
- `FREQuency` - lists the peaks in order of occurrence, left to right across the x-axis
- `TIME` - lists the peaks in order of occurrence, left to right across the x-axis

Peaks vs. Display Line:

- `ALL` - lists all of the peaks found (default if optional parameter not sent)
- `GTDLine` (greater than display line) - lists all of the peaks found above the display line
- `LTDLine` (less than display line) - lists all of the peaks found below the display line

As an example, for Swept SA measurement in Spectrum Analyzer Mode:

```
:CALC:DATA4:PEAK? -40,10,FREQ,GTDL
```

This identifies the peaks of trace 4 that are above –40 dBm, with excursions of at least 10 dB. The peaks are returned in order of increasing frequency, starting with the lowest frequency. Only the peaks that are above the display line are returned

Query Results 1:

With `:FORMat:DATA REAL,32` selected, returns a list of floating-point numbers. The first value in the list is the number of peak points that are in the following list. A peak point consists of two values: a peak amplitude followed by its corresponding frequency (or time)

If no peaks are found, the peak list consists of only the number of peaks (0)

10.4.3.7 Smooth Trace Data (Remote Command Only)

Included for ESA compatibility. Not recommended for new designs. Use the `:CALCulate:DATA:COMPress` command instead.

Smoothes the trace according to the number of points specified in `:TRACe:MATH:SMOoth:POINts`. There is no equivalent front panel function.

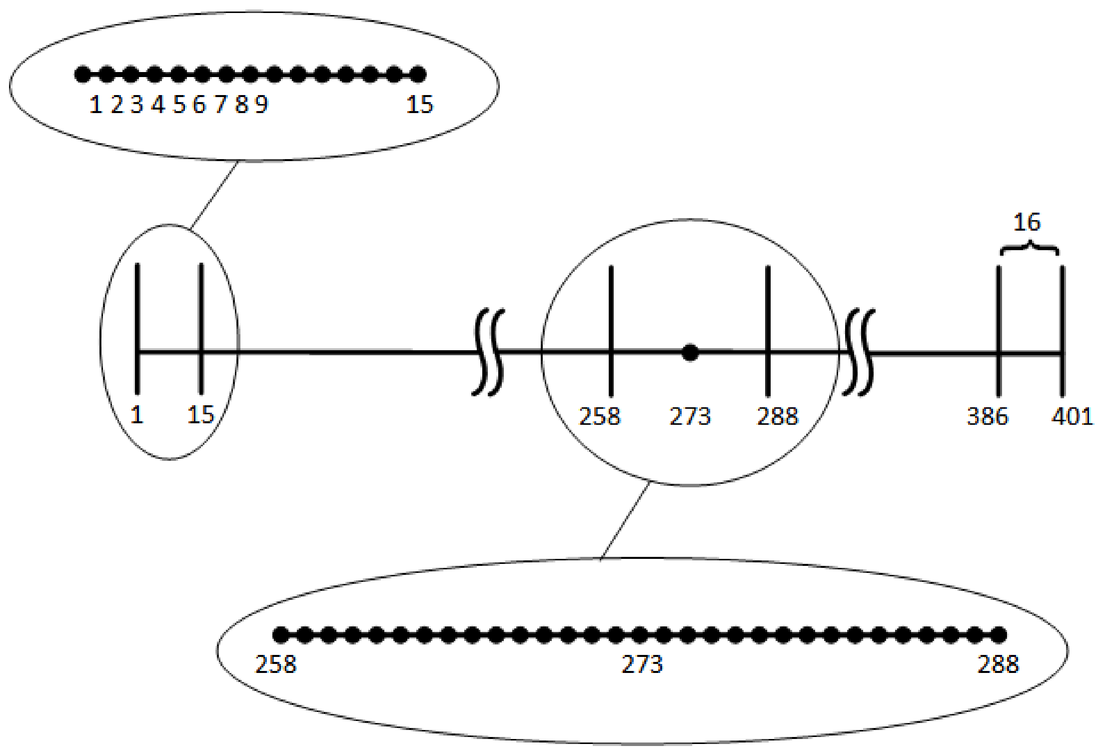
The purpose of this function is to perform a spatial video averaging, as compared to the temporal version supplied by the video-average command `[:SENSe]:AVERage:TYPE VIDeo`. The functions of `:TRACe:MATH:SMOoth <trace>` and `[:SENSe]:AVERage:TYPE VIDeo|POWer` are not interchangeable.

Remote Command	`:TRACe:MATH:SMOoth TRACE1 | TRACE2 | TRACE3 | TRACE4 | TRACE5 | TRACE6`

Each point value is replaced with the average of the values of the selected number of points, with half of those points located on each side of any particular point (when possible). Refer to the illustration below. This shows a 401 point trace with a smoothing number of 31. Think of the trace points as “buckets” of data. To smooth (arbitrary) point 273, the instrument averages buckets 258 through 288, and applies that value to point 273.

Increasing the number of points increases smoothing, at the cost of decreasing resolution.

The amount of smoothing decreases at the end points. Because `:TRACe:MATH:SMOoth <trace>` averages values that occur before and after the data point in time, display irregularities can be caused at the start and stop frequencies. To avoid possible irregularities (signal distortion) at the ends of the trace, use small values for the smooth parameter.



The following discussion of the end-point smoothing phenomenon refers to the illustration above.

With 31 smoothing points and a 401 point trace, point 16 will be the first point to have full 31-bucket smoothing. Likewise, point 386 will be the last point with full 31-

bucket smoothing. Under the conditions stated, points 2 through 15 will be smoothed as follows: Point 2 is derived from averaging buckets 1 through 3. Point 3 is derived from averaging buckets 1 through 5, Point 4 is derived from averaging buckets 1 through 7, and so forth until point 16 is reached. The quantity of buckets used for the smoothing running average increases at the rate of 2 buckets per point, from point 1 to point ([smoothing number+1]/2), at which time the full number of smoothing points is utilized. The same characteristic occurs at the completion of the trace, beginning at point 386, beyond which the number of averaging buckets begins to decrease until point 401 is reached.

By replacing the value of each point in a trace with the average of the values of a number of points centered about that point, any rapid variations in noise or signals are smoothed into more gradual variations. It thereby performs a function similar to reducing the video bandwidth without the corresponding changes in sweep time; as such, frequency resolution is decreased. Also, signal peaks are reduced with large smoothing values. This can cause the amplitude to appear to be less than its actual value.

10.4.3.8 Number of Points for Smoothing (Remote Command Only)

Included for ESA compatibility. Not recommended for new designs. Use the `:CALCulate:DATA:COMPress` command instead: "Calculate/Compress Trace Data Query (Remote Command Only)" on page 772.

Specifies the number of points that will be smoothed. Increasing the number of points increases smoothing, at the cost of decreasing resolution. If the number of points is an even number, then the number of points is increased by one. If the number of points is larger than the number of sweep points, then the number of sweep points is used, unless the number of sweep points is even, in which case the number of points will be the sweep points minus one. The number of points smoothed is always an odd number.

Remote Command	`:TRACe:MATH:SMOoth:POINts <integer>` `:TRACe:MATH:SMOoth:POINts?`
Example	`:TRAC:MATH:SMO:POIN 501`
Notes	Only odd values are allowed; if an even `<integer>` value is specified, add 1 unless `<integer>` = number of sweep points, in which case subtract 1 Used with the `:TRACe:MATH:SMOoth` command: "Smooth Trace Data (Remote Command Only) " on page 779
Preset	11
Min	3
Max	Number of sweep points

10.4.3.9 Mean Trace Data (Remote Command Only)

Included for ESA compatibility. Not recommended for new designs. Use the `:CALCulate:DATA:COMPress` command instead: "Calculate/Compress Trace Data Query (Remote Command Only)" on page 772.

Returns the mean of the amplitudes of the trace amplitude elements, in measurement units.

Remote Command	`:TRACe:MATH:MEAN? TRACE1 | TRACE2 | TRACE3 | TRACE4 | TRACE5 | TRACE6`
Example	`:TRAC:MATH:MEAN? TRACE2`

10.5 STATus Subsystem

The SCPI STATus Subsystem allows you to monitor a number of status conditions within the instrument through the use of a hierarchy of status registers containing bits which go true or false depending on various conditions.

10.5.1 Status Registers

This section provides an overview of SCPI status registers and how to manage them. The section "STATus Subsystem Registers and Commands" on page 789 gives detailed programming information for each of the X-Series status registers.

10.5.1.1 What Are Status Registers

The status system contains multiple registers that are arranged in a hierarchical order. The lower-level status registers propagate their data to the higher-level registers in the data structures by means of summary bits. The status byte register is at the top of the hierarchy and contains general status information for the instrument's events and conditions. All other individual registers are used to determine the specific events or conditions. For a diagram of the registers and their interconnections, see above.

The operation and questionable status registers are sets of registers that monitor the overall instrument condition. They are accessed with the STATus:OPERation and STATus:QUEStionable commands in the STATus command subsystem. Each register set is made up of five registers:

- Condition Register—Reports the real-time state of the signals monitored by this register set. There is no latching or buffering for a condition register
- Positive Transition Register—This filter register controls which signals will set a bit in the event register when the signal makes a low to high transition (when the condition bit changes from 0 to 1)
- Negative Transition Register—This filter register controls which signals will set a bit in the event register when the signal makes a high to low transition (when the condition bit changes from 1 to 0)
- Event Register—Latches any signal state changes, in the way specified by the filter registers. Bits in the event register are never cleared by signal state changes. Event registers are cleared when read. They are also cleared by `*CLS` and by presetting the instrument
- Event Enable Register—Controls which of the bits, being set in the event register, will be summarized as a single output for the register set. Summary bits are then used by the next higher register

The STATus:QUEStionable registers report abnormal operating conditions. The status register hierarchy is:

1. The summary outputs from the six STATus:QUEStionable:<keyword> detail registers are inputs to the STATus:QUEStionable register
2. The summary output from the STATus:QUEStionable register is an input to the Status Byte Register. See the overall system in Figure at the beginning of this section

The STATus:OPERation register set has no summarized inputs. The inputs to the STATus:OPERation:CONDition register indicate the real time state of the instrument. The STATus:OPERation:EVENt register summary output is an input to the Status Byte Register.

10.5.1.2 What Are Status Register SCPI Commands

Monitoring of the instrument conditions is done at the highest level using the following IEEE 488.2 common commands. Complete command descriptions are available in the section "IEEE 488.2 Common Commands" on page 614. Individual status registers can be set and queried using the commands in the "STATus Subsystem Registers and Commands" on page 789 section.

- *CLS (clear status) clears the status byte by emptying the error queue and clearing all the event registers.
- *ESE, *ESE? (event status enable) sets and queries the bits in the enable register part of the standard event status register.
- *ESR? (event status register) queries and clears the event register part of the standard event status register.
- *OPC, *OPC? (operation complete) sets the standard event status register to monitor the completion of all commands. The query stops any new commands from being processed until the current processing is complete, then returns a ‘1’.
- *PSC, *PSC? (power-on state clear) sets the power-on state so that it clears the service request enable register and the event status enable register at power on.
- *SRE, *SRE? (service request enable) sets and queries the value of the service request enable register.
- *STB? (status byte) queries the value of the status byte register without erasing its contents.

10.5.1.3 How to Use the Status Registers

A program often needs to be able to detect and manage error conditions or changes in instrument status. There are two methods you can use to programmatically access the information in status registers:

- The polling method
- The service request (SRQ) method

In the polling method, the instrument has a passive role. It only tells the controller that conditions have changed when the controller asks the right question. In the SRQ method, the instrument takes a more active role. It tells the controller when there has been a condition change without the controller asking. Either method allows you to monitor one or more conditions.

The polling method works well if you do not need to know about changes the moment they occur. The SRQ method should be used if you must know immediately when a condition changes. To detect a change using the polling method, the program must repeatedly read the registers.

Use the SRQ method when:

- you need time-critical notification of changes
- you are monitoring more than one device which supports SRQs
- you need to have the controller do something else while waiting
- you can't afford the performance penalty inherent to polling

Use polling when:

- your programming language/development environment does not support SRQ interrupts
- you want to write a simple, single-purpose program and don't want the added complexity of setting up an SRQ handler
- To monitor a condition:
- Determine which register contains the bit that reports the condition.
- Send the unique SCPI query that reads that register.
- Examine the bit to see if the condition has changed.

You can monitor conditions in different ways.

- **Check the current instrument hardware and firmware status.** Do this by querying the condition registers which continuously monitor status. These registers represent the current state of the instrument. Bits in a condition register are updated in real time. When the condition monitored by a particular bit becomes true, the bit is set to 1. When the condition becomes false, the bit is reset to 0.
- **Monitor a particular condition (bit).** You can enable a particular bit(s), using the event enable register. The instrument will then monitor that particular condition (s). If the bit becomes true (0 to 1 transition) in the event register, it will stay set

until the event register is cleared. Querying the event register allows you to detect that this condition occurred even if the condition no longer exists. The event register can only be cleared by querying it or sending the *CLS command.

- Monitor a particular type of change in a condition (bit).
- The transition registers are preset to register if the condition goes from 0 to 1 (false to true, or a positive transition).
- This can be changed so the selected condition is detected if the bit goes from 1 to 0 (true to false, or a negative transition).
- It can also be set for both types of transitions occurring.
- Or it can be set for neither transition. If both transition registers are set to 0 for a particular bit position, that bit will not be set in the event register for either type of change.

Using the Service Request (SRQ) Method

Your language, bus, and programming environment must be able to support SRQ interrupts. (For example, BASIC used with VXI-11.3 (GPIB over LAN). When you monitor a condition with the SRQ method, you must:

1. Determine which bit monitors the condition
2. Determine how that bit reports to the request service (RQS) bit of the status byte
3. Send SCPI commands to enable the bit that monitors the condition and to enable the summary bits that report the condition to the RQS bit
4. Enable the controller to respond to service requests

When the condition changes, the instrument sets its RQS bit. The controller is informed of the change as soon as it occurs. As a result, the time the controller would otherwise have used to monitor the condition can be used to perform other tasks. Your program determines how the controller responds to the SRQ.

Bit 6 of the status byte register is the request service (RQS) bit. The *SRE command is used to configure the RQS bit to report changes in instrument status. When such a change occurs, the RQS bit is set. It is cleared when the status byte register is queried using *SRE? (with a serial poll.) It can be queried without erasing the contents with *STB?.

