Agilent Technologies
Z5623A Option H46

Multiport Test Set

User's and Service Guide

Agilent Technologies

Agilent Technologies Part Number: Z5623-90014
Printed in USA February 2006

Notices

Restricted Rights Legend

Warranty

Agilent Technologies, Inc.

1212 Valley House Drive

Rohnert Park, CA 94928-4999, U.S.A.

Contents

5. Specifications

6. Service

Contents

7. Safety and Regulatory Information

1 Agilent Technologies Z5623A Option H46

The Agilent Z5623A Option H46 Multiport Test Set is designed for use with 50 Ω Network Analyzers such as the Agilent E8356A, E8357A, and E8358A.

The test set provides single connection, multiple measurements of multiport devices with up to six ports, such as distribution amplifiers, taps, switches and couplers. Throughput is increased by reducing the number of device reconnects the operator must perform. Switching is performed with solid-state switches.

The test set can be controlled by using a PNA Series analyzer or an external GPIB controller.

NOTE This User's and Service Guide documents the use of the test set with an Agilent E8358A only.

What You Will Find In This Chapter

This chapter contains the following sections:

- Checking the Shipment
- Meeting Electrical and Environmental Requirements

Checking the Shipment

After the test set has been unpacked, keep the original packaging materials so they can be used if you need to transport the instrument.

Check the items received against Table 1-1 to make sure that you have received everything.

Inspect the test set and all accessories for any signs of damage that may have occurred during shipment. If your test set or any accessories appear to be damaged or missing, call your nearest Agilent Technologies. Refer to "Contacting Agilent" on page 7-6.

Table 1-1 Z5623A Option H46 Accessories Supplied

Description	Agilent Part Number	Quantity
Power Cord	See Figure 1-2 on page 1-6	1
Front Handle Kit	5063-9226	1
Rack Mount Kit	5063-9232	1
RF Cable	8120-4782	2
GPIB Cable .5M	HP 10833D	1
User's and Service Guide	Z5623-90014	1

Meeting Electrical and Environmental Requirements

1. The line power module on your test set is an autoranging input. It is designed to be used with an ac power source with a nominal voltage of either 115 V or 230 V.
2. Ensure that the available ac power source meets the following requirements:
   - 90 to 250 Vac
   - 48 to 66 Hz
   - 40 Watts

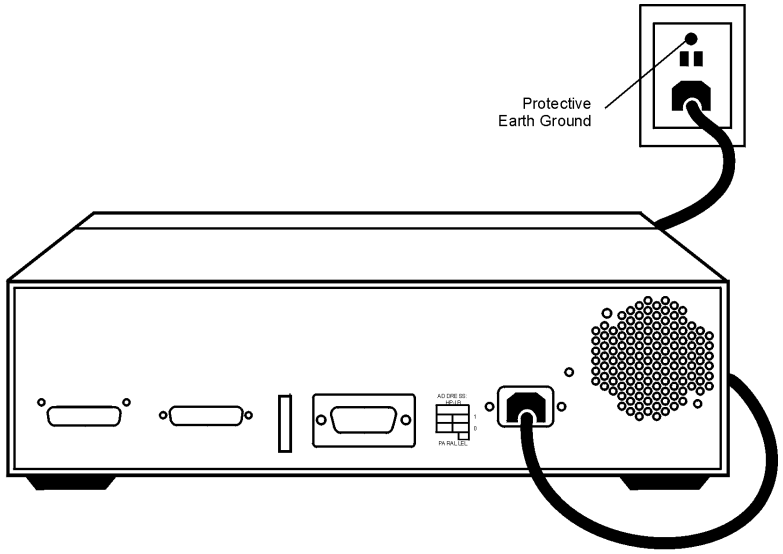
CAUTION This product has an autoranging line voltage input. Be sure the supply voltage is within the specified range. If the ac line voltage does not fall within these ranges, an autotransformer that provides third wire continuity to earth ground should be used.

3. Ensure that the operating environment meets the following safety requirements for
   - indoor use
   - altitude up to 15,000 feet (4,572 meters)
   - temperature range of 0 °C to 55 °C
   - maximum relative humidity: 80% for temperatures up to 31 °C, decreasing linearly to 50% relative humidity
   - enclosure protection, IP 20, according to IEC 529

CAUTION This product is designed for use in INSTALLATION CATEGORY II, and POLLUTION DEGREE 2, per IEC 101 and 664 respectively.

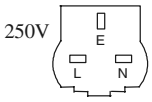
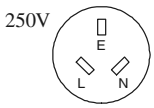
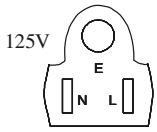
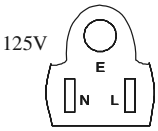
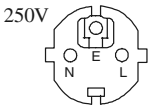
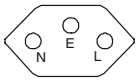
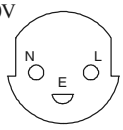
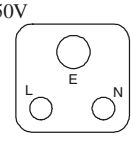
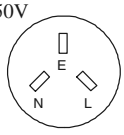
4. Verify that the power cable is not damaged, and that the power source outlet provides a protective earth ground contact. Note that the Figure 1-1 depicts only one type of power source outlet. Refer to Figure 1-2 on page 1-6 to see the different types of power cord plugs that can be used with your test set.

Figure 1-1 Protective 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 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 conductor is prohibited.**

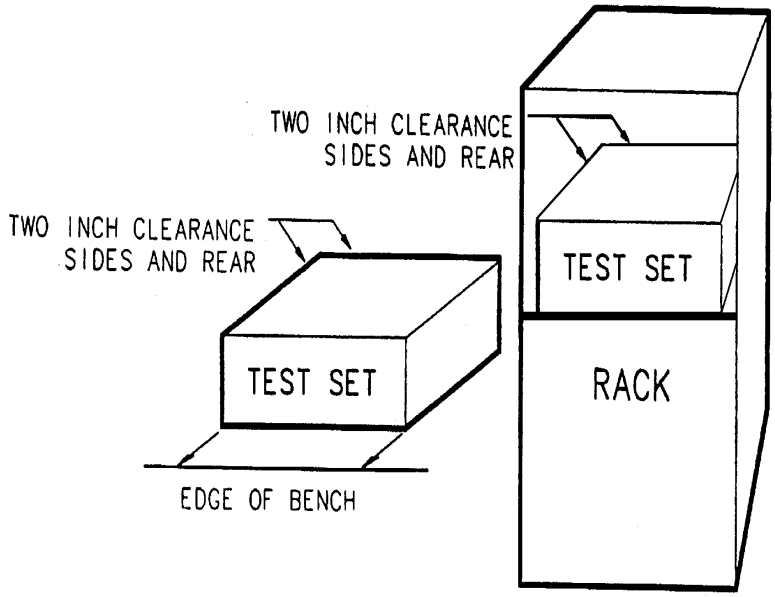
Figure 1-2 Power Cables

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

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.

5. If you are installing the test set into a cabinet, ensure there are at least two inches of clearance around the sides and back of the test set and the system cabinet. See Figure 1-3. The convection into and out of the test set must not be restricted. The ambient temperature (outside the cabinet) must be less than the maximum operating temperature of the test set by 4 °C for every 100 watts dissipated in the cabinet.

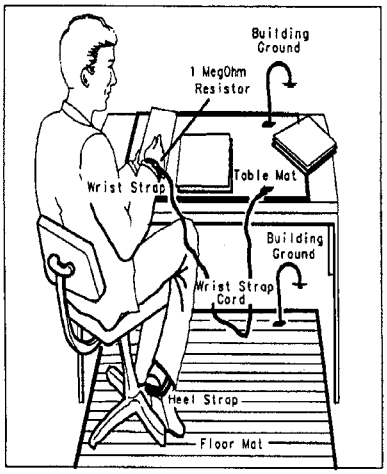
Figure 1-3 Ventilation Clearance Requirements



CAUTION If the total power dissipated in the cabinet is greater than 800 watts, forced convection must be used.

6. Set up a static safe workstation. Electrostatic discharge (ESD) can damage or destroy components (refer to Figure 1-4).

Figure 1-4 Example of an Antistatic Workstation



- Table mat with earth ground wire, 9300-0797
- Wrist strap cord with 1 Meg Ohm resistor, 9300-0980
- Wrist strap, 9300-1367
- Heel Straps, 9300-1308
- Floor mat, part number 1864R

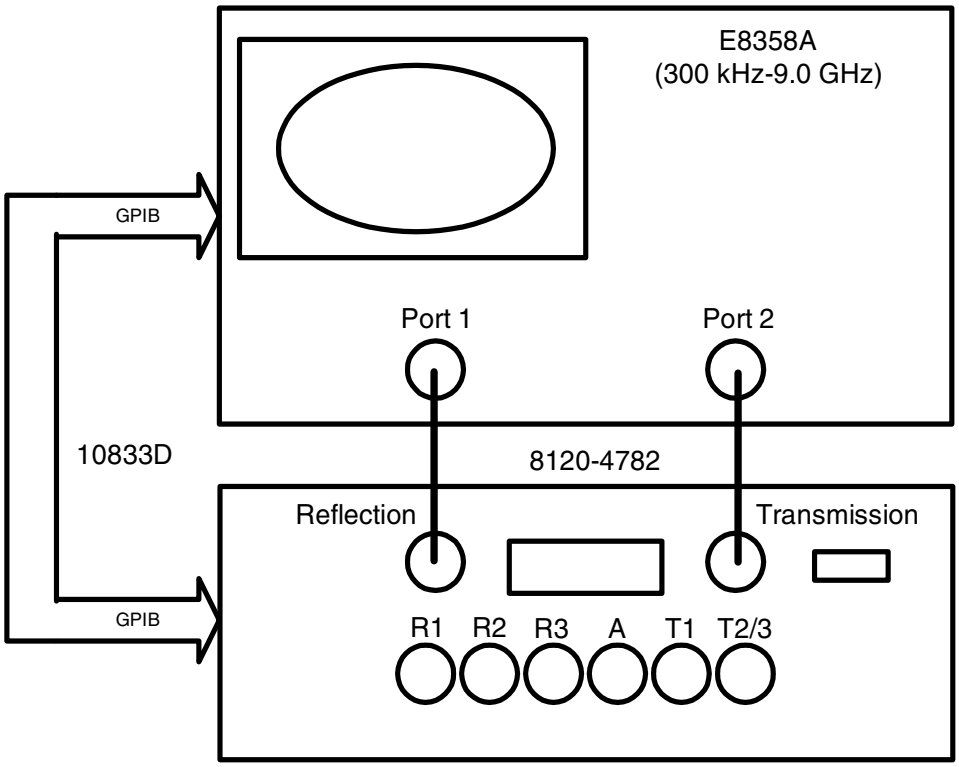
2 Installation and Calibration

Getting Started

Connecting and Turning on the Test Set

The test set is designed to be placed underneath the network analyzer in a rack system and connected to it as shown in Figure 2-1. Use the two Type-N 50 Ω jumper cables, part number 8120-4782, that were shipped with the test set. See Table 1-1 on page 1-3.

Figure 2-1 Connecting the Test Set to the Network Analyzer



After all the proper connections have been made, turn on the test set using the front panel line switch. (Refer to Figure 4-1 on page 4-2.)

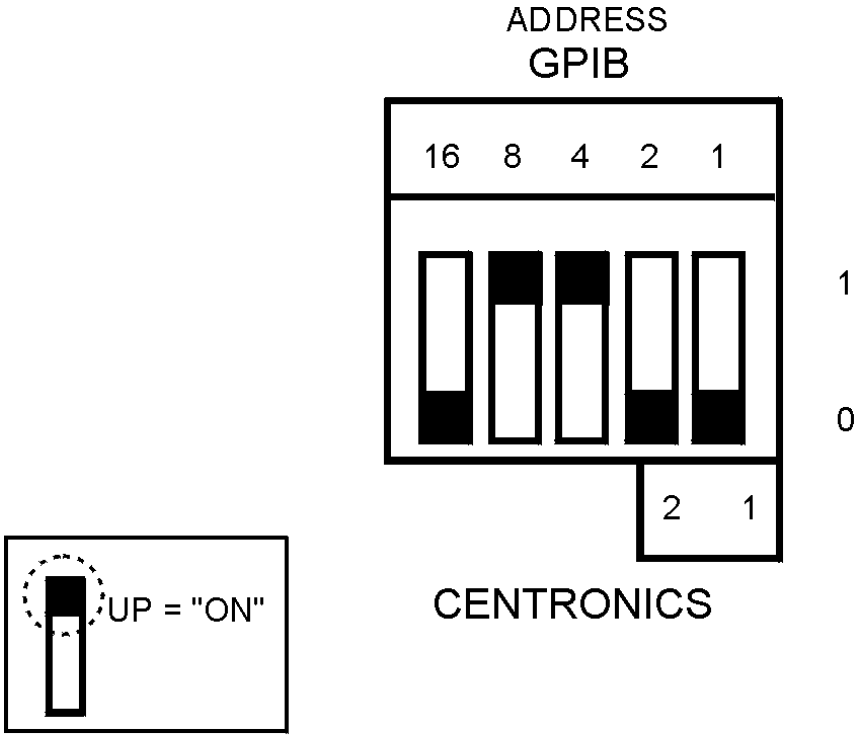
NOTE For accurate repeatable measurements, be sure to let the test set warm up for at least 2 hours. It is recommended that the test set not be turned off on a regular basis. For the most stable and accurate measurements, leave the test set turned on at all times.

