Agilent Technologies
U3042AE04

User's and Service Guide

Use this manual with the following documents:
PNA Series Network Analyzer On-line Help System

Agilent Technologies

Warranty Statement

DFARS/Restricted Rights Notice

Safety Notes

The following safety notes are used throughout this document. Familiarize yourself with each of these notes and its meaning before performing any of the procedures in this document.

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

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

Definitions

- *Specifications* describe the performance of parameters covered by the product warranty (temperature –0 to 55 °C, unless otherwise noted.)

- *Typical* describes additional product performance information that is not covered by the product warranty. It is performance beyond specification that 80% of the units exhibit with a 95% confidence level over the temperature range 20 to 30 °C. Typical performance does not include measurement uncertainty.

- *Nominal* values indicate expected performance or describe product performance that is useful in the application of the product, but is not covered by the product warranty.

- *Characteristic Performance* describes performance parameter that the product is expected to meet before it leaves the factory, but is not verified in the field and is not covered by the product warranty. A characteristic includes the same guard bands as a specification.

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Introduction

This document describes how to use and service the U3042AE04 Multiport Test Set Extension.

Figure 1   4-Port PNA-L with U3042AE04
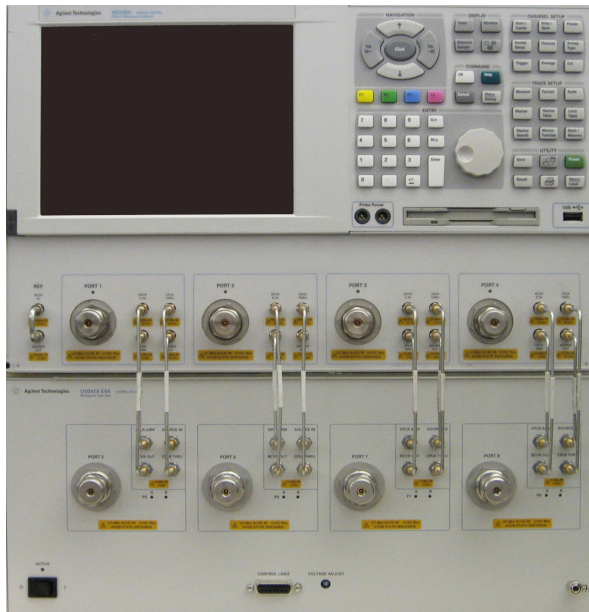
Figure 2   4-Port PNA or PNA-X with U3042AE04
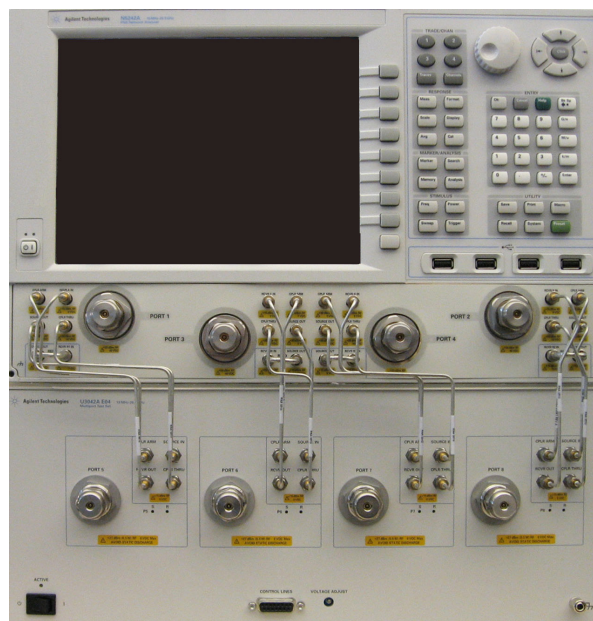
Description

The U3042AE04 is a 4-Port solid-state test set used for multiport applications. The test set can be connected to a 4-port PNA, PNA-L, or PNA-X, providing an 8-Port network analyzer solution for full crossbar measurements.

The U3042AE04 has the following key features:

- 4 test ports (3.5 mm male connectors)

- High speed, solid state RF switching

- Frequency range of operation:

  — 10 MHz to 26.50 GHz (Standard Opt 700)

  — 10 MHz to 20 GHz (Opt 001 or 002)

- Agilent PNA compatibility with rear panel Test Set I/O interface for operational control

- PNA Option 551 is required and provides N-Port calibration capabilities.

- The U3042AE04 is directly controlled by the network analyzer, no external personal computer or software is required.

The N5222A PNA, N5230A/C & N5232A PNA-L and N5242A PNA-X Network Analyzers will be referred to as the PNA, PNA-L and PNA-X throughout this document. Analyzer refers to all series of PNA, PNA-L and PNA-X. The U3042AE04 will be referred to as the test set.

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 Agilent" on page 84. Keep the damaged shipping materials (if any) for inspection by the carrier and an Agilent Technologies representative.

Network Analyzer Requirements

All network analyzers require Option 551 for multiport operation (N-Port error correction and measurement capability). Table 1 provides a listing of other network analyzer option requirements. The network analyzer's frequency range must be equal to or exceed that of the test set so that the measurement system covers the full frequency range of the test set.