When a register being set causes a summary bit in the status byte to change from 0 to 1, the instrument can initiate the service request (SRQ) process. However, the process is only initiated if both of the following conditions are true:

- The corresponding bit of the service request enable register is also set to 1.
- The instrument does not have a service request pending. (A service request is

considered to be pending between the time the instrument's SRQ process is initiated and the time the controller reads the status byte register.)

The SRQ process sets the SRQ true. It also sets the status byte's request service (RQS) bit to 1. Both actions are necessary to inform the controller that the instrument requires service. Setting the SRQ line only informs the controller that some device on the bus requires service. Setting the RQS bit allows the controller to determine which instrument requires service.

If your program enables the controller to detect and respond to service requests, it should instruct the controller to perform a serial poll when the SRQ is set true. Each device on the bus returns the contents of its status byte register in response to this poll. The device who's RQS bit is set to 1 is the device that requested service.

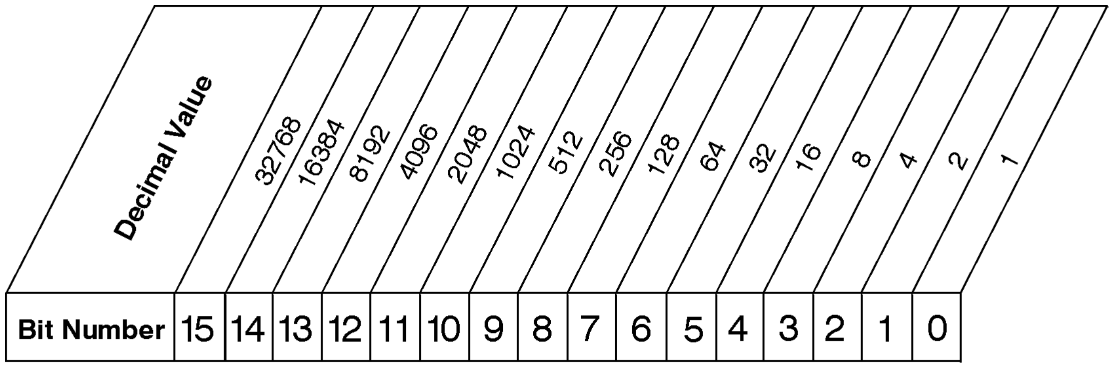
NOTE When you read the instrument's status byte register with a serial poll, the RQS bit is reset to 0. Other bits in the register are not affected.

If the status register is configured to SRQ on end-of-measurement and the measurement is in continuous mode, then restarting a measurement (INIT command) can cause the measuring bit to pulse low. This causes an SRQ when you have not actually reached the "end-of-measurement" condition. To avoid this:

1. Set `:INITiate:CONTinuous` off
2. Set/enable the status registers
3. Restart the measurement (send INIT)

10.5.1.4 Status Register Bit Parameters

The figure below shows a typical status register, the Standard Operation Event Enable register. Each bit in a register is represented by a numerical value based on its location. This number is sent with the command to enable a particular bit. If you want to enable more than one bit, you would send the sum of all the bits that you want to monitor.



STATus:OPERation:ENABle <num>
STATus:OPERation:ENABle?

Standard Operation Event Enable Register

ck730a

NOTE: Bit 15 is not used to report status.

Example 1:

1. To enable bit 0 and bit 6 of standard event status register, you would send the command `*ESE 65` because 1 + 64 = 65
2. The results of a query are evaluated in a similar way. If the `*STB?` command returns a decimal value of 140, (140 = 128 + 8 + 4) then bit 7 is true, bit 3 is true and bit 2 is true

Example 2:

1. Suppose you want to know if an Auto-trigger Timeout occurs, but you only cared about that specific condition. So you would want to know what was happening with bit 10 in the Status Questionable Integrity register, and not about any other bits
2. It's usually a good idea to start by clearing all the status registers with `*CLS`
3. Sending the STAT:QUES:INT:ENAB 1024 command lets you monitor only bit 10 events, instead of the default monitoring all the bits in the register. The register default is for positive transition events (0 to 1 transition). That is, when an auto-trigger timeout occurs. If instead, you wanted to know when the Auto-trigger timeout condition is cleared, then you would set the STAT:QUES:INT:PTR 0 and the STAT:QUES:INT:NTR 32767
4. So now the only output from the Status Questionable Integrity register will come from a bit 10 positive transition. That output goes to the Integrity Sum bit 9 of the Status Questionable register
5. You can do a similar thing with this register to only look at bit 9 using, STAT:QUES:ENAB 512
6. The Status Questionable register output goes to the "Status Questionable Summary" bit 3 of the Status Byte Register. The output from this register can be enabled using the `*SRE 8` command

7. Finally, you would use the serial polling functionality available for the particular bus/software that you are using to monitor the Status Byte Register. (You could also use `*STB?` to poll the Status Byte Register)

10.5.2 STATus Subsystem Registers and Commands

The STATus subsystem remote commands set and query the status registers. This system of registers monitors various events and conditions in the instrument. Software written to control the instrument may need to monitor some of these events and conditions.

NOTE **All status register commands are sequential. You can send them in the middle of an ongoing overlapped command to get the current status. You can also send them following a sequential command. In this case, the status register command waits for the completion of the previously-sent sequential command before performing the action.**

Most commands are sequential commands; only a few are overlapped.

If a command *is* overlapped, then that is explicitly stated in the command description.

Specific status bits are assigned to monitor various aspects of the instrument operation and status. See the "Status Register Diagram" on page 789 for information about the bit assignments and status register interconnections. See also the Keysight X-Series Signal Analyzers Instrument Messages manual for more detail on the instrument conditions that can cause these bits to be set.

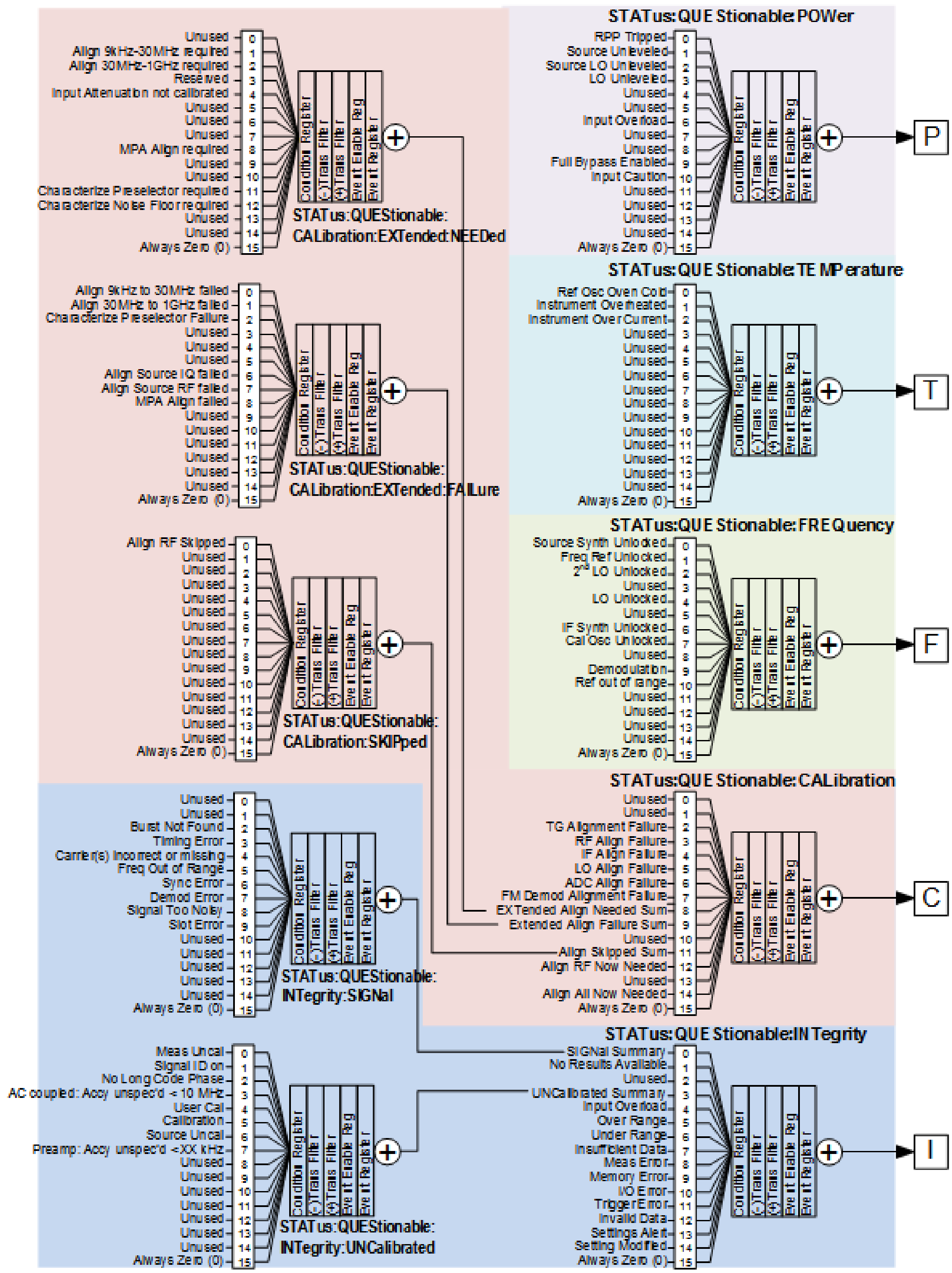
The STATus subsystem controls and queries the SCPI-defined instrument status reporting structures. Each status register has a set of five commands used for querying or masking that particular register.

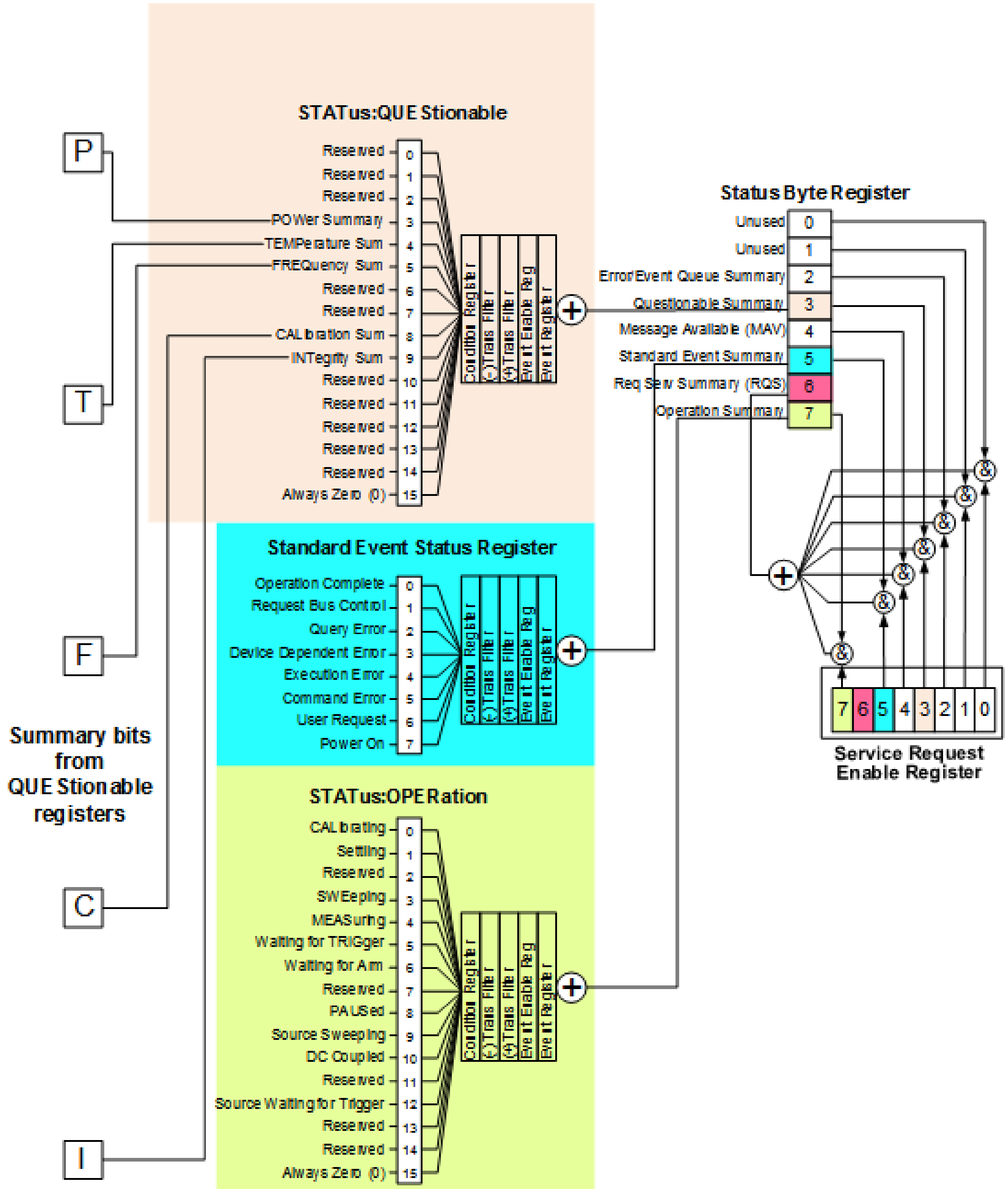
Numeric values for bit patterns can be entered using decimal or hexadecimal representations. (i.e. 0 to 32767 is equivalent to #H0 to #H7FFF. It is also equal to all ones, 111111111111111). See "Status Register Bit Parameters" on page 787 for information about using bit patterns for variable parameters.

10.5.2.1 Status Register Diagram

The following diagram provides a graphical overview of the entire X-Series Status Register Subsystem.