Setting the Test Set Address Switch

The test set is shipped with the GPIB address set to 12 as in Figure 2-2. Refer to Chapter 3 “Controlling the Test Set and Making Measurements” .

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

Figure 2-2 The Test Set Address Switch



Performing the Operator's Check

For information on how to control the test set, see Chapter 3.

Description

The following operator's check is designed to provide you with a high degree of confidence that your test set is working properly. It is not designed to verify specifications. To verify specifications, see Chapter 6.

Procedure

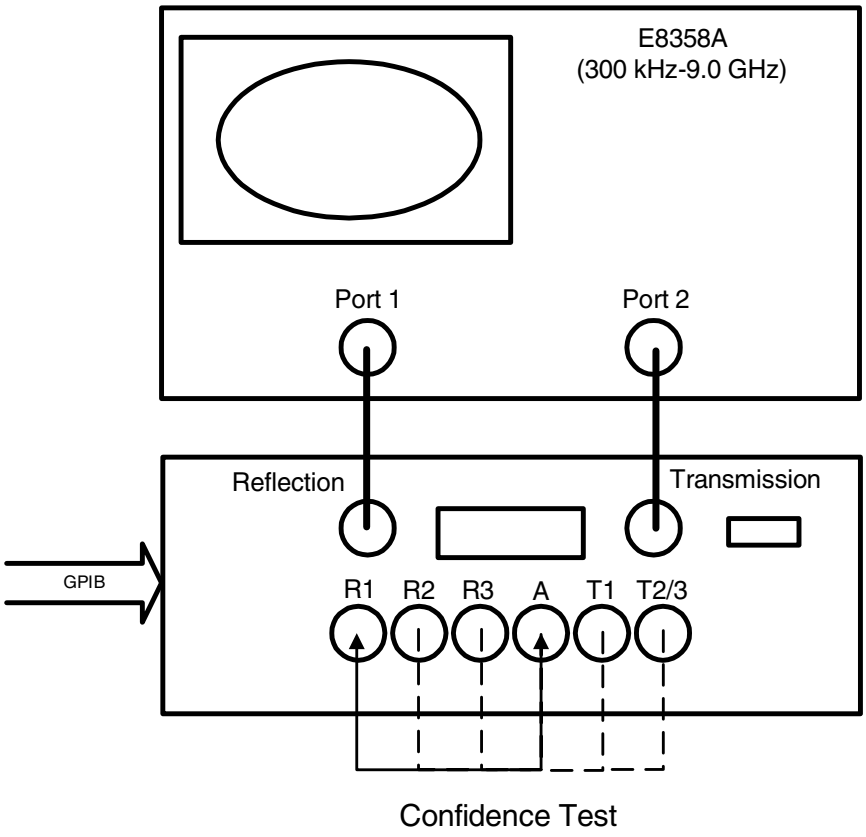
This procedure is for performing a simple operator's check using a network analyzer of the proper frequency range and impedance.

Equipment Required

- Performance Network Analyzer Series, 50 Ω impedance (Agilent E8358A)
- "MANUAL" procedure. See "Manual Control Procedure Using the PNA Series Analyzer" in Chapter 3.
- RF Jumper Cables, 50 Ω Type-N (part number 8120-4782 supplied)
- Cable, 50 Ω Type-N (part number 8120-4781 or equivalent)
- Cable, GPIB (part number HP 10833D supplied)
- Calibration Kit, 50 Ω (part number 85032B)

Process

Figure 2-3 Confidence Test Setup



Step 1. Connect the GPIB cable to the rear panel GPIB connectors on the PNA Series Network Analyzer to the Z5623A Option H46 Multiport Test Set.

Step 2. Connect Port 1 to the Reflection Port and Port 2 to the Transmission Port as shown in Figure 2-3, "Confidence Test Setup."

Step 3. Set up the network analyzer to measure the S_{21} parameter. For more information, refer to the *PNA Series Network Analyzers User Guide,* part number E8356-90001.

Step 4. Connect the RF Cable 8120-4781 between Ports R1 and A on the Z5623A Option H46.

Step 5. Using the "MANUAL" control procedure (see Chapter 3, "Manual Control Procedure Using the PNA Series Analyzer" and Table 3-1) select ports R1 and A. Check the LCD display on the Z5623A Option H46 for the correct port selection.

Step 6. After ports R1 and A have been selected, perform a THRU response calibration at the end of a 50 Ω cable over the frequency range of 300 kHz to 9.0 GHz on the analyzer. Verify the calibration is active and that the RF cable displays a S_{21} loss of 0 ±0.1 dB. For more information, refer to the *PNA Series Network Analyzers User Guide,* part number E8356-90001.

Step 7. Connect the cable (already connected to port R1 of the Z5623A Option H46) to port R2 of the Agilent Z5623A Option H46 test set.

Step 8. Measure the S_{21} loss of each section of the test set by selecting ports R2 through T2/3, one at a time, and using the "MANUAL" control procedure and viewing the display on the analyzer. The resulting S_{21} loss should be less than .5 dB (the absolute value should be less than .5 dB).

NOTE The "Z5623A Option J46" program can be used instead of the “MANUAL” example procedure for selecting the Z5623A Option H46 port paths. When using the J46 program, select the port path you want to measure. See the *Z5623 Series Option J46/48 User’s Guide,* part number Z5623-90019, for more details.

NOTE This is an 80% confidence test only. A unit could pass this simple test and yet still not function properly. For more complete testing, see "Performance Tests" in Chapter 6.

3 Controlling the Test Set and Making Measurements

The Agilent Z5623A Option H46 is a “slave” instrument: a controller or the PNA Series network analyzer must be used to control the test set. There are three ways in which the test set can be controlled:

- the PNA Series network analyzer via GPIB, which then controls the test set via GPIB connection.
- the external controller can control the test set directly via GPIB.
- the Z5623A Option J46 software interface.

NOTE Only the first two ways outlining the PNA Series and external controller will be discussed in this manual. For more information on using the Z5623A Option J46 software interface, refer to the *Z5623 Series Option J46/48 User’s Guide,* part number Z5623-90019.

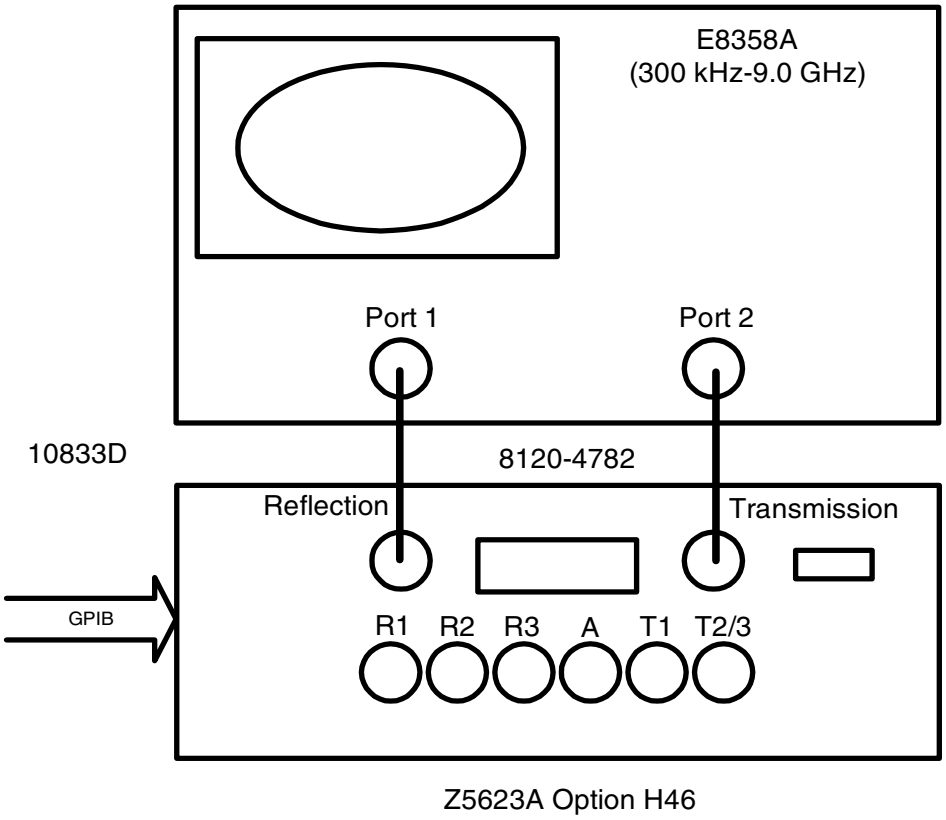
Commands

As mentioned earlier, the test set can be controlled in two ways. The first way uses a separate controller. The second way uses the PNA Series network analyzer. These methods of control are detailed below.

External Computer Control

The first way to control the Z5623A Option H46 is to write GPIB commands directly to the test set's GPIB port. See Figure 3-1, "Controlling the Test Set Over GPIB Using a Separate Controller."

Figure 3-1 Controlling the Test Set Over GPIB Using a Separate Controller



NOTE Connection to the network analyzer is not required when controlling the test set over GPIB with a separate controller.

Using RMB

To address the Z5623A Option H46 test set directly over GPIB, use 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. (Note the semi- colon ";" .)

Write Commands:

```
OUTPUT 712;"STRING$;" ! Output Command
```

Read Commands:

```
OUTPUT 712;"STRING$;" ! Output Command
ENTER 712;String$ ! Enter Command
```

Using Quick Basic or Visual Basic

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

NOTE Be sure to re-enable EOI and EOL before sending data to another instrument.

Write Commands:

```
info$="rl_A" 'command for reflection to port R1
             Transmission to A
length%=len(info$) 'length of command
HpibEoi(hHpib;7,0) 'disable EOI
HpibEol(hHpib;7,"",0) 'disable EOL
HpibOutputs (hHpib;712,info$,length%)) 'send command to  test set
HpibEol(hHpib;7,chr$(13)+chr$(10),2) 're-enable EOL and set to
chr$(13)+chr$(10)
HpibEoi(hHpib;7,1,) 're-enable EOI hHpib specifies the handle
returned by HpibOpen.
```

Read Commands:

```
info$="id?" 'command for test set identification.
length%=len(info$) 'length of command
max.len% = 10 'max length data from id? or swxx? function.
infi$ = space$(max.len%)
HpibEoi(hHpib;7,0) 'disable EOI.
HpibEol(hHpib;7,"",0) 'disable EOL
HpibOutputs (hHpib;712,info$,length%)) 'send command to test set.
HpibEnters(hHpib%,712,infi$,max.len%) 'get data from test set.
HpibEol(hHpib;7,chr$(13)+chr$(10),2) 're-enable EOL and set to
chr$(13)+chr$(10).
HpibEoi(hHpib;7,1,) 're-enable EOI hHpib specifies the handle
```

`returned by HpibOpen.`

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

Using HPVEE

If you are using HPVEE, be sure to set the Direct I/O in the Advance Device Configuration so the Read Terminator and Write EOL Sequence is set to "\n". In the I/O Transaction make sure the EOL is ON.

Using National Instruments VISA

If you are using National Instruments VISA, be sure to set the following variables as follows:

`VI_ATTR_SEND_END = VI_FALSE ' ` This specifies whether to assert END during the transfer of the last byte of the buffer

`VI_ATTR_TERMCHAR = 0x0A ' ` This is the termination character. When the termination character is read and `VI ATTR_TERMCHAR_EN` is enabled during a read operation, the read operation terminates.

`VI_ATTR_TERMCHAR_EN = VI_TURE ' ` This is a flag that determines whether the read operation should terminate when a termination character is received.

`VI_ATTR_SUPPRESS_END_EN = VI_FLASE ' ` Specifies whether to suppress the `END` bit termination. If this attribute is set to `VI_TRUE`, the `END` bit does not terminate read operations. If this attribute is set to `VI_FLASE`, the `END` bit terminates read operations.

