

Keysight Technologies Z5623A Option H01

Notice: This document contains references to Agilent. Please note that Agilent's Test and Measurement business has become Keysight Technologies. For more information, go to www.keysight.com.

Notices

© Keysight Technologies, Inc.
2002-2014, 2017, 2017

No part of this manual may be reproduced in any form or by any means (including electronic storage and retrieval or translation into a foreign language) without prior agreement and written consent from Keysight Technologies, Inc. as governed by United States and international copyright laws.

Trademark Acknowledgments

Manual Part Number

Z5623-90001

Edition

Edition 3, June 2017
Supersedes January 2015

Printed in USA

Published by:
Keysight Technologies
1400 Fountaingrove Parkway
Santa Rosa, CA 95403

Warranty

THE MATERIAL CONTAINED IN THIS DOCUMENT IS PROVIDED "AS IS," AND IS SUBJECT TO BEING CHANGED, WITHOUT NOTICE, IN FUTURE EDITIONS. FURTHER, TO THE MAXIMUM EXTENT PERMITTED BY APPLICABLE LAW, KEYSIGHT DISCLAIMS ALL WARRANTIES, EITHER EXPRESS OR IMPLIED WITH REGARD TO THIS MANUAL AND ANY INFORMATION CONTAINED HEREIN, INCLUDING BUT NOT LIMITED TO THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE. KEYSIGHT SHALL NOT BE LIABLE FOR ERRORS OR FOR INCIDENTAL OR CONSEQUENTIAL DAMAGES IN CONNECTION WITH THE FURNISHING, USE, OR PERFORMANCE OF THIS DOCUMENT OR ANY INFORMATION CONTAINED HEREIN. SHOULD KEYSIGHT AND THE USER HAVE A SEPARATE WRITTEN AGREEMENT WITH WARRANTY TERMS COVERING THE MATERIAL IN THIS

DOCUMENT THAT CONFLICT WITH THESE TERMS, THE WARRANTY TERMS IN THE SEPARATE AGREEMENT WILL CONTROL.

Technology Licenses

The hardware and/or software described in this document are furnished under a license and may be used or copied only in accordance with the terms of such license.

U.S. Government Rights

The Software is "commercial computer software," as defined by Federal Acquisition Regulation ("FAR") 2.101. Pursuant to FAR 12.212 and 27.405-3 and Department of Defense FAR Supplement ("DFARS") 227.7202, the U.S. government acquires commercial computer software under the same terms by which the software is customarily provided to the public. Accordingly, Keysight provides the Software to U.S. government customers under its standard commercial license, which is embodied in its End User License Agreement (EULA), a copy of which can be found at

<http://www.keysight.com/find/sweula>. The license set forth in the EULA represents the exclusive authority by which the U.S. government may use, modify, distribute, or disclose the Software. The EULA and the license set forth therein, does not require or permit, among other things, that Keysight: (1) Furnish technical information related to commercial computer software or commercial computer software documentation that is not customarily provided to the public; or (2) Relinquish to, or otherwise provide, the government rights in excess of these rights customarily provided to the public to use, modify, reproduce, release, perform, display, or disclose commercial computer software or commercial computer software documentation. No additional government requirements beyond those set forth in the EULA shall apply, except to the extent that those terms, rights, or licenses are explicitly required from all providers of commercial computer software pursuant to the FAR and the DFARS and are set forth specifically in

writing elsewhere in the EULA. Keysight shall be under no obligation to update, revise or otherwise modify the Software. With respect to any technical data as defined by FAR 2.101, pursuant to FAR 12.211 and 27.404.2 and DFARS 227.7102, the U.S. government acquires no greater than Limited Rights as defined in FAR 27.401 or DFAR 227.7103-5 (c), as applicable in any technical data.

Safety Notices

CAUTION

A **CAUTION** notice denotes a hazard. It calls attention to an operating procedure, practice, or the like that, if not correctly performed or adhered to, could result in damage to the product or loss of important data. Do not proceed beyond a CAUTION notice until the indicated conditions are fully understood and met.

WARNING

A **WARNING** notice denotes a hazard. It calls attention to an operating procedure, practice, or the like that, if not correctly performed or adhered to, could result in personal injury or death. Do not proceed beyond a WARNING notice until the indicated conditions are fully understood and met.

Table of Contents

Z5623A Option H01

Description	2
Verifying the Shipment	2
General Specifications	3
Power Requirements	3
Electrical and Environmental Requirements	4
Environmental Tests	4
Equipment Heating and Cooling	4
Dimensions and Space Requirements	4
Required Conditions for Accuracy Enhanced Measurement	7
Front and Rear Panel Features	8
Front Panel	8
Port Connection Status LCD	8
Front Panel Ports	8
Line Power Switch	8
Ground Connector	8
Rear Panel	9
GPIB Connector	9
Address Switch	9
Line Module	9
Power Cables	9
Available Fuses	10
System Setup	11
Setting the Test Set Address Switch	12
Operation	13
Commands	13
Reset Command	16
Switch Count Commands	16
Service Information	17
Functional Tests	17
Equipment Required	17
Insertion Loss	18
Functional Test Record	19
Replaceable Parts	21
Troubleshooting	23
Troubleshooting the Power Supply	23
Troubleshooting the Controller Board	23
Troubleshooting the Switches and Switch Driver Board	24
Theory of Operation	26
System Theory	26
A1 Power Supply Theory	27
A2 Front Panel Display Theory	27
A3 Controller Board Theory	27
Safety and Information	28
Introduction	28
Safety Earth Ground	28
Declaration of Conformity	28
Statement of Compliance	28
Before Applying Power	29
Connector Care and Cleaning Precautions	30

Table of Contents

Regulatory Information	31
Instrument Markings	31
Electrical Safety Compliance	32
EMI and EMC Compliance	32
Keysight Support, Services, and Assistance	33
Service and Support Options	33
Contacting Keysight	33
Shipping Your Product to Keysight for Service or Repair	33

Z5623A Option H01

Description

The Z5623A Option H01 Dynamic Accuracy Test Set is designed for use with the PNA and PNA-X Series Network Analyzers.

The Z5623A H01 can measure a receiver's relative power linearity (dynamic accuracy) when used with an E-Series power meter, a thermocouple power sensor, and a test algorithm. The Z5623A H01 was designed for maximum measurement accuracy over a 120 dB dynamic range. The signal's amplification and attenuation is controlled via internal switches and attenuators.

The Z5623A H01 can only be controlled using an external GPIB controller.

NOTE

Where necessary, part numbers will be provided in parentheses after the description of a part for clarification. Example: "Use two Type-N 50 Ω jumper cables (8120-6995)."

Verifying the Shipment

To verify the contents shipped with your product, refer to the "Box Content List" included with the shipment.

Inspect the shipping container. If the container or packing material is damaged, it should be kept until the contents of the shipment have been checked mechanically and electrically. If there is physical damage refer to "[Contacting Keysight](#)" on [page 33](#). Keep the damaged shipping materials (if any) for inspection by the carrier and an Keysight Technologies representative.

Table 1 Z5623A Option H01 Accessories Supplied

Description	Part Number	Qty
Power Cord	See Figure 2 on page 6	1
Rack Mount Kit	5063-9232	1
Front Handle Kit	5063-9226	1
User's and Service Guide	Z5623-90001	1

General Specifications

Specifications for the Z5623A Option H01 Dynamic Accuracy Test Set is characteristic for the System performance of the PNA and Test Set. Actual performance of the system is based on the customers PNA that is used with the test set.