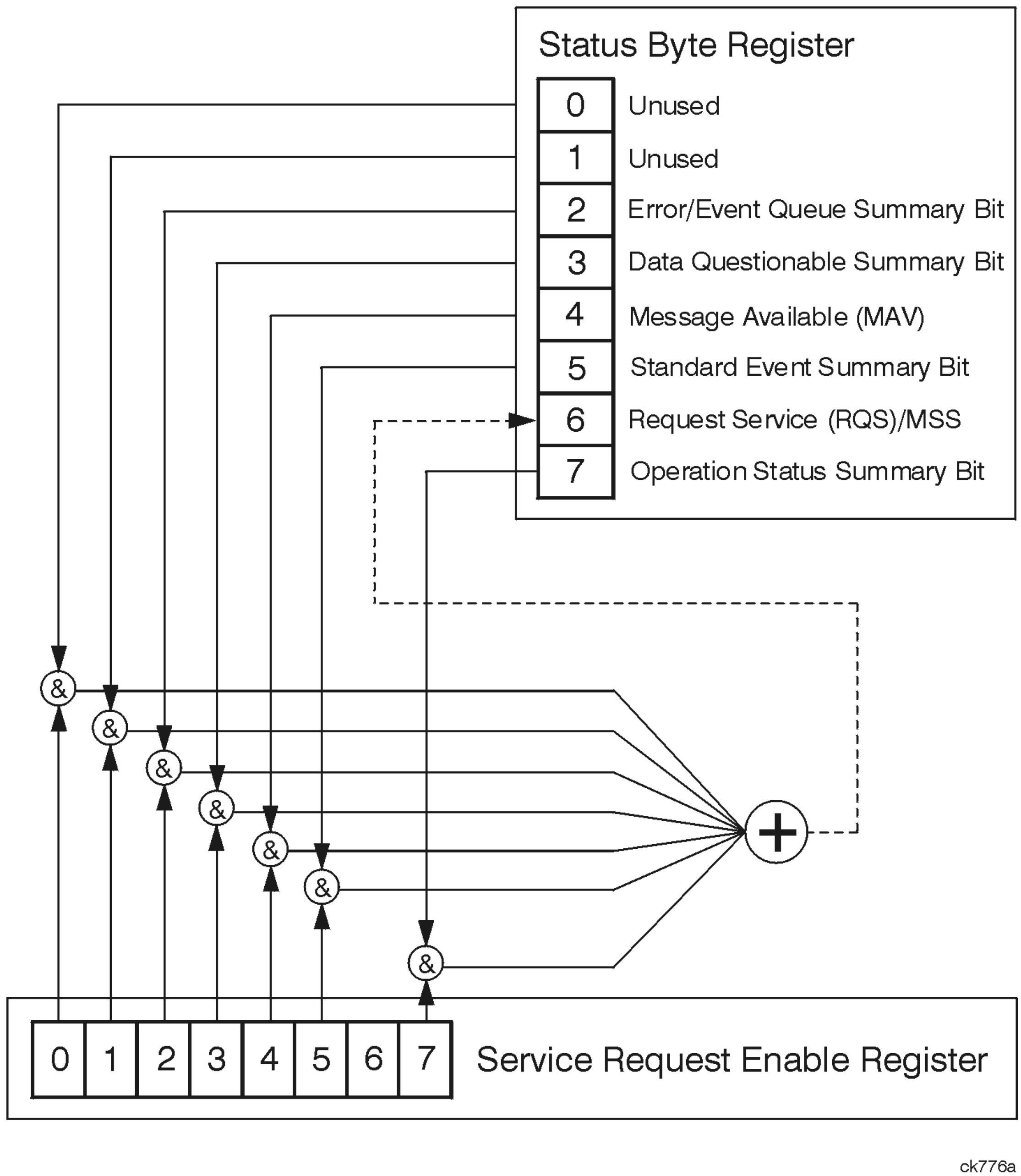
For readability, the diagram is split into two sections.

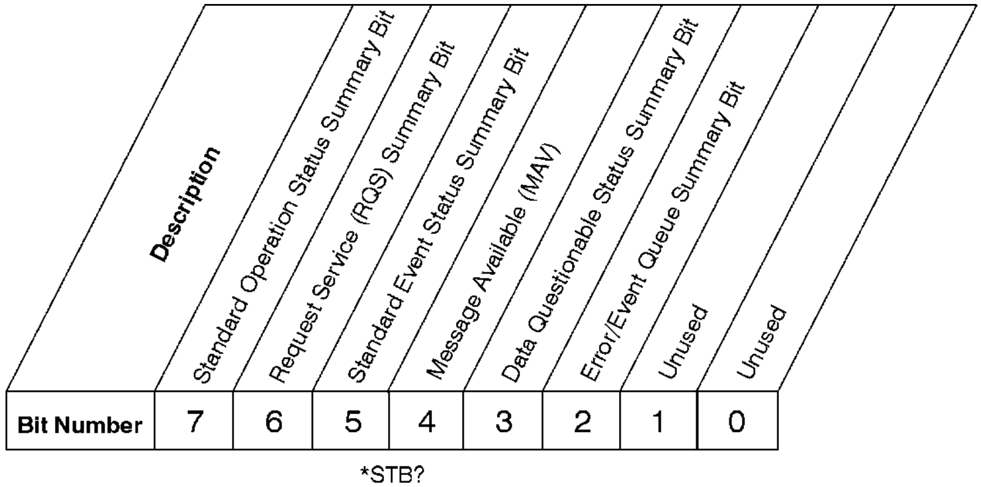

Unused
Align 9kHz-30MHz required
Align 30MHz-1GHz required
Reserved
Input Attenuation not calibrated
Unused
Unused
Unused
MPA Align required
Unused
Unused
Characterize Preselector required
Characterize Noise Floor required
Unused
Unused
Always Zero (0)
Condition Register
(-)Trans Filter
(+)Trans Filter
Event Enable Reg
Event Register
STATus:QUEStionable:CALibration:EXTended:NEEDed
Align 9kHz to 30MHz failed
Align 30MHz to 1GHz failed
Characterize Preselector Failure
Unused
Unused
Unused
Align Source IQ failed
Align Source RF failed
MPA Align failed
Unused
Unused
Unused
Unused
Unused
Unused
Always Zero (0)
STATus:QUEStionable:CALibration:EXTended:FAILure
Align RF Skipped
Unused
Unused
Unused
Unused
Unused
Unused
Unused
Unused
Unused
Unused
Unused
Unused
Unused
Unused
Always Zero (0)
STATus:QUEStionable:CALibration:SKIPped
Unused
Unused
Burst Not Found
Timing Error
Carrier(s) Incorrect or missing
Freq Out of Range
Sync Error
Demod Error
Signal Too Noisy
Slot Error
Unused
Unused
Unused
Unused
Unused
Always Zero (0)
STATus:QUEStionable:INTegrity:SIGNal
Meas Uncal
Signal ID on
No Long Code Phase
AC coupled: Accy unspec'd < 10 MHz
User Cal
Calibration
Source Uncal
Preamp: Accy unspec'd <XX kHz
Unused
Unused
Unused
Unused
Unused
Unused
Unused
Always Zero (0)
STATus:QUEStionable:INTegrity:UNCalibrated
STATus:QUEStionable:POWer
RPP Tripped
Source Unleveled
Source LO Unleveled
LO Unleveled
Unused
Unused
Input Overload
Unused
Unused
Full Bypass Enabled
Input Caution
Unused
Unused
Unused
Unused
Always Zero (0)
P
STATus:QUEStionable:TEMPerature
Ref Osc Oven Cold
Instrument Overheated
Instrument Over Current
Unused
Unused
Unused
Unused
Unused
Unused
Unused
Unused
Unused
Unused
Unused
Unused
Always Zero (0)
T
STATus:QUEStionable:FREQuency
Source Synth Unlocked
Freq Ref Unlocked
2nd LO Unlocked
Unused
LO Unlocked
Unused
IF Synth Unlocked
Cal Osc Unlocked
Unused
Demodulation
Ref out of range
Unused
Unused
Unused
Unused
Always Zero (0)
F
STATus:QUEStionable:CALibration
Unused
Unused
TG Alignment Failure
RF Align Failure
IF Align Failure
LO Align Failure
ADC Align Failure
FM Demod Alignment Failure
EXTended Align Needed Sum
Extended Align Failure Sum
Unused
Align Skipped Sum
Align RF Now Needed
Unused
Align All Now Needed
Always Zero (0)
C
STATus:QUEStionable:INTegrity
SIGNal Summary
No Results Available
Unused
UNCalibrated Summary
Input Overload
Over Range
Under Range
Insufficient Data
Meas Error
Memory Error
I/O Error
Trigger Error
Invalid Data
Settings Alert
Setting Modified
Always Zero (0)
I



10.5.2.2 Status Byte Register

The Status Byte register provides a one-byte overview of the entire STATus subsystem. All the other registers funnel into this register with summary bits, as shown in the "Status Register Diagram" on page 789.


Status Byte Register
0
Unused
1
Unused
2
Error/Event Queue Summary Bit
3
Data Questionable Summary Bit
4
Message Available (MAV)
5
Standard Event Summary Bit
6
Request Service (RQS)/MSS
7
Operation Status Summary Bit
&
+
0 1 2 3 4 5 6 7
Service Request Enable Register
ck776a



Status Byte Register

Bit	Description
0, 1	These bits are always set to 0
2	A 1 in this bit position indicates that the SCPI error queue is not empty which means that it contains at least one error message
3	A 1 in this bit position indicates that the data questionable summary bit has been set. The data questionable event register can then be read to determine the specific condition that caused this bit to be set
4	A 1 in this bit position indicates that the instrument has data ready in the output queue. There are no lower status groups that provide input to this bit
5	A 1 in this bit position indicates that the standard event summary bit has been set. The standard event status register can then be read to determine the specific event that caused this bit to be set
6	A 1 in this bit position indicates that the instrument has at least one reason to report a status change. This bit is also called the master summary status bit (MSS)
7	A 1 in this bit position indicates that the standard operation summary bit has been set. The standard operation event register can then be read to determine the specific condition that caused this bit to be set

To query the status byte register, send the query `*STB?` The response will be the decimal sum of the bits which are set to 1. For example, if bit number 7 and bit number 3 are set to 1, the decimal sum of the 2 bits is 128 plus 8. So the decimal value 136 is returned. The `*STB` command does not clear the status register.

The RQS bit is read and reset by a serial poll. The same bit position (MSS) is read, non-destructively by the *STB? query. If you serial poll bit 6 it is read as RQS, but if you send `*STB` it reads bit 6 as MSS. For more information refer to the IEEE 488.2 standard, section 11. In addition to the status byte register, the status byte group also contains the service request enable register. This register lets you choose which bits in the status byte register will trigger a service request.

See also "*STB? - Status Byte Query" on page 620

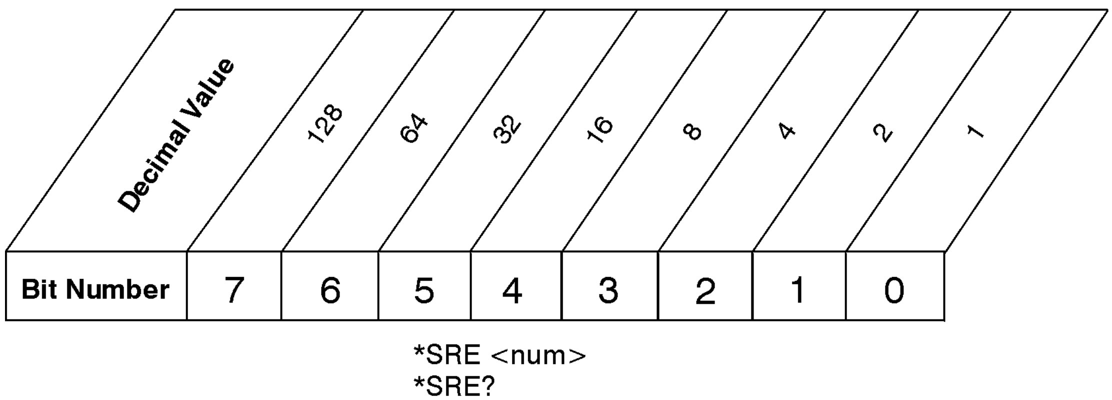
Service Request Enable Register

This register enables the desired bits of the Service Request (SRQ) subsystem.

Send the `*SRE <integer>` command, where `<integer>` is the sum of the decimal values of the bits you want to enable plus the decimal value of bit 6. For example, assume that you want to enable bit 7 so that whenever the standard operation status register summary bit is set to 1 it will trigger a service request. Send the command `*SRE 192` (because 192 = 128 + 64). You must always add 64 (the numeric value of RQS bit 6) to your numeric sum when you enable any bits for a service request.

The query `*SRE?` returns the decimal value of the sum of the bits previously enabled with the `*SRE <integer>` command.

The service request enable register presets to zeros (0).



