Notice.

The information contained in this document is subject to change without notice.

Agilent Technologies makes no warranty of any kind with regard to this material, including but not limited to, the implied warranties of merchantability and fitness for a particular purpose. Agilent Technologies shall not be liable for errors contained herein or for incidental or consequential damages in connection with the furnishing, performance, or use of this material.
Agilent Technologies Software Product License Agreement and Limited Warranty

Important
Please carefully read this License Agreement before opening the media envelope or operating the equipment. Rights in the software are offered only on the condition that the Customer agrees to all terms and conditions of the License Agreement. Opening the media envelope or operating the equipment indicates your acceptance of these terms and conditions. If you do not agree to the License Agreement, you may return the unopened package for a full refund.

License Agreement
In return for payment of the applicable fee, Agilent Technologies grants the Customer a license in the software, until terminated, subject to the following:

Use
- Customer may use the software on one instrument.
- Customer may not reverse assemble or decompile the software.

Copies and Adaptations
- Customer may make copies or adaptations of the software:
  □ For archival purposes, or
  □ When copying or adaptation is an essential step in the use of the software with a computer so long as the copies and adaptations are used in no other manner.
- Customer has no other rights to copy unless they acquire an appropriate license to reproduce which is available from Agilent Technologies for some software.
- Customer agrees that no warranty, free installation, or free training is provided by Agilent Technologies for any copies or adaptations made by Customer.
- All copies and adaptations of the software must bear the copyright notice(s) contained in or on the original.

Ownership
- Customer agrees that they do not have any title or ownership of the software, other than ownership of the physical media.
- Customer acknowledges and agrees that the software is copyrighted and protected under the copyright laws.
- Customer acknowledges and agrees that the software may have been developed by a third party software supplier named in the copyright notice(s) included with the software, who shall be authorized to hold the Customer responsible for any copyright infringement or violation of this License Agreement.
Transfer of Rights in Software

- Customer may transfer rights in the software to a third party only as part of the transfer of all their rights and only if Customer obtains the prior agreement of the third party to be bound by the terms of this License Agreement.
- Upon such a transfer, Customer agrees that their rights in the software are terminated and that they will either destroy their copies and adaptations or deliver them to the third party.
- Transfer to a U.S. government department or agency or to a prime or lower tier contractor in connection with a U.S. government contract shall be made only upon their prior written agreement to terms required by Agilent Technologies.

Sublicensing and Distribution

- Customer may not sublicense the software or distribute copies or adaptations of the software to the public in physical media or by telecommunication without the prior written consent of Agilent Technologies.

Termination

- Agilent Technologies may terminate this software license for failure to comply with any of these terms provided Agilent Technologies has requested Customer to cure the failure and Customer has failed to do so within thirty (30) days of such notice.

Updates and Upgrades

- Customer agrees that the software does not include future updates and upgrades which may be available from Agilent Technologies under a separate support agreement.

Export

- Customer agrees not to export or re-export the software or any copy or adaptation in violation of the U.S. Export Administration regulations or other applicable regulations.
Limited Warranty

Software Agilent Technologies warrants for a period of 1 year from the date of purchase that the software product will execute its programming instructions when properly installed on the spectrum-analyzer instrument indicated on this package. Agilent Technologies does not warrant that the operation of the software will be uninterrupted or error free. In the event that this software product fails to execute its programming instructions during the warranty period, customer’s remedy shall be to return the media to Agilent Technologies for replacement. Should Agilent Technologies be unable to replace the media within a reasonable amount of time, Customer’s alternate remedy shall be a refund of the purchase price upon return of the product and all copies.

Media Agilent Technologies warrants the media upon which this product is recorded to be free from defects in materials and workmanship under normal use for a period of 1 year from the date of purchase. In the event any media prove to be defective during the warranty period, Customer’s remedy shall be to return the media to Agilent Technologies for replacement. Should Agilent Technologies be unable to replace the media within a reasonable amount of time, Customer’s alternate remedy shall be a refund of the purchase price upon return of the product and all copies.

Notice of Warranty Claims
Customer must notify Agilent Technologies in writing of any warranty claim not later than thirty (30) days after the expiration of the warranty period.

Limitation of Warranty
Agilent Technologies makes no other express warranty, whether written or oral, with respect to this product. Any implied warranty of merchantability or fitness is limited to the 1 year duration of this written warranty.

This warranty gives specific legal rights, and Customer may also have other rights which vary from state to state, or province to province.

Exclusive Remedies The remedies provided above are Customer’s sole and exclusive remedies. In no event shall Agilent Technologies be liable for any direct, indirect, special, incidental, or consequential damages (including lost profit) whether based on warranty, contract, tort, or any other legal theory.

Warranty Service Warranty service may be obtained from the nearest Agilent Technologies sales office or other location indicated in the owner’s manual or service booklet.
### Safety Notes

The following safety notes are used throughout this manual. Familiarize yourself with each of the symbols and its meaning before operating this instrument.

#### Caution

The *caution* note denotes a hazard. It calls attention to a procedure which, if not correctly performed or adhered to, could result in damage to or destruction of the instrument. Do not proceed beyond a *caution* sign until the indicated conditions are fully understood and met.

#### Warning

The *warning* note denotes a hazard. It calls attention to a procedure which, if not correctly performed or adhered to, could result in injury or loss of life. Do not proceed beyond a *warning* sign until the indicated conditions are fully understood and met.

#### Instruction Manual

The *instruction manual* symbol. The product is marked with this symbol when it is necessary for the user to refer to the instructions in the manual.

### General Safety Considerations

#### Warning

*Before the spectrum analyzer is switched on, make sure it has been properly grounded through the protective conductor of the ac power cable to a socket outlet provided with protective earth contact.*

Any interruption of the protective (grounding) conductor, inside or outside the instrument, or disconnection of the protective earth terminal can result in personal injury.

#### Caution

*Before the spectrum analyzer is switched on, make sure its primary power circuitry has been adapted to the voltage of the ac power source.*

Failure to set the ac power input to the correct voltage could cause damage to the instrument when the ac power cable is plugged in.
How to Use This Guide

Key Conventions.

The following key conventions are used in this guide:

- **Front-panel key**
  Text shown like this represents a key physically located on the spectrum analyzer.

- **Softkey**
  Text shown like this represents a softkey. (The softkeys are located next to the softkey labels, and the softkey labels are the annotation on the right side of the spectrum analyzer display.)

- **Screen Text**
  Text printed in this typeface indicates text displayed on the instrument screen.
Contents

1. **Installing and Starting the Utility**
   Loading the Utility Into Memory and Labeling a Softkey ........................................ 1-3
   Moving the Mass Memory Module (and Utility) to Another Analyzer .............................. 1-5
   Removing the Utility From Memory ................................................................................. 1-6
   Starting the Spurious Response Measurements Utility ................................................. 1-7
   Using the Spurious Response Measurements Utility ....................................................... 1-8
   Alternating Between the 85672A Spurious Response Measurements Utility and the 85671A Phase Noise Utility .................................................................................. 1-9

2. **Measurement Examples**
   Making A Third Order Intercept Measurement ................................................................. 2-1
     Procedure ....................................................................................................................... 2-1
   Making A Harmonic Measurement .................................................................................. 2-4
     Procedure ....................................................................................................................... 2-4
   Making A General Spurious Measurement .................................................................... 2-7
     Procedure ....................................................................................................................... 2-8
   Making A Discrete Sidebands Measurement .................................................................. 2-11
     Procedure ....................................................................................................................... 2-12
   Making A Mixing Products Measurement ..................................................................... 2-15
     Procedure ....................................................................................................................... 2-15

3. **Softkey Menus and Descriptions**
   Overall Menu Map ......................................................................................................... 3-2
   Third-Order Intercept and Intermodulation Distortion Menu ......................................... 3-4
   Harmonic Menu ............................................................................................................... 3-5
   General Spurious Menu .................................................................................................. 3-7
   Sideband Menu ............................................................................................................... 3-11
   Mixer Menu ...................................................................................................................... 3-14
   Printing and Plotting ....................................................................................................... 3-17
   Quitting the Utility ......................................................................................................... 3-18

4. **Measurement Functions and Considerations**
   The Main Menu .............................................................................................................. 4-2
   Exiting the Utility ........................................................................................................... 4-3
   Third Order Intercept Measurement ............................................................................... 4-4
     Description ..................................................................................................................... 4-4
     Measurement Configuration ......................................................................................... 4-4
     Measurement Limitations ............................................................................................. 4-4
   Harmonics Measurements .............................................................................................. 4-5
     Description ..................................................................................................................... 4-5
     Measurement Configuration ......................................................................................... 4-5
     Measurement Configuration Menu Variable Limits ..................................................... 4-6
     Measurement Limitations ............................................................................................. 4-7
General Spurious Measurement ........................................ 4-8
Description .................................................................. 4-8
Measurement Configuration ......................................... 4-9
  Configuration Menu Variable Limits .............................. 4-9
Measurement Limitations ............................................. 4-10
Discrete Sidebands Measurement ................................. 4-12
Description .................................................................. 4-12
Measurement Configuration ......................................... 4-13
  Configuration Menu Variable Limits .............................. 4-13
Measurement Limitations ............................................. 4-13
Mixing Products Measurement ..................................... 4-15
Description .................................................................. 4-15
Measurement Configuration ......................................... 4-15
  Configuration Menu Variable Limits .............................. 4-16
Measurement Limitations ............................................. 4-17
  Mixing Product Frequency is 0 Hz ............................. 4-17
  Different Mixing Product Frequencies are Equal ........... 4-18
Printing and Plotting .................................................. 4-19

5. If You Have a Problem

6. Specifications and Characteristics
Specifications and Characteristics ................................ 6-1
  TOI and IMD .......................................................... 6-1
  Harmonics .................................................................. 6-1
  General Spurious Signals ........................................... 6-2
  Sidebands .................................................................. 6-2
  Mixing Products ....................................................... 6-2
  Repeatability ............................................................. 6-2

7. Remote Programming Commands and Examples
Programming Notes ..................................................... 7-1
  Command Syntax Basics ............................................ 7-1
  Setting Configuration Parameters ............................... 7-2
  Changing the Analyzer Mode from Remote to Local ....... 7-2
  Using Queries to Obtain Results ................................. 7-2
  Remote Error Codes ................................................ 7-2
  Using an External 10 MHz Reference .......................... 7-3
Remote Measurement of TOI/IMD .................................. 7-4
  Execute Command .................................................... 7-4
  Output Variables ..................................................... 7-4
  Error Codes .............................................................. 7-4
  Remote Third Order Intercept (TOI) Measurement
    Example .............................................................. 7-5
Remote Measurement of Harmonics ............................... 7-7
  Execute Command .................................................... 7-7
  Configuration Variables ........................................... 7-7
  Output Variables ..................................................... 7-7
  Error Codes .............................................................. 7-8
Remote Harmonics Measurement Example ....................... 7-9
Remote Measurement of General Spurious Signals ............ 7-11
  Execute Commands ................................................ 7-11
  Configuration Variables ........................................... 7-11
  Output Variables ..................................................... 7-11
  Error Codes .............................................................. 7-12
Remote General Spurious Signals Measurement
  Example ............................................. 7-13
Remote Measurement of Sidebands .......................... 7-16
  Execute Command .................................... 7-16
  Configuration Variables ............................ 7-16
  Output Variables ................................. 7-16
  Error Codes ...................................... 7-16
Remote Discrete Sideband Signals Measurement
  Example ............................................. 7-17
Remote Measurement of Mixing Products .................. 7-19
  Execute Command .................................... 7-19
  Configuration Variables ............................ 7-19
  Output Variables ................................. 7-19
  Error Codes ...................................... 7-20
Remote Mixing Products Measurement Example .......... 7-21

Index
Figures

1-1. Equipment Used with the Spurious Response Measurements Utility .......................... 1-2
2-1. Typical TOI/IMD Measurement Equipment Setup .............................................. 2-1
2-2. Typical TOI/IMD Measurement Spectrum Display ............................................... 2-2
2-3. TOI/IMD Measurement Results .............................................................................. 2-3
2-4. Typical Harmonic Measurement Equipment Setup ................................................. 2-4
2-5. Typical Harmonic Measurement Spectrum Display ................................................ 2-5
2-6. Harmonic Menu Configuration .............................................................................. 2-5
2-7. Harmonic Measurement Results ............................................................................. 2-6
2-8. Spurious Response Measurement Frequency and Power Level Bounds .................. 2-7
2-9. Typical General Spurious Measurement Equipment Setup .................................... 2-8
2-10. Typical General Spurious Measurement Spectrum Display .................................. 2-8
2-11. Spurious Menu Configuration .............................................................................. 2-9
2-12. General Spurious Measurement Results (Power in dBm) ....................................... 2-10
2-13. General Spurious Measurement Results (Power in dBc) ....................................... 2-10
2-14. Sidebands Frequency Offset Range Limits .......................................................... 2-11
2-15. Typical Carrier Sidebands Measurement Equipment Setup .................................. 2-12
2-16. Typical Discrete Sidebands Measurement Spectrum Display ................................ 2-12
2-17. Discrete Sidebands Menu Configuration .............................................................. 2-13
2-18. Carrier Sidebands Measurement Results ............................................................. 2-14
2-19. Typical Mixer Measurement Equipment Setup ..................................................... 2-15
2-20. Typical Mixing Products Measurement Spectrum Display .................................... 2-16
2-21. Mixer Menu Configuration .................................................................................... 2-16
2-22. Mixer Measurement Results ................................................................................. 2-17
2-23. Selecting A Mixing Product to View .................................................................... 2-17
2-24. Viewing a Product ............................................................................................... 2-18
3-1. Overall Menu Map (1 of 2) ................................................................................... 3-2
3-2. Overall Menu Map (2 of 2) ................................................................................... 3-3
3-3. TOI/IMD Menu .................................................................................................... 3-4
3-4. Harmonic Menu ................................................................................................... 3-5
3-5. General Spurious Menu ........................................................................................ 3-7
3-6. Spurious Measurement Frequency and Power Level Bounds ............................... 3-9
3-7. Sideband Menu ..................................................................................................... 3-11
3-8. Sidebands Frequency Offset Range Limits ........................................................... 3-13
3-9. Mixer Menu .......................................................................................................... 3-14
4-1. Main Menu ............................................................................................................ 4-2
4-2. Spurious Measurement Frequency and Power Level Bounds ............................... 4-8
4-3. Sidebands Frequency Offset Range Limits ........................................................... 4-12
## Tables

4-1. Harmonics Measurement Configuration Variable Limits  4-6
4-2. Spurious Measurement Configuration Variable Limits  4-10
4-3. Sidebands Measurement Configuration Variable Limits  4-13
4-4. Mixer Measurement Configuration Variable Limits  4-16
5-1. Agilent Technologies Sales and Service Offices  5-4
Installing and Starting the Utility

The 85672A Spurious Response Measurements Utility is a downloadable program (DLP) that is used with the 8560 E-Series and EC-Series spectrum analyzers. To install the utility, you also need an 85620A Mass Memory Module and one of the 8560 E-Series or EC-Series spectrum analyzers listed in the following table. Please note the firmware revisions required of the various equipment.

<table>
<thead>
<tr>
<th>Spurious Response Measurements Utility</th>
<th>Mass Memory Module</th>
<th>Spectrum Analyzer</th>
</tr>
</thead>
<tbody>
<tr>
<td>85672A</td>
<td>85620A</td>
<td>$560A (firmware 890720 and later)</td>
</tr>
<tr>
<td></td>
<td>(firmware revision C, 910116 and later)</td>
<td>$561A (all revisions of firmware)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>$561B (firmware 890720 and later)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>$561E/EC (all revisions of firmware)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>$562A (firmware 870728 and later)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>$562B (firmware 870728 and later)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>$562E/EC (all revisions of firmware)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>$563A (all revisions of firmware)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>$563E/EC (all revisions of firmware)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>$564E/EC (all revisions of firmware)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>$565E/EC (all revisions of firmware)</td>
</tr>
</tbody>
</table>
Figure 1-1.
Equipment Used with the Spurious Response Measurements Utility

The spurious response measurements utility is shipped on three memory cards that must be installed into the mass memory module before it can be used by the spectrum analyzer.

The spectrum analyzer has direct access to the mass memory module using the [Module] key. To access the spurious response measurements utility from the front panel of the spectrum analyzer, label one of the blank softkeys on the user menu. The following procedures describe how to copy the file, label the softkeys, and access the utility.
Loading the Utility Into Memory and Labeling a Softkey

The spurious response measurements utility is contained on three memory cards. Cards 1 of 3 and 2 of 3 contain the files SPURS1, and SPURS2, respectively. These files contain the entire program. Card 3 of 3 contains the removal routine SP_REMOVE, to be used only to erase the utility at a later time, if desired. The filename PH_EXIT is also on memory card 3 of 3. It is for users that alternately use the 85671A Phase Noise Utility, and then the 85672A Spurious Response Measurements Utility. See “Alternating Between the 85672A Spurious Response Measurements Utility and the 85671A Phase Noise Utility” in this chapter for more information about the use of this file.

Use the following procedure to install the utility for the first time, or to re-install the utility after troubleshooting.

**Note**

If you are re-installing the utility, first perform the procedure under “Removing the Utility From Memory,” in this chapter. While it is possible to simply overwrite the utility without removing it first, removing and then re-installing it is much faster.

1. With the spectrum analyzer turned off, attach the mass memory module to the rear panel of the spectrum analyzer if it is not already attached.

2. Insert 85672A memory card 1 of 3 into the module. Make sure the arrow on the card is facing the matching arrow on the rim of the module card slot.

3. Turn on the spectrum analyzer. After it completes its power-on sequence, press the [MODULE] key on the front panel.

4. Press the UTILTY softkey. After a short wait, the screen will list the current contents of the mass memory module.

5. Verify that there is at least 65 KB of free memory. If not, delete unwanted saved traces and files to make room. This utility will fit along with the 85671A Phase Noise Utility with approximately 10 KB of free memory left.

6. Press the CATALOG MEM CARD key so that CARD is underlined. The spectrum analyzer should now display the contents of the memory card. It should show file SPURS1 for card 1 of 3.

7. Move the knob so that SPURS1 is highlighted and press the COPY TO MEMORY softkey. This will copy the utility from the memory card to the mass memory module in less than one minute.

8. Remove the memory card and insert memory card 2 of 3 into the mass memory module. It is not necessary to turn off the spectrum analyzer.

9. Press the CATALOG MEM CARD key twice so that CARD is underlined again. This will show the contents of the second memory card. Repeat the above process to copy file SPURS2 into the mass memory module. The copying process for card 2
of 3 takes less than one minute. The utility is now loaded into memory.