A functional certificate is supplied for the Z5623A Option H01. The Z5623A Option H01 performance is based on external components such as the calibration kit and network analyzer. There are no internal adjustment in the Z5623A Option H01, therefore an annual calibration is not required.

CAUTION

This product has an autoranging line voltage input. Be sure the supply voltage is within the specified range. If the ac line voltage does not fall within these ranges, an autotransformer that provides third wire continuity to earth ground should be used.

Power Requirements

Verify that the required ac power is available at all necessary locations before installing the Test Set to the PNA.

- 100/120/220/240 V (50/60 Hz)
- Air conditioning equipment (or other motor-operated equipment) should not be placed on the same ac line that powers the Test Set.
- The instruments can operate with mains supply voltage fluctuations up to $\pm 10\%$ of the nominal voltage.
- Z5623AH01 maximum power is 40 Watts

CAUTION

This is a Safety Class I Product (provided with a protective earthing ground incorporated in the power cord). The mains plug shall be only be inserted in a socket outlet provided with a protective earth contact. Any interruption of the protective conductor inside or outside of the product is likely to make the product dangerous. Intentional interruption is prohibited

Electrical and Environmental Requirements

Refer to the Z5623A standard documentation for environmental specifications.

- Operating Environment (indoor use)
- Pressure Altitude (Operation)
0 to 3000 meters (~ 10,000 feet)
- The instrument can safely operate in a relative humidity of 80% for temperatures to 31 degrees C, decreasing linearly to 50% relative humidity at 40 degrees C.

Environmental Tests

The Z5623AH01 complies with all applicable safety and regulatory requirements for the intended location of use.

Equipment Heating and Cooling

If necessary, install air conditioning and heating to maintain the ambient temperature within the appropriate range. Air conditioning capacity must be consistent with the rating listed in the PNA and PNA-X standard documentation.

Dimensions and Space Requirements

Standard installation of the Z5623A Option H01 and PNA includes configuration and installation on a customer provided lab bench or table top of adequate size and strength.

Table 2 System Dimensions

Item	Weight
Required Bench Top Dimension:	
Clearance above the bench	89 cm (3.5 in)
Width	425 cm (16.75 in)
Depth	500 cm (19.7 in)
Weight	9 kg (19.85 lb)

CAUTION

Ventilation Requirements: When installing the instrument in a cabinet, the convection into and out of the instrument must not be restricted. The ambient temperature (outside the cabinet) must be less than the maximum operating temperature of the instrument by 4 °C for every 100 watts dissipated in the cabinet. If the total power dissipated in the cabinet is greater than 800 watts, forced convection must be used.

Figure 1 Ventilation Clearance Requirements

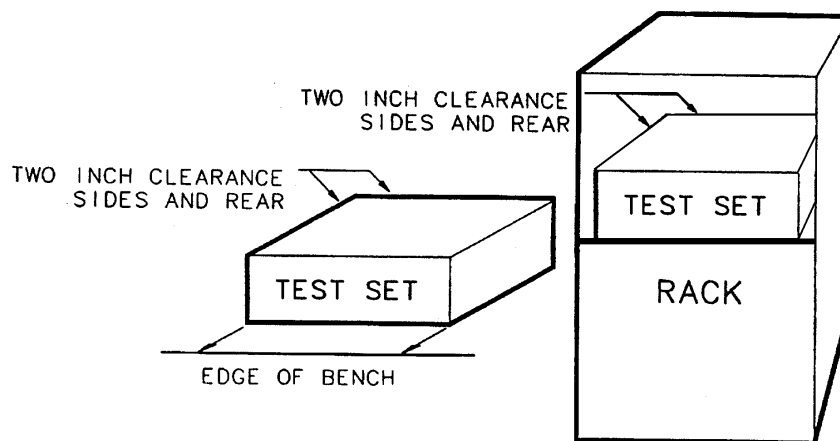
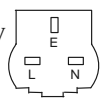
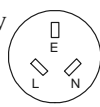
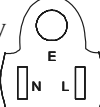
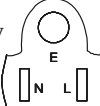
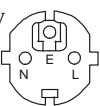
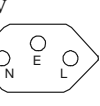

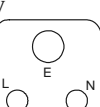



Figure 2 Power Cable and Line (Mains) Plug Part Numbers

Plug Type ^a	Cable Part Number	Plug ^b Description	Length cm (in.)	Cable Color	For Use in Country
250V 	8120-8705	Straight BS 1363A	229 (90)	Mint Gray	Option 900 United Kingdom, Hong Kong, Cyprus, Nigeria, Singapore, Zimbabwe
	8120-8709	90°	229 (90)	Mint Gray	
250V 	8120-1369	Straight AS 3112	210 (79)	Gray	Option 901 Argentina, Australia, New Zealand, Mainland China
	8120-0696	90°	200 (78)	Gray	
125V 	8120-1378	Straight NEMA 5-15P	203 (80)	Jade Gray	Option 903 United States, Canada, Brazil, Colombia, Mexico, Philippines, Saudi Arabia, Taiwan
	8120-1521	90°	203 (80)	Jade Gray	
125V 	8120-4753	Straight NEMA 5-15P	229 (90)	Gray	Option 918 Japan
	8120-4754	90°	229 (90)	Gray	
250V 	8120-1689	Straight CEE 7/VII	200 (78)	Mint Gray	Option 902 Continental Europe, Central African Republic, United Arab Republic
	8120-1692	90°	200 (78)	Mint Gray	
230V 	8120-2104	Straight SEV Type 12	200 (78)	Gray	Option 906 Switzerland
	8120-2296	90°	200 (78)	Gray	
220V 	8120-2956	Straight SR 107-2-D	200 (78)	Gray	Option 912 Denmark
	8120-2957	90°	200 (78)	Gray	
250V 	8120-4211	Straight IEC 83-B1	200 (78)	Mint Gray	Option 917 South Africa, India
	8120-4600	90°	200 (78)	Mint Gray	
250V 	8120-5182	Straight SI 32	200 (78)	Jade Gray	Option 919 Israel
	8120-5181	90°	200 (78)	Jade Gray	

a. E = earth ground, L = line, and N = neutral.
b. Plug identifier numbers describe the plug only. The Agilent Technologies part number is for the complete cable assembly.

Required Conditions for Accuracy Enhanced Measurement

Accuracy-enhanced (error-corrected) measurements require the ambient temperature of the PNA and Test Set to be maintained within ± 1 °C of the ambient temperature at calibration.

Table 3 Performance Characteristics

Parameter	Typical
Frequency Range	1.2 GHz
Insertion Loss ¹	
Source to Power Meter Port	-7.5 dB (\pm 3dB)
Source to Power Meter Port with Amplifier	+9.0 dB (\pm 4dB)
Source to Receiver Port	-7 dB (\pm 3 dB)
Power Meter Port to Source (Amplifier IN selected)	\leq -45 dB
Input Power Damage Level	>1 watt (RF + DC)