Write Commands:

Append all commands with "\n," for example, `*rst\n`.

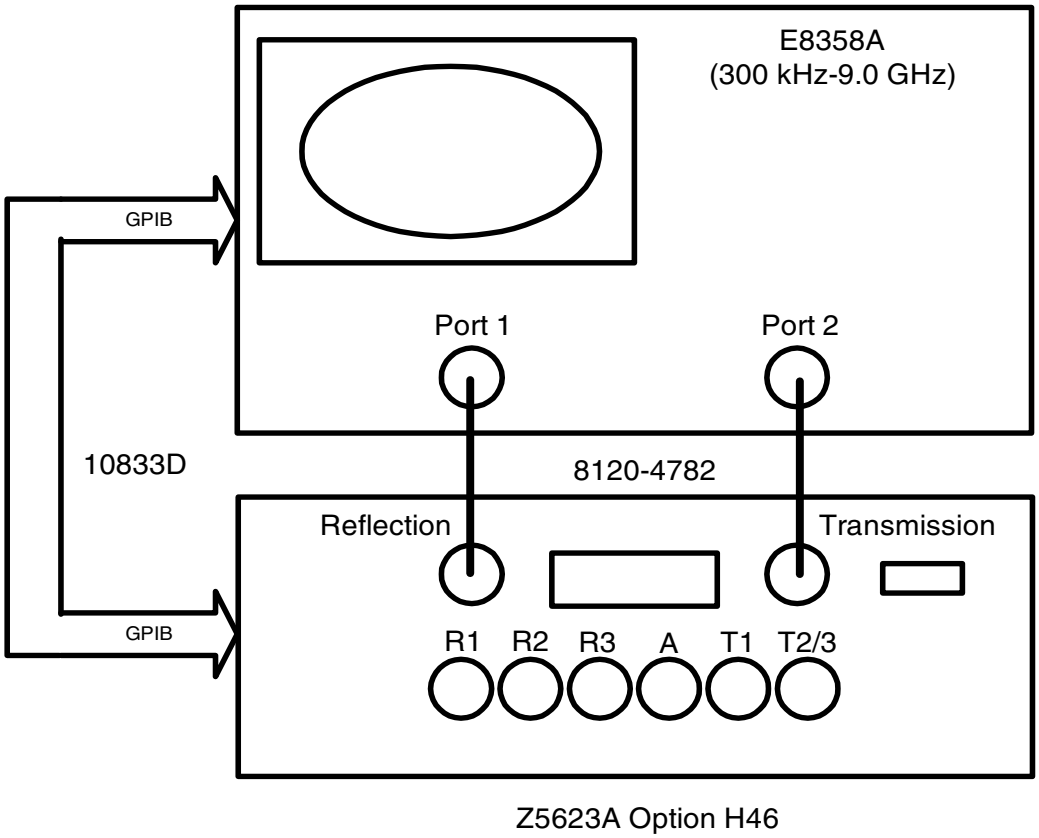
Read Commands:

The Z5623A Option H46 returns data terminated by `\r\n`.

Network Analyzer Control

The second method of sending commands uses the PNA Series network analyzer to control the test set directly. This method is performed with the standard setup of the network analyzer working with the test set. The GPIB cable is connected from the network analyzer GPIB connector to the test set GPIB connector, on both rear panels.
See Figure 3-2, "Controlling the Test Set Over GPIB Using PNA,"

Figure 3-2 Controlling the Test Set Over GPIB Using PNA



NOTE Connection is between the network analyzer and the Z5623A Option H46 when using "MANUAL" control of the test set over GPIB or when using the Z5623A Option J46 software interface.

Manual Control Procedure Using the PNA Series Analyzer

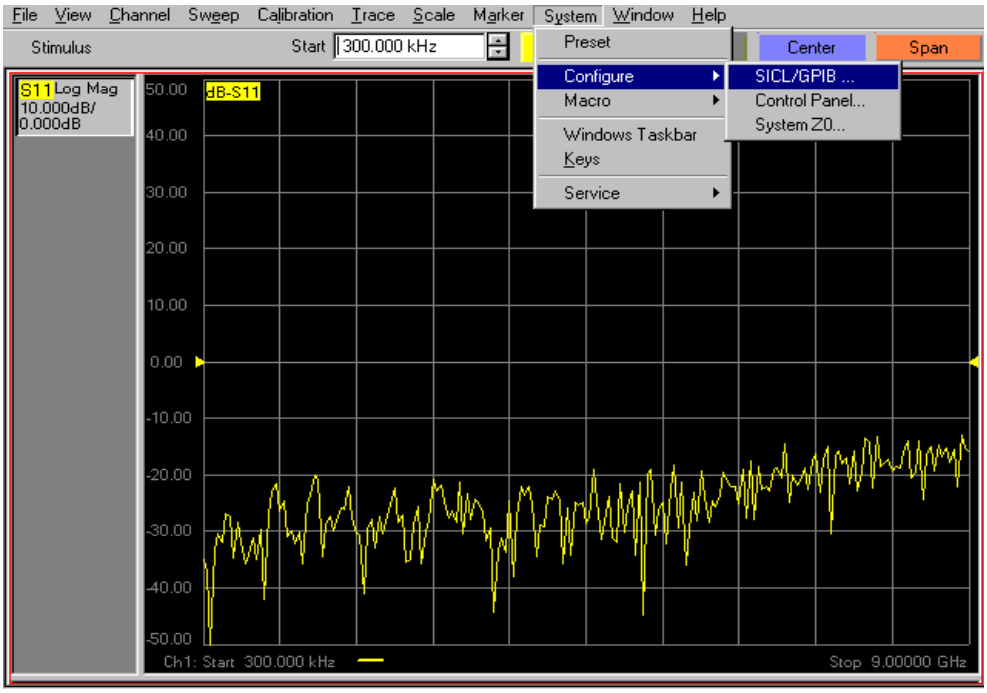
This procedure requires that you have a basic knowledge of the PNA Series network analyzer. For more information, refer to the *PNA Series Network Analyzers User Guide,* part number E8356-90001 and the *E8356A Service Guide*, part number E8356-90002.

Step 1. Connect the PNA Series analyzer to the Z5623A Option H46 as in Figure 3-2, “Controlling the Test Set Over GPIB Using PNA.”.

Step 2. Make sure that both the PNA Series analyzer and Z5623A Option H46 are turned on.

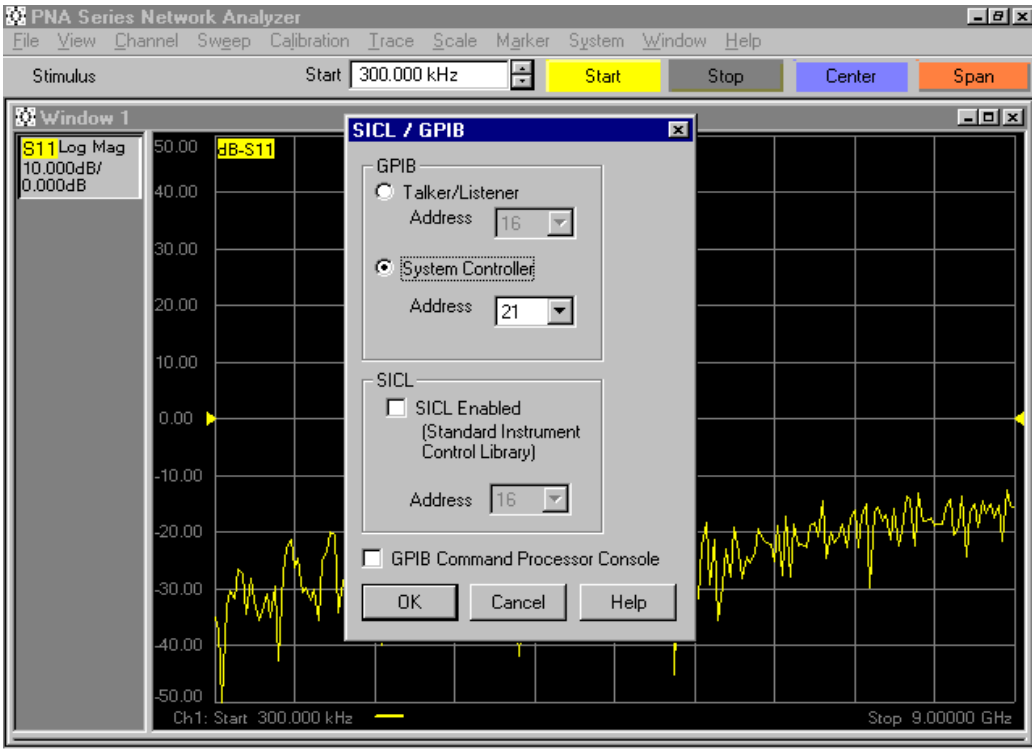
Step 3. On the analyzer menu, click the **System** menu, scroll down to **Configure**, and click **SICL/GPIB**. See Figure 3-3, “System Menu.”

Figure 3-3 System Menu



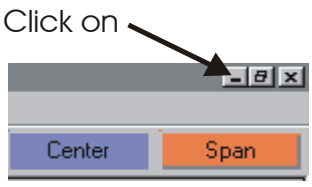
Step 4. In the SICL/GPIB window, click **System Controller** and then **OK**. See Figure 3-4, “SICL/GPIB Window.”

Figure 3-4 SICL/GPIB Window



Step 5. To return to the desktop, minimize the analyzer window by clicking on “-” in the top right corner of the window. See Figure 3-5, “Minimize Window.”

Figure 3-5 Minimize Window



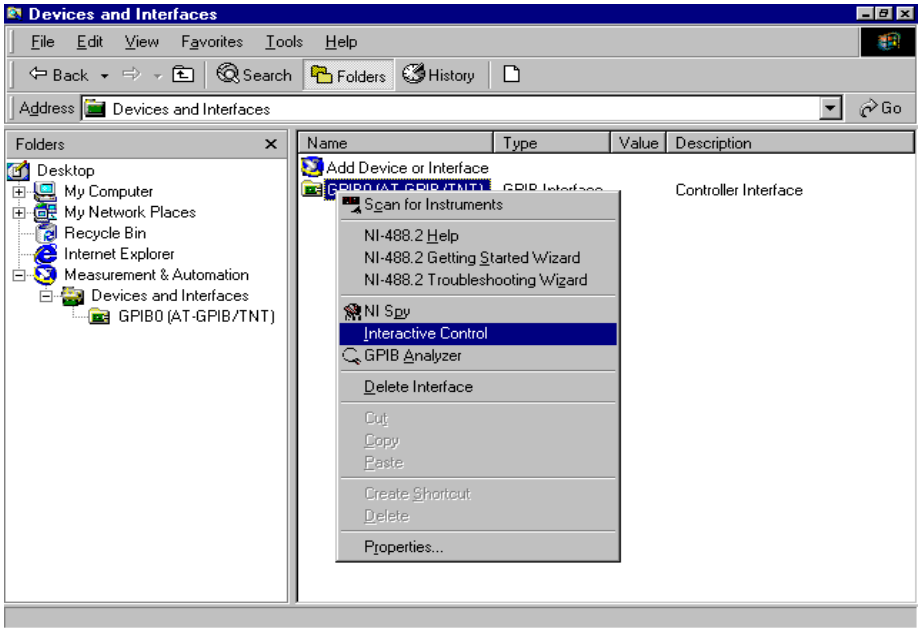
Step 6. On the desktop, double-click the **Measurement & Automation** icon. See Figure 3-6, "PNA DeskTop."

Figure 3-6 PNA DeskTop

Step 7. From the Measurement & Automation window, click on the **Devices and Interface**s folder to expand the directory.

Step 8. Right-click **GPIBO (AT-GPIB/TNT)**, then click **Interactive Control**. See Figure 3-7, "Interactive Control window."