The test set files indicated in Table 1 must be installed into the analyzer's file directory:
c:\Program Files\Agilent\Network Analyzer\testsets

Table 1   Network Analyzer Configuration Requirements

4-Port Network Analyzer	Options	Test Set File	System Figure
N5222A PNA	401, 417 or 419	u3042ae04_pnax_p4.tsx	Figure 2 on page 2[1]
N5230A/C PNA-L	145 or 146, 245 or 246	u3042ae04_p4.tsx	Figure 1 on page 2
N5232A PNA-L	416	u3042ae04_p4.tsx	Figure 1 on page 2[1]
N5242A PNA-X	400	u3042ae04_pnax_p4.tsx	Figure 2 on page 2

1. These graphics are not a N5222A or N5232A network analyzer, but the port configuration is similar.

Ensure that the network analyzer has the latest version of firmware installed. The following web site links provide the necessary information needed:

• Documentation - *http://www.agilent.com/find/pna*

• Network Analyzer Firmware - *http://na.tm.agilent.com/pna/firmware/firmware.htm*

• U3042AE04 Test Set Files - *http://na.tm.agilent.com/multiport* (see test set files)

Available Options

Test Set Options

The test set has three available options:
Refer to "System Block Diagrams" beginning on page 61.

- Option 700   Standard, Solid-State switches (no Option 001 or 002 on the serial tag)

- Option 001 - Solid-state switches with amplifiers to improve dynamic range.

- Option 002 - Solid-state switches with amplifiers and bias-tees for each port.

NOTE   The Options 700, 001, and 002 limit the frequency range due to blocking capacitors in the switches and amplifier performance. Solid-state switches degrade frequencies below 2 MHz, and 001 or 002 amplifiers degrade performance above 18 GHz.

Accessory Options

Installation instructions are included in the option package.

- U3042A-1CM - Rackmount Kit without Handles (5063-9215)

- U3042A-1CN - Front Handle Kit (5063-9228)

- U3042A-1CP - Rackmount with Front Handle Kit (5063-9222)

Network Analyzer RF Cable Interface Kit Options

The U3042AE04 requires one of the following kits to interface the test set with your analyzer. The interface kit model option includes the hardware lock-link and cable kit listed in Table 2.

Table 2   Cable Kit Options

8-Port Network Analyzer	Interface Kit Option	Hardware Lock-link	Cable Kit, Connector Type
N5222A PNA-X	U3021PL3 Opt 442	U3021-60002[1]	U3021-60047, SMA m/m[2]
N5230A/C PNA-L	U3021PL3 Opt 430	U3021-60001[3]	U3021-60045, SMA m/m[4]
N5232A/C PNA-L	U3021PL3 Opt 430	U3021-60001[3]	U3021-60045, SMA m/m[4]
N5242A PNA-X	U3021PL3 Opt 442	U3021-60002[1]	U3021-60047, SMA m/m[2]

1. "Hardware Lock-link Installation (U3021-60002)" on page 16.
2. "N5222A and N5242A RF Interface Cable Connections (U3021-60047)" on page 21.
3. "Hardware Lock-link Installation (U3021-60001)" on page 13.
4. "N5230A/C and N5232A RF Interface Cable Connections (U3021-60045)" on page 19.

General Specifications

Specifications for the test set are characteristic for the system performance of the network analyzer and test set. Actual performance of the system is based on the customer's network analyzer and options that are used with the test set. A functional certificate is only offered for the test set.

An N-Port calibration should be performed for optimum measurement accuracy.

A periodic calibration is not required. The Operators Check should be performed after System Setup, or if performance is in question.

When connected to a analyzer, the test set will degrade the performance at the test ports. The internal switch paths reduce test port power to the receivers. This affects the test port power of the analyzer and also reduces dynamic range. The reflection tracking values measured in the "Cal Kit Operational Check" on page 49 can be subtracted from the analyzers dynamic range to determine the approximate performance of the system.

Power Requirements

Verify that the required ac power is available before installing the test set to the analyzer.

- 100/120/220/240 VAC (50/60Hz)

- The instruments can operate with mains supply voltage fluctuations up to ± 10% of the nominal voltage.

- Air conditioning equipment (or other motor operated equipment) should not be placed on the same ac line that powers the test set and analyzer.

- U3042AE04 maximum power is 350 W.

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.**

Environmental Requirements

Refer to your network analyzer's standard documentation for environmental requirements.

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

- Pressure Altitude (Operation)
  3,000 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.

Equipment Heating and Cooling

If necessary, install air conditioning and heating to maintain the ambient temperature within the appropriate 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.

Required Conditions for Accuracy Enhanced Measurement

Accuracy enhanced (error–corrected) measurements require the ambient temperature of the analyzer and test set to be maintained within ± 1 °C of the ambient temperature at calibration.

Dimensions and Space Requirements

Standard installation of the test set and analyzer includes configuration and installation on a customer provided lab bench or table top of adequate size and strength. For weight, dimensions and space requirements, refer to the network analyzer documentation that is used to configure the test set.

CAUTION	The network analyzer is heavy. It is recommended that two individuals, or a mechanical lift be used to lift or transport the instrument.

Table 3   Instrument Dimensions

Model	Weight	Height	Width	Depth
U3042AE04	11.4 kg (25 lb)	19.1 cm (7.5 in)	42.5 cm (16.7 in)	43.2 cm (17 in)

Frequency Range and Power Levels

NOTE	When the test set is configured with your network analyzer, the system frequency range of operation will be determined by the frequency range limits of this combination.

CAUTION	It is recommended that you do not operate components near damage levels (+30 dBm). The power levels must be 3 dB below maximum level to ensure no damage.