1. Attenuator A = 0 dB, Attenuator B = 0 dB, Amplifier OUT

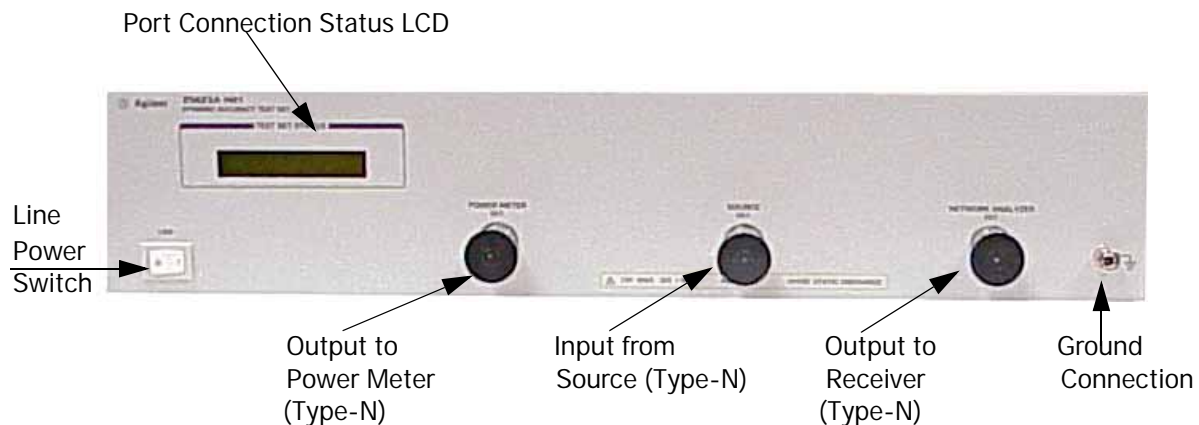
Front and Rear Panel Features

CAUTION

Refer to the standard instrument documentation for damage limits to the ports. Verify that your test setup will not cause those limits to be exceeded.

Front Panel

Figure 3 Front Panel



Port Connection Status LCD

The port connection status LCD provides visual feedback of the settings of the attenuator and the status of the amplifier.

Front Panel Ports


The OUTPUT to POWER METER, INPUT from SOURCE, and the OUTPUT to RECEIVER ports are 50 Ω , Type-N connectors.

CAUTION

Do not input more than 1 watt (RF and DC combined) to the source port, damage to the internal RF switches or the analyzer may occur.

Line Power Switch

The line switch disconnects the mains circuits from the mains supply after the EMI filters and before other parts of the instrument.

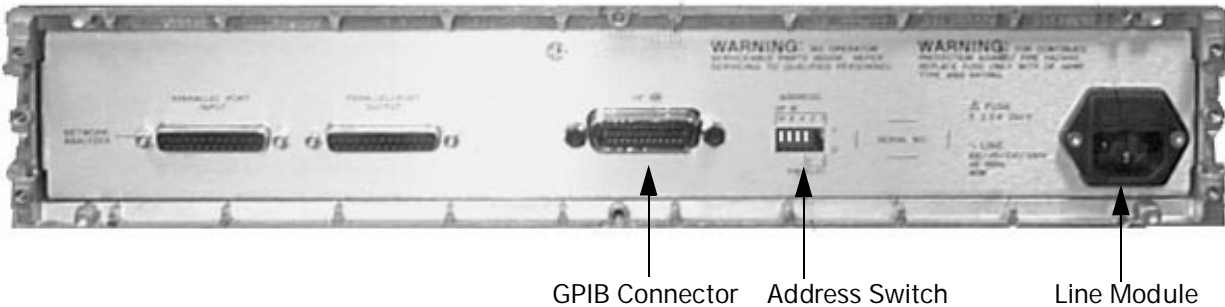
-  – Standby
- 1 – ON (Power LED On)

Ground Connector

The ground connector provides a convenient front panel ground connection for a standard banana plug.

Rear Panel

Figure 4 Rear Panel



GPIB Connector

This connector allows the test set to be connected directly to a controller.

Address Switch

The address switch sets the GPIB address of the test set. See [“Setting the Test Set Address Switch” on page 12](#) for information.

Line Module

The line module contains the power cable receptacle and the line fuse. The line module is an autoranging input and is designed to be used with an ac power source with a nominal voltage of either 115 V or 230 V.

Power Cables

The line power cable is supplied in one of several configurations, depending on the destination of the original shipment.

Each instrument is equipped with a three-wire power cable. When connected to an appropriate ac power receptacle, this cable grounds the instrument chassis. The type of power cable shipped with each instrument is dependent on the country of destination. See [Figure 2 on page 6](#) for the part numbers of these power cables. Cables are available in different lengths. Refer to [“Keysight Support, Services, and Assistance” on page 33](#) for descriptions and part numbers of cables other than those described in [Figure 2](#).

CAUTION

Always use the three-prong AC power cord supplied with this product. Failure to ensure adequate grounding by not using this cord may cause damage to the product.

WARNING

This is a Safety Class I product (provided with a protective earthing ground incorporated in the power cord). The mains plug shall only be inserted into a socket outlet provided with a protective earth contact. Any interruption of the protective conductor, inside or outside the instrument, is likely to make the instrument dangerous. Intentional interruption of the protective cover is prohibited.

Available Fuses

- Fuse (115 V orientation)
(F 3A/250V, 2110-0780)

Figure 5 Line Fuse**CAUTION**

Verify that the premise electrical voltage supply is within the range specified on the instrument.

System Setup

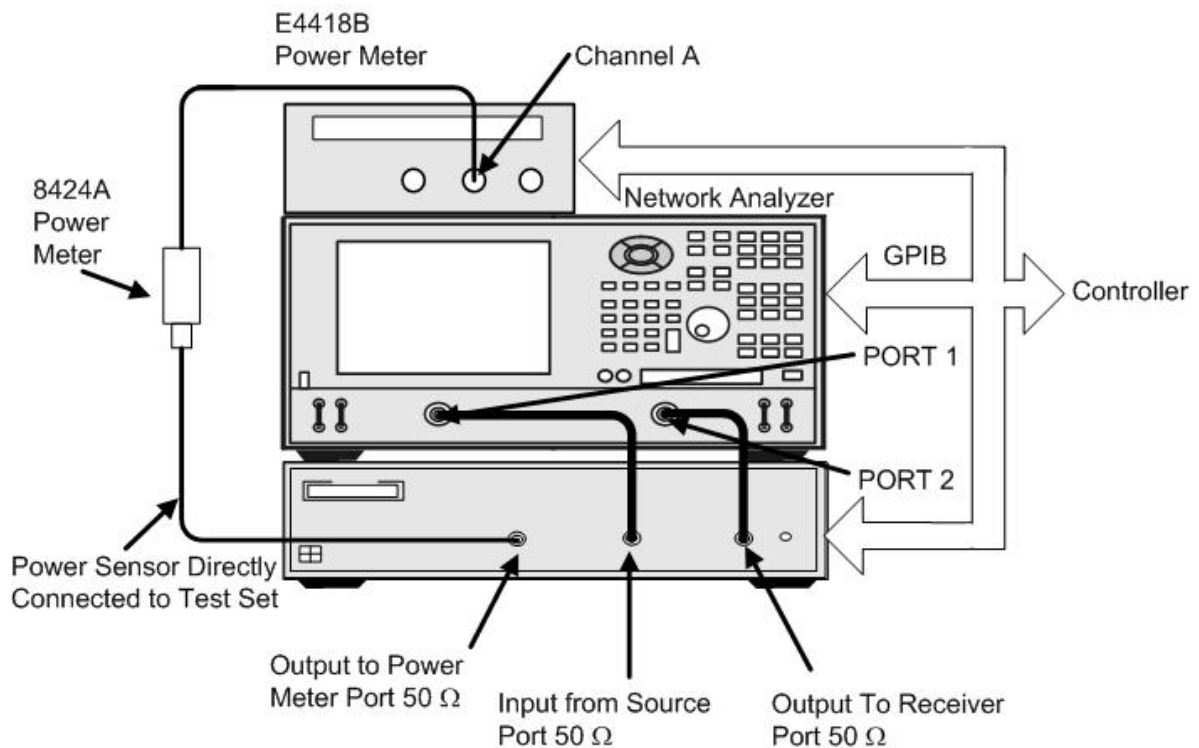
The Z5623A Option H01 Test Set is designed to be placed near the network analyzer on a bench top and connected as shown in [Figure 6](#).