10. Press **MODULE** KEYDEF CHOOSE DLP and then locate and highlight filename SP_SETUP, using the step keys, the NEXT COLUMN, and NEXT PAGE keys.

11. Press EXECUTE NOW and follow the instructions on the display. Choose the softkey associated with the desired location of the spurious response measurements utility softkey. Press the key labeled NO KEY if you do not want to label a softkey.

The setup routine can be used to label only the first five user keys. If you have other programs in use which are using all of those softkeys, press the NO KEY softkey.

If you press a softkey that is already labeled, it will be overwritten with the spurious response measurement utility label. If a softkey other than NO KEY is pressed, that softkey is labeled SPURS, and the installation is complete.
Moving the Mass Memory Module (and Utility) to Another Analyzer

The following procedure must be performed whenever the 85620A Mass Memory Module, with the loaded utility, is moved from one spectrum analyzer to another having a different model number.

The utility is saved in the mass memory module non-volatile memory. Therefore, the utility remains in the module when it is physically moved to another spectrum analyzer. The utility does not need to be re-installed after this is done, but the utility program variables should be reset to their factory default values. This procedure performs this task and helps prevent failure of the utility. This can occur when a utility variable saved in the module while connected to one spectrum analyzer becomes invalid when the module is moved to another analyzer having different specifications.

1. Press **(MODULE) KEYDEF** and then rotate the knob to highlight filename **SP_SETUP**.

2. Press **CHOOSE DLP** and then locate and highlight filename **SP_SETUP**, using the step keys, and the **NEXT COLUMN** and **NEXT PAGE** keys.

3. Press **EXECUTE NOW** and follow the instructions on the display. Choose the softkey associated with the desired location of the spurious response measurements utility softkey. Press the key labeled **NO KEY** if you do not want to label a softkey.

The setup routine can be used to label only the first five user keys. If you have other programs in use which are using all of those softkeys, press the **NO KEY** softkey.

If you press a softkey that is already labeled, it will be overwritten with the spurious response measurement utility label. If a softkey other than **NO KEY** is pressed, that softkey is labeled **SPURS**, and the installation is complete.
Removing the Utility From Memory

The following procedure removes the utility from the mass memory module memory. This is done to free up memory space, and to speed up re-installation of the utility.

1. With the spectrum analyzer turned off, attach the mass memory module to the rear panel of the spectrum analyzer if it is not already attached.

2. Insert 85672A memory card 3 of 3 into the module. Make sure the arrow on the card is facing the matching arrow on the rim of the module card slot.

3. Turn on the spectrum analyzer. After it completes its power-on sequence, press the MODULE key on the front panel.

4. Press the UTILITY softkey. After a short wait, the screen will list the current contents of the mass memory module.

5. Press the CATALOG MEM CARD key so that CARD is underlined. This will show the contents of the memory card.

6. Move the knob to highlight the filename SP_REMOVE and then press the COPY TO MEMORY softkey.

7. Press the hardkey (MODULE). Then press softkeys AUTOEXEC MENU EDIT AUTOEXEC CHOOSE DLP. Use the up/down keys and softkeys NEXT PAGE and NEXT COLUMN to highlight filename SP_REMOVE, and press EXECUTE NOW. All spurious response measurements utility files are removed in about one minute. This procedure is now complete.

The filename PH_EXIT is also on memory card 3 of 3. It is for users that alternately use the Agilent 85671A Phase Noise Utility, and then the 85672A Spurious Response Measurements Utility. See “Alternating Between the 85672A Spurious Response Measurements Utility and the Agilent 85671A Phase Noise Utility” in this chapter for more information about the use of this file.

Note

In some cases, an unwanted file named SP_JUNK is saved to memory after this procedure. If this occurs, then press hardkey (MODULE). Press softkey KEYDEF, use the knob to highlight SP_JUNK, and then press CLEAR.
Starting the Spurious Response Measurements Utility

The spurious response measurements utility can be started easily once the program is in the mass memory module and a spectrum analyzer user key has been labeled to access it.

The desired carrier signal should be visible on the spectrum analyzer before starting the utility. When the utility is started, it finds the largest signal in the current span and assumes this will be the carrier frequency.

1. With the spectrum analyzer turned off, attach the mass memory module to the rear panel of the spectrum analyzer if it is not already attached.

2. Turn on the spectrum analyzer. After it completes its power-on sequence, press the [MODULE] key on the front panel.

3. Press USER KEYS. This will display the user-defined softkey menu. The label [SPURS] should be on the softkey selected in the installation.

4. Press the [SPURS] softkey to start the utility.
Using the Spurious Response Measurements Utility

The spurious response measurements utility uses a series of softkey menus displayed along the right edge of the spectrum analyzer display. Always use the EXIT ALL softkey to exit the utility.

Note

DO NOT use other front-panel keys when the utility is running, except to enter data, or you will exit the utility prematurely. DO NOT turn the knob when the utility is running, or the spectrum analyzer may stop responding to key presses, requiring the ac power to be cycled.

The spurious response measurements utility main menu prompts you to choose from one of the following keys:

**MEASURE TOI/IMD**

Immediately measure third order intercept and intermodulation distortion of an amplifier (there is no intermediate setup menu). The two primary signals must be visible on the display before starting the utility.

**HARMONIC MENU**

Configure or measure harmonic amplitudes and total harmonic distortion within a spectrum. The fundamental signal must be visible on the display before starting the utility.

**GEN SPUR MENU**

Configure or measure general spurious signals within a spectrum. When this measurement is configured to measure relative signal levels (dBc), then the reference signal must be visible on the display before starting the utility.

**SIDEBAND MENU**

Configure or measure the close-in sidebands of a carrier. The carrier signal must be visible on the display before starting the utility.

**MIXER MENU**

Configure or measure the mixing products of a mixer.

**EXIT ALL**

Exits the spurious response measurements utility and recalls the menu invoked by pressing the MODULE hardkey.
Alternating Between the 85672A Spurious Response Measurements Utility and the 85671A Phase Noise Utility

Both the 85672A Spurious Response Measurements Utility and the 85671A Phase Noise Utility can reside in memory at the same time. However, when exiting the phase noise utility, the user softkeys are blanked unless a file named PH_EXIT is loaded into memory.

The following procedure allows the user softkeys to be displayed when switching between the phase noise utility and the spurious response measurements utility. Perform this procedure after the phase noise utility has been installed, and also whenever it has been reloaded.

1. With the spectrum analyzer turned off, attach the mass memory module to the rear panel of the spectrum analyzer if it is not already attached.

   85672A memory card 3 of 3 into the module. Make sure the arrow on the card is facing the matching arrow on the rim of the module card slot.

2. Turn on the spectrum analyzer. After it completes its power-on sequence, press the [MODULE] key on the front panel.

3. Press the [UTILITY] softkey. After a short wait, the screen will list the current contents of the mass memory module.

4. Press the [CATALOG | MEM CARD] key so that CARD is underlined. This will show the contents of the memory card.

5. Move the knob to highlight the filename PH_EXIT and then press the [COPY | TO MEMORY] softkey. This procedure is now complete.
Measurement Examples

This chapter gives examples of each spurious measurement performed by the 85672SA Spurious Response Measurements Utility, including typical equipment setups and example output displays. See Chapter 4, “Measurement Functions and Considerations,” for measurement conditions, limits, and default values.

Making A Third Order Intercept Measurement

The third order products at the output of a device (such as an amplifier) are measured, and both the extrapolated intercept point, and the intermodulation distortion are calculated. Make sure the signals are visible on the display in spectrum analyzer mode before invoking the spurious response measurements utility to run this measurement. Unlike the other spurious response measurements, this measurement is performed without any prior configuration by the user.

Procedure

1. Connect the equipment for the measurement as shown in Figure 2-1. The signal generators are typically set to frequencies that are about 10 kHz to 1 MHz apart. In any case, their frequencies should be well within the bandwidth of the device under test. The amplitudes should be approximately equal. Your particular setup may be different.

![Diagram of measurement setup]

Figure 2-1. Typical TOI/IMD Measurement Equipment Setup
2. Adjust the analyzer so that the signals are visible on the display before invoking the utility. In addition, the power level of the carriers must be greater than −40 dBm. If these conditions are not met, the utility will not make the measurement. Figure 2-2 shows an example of a typical spectrum analyzer display of a third order intercept measurement.

![Figure 2-2. Typical TOI/IMD Measurement Spectrum Display](image)

3. On the spectrum analyzer press **MODULE** USER KEYS SPURS.

4. Press **MEASURE TOI/IMD**. The utility makes the measurement and displays the results on the screen, as shown in Figure 2-3. Press **HARD COPY** to access a menu to print or plot the results.
INTERMODULATION MEASUREMENT RESULTS

LOWER SIGNAL: 500.0 MHz  0 dBm
UPPER SIGNAL: 500.0 MHz  0 dBm

SIGNAL SPACING: 29.92 kHz

IMD (LOWER PRODUCT): -79.5 dBc
IMD (UPPER PRODUCT): -79.3 dBc

TOI/IP3 (LOWER PRODUCT): 39.8 dBm
TOI/IP3 (UPPER PRODUCT): 39.7 dBm

Figure 2-3. TOI/IMD Measurement Results

Refer to Chapter 4, “Measurement Functions and Considerations,” for measurement limitations of this measurement.
Making A Harmonic Measurement

The harmonic power output of a device (such as an amplifier) is measured and the total harmonic distortion (based on the measured harmonics) is calculated. Make sure the fundamental is visible on the display in spectrum analyzer mode before invoking the spurious response measurements utility to run this measurement.

Procedure

1. Connect the equipment for the measurement as shown in Figure 2-4. The purpose of the low pass filter is to filter any harmonics appearing in the signal generator output. Any generated harmonics, then, are due to characteristics of the device under test. Your particular setup may be different.

![Diagram of harmonic measurement setup]

Figure 2-4. Typical Harmonic Measurement Equipment Setup

2. Set the signal generator and device under test to a CW frequency and power level that will show several harmonics within the frequency and power handling capabilities of the spectrum analyzer. Figure 2-5 shows an example of a typical spectrum analyzer display of a harmonic measurement.

3. Make sure the fundamental is visible on the display in spectrum analyzer mode before invoking the spurious response measurements utility.
4. On the spectrum analyzer press **USER KEYS**. **SPURS**.

5. Press **HARMONIC MENU**. The display now shows the configuration settings, and should look like Figure 2-6. If these settings are not appropriate, press **CONFIG HARMONIC** and change them to suitable values. When finished, press **CONFIG DONE**.

**Figure 2-6. Harmonic Menu Configuration**
6. Press **MEASURE HARMONIC**. The utility makes the measurement and displays the results on the screen, as shown in Figure 2-7. Press **HARD COPY** to access a menu to print or plot the results.

<table>
<thead>
<tr>
<th>HARMONIC</th>
<th>LEVEL (dBc)</th>
<th>FREQUENCY</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>-49.3</td>
<td>1.000 GHz</td>
</tr>
<tr>
<td>3</td>
<td>-29.8</td>
<td>1.500 GHz</td>
</tr>
<tr>
<td>4</td>
<td>-46.5</td>
<td>2.000 GHz</td>
</tr>
<tr>
<td>5</td>
<td>-53.0</td>
<td>2.500 GHz</td>
</tr>
<tr>
<td>6</td>
<td>-50.2</td>
<td>3.000 GHz</td>
</tr>
</tbody>
</table>

**TOTAL HARMONIC DISTORTION = 3.3 %** (OF HARMONICS MEASURED)

**Figure 2-7. Harmonic Measurement Results**

Refer to Chapter 4, “Measurement Functions and Considerations,” for configuration descriptions and limitations of this measurement.
Making A General Spurious Measurement

The general spurious signal frequencies and power levels from a device (such as an amplifier) are measured, within specified frequency and amplitude bounds. The measurement results list spurious signal power levels and frequencies in a table whose data can be sorted in order of amplitude, or frequency.

You can choose to measure spurious signals in relative, or absolute power levels. If relative power levels (dBC) are desired, the spectrum analyzer must be adjusted so that the reference signal is visible on the display before invoking the utility.

The desired search area is a "window" within which the utility will search for spurious signals. If none are found within this window, the results table will report TOTAL 0 OF 0 SPURS FOUND, even though significant spurious signals may appear close to (but outside of) this area. Figure 3-6 shows an example of a bounded search area.

![Spurious Response Measurement Frequency and Power Level Bounds](image)

**Figure 2-8.**
Spurious Response Measurement Frequency and Power Level Bounds
Procedure

1. Connect the equipment for the measurement as shown in Figure 2-9. Your particular setup may be different.

![Spectrum Analyzer Diagram]

Figure 2-9.
Typical General Spurious Measurement Equipment Setup

2. Make sure that the spurious signals output from the device under test are within the frequency and power handling capabilities of the spectrum analyzer. Figure 2-10 shows an example of a typical spectrum analyzer display of a general spurious measurement.

![Spectrum Display]

Figure 2-10.
Typical General Spurious Measurement Spectrum Display
3. If spurious signals relative power levels (dBC) are desired, adjust the spectrum analyzer so that the reference signal is visible on the display before invoking the utility.

4. On the spectrum analyzer press \texttt{MODULE USER KEYS SPURS}.

5. Press \texttt{GEN SPUR MENU CONFIG SPURS}. The display now shows the configuration settings, and should look like Figure 2-11. If these settings are not appropriate, press \texttt{CONFIG SPURS} and change them to suitable values. When finished, press \texttt{CONFIG DONE}.

\begin{center}
\begin{tabular}{|l|l|}
\hline
MINIMUM SEARCH FREQUENCY: & 38.00 MHz \texttt{MIN}\np \hline
MAXIMUM SEARCH FREQUENCY: & 356.0 MHz \texttt{MAX}\n\hline
UPPER SEARCH THRESHOLD: & 14 dBm \texttt{UP}\n\hline
LOWER SEARCH THRESHOLD: & -48 dBm \texttt{LO}\n\hline
ESTIMATED SEARCH TIME: & NEED UPDATE \texttt{ES}\n\hline
SORT SPURS BY: & FREQUENCY \texttt{SO}\n\hline
MEASURE SPURS IN: & dBm \texttt{ME}\n\hline
\end{tabular}
\end{center}

\textbf{Figure 2-11. Spurious Menu Configuration}

6. Press \texttt{MEASURE SPURS}. The utility makes the measurement and displays the results on the screen. Figure 2-12 shows the results of choosing an absolute power output (dBm). Figure 2-13 shows the results of choosing a relative power output (dBC). If relative power levels (dBC) are desired, the spectrum analyzer must be adjusted so that the reference signal is visible on the display before invoking the utility.

7. Press \texttt{HARD COPY} to access a menu to print or plot the results.

Refer to Chapter 4, "Measurement Functions and Considerations," for configuration descriptions and limitations of this measurement.
<table>
<thead>
<tr>
<th>MHz</th>
<th>dBm</th>
</tr>
</thead>
<tbody>
<tr>
<td>65.0</td>
<td>1</td>
</tr>
<tr>
<td>115</td>
<td>-31</td>
</tr>
<tr>
<td>165</td>
<td>-29</td>
</tr>
<tr>
<td>180</td>
<td>-30</td>
</tr>
<tr>
<td>195</td>
<td>-28</td>
</tr>
<tr>
<td>245</td>
<td>-21</td>
</tr>
<tr>
<td>295</td>
<td>-15</td>
</tr>
<tr>
<td>310</td>
<td>-32</td>
</tr>
<tr>
<td>325</td>
<td>-37</td>
</tr>
</tbody>
</table>

**TOTAL OF 9 SPURS FOUND**

---

Figure 2-12.
General Spurious Measurement Results (Power in dBm)

<table>
<thead>
<tr>
<th>MHz</th>
<th>dBC</th>
</tr>
</thead>
<tbody>
<tr>
<td>115</td>
<td>-31</td>
</tr>
<tr>
<td>165</td>
<td>-28</td>
</tr>
<tr>
<td>180</td>
<td>-30</td>
</tr>
<tr>
<td>195</td>
<td>-27</td>
</tr>
<tr>
<td>245</td>
<td>-20</td>
</tr>
<tr>
<td>295</td>
<td>-14</td>
</tr>
<tr>
<td>310</td>
<td>-32</td>
</tr>
<tr>
<td>325</td>
<td>-36</td>
</tr>
<tr>
<td>345</td>
<td>-46</td>
</tr>
</tbody>
</table>

**TOTAL OF 9 SPURS FOUND**

---

Figure 2-13.
General Spurious Measurement Results (Power in dBC)
Making A Discrete Sidebands Measurement

The discrete sidebands close to and on either side of a carrier signal are measured within specified frequency bounds.

The desired search area is bounded by a minimum and a maximum frequency from the carrier, between which bounds the utility will search for discrete sideband spurious signals. If none are found within this window, the results table will report FOUND: 0 SETS OF SIDEBANDS, even though significant sideband spurious signals may appear close to (but outside of) this area. Figure 2-14 shows an example of a bounded search area defined by minimum and maximum frequency offset values.

![Sidebands Frequency Offset Range Limits](image)

Figure 2-14. Sidebands Frequency Offset Range Limits
Procedure

1. Connect the equipment for the measurement as shown in Figure 2-15. Your particular setup may be different.

![Spectrum Analyzer](image)

**Figure 2-15.**
Typical Carrier Sidebands Measurement Equipment Setup

2. Set the signal source to generate an FM signal whose frequencies and power levels are within the frequency and power handling capabilities of the spectrum analyzer. Figure 2-16 shows an example of a typical spectrum analyzer display of a discrete sidebands measurement.

![Spectrum Display](image)

**Figure 2-16.**
Typical Discrete Sidebands Measurement Spectrum Display
3. Adjust the analyzer so that the carrier is visible on the display before performing this measurement. In addition, the power level of the carrier must be greater than −50 dBm. If these conditions are not met, the utility will not make the measurement.

4. On the spectrum analyzer press \( \text{MODULE USER KEYS SPURS} \).

5. Press \text{SIDEBAND MENU}. The display now shows the configuration settings, and should look like Figure 2-17. If these settings are not appropriate, press \text{CONFIG SIDEBND} and change them to suitable values. When finished, press \text{CONFIG DONE}.