Table 4   **Maximum Power Levels**

U3042AE04 Test Port RF Power Levels:	
PORT 5-8	+27 dBm
U3042AE04 Access Ports:	
SOURCE OUT	+20 dBm
CPLR ARM	+20 dBm
CPLR THRU	+20 dBm
RCVR OUT	+20 dBm

NOTE	Refer to your analyzer's specifications to determine the maximum input power levels for the analyzer's access and test ports, or to optimize the power levels in the receivers.

NOTE	Damage and maximum levels are not necessarily the optimum level.

Typical Reflection Tracking

Performance for the test set is typical. System performance for the analyzer and test set are only characteristic and are intended as non-warranted information.

| NOTE | Typical performance is based on 1 to 2 units performance. Refer to Table 5 and Table 6. |

Table 5   Typical Reflection Tracking PNA-L

Frequency	Standard 700	Option 001	Option 002
300 kHz to 10 MHz[1]	−80	−100	−100
10 MHz to 4 GHz	−10	+2	+1
4 GHz to 6 GHz	−12	+1	+0
6 GHz to 10.5 GHz	−13	−2	−3
10.5 GHz to 13.5 GHz	−14	−3	−4
13.5 GHz to 15 GHz	−15	−3	−4
15 GHz to 20 GHz	−20	−13	−15

1. Generally improves at 3 MHz to −6 dBm.

Table 6   Typical Reflection Tracking PNA and PNA-X

Frequency	Standard 700	Option 001	Option 002
10 MHz to 50 MHz	−3	+5	+4
50 MHz to 500 MHz	−5	+5	+4
500 MHz to 3.2 GHz	−10	+2	+1
3.2 GHz to 10 GHz	−12	−2	−3
10 GHz to 16 GHz	−17	−4	−5
16 GHz to 20 GHz	−20	−13	−15
20 GHz to 24 GHz	−22	−21	−23
24 GHz to 26.5 GHz	−25	−35	−37

Front and Rear Panel Features

Figure 3   U3042AE04 Front Panel
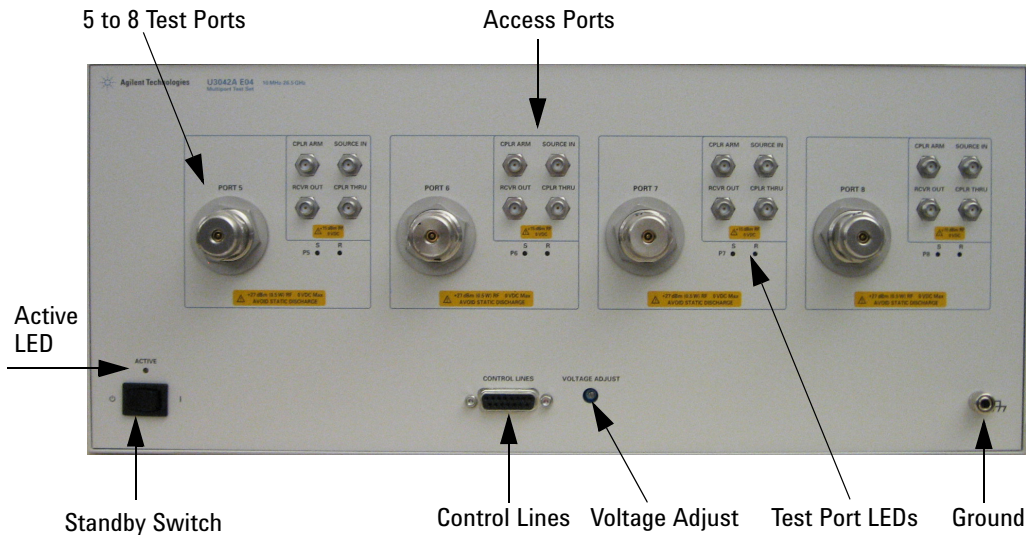
Test Ports - 3.5 mm Bulkhead (male)

• Port 5 – 8

Access Ports – SMA (female)

• CPLR ARM
• SOURCE IN
• CPLR THRU
• RCVR OUT

Ground

Ground is provided for ESD and safety connection.

Test Port LEDs

An illuminated LED indicates an active port in Source or Receiver mode. On the front panel "S" indicates Source test ports and "R" indicates Receiver test ports.

Control Lines and Voltage Adjust

For further information pertaining to control lines and voltage adjustments see "Control Lines" on page 43.

Standby Switch

The switch is only a Standby switch, not a AC line power switch.The main power cord can be used as the system disconnecting device. It disconnects the mains circuits from the mains supply.

Active LED

The Active LED is *on* when the test set is connected and addressed by a network analyzer. The LED is *off* when the test set is in Standby, or not addressed by the network analyzer.