1. Connect a GPIB cable from the controller to the rear panel of the network analyzer. See ["Operation" on page 13](#).
2. After the proper front and rear panel connections have been made, turn on the test set using the front panel line switch. The front panel line switch disconnects the mains circuits from the mains supply after the EMI filters and before other parts of the instrument.

NOTE

For accurate repeatable measurements, be sure to let the test set warm up for at least two hours. For the most stable and accurate measurements, leave the test set turned on at all times. Do not touch the power sensor for at least 30 minutes before making measurements.

Figure 6 Connecting the Test Set to the Network Analyzer

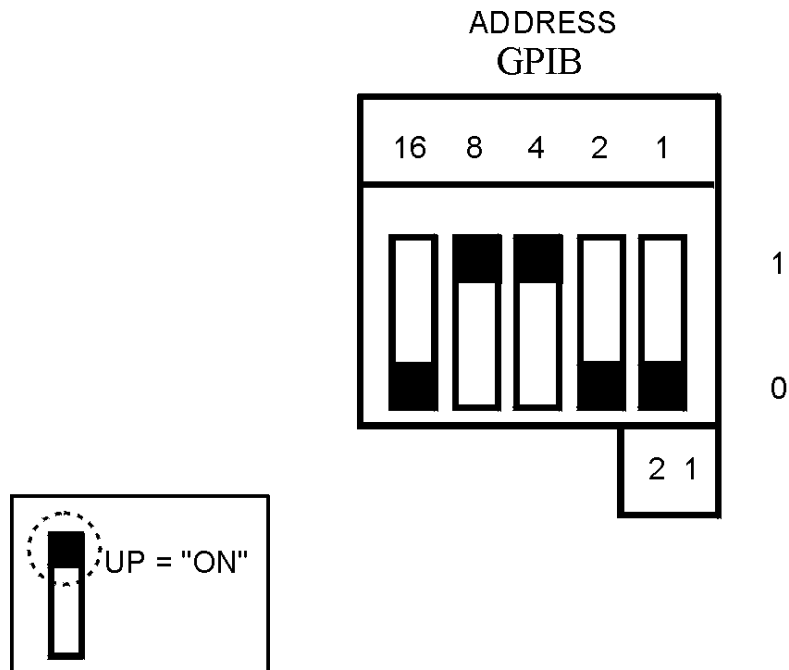


Setting the Test Set Address Switch

The test set is shipped with the GPIB address set to 12, as shown in [Figure 7](#).

To set the GPIB address, set all five switches so that the sum of the switches in the "ON" (or 1) position equals the desired address. In the example below, the two switches in the "ON" position are 8 and 4, thus the GPIB address equals 12.

Figure 7 The Test Set Address Switch



Operation

The Z5623A Option H01 is a “slave” instrument: a controller must be used to control the test set. The controller can control the test set using GPIB commands via the GPIB connector.

Commands

The only way to control the test set is to address the Option H01 test set directly over GPIB using a controller to write directly to the test set's GPIB port. The following example assumes that the address of the test set is 12.

```
OUTPUT 712;"command$"
```

If using Quick Basic or Visual Basic, be sure to disable EOI and EOL before sending commands to the test set. Including the semicolon will not ensure that these commands are disabled as would be the case in HP Basic/RMB. Using the Keysight 82335 GPIB Interface and Visual Basic, the following commands will disable the EOI and EOL, send the necessary data to the test set, and re-enable EOI and EOL. Be sure to re-enable the EOI and EOL before sending data to another instrument.

```
HpibEoi(hHpib;7,0) 'disable EOI  
HpibEol(hHpib;7,"",0) 'disable EOL  
HpibOutput(hHpib;712,chr$([D])) 'send command to test set  
HpibEol(hHpib;7,chr$(13)+chr$(10),2) 're-enable EOL and set  
to'chr$(13)+chr$(10)  
HpibEoi(hHpib;7,1,) 're-enable EOI
```

where hHpib specifies the handle returned by HpibOpen.

For more information on the EOI and EOL commands, refer to the programming library manual supplied with the Keysight 82335 interface.

Figure 8 Controlling the Test Set Over the GPIB

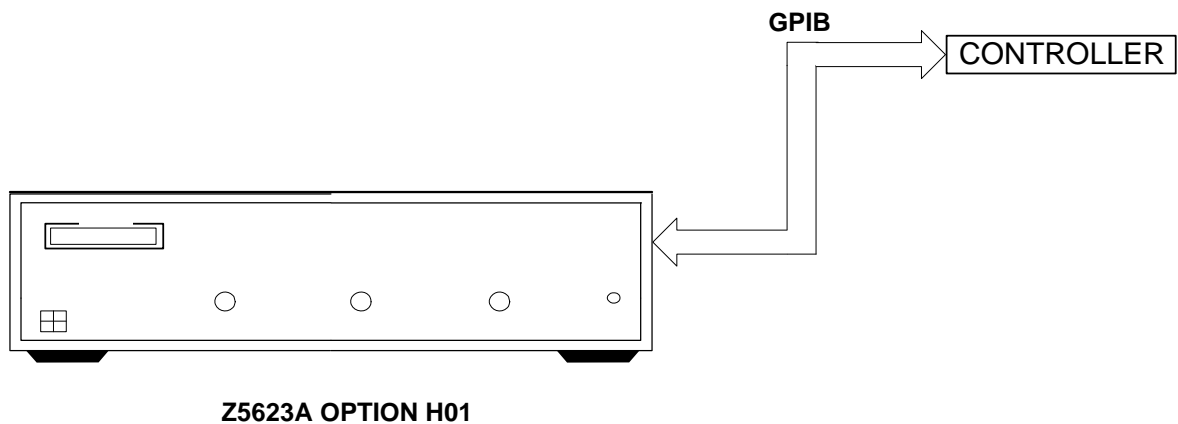


Table 4 Test Port Addresses

Connection Path	GPIB Command
Attenuator A = 0 dB	at_a = 0
Attenuator A = 1 dB	at_a = 1
Attenuator A = 2 dB	at_a = 2
Attenuator A = 3 dB	at_a = 3
Attenuator A = 4 dB	at_a = 4
Attenuator A = 5 dB	at_a = 5
Attenuator A = 6 dB	at_a = 6
Attenuator A = 7 dB	at_a = 7
Attenuator A = 8 dB	at_a = 8
Attenuator A = 9 dB	at_a = 9
Attenuator A = 10 dB	at_a = 10
Attenuator A = 11 dB	at_a = 11
Attenuator B = 0 dB	at_b = 0
Attenuator B = 10 dB	at_b = 10
Attenuator B = 20 dB	at_b = 20
Attenuator B = 30 dB	at_b = 30
Attenuator B = 40 dB	at_b = 40
Attenuator B = 50 dB	at_b = 50
Attenuator B = 60 dB	at_b = 60
Attenuator B = 70 dB	at_b = 70
Attenuator B = 80 dB	at_b = 80
Attenuator B = 90 dB	at_b = 90
Attenuator B = 100 dB	at_b = 100
Attenuator B = 110 dB	at_b = 110
Amplifier IN	amp_in
Amplifier OUT	amp_out
Reset Attenuators 0dB, Amplifier OUT	*rst
Test Set Identification	idn? (no response over GPIB)
Test Set Serial Number	sn?