<table>
<thead>
<tr>
<th>DISCRETE SIDEBAND MENU</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
</tr>
<tr>
<td>CONFIGURATION</td>
</tr>
<tr>
<td>MINIMUM FREQUENCY OFFSET: 500.0 Hz</td>
</tr>
<tr>
<td>MAXIMUM FREQUENCY OFFSET: 3.500 kHz</td>
</tr>
<tr>
<td>MEASURE BOTH SIDES OF CARRIER</td>
</tr>
<tr>
<td>HIGH FREQUENCY ACCURACY (SLOWER)</td>
</tr>
</tbody>
</table>

\text{Figure 2-17. Discrete Sidebands Menu Configuration}

6. Press \text{MEASURE SIDEBNDS}. The utility makes the measurement and displays the results on the screen, as shown in Figure 2-18. Press \text{HARD COPY} to access a menu to print or plot the results.
**DISCRETE SIDEBAND SEARCH RESULTS**

12:38 05/01/96

**CARRIER FREQ:** 500.0 MHz  
**CARRIER POWER:** .5 dBm

<table>
<thead>
<tr>
<th>OFFSET FREQ</th>
<th>- OFFSET dBc</th>
<th>+ OFFSET dBc</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.001 kHz</td>
<td>-10.0</td>
<td>-10.2</td>
</tr>
<tr>
<td>2.002 kHz</td>
<td>-26.2</td>
<td>-26.5</td>
</tr>
<tr>
<td>3.003 kHz</td>
<td>-47.2</td>
<td>-49.0</td>
</tr>
</tbody>
</table>

**FOUND:** 3 SETS OF SIDEBANDS

---

**Figure 2-18. Carrier Sidebands Measurement Results**

Refer to Chapter 4, "Measurement Functions and Considerations," for configuration descriptions and limitations of this measurement.
Making A Mixing Products Measurement

The amplitudes of mixer products are measured, and the results are listed in terms most commonly given in specification data sheets by mixer manufacturers.

Power levels of mixing products are measured relative to the signal at either LO + RF, or |LO – RF|. Mixing product frequencies are determined by the equations N (LO) + M (RF), or |N (LO) – M (RF)|. Valid values of either N or M range from 1 to 10 in any combination. A table lists the measurement results of mixing products defined by their N and M values in relative dB power levels.

You can view a selected mixing product in spectrum analyzer mode without leaving the utility by choosing an LO product (N) and an RF product (M) following a measurement.

Procedure

1. Connect the equipment for the measurement as shown in Figure 2-19. Your particular setup may be different.

![Figure 2-19. Typical Mixer Measurement Equipment Setup](image)

2. Set the signal generators to CW frequencies and power levels that are appropriate to the mixer under test. Figure 2-20 shows an example of a typical spectrum analyzer display of a mixing products measurement.

4. Press MIXER MENU. The display now shows the configuration settings, and should look like Figure 2-21. If these settings are not appropriate, press CONFIG MIXER and change them to suitable values. When finished, press CONFIG DONE.

```
MIXER MENU

CONFIGURATION

MIXING PRODUCTS OF: :N*LO-MRF:
WILL BE MEASURED FOR:
  N FROM 1 TO 4
  M FROM 1 TO 4

WITH: LO FREQUENCY = 480.0 MHz
      RF FREQUENCY = 500.0 MHz

RESULTS WILL BE IN dB BELOW
THE REFERENCE SIGNAL AT :LO-RF:

THE MINIMUM RESOLUTION BANDWIDTH
THAT WILL BE USED DURING SEARCHES
WILL BE 100.0 Hz.
```

**Figure 2-21. Mixer Menu Configuration**
5. Press **MEASURE MIXER**. The utility makes the measurement and displays the results on the screen, as shown in Figure 2-22. Press **HARD COPY** to access a menu to print or plot the results.

### Table 2-22: Mixer Measurement Results

<table>
<thead>
<tr>
<th>N (LO)</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>-1</td>
<td>24</td>
<td>30</td>
<td>50</td>
</tr>
<tr>
<td>2</td>
<td>34</td>
<td>35</td>
<td>42</td>
<td>51</td>
</tr>
<tr>
<td>3</td>
<td>45</td>
<td>44</td>
<td>34</td>
<td>44</td>
</tr>
<tr>
<td>4</td>
<td>57</td>
<td>63</td>
<td>49</td>
<td>51</td>
</tr>
</tbody>
</table>

**VALUES IN dB BELOW REFERENCE**

6. Press **VIEW PRODUCT** and select the softkeys that identify a measured mixing product using N and M values to view a product in real-time spectrum analyzer mode. Figure 2-23 shows the N value selection screen, and an example of a viewed product is shown in Figure 2-24.

### Table 2-23: Selecting A Mixing Product to View

13:01 05/01/96

**SELECT N (OF N*LO):**

(FROM THE HORIZONTAL AXIS OF THE PREVIOUS TABLE)

PRESS THE SOFT KEY THAT HAS N, THE MULTIPLE OF THE LO TO BE VIEWED.
Figure 2-24. Viewing a Product

Refer to Chapter 4, "Measurement Functions and Considerations," for configuration descriptions and limitations of this measurement.
Softkey Menus and Descriptions

This chapter includes the following:

- An overall menu of the 85726A Spurious Response Measurements Utility
- Menus of the five specific measurements featured in the measurements utility
- Short descriptions of each softkey, including some parameter limits

Refer to Chapter 4, “Measurement Functions and Considerations,” for measurement conditions, limits and default values.
Figure 3-1. Overall Menu Map (1 of 2)

* Present only following a measurement.
† Present only following a measurement with one page of data.
‡ Present only following a measurement with more than two pages of data. The page wording changes as various pages are viewed.
Figure 3-2. Overall Menu Map (2 of 2)

* Present only following a measurement with more than one page of data.
Third-Order Intercept and Intermodulation Distortion Menu

Figure 3-3. TOI/IMD Menu

**MEASURE TOI/IMD**
Press this key to begin a third-order intercept and intermodulation distortion measurement. The measurement begins immediately; there is no setup menu for this measurement. Make sure that the two carriers are visible on the display before entering the utility to make this measurement.

**HARD COPY**
Press this key to access the softkeys that control direct printer or plotter outputs from the spurious response measurements utility. See “Printing and Plotting” at the end of this chapter for a description of this softkey and the keys in the menus associated with it.

**MAIN MENU**
Press this key to access the main menu; this is the menu shown upon starting the utility.

**EXIT ALL**
Press this key to access the USER KEYS menu or to return to spectrum analyzer mode (this allows you to use the hard keys).
Figure 3-4. Harmonic Menu

Press this key to access the harmonic menu.

Press this key to begin a harmonic measurement. If no parameters are set prior to pressing this key, parameters that were set for the most recent harmonic measurement are used. Make sure the fundamental is visible on the display in spectrum analyzer mode before invoking the spurious response measurements utility.

Press this key to access the harmonic configuration menu. Parameters that can be set in this menu are maximum harmonic to be measured, minimum search bandwidth, and whether or not to display the frequencies in the results table.

Press this key to access the previous menu to make a measurement after setting any desired configurations. It is not necessary to press this key to store updated configuration information into memory, but it is the only way to exit from the CONFIG menu softkeys.

* Present only following a measurement.
SET MAX HARMONIC: Press this key to set the maximum harmonic to be measured; then choose the softkey that corresponds with the maximum harmonic that you want to measure. The allowable range is 2 through 10; the default value is 6. The minimum value for this parameter is 2 because the fundamental is considered to be harmonic number 1.

SET FREQ DISPLAY: Press this key to cause the utility to either display the harmonic frequencies in the results table (DISPLAY FREQS), or to omit the frequency information (HIDE FREQS). Measurement speed is increased when HIDE FREQS is chosen.

SET MIN SRCH BW: This key is used to control the depth of the harmonic search. If the measured harmonic is near or in the noise, the program will zoom in on the frequency by reducing the analyzer span and bandwidth. This key sets the limit at which the zoom will stop. Measurement time will either decrease or stay the same by setting minimum search bandwidth to a larger value. Set a lesser value of minimum search bandwidth to increase sensitivity. The default is 100 Hz. The allowable range is from the minimum resolution bandwidth of the spectrum analyzer up to 10 kHz.

HARD COPY: Press this key to access the softkeys that control direct printer or plotter outputs from the spurious response measurements utility. This key is present only following a measurement. See “Printing and Plotting” at the end of this chapter for a description of this softkey and the keys in the menus associated with it.

MAIN MENU: Press this key to access the main menu; this is the menu shown upon starting the utility.

EXIT ALL: Press this key to access the USER KEYS menu or to return to spectrum analyzer mode (this allows you to use the hard keys).
General Spurious Menu

Figure 3-5. General Spurious Menu

* Present only following a measurement with one table of data.
† Present only following a measurement with more than two tables of data.

**GEN SPUR** Press this key to access the general spurious measurements menu.

**MEASURE** Press this key to make a general spurious signals measurement. After the measurement, a table lists the frequency and power levels of all spurious signals within the measurement parameters. The frequency and power level of the reference signal is also given, if the dBm/dbc parameter is set to dbc. If in dbc mode, power levels of all spurious signals are shown in dbc, relative to the reference signal. If no parameters are set prior to pressing this key, parameters that were set for the most recent general spurious measurement are used.

**SPURS** Press this key to access the menu showing the next page of measurement data. This key appears only when there are more than two pages of data. The softkey wording changes to FIRST PAGE or LAST PAGE as various pages are viewed.
Press this key to access the menu showing the last page of measurement data. This key appears in this location only when there are more than two pages of data. The softkey wording changes to PREVIOUS PAGE as various pages are viewed.

Press this key to access the softkeys that control direct printer or plotter outputs from the spurious response measurements utility. See “Printing and Plotting” at the end of this chapter for a description of this softkey and the keys in the menus associated with it.

Press this key to access the general spurious measurements menu.

Press this key to access the main menu; this is the menu shown upon starting the utility.

Press this key to access the USER KEYS menu or to return to spectrum analyzer mode (this allows you to use the hard keys).

Press this key to set various parameters prior to the measurement. These include search frequency and amplitude threshold ranges, as well as choosing the method by which the results table will be sorted (amplitude or frequency), and whether the power levels are listed in relative or absolute values (dBc or dBm).

Press this key to access the previous menu to make a measurement after setting any desired configurations. It is not necessary to press this key to store updated configuration information into memory, but it is the only way to exit from the CONFIG menu softkeys.

Press these keys to set a range of minimum and maximum search frequencies between which the spectrum analyzer will search to measure spurious signals. Figure 3-6 shows an example of a bounded search area.
Press this key and the **UPPER THRESHOLD** softkey to set the minimum and maximum power level threshold between which the spectrum analyzer will search to measure spurious signals. The **UPPER THRESHOLD** softkey is located in the second configuration menu (press MORE 1 OF 2). Figure 3-6 shows an example of a bounded search area.

![Figure 3-6. Spurious Measurement Frequency and Power Level Bounds](image)

Press this key to obtain a time estimate of the duration of any general spurious measurement prior to running the measurement. The time estimate can be set to automatic or manual mode by pressing the **SET UPDATE**, and then the **SET AUTO UPDATE** or **SET MAN UPDATE** softkeys. Press MORE 1 OF 2 to access these keys.

When the time estimate function is set to automatic, a new search time estimate is generated whenever there is a change in any of these parameters:

- **MINIMUM SEARCH FREQUENCY**
- **MAXIMUM SEARCH FREQUENCY**
- **LOWER SEARCH THRESHOLD**
- **SET dBm/dBc**

When the function is set to manual, a new search time estimate is generated only when the **UPDATE TIME EST** softkey is pressed.
A numeric time estimate is shown on the General Spur Menu Configuration screen following the words: ESTIMATED SEARCH TIME. The time estimate value changes to the words NEED UPDATE in manual update mode whenever any of the previous list of parameters is changed. The default setting is manual mode.

Press this key to access the previous menu to make a measurement after setting any desired configurations. It is not necessary to press this key to store updated configuration information into memory, but it is the only way to exit from the CONFIG menu softkeys.

See the description for the LOWER THRESHOLD softkey earlier in this chapter.

Press this key to set the sort criteria in the measurement results table between frequency (SORT BY FREQUENCY) or amplitude (SORT BY AMPLITUDE). The current sort criteria is listed at the bottom of the screen. The default is set to sort by frequency.

Press this key to set the method by which harmonic power levels are listed in the measurements results table. Choose MEASURE IN dBm to view absolute amplitude, or MEASURE IN dBC to view relative amplitude values. The default is set to measure in dBC.

Press this key to set the measurement time estimate function to either automatic (SET AUTO UPDATE), or to manual (SET MAN UPDATE). See the description of the UPDATE TIME EST softkey for an explanation of this function.

Press this key to access the softkeys that control direct printer or plotter outputs from the spurious response measurements utility. This key is present only following a measurement with one page of data. See “Printing and Plotting” at the end of this chapter for a description of this softkey and the keys in the menus associated with it.

Press this key to access the main menu; this is the menu shown upon starting the utility.

Press this key to access the USER KEYS menu or to return to spectrum analyzer mode (this allows you to use the hard keys).
Figure 3-7. Sideband Menu

* Present only following a measurement.
† Present only following a measurement with more than two tables of data.

**SIDEBAND MENU**
Press this key to access the discrete sideband measurements menu. This is used to measure discrete sidebands that are relatively close to a carrier.

**MEASURE SIDEBANDS**
Press this key to make a discrete sidebands measurement. Adjust the analyzer so that the carrier is visible on the display before performing this measurement. If no parameters are set prior to pressing this key, parameters that were set for the most recent sidebands measurement are used.

**NEXT PAGE**
Press this key to access the menu showing the next page of measurement data. This key appears only when there are more than two pages of data. The softkey wording changes to **FIRST PAGE** or **LAST PAGE** as various pages are viewed.

**LAST PAGE**
Press this key to access the menu showing the last page of measurement data. This key appears in this location only when there are more than two pages of data. The softkey wording changes to **PREVIOUS PAGE** as various pages are viewed.

**HARD COPY**
Press this key to access the softkeys that control direct printer or plotter outputs from the spurious response measurements utility. See “Printing and Plotting” at the end of this chapter for a description of this softkey and the keys in the menus associated with it.
| **SIDEBAND MENU** | Press this key to access the sideband measurements menu. |
| **MAIN MENU** | Press this key to access the main menu; this is the menu shown upon starting the utility. |
| **EXIT ALL** | Press this key to access the **USER KEYS** menu or to return to spectrum analyzer mode (this allows you to use the hard keys). |
| **CONFIG SIDEBANDS** | Press this key to set various parameters prior to the measurement. These include setting the spectrum analyzer to measure: the sidebands frequency range from the carrier (minimum and maximum offset frequencies), carrier side, sensitivity, and frequency accuracy. Measurement speed is increased when each of these criteria are set to minimum amount required. |
| **CONFIG DONE** | Press this key to access the previous menu to make a measurement after setting any desired configurations. It is not necessary to press this key to store updated configuration information into memory, but it is the only way to exit from the **CONFIG** menu softkeys. |
| **MIN FREQ OFFSET** | See **MAX FREQ OFFSET**. |
| **MAX FREQ OFFSET** | Press these keys to set a range of minimum and maximum frequencies offset from the carrier between which the spectrum analyzer will measure discrete sideband spurious signals. All offset values are entered as positive numbers, regardless of the carrier side to which they apply. Figure 3-8 shows an example of a bounded search area defined by minimum and maximum frequency offset values. |
Figure 3-8. 
Sidebands Frequency Offset Range Limits

Press this key to set the carrier side or sides that the spectrum analyzer will measure discrete sideband spurious signals. The choices are: **LEFT SIDE** (frequencies less than the carrier), **RIGHT SIDE** (frequencies greater than the carrier), and **BOTH SIDES** (frequencies less than and greater than the carrier). The default is set to left side.

Press this key to access a menu to set the frequency measurement accuracy to normal (**NORMAL ACCURACY**) or high (**HIGH ACCURACY**). A normal accuracy setting yields normal measurement speed. A high accuracy setting yields slower measurement speed because it requires that the spectrum analyzer internal frequency counter be used.

Press this key to access the softkeys that control direct printer or plotter outputs from the spurious response measurements utility. This key is present only following a measurement. See “Printing and Plotting” at the end of this chapter for a description of this softkey and the keys in the menus associated with it.

Press this key to access the main menu; this is the menu shown upon starting the utility.

Press this key to access the **USER KEYS** menu or to return to spectrum analyzer mode (this allows you to use the hard keys).
Figure 3-9. Mixer Menu

MIXER MENU

Press this key to access the mixer measurements menu. This menu allows measurements of mixer products according to M and N numbers in the equation: N X LO ± M X RF. The measured power levels of mixing products are shown in terms of dBC relative to the reference signal at LO + RF, or [LO – RF]. Frequencies of mixing products are not given, but can be shown individually using VIEW PRODUCT.

MEASURE MIXER

Press this key to make a mixer products measurement. If no parameters are set prior to pressing this key, parameters that were set for the most recent mixer measurement are used.

MORE PRODUCTS

This key appears only when there are two or more pages of results data. Press this key to access the next page of data.
Press this key to view a selected mixing product real-time by choosing an LO multiple (N) and an RF multiple (M). Valid integers for both N and M are 1 through 10, chosen using softkeys after this key is pressed.

Press this key to view another selected mixing product real-time. You will be asked to choose another LO multiple (N) and an RF multiple (M) prior to viewing.

Press this key to see the measurement results table again. The VIEW PRODUCT softkey menu is accessed when you press VIEW TABLE, so that you can easily view a selected product after seeing data in the results table.

Press this key to access the softkeys that control direct printer or plotter outputs from the spurious response measurements utility. See “Printing and Plotting” at the end of this chapter for a description of this softkey and the keys in the menus associated with it.

Press this key to access the mixer measurements menu.

Press this key to access the main menu; this is the menu shown upon starting the utility.

Press this key to access the USER KEYS menu or to return to spectrum analyzer mode (this allows you to use the hard keys).

Press this key to set various parameters prior to the measurement. These include setting the following:

- Maximum values of N and M
- The LO and RF frequencies
- Whether to measure the sum products (LO + RF), or difference products ([LO – RF])
- Designating the reference signal ([LO – RF]), or (LO + RF).

If no parameters are set prior to pressing this key, default parameters, or parameters that were set for the most recent mixer measurement are used.