Figure 4   U3042AE04 Rear Panel
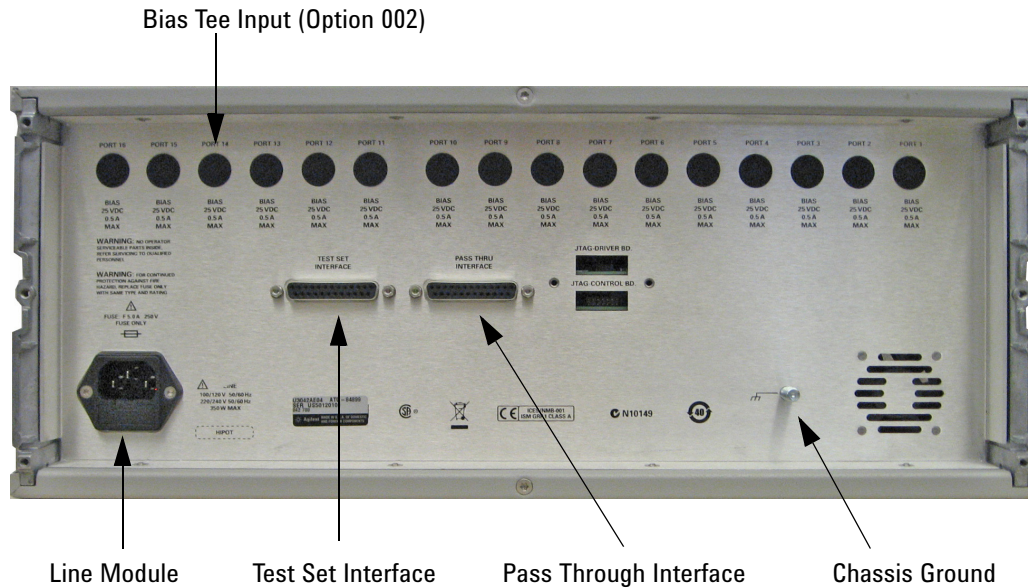
Bias Tee Input

BNC Input connectors for Option 002.

Chassis Ground

A threaded terminal post for connecting the test set to a conductive object, cabinet or structure to ensure a common potential and reduce leakage current in a system. Requires an English 1/4-20 thread nut (2950-0004) and lock washer (2190-0067).

Pass Through Interface

Connection to another test set.

Test Set Interface

The Test Set I/O connector is used to send address and data to the test set from the network analyzer.

Line Module

This assembly houses the line cord connection, line fuse, and line voltage selector. Remove the line module cover to replace or change the fuse. Line voltage selection is automatic and no setting is required.

Install the instrument so that the detachable power cord is readily identifiable and is easily reached by the operator. 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. Alternatively, an externally installed switch or circuit breaker (which is readily identifiable and is easily reached by the operator) may be used as a disconnecting device.

Available Fuses

Fuse (F 5 A/250V, 2110-0709) UL listed and CSA certified.

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.**

Figure 5   Line Module and Fuse

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

Hardware Lock-link Installation (U3021-60001)

If your system is to be rack mounted, this installation procedure does not have to be performed.

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 being opened.**

Locking the Test Set to the PNA-L

1. The lock-link kit (U3021-60001) includes:

   • 5063-9253 - Lock-links (left, 5022-2816 and right 5022-2817), Test Set
   • 5023-0132 - Lock-links kit (left, right and screws), Analyzer

2. Remove the feet from the bottom of the analyzer.

3. Remove the 2 lower standoffs from the rear panel on the analyzer using a T20 torx driver.

Figure 6   Rear Bottom Feet
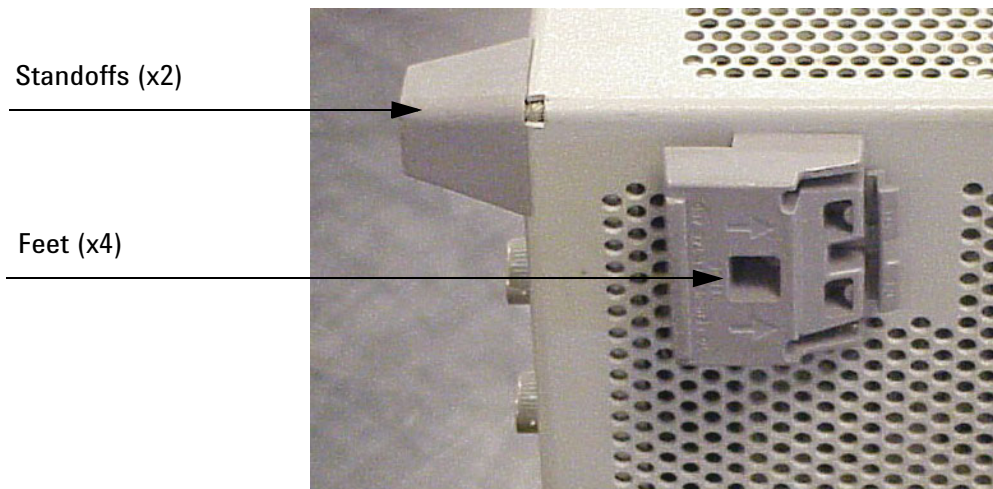
Standoffs (x2)

Feet (x4)

4. Install the lower left and right lock-links (left not shown) onto the analyzer, as shown in Figure 7.

Figure 7   Install Lock-links to the Analyzer
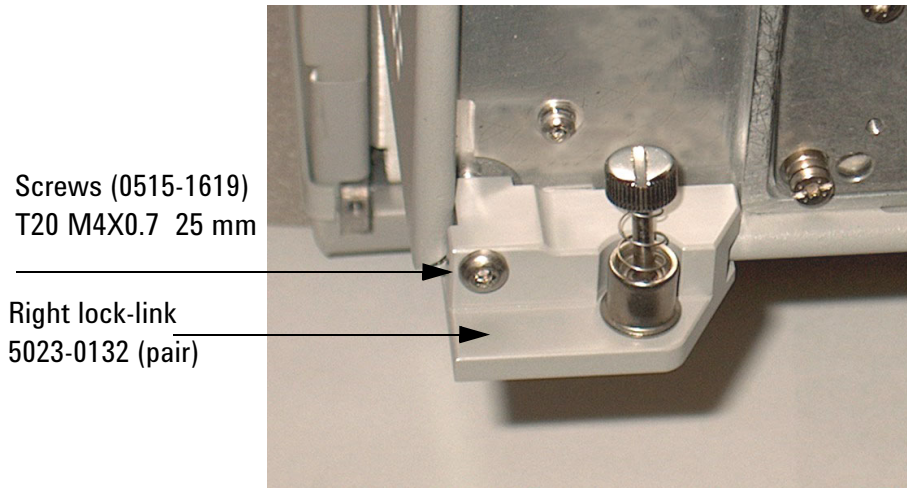
Screws (0515-1619)
T20 M4X0.7 25 mm