Table 4 Test Port Addresses

Connection Path	GPIB Command
Filter IN	f_in
Filter OUT	f_out
Isolator IN	i_in
Isolator OUT	i_out
Standard Configuration	standard
Modified Configuration	modified

To identify the test set serial number, send the following commands:

```
OUTPUT 712;"sn?"
ENTER 712;Sn$
DISP Sn$
```

NOTE

The "idn?" command displays the instrument IP on the front panel; it does not respond over the GPIB.

Reset Command

When the Reset command is sent, the test set is set to the default state where the attenuators are set to 0 dB and the amplifier is switched out. (The test set is in the default state at power on).

Switch Count Commands

Refer to the Option H01 block diagram, [Figure 9 on page 24](#) for the switch paths.

To read the individual switch count, send the following command:

```
Output 712;"sw53?"
```

The above example shows the command for switch 53 only. This command returns a value that indicates the number of times the particular switch has been addressed and switched. To enter additional commands, refer to [Table 5](#).

Table 5 Switch Count Commands

Switch Number	GPIB Command
SW50	sw50?
SW51	sw51?
SW53	sw53?
SW54	sw54?
SW55	sw55?
SW56	sw56?
SW57	sw57?
SW74	sw74?
SW75	sw75?
SW76	sw76?
SW77	sw77?

NOTE

Although the attenuator specification for switching and settling time is 20 milliseconds, it is recommended that test software that utilizes this test set allow 100 milliseconds.

Service Information

Functional Tests

Functional testing consists of measuring insertion loss, return loss, and isolation between all ports. For the most accurate measurements, the use of an Keysight PNA Network Analyzer is recommended and its use is assumed in these notes. Familiarity with RF/microwave measurements is also assumed. The use of adapters may be required and their effects should be accounted within the measurements.

Prior to June, 2007 the Z5623A Option H01 had hard specifications, therefore a calibration certificate was available for the test set. The specifications have now been replaced with typical performance characteristics. This change was made because performance specification from the Z5623A H01 are not critical to the network analyzer dynamic accuracy test. The "accuracy" of the test set does not affect the accuracy of the dynamic accuracy test result. Therefore, only a functional test certificate is offered for the Z523A H01 Test Set.

NOTE

The "**Functional Test Record**" on page 19 may be duplicated to record the results of the functional tests.

Equipment Required

- Keysight PNA Series Network Analyzer (or equivalent)
- Test Port Extension Cables and Adapters
- 85032B Calibration Kit (50 W, Type-N or equivalent)

There are no adjustments required for the Keysight Z5623A Option H01 test set.

Set up the network analyzer as follows:

1. Center Frequency = 1.2 GHz
2. Frequency Span = 1.0 GHz

Perform a full two-port calibration at the ends of two cables attached to the two test ports of the network analyzer. (Use a Type-N female-to-female adaptor for the transmission calibration).

Insertion Loss

1. Connect the cable attached to PORT 1 of the network analyzer to the "INPUT FROM SOURCE" port of the test set.
2. Connect the cable from PORT 2 of the network analyzer to the "OUTPUT TO POWER METER" port of the test set.
3. Set up the test set with the attenuators at 0 dB and the amplifier switched out. Execute the following command over GPIB:

```
output712;"*rst;"
```

For complete information on controlling the test set, refer to "Operation" on page 13.

4. Set up the network analyzer to measure S21, Source to Power Meter.
5. Measure the amplitude at 1.2 GHz and record the value in Table 6.
6. Measure the amplitude at 1.1 GHz and record the value.
7. Measure the amplitude at 1.3 GHz and record the value.
8. Set up the test set with the amplifier switched in. Execute the following command over GPIB:

```
output 712;"amp_in;"
```

9. Measure the amplitude at 1.2 GHz and record the value.
10. Set up the network analyzer to measure S12, Power Meter to Source.
11. Measure the amplitude at 1.2 GHz and record the value.
12. Connect PORT 2 of the network analyzer to the "OUTPUT TO RECEIVER" port.
13. Setup the network analyzer to measure S21, Source to Receiver. See Figure 9 on page 24.
14. Set up the test set with the amplifier switched out. Execute the following command over GPIB:

```
output 712;"amp_out;"
```

15. Measure the amplitude at 1.2 GHz and record the value in Table 6 on page 20.
16. Step through all of the 11 dB attenuator steps and 110 dB attenuator steps using the commands listed in Table 5 on page 16. Verify that all steps are functioning correctly.

Functional Test Record

The following pages are designed to be duplicated and used as a template for the performance tests.

Test Facility_____	Report Number_____		
_____	Date_____		
_____	Date of Last System Calibration_____		
Tested by_____	Customer_____		
Model_____	Serial Number_____		
Ambient Temperature_____°C	Relative Humidity_____%		
Test Equipment Used	Model Number	Trace Number	Cal Due Date
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
Special Notes:_____			

Table 6 Z5623A Option H01 Insertion Loss Test Record

Test Description	Port	Typical	Measured Results
Insertion Loss w/o amplifier 1.2 GHz 1.1 GHz 1.3 GHz	INPUT from SOURCE Port to OUTPUT to Power Meter Port	$-7.5 (\pm 3 \text{ dB})$ $\leq -17 \text{ dB}$ $\leq -17 \text{ dB}$	_____ _____ _____
Insertion Loss w/ amplifier 1.2 GHz	INPUT from SOURCE Port to OUTPUT to Power Meter Port	$+9.0 (\pm 4 \text{ dB})$	_____
Insertion Loss w/ amplifier 1.2 GHz	OUTPUT to Power Meter Port to INPUT from SOURCE Port	$\leq 45 \text{ dB}$	_____
Insertion Loss w/o amplifier 1.2 GHz	INPUT from SOURCE Port to OUTPUT to RECEIVER Port	$-7.0 (\pm 3 \text{ dB})$	_____

Replaceable Parts

The following table contains the list of replaceable parts for the Keysight Z5623A Option H01 Dynamic Accuracy Test Set. If any of these parts or assemblies are replaced, you must run all performance tests to verify conformance to specifications.

NOTE

Special options are built to order, long lead times may be encountered when ordering replacement parts.

Table 7 Replaceable Parts

Replacement Part	Part Number	Qty
Isolator 1.19 to 1.21 GHz	0955-1322	1
Amplifier .02 to 4.0 GHz	0955-1323	1
Filter BP 1.2 GHz	0955-1324	1
Power Supply, 110 W	0950-2252	1
Adapter SMA (m)-SMA (m)	1250-1159	2
Fuse, daughter board	2110-0518	1
Fuse, 3A 250V (f), ac line module	2110-0780	2
Power Splitter	5086-7408	1
LCD Display Cable	8120-8794	1
Front Panel Display	08720-60193	1
Switch, 4 Port (SMA) 24 V	33312-60004	3
Attenuator Programmable 11 dB	33320-60005	1
Attenuator Programmable 110 dB	33322-60010	1
Connector Assembly, Type-N	86290-60005	3
Wire Harness, 04c, 0.3m, 13f-06f	87050-60021	1
Wire Harness, 04c, 0.13m, 04f-04f	87050-60022	1
Wire Harness, 40c, 0.09m, 40f-40f	87050-60023	2
Fan Assembly 5 cfm	87050-60027	1
AC PS Cable	87050-60112	1
Daughter Control Board	87050-60324	1
Board Assembly Interim	87050-63149	1
Cable Assembly AC Line	N5260-60015	1
RF Cable SW-2/8494	Z5623-20005	1

Table 7 Replaceable Parts (Continued)

RF Cable NA PT8496	Z5623-20006	1
RF Cable WS-4/A IN	Z5623-20007	1
RF Cable SW-1/AMOUT	Z5623-20008	1
RF Cable Semi-rigid	Z5623-20681	1
RF Cable Semi-rigid	Z5623-20682	1
RF Cable Semi-rigid	Z5623-20683	1
RF Cable Semi-rigid	Z5623-20684	1
RF Cable Semi-rigid	Z5623-20685	1
RF Cable Semi-rigid	Z5623-20686	1
RF Cable Semi-rigid	Z5623-20687	1
RF Cable Semi-rigid	Z5623-20688	1
RF Cable SW-2/8494	Z5623-20005	1
RF Cable NA PT8496	Z5623-20006	1
RF Cable WS-4/A IN	Z5623-20007	1
RF Cable SW-1/AMOUT	Z5623-20008	1
Cable Assembly AMP, H01	Z5623-60003	1
Cable Assembly SW, H01	Z5623-60004	3
Cable Ribbon ATTN, H01	Z5623-60005	2
Program Flash	Z5623-80001	1

NOTE

Before replacing an assembly or board, inspect the assembly for obvious, easily repaired defects such as bent pins on ICs or cold solder joints.