Press this key to access the previous menu to make a measurement after setting any desired configurations. It is not necessary to press this key to store updated configuration information into memory, but it is the only way to exit from the CONFIG menu softkeys.
<table>
<thead>
<tr>
<th>Key</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>SET MAX N</td>
<td>See SET MAX M.</td>
</tr>
<tr>
<td>SET MAX M</td>
<td>Press these keys to set the maximum values of N and M for use in the mixing products equation: N X LO ± M X RF. These values determine the number of mixing products that will be measured. For example, for N and M set to 3, there will be 9 products measured. Valid integers for both N and M are 1 through 10.</td>
</tr>
<tr>
<td>SET LO FREQ</td>
<td>See SET RF FREQ.</td>
</tr>
<tr>
<td>SET RF FREQ</td>
<td>These keys designate the LO and RF frequencies of the device being measured.</td>
</tr>
<tr>
<td>CONFIG</td>
<td>Press this key to access the previous menu to make a measurement after setting any desired configurations. It is not necessary to press this key to store updated configuration information into memory, but it is the only way to exit from the CONFIG menu softkeys.</td>
</tr>
<tr>
<td>SET SUM/DIFF</td>
<td>Press this key to choose either the difference mixer products (DIFF LO — RF), or the sum mixer products (SUM LO + RF) to be measured. The spurious response measurements utility cannot measure the sum and difference mixer products at the same time.</td>
</tr>
<tr>
<td>SET REFERENCE</td>
<td>Press this key to choose which first-order mixing product</td>
</tr>
<tr>
<td>SET MIN SRCH BW</td>
<td>This key is used to control the depth of the mixing products search. If the measured signal is near or in the noise, the program will zoom in on the frequency by reducing the analyzer span and bandwidth. This key sets the limit at which the zoom will stop. Measurement time will either decrease or stay the same by setting minimum search bandwidth to a larger value. Set a lesser value of minimum search bandwidth to increase sensitivity. The default is 100 Hz. The allowable range is from the analyzer minimum resolution bandwidth up to 10 kHz.</td>
</tr>
<tr>
<td>MAIN MENU</td>
<td>Press this key to access the main menu; this is the menu shown upon starting the utility.</td>
</tr>
<tr>
<td>EXIT ALL</td>
<td>Press this key to access the USER KEYS menu or to return to spectrum analyzer mode (this allows you to use the hard keys).</td>
</tr>
</tbody>
</table>
Press this key to access the softkeys that control direct printer or plotter outputs from the spurious response measurements utility. HPGL, plotters and HP raster graphics printers are supported. To use LaserJets, DeskJets, and other PCL printers, contact your local Agilent Technologies sales and service office. A list of these offices are located at the end of Chapter 5, "If You Have a Problem."

When using a plotter or printer with the spurious response measurements utility, make a trial plot from the normal spectrum analyzer mode to verify plotter operation whenever a change in the plotter setup has occurred.

Press this key to access the softkeys that initiate a screen dump to an attached GPIB HPGL plotter. The plotter GPIB address must be set to 5. All of the display is plotted with the exception of the softkey labels.

The plotter must be set up correctly. It must be turned on, have paper loaded, have the correct address, and be connected. Make sure that it is not set to LISTEN ALWAYS mode. If the plotter is not set up properly when WHOLE PAGE, UPPER LEFT, UPPER RIGHT, LOWER LEFT, or LOWER RIGHT is pressed, the spectrum analyzer is likely to lock up and require the power be turned off and then back on. This is why a test plot from normal spectrum analyzer mode is highly recommended.

Some plotters must be configured to respond to HP-GL commands (as opposed to HP-GL/2 commands). For example, the 7550B must be set to 7550A emulation mode before it can be used.

Press this key to initiate a screen dump to an attached black and white GPIB printer that supports HP raster graphics, such as an HP ThinkJet or QuietJet. The printer GPIB address must be set to 1. All of the display is printed with the exception of the softkeys.
The printer must be set up correctly. It must be turned on, have paper loaded, have the correct address, and be connected. If the printer is not set up properly when PRINT B&W is pressed, the spectrum analyzer is likely to lock up and require the power be turned off and then back on.

PRINT
COLOR

Press this key to initiate a screen dump to an attached color GPIB printer that supports HP raster graphics, such as the HP PaintJet. The printer GPIB address must be set to 1. All of the display is printed with the exception of the softkeys.

The printer must be set up correctly. It must be turned on, have paper loaded, have the correct address, and be connected. If the printer is not set up properly when PRINT COLOR is pressed, the spectrum analyzer is likely to lock up and require the power be turned off and then back on.

WHOLE
PAGE

Press this key to cause the spectrum analyzer to plot the display contents to a full page.

UPPER
LEFT

Press this key to cause the spectrum analyzer to plot the display contents in the upper left quadrant of the page.

UPPER
RIGHT

Press this key to cause the spectrum analyzer to plot the display contents in the upper right quadrant of the page.

LOWER
LEFT

Press this key to cause the spectrum analyzer to plot the display contents in the lower left quadrant of the page.

LOWER
RIGHT

Press this key to cause the spectrum analyzer to plot the display contents in the lower right quadrant of the page.

**Quitting the Utility**

To quit the utility and return to spectrum analyzer mode, press EXIT ALL at the main menu.

Pressing EXIT ALL returns the instrument to the state that existed when the utility was first invoked. This is the only recommended way to exit the spurious response measurements utility. Using other keys such as (PRESET) may exit the utility, but may also put the utility in a state that will cause unpredictable results the next time the utility is run.
Measurement Functions and Considerations

The main function of this utility is to make five different types of spurious measurements:

- TOI/IMD
- Harmonics
- General spurious
- Carrier sidebands
- Mixer products

This chapter describes the purposes and limits of each of these measurements. It also lists the range limitations and default values of the configuration settings for each measurement.
The Main Menu

When the spurious response measurements utility is started, the screen displays the main menu showing the various spurious measurements, as shown in Figure 4-1.

```
MAIN MENU
* THIRD ORDER INTERCEPT AND --- >
   INTERMODULATION DISTORTION
* HARMONIC AMPLITUDES AND ------- >
   TOTAL HARMONIC DISTORTION
   GENERAL SPURIOUS SIGNALS -------- >
* DISCRETE SIDEBANDS ON A CARRIER >
   MIXING PRODUCTS ---------------- >
   PRIMARY SIGNAL(S) MUST BE ON THE
   SCREEN BEFORE RUNNING PROGRAM.
```

REU: 960603

Figure 4-1. Main Menu

The configuration parameters are either the default set for the first time the program is run, or they are the same as the last time the program was used. The only exceptions to this are frequency and amplitude of:

- The two tones for the TOI/IMD measurement
- The fundamental signal in the harmonic measurement
- The reference signal in the general spurious measurement
- The carrier signal in the carrier sidebands measurement

These signals represent the largest signals on the spectrum analyzer display when the spurious response measurements utility is invoked, and are identified in the main menu and shown in Figure 4-1 by a single asterisk (*). GENERAL SPURIOUS SIGNALS is identified with an asterisk if the measurement is configured to measure relative signal amplitudes (dBc).

Note

General spurious measurements can be configured to make absolute power measurements, or measurements relative to a reference signal. If relative power level (dBc) is chosen in the CONFIG SPURS menu, then the reference signal must be on the display prior to invoking the utility.
Exiting the Utility

To quit the utility and return to spectrum analyzer mode, press \texttt{EXIT\ ALL} at the main menu.

Pressing \texttt{EXIT\ ALL} returns the instrument to the state that existed when the utility was first invoked. This is the only recommended way to exit the spurious response measurements utility. Using other keys such as \texttt{PRES\ \} may exit the utility, but may also put the utility in a state that will cause unpredictable results the next time the utility is run.
Third Order Intercept Measurement

**Description**
From the main menu, press **MEASURE T0I/IMD** to measure the third order intercept point and the third order distortion. There is no pre-measurement configuration. The two primary signals must be visible and distinguishable from each other on the display before running the utility. The third order products need not be on-screen.

The utility measures all four signals and adjusts the spectrum analyzer settings appropriately so that the measured distortion is not affected by distortion from the analyzer itself. In addition, any difference in the amplitudes of the two primary signals will be taken into account in the calculation of the intercept point.

The signal information and calculation results are displayed on screen at the end of the measurement. The third order intercept is calculated from both the upper and lower third order product. If the amplitude of the distortion products was close to the noise level, the results are flagged with a double asterisk, and an explanatory note is displayed. The results screen may be printed or plotted using the **HARD COPY** softkey.

**Measurement Configuration**
There is no configuration available for this measurement.

**Measurement Limitations**
The measurement is limited by the following criteria:

- The amplitude of the two primary signals must be at least −40 dBm.
- The primary signals should have reasonably low phase noise compared to the frequency spacing and distortion product level.
- The primary signal spacing must be greater or equal to 100 Hz.
- The primary signals should be stable, especially when distortion products are low. In this case, the utility will narrow the span and bandwidth in an attempt to obtain a valid measurement.
- Both primary signals must be ≥−40 dBm, and visible on the screen, before invoking the utility.
Harmonics Measurements

Description

This measurement searches for the even and odd harmonics of a signal and computes the total harmonic distortion based on the measured harmonics. Harmonic numbers up to the tenth harmonic are chosen by the user via a configuration menu prior to the measurement. In addition, the user can configure the display and minimum search bandwidth to optimize the measurement speed.

The fundamental frequency must be visible on the display before the utility is invoked. If the harmonic to be measured is near or below the noise level, the utility will adjust the span and bandwidth in an attempt to obtain a valid measurement. The program also adjusts the spectrum analyzer settings to eliminate any internal analyzer contribution to the second or third harmonic distortions. If the noise cannot be reduced enough for the analyzer to make a valid measurement on a given harmonic, the results are flagged with a double asterisk, and an explanatory note is displayed. The results screen may be printed or plotted using the HARD COPY softkey.

The % total harmonic distortion is determined using the equation:

\[
%THD = 100 \times \frac{\sum_{n=2}^{m} V^2(n)}{V(f_s)}
\]

where:
- \( n = 2 \) to 10 maximum
- \( m = 10 \) maximum
- \( V \) = harmonic voltage
- \( f_s \) = fundamental signal

Measurement Configuration

The configuration menu provides for the following settings:

- Set the number of harmonics to be measured.
- Omit, or retain harmonic frequency information in the results table.
- Control the depth of the harmonic search for signals near the noise level.

Use the CONFIG HARMONIC softkey to set the number of harmonics to be measured. This configuration must be set prior to a making a harmonic measurement. Harmonic number 1 is considered to be the fundamental; the range of harmonic multiples of the fundamental is from 2 to 10.
The two other configuration settings are optional. You can opt to omit the harmonic frequencies in the measurement results table (SET FREQ DISPLAY). This omission slightly increases measurement speed. You can also set the minimum search bandwidth (SET MIN SRCH BW), which is used to control the depth of the harmonic search if a signal is near or in the noise. It sets the frequency limit at which the spectrum analyzer will zoom in on the frequency by reducing the span and the bandwidth. The default value is 100 Hz. The allowable range is from the analyzer minimum resolution bandwidth up to 10 kHz. Measurement speed either increases or stays the same as the minimum search bandwidth frequency is increased.

**Measurement Configuration Menu Variable Limits**

Table 4-1 lists the configuration variables, their limits, and initial default values.

<table>
<thead>
<tr>
<th>Configuration Variable</th>
<th>Limit/Range</th>
<th>Initial Default Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>SET MAX HARMONIC</td>
<td>2 to 10</td>
<td>6</td>
</tr>
<tr>
<td>SET FREQ DISPLAY</td>
<td>HIDE FREQS or DISPLAY FREQS</td>
<td>HIDE FREQS</td>
</tr>
<tr>
<td>SET MIN SRCH BW</td>
<td>1 Hz* to 10 kHz</td>
<td>100 Hz</td>
</tr>
</tbody>
</table>

* This value is the minimum bandwidth limit of the spectrum analyzer used. Your analyzer may have a different limit.

See Chapter 3, "Softkey Menus and Descriptions" for more information about these variables, as well as descriptions of all softkeys.
Measurement Limitations

The measurement is limited by the following criteria:

- The fundamental amplitude must be at least -50 dBm.

- The greatest harmonic number to be measured may be reduced during measurement execution if the spectrum analyzer frequency range is exceeded.

- The fundamental frequency should be stable in order to measure low-amplitude harmonics, since the utility narrows the span in an effort to obtain a valid measurement.

- When measuring very low amplitude harmonics, it may be necessary to have a common frequency reference for both the spectrum analyzer and the source signal. This assures that frequency reference inaccuracies will not affect the ability of the utility to narrow the span and bandwidth without losing the harmonic.

It will be necessary to use the spectrum analyzer 10 MHz reference as the common frequency reference. An external frequency reference will not be used during execution of the spurious response measurements utility, except when in remote operation. In this case, refer to Chapter 7, “Remote Programming Commands and Examples,” for more information.
General Spurious Measurement

Description  The general spurious measurement searches for any signals within prescribed frequency and amplitude bounds. The desired search area is a "window" within which the utility will search for spurious signals. If none are found within this window, the results table will report TOTAL 0 OF 0 SPURS FOUND, even though significant spurious signals may appear close to (but outside of) this area. Figure 4-2 shows an example of a bounded search area.

![Figure 4-2. Spurious Measurement Frequency and Power Level Bounds](image)

Output amplitudes can be expressed in dBm or dBC. If the dBC mode is chosen, there must be a reference signal greater than −50 dBm on the screen before invoking the utility.

The time required to execute a search can vary widely. The time depends heavily on the lower amplitude search threshold and also on the search frequency range. In general, it is best to start with a lower search threshold at −60 dBm or greater, note the measurement time required, and then reduce the threshold in steps of approximately 5 dB until the time becomes excessive, or the threshold meets the target. An estimate of the search time is presented to help make reasonable configuration choices.
When measuring amplitudes with respect to a reference signal (dBc mode), the search time is dependent upon the reference signal amplitude, as well as the other factors already mentioned. A new estimate of the search time should be made whenever the amplitude of the reference signal is changed.

The measurement results lists all signals found within the search criteria window. You can choose to list signals in order of frequency or amplitude using the configuration menu. The default listing is in frequency order. If many signals are found, the utility may require several minutes to reorder the signals by amplitude. The results screen may be printed or plotted using the HARD COPY softkey.

Measurement Configuration

The configuration menu provides for the following settings:

- Set the lower (minimum search) frequency limit for the search.
- Set the upper (maximum search) frequency limit for the search.
- Set the lower threshold (minimum amplitude) that a measured signal may have and still be retained.
- Set the upper threshold (maximum amplitude) that a measured signal may have and still be retained. Signals having amplitudes greater than this threshold are discarded.
- Order the measured signals in the results screen by either ascending frequency or descending amplitude.
- Express measured signal amplitudes in dBm, or dBc relative to a reference signal. For dBc configurations, the reference signal must be visible on the display before the utility is invoked.
- Set the general spurious measurement time estimate function to either update automatically, or to update manually. This function is useful to obtain a time estimate of the duration of any general spurious measurement prior to running the measurement.

The default setting is automatic mode.

Configuration Menu Variable Limits

Table 4-2 lists the configuration variables, their limits, and initial default values.
Table 4-2.
Spurious Measurement Configuration Variable Limits

<table>
<thead>
<tr>
<th>Configuration Variable</th>
<th>Limit/Range</th>
<th>Initial Default Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>MINIMUM SRCH FRQ</td>
<td>&gt; 1 MHz to analyzer upper limit</td>
<td>100 MHz</td>
</tr>
<tr>
<td>MAXIMUM SRCH FRQ</td>
<td>&gt; 100 kHz above MINIMUM SRCH FRQ, up to the spectrum analyzer upper limit</td>
<td>1 GHz</td>
</tr>
<tr>
<td>LOWER THRESHLD</td>
<td>−130 dBm to +40 dBm*</td>
<td>−60 dBm</td>
</tr>
<tr>
<td>UPPER THRESHLD</td>
<td>−100 dBm to +50 dBm*</td>
<td>+50 dBm*</td>
</tr>
<tr>
<td>SET SORT ORDER</td>
<td>AMPLITUDE or FREQUENCY</td>
<td>FREQUENCY</td>
</tr>
<tr>
<td>SET dBm/dBc</td>
<td>MEASURE IN dBm, or dBc</td>
<td>MEASURE IN dBm</td>
</tr>
<tr>
<td>SET UPDATE</td>
<td>AUTOMATIC, or MANUAL UPDATE</td>
<td>AUTOMATIC UPDATE</td>
</tr>
</tbody>
</table>

* Do not exceed the maximum input signal amplitude to the spectrum analyzer. See the following CAUTION statement.

Caution

Maximum input signal amplitude to the spectrum analyzer is +30 dBm with at least 10 dB of input attenuation. Higher amplitude signals can result in damage to the input attenuator or to the input mixer.

See Chapter 3, “Softkey Menus and Descriptions” for more information about these variables, as well as descriptions of all softkeys.

Measurement Limitations

The measurement is limited by the following criteria:

- A maximum of 50 spurious signals are retained from the measurement. Those kept are the first ones found.
- When configured to measure signals in dBc, signal amplitudes must be less than the reference signal amplitude.
- When configured to measure signals in dBc, the reference signal must be visible on the screen before the utility is invoked. It must also be the greatest signal amplitude on the screen, and at least −50 dBm.
When the time estimate function is set to automatic, then a new search time estimate is generated whenever there is a change in any of these parameters:

- MINIMUM SEARCH FREQUENCY
- MAXIMUM SEARCH FREQUENCY
- LOWER SEARCH THRESHOLD
- SET dBm/dBe

When the function is set to manual, then a new search time estimate is generated only when the UPDATE TIME EST softkey is pressed.

The time estimate is shown on the General Spur Menu Configuration screen following the words: ESTIMATED SEARCH TIME:. The time estimate value changes to the words NEED UPDATE in manual update mode whenever any of the parameters in the previous list is changed.

If the maximum search frequency is set below the minimum search frequency and a time estimate is requested, the display will show: ESTIMATED SEARCH TIME: ******
Discrete Sidebands Measurement

Description

The sidebands measurement searches one or both sides of a carrier for discrete sidebands. If both sides are desired, the program searches the right side to find sidebands, then it measures the amplitudes for the same sidebands on the left side of the carrier, assuming that all of the sidebands occur in pairs. The offset numbers are always positive, even when searching the left side.

The desired search area is bounded by a minimum and a maximum frequency from the carrier, between which bounds the utility will search for spurious sideband signals. If none are found within this window, the results table will report FOUND: 0 SETS OF SIDEBANDS, even though significant sideband spurious signals may appear close to (but outside of) this area. Figure 4-3 shows an example of a bounded search area.

![Figure 4-3. Sidebands Frequency Offset Range Limits](image)

The carrier must be visible on the display before the utility is invoked.