Right lock-link
5023-0132 (pair)

5. Remove the two upper standoffs from the rear panel of the test set using a T20 torx driver.

6. Install the left and right lock-links onto the test set, as shown in Figure 8.

Figure 8   Rear Lock-links to the Test Set

Right lock-link
5022-2816

Left lock-link
5022-2818

Screw 0515-1244 (x2)

T20 M3.5X0.6 12 mm

7. Place the analyzer on top of the test set and ensure that the front frame of the analyzer is positioned slightly forward of the locks that are attached to the test set. Slide the analyzer back so the locks engage the front frame of the analyzer.

Figure 9   Locking the Analyzer
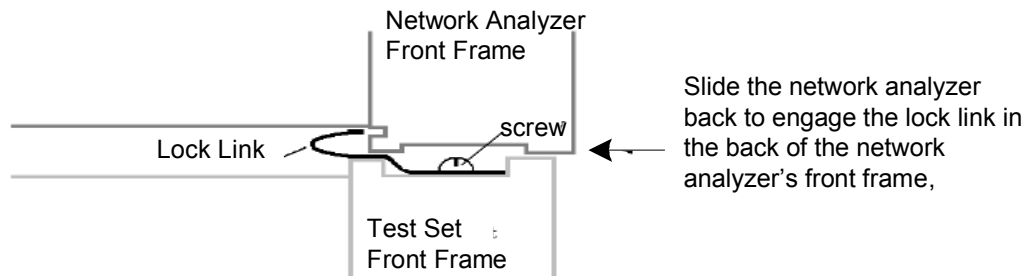
8. Secure the analyzer's lower lock-links to the test set's upper lock-links using the spring–loaded screw. If the analyzer's lock-links are not aligned with the screw holes, loosen the screws securing the feet to the instrument to align and tighten.

Figure 10   Lock-link Secured
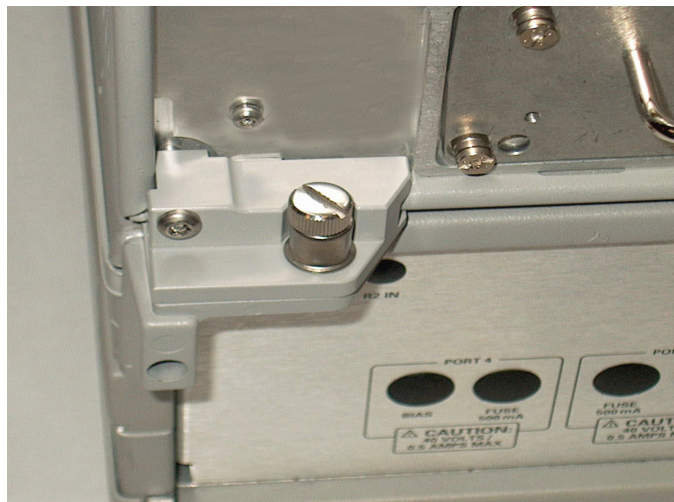
NOTE   Refer to "Network Analyzer RF Cable Interface Kit Options" on page 5.

Hardware Lock-link Installation (U3021-60002)

If your system is to be rack mounted, this installation procedure does not have to be performed.

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 being opened.

Locking the Test Set to the PNA or PNA-X

1. The lock-link kit (U3021-60002) includes:

   - 5023-0132 – Lock-links kit (left, right pair and screws), Analyzer
   - 0515-2317 – Screw T15 M3.5x0.6 12 mm
   - N5242-20138 – Right Lock-link, Test Set
   - N5242-20139 – Left Lock-link, Test Set

2. Remove the feet from the bottom of the analyzer.

3. Remove the 2 lower standoffs from the rear panel on the analyzer using a T20 torx driver.

Figure 11   Rear Bottom Feet & Standoffs
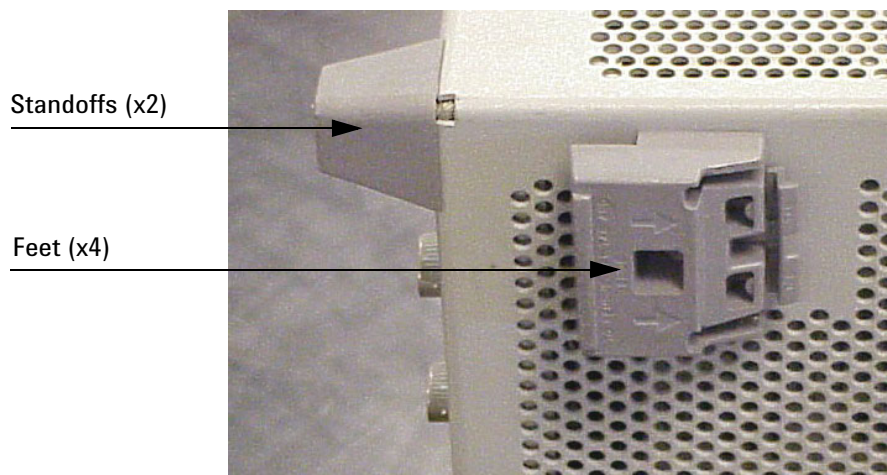
Standoffs (x2)