Troubleshooting

This section contains information on troubleshooting the test set to the assembly level only. By following these procedures, you may determine if the power supply, front panel, or main switch board needs replacing. Refer to [Figure 9, "Z5623A Option H01 Standard Block Diagram,"](#) as an aid in troubleshooting.

The theory of operation information can be found beginning on [page 26](#).

WARNING

Always turn the instrument power off before removing or installing an assembly.

NOTE

If you need to disassemble the instrument, be sure to work at an antistatic workstation and use a grounded wrist strap to prevent damage from electrostatic discharge (ESD).

Troubleshooting the Power Supply

Turn on the instrument. Verify the condition of the LCD on the front panel:

1. If the LCD is off, check the main fuse located in the line module at the rear of the instrument. Refer to [Figure 5 on page 10](#).
2. If the fuse is in working order and the LCD is still off, check the cable and connections between the main board and front panel board.
3. If the cable and connections are working and the LCD is still off, there is still a possibility that the power supply is not supplying the necessary +24 V, +12 V, and +5 V to the main board.

Disconnect the DC power cable from the power supply to the main switch board and measure the voltages. They should be +24 V, +12 V, and +5 V. If not, replace the power supply.

Troubleshooting the Controller Board

Turn on the instrument and verify the following:

1. Check the LCD display for the model/option and revision information; if there is no backlite or horizontal/vertical lines are missing, verify that the power supply is working properly, if so replace the LCD display.
2. If there is no information or the information is scrambled, replace the controller board.
3. Verify the switching paths by issuing commands to switch each of the paths. Ensure that the LCD indicates the appropriate path.

Troubleshooting the Switches and Switch Driver Board

Turn the instrument power on. Verify the condition of each of the switching paths by issuing commands to switch each of the paths. Verify each of the RF paths connections. If an RF path is not connected to the necessary port or terminated in 50 Ω . Check for proper bias voltages on the switch. If the voltages are correct replace the switch. If the voltages are not correct, replace the switch driver (daughter) board.

Refer to **Figure 9** for a block diagram of the major components and the switching paths of the Keysight Z5623A Option H01.

Figure 9 Z5623A Option H01 Standard Block Diagram

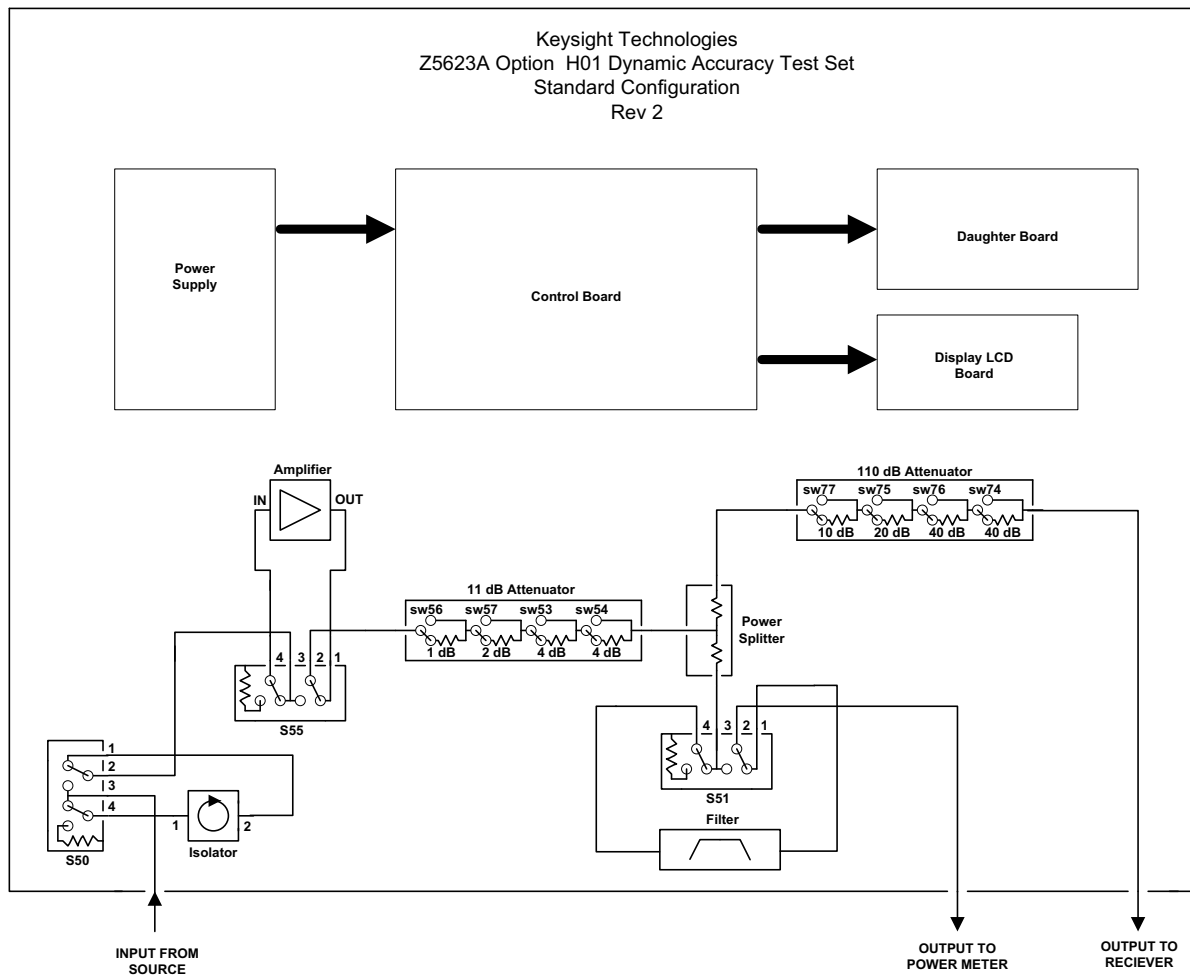
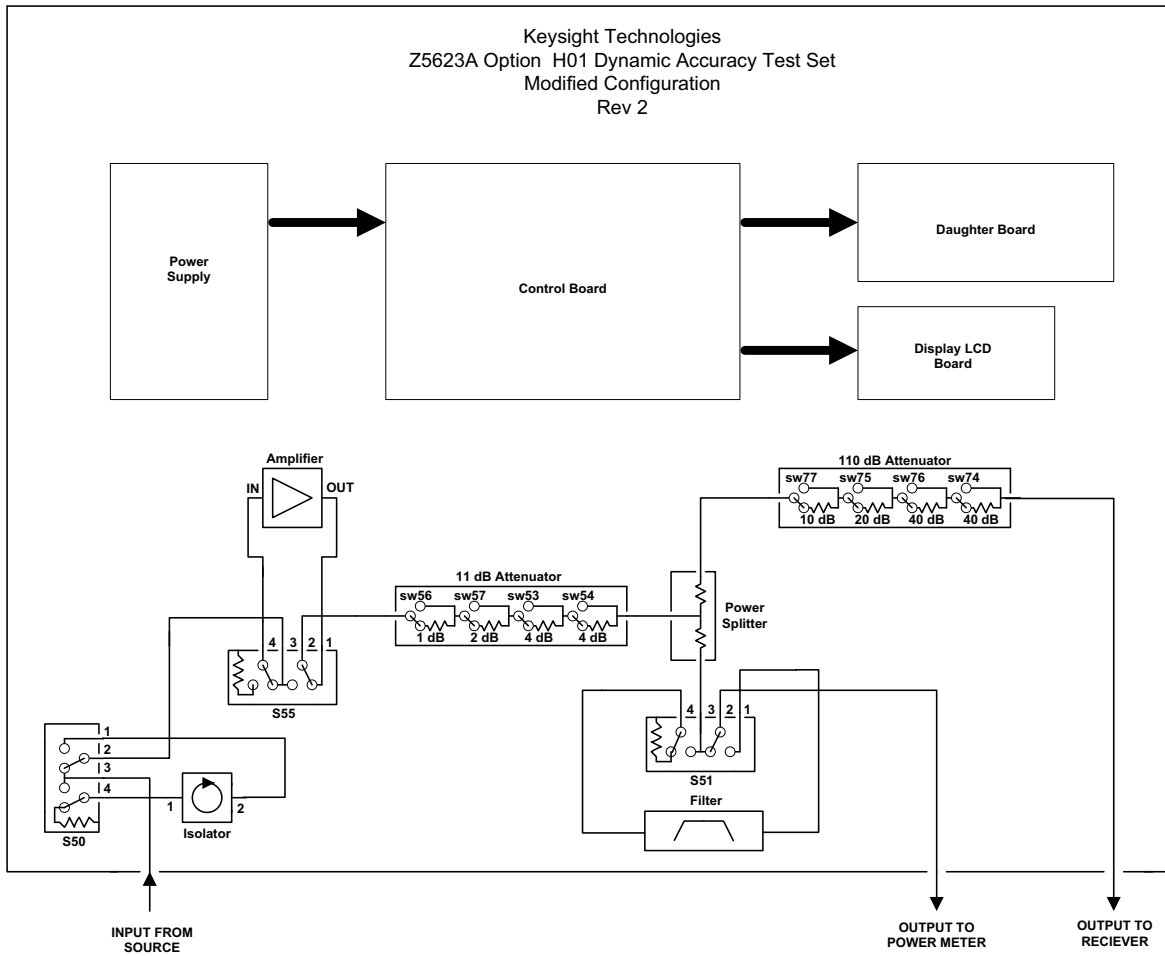