Service Request Enable Register

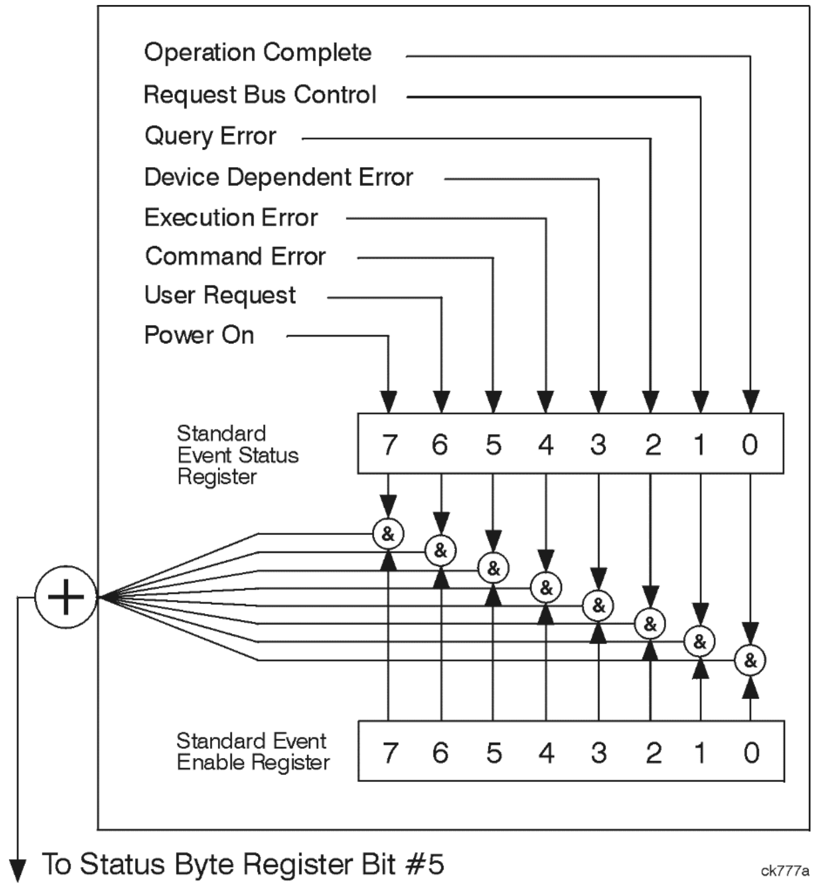
See also "*SRE - Service Request Enable" on page 620

Preset the Status Byte

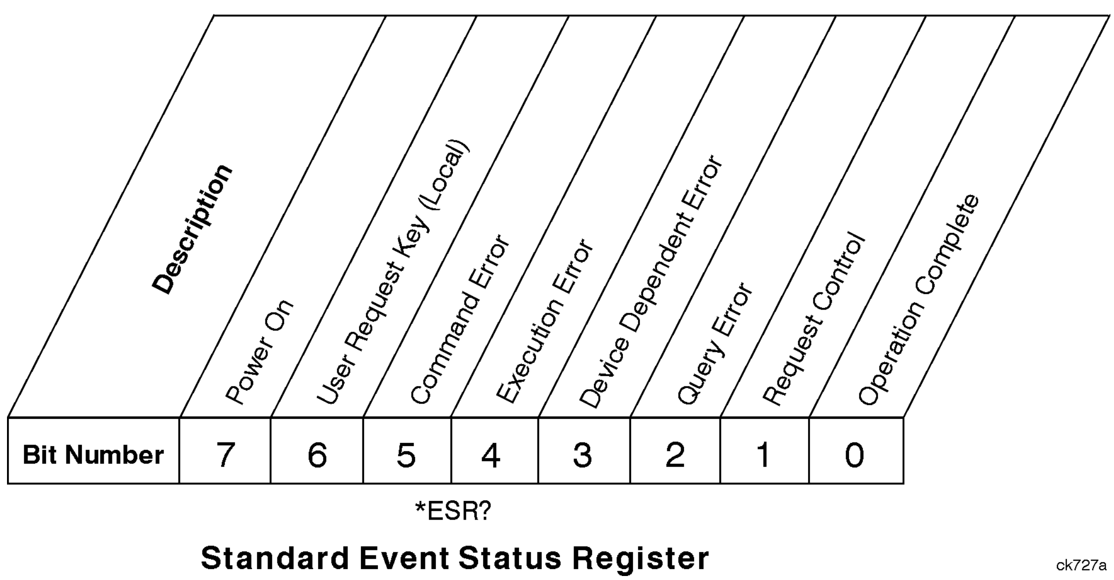
Sets bits in most of the enable and transition registers to their default state. It presets all the Transition Filters, Enable Registers, and the Error/Event Queue Enable. It has no effect on Event Registers, Error/Event QUEue, IEEE 488.2 ESE, and SRE Registers as described in IEEE Standard 488.2-1992, IEEE Standard Codes, Formats, Protocols, and Common Commands for Use with ANSI/IEEE Std 488.1-1987. New York, NY, 1992.

Remote Command	`:STATus:PRESet`
Example	`:STAT:PRES`

10.5.2.3 Standard Event Status Register



The standard event status register contains the following bits:



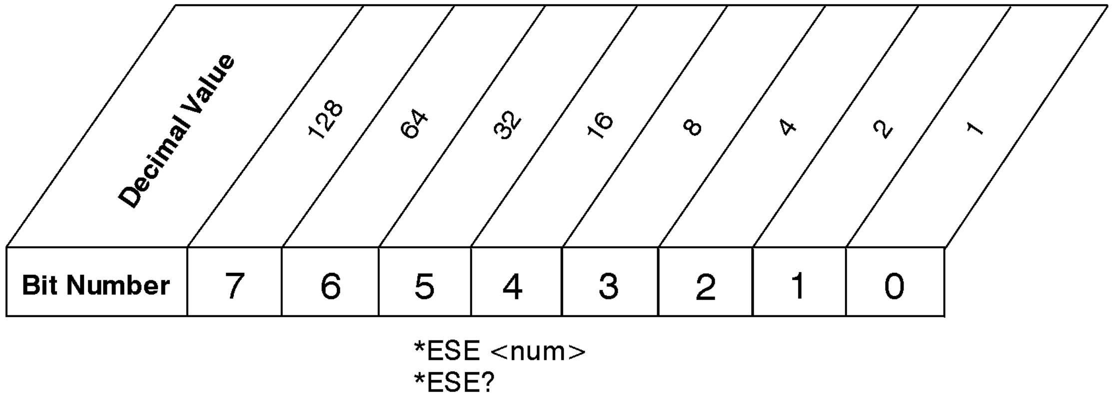
Bit	Description
0	A 1 in this bit position indicates that all pending operations were completed following execution of the *OPC command
1	This bit is for GPIB handshaking to request control. Currently it is set to 0 because there are no implementations where the spectrum analyzer controls another instrument
2	A 1 in this bit position indicates that a query error has occurred. Query errors have SCPI error numbers from -499 to -400
3	A 1 in this bit position indicates that a device dependent error has occurred. Device dependent errors have SCPI error numbers from -399 to -300 and 1 to 32767
4	A 1 in this bit position indicates that an execution error has occurred. Execution errors have SCPI error numbers from -299 to -200
5	A 1 in this bit position indicates that a command error has occurred. Command errors have SCPI error numbers from -199 to -100
6	A 1 in this bit position indicates that the LOCAL key has been pressed. This is true even if the instrument is in local lockout mode
7	A 1 in this bit position indicates that the instrument has been turned off and then on

The standard event status register is used to determine the specific event that set bit 5 in the status byte register. To query the standard event status register, send the query `*ESR?`. The response will be the decimal sum of the bits that are enabled (set to 1). For example, if bit number 7 and bit number 3 are enabled, the decimal sum of the 2 bits is 128 plus 8. So the decimal value 136 is returned. See also "*ESR? - Standard Event Status Register Query" on page 616

The Standard Event Status Enable Register

In addition to the standard event status register, the standard event status group also contains a standard event status enable register. This register lets you choose which bits in the standard event status register will set the summary bit (bit 5 of the status byte register) to 1. Send the `*ESE <integer>` command where <integer> is the sum of the decimal values of the bits you want to enable. For example, to enable bit 7 and bit 6 so that whenever either of those bits is set to 1, the standard event status summary bit of the status byte register will be set to 1, send the command `*ESE 192` (128 + 64). The command `*ESE?` returns the decimal value of the sum of the bits previously enabled with the `*ESE <integer>` command.

The standard event status enable register presets to zeros (0).



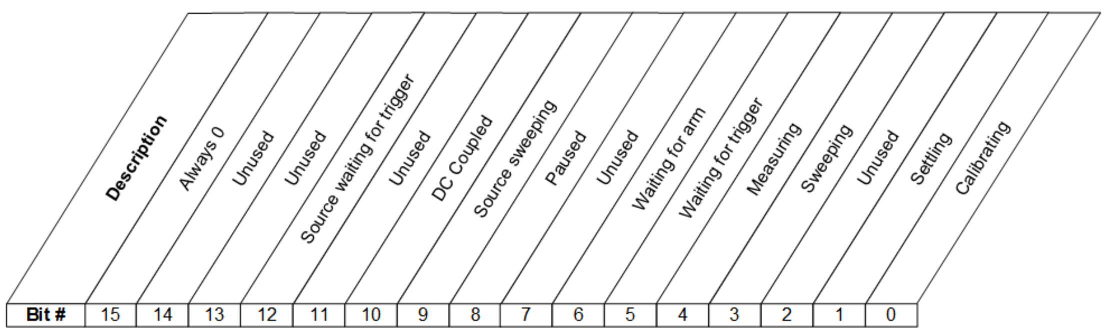
Standard Event Status Enable Register

See also "*ESE - Standard Event Status Enable" on page 615

10.5.2.4 STATus:OPERation Register

The operation and questionable status registers are registers that monitor the overall instrument condition. They are accessed with the STATus:OPERation and STATus:QUEStionable commands.

The operation status register monitors the current instrument measurement state and various instrument operations for a quick summary of what is happening within the instrument. It checks to see if the instrument is calibrating, sweeping, or waiting for a trigger. Also see "*OPC? - Operation Complete" on page 617.



STATus:OPERation Register

Bit	Condition	Operation
0	Calibrating	The instrument is busy executing its Align Now process
1	Settling	The instrument circuitry is settling
3	Sweeping	The instrument is busy taking a sweep.
4	Measuring	The instrument is busy making a measurement. Measurements often require multiple sweeps. They are initiated by keys under the **MEASURE** key or with the MEASure group of commands. The bit is valid for most X-Series Modes.
5	Waiting for	The instrument is waiting for the trigger conditions to be met, then it

Bit	Condition	Operation
	trigger	will trigger a sweep or measurement.
6	Waiting for arm	The instrument is waiting for the trigger to be armed
8	Paused	The measurement is paused
9	Source Sweeping	The List Sequencer is running or Freq Scan results are available
10	DC Coupled	The instrument is DC coupled
12	Source Waiting for Trigger	The built in source is waiting for a trigger

Operation Condition Query

This query returns the decimal value of the sum of the bits in the Status Operation Condition register.

NOTE **The data in this register is continuously updated and reflects the current conditions.**

Remote Command	`:STATus:OPERation:CONDition?`
Example	`:STAT:OPER:COND?`
Preset	0
Status Bits/OPC dependencies	Sequential command

Operation Enable

This command determines which bits in the Operation Event register, will set the Operation Status Summary bit (bit 7) in the Status Byte Register. The variable <integer> is the sum of the decimal values of the bits you want to enable.

NOTE **The preset condition is to have all bits in this enable register set to 0. To have any Operation Events reported to the Status Byte Register, one or more bits need to be set to 1.**

Remote Command	`:STATus:OPERation:ENABle <integer>` `:STATus:OPERation:ENABle?`
Example	`:STAT:OPER:ENAB 1` Sets the register so that Align Now events will be reported to the Status Byte Register.
Preset	0
Min	0

Max	32767
Status Bits/OPC dependencies	Sequential command

Operation Event Query

This query returns the decimal value of the sum of the bits in the Operation Event register.

NOTE The register requires that the associated PTR or NTR filters be set before a condition register bit can set a bit in the event register. The data in this register is latched until it is queried. Once queried, the register is cleared.

Remote Command	`:STATus:OPERation[:EVENt]?`
Example	`:STAT:OPER?`
Preset	0
Status Bits/OPC dependencies	Sequential command

Operation Negative Transition

This command determines which bits in the Operation Condition register will set the corresponding bit in the Operation Event register when the condition register bit has a negative transition (1 to 0). The variable <integer> is the sum of the decimal values of the bits that you want to enable.

Remote Command	`:STATus:OPERation:NTRansition <integer>` `:STATus:OPERation:NTRansition?`
Example	`:STAT:OPER:NTR 1` Align Now operation complete will be reported to the Status Byte Register
Preset	0
Min	0
Max	32767
Status Bits/OPC dependencies	Sequential command

Operation Positive Transition

This command determines which bits in the Operation Condition register will set the corresponding bit in the Operation Event register when the condition register bit has a positive transition (0 to 1). The variable <integer> is the sum of the decimal values of the bits that you want to enable.

Remote Command	`:STATus:OPERation:PTRansition <integer>` `:STATus:OPERation:PTRansition?`
Example	`:STAT:OPER:PTR 1` Align Now operation beginning will be reported to the Status Byte Register
Preset	32767
Min	0
Max	32767
Status Bits/OPC dependencies	Sequential command

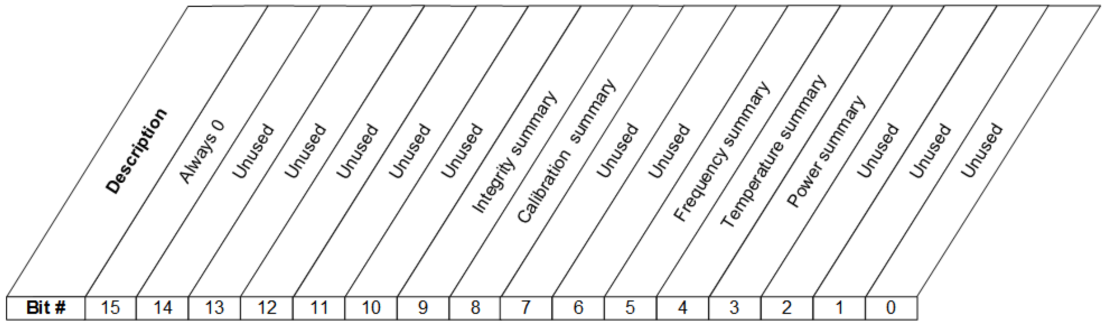
Backwards Compatibility

1. The STATus:OPERation register bit 4 is a “Measuring” bit. The bit is valid for SA mode and all the application modes. In older products the bit was only valid for ESA/PSA Spectrum Analysis, Phase Noise, and Noise Figure modes. It was also in ESA’s Bluetooth, cdmaOne, and GSM modes.
2. The STATus:OPERation register bit 8 is a “Paused” bit. The bit is valid for SA mode and all the application modes. In older products the bit was only valid for ESA/PSA Spectrum Analysis, Phase Noise, and Noise Figure modes. It was also in ESA’s Bluetooth, cdmaOne, and GSM modes.
3. The STATus:OPERation register bit 11 was a “Printing” bit in VSA and in the VSA/PSA applications. Bit 11 is not used in Next Generation because it is not needed in a Windows operation system.
4. The STATus:OPERation register bit 12 was a “Mass memory busy” bit in VSA and in the VSA/PSA applications. Bit 12 is not used in Next Generation because it is not needed in a Windows operation system.

10.5.2.5 STATus:QUEStionable Register

The operation and questionable status registers are registers that monitor the overall instrument condition. They are accessed with the STATus:OPERation and STATus:QUEStionable commands.

The questionable status register monitors the instrument’s condition to see if anything questionable has happened to it. It is looking for anything that might cause an error or a bad measurement like a hardware problem, an out of calibration situation, or a unusual signal. All the bits are summary bits from lower-level event registers.