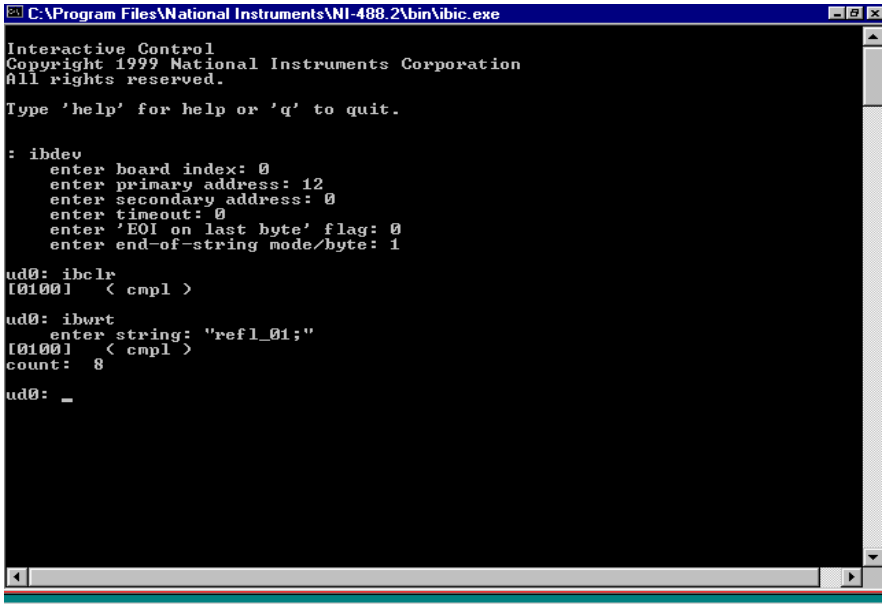
Figure 3-7 Interactive Control window



Step 9. When the `C:\Progam Files\National Instruments\ NI-488.2\ bin\ibic.exe` window appears, type `ibdev`. See Figure 3-8, "User Controller window." Then you will be prompted to:

```
Enter board index: "0"
Enter primary address: "12"
Enter secondary address: "0"
Enter timeout: "0"
Enter 'EOI on last byte' flag: "0"
Enter end-of-string byte/mode: "1"
```

Figure 3-8 User Controller window



NOTE The command `ref1_01,` shown in Figure 3-8, "User Controller window," will not work with the Z5623A Option H46.

Step 10. If you make a mistake, close the window, and repeat steps 7, 8, and 9.

Step 11. When the prompt `ud0:` appears in the window, enter `ibclr`. This command clears the internal bus. You are now ready to issue commands to the Z5623A Option H46 from this window.

Step 12. At the `ud0:` prompt, enter `ibwrt`.

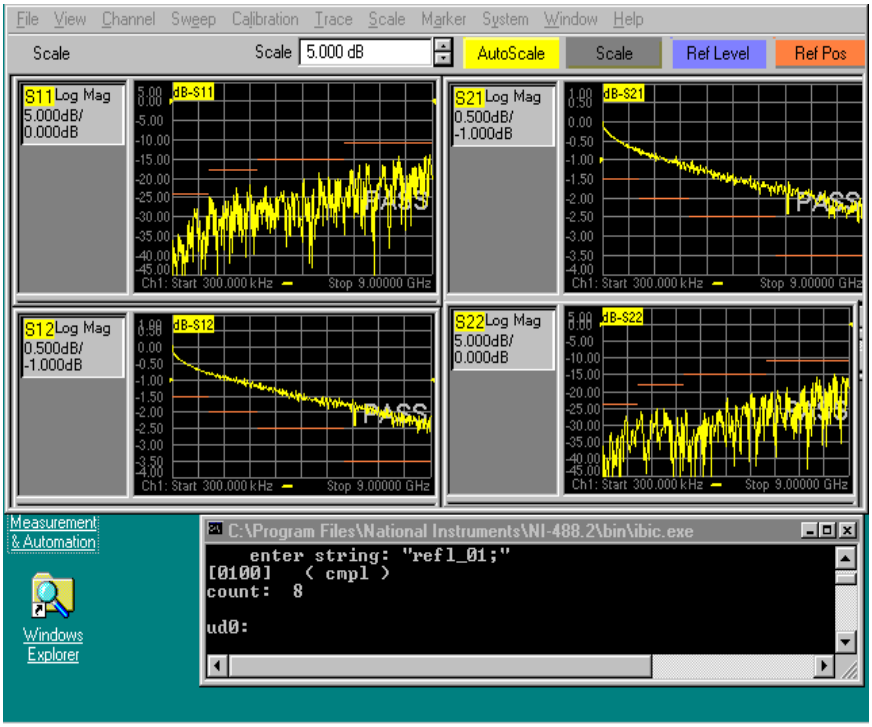
Step 13. When the prompt`enter string:` appears, enter the port path or command you would like to execute in quotes. Remember to include the semi-colon ";". See Figure 3-8, "User Controller window."

Step 14. If you make a mistake while entering the command path or function, enter the `ibclr` command to clear the bus and re-enter your initial command.

Step 15. See Table 3-1, "Test Port Commands," on page 3-11 for controlling port path operation of the Z5623A Opiton H46.

Step 16. For measurement and manual control of the test set, configure the PNA Series analyzer display so both the PNA Series Network Analyzer and `C:\Progam Files\National Instruments\NI-488.2\bin\ibic.exe` windows are displayed. See Figure 3-9, “Manual Control Window.”

Figure 3-9 Manual Control Window



Z5623A Option H46 GPIB Commands

Table 3-1 Test Port Commands

Connection Path	GPIB Command	Decimal	Binary Equivalent
R1 to A	r1_a		
R1 to T1	r1_t1		
R1 to T2/3	r1_t23		
R2 to A	r2_a		
R2 to T1	r2_t23		
R3 to A	r3_a		
R3 to T2/3	r3_t23		
R3 to T1	r3_t1		
R3_T2/3	r3_t23		
A to T1	a_t1		
A to T2/3	a_t23		
C1 ON	c1_on	1	00000001
C1 OFF	c1_off		
C2 ON	c2_on	2	00000010
C2 OFF	c2_off		
C3 ON	c3_on	4	00000100
C3 OFF	c3_off		
C4 ON	c4_on	8	00001000
C4 OFF	c4_off		
C5 ON	c5_on	16	00010000
C5 OFF	c5_off		
9Pin O/C Line C5,C4,C3,C2,C1	Use Decimal or Binary Equivalent		
OOOOO	Decimal/Binary	0	00000000
OOOOL	Decimal/Binary	1	00000001
OOOLO	Decimal/Binary	2	00000010
OOOLL	Decimal/Binary	3	00000011
OOLOO	Decimal/Binary	4	00000100

Table 3-1 Test Port Commands

Connection Path	GPIB Command	Decimal	Binary Equivalent
OOLOL	Decimal/Binary	5	00000101
OOLLO	Decimal/Binary	6	00000110
OOLLL	Decimal/Binary	7	00000111
OLOOO	Decimal/Binary	8	00001000
OLOOL	Decimal/Binary	9	00001001
OLOLO	Decimal/Binary	10	00001010
OLOLL	Decimal/Binary	11	00001011
OLLOO	Decimal/Binary	12	00001100
OLLOL	Decimal/Binary	13	00001101
OLLLO	Decimal/Binary	14	00001110
OLLLL	Decimal/Binary	15	00001111
LOOOO	Decimal/Binary	16	00010000
LOOOL	Decimal/Binary	17	00010001
LOOLO	Decimal/Binary	18	00010010
LOOLL	Decimal/Binary	19	00010011
LOLOO	Decimal/Binary	20	00010100
LOLOL	Decimal/Binary	21	00010101
LOLLO	Decimal/Binary	22	00010110
LOLLL	Decimal/Binary	23	00010111
LLOOO	Decimal/Binary	24	00011000
LLOOL	Decimal/Binary	25	00011001
LLOLO	Decimal/Binary	26	00011010
LLOLL	Decimal/Binary	27	00011011
LLLOO	Decimal/Binary	28	00011100
LLLOL	Decimal/Binary	29	00011101
LLLLO	Decimal/Binary	30	00011110
LLLLL	Decimal/Binary	31	00011111
Reset	*rst		
Box ID	id?		

To connect all Test ports to their internal 50 Ω loads, send the following command:

```
OUTPUT 712;"*all_term"
```

NOTE When a test set port is not in use, it is terminated in 50 Ω.

Box Identification Command:

To read the Box Identification, send the following commands:

```
OUTPUT 712;"id?"

ENTER 712;Box_id$
```

Reset Command:

When the `*rst` is set, the instrument is set to a known state (Reflection to port 1, Transmission to port 8, C5 - C1 all O). See Figure 6-5, "Z5623A Option H46 Block Diagram," for internal and port path configuration.

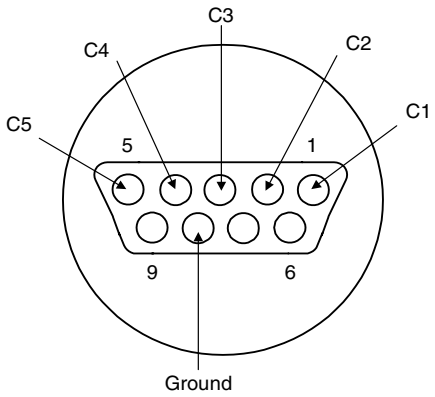
9 PIN Control Line Commands:

To set the individual Control lines 1 to 5, send the following command:

```
OUTPUT 712;"1;" ! sets control line 1 to Low, or

OUTPUT 712;"00000001;" ! sets control line 1 to Low
```

Figure 3-10 **Control Lines**



Control Lines

Calibrating the Test System

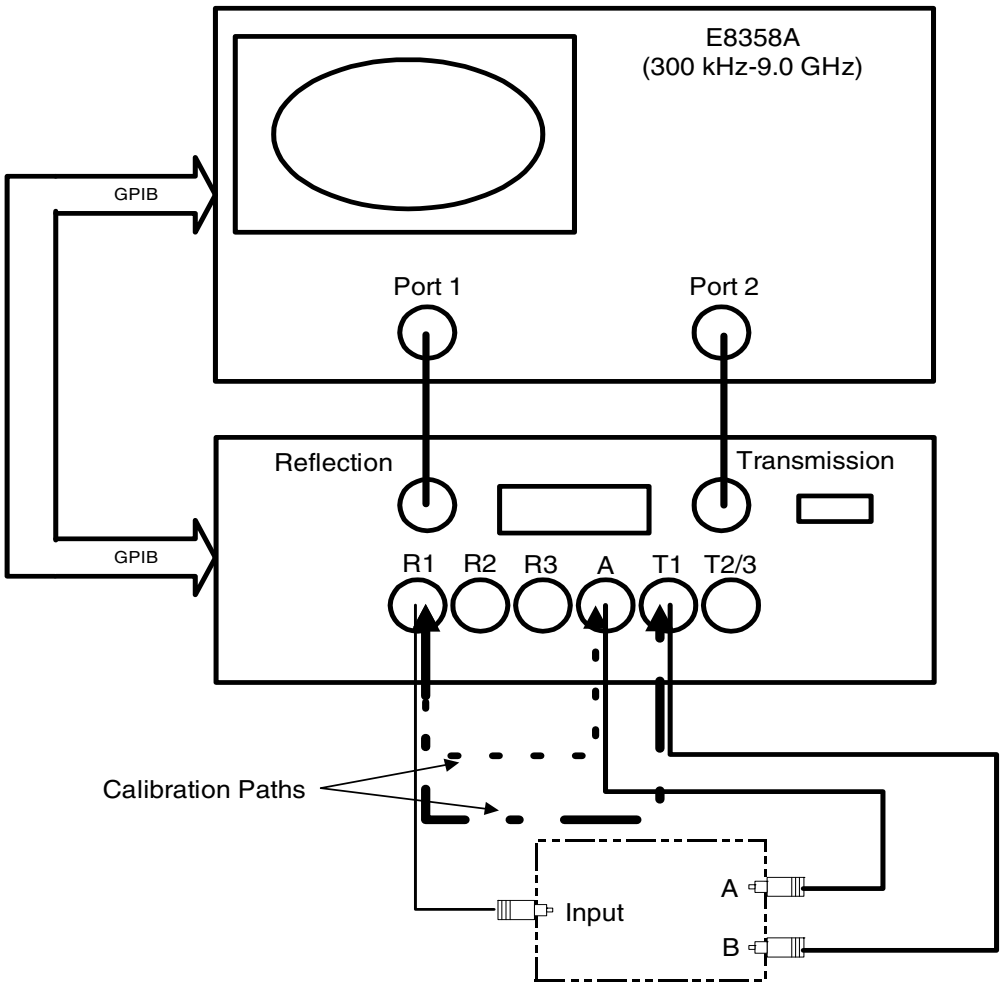
After the test set has warmed up for at least two hours, you must calibrate the instrument before making any measurements. To determine the type of calibration appropriate for the measurements you will be making, refer to the *PNA Series Network Analyzers User Guide,* part number E8356-90001.

You will need to calibrate each measurement path separately and store the calibration as an instrument state in the network analyzer. For information on how to calibrate and store instrument states, refer to the *PNA Series Network Analyzers User Guide,* part number E8356-90001.