Figure 10 Z5623A Option H01 Modified Block Diagram



Theory of Operation

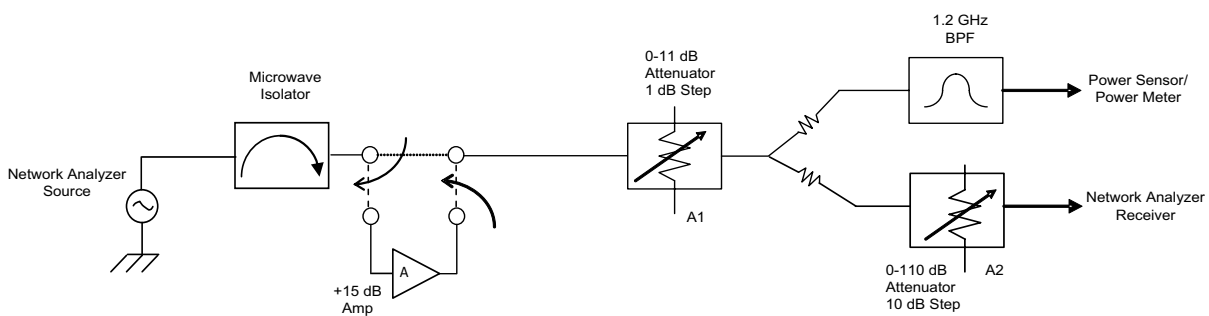
The theory of operation begins with a general description of the Keysight Z5623A Option H01 Dynamic Accuracy Test Set. This is followed by more detailed operating theory. The operation of each group is described briefly, to the assembly level only. Detailed component level circuit theory is not provided.

System Theory

The test set consists of three main components: a power supply, a front panel display, and a controller interface mother board. The purpose of the power supply is to provide power to both the front panel display and the main switch board. The front panel display serves to indicate the switching paths to the user. Finally, the controller interface mother board does the actual switching between the different ports.

The Z5623A Option H01 Dynamic Accuracy Test Set is used to measure the dynamic accuracy of a network analyzer's receiver. **Figure 11** shows a simplified block diagram of the test set.

Figure 11 Simplified Block Diagram



The Z5623A Option H01 was designed to allow a power meter to be used as the linearity reference. The power splitter and attenuators A1 and A2 are used in conjunction to vary the power to the receiver by 120 dB while the power delivered to the power meter stays within a 10 dB range.

Attenuators A1 and A2 work as follows: assume the source is set to approximately +7 dBm (to account for the insertion loss through the signal path). With the source power set, the power meter measures 0 dBm.

As the dynamic accuracy test progresses, A1 is stepped from 0 to 10 dB. When the 1 dB step attenuator (A1) reaches 10 dB, the power meter is at -10 dBm which is at the limit predefined for the sensor. At this point, attenuator A2 is increased by 10 dB and A1 is decreased 10 dB (set back to 0). The power meter again reads 0 dBm while the power delivered to the network analyzer remains the same. This progression is repeated until A2 is set to maximum attenuation of 110 dB.

It is necessary to eliminate the step size error and the mismatch error between the receiver and the test set whenever A2 switches. This is done using an attenuator correction measurement embedded into the measurement algorithm. The source power of the network analyzer is adjusted until the receiver reads the same power before and after the attenuators are changed. The difference in source power is recorded and used within the measurement algorithm.

NOTE

The power sensor used by the power meter must be a thermocouple type sensor. The linearity uncertainty error associated with the thermocouple power sensors is much lower than the uncertainty error of the diode based power sensors.

CAUTION

It is mandatory to leave the power sensor untouched for a minimum of 30 minutes to allow the sensor to stabilize. This test is sensitive to heating of the power sensor caused by handling.

A1 Power Supply Theory

The switching power supply provides regulated DC voltages to power all assemblies in the test set. A DC cable provides power to the main switch board. A connector from the main switch board to the front panel display provides DC power and control signals to the front panel. The power supply provides the following supplies: +24 V, +12 V, and +5 V.

A2 Front Panel Display Theory

The front panel display consists of an LCD. The LCD is divided into two lines. The top line indicates the attenuator settings. The bottom line indicates the status of the amplifier. Control signals and DC power are provided by a cable connected to the controller board.

A3 Controller Board Theory

The controller and daughter boards provide the bias for the switching paths. Refer to the block diagram, [Figure 9 on page 24](#).

Safety and Information

Introduction

Review this product and related documentation to familiarize yourself with safety markings and instructions before you operate the instrument.

This product has been designed and tested in accordance with accepted industry standards, and has been supplied in a safe condition. The documentation contains information and warnings that must be followed by the user to ensure safe operation and to maintain the product in a safe condition.