STATus:QUEStionable Register

Bit	Condition	Operation
3	Power summary	This bit is the summary bit for the STATus:QUEStionable:POWer register
4	Temperature summary	This bit is the summary bit for the STATus:QUEStionable:TEMPerature register
5	Frequency summary	This bit is the summary bit for the STATus:QUEStionable:FREQuency register
8	Calibration summary	This bit is the summary bit for the STATus:QUEStionable:CALibration register
9	Integrity summary	This bit is the summary bit for the STATus:QUEStionable:INTegrity register

See:

– "Questionable Condition" on page 801

– "Questionable Enable" on page 802

– "Questionable Event Query" on page 802

– "Questionable Negative Transition" on page 803

– "Questionable Positive Transition" on page 803

Questionable Condition

This query returns the decimal value of the sum of the bits in the Questionable Condition register.

NOTE **The data in this register is continuously updated and reflects the current conditions.**

Remote Command	`:STATus:QUEStionable:CONDition?`
Example	`:STAT:QUES:COND?`
Preset	0
Status Bits/OPC depend-	Sequential command

encies	

Questionable Enable

This command determines which bits in the Questionable Event register will set the Questionable Status Summary bit (bit3) in the Status Byte Register. The variable <integer> is the sum of the decimal values of the bits you want to enable.

NOTE The preset condition is all bits in this enable register set to 0. To have any Questionable Events reported to the Status Byte Register, one or more bits need to be set to 1. The Status Byte Event Register should be queried after each measurement to check the Questionable Status Summary (bit 3). If it is equal to 1, a condition during the test may have made the test results invalid. If it is equal to 0, this indicates that no hardware problem or measurement problem was detected by the analyzer.

Remote Command	`:STATus:QUEStionable:ENABle <integer>` `:STATus:QUEStionable:ENABle?`
Example	`:STAT:QUES:ENAB 16` Sets the register so that questionable temperature events will be reported to the Status Byte Register
Preset	0
Min	0
Max	32767
Status Bits/OPC dependencies	Sequential command

Questionable Event Query

This query returns the decimal value of the sum of the bits in the Questionable Event register.

NOTE The register requires that the associated PTR or NTR filters be set before a condition register bit can set a bit in the event register. The data in this register is latched until it is queried. Once queried, the register is cleared.

Remote Command	`:STATus:QUEStionable[:EVENt]?`
Example	`:STAT:QUES?`
Preset	0
Status Bits/OPC dependencies	Sequential command

Questionable Negative Transition

This command determines which bits in the Questionable Condition register will set the corresponding bit in the Questionable Event register when the condition register bit has a negative transition (1 to 0). The variable `<integer>` is the sum of the decimal values of the bits that you want to enable.

Remote Command	`:STATus:QUEStionable:NTRansition <integer>` `:STATus:QUEStionable:NTRansition?`
Example	`:STAT:QUES:NTR 16` Temperature summary 'questionable cleared' will be reported to the Status Byte Register
Preset	0
Min	0
Max	32767
Status Bits/OPC dependencies	Sequential command

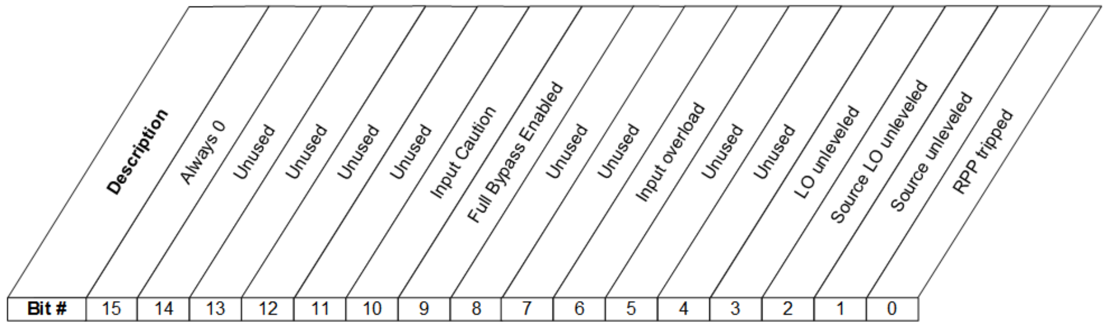
Questionable Positive Transition

This command determines which bits in the Questionable Condition register will set the corresponding bit in the Questionable Event register when the condition register bit has a positive transition (0 to 1). The variable `<integer>` is the sum of the decimal values of the bits that you want to enable.

Remote Command	`:STATus:QUEStionable:PTRansition <integer>` `:STATus:QUEStionable:PTRansition?`
Example	`:STAT:QUES:PTR 16` Temperature summary 'questionable asserted' will be reported to the Status Byte Register
Preset	32767
Min	0
Max	32767
Status Bits/OPC dependencies	Sequential command

10.5.2.6 Questionable Power Register

The STATus:QUEStionable:POWer register monitors power-related conditions within the instrument and summarizes them in bit 3 of the STATus:QUEStionable register.



STATus:QUEStionable:POWer Register

Bit	Condition	Operation
0	RPP tripped	(not currently in use)
1	Source Unleveled	The built-in source is not properly leveled
2	Source LO Unleveled	(not currently in use)
3	LO Unleveled	(not currently in use)
6	Input Overload	A power overload condition exists at an input
9	Full Bypass Enabled	Frontend circuitry is bypassed, use caution to protect the mixer
10	Input Caution	Input circuitry is configured such that care is required to prevent damage

See:

– "Questionable Power Condition" on page 804
– "Questionable Power Enable" on page 805
– "Questionable Power Event Query" on page 805
– "Questionable Power Negative Transition" on page 805
– "Questionable Power Positive Transition" on page 806

Questionable Power Condition

This query returns the decimal value of the sum of the bits in the Questionable Power Condition register.

NOTE The data in this register is continuously updated and reflects the current conditions.

Remote Command	`:STATus:QUEStionable:POWer:CONDition?`
Example	`:STAT:QUES:POW:COND?`
Preset	0
Status Bits/OPC dependencies	Sequential command

Questionable Power Enable

This command determines which bits in the Questionable Power Condition Register will set bits in the Questionable Power Event register, which also sets the Power Summary bit (bit 3) in the Questionable Register. The variable `<integer>` is the sum of the decimal values of the bits you want to enable.

Remote Command	`:STATus:QUEStionable:POWer:ENABle <integer>` `:STATus:QUEStionable:POWer:ENABle?`
Example	`:STAT:QUES:POW:ENAB 2` Source Unleveled will be reported to the Power Summary of the Status Questionable register
Preset	32767
Min	0
Max	32767
Status Bits/OPC dependencies	Sequential command

Questionable Power Event Query

This query returns the decimal value of the sum of the bits in the Questionable Power Event register.

NOTE **The register requires that the associated PTR or NTR filters be set before a condition register bit can set a bit in the event register. The data in this register is latched until it is queried. Once queried, the register is cleared.**

Remote Command	`:STATus:QUEStionable:POWer[:EVENt]?`
Example	`:STAT:QUES:POW?`
Preset	0
Status Bits/OPC dependencies	Sequential command

Questionable Power Negative Transition

This command determines which bits in the Questionable Power Condition register will set the corresponding bit in the Questionable Power Event register when the condition register bit has a negative transition (1 to 0). The variable `<integer>` is the sum of the decimal values of the bits that you want to enable.

Remote Command	`:STATus:QUEStionable:POWer:NTRansition <integer>` `:STATus:QUEStionable:POWer:NTRansition?`

Example	`:STAT:QUES:POW:NTR 2` Source Unlevelled being cleared will be reported to the Power Summary of the Status Questionable register
Preset	0
Min	0
Max	32767
Status Bits/OPC dependencies	Sequential command

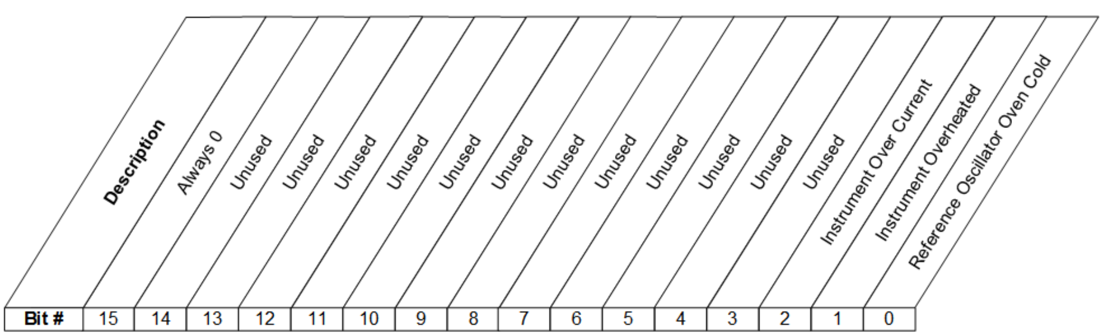
Questionable Power Positive Transition

This command determines which bits in the Questionable Power Condition register will set the corresponding bit in the Questionable Power Event register when the condition register bit has a positive transition (0 to 1). The variable `<integer>` is the sum of the decimal values of the bits that you want to enable.

Remote Command	`:STATus:QUEStionable:POWer:PTRansition <integer>` `:STATus:QUEStionable:POWer:PTRansition?>`
Example	`:STAT:QUES:POW:PTR 32` Source Unleveled being set will be reported to the Power Summary of the Status Questionable register
Preset	32767
Min	0
Max	32767
Status Bits/OPC dependencies	Sequential command

10.5.2.7 Questionable Temperature Register

The STATus:QUEStionable:TEMPerature register monitors temperature-related conditions within the instrument and summarizes them in bit 4 of the STATus:QUEStionable register.



STATus:QUEStionable:TEMPerature Register

Bit	Condition	Operation
0	Reference Oscillator Oven Cold	(not currently in use)
1	Instrument overheated (over temperature)	Excessive heat has been detected in some part of the instrument
2	Instrument over current	Excessive heat has been detected in some part of the instrument, the instrument should be restarted

See:

- "Questionable Temperature Condition" on page 807
- "Questionable Temperature Enable" on page 807
- "Questionable Temperature Event Query" on page 808
- "Questionable Temperature Negative Transition" on page 808
- "Questionable Temperature Positive Transition" on page 809

Questionable Temperature Condition

This query returns the decimal value of the sum of the bits in the Questionable Temperature Condition register.

NOTE The data in this register is continuously updated and reflects the current conditions.

Remote Command	`:STATus:QUEStionable:TEMPerature:CONDition?`
Example	`:STAT:QUES:TEMP:COND?`
Preset	0
Status Bits/OPC dependencies	Sequential command

Questionable Temperature Enable

This command determines which bits in the Questionable Temperature Condition Register will set bits in the Questionable Temperature Event register, which also sets the Temperature Summary bit (bit 4) in the Questionable Register. The variable <integer> is the sum of the decimal values of the bits you want to enable.

Remote Command	`:STATus:QUEStionable:TEMPerature:ENABle <integer>` `:STATus:QUEStionable:TEMPerature:ENABle?`
Example	`:STAT:QUES:TEMP:ENAB 2` Instrument Overheated will be reported to the Temperature Summary of the Status Questionable

	register
Preset	32767
Min	0
Max	32767
Status Bits/OPC dependencies	Sequential command

Questionable Temperature Event Query

This query returns the decimal value of the sum of the bits in the Questionable Temperature Event register.

NOTE: The register requires that the associated PTR or NTR filters be set before a condition register bit can set a bit in the event register. The data in this register is latched until it is queried. Once queried, the register is cleared.

Remote Command	`:STATus:QUEStionable:TEMPerature[:EVENt]?`
Example	`:STAT:QUES:TEMP?`
Preset	0
Status Bits/OPC dependencies	Sequential command

Questionable Temperature Negative Transition

This command determines which bits in the Questionable Temperature Condition register will set the corresponding bit in the Questionable Temperature Event register when the condition register bit has a negative transition (1 to 0). The variable <integer> is the sum of the decimal values of the bits that you want to enable.

Remote Command	`:STATus:QUEStionable:TEMPerature:NTRansition <integer>` `:STATus:QUEStionable:TEMPerature:NTRansition?`
Example	`:STAT:QUES:TEMP:NTR 2` Instrument Overheated being cleared will be reported to the Temperature Summary of the Status Questionable register
Preset	0
Min	0
Max	32767
Status Bits/OPC dependencies	Sequential command

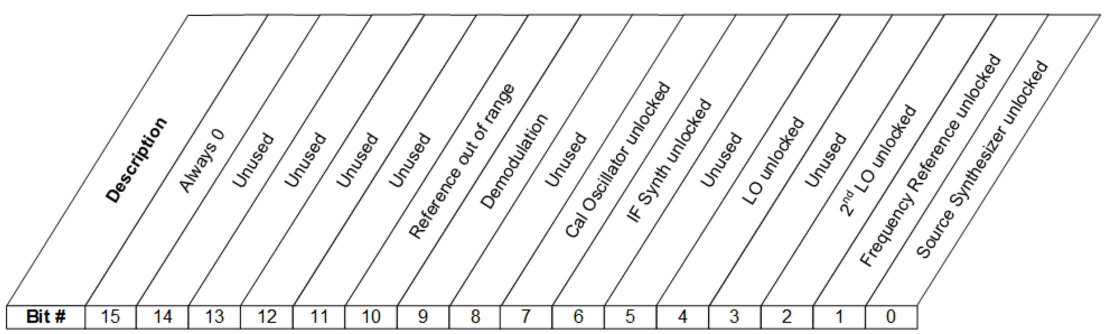
Questionable Temperature Positive Transition

This command determines which bits in the Questionable Temperature Condition register will set the corresponding bit in the Questionable Temperature Event register when the condition register bit has a positive transition (0 to 1). The variable <integer> is the sum of the decimal values of the bits that you want to enable.

Remote Command	`:STATus:QUEStionable:TEMPerature:PTRansition <integer>` `:STATus:QUEStionable:TEMPerature:PTRansition?`
Example	`:STAT:QUES:TEMP:PTR 2` Instrument Overheated being set will be reported to the Temperature Summary of the Status Questionable register
Preset	32767
Min	0
Max	32767
Status Bits/OPC dependencies	Sequential command

10.5.2.8 Questionable Frequency Register

The STATus:QUEStionable:FREQuency register monitors frequency-related conditions within the instrument and summarizes them in bit 5 of the STATus:QUEStionable register.