In the example setup shown in Figure 3-11, the following tests will be made:

- Return loss on the DUT's input and 2 output ports (A and B)
- Insertion loss (or gain) between the DUT's input and port A
- Insertion loss (or gain) between the DUT's input and port B

Figure 3-11 Calibrating the Test System



Calibration and Test

For the best accuracy, you should perform a full two-port calibration between ports 1 and 3 on the test set, and again between ports 1 and 5. As mentioned before, you need to save the calibrations as instrument states. For information on how to calibrate and store instrument states, refer to the *PNA Series Network Analyzers User Guide,* part number E8356-90001.

CAUTION Do not use the test set to change the RF signal path direction when you are using a full two-port calibration. Doing so will render the calibration invalid. Instead, use the internal transfer switch in the analyzer.

Making Measurements

Measuring Transmission

With the analyzer set to measure forward transmission (S_{21}), the analyzer's RF source is being output through the analyzer's PORT 1, and PORT 2 is set to receive the RF signal.

By using the following commands, you will connect PORT R1 of the test set to the Reflection port, and you will connect PORT A of the test set to the Transmission port. In that way, you will be measuring forward transmission through the device under test when measuring S_{21}. This will provide you with gain or insertion loss information.

If directly controlling the Z5623A Option H46, use the following GPIB commands:

```
OUTPUT 712;"rl_a"
```

Measuring Reflection

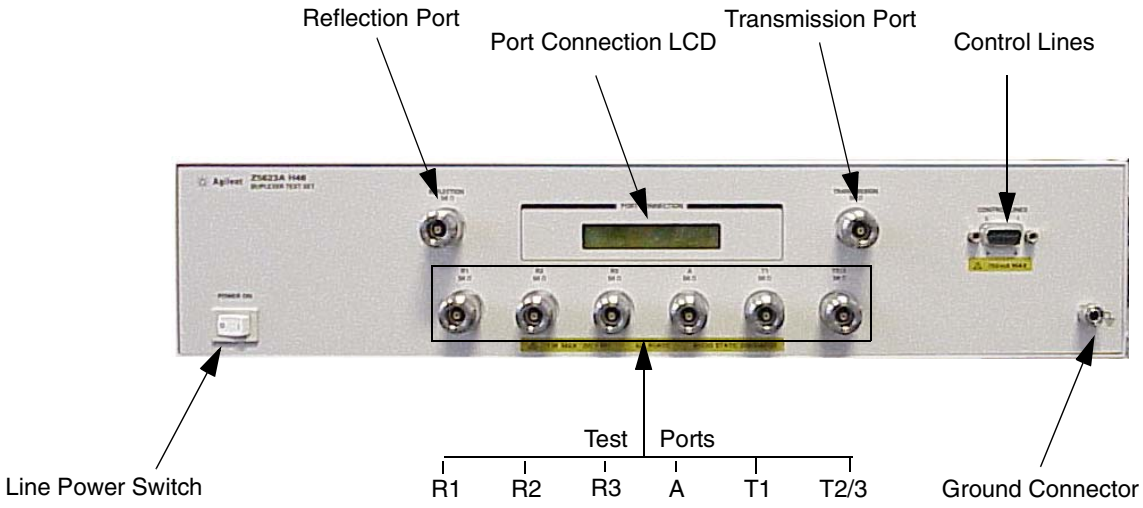
By leaving the DUT connected as before and setting the network analyzer to measure S_{11}, you can measure reflection or return loss.

4 Front and Rear Panels

This chapter contains information about the front and rear panels of the test set. This chapter is divided into two sections: Front Panel and Rear Panel.

Front Panel

Figure 4-1 **Front Panel Features**



Line Power Switch

The test set line POWER switch is located at the bottom left corner of the front panel. See Figure 4-1. The line POWER switch turns the power to the test set either on or off.

The front panel line POWER switch disconnects the mains circuits from the mains supply after the EMC filters and before other parts of the instrument

Reflection, Transmission and Test Ports

Reflection, Transmission and Test Ports R1 through T2/3 are 50 Ω connectors that are used to connect to the device under test.

CAUTION Do not input more than 1 Watt maximum RF+DC to these ports or damage to the internal RF switches or the analyzer may occur.

The GROUND Connector

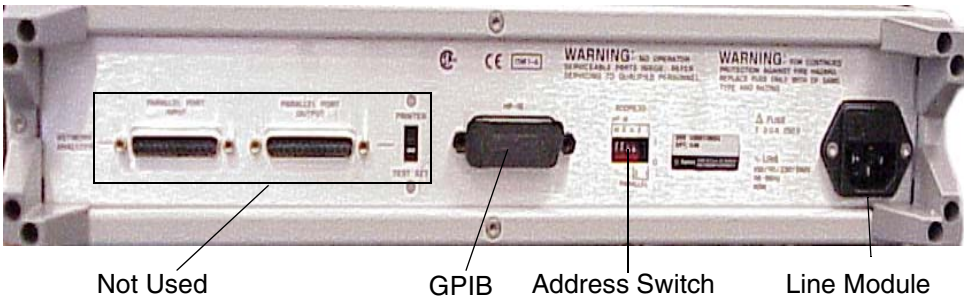
The GROUND connector provides a convenient front panel ground connection for a standard banana plug.

The PORT CONNECTION Status LCD

The PORT CONNECTION status LCD provides visual feedback of which port(s) are connected to the Reflection and Transmission ports of the test set. When the LCD displays a path connection, all other corresponding test ports are internally terminated in 50 Ω.

Rear Panel

Figure 4-2 Rear Panel Features



The GPIB Connector

This connector allows the test set to be connected directly to the PNA analyzer or to the external controller.

Address Switch

The address switch sets the GPIB address of the test set. See "Setting the Test Set Address Switch" on page 2-3 for information.

Line Module

The line module contains the power cable receptacle and the line fuse.

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 depends on the country of destination. See Figure 1-2 on page 1-6 for the part numbers of these power cables. Cables are available in different lengths. Check with your nearest Agilent Technologies Sales and Service Office, listed under "Contacting Agilent" on page 7-6, for descriptions and part numbers of cables other than those described in Figure 1-2.

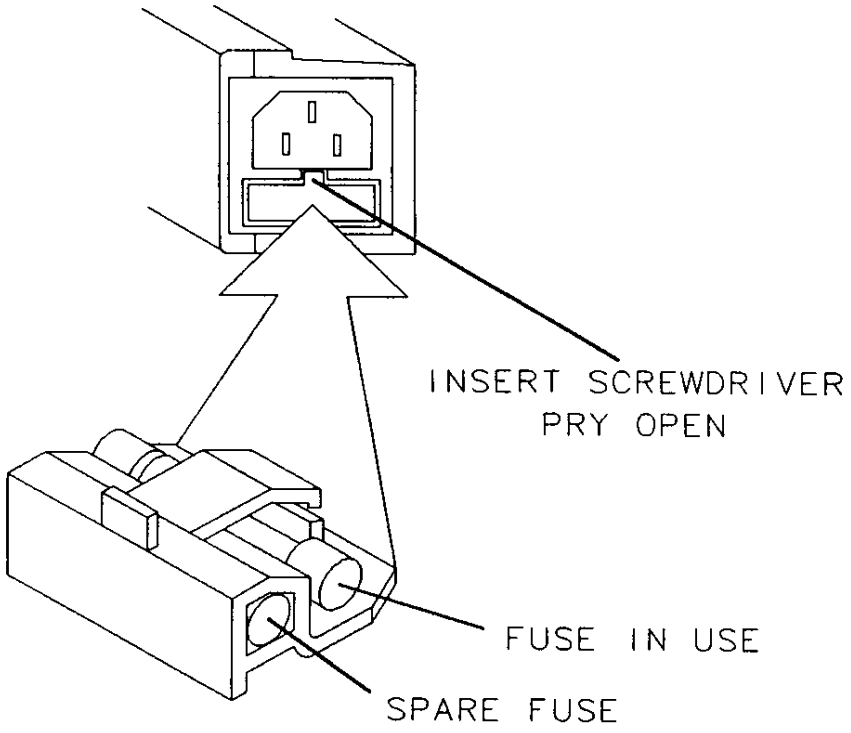
WARNING **This is a Safety Class I product (provided with a protective earthing ground incorporated in the power cord). The mains plug shall only be inserted in a socket outlet provided with a protective earth contact. Any interruption of the protective conductor, inside or outside the instrument, is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

The Line Fuse

The line fuse (F 3 A/250 V, part number 2110-0780) and a spare reside within the line module. Figure 4-3 illustrates where the fuses are and how to access them.

Location of Line Fuses

Figure 4-3 **Line fuse location**



5 Specifications

This chapter covers the specifications of the Z5623A Option H46.

Table 5-1 Agilent Z5623A Option H46 Specifications

Parameter	Specification
Frequency Range	300 kHz to 9.0 GHz
Crosstalk[a]	1) –110 dB[b] 2) –110 dB[c] 3) –105 dB[d] 4) –95 dB[e] 5) –90 dB[f]
Return Loss (port active)[f] R1, R2, R3, T1, T2/3	1) – 8 dB[b] 2) –16 dB[d] 3) –14 dB[e] 4) –10 dB[g] 5) – 7 dB [f]
Return Loss (port off)[h] R1, R2, R3, A, T1, T2/3	1) – 8 dB[b] 2) –20 dB[d] 3) –14 dB[e] 4) –10 dB[g] 5) – 7 dB [f]
Insertion Loss[i] R1, A, T1, T2/3	1) –5.0 dB[b] 2) –5.5 dB[d] 3) –6.5 dB[e] 4) –7.5 dB[g] 5) –9.0 dB[f]
Insertion Loss[i] R2 and R3	1) –7.5 dB[b] 2) –7.5 dB[d] 3) –8.0 dB[e] 4) –9.5 dB[g] 5) –12.0 dB[f]

a. Between any two non-connected signal paths
b. Break Down Band 1, 300 kHz to 1.0 MHz
c. Break Down Band 2, 1.0 MHz to 1.3 GHz
d. Break Down Band 3, 1.3 GHz to 3.0 GHz
e. Break Down Band 4, 3.0 GHz to 6.0 GHz
f. When externally terminated (PNA) in 50 Ω
g. Break Down Band 5, 6.0 GHz to 9.0 GHz
h. When internally terminated (Test Set) in 50 Ω
i. From any test set port to the Reflection or Transmission port

Table 5-2 Agilent Z5623A Option H46 Characteristics

Parameter	Characteristics
Maximum Power Input	1Watt (RF + DC)
Switching Time	11ms
Switch Type	Solid-State
Switch Lifetime	5 million cycles
Connectors	Type-N (F)
I/O Control	GPIB
Internal Power Supply	120/240 Vac Normal Operation at 100 Vac 50 or 60 Hz

Table 5-3 Agilent Z5623A Option H46 System Performance (typical)

Parameter	System Performance (typical)
Source Power (max)[a]	1) 2.5 dBm[b] 2) 1.5 dBm[c] 3) 0.0 dBm[d] 4) –7.5 dBm[e]
Dynamic Range (max)[f]	1) –110 dB[b] 2) –105 dB[d] 3) –95 dB[e] 4) –90 dB[f]
Cycle Time (minimum; IF BW = 35 kHz)[g]	1) 430 ms (Dynamic Range =86 dB)[b] 2) 430 ms (Dynamic Range =89 dB)[d] 3) 430 ms (Dynamic Range =78 dB)[e] 4) 430 ms (Dynamic Range =71dB)[f]
Cycle Time (@ 100 dB Dynamic Range; IF BW = 3 kHz)[g]	2) 900 ms[d] 3) 900 ms[e]

a. Power measured at test ports R1-T2/3 on Z5623A Option H46 when connected to the E8358A using the part number 8120-4782 RF Jumper cables supplied.
b. Break Down Band 1, 300 kHz to 1.3 GHz
c. Break Down Band 2, 1.3 GHz to 3.0 GHz
d. Break Down Band 3, 3.0 GHz to 6.0 GHz
e. Break Down Band 4, 6.0 GHz to 9.0 GHz
f. IF Bandwidth set to 10 Hz
g. Conditions: 2 Windows, 4 Channels, 8 Traces, 2-port cal, no bandcrossings, 201points.

General Characteristics

Environmental Characteristics

General Conditions

ESD (electrostatic discharge): must be eliminated by use of static-safe work procedures and an anti-static bench mat (such as part number 92175T).

Operating Environment

Indoor use only

Operating temperature: 0 to 55° C

Maximum relative humidity: 80 percent for temperatures up to 31° C decreasing linearly to 50 percent relative humidity at 40° C

Altitude: up to 15,000 feet (4,572 meters)

Non-Operating Storage Conditions

Temperature: –40° C to +70° C

Humidity: 0 to 90 percent relative at +65° C (non-condensing)

Altitude: 0 to 15,240 meters (50,000 feet)

Weight

Net: Approximately 9 kg

Shipping: Approximately 20 kg

Cabinet Dimensions

These dimensions exclude front and rear panel protrusions.