Feet (x4)

4. Install the lower left and right lock-links (left not shown) onto the analyzer, as shown in Figure 12.

Figure 12   Install Lock-links to the Analyzer
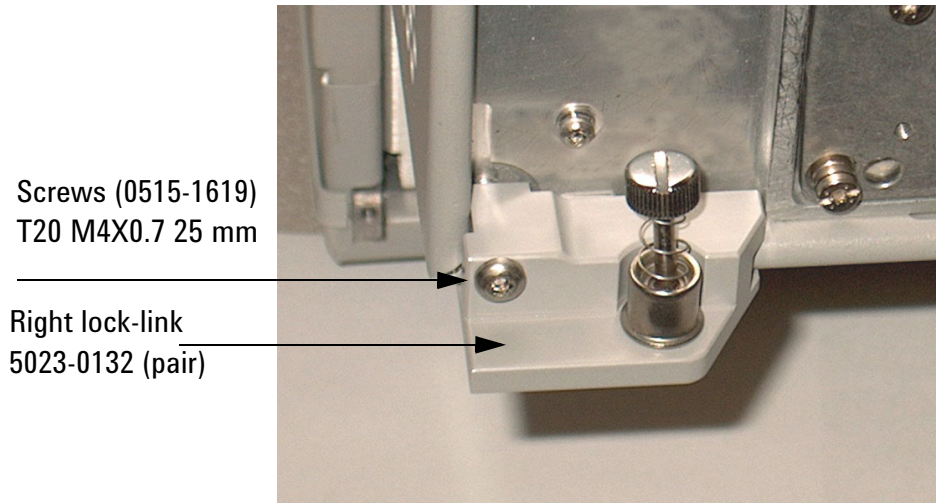
Screws (0515-1619)
T20 M4X0.7 25 mm

Right lock-link
5023-0132 (pair)

5. Remove the two upper standoffs from the rear panel of the test set using a T20 torx driver.

6. Install the left and right lock-links onto the test set, as shown in Figure 13.

Figure 13   Install Lock-links to Test Set

Right lock-link
N5242-20138

Left lock-link
N5242-20139

Screw 0515-2317 (x2)
T15 M3.5X0.6 12 mm

7. Place the analyzer on top of the test set and ensure that the front frame of the analyzer is positioned slightly forward of the locks that are attached to the test set. Slide the analyzer back so the locks engage the front frame of the analyzer.

Figure 14   Locking the Analyzer

Network Analyzer
Front Frame

Lock Link

screw

Slide the network analyzer
back to engage the lock link in
the back of the network
analyzer's front frame,

Test Set
Front Frame
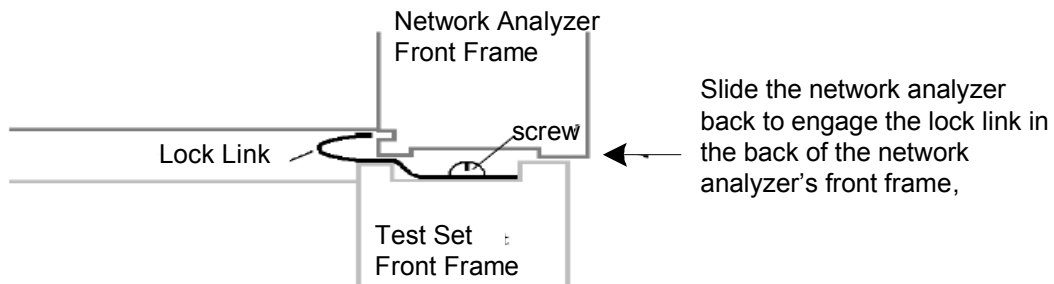
8. Secure the analyzer's lower lock-links to the test set's upper lock-link using the spring–loaded screws. If the analyzer's lock-links are not aligned with the screw holes, loosen the screws securing the feet to the instrument to align and tighten.

Figure 15   Locked

N5230A/C and N5232A RF Interface Cable Connections (U3021-60045)

Figure 16 illustrates the cable configuration of the test set to the PNA-L. The cables have been supplied with the kit (U3021-60045).

Cable Connection Procedure

1. Remove the SOURCE OUT to CPLR THRU and RCVR IN to CPLR ARM jumpers (x16) on the PNA-L. The RCVR R1 to SOURCE OUT reference loop jumper (x1) remain on the front panel.

2. Connect the RF interconnect cables, supplied with this option, from the PNA-L to the test set. Torque each cable to 8 in-lb. The Z5623-20418 are the short cables and the Z5623-20419 are the long cables. Refer to Table 7 and Figure 16.

CAUTION	Over torque will cause damage to the test set and may cause the connectors to spin or become loose.

CAUTION	Each end of the interconnect RF cables have a different length from the bend. When connecting the RF Interconnect cables be sure that the longer end (from the bend) is connected to the PNA-L.