STATus:QUEStionable:FREQuency Register

Bit	Condition	Operation
0	Source Synth Unlocked	The synthesizer in the built-in source is not locked
1	Frequency Reference Unlocked	The instrument's frequency reference is unlocked
2	2nd LO Unlocked	The instrument's second LO (local oscillator) is unlocked

Bit	Condition	Operation
4	LO Unlocked	The instrument’s main LO (local oscillator) is unlocked
6	IF Synth Unlocked	The synthesizer in the IF is not locked
7	Cal Osc Unlocked	The oscillator used for internal calibrations is not locked
9	Demodulation	Demodulation cannot be performed due to an out of range frequency
10	Reference missing or out of range	The signal being fed to a reference input is missing or too high or low in frequency for the reference to lock

See:

– "Questionable Frequency Condition" on page 810
– "Questionable Frequency Enable" on page 810
– "Questionable Frequency Event Query" on page 811
– "Questionable Frequency Negative Transition" on page 811
– "Questionable Frequency Positive Transition" on page 812

Questionable Frequency Condition

This query returns the decimal value of the sum of the bits in the Questionable Frequency Condition register.

NOTE The data in this register is continuously updated and reflects the current conditions.

Remote Command	`:STATus:QUEStionable:FREQuency:CONDition?`
Example	`:STAT:QUES:FREQ:COND?`
Preset	0
Status Bits/OPC dependencies	Sequential command

Questionable Frequency Enable

This command determines which bits in the Questionable Frequency Condition Register will set bits in the Questionable Frequency Event register, which also sets the Frequency Summary bit (bit 5) in the Questionable Register. The variable `<integer>` is the sum of the decimal values of the bits you want to enable.

Remote Command	`:STATus:QUEStionable:FREQuency:ENABle <integer>` `:STATus:QUEStionable:FREQuency:ENABle?`
Example	`:STAT:QUES:FREQ:ENAB 2`

	Frequency Reference Unlocked will be reported to the Frequency Summary of the Status Questionable register
Preset	32767
Min	0
Max	32767
Status Bits/OPC dependencies	Sequential command

Questionable Frequency Event Query

This query returns the decimal value of the sum of the bits in the Questionable Frequency Event register.

NOTE **The register requires that the associated PTR or NTR filters be set before a condition register bit can set a bit in the event register. The data in this register is latched until it is queried. Once queried, the register is cleared.**

Remote Command	`:STATus:QUEStionable:FREQuency[:EVENt]?`
Example	`:STAT:QUES:FREQ?`
Preset	0
Status Bits/OPC dependencies	Sequential command

Questionable Frequency Negative Transition

This command determines which bits in the Questionable Frequency Condition register will set the corresponding bit in the Questionable Frequency Event register when the condition register bit has a negative transition (1 to 0). The variable `<integer>` is the sum of the decimal values of the bits that you want to enable.

Remote Command	`:STATus:QUEStionable:FREQuency:NTRansition <integer>` `:STATus:QUEStionable:FREQuency:NTRansition?`
Example	`:STAT:QUES:FREQ:NTR 2` Frequency Reference 'regained lock' will be reported to the Frequency Summary of the Status Questionable register
Preset	0
Min	0
Max	32767
Status Bits/OPC dependencies	Sequential command

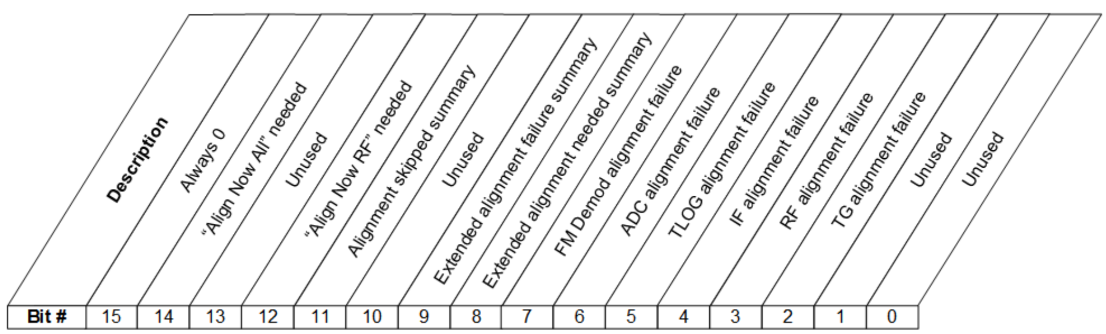
Questionable Frequency Positive Transition

This command determines which bits in the Questionable Frequency Condition register will set the corresponding bit in the Questionable Frequency Event register when the condition register bit has a positive transition (0 to 1). The variable `<integer>` is the sum of the decimal values of the bits that you want to enable.

Remote Command	`:STATus:QUEStionable:FREQuency:PTRansition <integer>` `:STATus:QUEStionable:FREQuency:PTRansition?`
Example	`:STAT:QUES:FREQ:PTR 2` Frequency Reference 'became unlocked' will be reported to the Frequency Summary of the Status Questionable register
Preset	32767
Min	0
Max	32767
Status Bits/OPC dependencies	Sequential command

10.5.2.9 Questionable Calibration Register

The STATus:QUEStionable:CALibration register monitors calibration-related conditions within the instrument and summarizes them in bit 8 of the STATus:QUEStionable register. Three of the bits are summary bits from lower-level event registers.



STATus:QUEStionable:CALibration Register

Bit	Condition	Operation
2	TG Alignment Failure	The Tracking Generator failed to align properly
3	RF Alignment Failure	The RF section (frontend) failed to align properly
4	IF Alignment Failure	The IF section failed to align properly
5	LO Alignment Failure	The LO (local oscillator) failed to align properly
6	ADC Alignment Failure	The ADC section failed to align properly
7	FM Demod Alignment	The FM Demod section failed to align properly

Bit	Condition	Operation
	Failure	
8	Extended Align Needed Summary	Summary bit for the STATus:QUEStionable:CALibration:EXTended:NEEDed sub-register
9	Extended Align Failure Summary	Summary bit for the STATus:QUEStionable:CALibration:EXTended:FAILure sub-register
11	Align Skipped Sum Summary	Summary bit for the STATus:QUEStionable:CALibration:SKIPped sub-register
12	"Align Now RF" required	Go to the System, Alignments, Align Now menu and perform an "Align Now RF"
14	"Align Now All" required	Go to the System, Alignments, Align Now menu and perform an "Align Now All"

See:

– "Questionable Calibration Condition" on page 813

– "Questionable Calibration Enable" on page 813

– "Questionable Calibration Event Query" on page 814

– "Questionable Calibration Negative Transition" on page 814

– "Questionable Calibration Positive Transition" on page 815

Questionable Calibration Condition

This query returns the decimal value of the sum of the bits in the Questionable Calibration Condition register.

NOTE The data in this register is continuously updated and reflects the current conditions.

Remote Command	`:STATus:QUEStionable:CALibration:CONDition?`
Example	`:STAT:QUES:CAL:COND?`
Preset	0
Status Bits/OPC dependencies	Sequential command

Questionable Calibration Enable

This command determines which bits in the Questionable Calibration Condition Register will set bits in the Questionable Calibration Event register, which also sets the Calibration Summary bit (bit 8) in the Questionable Register. The variable <integer> is the sum of the decimal values of the bits you want to enable.

Remote Command	`:STATus:QUEStionable:CALibration:ENABle <integer>` `:STATus:QUEStionable:CALibration:ENABle?`
Example	`:STAT:QUES:CAL:ENAB 16384` Can be used to query if an alignment is needed, if you have turned off the automatic alignment process
Min	0
Max	32767
Status Bits/OPC dependencies	Sequential command

Questionable Calibration Event Query

This query returns the decimal value of the sum of the bits in the Questionable Calibration Event register.

NOTE The register requires that the associated PTR or NTR filters be set before a condition register bit can set a bit in the event register. The data in this register is latched until it is queried. Once queried, the register is cleared.

Remote Command	`:STATus:QUEStionable:CALibration[:EVENt]?`
Example	`:STAT:QUES:CAL?`
Preset	0
Status Bits/OPC dependencies	Sequential command

Questionable Calibration Negative Transition

This command determines which bits in the Questionable Calibration Condition register will set the corresponding bit in the Questionable Calibration Event register when the condition register bit has a negative transition (1 to 0). The variable `<integer>` is the sum of the decimal values of the bits that you want to enable.

Remote Command	`:STATus:QUEStionable:CALibration:NTRansition <integer>` `:STATus:QUEStionable:CALibration:NTRansition?`
Example	`:STAT:QUES:CAL:NTR 16384` “Align All Now Needed” being cleared will be reported to the Calibration Summary of the Status Questionable register
Preset	0
Min	0
Max	32767

Status Bits/OPC dependencies	Sequential command

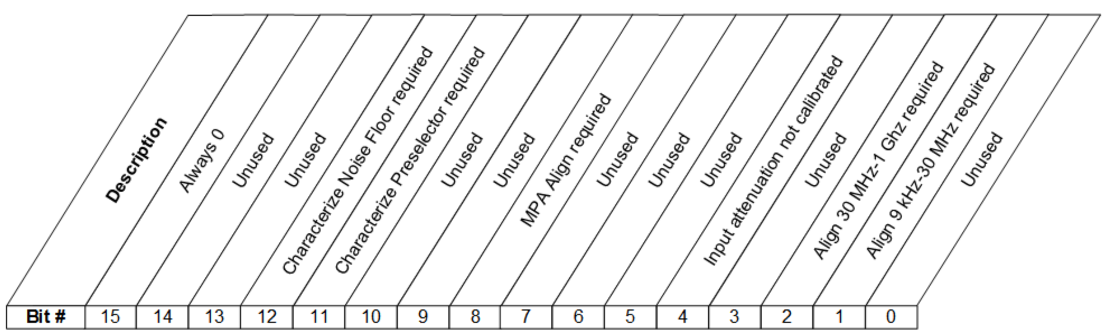
Questionable Calibration Positive Transition

This command determines which bits in the Questionable Calibration Condition register will set the corresponding bit in the Questionable Calibration Event register when the condition register bit has a positive transition (0 to 1). The variable `<integer>` is the sum of the decimal values of the bits that you want to enable.

Remote Command	`:STATus:QUEStionable:CALibration:PTRansition <integer>` `:STATus:QUEStionable:CALibration:PTRansition?`
Example	`:STAT:QUES:CAL:PTR 16384` "Align All Now Needed" being set will be reported to the Calibration Summary of the Status Questionable register
Preset	32767
Min	0
Max	32767
Status Bits/OPC dependencies	Sequential command

10.5.2.10 Questionable Calibration Extended Needed Register

The STATus:QUEStionable:CALibration:EXTended:NEEDed register monitors conditions which occur because a calibration or alignment is required to guarantee accurate measurements. It summarizes them in bit 8 of the STATus:QUEStionable:CALibration register.



STATus:QUEStionable:CALibration:EXTended:NEEDed Register

Bit	Condition	Operation
1	Align 9kHz-30MHz required	EMI receiver alignment required, 9kHz-30 MHz (conducted band)
2	Align 30MHz-1GHz	EMI receiver alignment required, 30 MHz-1 GHz (radiated

Bit	Condition	Operation
	required	band)
4	Input Attenuation not calibrated	The input attenuator is uncalibrated
8	MPA Align required	The Multiport Adaptor must be calibrated (EXT only)
11	Characterize Preselector required	Go to the System, Alignments, Advanced menu and perform a “Characterize Preselector”
12	Characterize Noise Floor required	Go to the System, Alignments, Advanced menu and perform a “Characterize Noise Floor”

See:

– "Questionable Calibration Extended Needed Condition " on page 816
– "Questionable Calibration Extended Needed Enable" on page 816
– "Questionable Calibration Extended Needed Event Query" on page 817
– "Questionable Calibration Extended Needed Negative Transition" on page 817
– "Questionable Calibration Extended Needed Positive Transition" on page 818

Questionable Calibration Extended Needed Condition

This query returns the decimal value of the sum of the bits in the Questionable Calibration Extended Needed Condition register.

NOTE The data in this register is continuously updated and reflects the current conditions.

Remote Command	`:STATus:QUEStionable:CALibration:EXTended:NEEDed:CONDition?`
Example	`:STAT:QUES:CAL:EXT:NEED:COND?`
Preset	0
Status Bits/OPC dependencies	Sequential command

Questionable Calibration Extended Needed Enable

This command determines which bits in the Questionable Calibration Extended Needed Condition Register will set bits in the Questionable Calibration Extended Needed Event register, which also sets bit 14 of the Questionable Calibration Register. The variable <integer> is the sum of the decimal values of the bits you want to enable.

Remote Command	`:STATus:QUEStionable:CALibration:EXTended:NEEDed:ENABle <integer>` `:STATus:QUEStionable:CALibration:EXTended:NEEDed:ENABle?`

Example	:STAT:QUES:CAL:EXT:NEED:ENAB 2 Can be used to query if an EMI conducted alignment is needed
Preset	32767
Min	0
Max	32767
Status Bits/OPC dependencies	Sequential command

Questionable Calibration Extended Needed Event Query

This query returns the decimal value of the sum of the bits in the Questionable Calibration Extended Needed Event register.

NOTE: The register requires that the associated PTR or NTR filters be set before a condition register bit can set a bit in the event register. The data in this register is latched until it is queried. Once queried, the register is cleared.

Remote Command	:STATus:QUEStionable:CALibration:EXTended:NEEDed[:EVENt]?
Example	:STAT:QUES:CAL:EXT:NEED?
Preset	0
Status Bits/OPC dependencies	Sequential command

Questionable Calibration Extended Needed Negative Transition

This command determines which bits in the Questionable Calibration Extended Needed Condition register will set the corresponding bit in the Questionable Calibration Extended Needed Event register when the condition register bit has a negative transition (1 to 0). The variable `<integer>` is the sum of the decimal values of the bits that you want to enable.