89 mm H by 425 mm W by 500 mm D (3.5 in by 16.75 in by 19.7 in)

If you should need technical assistance, contact the nearest Agilent Technologies Sales and Service Office. A listing of these is located under .

Agilent Z5623A Option H46 Options

UK6

Option UK6 provides a commercial calibration certificate including actual test data. Data includes test results including reflection, transmission, and crosstalk from Reflection to Transmission for all test ports.

Rack Ear Mounts

Option 908, part number 5062-3974, provides rack mounts that make it quick and easy to install or remove the test set from a main frame.

For further information on these options please contact the nearest Agilent Technologies Sales and Service Office. A listing of these is located on page 7-6.

6 Service

This chapter discusses how to verify the performance of your test set and how to troubleshoot it if necessary. It also contains the theory of operation and a block diagram.

Please read all applicable safety warnings and cautions in Chapter 7 before servicing the test set.

Performance Tests

Performance testing consists of measuring insertion loss, return loss, and isolation between all ports. For the most accurate measurements, the use of an Agilent E8358A 50 Ω 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 for. Performance tests will require the following equipment:

- Agilent E8358A Network Analyzer
- Test Port Extension Cables, part number 8120-4781
- 85032B Cal Kit
- Shorts, part number 85032-60008
- HP 10833D GPIBCable

Make a photocopy of the performance test record pages (later in this chapter) to record the results of the performance tests. There are no adjustments required for the Z5623A Option H46 test set.

Perform a full two-port calibration from 300 kHz to 9.0 GHz at the ends of two cables attached to the two test ports of the analyzer. Make sure the calibration is active. For more information on calibration, refer to the *PNA Series Network Analyzers User Guide,* part number E8356-90001.

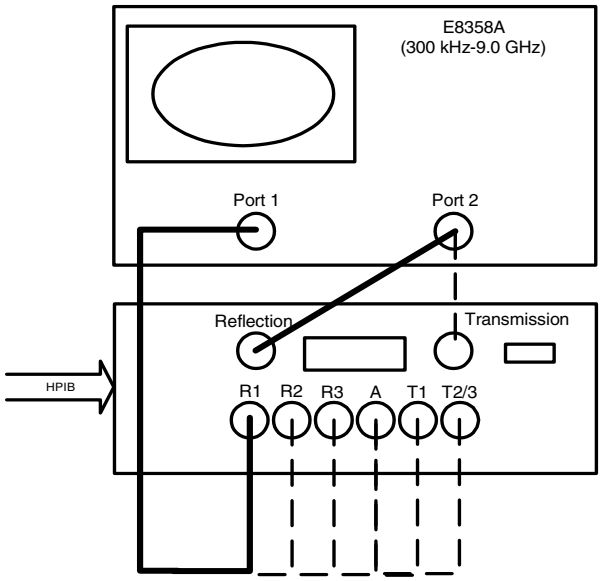
On the analyzer:

1. Set the number of points to “401”
2. Set the Bandwidth to “10”
3. Set the Power Level at “10”

NOTE The Isolation Cal Routine must be done for the Crosstalk Test.

Insertion Loss

Figure 6-1 Insertion Loss Performance Setup



Insertion Loss

Step 1. Recall full two-port calibration.

Step 2. Connect the cable that is attached to Port 2 of the network analyzer to the Reflection port of the Z5623A Option H46.

Step 3. Connect the cable from Port 1 of the analyzer to Port R1 of the Z5623A Option H46.

Step 4. Using the "MANUAL" control procedure, issue the command `r1_a`. The selected transmission port does not matter.

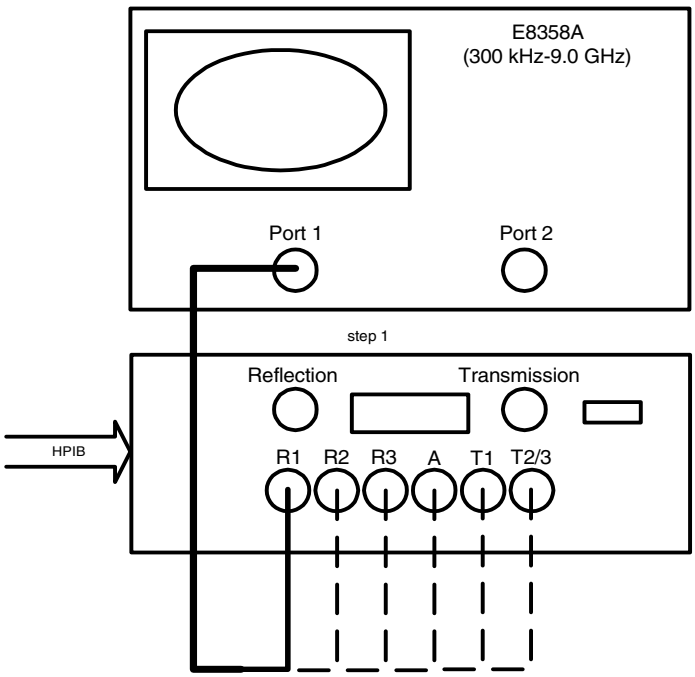
Step 5. Verify using Table 5-1 on page 5-1. Record the results on the appropriate line in Table 6-1.

Step 6. Repeat steps 4 and 5 for the test ports R2, R3, and A.

Step 7. Repeat steps 2 through 5, but connect the cable in step 2 to the Transmission port of the Z5623A Option H46. In step 4, again issue the command `r1_a`, then select only the commands `a_t1` and `a_t23`.

Return Loss

Figure 6-2 Return Loss Performance Setup



Return Loss (Off State)

This test will check both the internal termination (port off) load of each port and the through match (port active) when the appropriate input port is selected.

Step 1. Recall full two-port calibration.

Step 2. Connect the cable that is attached to Port 2 of the analyzer to the Reflection port of the Z5623A Option H46.

Step 3. Connect the cable from Port 1 of the analyzer to Port R1 of the Z5623A Option H46.

Step 4. Using the “MANUAL” control procedure, issue the command `r1_a`. The selected transmission port does not matter.

Step 5. Verify using Table 5-1 on page 5-1. Record the results on the appropriate line in Table 6-2 for the ports (port active) return loss.

Step 6. Issue the command `r2_a`.

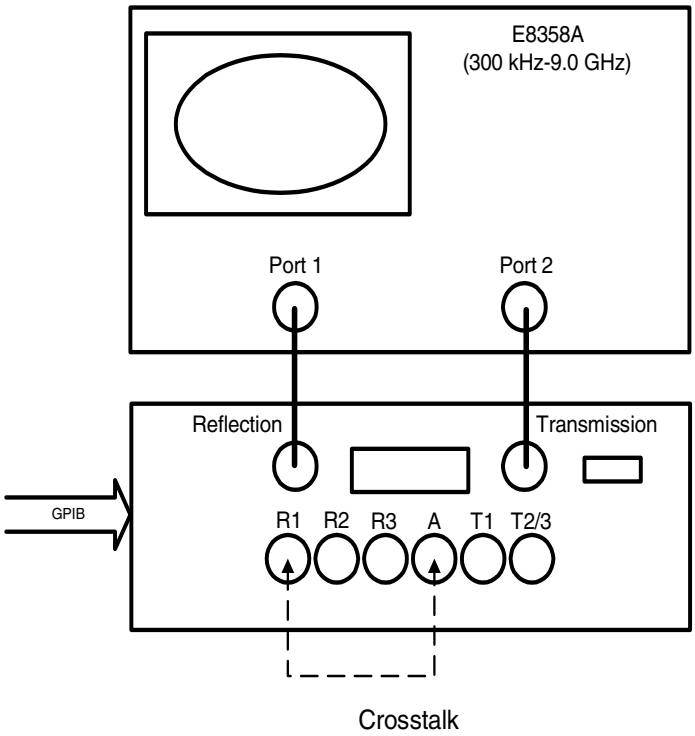
Step 7. Verify using Table 5-1 on page 5-1. Record the results on the appropriate line in Table 6-3 for the ports (port off) return loss.

Step 8. Move the cable to Port R2 on the Z5623A Option H46 and repeat steps 4 through 7, selecting Port R2. Repeat steps 4 through 7 for Port R3.

Step 9. Repeat steps 2 through 5, but connect the cable in step 2 to the Transmission port of the Z5623A Option H46. Issue the command `r1_a`, then select only the `a_t1` and `a_t23` commands.

Crosstalk

Figure 6-3 Crosstalk Performance Setup



Crosstalk need only be measured on adjacent ports. Two 50 Ω shorts are required for this test.

Step 1. Recall full two-port calibration.

Step 2. Connect the cable that is attached to Port 1 of the analyzer to the Reflection port of the Z5623A Option H46 and connect Port 2 of the analyzer to the Transmission port.

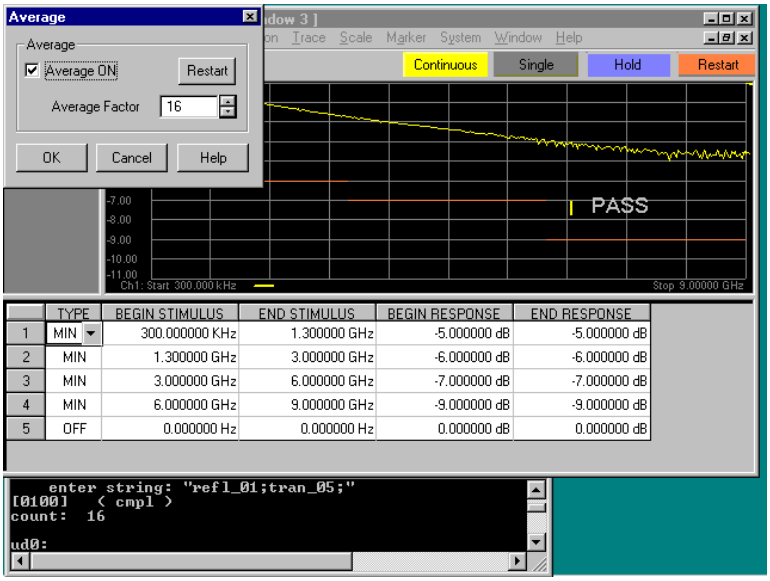
Step 3. Connect a 50 Ω RF cable, part number 8120-4781, to both Port R1 and Port A of the Z5623A Option H46.

Step 4. Using the “MANUAL” control procedure, issue the `r1_a` command, then select reflection port 1.

Step 5. Normalize the S_{21} and S_{12} through response.

Step 6. On the network analyzer menu, click on the **Channel** menu, scroll down to **Average**, then turn Average **ON** and set the Average Factor to **16**. See Figure 6-4, "Averaging menu."

Figure 6-4 Averaging menu



Step 7. Connect 50 Ω shorts, part number 85032-60008, to both Port R1 and Port A of the Z5623A Option H46.

Step 8. Using the "MANUAL" control procedure, select reflection port R1 and transmission port A (`r1_a`).

Step 9. Make sure the calibration is active. Set the averaging factor to “16” and then turn the averaging “on” when making measurements.

Step 10. Verify using Table 5-1 on page 5-1. Record the test results on the appropriate line in Table 6-4.

Step 11. Repeat steps 7 through 10 for the next two ports: R2 and A. Make sure the appropriate “MANUAL” inputs are selected. Repeat again for ports R3 and A, then A and T1, and so on, ending with ports A and T2/3.

Performance Test Record

NOTE The following pages (Performance Test Record) are designed to be duplicated and used as a template for all of the input ports during each of the performance tests (Insertion Loss, Return Loss, and Isolation). At the top of each page, circle the appropriate input port (Reflection or Transmission), and write in the test date.