Safety Earth Ground

WARNING

This is a Safety Class I Product (provided with a protective earthing ground incorporated in the power cord). The mains plug shall only be inserted in a socket outlet provided with a protective earth contact. Any interruption of the protective conductor inside or outside of the product is likely to make the product dangerous. Intentional interruption is prohibited.

CAUTION

Always use the three prong AC power cord supplied with this product. Failure to ensure adequate earth grounding by not using this cord may cause product damage and the risk of electrical shock.

Declaration of Conformity

A copy of the Declaration of Conformity is available upon request, or a copy is available on the Keysight Technologies web site at <http://regulations.keysight.com/DoC.htm>

Statement of Compliance

This product has been designed and tested in accordance with accepted industry standards, and has been supplied in a safe condition. The documentation contains information and warnings that must be followed by the user to ensure safe operation and to maintain the product in a safe condition.

Before Applying Power

Verify that the premises electrical supply is within the range of the instrument. The instrument has an autoranging power supply.

WARNING

If this product is not used as specified, the protection provided by the equipment could be impaired. This product must be used in a normal condition (in which all means for protection are intact) only.

CAUTION

The Mains wiring and connectors shall be compatible with the connector used in the premise electrical system. Failure, to ensure adequate earth grounding by not using the correct components may cause product damage, and serious injury.

CAUTION

Always use the three prong AC power cord supplied with this product. Failure to ensure adequate earth grounding by not using this cord may cause product damage and the risk of electrical shock.

CAUTION

This product is designed for use in Installation Category II and Pollution Degree.

CAUTION

Before switching on this instrument, make sure the supply voltage is in the specified range.

CAUTION

Verify that the premise electrical voltage supply is within the range specified on the instrument.

CAUTION

Ventilation Requirements: When installing the instrument in a cabinet, the convection into and out of the instrument must not be restricted. The ambient temperature (outside the cabinet) must be less than the maximum operating temperature of the instrument by 4 °C for every 100 watts dissipated in the cabinet. If the total power dissipated in the cabinet is greater than 800 watts, forced convection must be used.

WARNING

Danger of explosion if battery is incorrectly replaced. Replace only with the same or equivalent type recommended. Discard used batteries according to manufacturer's instructions.

WARNING

For continued protection against fire hazard replace line fuse only with same type and rating. The use of other fuses or material is prohibited.

WARNING

These servicing instructions are for use by qualified personnel only. To avoid electrical shock, do not perform any servicing unless you are qualified to do so.

WARNING

The opening of covers or removal of parts is likely to expose the user to dangerous voltages. Disconnect the instrument from all voltage sources before opening.

WARNING

No operator serviceable parts inside. Refer servicing to qualified personnel. To prevent electrical shock, do not remove covers.

WARNING

The detachable power cord is the instrument disconnecting device. It disconnects the mains circuits from the mains supply before other parts of the instrument. The front panel switch is only a standby switch and is not a LINE switch (disconnecting device).

Connector Care and Cleaning Precautions

Remove the power cord to the instrument. To clean the connectors use alcohol in a well ventilated area. Allow all residual alcohol moisture to evaporate, and fumes to dissipate prior to energizing the instrument.

WARNING

To prevent electrical shock, disconnect the **Z5623A Option H01** from mains electrical supply before cleaning. Use a dry cloth or one slightly dampened with water to clean the external case parts. Do not attempt to clean internally.

WARNING

If flammable cleaning materials are used, the material shall not be stored, or left open in the area of the equipment. Adequate ventilation shall be assured to prevent the combustion of fumes, or vapors.

Regulatory Information

This section contains information that is required by various government regulatory agencies.

Instrument Markings



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



The AC symbol indicates the required nature of the line module input power.



This symbol indicates separate collection for electrical and electronic equipment, mandated under EU law as of August 13, 2005. All electric and electronic equipment are required to be separated from normal waste for disposal (Reference WEEE Directive, 2002/96/EC).



This symbol indicates that the power line switch is ON.



This symbol indicates that the power line switch is in the STANDBY position.



This symbol indicates that the power line switch is in the OFF position.



This symbol is used to identify a terminal which is internally connected to the product frame or chassis.



The CSA mark is a registered trademark of the CSA International.



This mark designates the product is an Industrial Scientific and Medical Group 1 Class A product (reference CISPR 11, Clause 5)



This is a marking to indicate product compliance with the Canadian Interference-Causing Equipment Standard (ICES-001).



Direct Current.



The instrument has been designed to meet the requirements of IP 2 0 for ingress and operational environment.



The RCM mark is a registered trademark of the Australian Communications and Media Authority



Indicates the time period during which no hazardous or toxic substance elements are expected to leak or deteriorate during normal use. Forty years is the expected useful life of the product.



This symbol on all primary and secondary packaging indicates compliance to China standard GB 18455-2001.



South Korean Certification (KC) mark; includes the marking's identifier code which follows the format: MSIP-REM-YYY-ZZZZZZZZZZZZZZ.

Electrical Safety Compliance

SAFETY

Complies with European Low Voltage Directive 2014/35/EU

- IEC/EN 61010-1:2010, 3rd Edition
- Canada: CSA C22.2 No. 61010-1-12
- USA: UL std no. 61010-1, 3rd Edition
- Acoustic statement (European Machinery Directive 2022/42/EC, 1.7.4.2U)
 Accoustical noise emission
 LpA<70 dB
 Operator position
 Normal operation mode
 Per ISO 7779

EMI and EMC Compliance

EMC

Complies with European EMC Directive 2014/30/EU

- IEC 61326-1:2012/EN 61326-1:2013
- CISPR Pub 11 Group 1, class A
- AS/NZS CISPR 11:2011
- ICES/NMB-001
 This ISM device complies with Canadian ICES-001.
 Cet appareil ISM est conforme a la norme NMB du Canada.
- South Korean Class A EMC declaration: This equipment is Class A suitable for professional use and is for use in electromagnetic environments outside of the home.

A () (A)
 , 가 .

Keysight Support, Services, and Assistance

Service and Support Options

There are many other repair and calibration options available from the Keysight Technologies support organization. These options cover a range of service agreements with varying response times. Contact Keysight for additional information on available service agreements for this product.

Contacting Keysight

Assistance with test and measurement needs, and information on finding a local Keysight office are available on the Internet at:

<http://www.keysight.com/find/assist>

You can also purchase accessories or documentation items on the Internet at:

<http://www.keysight.com/find>

If you do not have access to the Internet, contact your field engineer.

NOTE

In any correspondence or telephone conversation, refer to the Keysight product by its model number and full serial number. With this information, the Keysight representative can determine the warranty status of your unit.

Shipping Your Product to Keysight for Service or Repair

IMPORTANT Keysight Technologies reserves the right to reformat or replace the internal hard disk drive in your analyzer as part of its repair. This will erase all user information stored on the hard disk. It is imperative, therefore, that you make a backup copy of your critical test data located on the analyzer's hard disk before shipping it to Keysight for repair.

If you wish to send your instrument to Keysight Technologies for service or repair:

- Include a complete description of the service requested or of the failure and a description of any failed test and any error message.
- Remove and retain the front handles and all rack mount hardware. The analyzer should be sent to Keysight in the same configuration as it was originally shipped.
- Remove and retain the front handles and all rack mount hardware. The analyzer should be sent to Keysight in the same configuration as it was originally shipped.
- Contact Keysight for instructions on where to ship your analyzer.

This information is subject to change without notice. © Keysight Technologies 2002-2014, 2017
Edition 3, June 2017
Supersedes: January 2015



Z5623-90001
www.keysight.com