Remote Command	:STATus:QUEStionable:CALibration:EXTended:NEEDed:NTRansition <integer> :STATus:QUEStionable:CALibration:EXTended:NEEDed:NTRansition?
Example	:STAT:QUES:CAL:EXT:NEED:NTR 2 Conducted alignment required bit being cleared will be reported
Preset	0
Min	0
Max	32767
Status Bits/OPC dependencies	Sequential command

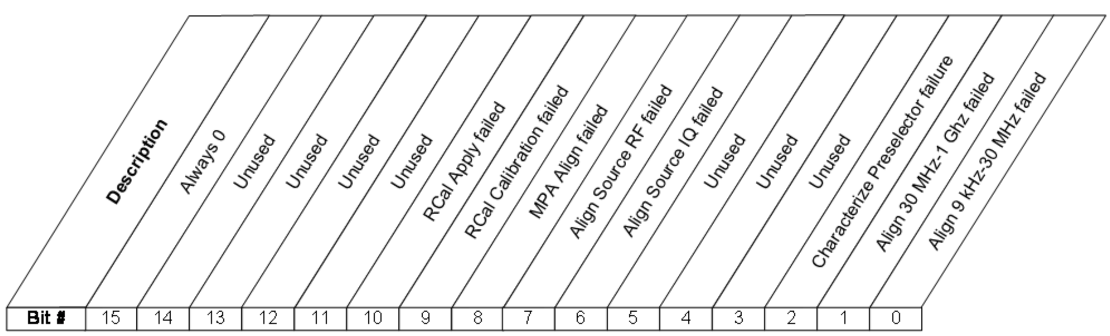
Questionable Calibration Extended Needed Positive Transition

This command determines which bits in the Questionable Calibration Extended Needed Condition register will set the corresponding bit in the Questionable Calibration Extended Needed Event register when the condition register bit has a positive transition (0 to 1). The variable `<integer>` is the sum of the decimal values of the bits that you want to enable.

Remote Command	`:STATus:QUEStionable:CALibration:EXTended:NEEDed:PTRansition <integer>` `:STATus:QUEStionable:CALibration:EXTended:NEEDed:PTRansition?`
Example	`:STAT:QUES:CAL:EXT:NEED:PTR 2` Conducted alignment required bit being set will be reported
Preset	32767
Min	0
Max	32767
Status Bits/OPC dependencies	Sequential command

10.5.2.11 Questionable Calibration Extended Failure Register

The STATus:QUEStionable:CALibration:EXTended:FAILure register monitors conditions which occur because a calibration or alignment has failed to complete properly. It summarizes them in bit 9 of the STATus:QUEStionable:CALibration register.



STATus:QUEStionable:CALibration:EXTended:FAILure Register

Bit	Condition	Operation
0	Align 9kHz-30MHz failed	EMI receiver alignment failed, 9kHz-30 MHz (conducted band)
1	Align 30MHz-1GHz failed	EMI receiver alignment failed, 30 MHz-1 GHz (radiated band)
2	Characterize Preselector required	The preselector characterization failed

Bit	Condition	Operation
6	Align Source IQ failed	The alignment of the built-in source IQ section failed
7	Align Source RF failed	The alignment of the built-in source RF section failed
8	MPA Align failed	The Multiport Adaptor must be calibrated (EXT only)
9	RCal Calibration failed	The calibration request sent to the RCal module failed
10	RCal Apply failed	The applying of the calibration data failed

See:

– "Questionable Calibration Extended Failure Condition" on page 819
– "Questionable Calibration Extended Failure Enable" on page 819
– "Questionable Calibration Extended Failure Event Query" on page 820
– "Questionable Calibration Extended Failure Negative Transition" on page 820
– "Questionable Calibration Extended Failure Positive Transition" on page 821

Questionable Calibration Extended Failure Condition

This query returns the decimal value of the sum of the bits in the Questionable Calibration Extended Failure Condition register.

NOTE The data in this register is continuously updated and reflects the current conditions.

Remote Command	`:STATus:QUEStionable:CALibration:EXTended:FAILure:CONDition?`
Example	`:STAT:QUES:CAL:EXT:FAIL:COND?`
Preset	0
Status Bits/OPC dependencies	Sequential command

Questionable Calibration Extended Failure Enable

This command determines which bits in the Questionable Calibration Extended Failure Condition Register will set bits in the Questionable Calibration Extended Failure Event register, which also sets bit 9 of the Questionable Calibration Register. The variable `<integer>` is the sum of the decimal values of the bits you want to enable.

Remote Command	`:STATus:QUEStionable:CALibration:EXTended:FAILure:ENABle <integer>` `:STATus:QUEStionable:CALibration:EXTended:FAILure:ENABle?`
Example	`:STAT:QUES:CAL:EXT:FAIL:ENAB 1` Can be used to query if an EMI conducted alignment failed

Preset	32767
Min	0
Max	32767
Status Bits/OPC dependencies	Sequential command

Questionable Calibration Extended Failure Event Query

This query returns the decimal value of the sum of the bits in the Questionable Calibration Extended Failure Event register.

NOTE

The register requires that the associated PTR or NTR filters be set before a condition register bit can set a bit in the event register. The data in this register is latched until it is queried. Once queried, the register is cleared.

Remote Command	`:STATus:QUEStionable:CALibration:EXTended:FAILure[:EVENt]?`
Example	`:STAT:QUES:CAL:EXT:FAIL?`
Preset	0
Status Bits/OPC dependencies	Sequential command

Questionable Calibration Extended Failure Negative Transition

This command determines which bits in the Questionable Calibration Extended Failure Condition register will set the corresponding bit in the Questionable Calibration Extended Failure Event register when the condition register bit has a negative transition (1 to 0). The variable `<integer>` is the sum of the decimal values of the bits that you want to enable.

Remote Command	`:STATus:QUEStionable:CALibration:EXTended:FAILure:NTRansition <integer>` `:STATus:QUEStionable:CALibration:EXTended:FAILure:NTRansition?`
Example	`:STAT:QUES:CAL:EXT:FAIL:NTR 1` Conducted alignment failed bit being cleared will be reported
Preset	0
Min	0
Max	32767
Status Bits/OPC dependencies	Sequential command

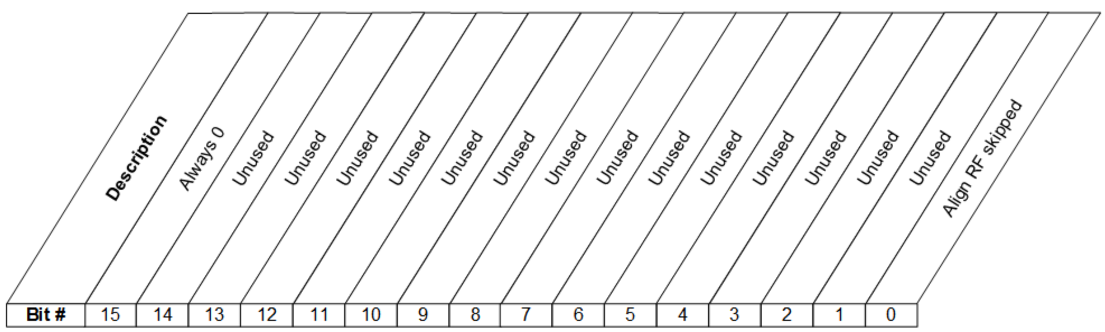
Questionable Calibration Extended Failure Positive Transition

This command determines which bits in the Questionable Calibration Extended Failure Condition register will set the corresponding bit in the Questionable Calibration Extended Failure Event register when the condition register bit has a positive transition (0 to 1). The variable `<integer>` is the sum of the decimal values of the bits that you want to enable.

Remote Command	`:STATus:QUEStionable:CALibration:EXTended:FAILure:PTRansition <integer>` `:STATus:QUEStionable:CALibration:EXTended:FAILure:PTRansition?`
Example	`:STAT:QUES:CAL:EXT:FAIL:PTR 1` Conducted alignment failed bit being set will be reported
Preset	32767
Min	0
Max	32767
Status Bits/OPC dependencies	Sequential command

10.5.2.12 Questionable Calibration Skipped Register

The STATus:QUEStionable:CALibration:EXTended:NEEDed register monitors conditions which occur because a calibration or alignment has been skipped due to various settings or conditions. It summarizes them in bit 11 of the STATus:QUEStionable:CALibration register.



STATus:QUEStionable:CALibration:SKIPped Register

Bit	Condition	Operation
0	Align RF skipped	During an alignment, the calibration of the RF section (frontend) of the instrument was not performed. This can be caused by an interfering user signal present at the RF Input See "Auto Align" on page 355, "Align Now All" on page 361 and "Align Now RF" on page 365

See:

– "Questionable Calibration Skipped Condition" on page 822
– "Questionable Calibration Skipped Enable" on page 822
– "Questionable Calibration Skipped Event Query" on page 823
– "Questionable Calibration Skipped Negative Transition" on page 823
– "Questionable Calibration Skipped Positive Transition" on page 823

Questionable Calibration Skipped Condition

This query returns the decimal value of the sum of the bits in the Questionable Calibration Skipped Condition register.

NOTE: The data in this register is continuously updated and reflects the current conditions.

Remote Command	`:STATus:QUEStionable:CALibration:SKIPped:CONDition?`
Example	`:STAT:QUES:CAL:SKIP:COND?`
Preset	0
Status Bits/OPC dependencies	Sequential command

Questionable Calibration Skipped Enable

This command determines which bits in the Questionable Calibration Skipped Condition Register will set bits in the Questionable Calibration Skipped Event register, which also sets bit 11 of the Questionable Calibration Register. The variable `<integer>` is the sum of the decimal values of the bits you want to enable.

Remote Command	`:STATus:QUEStionable:CALibration:SKIPped:ENABle <integer>` `:STATus:QUEStionable:CALibration:SKIPped:ENABle?`
Example	`:STAT:QUES:CAL:SKIP:ENAB 1` Can be used to query if an RF alignment skipped condition is detected
Preset	32767
Min	0
Max	32767
Status Bits/OPC dependencies	Sequential command

Questionable Calibration Skipped Event Query

This query returns the decimal value of the sum of the bits in the Questionable Calibration Event register.

NOTE: The register requires that the associated PTR or NTR filters be set before a condition register bit can set a bit in the event register. The data in this register is latched until it is queried. Once queried, the register is cleared.

Remote Command	`:STATus:QUEStionable:CALibration:SKIPped[:EVENt]?`
Example	`:STAT:QUES:CAL:SKIP?`
Preset	0
Status Bits/OPC dependencies	Sequential command

Questionable Calibration Skipped Negative Transition

This command determines which bits in the Questionable Calibration Skipped Condition register will set the corresponding bit in the Questionable Calibration Skipped Event register when the condition register bit has a negative transition (1 to 0). The variable `<integer>` is the sum of the decimal values of the bits that you want to enable.

Remote Command	`:STATus:QUEStionable:CALibration:SKIPped:NTRansition <integer>` `:STATus:QUEStionable:CALibration:SKIPped:NTRansition?`
Example	`:STAT:QUES:CAL:SKIP:NTR 1` RF Align Skipped bit being cleared will be reported
Preset	0
Min	0
Max	32767
Status Bits/OPC dependencies	Sequential command

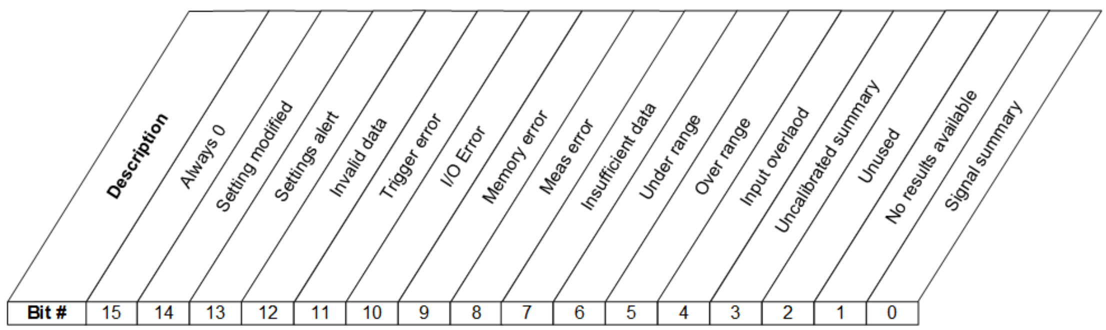
Questionable Calibration Skipped Positive Transition

This command determines which bits in the Questionable Calibration Skipped Condition register will set the corresponding bit in the Questionable Calibration Skipped Event register when the condition register bit has a positive transition (0 to 1). The variable `<integer>` is the sum of the decimal values of the bits that you want to enable.

Remote Command	`:STATus:QUEStionable:CALibration:SKIPped:PTRansition <integer>` `:STATus:QUEStionable:CALibration:SKIPped:PTRansition?`
Example	`:STAT:QUES:CAL:SKIP:PTR 1` RF Align Skipped bit being set will be reported
Preset	32767
Min	0
Max	32767
Status Bits/OPC dependencies	Sequential command

10.5.2.13 Questionable Integrity Register

The STATus:QUEStionable:INTegrity register monitors measurement integrity-related conditions within the instrument and summarizes them in bit 9 of the STATus:QUEStionable register. Two of the bits are summary bits from lower-level event registers.



STATus:QUEStionable:INTegrity Register

Bit	Condition	Operation
0	Signal Summary	This bit is the summary bit for the STATus:QUEStionable:INTegrity:SIGNal sub-register
1	No Result	The current measurement is incompatible with a setting or combination of settings, such as the selected Input, Radio Standard, etc.
3	Uncalibrated Summary	This bit is the summary bit for the STATus:QUEStionable:INTegrity:UNCalibrated sub-register
4	Input Overload	A signal overload condition exists
5	Over Range	The signal at the input for this measurement is too high. You should increase the attenuation or decrease the signal level
6	Under Range	The signal at the input for this measurement is too low. You should decrease the attenuation or increase the signal level
7	Insufficient Data	Signal or settings conditions did not allow enough data to be taken during an acquisition for a valid measurement

Bit	Condition	Operation
8	Meas Error	(not currently in use)
9	Memory Error	There is not enough memory to perform the desired operation
10	I/O Error	I/O settings are preventing communication with an instrument or peripheral
11	Trigger Error	Signal or settings conditions did not allow enough data to be taken during an acquisition for a valid measurement
12	Invalid data	The Invalid Data indicator (* in upper right of display) is on, indicating that onscreen data may be stale and not match the current settings
13	Settings Alert	Settings are not right for a valid measurement, but the instrument is nonetheless allowing a measurement to be taken
14	Setting Modified	Settings are not right for a valid measurement, and the instrument is using different settings than the ones you entered in order to take a measurement

See:

– "Questionable Integrity Condition" on page 825
– "Questionable Integrity Enable" on page 825
– "Questionable Integrity Event Query" on page 826
– "Questionable Integrity Negative Transition" on page 826
– "Questionable Integrity Positive Transition" on page 827

Questionable Integrity Condition

This query returns the decimal value of the sum of the bits in the Questionable Integrity Condition register.