Agilent Z5623A Option H46 Test Record

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:

_____

_____

_____

_____

_____

Date _____

Table 6-1 Agilent Z5623A Option H46 Insertion Loss Test Record

Test Description	Port	Minimum Specifications	Measured Results	Measured Uncertainty
Insertion Loss Band 1				
300 kHz to 1.0 MHz	Refl to R1	–5.0 dB	_____	±0.3 dB
	Refl to R2	–7.5 dB	_____	±0.3 dB
	Refl to R3	–7.5 dB	_____	±0.3 dB
	Refl to A	–5.0 dB	_____	±0.3 dB
	Tran to A	–5.0 dB	_____	±0.3 dB
	Tran to T1	–5.0 dB	_____	±0.3 dB
	Tran to T2/3	–5.0 dB	_____	±0.3 dB
Insertion Loss Band 2				
1.0 MHz to 1.3 GHz	Refl to R1	–5.5 dB	_____	±0.3 dB
	Refl to R2	–7.5 dB	_____	±0.3 dB
	Refl to R3	–7.5 dB	_____	±0.3 dB
	Refl to A	–5.5 dB	_____	±0.3 dB
	Tran to A	–5.5 dB	_____	±0.3 dB
	Tran to T1	–5.5 dB	_____	±0.3 dB
	Tran to T2/3	–5.5 dB	_____	±0.3 dB
Insertion Loss Band 3				
1.3 GHz to 3.0 GHz	Refl to R1	–6.5 dB	_____	±0.3 dB
	Refl to R2	–8.0 dB	_____	±0.3 dB
	Refl to R3	–8.0 dB	_____	±0.3 dB
	Refl to A	–6.5 dB	_____	±0.3 dB
	Tran to A	–6.5 dB	_____	±0.3 dB
	Tran to T1	–6.5 dB	_____	±0.3 dB
	Tran to T2/3	–6.5 dB	_____	±0.3 dB

Date _____

Table 6-1 Agilent Z5623A Option H46 Insertion Loss Record

Test Description	Port	Minimum Specifications	Measured Results	Measured Uncertainty
Insertion Loss Band 4				
3.0 GHz to 6.0 GHz	Refl to R1	–7.5 dB	_____	±0.3 dB
	Refl to R2	–9.5 dB	_____	±0.3 dB
	Refl to R3	–9.5 dB	_____	±0.3 dB
	Refl to A	–7.5 dB	_____	±0.3 dB
	Tran to A	–7.5 dB	_____	±0.3 dB
	Tran to T1	–7.5 dB	_____	±0.3 dB
	Tran to T2/3	–7.5 dB	_____	±0.3 dB
Insertion Loss Band 5				
6.0 GHz to 9.0 GHz	Refl to R1	–9.0 dB	_____	±0.3 dB
	Refl to R2	–12.0 dB	_____	±0.3 dB
	Refl to R3	–12.0 dB	_____	±0.3 dB
	Refl to A	–9.0 dB	_____	±0.3 dB
	Tran to A	–9.0 dB	_____	±0.3 dB
	Tran to T1	–9.0 dB	_____	±0.3 dB
	Tran to T2/3	–9.0 dB	_____	±0.3 dB

Date _____

Table 6-2 Agilent Z5623A Option H46 Return Loss(port active) Test Record

Test Description	Port	Minimum Specifications	Measured Results	Measured Uncertainty
Return Loss Band 1				
300 kHz to 1.0 MHz	Refl to R1	–8.0 dB	_____	±0.5 dB
	Refl to R2	–8.0 dB	_____	±0.5 dB
	Refl to R3	–8.0 dB	_____	±0.5 dB
	Refl to A	–8.0 dB	_____	±0.5 dB
	Tran to A	–8.0 dB	_____	±0.5 dB
	Tran to T1	–8.0 dB	_____	±0.5 dB
	Tran to T2/3	–8.0 dB	_____	±0.5 dB
	Reflection	–8.0 dB	_____	±0.5 dB
	Transmission	–8.0 dB	_____	±0.5 dB
Return Loss Band 2				
1.0 MHz to 1.3 GHz	Refl to R1	–16.0 dB	_____	±1.0 dB
	Refl to R2	–16.0 dB	_____	±1.0 dB
	Refl to R3	–16.0 dB	_____	±1.0 dB
	Refl to A	–16.0 dB	_____	±1.0 dB
	Tran to A	–16.0 dB	_____	±1.0 dB
	Tran to T1	–16.0 dB	_____	±1.0 dB
	Tran to T2/3	–16.0 dB	_____	±1.0 dB
	Reflection	–16.0 dB	_____	±1.0 dB
	Transmission	–16.0 dB	_____	±1.0 dB
Return Loss Band 3				
1.3 GHz to 3.0 GHz	Refl to R1	–14.0 dB	_____	±0.5 dB
	Refl to R2	–14.0 dB	_____	±0.5 dB
	Refl to R3	–14.0 dB	_____	±0.5 dB
	Refl to A	–14.0 dB	_____	±0.5 dB
	Tran to A	–14.0 dB	_____	±0.5 dB
	Tran to T1	–14.0 dB	_____	±0.5 dB
	Tran to T2/3	–14.0 dB	_____	±0.5 dB

Table 6-2 Agilent Z5623A Option H46 Return Loss(port active) Test Record

Test Description	Port	Minimum Specifications	Measured Results	Measured Uncertainty
Return Loss Band 3 (cont.)	Reflection	–14.0 dB	_____	±0.5 dB
	Transmission	–14.0 dB	_____	±0.5 dB
Return Loss Band 4				
3.0 GHz to 6.0 GHz	Refl to R1	–10.0 dB	_____	±0.5 dB
	Refl to R2	–10.0 dB	_____	±0.5 dB
	Refl to R3	–10.0 dB	_____	±0.5 dB
	Refl to A	–10.0 dB	_____	±0.5 dB
	Tran to A	–10.0 dB	_____	±0.5 dB
	Tran to T1	–10.0 dB	_____	±0.5 dB
	Tran to T2/3	–10.0 dB	_____	±0.5 dB
	Reflection	–10.0 dB	_____	±0.5 dB
	Transmission	–10.0 dB	_____	±0.5 dB
Return Loss Band 5				
6.0 GHz to 9.0 GHz	Refl to R1	–7.0 dB	_____	±0.5 dB
	Refl to R2	–7.0 dB	_____	±0.5 dB
	Refl to R3	–7.0 dB	_____	±0.5 dB
	Refl to A	–6.5 dB	_____	±0.5 dB
	Tran to A	–6.5 dB	_____	±0.5 dB
	Tran to T1	–7.0 dB	_____	±0.5 dB
	Tran to T2/3	–7.0 dB	_____	±0.5 dB
	Reflection	–6.5 dB	_____	±0.5 dB
	Transmission	–6.5 dB	_____	±0.5 dB

Date _____

Table 6-3 Agilent Z5623A Option H46 Return Loss(port off) Test Record

Test Description	Port	Minimum Specifications	Measured Results	Measured Uncertainty
Return Loss Band 1				
300 kHz to 1.0 MHz	Refl to R1	–8.0 dB	_____	±0.5 dB
	Refl to R2	–8.0 dB	_____	±0.5 dB
	Refl to R3	–8.0 dB	_____	±0.5 dB
	Refl to A	–8.0 dB	_____	±0.5 dB
	Tran to A	–8.0 dB	_____	±0.5 dB
	Tran to T1	–8.0 dB	_____	±0.5 dB
	Tran to T2/3	–8.0 dB	_____	±0.5 dB
	Reflection	–8.0 dB	_____	±0.5 dB
	Transmission	–8.0 dB	_____	±0.5 dB
Return Loss Band 2				
1.0 MHz to 1.3 GHz	Refl to R1	–20.0 dB	_____	±1.5 dB
	Refl to R2	–20.0 dB	_____	±1.5 dB
	Refl to R3	–20.0 dB	_____	±1.5 dB
	Refl to A	–20.0 dB	_____	±1.5 dB
	Tran to A	–20.0 dB	_____	±1.5 dB
	Tran to T1	–20.0 dB	_____	±1.5 dB
	Tran to T2/3	–20.0 dB	_____	±1.5 dB
	Reflection	–20.0 dB	_____	±1.5 dB
	Transmission	–20.0 dB	_____	±1.5 dB

Date _____

Table 6-3 Agilent Z5623A Option H46 Return Loss(port off) Test Record

Test Description	Port	Minimum Specifications	Measured Results	Measured Uncertainty
Return Loss Band 3				
1.3 GHz to 3.0 GHz	Refl to R1	–14.0 dB	_____	±0.5 dB
	Refl to R2	–14.0 dB	_____	±0.5 dB
	Refl to R3	–14.0 dB	_____	±0.5 dB
	Refl to A	–14.0 dB	_____	±0.5 dB
	Tran to A	–14.0 dB	_____	±0.5 dB
	Tran to T1	–14.0 dB	_____	±0.5 dB
	Tran to T2/3	–14.0 dB	_____	±0.5 dB
	Reflection	–14.0 dB	_____	±0.5 dB
	Transmission	–14.0 dB	_____	±0.5 dB
Return Loss Band 4				
3.0 GHz to 6.0 GHz	Refl to R1	–10.0 dB	_____	±0.5 dB
	Refl to R2	–10.0 dB	_____	±0.5 dB
	Refl to R3	–10.0 dB	_____	±0.5 dB
	Refl to A	–10.0 dB	_____	±0.5 dB
	Tran to A	–10.0 dB	_____	±0.5 dB
	Tran to T1	–10.0 dB	_____	±0.5 dB
	Tran to T2/3	–10.0 dB	_____	±0.5 dB
	Reflection	–10.0 dB	_____	±0.5 dB
	Transmission	–10.0 dB	_____	±0.5 dB
Return Loss Band 5				
6.0 GHz to 9.0 GHz	Refl to R1	–7.0 dB	_____	±0.5 dB
	Refl to R2	–7.0 dB	_____	±0.5 dB
	Refl to R3	–7.0 dB	_____	±0.5 dB
	Refl to A	–7.0 dB	_____	±0.5 dB
	Tran to A	–7.0 dB	_____	±0.5 dB
	Tran to T1	–7.0 dB	_____	±0.5 dB
	Tran to T2/3	–7.0 dB	_____	±0.5 dB
	Reflection	–7.0 dB	_____	±0.5 dB
	Transmission	–7.0 dB	_____	±0.5 dB

Date _____

Table 6-4 Agilent Z5623A Option H46 Crosstalk Test Record

Test Description	Port	Minimum Specifications	Measured Results	Measured Uncertainty
Crosstalk Band 1				
300 kHz to 1.0 MHz	R1 to A	–110 dB	_____	±5 dB
	R2 to A	–110 dB	_____	±5 dB
	R3 to A	–110 dB	_____	±5 dB
	A to T1	–110 dB	_____	±5 dB
	A to T2/3	–110 dB	_____	±5 dB
Crosstalk Band 2				
1.0 MHz to 1.3 GHz	R1 to A	–110 dB	_____	±5 dB
	R2 to A	–110 dB	_____	±5 dB
	R3 to A	–110 dB	_____	±5 dB
	A to T1	–110 dB	_____	±5 dB
	A to T2/3	–110 dB	_____	±5 dB
Crosstalk Band 3				
1.3 GHz to 3.0 GHz	R1 to A	–105 dB	_____	±5 dB
	R2 to A	–105 dB	_____	±5 dB
	R3 to A	–105 dB	_____	±5 dB
	A to T1	–105 dB	_____	±5 dB
	A to T2/3	–105 dB	_____	±5 dB
Crosstalk Band 4				
3.0 GHz to 6.0 GHz	R1 to A	–95 dB	_____	±5 dB
	R2 to A	–95 dB	_____	±5 dB
	R3 to A	–95 dB	_____	±5 dB
	A to T1	–95 dB	_____	±5 dB
	A to T2/3	–95 dB	_____	±5 dB
Crosstalk Band 5				
6.0 GHz to 9.0 GHz	R1 to A	–90 dB	_____	±5 dB
	R2 to A	–90 dB	_____	±5 dB
	R3 to A	–90 dB	_____	±5 dB
	A to T1	–90 dB	_____	±5 dB
	A to T2/3	–90 dB	_____	±5 dB

Adjustments

There are no adjustments for the test set.

Assembly Replacement and Post-Repair Procedures

The following table contains the list of replaceable parts for the Z5623A Option H46H46 test set. If any of these parts or assemblies are replaced, you must perform all performance tests to verify conformance to specifications.

Table 6-5 Replaceable Parts

Reference Designator	Description	Part Number	Quantity
A1	24 Volt Power Supply	0950-2252	1
A4	2x16 LCD	2090-0370	1
Sw50-Sw55	1P2T Switch 9 GHz	87050-60159	1
	J50-J57 CA AY	Z5623-60013	1
A3	Driver PCB	87050-60324	1
	Connector Type-N (F)	86290-60005	8
W1	RF Cable	Z5623-20051	1
W2	RF Cable	Z5623-20052	1
W3	RF Cable	Z5623-20053	1
W4	RF Cable	Z5623-20054	1
W6	RF Cable	Z5623-20055	1
W7	RF Cable	Z5623-20056	1
W8	RF Cable	Z5623-20057	1
W10	RF Cable	Z5623-20058	1
W11	RF Cable	Z5623-20059	1
W12	RF Cable	Z5623-20060	1
W13	RF Cable	Z5623-20061	1
W14	RF Cable	Z5623-20062	1
W15	RF Cable	Z5623-20063	1
A2	Control Mother PCB	Z5623-60018	1
	Front Panel AY	Z5623-60009	1
C1-C6	DC Blocking Capacitor	0955-0892	6

NOTE The above parts are unique to this special option. To order replacement parts, please contact the Component Test PGU Support Group at (707) 577-6802 with the part number, module/model number and option number. If ordering parts through your local Agilent Technologies Sales and Service Office, specify that they are ordered through the Component Test PGU Support Group.