The output table lists the sideband offset frequencies and their respective power levels in dBc from the carrier. Also displayed is the carrier frequency, and amplitude in dBm. The normal offset frequency accuracy is about ±10%. This accuracy can be greatly improved by setting the frequency accuracy to high. But this setting requires use of the analyzer internal frequency counter, and reduces measurement speed. The results screen may be printed or plotted using the HARD COPY softkey.
Measurement Configuration

The configuration menu provides for the following settings:

- Minimum frequency offset from the carrier (from which to search).
- Maximum frequency offset from the carrier (from which to search).
- Search the left side, right side, or both sides of the carrier.
- Set the frequency accuracy (either normal, or high).

Configuration Menu Variable Limits

Table 4-3 lists the configuration variables, their limits, and initial default values.

<table>
<thead>
<tr>
<th>Configuration Variable</th>
<th>Limit/Range</th>
<th>Initial Default Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>MIN FREQ OFFSET</td>
<td>≥ 50 Hz to analyzer upper limit</td>
<td>1 kHz</td>
</tr>
<tr>
<td>MAX FREQ OFFSET</td>
<td>≥ 1 kHz and &gt; MIN FREQ OFFSET, up to the spectrum analyzer upper limit</td>
<td>1 MHz</td>
</tr>
<tr>
<td>SET SIDE</td>
<td>LEFT, or RIGHT, or BOTH SIDES</td>
<td>LEFT SIDE</td>
</tr>
<tr>
<td>SET FREQ ACCURACY</td>
<td>NORMAL, or HIGH ACCURACY</td>
<td>NORMAL ACCURACY</td>
</tr>
</tbody>
</table>

See Chapter 3, “Softkey Menus and Descriptions” for more information about these variables, as well as descriptions of all softkeys.

Measurement Limitations

The measurement is limited by the following criteria:

- The carrier frequency less the maximum offset frequency must be greater than 100 kHz.
- The carrier amplitude must be at least −50 dBm.
- A maximum of 25 sets of sidebands will be retained from the measurement.
- Closely-spaced sidebands may not be resolved.
- If the carrier is drifty or unstable, the measurement will be accurate only for frequency offsets that are much greater than the instability.
- Noise bursts and pulse noise will cause erratic results.
- When measuring sidebands on both sides, it is expected that all sidebands occur in pairs. The detection is done on the right side, and only the amplitudes are measured on the left side.
- The normal frequency offset accuracy is about ±10%.
- Using high frequency offset accuracy requires use of the analyzer internal frequency counter, and reduces measurement speed.
Mixing Products Measurement

Description

The mixer products measurement identifies the amplitudes of the mixing products generated by designated RF and LO signals. The RF and LO frequencies and maximum M and N product values to be measured must be specified by you prior to making a measurement. These are set in the configuration menu, along with two other important settings:

Mixing products are determined by using the equation (N X LO ± M X RF), but the utility measures either sum products, or difference products during each measurement. For example, if you select sum products (SUM LO + RF), then the program calculates (N X LO + M X RF). If you select difference products (DIFF LO - RF), then the program calculates (|N X LO - M X RF|). This is set in the configuration menu.

Measured product amplitudes are expressed in dB below a reference product. You set the reference to be the signal at either frequency (LO + RF), or at frequency (|LO - RF|). This is set in the configuration menu.

The output screen displays a table of amplitudes with the rows corresponding to the RF harmonics, and the columns corresponding to the LO harmonics. The top of the display shows the basic configuration. More than one table is displayed if all the data cannot fit on a single screen. Products with a 0 Hz frequency are not measured, and a - appears in the results table in place of a measured amplitude value. If a product is near or in the noise (or if it drifts out of range), an asterisk appears next to the amplitude value.

After each measurement is completed, you may view any particular product in spectrum analyzer mode by specifying the appropriate multiples of RF and LO associated with the desired product. The results screen may be printed or plotted using the HARD COPY softkey.

Measurement Configuration

The configuration menu provides for the following settings:

- MAX N sets the maximum LO multiple to use in the search equation.
- MAX M sets the maximum RF multiple to use in the search equation.
- LO FREQ specifies the frequency of the LO signal.
- RF FREQ specifies the frequency of the RF signal.
- SET SUM/DIFF specifies whether (N X LO + M X RF) or (|N X LO - M X RF|) is used.
- SET REFERENCE specifies whether to use (LO + RF) or (|LO - RF|) for the reference.
- **SET MIN SRCH BW** controls the depth of the mixer product search for signals near the noise level.

You can optionally set the minimum search bandwidth (**SET MIN SRCH BW**), which is used to control the depth of the mixer product search if a signal is near or in the noise. It sets the frequency limit at which the spectrum analyzer will zoom in on the frequency by reducing the span and the bandwidth. The default value is 100 Hz. The allowable range is from the analyzer minimum resolution bandwidth up to 10 kHz. Measurement speed either increases or stays the same as the minimum search bandwidth frequency is increased.

**Configuration Menu Variable Limits**

Table 4-4 lists the configuration variables, their limits, and initial default values.

<table>
<thead>
<tr>
<th>Configuration Variable</th>
<th>Limit/Range</th>
<th>Initial Default Value</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>SET MAX N</strong></td>
<td>1 to 10</td>
<td>4</td>
</tr>
<tr>
<td><strong>SET MAX M</strong></td>
<td>1 to 10</td>
<td>4</td>
</tr>
<tr>
<td><strong>SET LO FREQ</strong></td>
<td>≥ 1 MHz up to the spectrum analyzer upper limit</td>
<td>310 MHz</td>
</tr>
<tr>
<td><strong>SET RF FREQ</strong></td>
<td>≥ 1 MHz up to the spectrum analyzer upper limit</td>
<td>300 MHz</td>
</tr>
<tr>
<td><strong>SET SUM/DIFF</strong></td>
<td>DIFF LO − RF*, or SUM LO + RF</td>
<td>DIFF LO − RF</td>
</tr>
<tr>
<td><strong>SET REFERencing</strong></td>
<td>REF − LO − RF*, or REF − LO + RF</td>
<td>REF − LO − RF</td>
</tr>
<tr>
<td><strong>SET MIN SRCH BW</strong></td>
<td>1 Hz to 10 kHz</td>
<td>100 Hz</td>
</tr>
</tbody>
</table>

*This quantity is actually [LO − RF].

† This value is the minimum bandwidth limit of the spectrum analyzer used. Your analyzer may have a different limit.

See Chapter 3, “Softkey Menus and Descriptions” for more information about these variables, as well as descriptions of all softkeys.
Measurement Limitations

The measurement is limited by the following criteria:

- The LO and RF frequencies must differ by at least 100 kHz.
- The LO amplitude must be at least −50 dBm.
- The RF amplitude must be at least −60 dBm.
- The reference amplitude must be greater than that of the products to be measured.

Mixing Product Frequency is 0 Hz

Invalid results occur if the frequency of any mixing product is 0 Hz. In this case, the result is flagged with "—" to denote a meaningless measurement. This situation occurs if the following things are true:

1. The difference products |N X LO - M X RF| are being measured.
2. The following fraction can be reduced by removing common factors until both the numerator and denominator are integers:

\[
\frac{\text{LO Frequency}}{\text{RF Frequency}}
\]

and,

the numerator ≤ Max N, and the denominator ≤ Max M

For example:

Measure |N X LO - M X RF|

Max N = 10
Max M = 10
LO Frequency = 300 MHz
RF Frequency = 270 MHz

\[
\frac{\text{Fraction}}{\text{LO Frequency}} = \frac{300}{270} = \frac{10}{9}
\]

In this example, an invalid result will occur. However, if Max N is set to 9, a valid result will occur.

Products with a 0 Hz frequency are not measured, and a - appears in the results table in place of a measured amplitude value. When this occurs, the table usually has several - entries, and multiple entries with the same value (which represent multiple products at the same frequency).
Different Mixing Product Frequencies are Equal

Invalid results will occur when different mixing products are at the same frequency. In this case, the combination of the products will be measured and reported at all of the contributing LO and RF multiples. This will occur if the fraction:

\[ \frac{LO\text{Frequency}}{RF\text{Frequency}} \]

can be reduced to integers in both the numerator and the denominator such that the numerator ≤ 2 X Max N and the denominator ≤ 2 X Max M.

For example:

Measure |N X LO - M X RF|

Max N = 7
Max M = 7
LO Frequency = 819 MHz
RF Frequency = 756 MHz

\[ \text{Fraction} = \frac{LO\text{Frequency}}{RF\text{Frequency}} = \frac{819}{756} = \frac{13}{12} \]

since 13 ≤ 2 X Max N = 14
and 12 ≤ 2 X Max M = 14

then different mixing products will occur at the same frequency. With the frequencies in this example and N = 7 and M = 7, the product frequency is 441 MHz. With the same frequencies, but N = 5 and M = 6, the product frequency is also 441 MHz.

If the frequencies are such that different mixing products are close to each other but not exactly identical, the wrong product may be measured. This is because several products will appear in a single span. This situation is difficult to predict because it depends on amplitude levels as well as frequencies. The best check is to observe the display while the utility performs the measurement to see if multiple signals appear at the measurement for any given product.
Printing and Plotting

Measurement results for each measurement may be sent to a GPIB plotter or GPIB printer such as a Hewlett-Packard ThinkJet or PaintJet by using the **HARD COPY** softkey. This softkey menu structure is shown in Figure 4-4.

![Figure 4-4. Copy Menu](image)

The **PLOT** softkey will plot everything on the screen except the softkey annotation to a GPIB plotter set to address 5. The **PRINT B&W** softkey should be used with monochrome printers, such as the HP ThinkJet. The printer needs to have its GPIB address set to 1. The **PRINT COLOR** softkey should be used with HP PaintJets. Their GPIB addresses should also be set to 1.

Press the **WHOLE PAGE** softkey to cause the spectrum analyzer to plot the display contents to a full page.

Press the **UPPER LEFT** softkey to cause the spectrum analyzer to plot the display contents in the upper left quadrant of the page.

Press the **UPPER RIGHT** softkey to cause the spectrum analyzer to plot the display contents in the upper right quadrant of the page.

Press the **LOWER LEFT** softkey to cause the spectrum analyzer to plot the display contents in the lower left quadrant of the page.

Press the **LOWER RIGHT** softkey to cause the spectrum analyzer to plot the display contents in the lower right quadrant of the page.

**Note**

Only the softkeys in the utility should be used to plot or print. Unpredictable results will occur if any other keys are used, such as the [COPY] key. It is also important that the plotter or printer be connected and functional (that it have paper ready and be on line). If this is not the case, the spectrum analyzer may lock up and need to be turned off and back on to recover. When using a plotter or printer with the spurious response measurements utility, make a trial plot using the normal spectrum analyzer mode and the [COPY] key to verify plotter operation whenever a change in the plotter setup has occurred.
If You Have a Problem

How to terminate the program during a measurement
At times you may want to stop a measurement in progress (for instance, when it appears as if the measurement is taking too long). To stop a measurement, first press **PRESET**. Then press **RECALL**. This will normally bring the spectrum analyzer back to the same settings that were in effect before the utility was last started.

In rare cases, the utility may not begin correctly the next time it is started after pressing the above keys. In this case, cycle power, run the utility, and Press EXIT ALL to exit. The utility should function normally the next time it is run.

Cannot print or plot

- The printer or plotter must be functional before trying to output. It is a good idea to try it before starting the spurious response measurements utility. If it is not functional, the spectrum analyzer power must be turned off and on to recover. Check the following:
  - The power is turned on.
  - The printer is on line.
  - The paper is in place.
  - It is a GPIB printer or plotter.
  - The GPIB cable connected.
  - The GPIB address is set to 5 for a plotter.
  - If a plotter is connected, it is not set to LISTEN ALWAYS.
  - The GPIB address is set to 1 for a printer.

Spectrum analyzer states are lost

- The spurious response measurements utility should not be invoked if a state is already saved in state 9 that must not be overwritten. This state register is used to save the initial instrument settings so that they can be restored when the utility is finished.
Spurious response measurements utility terminates unexpectedly
Pressing almost any of the front panel hard keys will abort the utility. After the DLP is started, no hard keys should be pressed except when there is an active function waiting for a user input. Then use the number keys and the terminators (such as kHz, or MHz). The knob should never be turned when the utility is running because it can cause the spectrum analyzer not to accept any key presses, requiring the ac power to be cycled.

The [Preset] key may be used to exit the utility in the middle of a measurement. Use of the [Preset] key will prevent the original instrument state from being restored. This may give unpredictable results when the utility is restarted. The original instrument state can be restored by recalling state 9. If the power is turned off and back on again the utility can be restarted.

The utility behavior is erratic
First, try resetting the utility variables to factory default values. This procedure is described under “Moving the Mass Memory Module (and Utility) to Another Analyzer,” in Chapter 1, “Installing and Starting the Utility.”

Second, try removing, then re-installing the utility as described in Chapter 1, “Installing and Starting the Utility.” While it is possible to simply overwrite the utility without removing it first, removing and then re-installing it is much faster.

Unexpected measurement results
Avoid the following situations; they can cause unexpected measurement results:

- **TOI/IMD**
  - Extraneous signals near the desired signals
  - Drifting primary signals
  - Modulation on the primary signals

- **Harmonics**
  - Extraneous signals
  - Drifting fundamental, especially when measuring harmonics having low amplitude and high harmonic numbers
  - Modulation on the carrier, especially when measuring harmonics having high harmonic numbers

- **General Spurious**
  - Excess noise floor that is not monotonic with frequency
- Sidebands
  - Drifting carrier
  - Extraneous signals near the carrier
- Mixing Products
  - Drifting LO or RF signal, especially when measuring products having high M or N numbers, and low-level products
  - Extraneous signals
  - Modulation on the RF or LO signals, especially when measuring products having high M or N numbers

For spurious sidebands, and general spurious measurements, it is possible that noise will be detected and displayed as a signal. This is rare, but is possible due to the randomness of noise, and to setting the thresholds and bandwidths to minimize search time while maximizing spurious detection.

Third order intercept results can vary with signal amplitude, even though theoretically results should be constant. Use a constant power level when comparing data from different devices under test.
Table 5-1. Agilent Technologies Sales and Service Offices

<table>
<thead>
<tr>
<th>UNITED STATES</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Instrument Support Center</strong></td>
</tr>
<tr>
<td>Agilent Technologies</td>
</tr>
<tr>
<td>(800) 403-0801</td>
</tr>
<tr>
<td><strong>EUROPEAN FIELD OPERATIONS</strong></td>
</tr>
<tr>
<td><strong>Headquarters</strong></td>
</tr>
<tr>
<td>Agilent Technologies S.A.</td>
</tr>
<tr>
<td>156, Route du Nant-d’Avril</td>
</tr>
<tr>
<td>1217 Meyrin 2/Geneva</td>
</tr>
<tr>
<td>Switzerland</td>
</tr>
<tr>
<td>(41 22) 780.8111</td>
</tr>
<tr>
<td><strong>Great Britain</strong></td>
</tr>
<tr>
<td>Agilent Technologies Ltd.</td>
</tr>
<tr>
<td>Eskdale Road, Wimersh Triangle</td>
</tr>
<tr>
<td>Wokingham, Berkshire RG41 5DZ</td>
</tr>
<tr>
<td>England</td>
</tr>
<tr>
<td>(44 118) 9696622</td>
</tr>
</tbody>
</table>

| **INTERCON FIELD OPERATIONS** |
| **Headquarters** |
| Agilent Technologies |
| 3495 Deer Creek Road |
| Palo Alto, California, USA |
| 94304-1316 |
| (415) 857-5027 |
| **China** |
| China Agilent Technologies |
| 38 Bei San Huan X1 Road |
| Shuang Yu Shu |
| Hai Dian District |
| Beijing, China |
| (86 1) 256-6888 |
| **Taiwan** |
| Agilent Technologies Taiwan |
| 8th Floor HP Building 337 Fu Hsing North Road |
| Taïpeï, Taiwan |
| (886 2) 712-0404 |

| **France** |
| Agilent Technologies France |
| 1 Avenue Du Canada |
| Zone D’Activitie De Courtaboeuf |
| F-91947 Les Ulis Cedex |
| France |
| (33 1) 69 82 60 60 |

| **Germany** |
| Agilent Technologies GmbH |
| Agilent Technologies Strasse |
| 61352 Bad Homburg v.d.B |
| Germany |
| (49 6172) 14-0 |

| **Australia** |
| Agilent Technologies Australia Ltd. |
| 31-41 Joseph Street |
| Blackburn, Victoria 3130 |
| (61 3) 885-2895 |

| **Canada** |
| Agilent Technologies (Canada) Ltd. |
| 17500 South Service Road |
| Trans-Canada Highway |
| Kirkland, Quebec H9J 2X8 |
| Canada |
| (514) 697-4282 |

| **Japan** |
| Agilent Technologies Japan, Ltd. |
| 1-27-15 Yabe, Sagamihara |
| Kanagawa 229, Japan |
| (81 427) 53-1311 |

| **Singapore** |
| Agilent Technologies Singapore (Pte.) Ltd. |
| 150 Beach Road |
| #29-00 Gateway West |
| Singapore 0718 |
| (65) 291-9088 |
Specifications and Characteristics

Specifications and Characteristics

Measurement accuracy depends upon the specifications of the host spectrum analyzer and on the characteristics of the signal. In general, the amplitude specifications that may be pertinent for a given measurement are as follows:

A. Reference Level Uncertainty (Frequency Response)
B. Bandswitching Uncertainty
C. Input Attenuator Switching Uncertainty
D. IF Gain Uncertainty
E. Resolution Bandwidth Switching Uncertainty
F. Scale Fidelity
G. Marker Amplitude Resolution
H. Calibrator Uncertainty

The equations listed in the following discussions of the individual utility measurements refer to the characteristics in the preceding list, by letter.

**TOI and IMD**

IMD Uncertainty = \(2 \times (D+E+G) + F\)

TOI/IP3 Uncertainty = \(2 \times (D+E+G) + A+B+H + 0.5 \times F\)

These are worst-case uncertainties based on the primary signals being within approximately 1 MHz of each other. The bandswitching uncertainty (B) can be omitted if the signals are less than 2.9 GHz. The input attenuator switching uncertainty (C) must be included if the attenuator changes settings during the measurement. This may happen if the fundamental signals are greater than 0 dBm, or if the TOI/IP3 value is greater than 10 dBm.

**Harmonics**

Harmonic Uncertainties = \(2 \times (A+B+D+E+G) + F\)

This is a worst-case number. If the fundamental and all of the measured harmonics fall within the same band, \(2 \times B\) may be omitted. If the fundamental amplitude is greater than 0 dBm, the input attenuator switching uncertainty (C) must be included. This quantity (C) may also need to be added to the second and third harmonic uncertainties if those amplitudes are small compared to the spectrum analyzer distortion. (In this case, the input attenuation will increase to ensure a valid measurement.)
General Spurious Signals

In the relative power level mode (dBc), the accuracy considerations are the same as for harmonics. In the absolute power level mode (dBm), the following applies:

Spurious Uncertainty = A+B+ D+E+F+G+H

This is a worst-case number. If the search range is confined to 2.9 GHz or less, the bandswitching uncertainty (B) may be omitted.