NOTE **The data in this register is continuously updated and reflects the current conditions.**

Remote Command	`:STATus:QUEStionable:INTegrity:CONDition?`
Example	`:STAT:QUES:INT:COND?`
Preset	0
Status Bits/OPC dependencies	Sequential command

Questionable Integrity Enable

This command determines which bits in the Questionable Integrity Condition Register will set bits in the Questionable Integrity Event register, which also sets the

Integrity Summary bit (bit 9) in the Questionable Register. The variable <integer> is the sum of the decimal values of the bits you want to enable.

Remote Command	:STATus:QUEStionable:INTegrity:ENABle <integer> :STATus:QUEStionable:INTegrity:ENABle?
Example	:STAT:QUES:INT:ENAB 8 Uncalibrated Summary will be reported to the Integrity Summary of the Status Questionable register
Preset	32767
Min	0
Max	32767
Status Bits/OPC dependencies	Sequential command

Questionable Integrity Event Query

This query returns the decimal value of the sum of the bits in the Questionable Integrity Event register.

NOTE **The register requires that the associated PTR or NTR filters be set before a condition register bit can set a bit in the event register. The data in this register is latched until it is queried. Once queried, the register is cleared.**

Remote Command	:STATus:QUEStionable:INTegrity[:EVENt]?
Example	:STAT:QUES:INT?
Preset	0
Status Bits/OPC dependencies	Sequential command

Questionable Integrity Negative Transition

This command determines which bits in the Questionable Integrity Condition register will set the corresponding bit in the Questionable Integrity Event register when the condition register bit has a negative transition (1 to 0).

The variable <integer> is the sum of the decimal values of the bits that you want to enable.

Remote Command	:STATus:QUEStionable:INTegrity:NTRansition <integer> :STATus:QUEStionable:INTegrity:NTRansition?
Example	:STAT:QUES:INT:NTR 8 Uncalibrated Summary being cleared will be reported to the Integrity Summary of the Status Questionable register

Preset	0
Min	0
Max	32767
Status Bits/OPC dependencies	Sequential command

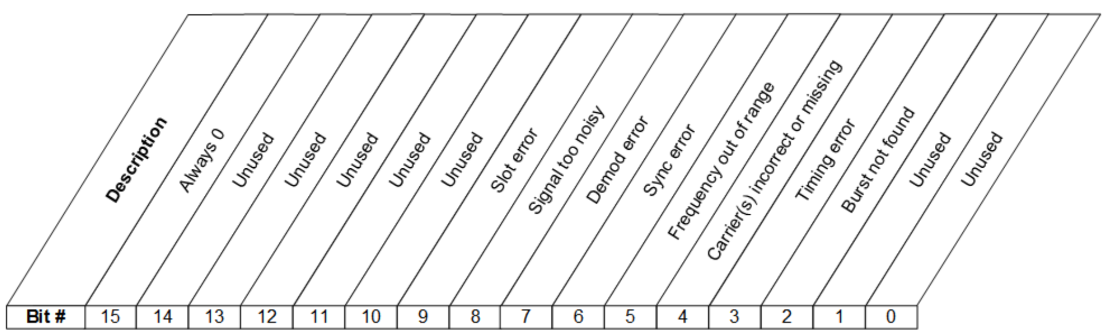
Questionable Integrity Positive Transition

This command determines which bits in the Questionable Integrity Condition register will set the corresponding bit in the Questionable Integrity Event register when the condition register bit has a positive transition (0 to 1). The variable `<integer>` is the sum of the decimal values of the bits that you want to enable.

Remote Command	`:STATus:QUEStionable:INTegrity:PTRansition <integer>` `:STATus:QUEStionable:INTegrity:PTRansition?`
Example	`:STAT:QUES:INT:PTR 8` Uncalibrated Summary being set will be reported to the Integrity Summary of the Status Questionable register
Preset	32767
Min	0
Max	32767
Status Bits/OPC dependencies	Sequential command

10.5.2.14 Questionable Integrity Signal Register

The STATus:QUEStionable:INTegrity:SIGNal register monitors conditions which occur because a measurement may not be able to return an accurate or valid result due to signal conditions. It summarizes them in bit 0 of the STATus:QUEStionable:INTegrity register.



STATus:QUEStionable:INTegrity:SIGNal Register

Bit	Condition	Operation
2	Burst not found	The instrument is expecting a bursted signal but such a signal cannot be detected because of inappropriate parameter settings or incorrect signal content
3	Timing Error	The instrument can't establish appropriate timing from the signal
4	Carrier(s) incorrect or missing	The instrument can't find the expected carrier(s) within the frequency ranges in which it is looking
5	Frequency out of range	One or more system or signal input frequencies are out of range
6	Sync error	The instrument can't establish sync with the measured signal
7	Demod error	The instrument cannot demodulate the signal due to inappropriate signal or settings conditions
8	Signal Too Noisy	The instrument cannot measure the desired signal because it is too noisy
9	Slot Error	No valid signal slot found in captured data

See:

– "Questionable Integrity Signal Condition" on page 828
– "Questionable Integrity Signal Enable" on page 829
– "Questionable Integrity Signal Event Query" on page 829
– "Questionable Integrity Signal Negative Transition" on page 829
– "Questionable Integrity Signal Positive Transition" on page 830

Questionable Integrity Signal Condition

This query returns the decimal value of the sum of the bits in the Questionable Integrity Signal Condition register.

NOTE The data in this register is continuously updated and reflects the current conditions.

Remote Command	`:STATus:QUEStionable:INTegrity:SIGNal:CONDition?`
Example	`:STAT:QUES:INT:SIGN:COND?`
Preset	0
Status Bits/OPC dependencies	Sequential command

Questionable Integrity Signal Enable

This command determines which bits in the Questionable Integrity Signal Condition Register will set bits in the Questionable Integrity Signal Event register, which also sets the Integrity Summary bit (bit 9) in the Questionable Register. The variable `<integer>` is the sum of the decimal values of the bits you want to enable.

Remote Command	`:STATus:QUEStionable:INTegrity:SIGNal:ENABle <integer>` `:STATus:QUEStionable:INTegrity:SIGNal:ENABle?`
Example	`:STAT:QUES:INT:SIGN:ENAB 4` Burst Not Found will be reported to the Integrity Summary of the Status Questionable register
Preset	32767
Min	0
Max	32767
Status Bits/OPC dependencies	Sequential command

Questionable Integrity Signal Event Query

This query returns the decimal value of the sum of the bits in the Questionable Integrity Signal Event register.

NOTE The register requires that the associated PTR or NTR filters be set before a condition register bit can set a bit in the event register. The data in this register is latched until it is queried. Once queried, the register is cleared.

Remote Command	`:STATus:QUEStionable:INTegrity:SIGNal[:EVENt]?`
Example	`:STAT:QUES:INT:SIGN?`
Preset	0
Status Bits/OPC dependencies	Sequential command

Questionable Integrity Signal Negative Transition

This command determines which bits in the Questionable Integrity Signal Condition register will set the corresponding bit in the Questionable Integrity Signal Event register when the condition register bit has a negative transition (1 to 0). The variable `<integer>` is the sum of the decimal values of the bits that you want to enable.

Remote Command	`:STATus:QUEStionable:INTegrity:SIGNal:NTRansition <integer>` `:STATus:QUEStionable:INTegrity:SIGNal:NTRansition?`

Example	:STAT:QUES:INT:SIGN:NTR 4 Burst not found being cleared will be reported to the Integrity Summary of the Status Questionable register
Preset	0
Min	0
Max	32767
Status Bits/OPC dependencies	Sequential command

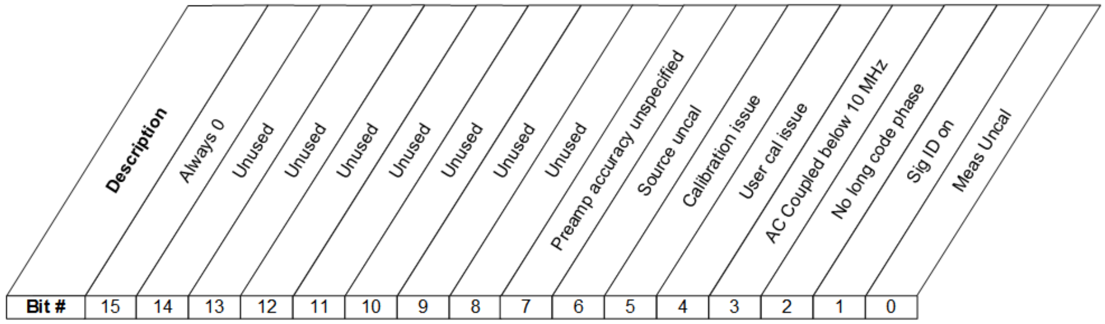
Questionable Integrity Signal Positive Transition

This command determines which bits in the Questionable Integrity Signal Condition register will set the corresponding bit in the Questionable Integrity Signal Event register when the condition register bit has a positive transition (0 to 1). The variable <integer> is the sum of the decimal values of the bits that you want to enable.

Remote Command	:STATus:QUEStionable:INTegrity:SIGNal:PTRansition <integer> :STATus:QUEStionable:INTegrity:SIGNal:PTRansition?
Example	:STAT:QUES:INT:SIGN:PTR 4 Burst not found being set will be reported to the Integrity Summary of the Status Questionable register
Preset	32767
Min	0
Max	32767
Status Bits/OPC dependencies	Sequential command

10.5.2.15 Questionable Integrity Uncalibrated Register

The STATus:QUEStionable:INTegrity:UNCalibrated register monitors conditions which occur because a measurement may not be able to return an accurate or valid result due to a mismatch between instrument settings and the signal, placing the instrument in an uncalibrated state for that signal. It summarizes them in bit 3 of the STATus:QUEStionable:INTegrity register.



STATus:QUEStionable:INTegrity:UNCalibrated Register

Bit	Condition	Operation
0	Meas Uncal	A Meas Uncal warning is being displayed; generally this means the sweep time must be reduced or the RBW increased
1	Signal ID on	In external mixing, the Sig ID function is on, which will impact the trace results
2	No Long Code Phase	The long code phase that identifies an access channel cannot be found (WCDMA)
3	AC coupled: Accy unspec'd <10 MHz	The instrument is AC coupled but is operating below 10 MHz, where the blocking capacitor will impact measurement accuracy
4	User cal issue	In noise figure measurements, the User Cal has not been performed or has been invalidated
5	Calibration issue	In noise figure measurements, one or more calibration or measurement frequency point exceeds the currently loaded Cal or Meas ENR Table frequency ranges.
6	Source uncal	While using a Tracking Source, settings are putting it into an uncalibrated operational state
7	Preamp accuracy unspecified below XX MHz	The preamp is being used but is operating below frequencies for which its accuracy is specified

See:

– "Questionable Integrity Uncalibrated Condition" on page 832
– "Questionable Integrity Uncalibrated Enable" on page 832
– "Questionable Integrity Uncalibrated Event Query" on page 832
– "Questionable Integrity Uncalibrated Negative Transition" on page 833
– "Questionable Integrity Uncalibrated Positive Transition" on page 833

Questionable Integrity Uncalibrated Condition

This query returns the decimal value of the sum of the bits in the Questionable Integrity Uncalibrated Condition register.

NOTE The data in this register is continuously updated and reflects the current conditions.

Remote Command	`:STATus:QUEStionable:INTegrity:UNCalibrated:CONDition?`
Example	`:STAT:QUES:INT:UNC:COND?`
Preset	0
Status Bits/OPC dependencies	Sequential command

Questionable Integrity Uncalibrated Enable

This command determines which bits in the Questionable Integrity Uncalibrated Condition Register will set bits in the Questionable Integrity Uncalibrated Event register, which also sets the Data Uncalibrated Summary bit (bit 3) in the Questionable Integrity Register. The variable `<integer>` is the sum of the decimal values of the bits you want to enable.

Remote Command	`:STATus:QUEStionable:INTegrity:UNCalibrated:ENABle` `:STATus:QUEStionable:INTegrity:UNCalibrated:ENABle?`
Example	`:STAT:QUES:INT:UNC:ENAB 1` Oversweep (Meas Uncal) will be reported to the Integrity Summary of the Status Questionable register
Preset	32767
Min	0
Max	32767
Status Bits/OPC dependencies	Sequential command

Questionable Integrity Uncalibrated Event Query

This query returns the decimal value of the sum of the bits in the Questionable Integrity Uncalibrated Event register.

NOTE The register requires that the associated PTR or NTR filters be set before a condition register bit can set a bit in the event register. The data in this register is latched until it is queried. Once queried, the register is cleared.

Remote Command	`:STATus:QUEStionable:INTegrity:UNCalibrated[:EVENt]?`

Example	`:STAT:QUES:INT:UNC?`
Preset	0
Status Bits/OPC dependencies	Sequential command

Questionable Integrity Uncalibrated Negative Transition

This command determines which bits in the Questionable Integrity Uncalibrated Condition register will set the corresponding bit in the Questionable Integrity Uncalibrated Event register when the condition register bit has a negative transition (1 to 0). The variable `<integer>` is the sum of the decimal values of the bits that you want to enable.

Remote Command	`:STATus:QUEStionable:INTegrity:UNCalibrated:NTRansition <integer>` `:STATus:QUEStionable:INTegrity:UNCalibrated:NTRansition?`
Example	`:STAT:QUES:INT:UNC:NTR 1` Oversweep cleared will be reported to the Integrity Summary of the Status Questionable register
Preset	0
Min	0
Max	32767
Status Bits/OPC dependencies	Sequential command

Questionable Integrity Uncalibrated Positive Transition

This command determines which bits in the Questionable Integrity Uncalibrated Condition register will set the corresponding bit in the Questionable Integrity Uncalibrated Event register when the condition register bit has a positive transition (0 to 1). The variable `<integer>` is the sum of the decimal values of the bits that you want to enable.

Remote Command	`:STATus:QUEStionable:INTegrity:UNCalibrated:PTRansition <integer>` `:STATus:QUEStionable:INTegrity:UNCalibrated:PTRansition?`
Example	`:STAT:QUES:INT:UNC:PTR 1` Oversweep set will be reported to the Integrity Summary of the Status Questionable register
Preset	32767
Min	0
Max	32767
Status Bits/OPC dependencies	Sequential command

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