Table 7   PNA-L Interface Cable Connection (U3021-60045)

RF Cables	From PNA-L	To Test Set
Z5623-20418	SOURCE OUT	SOURCE OUT
Z5623-20418	CPLR ARM	CPLR ARM
Z5623-20419	CPLR THRU	CPLR THRU
Z5623-20419	RCVR IN	RCVR OUT

Figure 16   8-Port Interface Connections
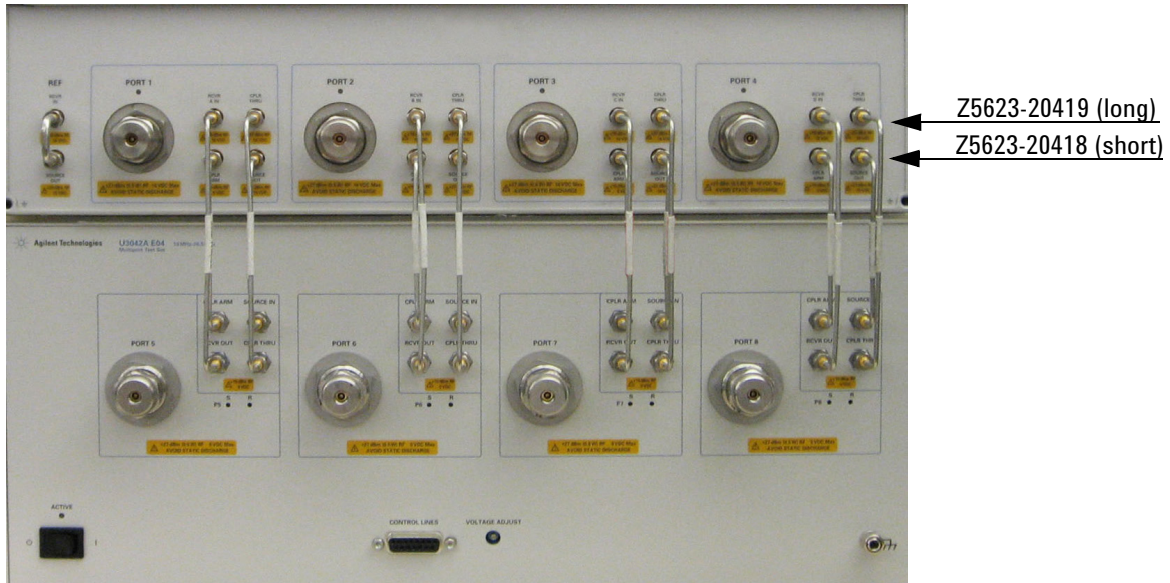
Z5623-20419 (long)
Z5623-20418 (short)

3. Connect the Test Set I/O cable (N4011-21002) to the Test Set Interface connector on the rear panel, similar Figure 18 on page 23.

   Refer to "System Operational Check" on page 24"for turn-on verification of the multiport system.

N5222A and N5242A RF Interface Cable Connections (U3021-60047)

Figure 17 on page 22 illustrates the cable configuration of the test set to the analyzer. The cables have been supplied with the kit (U3021-60047).

Cable Connection Procedure

1. Remove the SOURCE OUT to CPLR THRU and RCVR IN to CPLR ARM jumpers (x8) on the analyzer. The RCVR R1 - R4 to SOURCE OUT reference loop jumpers (x4) remain on the front panel.

2. Connect the RF interconnect cables from the PNA or PNA-X to the test set in the order listed. As you are connecting each cable, torque to 8 in-lb. The longer, straight end of each cable is connected to the test set. Refer to Table 8 and Figure 17.

CAUTION	Over torque will cause damage to the test set and may cause connectors to spin or become loose.

**Table 8   PNA or PNA-X RF Interface Cable Connection (U3021-60047)**

Numeric Order	RF Cables	From PNA-X	To Test Set
1	U3042-20031	Port 1 SOURCE OUT	Port 5 SOURCE IN
2	U3042-20032	Port 1 CPLR THRU	Port 5 CPLR THRU
3	U3042-20029	Port 1 CPLR ARM	Port 5 CPLR ARM
4	U3042-20030	Port 1 RCVR A IN	Port 5 RCVR OUT
5	U3042-20035	Port 3 SOURCE OUT	Port 6 SOURCE IN
6	U3042-20033	Port 3 CPLR ARM	Port 6 CPLR ARM
7	U3042-20034	Port 3 RCVR C IN	Port 6 RCVR OUT
8	U3042-20036	Port 3 CPLR THRU	Port 6 CPLR THRU
9	U3042-20038	Port 4 RCVR D IN	Port 7 RCVR OUT
10	U3042-20037	Port 4 CPLR ARM	Port 7 CPLR ARM
11	U3042-20039	Port 4 SOURCE OUT	Port 7 SOURCE IN
12	U3042-20040	Port 4 CPLR THRU	Port 7 CPLR THRU
13	U3042-20041	Port 2 CPLR ARM	Port 8 CPLR ARM
14	U3042-20044	Port 2 CPLR THRU	Port 8 CPLR THRU
15	U3042-20043	Port 2 SOURCE OUT	Port 8 SOURCE IN
16	U3042-20042	Port 2 RCVR B IN	Port 8 RCVR OUT

Refer to "Interconnect Cable Verification" on page 23.

Figure 17 illustrates the final two digits of the part number for each cable. The cables must be connected in the numeric order listed in Table 8 on page 21.