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

WARNING **Some parts in the instrument have sharp edges. Work carefully to avoid injury.**

CAUTION Before replacing an assembly or board, inspect for obvious, easy-to-fix defects such as bent pins on ICs or cold solder joints.

Troubleshooting and Block Diagram

This section contains information on troubleshooting the test set to assembly level only. Following these procedures should enable you to determine whether the power supply, front panel, or main switch board need replacing. A block diagram is included at the end of this section as an aid in troubleshooting.

Theory of operation information can be found in the next section of this manual.

General Troubleshooting Notes

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

CAUTION 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 Power Supply Problems

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

- If it is off, there is still a possibility that the power supply is not supplying the necessary +24V, +12V, and +5V to the main board.
- If the LCD is off, check the main fuse located in the power supply filter at the rear of the instrument.
- If the LCD is still off, check the cable between the main board and front panel board.
- Finally, disconnect the DC power cable from the power supply to the main switch board and measure the voltages. They should be +24V, +12V, and +5V. If not, replace the power supply.

Troubleshooting the Front Panel Board

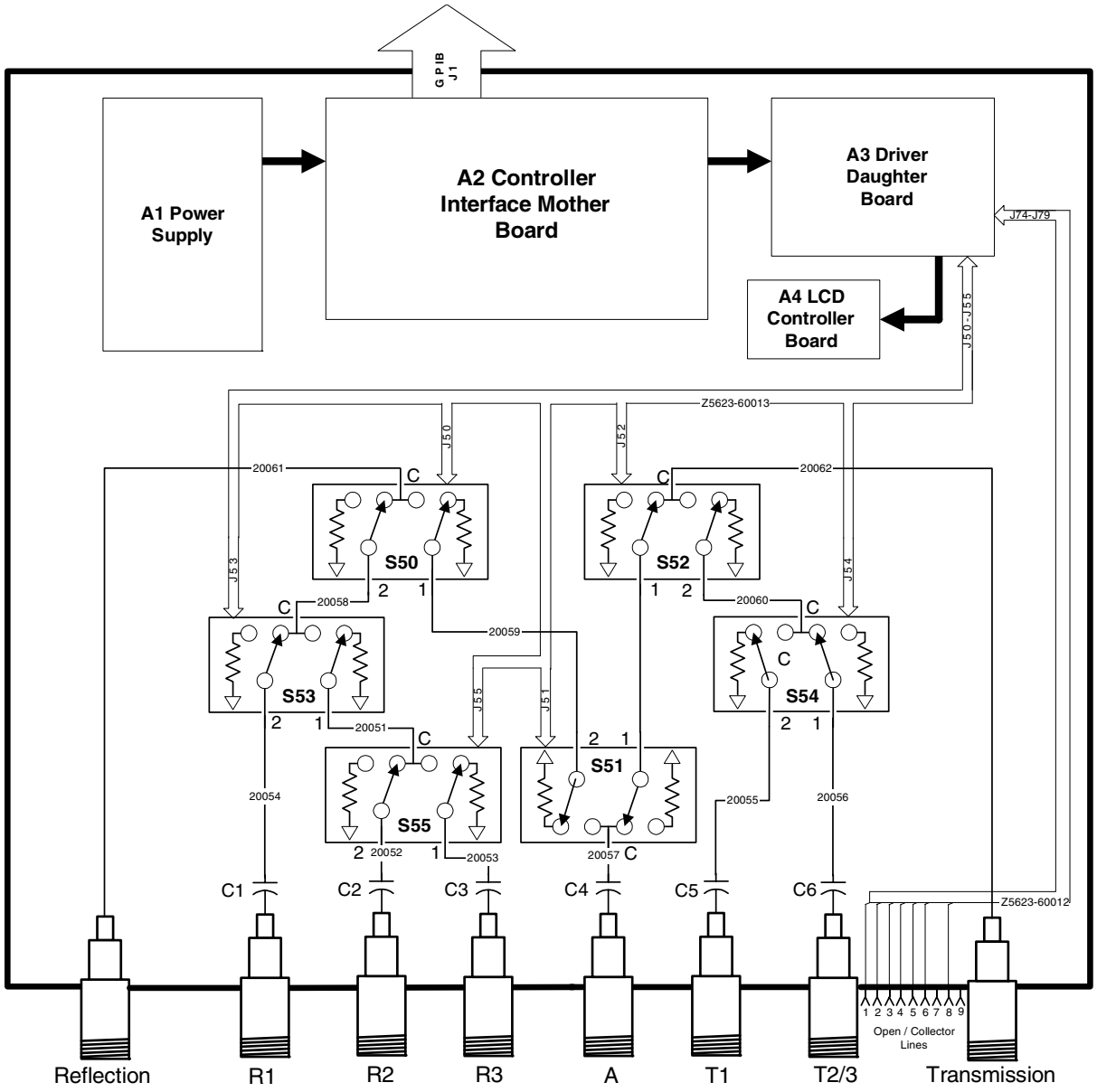
Turn the instrument power on and check the following:

- Check the condition of each of the switching paths by issuing commands to switch each of the paths to either the transmission or reflection path. Ensure that the LCD indicates the appropriate path.
- If the LCD indicates a wrong path, the problem can lie with either the front panel board or the main switch board. Measure the RF path to determine where the problem is.
- Ensure that the front panel washers between the board and front panel assembly are present. Missing washers can cause erratic LCD behavior.
- If the LCD does not display the proper path, check to see if the RF path has indeed been switched. If the problem lies with the front panel board, replace it.

Troubleshooting the Controller and Switch Driver Boards

Turn the instrument power on. Check the condition of each of the switching paths by issuing commands to switch each of the paths to either the Reflection or Transmission path. Check each of the RF paths for connection. If an RF path is not connected to the necessary port or terminated in 50 Ω, replace the controller and switch driver board.

Figure 6-5 Z5623A Option H46 Block Diagram



(Type-N)

Z5623A Option H46

Theory of Operation

The theory of operation begins with a general description of the Agilent Z5623A Option H46 multiport 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, front panel display, and main switch board. The purpose of the power supply is to supply 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 main switch board does the actual switching between the different ports.

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: +24V, +12V, +5V.

The power LED on the front panel indicates that the instrument is on and that the power supply is providing power.

A2 Front Panel Display Theory

The front panel display consists of an LCD. The LCD is divided into two lines, forward and reverse. The first line indicates which of the six ports are connected to the forward path. The second line indicates which of the six ports are connected to the reverse path. Control signals and DC power are provided by a cable connected to the main switch board.

A3 Controller (Mother Board) and Switch Driver (Daughter Board) Board Theory

The mother and daughter boards provide the bias for the switching paths for the various ports to the Reflection or Transmission ports. The front panel display contains an LCD that indicates the switched ports. A particular test port (R1 through T2/3) can be in one of two states. The three states are:

- Switched to the Reflection path R1, R2, R3, A
- Switched to the Transmission path A, T1, T2/3
- Terminated in 50 Ω

When a port is not connected, it is automatically terminated in 50 Ω. Only one test port can be connected to any one reflection port and only one test port can be connected to any transmission port at any given time.

The test set consists of six 1x2 switches. The 1x2 switches divide each of the input ports (R1 through T2/3) into two separate paths.

All switches are solid state and are biased according to the necessary switching path. A user interface through the GPIB and parallel ports converts the necessary input signals from the user to the necessary control signals to control the switching paths.

Connector Replacement

The 50 Ω Type-N mm connectors are available separately. It is possible to replace them in the field.

7 Safety and Regulatory Information

Safety and Regulatory 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 international standards.

Cleaning Instructions

Clean the instrument cabinet using a damp cloth only.

Shipping Instructions

Always transport or ship the instrument using the original packaging if possible. If not, comparable packaging must be used.

Before Applying Power

Verify that the product is configured to match the available main power source as described in the input power configuration instructions in this manual. If this product is to be powered by autotransformer, make sure the common terminal is connected to the neutral (grounded) side of the ac power supply.

Safety Information

Warnings

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

Warnings applicable to this instrument are:

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

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

WARNING **For continued protection against fire hazard replace line fuse only with same type and rating:**
• United States—F 3A/250V, Part Number 2110-0780
• Europe—F 3.15A/250V, Part Number 2110-0655
The use of other fuses or material is prohibited.

WARNING **This is a Safety Class I product (provided with a protective earthing ground incorporated in the power cord). The mains plug shall be inserted only 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 is prohibited.**

WARNING **The power cord is connected to internal capacitors that may retain dangerous electrical charges for 5 seconds after disconnecting the plug from its power supply.**

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 dangerous voltages. Disconnect the instrument from all voltage sources while it is being opened.**

WARNING **This product is designed for use in Installation Category II and Pollution Degree 2 per IEC 1010 and 664 respectively.**

Cautions

CAUTION The CAUTION notice denotes a hazard. It calls attention to an operating procedure, practice, or the like, which 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.

Cautions applicable to this instrument are:

CAUTION Always use the three-prong ac power cord supplied with this instrument. Failure to ensure adequate earth grounding (by not using this cord) can cause instrument damage.

CAUTION This instrument has autoranging line voltage input; be sure the supply voltage is within the specified range.

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.

Instrument Markings

	When you see this symbol on your instrument, you should refer to the instrument's instruction manual for important information.
	This symbol indicates hazardous voltages.
	The laser radiation symbol is marked on products that have a laser output.
	This symbol indicates that the instrument requires alternating current (ac) input.
	The CE mark is a registered trademark of the European Community. If it is accompanied by a year, it indicates the year the design was proven.
	The CSA mark is a registered trademark of the Canadian Standards Association.
ISM1-A	This text indicates that the instrument is an Industrial Scientific and Medical Group 1 Class A product (CISPER 11, Clause 4).
	This symbol indicates that the power line switch is ON.
	This symbol indicates that the power line switch is OFF or in STANDBY position.
	This symbol indicates the product meets the Australian Standards.

Safety Earth Ground

This is a Safety Class I product (provided with a protective earthing terminal). An uninterruptible safety earth ground must be provided from the main power source to the product input wiring terminals, power cord, or supplied power cord set. Whenever it is likely that the protection has been impaired, the product must be made inoperative and secured against any unintended operation.

Notice for Germany: Noise Declaration

LpA < 70 dB

am Arbeitsplatz (operator position)

normaler Betrieb (normal position)

nach DIN 45635 T. 19 (per ISO 7779)

Contacting Agilent

Online assistance: www.agilent.com/find/assist			
United States *(tel)* 1 800 452 4844	**Latin America** *(tel)* (305) 269 7500 *(fax)* (305) 269 7599	**Canada** *(tel)* 1 877 894 4414 *(fax)* (905) 282-6495	**Europe** *(tel)* (+31) 20 547 2323 *(fax)* (+31) 20 547 2390
New Zealand *(tel)* 0 800 738 378 *(fax)* (+64) 4 495 8950	**Japan** *(tel)* (+81) 426 56 7832 *(fax)* (+81) 426 56 7840	**Australia** *(tel)* 1 800 629 485 *(fax)* (+61) 3 9210 5947	**Singapore** *(tel)* 1 800 375 8100 *(fax)* (65) 836 0252
Malaysia *(tel)* 1 800 828 848 *(fax)* 1 800 801 664	**Philippines** *(tel)* (632) 8426802 *(tel) (PLDT subscriber only):* 1 800 16510170 *(fax)* (632) 8426809 *(fax) (PLDT subscriber only):* 1 800 16510288	**Thailand** *(tel) outside Bangkok:* (088) 226 008 *(tel) within Bangkok:* (662) 661 3999 *(fax)* (66) 1 661 3714	**Hong Kong** *(tel)* 800 930 871 *(fax)* (852) 2506 9233
Taiwan *(tel)* 0800-047-866 *(fax)* (886) 2 25456723	**People's Republic of China** *(tel) (preferred):* 800-810-0189 *(tel) (alternate):* 10800-650-0021 *(fax)* 10800-650-0121	**India** *(tel)* 1-600-11-2929 *(fax)* 000-800-650-1101	