Sidebands

Sideband Uncertainty = 2 X (D+E+G) + F

This is a worst-case number. This assumes that the sidebands are within about 1 MHz of the carrier frequency. If the carrier amplitude is greater than 0 dBm, the input attenuator switching uncertainty (C) must be included.

Mixing Products

Mixing Products Uncertainty = 2 X (A+B+D+E+G) + F

This is a worst-case number.

Repeatability

The repeatability of any of the measurements is primarily a function of how close the signal is to the noise. In general, all measurements that are not flagged as being near the noise are repeatable to at least ±2 dB.
Remote Programming Commands and Examples

This chapter explains how functions of the 85672A Spurious Response Measurements Utility can be executed by using programming commands. This is done by using a computer to remotely send instructions to the spectrum analyzer to operate the utility instead of pressing the softkeys.

Before you can program the spectrum analyzer, you must connect the spectrum analyzer to the computer. See the programming documentation for the spectrum analyzer for more information.

All the programming examples in this chapter are written in HP BASIC.

Programming Notes

Command Syntax Basics

In general, commands are issued just like the standard GPIB commands. For example, in the Basic programming language, executing the TOI/IMD measurement is done with the command:

```
OUTPUT 718;"SP_TOI";
```

All commands associated with the Spurious Response Measurements Utility begin with SP_.

All commands should be issued in capital letters.

Before a particular measurement program is invoked, the variable SP_RMT should be set to 1. This tells the program to save the current state in state register 9 so that the state can be restored with SP_EXIT after the program has terminated. See the example programs.

Note

Spurious response measurements utility command syntax is different than GPIB command syntax. For example, the GPIB command set does not include the MOV command. Also, units terminators such as Hz and dB, required with GPIB commands, are absent in utility commands. For example, the utility command OUTPUT 718; "MOV SP_HBWMIN, 100;" refers to 100 Hz, but lacks the units terminator Hz. An example of the MOV command is shown in the next paragraph under “Setting Configuration Parameters.”
Setting Configuration Parameters

A configuration parameter is set using the keyword MOV. The syntax is: MOV {destination},{source}. For example, to set the maximum harmonic to be measured to 7, issue the command: OUTPUT 718;"MOV SP_H_MAX,7;". Note the comma between the variable and the value.

Changing the Analyzer Mode from Remote to Local

Use SP(EXIT) to end any remote measurements and return the spectrum analyzer to its original state.

Using Queries to Obtain Results

A result is obtained by first querying the host spectrum analyzer and then reading the value. A query is formed by sending the variable name followed by a question mark and semicolon. For example, to read the TOI based on the lower distortion product, issue the following commands:

```
OUTPUT 718;"SP_TOI_A?;"

ENTER 718;Toi_lwr
```

In the previous example, the BASIC variable Toi_lwr can be changed to any valid variable name desired.

Some of the results are stored in arrays. Individual elements of any array can be accessed by using square brackets with an index inside. For example, OUTPUT 718;"SP_H_LVL[3]?;"; requests the amplitude of the third harmonic.

An entire array can be accessed with the base name. For example, OUTPUT 718;"SP_H_LVL?;"; In this case, the ENTER statement that follows the array statement must be configured to accept the entire array. An array from the spectrum analyzer is sent as a string of ASCII characters which are comma delimited.

The computer must wait for the measurement to be completed before querying for results. This can be done with a simple WAIT statement, but the maximum expected wait execution time must be given. Use the GPIB DONE command instead. See the example programs in this chapter for more details about how this command is used.

Remote Error Codes

If a measurement does not complete successfully, an error code will be contained in the variable SP_OK. If the measurement is successful, the value will be 1. 0 designates an unknown error, although one known situation that will generate this will be if the measurement did not execute to completion. This can occur if a wait time was not long enough, or if the interrupt scheme did not function correctly. Negative error code numbers refer to specific errors; these are listed with the remote description of each module, in this chapter.
Using an External 10 MHz Reference

An external 10 MHz reference can be used when making measurements in remote operation only. To do this, set the variable SP_EXTREF equal to 1 by using the command:

OUTPUT @Sa;"MOV SP_EXTREF,1;";

To use the internal frequency reference, set SP_EXTREF to 0 (its default value).

The state of the SP_EXTREF variable remains in effect for all measurements (including manual mode) until it is remotely reset.
Remote Measurement of TOI/IMD

Execute Command  SP_TOI

Output Variables

<table>
<thead>
<tr>
<th>Variable</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>SP_TOIFA</td>
<td>Lower Primary Signal Frequency in Hz</td>
</tr>
<tr>
<td>SP_TOIFB</td>
<td>Upper Primary Signal Frequency in Hz</td>
</tr>
<tr>
<td>SP_TOIFS</td>
<td>Primary Signal Frequency Spacing in Hz</td>
</tr>
<tr>
<td>SP_TOI SL</td>
<td>Lower Signal Amplitude in dBm</td>
</tr>
<tr>
<td>SP_TOI SU</td>
<td>Upper Signal Amplitude in dBm</td>
</tr>
<tr>
<td>SP_TOI PL</td>
<td>Lower Distortion Product Amplitude in dBm</td>
</tr>
<tr>
<td>SP_TOI PU</td>
<td>Upper Distortion Product Amplitude in dBm</td>
</tr>
<tr>
<td>SP_TOI A</td>
<td>Third Order Intercept Point based on the lower distortion product in dBm</td>
</tr>
<tr>
<td>SP_TOI B</td>
<td>Third Order Intercept Point based on the upper distortion product in dBm</td>
</tr>
<tr>
<td>SP_TOINA</td>
<td>If this flag = 1, the lower distortion product was near the noise level, and SP_TOI A is likely to be higher than reported. This flag = 0 for a good measurement.</td>
</tr>
<tr>
<td>SP_TOINB</td>
<td>If this equals 1, the upper distortion product was near the noise level, and SP_TOI B is likely to be higher than reported. This could also occur if a primary signal is drifting in frequency. This flag = 0 for a good measurement.</td>
</tr>
</tbody>
</table>

Error Codes

<table>
<thead>
<tr>
<th>Error Code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Successful Measurement</td>
</tr>
<tr>
<td>0</td>
<td>Unsuccessful Measurement, unknown reason. This may occur if the measurement was interrupted before complete.</td>
</tr>
<tr>
<td>-101</td>
<td>The spacing between the two signals was not 100 Hz or greater.</td>
</tr>
<tr>
<td>-102</td>
<td>Two signals above 40 dBm were not found.</td>
</tr>
</tbody>
</table>
Remote Third Order Intercept (TOI) Measurement Example

This example shows how you can remotely measure TOI with the 85672A Spurious Response Measurements Utility.

10!
20!
30!
40!******************************************************************************
50!******************************************************************************
60!
70! EXAMPLE OF REMOTE MEASUREMENT OF THIRD ORDER DISTORTION
80!
90!******************************************************************************
100!
110 ASSIGN $a TO 718
120!
130 CLEAR SCREEN
140 OPTION BASE 1 ! Start array index with 1
150!
160! Declare and Dimension the Variables
170!
180 REAL Sigamp1 ! Lower Signal’s Amplitude
190 REAL Sigamp2 ! Upper Signal’s Amplitude
200 REAL Distamp1 ! Lower Distortion Product’s Amplitude
210 REAL Distamp2 ! Upper Distortion Product’s Amplitude
220 REAL To1 ! TOI from Lower Product
230 REAL To2 ! TOI from Upper Product
240 REAL Imdi ! IMD from Lower Product
250 REAL Imd2 ! IMD from Upper Product
260 REAL Sigspc ! Signal Spacing
270 REAL Freq ! Temporary Frequency Variable
280 INTEGER Sflg ! The Completion Status
290 INTEGER Done ! Status Byte from Analyzer
300!
310! Do the Measurement
320!
330 OUTPUT $a;"SP_TOI;";
340!
350! Sense when the Measurement is done
360!
370 OFF TIMEOUT ? ! Use this or a long timeout
380! for Basic for Windows
390 OUTPUT $a;"DONE;";! Ask for DONE flag
400 ENTER $a;Done ! This will be read only when all
410! commands have completed
420!
430! Get the Results
440!
450 OUTPUT $a;"SP_OK?;";! Ask for status code
460 ENTER $a USING "K,%";Sflg ! Save the status code in Sflg
470 IF Sflg<.5 THEN ! If there was an error ... 
480 PRINT "Error in the measurement. Error flag: ";Sflg
490 ELSE ! If there were no errors ...
500 OUTPUT $a;"SP_TOI SL?;";
510 ENTER $a USING "K,%";Sigamp1
520 OUTPUT @Sa:"SP_TOI_SU?";
530 ENTER @Sa USING "K,W":Sigampl2
540 OUTPUT @Sa:"SP_TOI_PL?";
550 ENTER @Sa USING "K,W":Dstampil1
560 OUTPUT @Sa:"SP_TOI_FU?";
570 ENTER @Sa USING "K,W":Dstampil2
580 OUTPUT @Sa:"SP_TOI_A?";
590 ENTER @Sa USING "K,W":Toi1
600 OUTPUT @Sa:"SP_TOI_B?";
610 ENTER @Sa USING "K,W":Toi2
620 OUTPUT @Sa:"SP_TOIIFS?";
630 ENTER @Sa USING "K,W":Sigpcg
640 !
650 Do the Necessary Calculations
660 !
670 Imd1=Dstampil1-Sigampl1
680 Imd2=Dstampil2-Sigampl2
690 Freq=Sigpcg
700 !
710 Display the Results
720 !
730 CLEAR SCREEN
740 PRINT ""
750 PRINT ""
760 PRINT " THIRD HARMONIC DISTORTION"
770 PRINT ""
780 PRINT " FROM FROM"
790 PRINT " LOWER UPPER"
800 PRINT " SIGNAL SIGNAL"
810 PRINT USING "K,3X,DDD.D,5X,DDD.D,3X,K":"TOI":"TOI":"TOI":"TOI":"dEm"
820 PRINT USING "K,2X,DDD.D,4X,DDD.D,3X,K":"IMD":"IMD":"IMD":"IMD":"dEc"
830 PRINT ""
840 PRINT "SIGNAL SPACING:";
850 IF Freq>9999 THEN
860 PRINT USING "3X,DDD.D,K";Freq/1.E+4;" MHz"
870 Freq=0
880 END IF
890 IF Freq>999 THEN
900 PRINT USING "3X,DDD.D,K";Freq/1000.;" kHz"
910 Freq=0
920 END IF
930 IF Freq>0 THEN
940 PRINT USING "3X,DDD.D,K";Freq;" Hz"
950 END IF
960 PRINT ""
970 END IF
980 !
990 Exit Gracefully
1000 !
1010 OUTPUT @Sa:"SP_EXIT;";
1020 OUTPUT @Sa:"DONE?;" ! Ask for DONE flag
1030 ENTER @Sa;Done
1040 !
1050 LOCAL @Sa
1060 !
1070 END
Remote Measurement of Harmonics

Execute Command  
**SP_HARM**

Configuration Variables

<table>
<thead>
<tr>
<th>Variable</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>SP_H_MAX</td>
<td>Maximum harmonic to be measured. Range is from 2 to 10. If SP_H_MAX is 5, the 2nd, 3rd, 4th, and 5th harmonics will be measured.</td>
</tr>
<tr>
<td>SP_H_FFLG</td>
<td>Display or hide the frequencies of the harmonics on the screen. If the value is 0, frequencies will not be displayed. If the value is 1, frequencies will be displayed. The harmonic measurement will executed slightly faster if frequencies are not displayed.</td>
</tr>
<tr>
<td>SP_HBWMN</td>
<td>Sets the minimum resolution bandwidth of the spectrum analyzer that will be used when searching (zooming in) for a harmonic that starts out in or near the noise level. Execution is faster with larger bandwidths, but the dynamic range is more limited. This number has a range of the minimum resolution bandwidth of the host spectrum analyzer up to a maximum of 10 kHz, and it has the units of Hz.</td>
</tr>
</tbody>
</table>

Output Variables

<table>
<thead>
<tr>
<th>Variable</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>SP_H_THD</td>
<td>Total Harmonic Distortion in percent</td>
</tr>
<tr>
<td>SP_H_NS[1-10]</td>
<td>Array of flags corresponding to each measurement in the <em>SP_H_LVL[] array</em>. A value of 0 denotes a good measurement. A value of 1 indicates that the measured level was near or in the noise level. This could also be caused by a drifting fundamental frequency. <em>SP_H_NS[11] contains invalid data.</em></td>
</tr>
<tr>
<td>SP_H_FIQ</td>
<td>Frequency of the Fundamental in Hz</td>
</tr>
<tr>
<td>SP_H_AMP</td>
<td>Amplitude of the Fundamental in dBm</td>
</tr>
</tbody>
</table>
## Error Codes

### Harmonics Error Codes

<table>
<thead>
<tr>
<th>Error Code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Successful Measurement.</td>
</tr>
<tr>
<td>0</td>
<td>Unsuccessful Measurement for an unknown reason. This may occur if the measurement was interrupted before complete.</td>
</tr>
<tr>
<td>-201</td>
<td>A Fundamental was not found above -50 dBm.</td>
</tr>
<tr>
<td>-202</td>
<td>No harmonics are in the spectrum analyzer frequency range.</td>
</tr>
<tr>
<td>-203</td>
<td>The maximum harmonic to measure is not 10 or less.</td>
</tr>
<tr>
<td>-204</td>
<td>The maximum harmonic to measure is not 2 or greater.</td>
</tr>
<tr>
<td>-205</td>
<td>Minimum search bandwidth is not equal to or greater than the spectrum analyzer minimum resolution bandwidth.</td>
</tr>
<tr>
<td>-206</td>
<td>The minimum search bandwidth is not 10 kHz or less.</td>
</tr>
</tbody>
</table>
Remote Harmonics Measurement Example

This example shows how you can remotely measure harmonics with the 85672A Spurious Response Measurements Utility.

```plaintext
10 !
20 !******************************************************************************
30 !******************************************************************************
40 !
50 ! EXAMPLE OF REMOTE MEASUREMENT OF HARMONICS
60 !
70 !******************************************************************************
80 !
90 ASSIGN @Sa TO 718
100 !
110 CLEAR SCREEN
120 OPTION BASE 1 ! Start array index with 1
130 !
140 ! Declare and Dimension the Variables
150!
160 INTEGER Hmax ! The Maximum Harmonic to Measure
170 REAL Hvlrs(10) ! The Harmonic Levels
180 INTEGER Hflgs(10) ! The Near-the-Noise Flags
190 REAL Thd ! Total Harmonic Distortion
200 REAL Fundfreq ! Fundamental Frequency
210 REAL Fundamp ! Fundamental Amplitude
220 INTEGER Sflg ! Completion Status Code
230 INTEGER Done ! Accepts the DONE command output
240 INTEGER I ! A Counter Index
250 !
260 ! Configure the Measurement
270!
280 Hmax=4
290 OUTPUT @Sa;"MOV SP_H_MAX,",";Hmax;");
300 OUTPUT @Sa;"MOV SP_H_FFLG,0;"); ! Don’t display frequencies
310 OUTPUT @Sa;"MOV SP_HBWMIN,100;"); ! Limit searching to 100 Hz
320 !
330 ! Do the Measurement
340!
350 OUTPUT @Sa;"SP_HARM;");
360 !
370 ! Sense when the Measurement is done
380!
390 OFF TIMEOUT 7 ! Use this or a long timeout
400 ! for Ibasic for Windows
410 OUTPUT @Sa;"DONE?;";
420 ENTER @Sa;Done ! This will be read only when all
430 ! commands have completed
440 !
450 ! Get the Results
460 !
470 OUTPUT @Sa;"SP_OK?;"; ! Ask for status code
480 ENTER @Sa USING "@K,%;";Sflg ! Save the status code in Sflg
```

Remote Programming Commands and Examples   7-9
490 IF Sflg<.5 THEN ! If there was an error ...
500 PRINT "Error in the measurement. Error flag: ",Sflg
510 ELSE ! If there were no errors ...
520 OUTPUT @Sa:"SP_H_LVL?:"; ! Ask for the harmonic levels
530 ENTER @Sa USING "K,%,Hlvls(*);" ! 2nd Harmonic is in 2nd Index
540 OUTPUT @Sa:"SP_H_IDX?:"; ! Ask for the near-noise flags
550 ENTER @Sa USING "K,%,Hflgs(*)" ! These match Hlvls
560 OUTPUT @Sa:"SP_THD?:"; ! Ask for the THD
570 ENTER @Sa USING "K,%";Thd
580 OUTPUT @Sa:"SP_FREQ?:"; ! Get the fundamental frequency
590 ENTER @Sa USING "K,%";Fundfreq
600 Fundfreq=Fundfreq/1.E+6 ! Convert to MHz
610 OUTPUT @Sa:"SP_AMP?:"; ! Get the fundamental amplitude
620 ENTER @Sa USING "K,%";Fundamp
630 !
640 ! Display the Results
650 !
660 PRINT "" ! Print a couple blank lines
670 PRINT ""
680 PRINT USING "";"FUNDAMENTAL FREQUENCY: ",Fundfreq;" MHz" ! Name harmonic
690 PRINT "";"FUNDAMENTAL AMPLITUDE: ",Fundamp;" dBm"
700 PRINT ""
710 PRINT "HARMONIC   HARMONIC"
720 PRINT " NUMBER LEVEL "
730 PRINT " dBC "
740 FOR I=2 TO Hmax
750 PRINT USING ";";"X,DD,7X,SD.D,#";I;Hlvls(I)
760 IF Hflgs(I)>.5 THEN ! If harmonic near the noise...
770 PRINT USING "X,2A,#":"**" ! print a noise flag
780 END IF
790 PRINT "" ! Start a new line
800 NEXT I
810 PRINT ""
820 PRINT "TOTAL HARMONIC DISTORTION"
830 PRINT USING "6X,DDD.D,A";Thd,"%"
840 PRINT ""
850 END IF
860 !
870 ! Exit Gracefully
880 !
890 OUTPUT @Sa;"SP_EXIT;";
900 OUTPUT @Sa;"DONE?;";
910 ENTER @Sa;Done
920 LOCAL @Sa
930 !
940 END
Remote Measurement of General Spurious Signals

Execute Commands

<table>
<thead>
<tr>
<th>Command</th>
<th>General Spurious Execute Commands</th>
</tr>
</thead>
<tbody>
<tr>
<td>SP_TIME</td>
<td>Generates an estimate of the search time required for the current configuration. This should be run whenever SP_DBCFLG is changed; or when the reference signal amplitude is changed, if in dBC mode.</td>
</tr>
<tr>
<td>SP_GEN</td>
<td>Does the general spurious search</td>
</tr>
</tbody>
</table>

Configuration Variables

<table>
<thead>
<tr>
<th>Variable</th>
<th>General Spurious Configuration Variables</th>
</tr>
</thead>
<tbody>
<tr>
<td>SP_SR_FL</td>
<td>Lower search frequency limit in Hz. This must be at least 1 MHz, and must be at least 100 kHz below the upper search frequency limit.</td>
</tr>
<tr>
<td>SP_SR_FU</td>
<td>Upper search frequency limit in Hz. This must be at least 1.1 MHz, and must be at least 100 kHz above the lower search frequency limit.</td>
</tr>
<tr>
<td>SP_DBCFLG</td>
<td>Express results in dBm (value - 0) or dBC (value - 1). If dBC is used, the reference signal will be the largest signal on the screen when this utility is invoked. That signal must be at least -50 dBm in amplitude.</td>
</tr>
<tr>
<td>SP_SR_TH</td>
<td>Lower search amplitude limit in dBC or dBm. The value for this parameter must be between -150 dBC and +40 dB</td>
</tr>
<tr>
<td>SP_SR_TG</td>
<td>Upper search amplitude limit in dBC or dBm. The value for this parameter must be between -100 dB and +50 dB</td>
</tr>
<tr>
<td>SP_SRFL</td>
<td>Sort flag. 0 - sort output by frequency. 1 - sort output by amplitude. Sorting by amplitude will take more time, especially if many spurious signals are detected.</td>
</tr>
</tbody>
</table>

Output Variables

<table>
<thead>
<tr>
<th>Variable</th>
<th>General Spurious Output Variables</th>
</tr>
</thead>
<tbody>
<tr>
<td>SP_SR_TM</td>
<td>Estimated search time in seconds</td>
</tr>
<tr>
<td>SP_NUMSP</td>
<td>Number of spurious signals found</td>
</tr>
<tr>
<td>SP_SR_F[1-50]</td>
<td>Array of frequencies in Hz for spurious signals found</td>
</tr>
<tr>
<td>SP_SR_A[1-50]</td>
<td>Array of amplitudes of the spurious signals found in dBC or dBm, depending on SP_DBCFLG</td>
</tr>
<tr>
<td>SP_SR_CF</td>
<td>Reference Frequency in Hz for dBC mode</td>
</tr>
<tr>
<td>SP_SR_CA</td>
<td>Reference Amplitude in dBm for dBC mode</td>
</tr>
</tbody>
</table>
## Error Codes

### General Spurious Error Codes

<table>
<thead>
<tr>
<th>Error Code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Successful Measurement</td>
</tr>
<tr>
<td>0</td>
<td>Unsuccessful Measurement, unknown reason This may occur if the measurement was interrupted before complete.</td>
</tr>
<tr>
<td>-301</td>
<td>A reference signal was not found above -50 dBm.</td>
</tr>
<tr>
<td>-302</td>
<td>The Minimum Search Frequency is not 1 MHz or greater.</td>
</tr>
<tr>
<td>-303</td>
<td>The Maximum Search Frequency is not 1.1 MHz or greater.</td>
</tr>
<tr>
<td>-304</td>
<td>The Maximum Search Frequency is not greater than the Minimum Search Frequency + 100 kHz.</td>
</tr>
<tr>
<td>-305</td>
<td>The Lower Search Threshold is not -130 dB or greater.</td>
</tr>
<tr>
<td>-306</td>
<td>The Lower Search Threshold is not +40 dB or less.</td>
</tr>
<tr>
<td>-307</td>
<td>The Upper Search Threshold is not -100 dB or greater.</td>
</tr>
<tr>
<td>-308</td>
<td>The Upper Search Threshold is not +50 dB or less.</td>
</tr>
<tr>
<td>-309</td>
<td>The Upper Search Threshold is not less than the Lower Search Threshold.</td>
</tr>
<tr>
<td>-310</td>
<td>The Estimated Search Time is not less than 24 hours.</td>
</tr>
<tr>
<td>-311</td>
<td>The Lower Search Threshold is too low for the host spectrum analyzer.</td>
</tr>
</tbody>
</table>
Remote General Spurious Signals Measurement Example

This example shows how you can remotely measure general spurious signals with the 85672A Spurious Response Measurements Utility.

10 !
20 !******************************************************************************
30 !******************************************************************************
40 !
50 ! EXAMPLE OF REMOTE GENERAL SPURIOUS SEARCH
60 !
70 !******************************************************************************
80 !
90 ASSIGN OSa TO 718
100 !
110 OPTION BASE 1 ! Start array index with 1
120 CLEAR SCREEN
130 !
140 ! Declare and Dimension the Variables
150 !
160 REAL Fmin ! Minimum Search Frequency
170 REAL Fmax ! Maximum Search Frequency
180 REAL Amin ! Lower Amplitude Threshold
190 REAL Amax ! Upper Amplitude Threshold
200 REAL Stime ! Estimated Search Time
210 REAL Spfreq(50) ! Frequency of spurs found
220 REAL S ampl(50) ! Amplitude of spurs found
230 INTEGER Snum ! Number of spurs found
240 INTEGER Sflag ! The completion status
250 INTEGER Done ! Command complete flag
260 INTEGER I ! A Counter Index
270 !
280 ! Configure the Measurement
290 !
300 Fmin=1.E+8 ! Fmin is 100 MHz
310 Fmax=2.E+9 ! Fmax is 2 GHz
320 Amin=-65 ! Lower Threshold is -65 dBm
330 Amax=-20 ! Upper Threshold is -20 dBm
340 OUTPUT OSa;"MOV SP_SR_TH,";Amin;";"; ! Lower Threshold
350 OUTPUT OSa;"MOV SP_SR_TH,";Amax;";"; ! Upper Threshold
360 OUTPUT OSa;"MOV SP_SR_FL,";Fmin;";"; ! Minimum Offset Frequency
370 OUTPUT OSa;"MOV SP_SR_FL,";Fmax;";"; ! Maximum Offset Frequency
380 OUTPUT OSa;"MOV SP_DBCFLG,0;"; ! Measure in dBm
390 OUTPUT OSa;"MOV SP_SRTFLG,0;"; ! Sort by Frequency
400 !
410 ! Estimate the Search Time
420 !
430 OUTPUT OSa;"SP_TIME;"; ! Estimate the search time
440 !
450 ! Sense when the Time Estimation is done
460 !
470 OFF TIMEOUT 7 ! Use this or a long timeout
480 ! for Ibasic for Windows
490 OUTPUT OSa;"DONE?;"; ! Ask for DONE flag
500 ENTER OSa;Done ! This will be read only when all
510 ! commands have completed

Remote Programming Commands and Examples 7-13
520 ! Check for errors
530 !
540 !
550 OUTPUT @Sa:"SP_OK?;";  ! Ask for status code
560 ENTER @Sa USING "K,%";Sflg  ! Save the status code in Sflg
570 IF Sflg<.5 THEN  ! If there was an error ...
580 PRINT "Error in the measurement. Error flag: ",Sflg
590 OUTPUT @Sa:"SP_EXIT;";
600 OUTPUT @Sa:"DONE?;";  ! Ask for DONE flag
610 ENTER @Sa;Done
620 LOCAL @Sa
630 STOP
640 END IF
650 !
660 ! If no Errors, Get the Estimate
670 !
680 OUTPUT @Sa:"SP_SR_TM?;";  ! Ask for the estimate
690 ENTER @Sa USING "K,%";Stime  ! Receive the estimate
700 IF Stime<60 THEN
710 PRINT "Sweep time estimate is negative."
720 PRINT "Invalid parameters. The upper frequency"
730 PRINT "limit is probably less than the lower one."
740 ELSE
750 PRINT USING "K,DD,K";"Estimated Search Time is ";Stime;" Seconds"
760 END IF
770 ELSE
780 Stime=Stime/60
790 PRINT "Estimated Search Time is ";Stime;" Minutes"
800 END IF
810 !
820 PRINT ""
830 ! This is a place to let the user change the lower !
840 ! amplitude threshold or the frequency search range  
850 ! if the estimated search time is excessive.        
860 !
870 ! Do the Spurious Search
880 !
890 OUTPUT @Sa:"SP_GEN;";
900 !
910 ! Sense when the Measurement is done
920 !
930 OFF TIMEOUT 7  ! Use this or a long timeout
940 ! for Ibasic for Windows
950 OUTPUT @Sa:"DONE?;";  ! Ask for DONE flag
960 ENTER @Sa;Done  ! This will be read only when all
970 ! commands have completed
980 !
990 ! Get the Results
1000 !
1010 OUTPUT @SA:"SP_OK?";               ! Ask for status code
1020 ENTER @S4 USING "Y,%";Sfig         ! Save the status code in Sfig
1030 IF Sfig<.5 THEN
1040 PRINT "Error in the measurement. Error flag: ",Sfig
1050 ELSE
1060 OUTPUT @Sa:"SP_NUMSP?";             ! Ask for number of spurs
1070 ENTER @Sa USING "K,%”;Spnum        !
1080 IF Spnum>0 THEN
1090 FOR I=1 TO Spnum
1100 OUTPUT @Sa;"SP_SR_F[";I"];";"; ! Ask for the spurious freq
1110 ENTER @Sa USING "Y,%";Spfreq(I) ! Retrieve the frequency
1120 OUTPUT @Sa;"SP_SR_A[";I"];";";    !
1130 ENTER @Sa USING "Y,%";Spamp(I)    
1140 NEXT I
1150 ! Display the Results
1160 !
1180 PRINT ""                       ! Print a couple blank lines
1190 PRINT ""
1200 IF Spnum>1 THEN
1210 PRINT "FOUND ";Spnum;" SPURIOUS SIGNALS"
1220 ELSE
1230 PRINT "FOUND ";Spnum;" SPURIOUS SIGNAL"
1240 END IF
1250 PRINT ""
1260 PRINT " FREQUENCY AMPLITUDE 
1270 PRINT " MHz dBm"
1280 FOR I=1 TO Spnum
1290 Spfreq(I)=Spfreq(I)/1.E6       ! Convert to MHz
1300 PRINT USING "3X,DDDD.D, #";Spfreq(I)
1310 PRINT USING "3X,DDDD.D, #";Spamp(I)
1320 NEXT I
1330 PRINT ""
1340 ELSE
1350 PRINT "No Spurious Signals Found!"
1360 END IF                       ! End of Spnum>0 test
1370 END IF                      ! End of SP_OK test
1380 ! Exit Gracefully
1390 !
1410 OUTPUT @Sa;"SP_EXIT;";
1420 OUTPUT @Sa;"DONE?";            ! Ask for DONE flag
1430 ENTER @Sa;Done                !
1440 !
1450 LOCAL @Sa
1460 !
1470 END
Remote Measurement of Sidebands

Execute Command  SP_SIDEBD

Configuration Variables

<table>
<thead>
<tr>
<th>Variable</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>SP_SB_FL</td>
<td>Minimum frequency offset in Hz. Must be at least 50 Hz.</td>
</tr>
<tr>
<td>SP_SB_FU</td>
<td>Maximum frequency offset in Hz. Must be at least 300 Hz, and must be greater than SP_SB_FL. If measuring the left side sidebands (or both sides), the carrier frequency minus SP_SB_FU must be greater than 100 kHz.</td>
</tr>
<tr>
<td>SP_SB_SD</td>
<td>Side(s) of carrier to measure: 0 - Left, 1 - Both, 2 - Right</td>
</tr>
<tr>
<td>SP_SB_FC</td>
<td>Frequency Accuracy: 0 - Normal, 1 - High (Uses Frequency Counter)</td>
</tr>
</tbody>
</table>

Output Variables

<table>
<thead>
<tr>
<th>Variable</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>SP_SB_NUM</td>
<td>Number of sideband sets found</td>
</tr>
<tr>
<td>SP_SB_FL[1-2]</td>
<td>Array of sideband frequencies in Hz</td>
</tr>
<tr>
<td>SP_SB_AL[1-2]</td>
<td>Array of sideband amplitudes on the left side of the carrier in dBc</td>
</tr>
<tr>
<td>SP_SB_AR[1-2]</td>
<td>Array of sideband amplitudes on the right side of the carrier in dBc</td>
</tr>
<tr>
<td>SP_SB_CF</td>
<td>Carrier Frequency in Hz</td>
</tr>
<tr>
<td>SP_SB_CP</td>
<td>Carrier Amplitude in dBm</td>
</tr>
</tbody>
</table>

Error Codes

<table>
<thead>
<tr>
<th>Error Code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Successful Measurement</td>
</tr>
<tr>
<td>0</td>
<td>Unsuccessful Measurement for an unknown reason. This may occur if the measurement was interrupted before completion.</td>
</tr>
<tr>
<td>-401</td>
<td>A Carrier was not found above -50 dBm.</td>
</tr>
<tr>
<td>-402</td>
<td>The Carrier Frequency is not 100 kHz or greater</td>
</tr>
<tr>
<td>-403</td>
<td>The Minimum Frequency Offset is not 50 Hz or greater</td>
</tr>
<tr>
<td>-404</td>
<td>The Maximum Offset Frequency is not 300 Hz or greater</td>
</tr>
<tr>
<td>-405</td>
<td>The Maximum Offset Frequency is not greater than the Minimum Offset Frequency.</td>
</tr>
<tr>
<td>-406</td>
<td>The Lowest Frequency to be measured is not 100 kHz or greater.</td>
</tr>
</tbody>
</table>
Remote Discrete Sideband Signals Measurement Example

This example shows how you can remotely measure discrete sideband signals with the 85672A Spurious Response Measurements Utility.

10 !
20 !******************************************************************************
30 !******************************************************************************
40 !
50 ! EXAMPLE OF REMOTE MEASUREMENT OF SIDEBANDS
60 !
70 !******************************************************************************
80 !
90 ASSIGN @Sa TO 718
100 !
110 OPTION BASE 1     ! Start array index with 1
120 CLEAR SCREEN
130 !
140 ! Declare and Dimension the Variables
150 !
160 REAL Fmin         ! Minimum Offset Frequency
170 REAL Fmax         ! Maximum Offset Frequency
180 REAL Fcarrier     ! Carrier Frequency
190 REAL Acarrier     ! Carrier Amplitude
200 REAL Shfreq(25)   ! Sideband Frequencies
210 REAL Slamplt(25)  ! Left Sideband Amplitudes
220 REAL Slampqrt(25) ! Right Sideband Amplitudes
230 INTEGER Snum      ! Number of sets of sidebands
240 INTEGER Sside     ! 0=left, 1=both, 2=right side
250 INTEGER Sflag     ! The completion status
260 INTEGER Done      ! Completion Flag
270 INTEGER I         ! A Counter Index
280 !
290 ! Configure the Measurement
300 !
310 Fmin=1000.        ! Fmin is 1 kHz
320 Fmax=1.E+6        ! Fmax is 1 MHz
330 Sside=1           ! 0=left, 1=both, 2=right side
340 OUTPUT @Sa;"MOV SP_SB_FL,";Fmin;"";  ! Minimum Offset Frequency
350 OUTPUT @Sa;"MOV SP_SB_FU,";Fmax;"";  ! Maximum Offset Frequency
360 OUTPUT @Sa;"MOV SP_SB_SD,";Sside;"";  ! Search right side only
370 OUTPUT @Sa;"MOV SP_SB_FC,0;";       ! Normal frequency accuracy
380 !
390 ! Do the Measurement
400 !
410 OUTPUT @Sa;"SP_SIDEBD;";
420 !
430 ! Sense when the Measurement is done
440 !
450 OFF TIMEOUT 7     ! Use this or a long timeout
460 ! for Ibasic for Windows
470 OUTPUT @Sa;"DONE?;";  ! Ask for DONE flag
480 ENTER @Sa;Done     ! This will be read only when all
490 ! commands have completed
! Get the Results

OUTPUT $a:"SP.OK?";  ! Ask for status code
ENTER $a USING "K,%";Sfig  ! Save the status code in Sfig
IF Sfig<.5 THEN  ! If there was an error ...
  PRINT "Error in the measurement. Error flag =";Sfig
ELSE  ! If there were no errors ...
  OUTPUT $a:"SP_SB_NUM?";  ! Ask for number of sidebands
  ENTER $a USING "K,%";Sbnum  !
END IF

IF Sbnum>0 THEN
  FOR I=1 TO Sbnum
    OUTPUT $a;"SP_SB_F[";I;">";";
    ENTER $a USING "K,%";Sbreq(I)  ! Retrieve the frequency
    IF Sbside<1.5 THEN  ! Left side measured?
      OUTPUT $a;"SP_SB_AL[";I;">";";
      ENTER $a USING "K,%";Sbamp1ft(I)
    END IF
    IF Sbside>.5 THEN  ! Right side measured?
      OUTPUT $a;"SP_SB_AR[";I;">";";
      ENTER $a USING "K,%";Sbampright(I)
    END IF
  NEXT I

! Display the Results

PRINT "****"  ! Print a couple blank lines
PRINT "****
PRINT " NUMBER OF SIDEBANDS = ";Sbnum
PRINT "****
PRINT " SIDEBAND  LEFT SIDEBAND  RIGHT SIDEBAND"
PRINT " FREQUENCY  LEVEL  LEVEL"
PRINT " kHz  dBc  dBc"
FOR I=1 TO Sbnum
  Sbreq(I)=Sbreq(I)/1000  ! Convert to kHz
  PRINT USING "2X,DDD.DDD,D,";Sbreq(I)
  IF Sbside<1.5 THEN
    PRINT USING "9X,DDD.D,13X,";Sbamp1ft(I)
  ELSE
    PRINT USING "2X,";
  END IF
  IF Sbside>.5 THEN
    PRINT USING "DDD.D,13X,";Sbampright(I)
  END IF
  PRINT "****"  ! Start a new line
  NEXT I
PRINT "****"
PRINT "****"
ELSE
PRINT "No Sidebands Found!"
ENDIF  ! End of Sbnum>0 test
ENDIF  ! End of SP_OK test

! Exit Gracefully
OUTPUT $a;"SP_EXIT;";
OUTPUT $a;"DONE?;";  ! Ask for DONE flag
ENTER $a;Done  !
LOCAL $a
END
Remote Measurement of Mixing Products

**Execute Command**  
SP_MXR

**Configuration Variables**

<table>
<thead>
<tr>
<th>Variable</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>SP_MX_RF</td>
<td>RF frequency entered by user in Hz. It must be at least 100 kHz and</td>
</tr>
<tr>
<td></td>
<td>at least 100 kHz separate from the LO frequency.</td>
</tr>
<tr>
<td>SP_MX_LO</td>
<td>LO frequency entered by user in Hz. It must be at least 100 kHz and</td>
</tr>
<tr>
<td></td>
<td>at least 100 kHz separate from the RF frequency.</td>
</tr>
<tr>
<td>SP_MXMAX</td>
<td>Maximum multiple of RF frequency to be searched. Range is 1 through 10.</td>
</tr>
<tr>
<td>SP_MXNMAX</td>
<td>Maximum multiple of LO frequency to be searched. Range is 1 through 10.</td>
</tr>
<tr>
<td>SP_MXPFLAG</td>
<td>Polarity flag: 0 - N<em>LO-M</em>RF; 1 - N<em>LO+M</em>RF</td>
</tr>
<tr>
<td>SP_MXRFLAG</td>
<td>Reference flag: 0 - [LO-RF]; 1 - LO + RF</td>
</tr>
<tr>
<td>SP_MBWMN</td>
<td>Minimum Search Bandwidth to be used. Range is from the minimum</td>
</tr>
<tr>
<td></td>
<td>resolution bandwidth of the host spectrum analyzer through 10 kHz.</td>
</tr>
</tbody>
</table>

**Output Variables**

<table>
<thead>
<tr>
<th>Variable</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>SP_MXR_RF</td>
<td>Measured RF frequency in Hz</td>
</tr>
<tr>
<td>SP_MXI_O</td>
<td>Measured LO frequency in Hz</td>
</tr>
<tr>
<td>SP_MXI_A</td>
<td>Measured LO amplitude in dBm</td>
</tr>
<tr>
<td>SP_MXR_A</td>
<td>Measured RF amplitude in dBm</td>
</tr>
<tr>
<td>SP_MXREF</td>
<td>Reference frequency in Hz</td>
</tr>
<tr>
<td>SP_MXREFA</td>
<td>Reference amplitude in dBm</td>
</tr>
<tr>
<td>SP_MX_A[100]</td>
<td>Amplitudes of the mixing products. N (LO Multiple) changes with each array</td>
</tr>
<tr>
<td></td>
<td>index (inner loop) while M (RF Multiple) changes after Nmax indices. The</td>
</tr>
<tr>
<td></td>
<td>following shows the array indices for Nmax - 3 and Nmax - 3: The unused</td>
</tr>
<tr>
<td></td>
<td>values of the array are set to 0 (in the case of the table above, data with</td>
</tr>
<tr>
<td></td>
<td>indices above 0 would have zeroes).</td>
</tr>
<tr>
<td>SP_MX_NF[100]</td>
<td>Array of flags that correspond to the amplitudes of the mixing products in</td>
</tr>
<tr>
<td></td>
<td>SP_MX_A. The flag has a value of 0 for a good measurement and has a value</td>
</tr>
<tr>
<td></td>
<td>of 1 if the reading was in the noise or near the noise level.</td>
</tr>
</tbody>
</table>
## Error Codes

### Mixing Products Error Codes

<table>
<thead>
<tr>
<th>Error Code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Successful Measurement</td>
</tr>
<tr>
<td>0</td>
<td>Unsuccessful Measurement, unknown reason. This may occur if the measurement was interrupted before complete.</td>
</tr>
<tr>
<td>-501</td>
<td>$N_{\text{max}}$, the maximum $N$, is not 1 or greater.</td>
</tr>
<tr>
<td>-502</td>
<td>$N_{\text{max}}$, the maximum $N$, is not 10 or less.</td>
</tr>
<tr>
<td>-503</td>
<td>$N_{\text{max}}$, the maximum $M$, is not 1 or greater.</td>
</tr>
<tr>
<td>-504</td>
<td>$N_{\text{max}}$, the maximum $M$, is not 10 or less.</td>
</tr>
<tr>
<td>-505</td>
<td>The LO Frequency is not 100 kHz or greater.</td>
</tr>
<tr>
<td>-506</td>
<td>The LO Frequency is greater than the maximum frequency of the host spectrum analyzer.</td>
</tr>
<tr>
<td>-507</td>
<td>The LO Signal was not found above -50 dBm.</td>
</tr>
<tr>
<td>-508</td>
<td>The RF Frequency is not 100 kHz or greater.</td>
</tr>
<tr>
<td>-509</td>
<td>The RF Frequency is greater than the maximum frequency of the host spectrum analyzer.</td>
</tr>
<tr>
<td>-510</td>
<td>The RF Signal was not found above -60 dBm.</td>
</tr>
<tr>
<td>-511</td>
<td>The difference in frequency between the LO and the RF is not 100 kHz or greater.</td>
</tr>
<tr>
<td>-512</td>
<td>The Minimum Search Bandwidth is not equal or greater than the minimum bandwidth of the host spectrum analyzer.</td>
</tr>
<tr>
<td>-513</td>
<td>The Minimum Search Bandwidth is not 10 kHz or less.</td>
</tr>
</tbody>
</table>
Remote Mixing Products Measurement Example

This example shows how you can remotely measure mixing products with the 85672A Spurious Response Measurements Utility.

```
!*****************************************************************************
!*****************************************************************************
!*****************************************************************************
40 !
50 ! EXAMPLE OF REMOTE MEASUREMENT OF MIXING PRODUCTS
60 !
70 !*****************************************************************************
80 !
90 ASSIGN 0Sa T0 718
100 !
110 OPTION BASE 1 ! Start array index with 1
120 CLEAR SCREEN
130 !
140 ! Declare and Dimension the Variables
150 !
160 REAL Flo ! LO Frequency
170 REAL Frf ! RF Frequency
180 REAL Sbfrq(25) ! Sideband Frequencies
190 REAL Levels(10,10) ! Product Amplitude Array
200 REAL Noise(10,10) ! Associated Near-Noise Flags
210 INTEGER Mmax ! Maximum RF Multiple
220 INTEGER Nmax ! Maximum LO Multiple
230 INTEGER Sumdiff ! 0=Difference, 1=Sum Products
240 INTEGER Refpol ! 0=|LO-RF|, 1=LO+RF
250 INTEGER Sfig ! The completion status
260 INTEGER Done ! Placeholder for DONE flag
270 INTEGER I ! A Counter Index
280 INTEGER J ! Another Counter Index
290 INTEGER K ! Yet another Counter Index
300 !
310 ! Configure the Measurement
320 !
330 Mmax=2
340 Nmax=2
350 Flo=3.1E+8
360 Frf=3.1E+8
370 Sumdiff=0
380 Refpol=0
390 OUTPUT @Sa;"MOV SP_MXMAX,";Mmax;";"
400 OUTPUT @Sa;"MOV SP_MXMAX,";Nmax;";"
410 OUTPUT @Sa;"MOV SP_MX_LO,";Flo;";"
420 OUTPUT @Sa;"MOV SP_MX_RF,";Frf;";"
430 OUTPUT @Sa;"MOV SP_MXFLG,";Sumdiff;";"
440 OUTPUT @Sa;"MOV SP_MXRFGL,";Refpol;";"
450 OUTPUT @Sa;"MOV SP_MBWMIN,100;" ! Limit searching to 100 Hz
460 !
470 ! Do the Measurement
480 !
490 OFF TIMEOUT 7 ! Use this or a long timeout
500 OUTPUT @Sa;"SP_MXR;";
```
510 ! Sense when the Measurement is done
520 !
530 !
540 ! for Ibasic for Windows
550 OUTPUT 0Sa:"DONE?:";  ! Ask for DONE flag
560 ENTER 0Sa;Done   ! This will be read only when all
570 ! commands have completed
580 !
590 ! Get the Results
600 !
610 OUTPUT 0Sa:"SP_OK?:";  ! Ask for status code
620 ENTER 0Sa USING "K,%;Sflg  ! Save the status code in Sflg
630 IF Sflg<.5 THEN ! If there was an error ...
640 PRINT "Error in the measurement. Error flag: ",Sflg
650 ELSE  ! If there were no errors ...
660 !
670 ! The values in the spectrum analyzer are stored in
680 ! a single-dimensional array (SP_MX_A). N, the LO
690 ! multiple is the inner (fastest changing) index,
700 ! while M is the outer index. Below, the values
710 ! are read, using the index K, into a two-dimensional
720 ! array (Levels) where the first index corresponds
730 ! to M (the RF multiple) and the second index
740 ! corresponds to N (the LO multiple).
750 K=1
760 FOR I=1 TO Mmax
770 FOR J=1 TO Mmax
780 OUTPUT 0Sa:"SP_MX_A[";K;";"];
790 ENTER 0Sa USING "K,%;Levels(I,J)
800 OUTPUT 0Sa:"SP_MX_NF[";K;";"];
810 ENTER 0Sa USING "K,%;Noise(I,J)
820 K=K+1
830 NEXT J
840 NEXT I
850 !
860 ! Display the Results
870 !
880 PRINT ""  ! Print a couple blank lines
890 PRINT ""
900 PRINT USING "12X,K";" MIXING PRODUCTS"
910 PRINT USING "12X,K";" dBc BELOW REFERENCE"
920 PRINT ""
930 PRINT USING "12X,K";" N (*LO)"
940 !
950 PRINT USING "8X,#"
960 FOR J=1 TO Mmax  ! Print LO Multiple Number Headings
970 PRINT USING "5X,DD,#";J
980 NEXT J
990 PRINT ""
1000 PRINT ""
1010 !
1020 PRINT " M (*RF) I"; ! Print first row of products
1030 FOR J=1 TO Nmax
1040 PRINT USING "2X,DDD,";Levels(I,J)
1050 IF Noise(I,J)>.5 THEN
1060 PRINT "**";
1070 ELSE
1080 PRINT " ";
1090 END IF
1100 NEXT J
1110 FOR I=2 TO Nmax ! Print rest of products
1120 PRINT " 
1130 PRINT USING "8X,DD,";I
1140 FOR J=1 TO Nmax
1150 PRINT USING "2X,DDD,";Levels(I,J)
1160 IF Noise(I,J)>.5 THEN
1170 PRINT "**";
1180 ELSE
1190 PRINT " ";
1200 END IF
1210 NEXT J
1220 NEXT I
1230 END IF ! End of SP_OK test
1240 !
1250 ! Exit Gracefully
1260 !
1270 OUTPUT $Sa;"SP_EXIT;"; ! Ask for DONE flag to show that
1280 OUTPUT $Sa;"DONE?;"; ! SP_EXIT has finished.
1290 ENTER $Sa;Done
1300 !
1310 LOCAL $Sa
1320 !
1330 END
Index

A  accessing the utility, 1-7
    averaging. See smoothing

C  carrier sidebands measurement example, 2-11
    caution
        the caution symbol, vi
    compatible firmware, 1-1
    CONFIG DONE softkey, 3-5, 3-8, 3-10, 3-12, 3-15, 3-16
    CONFIG HARMONIC softkey, 3-5
    CONFIG MIXER softkey, 3-15
    CONFIG SIDEBNDS softkey, 3-12
    CONFIG SPURS softkey, 3-8

D  description of starting, 4-2
    discrete sidebands measurement
        remote programming example, 7-17
    discrete sidebands measurement configuration, 4-13
    discrete sidebands measurement description, 4-12
    discrete sidebands measurement limits, 4-13
    discrete sidebands spurious measurement example, 2-11

E  ending the utility, 3-18
    equipment required, 1-1
    erratic utility troubleshooting, 5-2
    example measurement, carrier sidebands, 2-11
    example measurement, general spurious, 2-7
    example measurement, harmonic, 2-4
    example measurement, mixing products, 2-15
    example measurement, THD, 2-4
    example measurement, third order intercept, 2-1
    EXIT ALL softkey, 3-18
    exiting the utility, 1-8, 3-18

F  firmware compatibility, 1-1
G  general safety considerations, vi
   general spurious measurement
      remote programming example, 7-13
   general spurious measurement configuration, 4-9
   general spurious measurement description, 4-8
   general spurious measurement example, 2-7
   general spurious measurement limits, 4-9, 4-10
   general spurious menu softkey descriptions, 3-7
   general spurious signals remote programming example, 7-11
   GEN SPUR MENU softkey, 3-7

H  HARD COPY softkey, 3-17
   harmonic measurement example, 2-4
   HARMONIC MENU softkey, 3-5
   harmonic menu softkey descriptions, 3-5
   harmonics measurement
      remote programming example, 7-9
   harmonics measurements configuration, 4-5
   harmonics measurements description, 4-5
   harmonics measurements limits, 4-6, 4-7
   harmonics measurement specifications, 6-1
   harmonics remote programming example, 7-7

I  installing the utility, 1-3
   instrument firmware compatibility, 1-1
   intermodulation distortion measurement limitations, 4-4

L  LAST PAGE softkey, 3-8, 3-11
   license agreement, iii
   loading the utility into memory and labeling a softkey, 1-3
   LOWER LEFT softkey, 3-18
   LOWER RIGHT softkey, 3-18
   LOWER THRESHLD softkey, 3-9

M  main menu, 4-2
   making a discrete sidebands measurement, 2-11
   making a general spurious measurement, 2-7
   making a harmonic measurement, 2-4
   making a mixing products4 measurement, 2-15
   making a THD measurement, 2-4
   making a TOI measurement, 2-1
   MAX FREQ OFFSET softkey, 3-12
   MAXIMUM SRCH FRQ softkey, 3-8
   MEASURE HARMONIC softkey, 3-5
   MEASURE MIXER softkey, 3-14
   MEASURE SIDEBNDS softkey, 3-11
   MEASURE SPURS softkey, 3-7
   MEASURE TOI/IMD softkey, 3-4
   menu map, overall, 3-2
   MIN FREQ OFFSET softkey, 3-12
   MINIMUM SRCH FRQ softkey, 3-8
   MIXER MENU softkey, 3-14
   mixer menu softkey descriptions, 3-14
mixing products measurement
remote programming example, 7-21
mixing products measurement configuration, 4-15
mixing products measurement description, 4-15
mixing products measurement example, 2-15
mixing products measurement limits, 4-16, 4-17
mixing products measurement specifications, 6-2
mixing products remote programming example, 7-19
MORE PRODUCTS softkey, 3-14
moving the utility to another analyzer, 1-5

N  NEXT PAGE softkey, 3-7, 3-11

O  overall menu map, 3-2

P  phase noise utility, using with spurious utility, 1-9
PLOT softkey, 3-17
plotting, 3-17, 4-19
PRINT B&W softkey, 3-17
PRINT COLOR softkey, 3-18
printing, 3-17, 4-19
printing/plotting troubleshooting, 5-1
programming examples
measuring discrete sideband signals, 7-17
measuring general spurious signals, 7-13
measuring harmonics, 7-9
measuring mixing products, 7-21
measuring TOI, 7-5

Q  quitting the utility, 3-18

R  re-installation, save time during, 1-6
remote discrete sidebands measurement
programming example, 7-17
remote general spurious measurement
programming example, 7-13
remote harmonics measurement
programming example, 7-9
remote mixing products measurement
programming example, 7-21
remote programming, 10 MHz reference use, 7-3
remote programming analyzer mode switching, 7-2
remote programming commands and examples, 7-1
remote programming configuration parameters, 7-2
remote programming error codes, 7-2
remote programming example, general spurious signals, 7-11
remote programming example, harmonics, 7-7
remote programming example, mixing products, 7-19
remote programming example, sidebands, 7-16
remote programming example, TOI, 7-4
remote programming queries, using, 7-2
remote programming syntax basics, 7-1
remote TOI measurement
  programming example, 7-5
removing the utility from memory, 1-6
repeatability, 6-2
running the utility, 1-7

S
  safety, vi
  safety symbols, vi
  SET dBm/dBe softkey, 3-10
  SET FREQ ACCURACY softkey, 3-13
  SET FREQ DISPLAY softkey, 3-6
  SET LO FREQ softkey, 3-16
  SET MAX HARMONIC softkey, 3-6
  SET MAX M softkey, 3-16
  SET MAX N softkey, 3-16
  SET REFERENC softkey, 3-16
  SET RF FREQ softkey, 3-16
  SET SIDE softkey, 3-13
  SET SORT ORDER softkey, 3-10
  SET SUM/DIFF softkey, 3-16
  SET UPDATE softkey, 3-10
  SIDE BAND MENU softkey, 3-11
  sideband menu softkey descriptions, 3-11
  sidebands measurement
    remote programming example, 7-17
  sidebands measurement specifications, 6-2
  sidebands remote programming example, 7-16
  softkey descriptions, general spurious menu, 3-7
  softkey descriptions, harmonic menu, 3-5
  softkey descriptions, mixer menu, 3-14
  softkey descriptions, sideband menu, 3-11
  softkey descriptions, TOI/IMD menu, 3-4
  softkeys to avoid, 1-8
  software product license, ii
  specifications, 6-1
  spectrum analyzer firmware compatibility, 1-1
  spurious measurement
    remote programming example, 7-13
  starting the utility, 1-7, 4-2
  stopping the program during a measurement, 5-1

T
  THD measurement example, 2-4
  third order intercept measurement description, 4-4
  third order intercept measurement example, 2-1
  third order intercept measurement limitations, 4-4
  TOI and IMD specifications, 6-1
  TOI/IMD measurement description, 4-4
  TOI/IMD measurement limitations, 4-4
  TOI/IMD menu softkey descriptions, 3-4
  TOI/IMD remote programming example, 7-4
  TOI measurement
    remote programming example, 7-5
  TOI measurement, making a, 2-1
  trace averaging. See averaging
troubleshooting erratic utility behavior, 5-2
troubleshooting lost analyzer states, 5-1
troubleshooting printing/plotting problems, 5-1
troubleshooting unexpected measurement results, 5-2
troubleshooting unexpected utility termination, 5-2

U  UPDATE TIME EST softkey, 3-9
    UPPER LEFT softkey, 3-18
    UPPER RIGHT softkey, 3-18
    UPPER THRESHLD softkey, 3-10
    using the phase noise and spurious utilities, 1-9
    using the utility, 1-8, 4-2
    utility specifications, 6-1

V  VIEW ANOTHER softkey, 3-15
    VIEW PRODUCT softkey, 3-15
    VIEW TABLE softkey, 3-15

W  warning
    the warning symbol, vi
    warranty statement, ii
    WHOLE PAGE softkey, 3-18