Figure 17   RF Interface Cable Connections
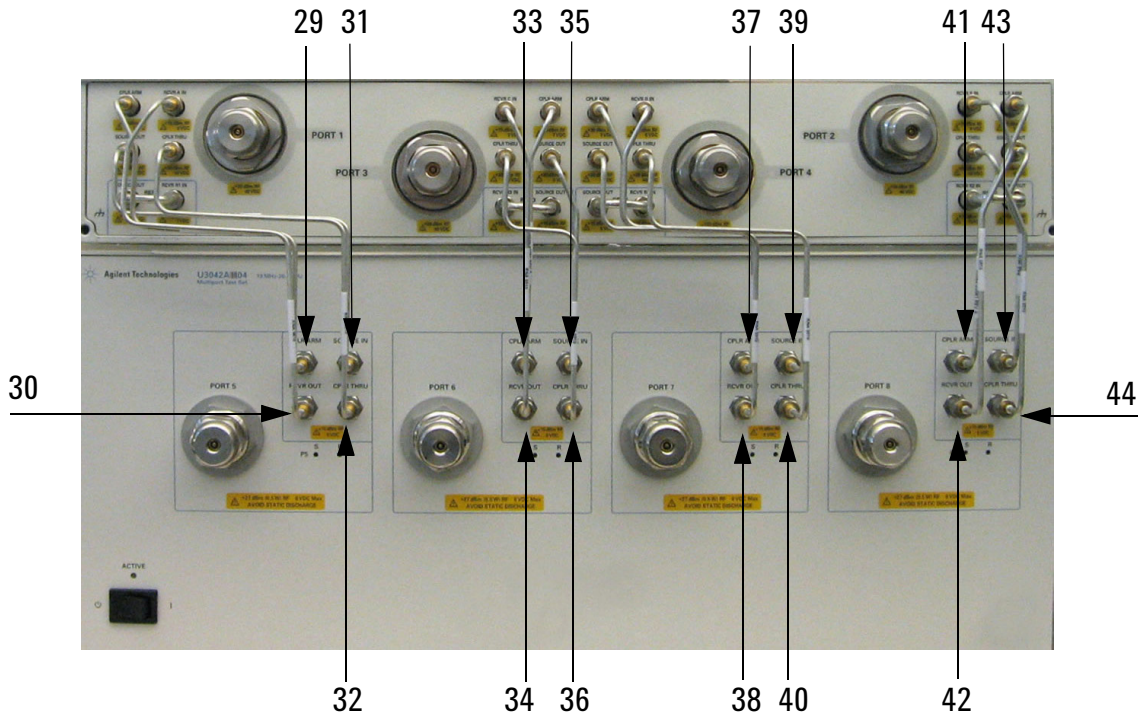
3. Connect the Test Set I/O cable (N4011-21002) to the test set Interface connector on the rear panel, similar to Figure 18 on page 23.

Test Set I/O Cable Installation

1. Connect the Test Set I/O cable (N4011-21002) to the Test Set Interface connector on the rear panel, similar to Figure 18.

Figure 18   Test Set I/O Cable Connection

N4011-21002
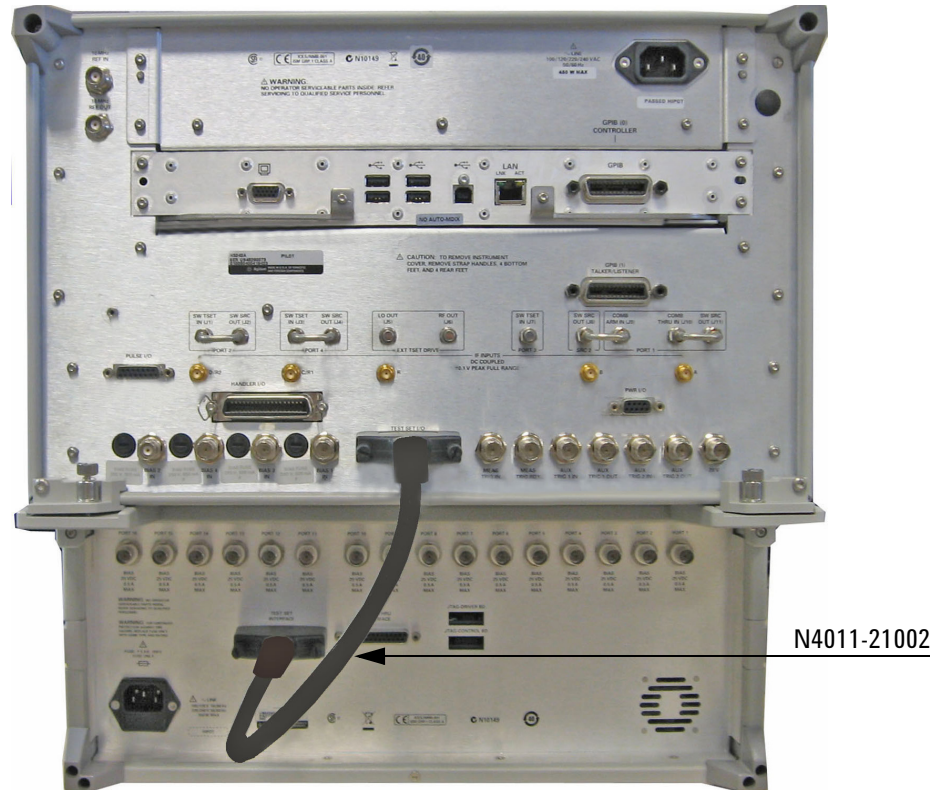
Interconnect Cable Verification

1. Perform the "System Operational Check" on page 24.

2. If the problem still exists, perform the "RF Switching Failures" on page 70.

3. If a power hole or other failure still exists, refer to "Contacting Agilent" on page 84.

System Operational Check

The following procedure will confirm that the RF interface cables between the Test Set and PNA-X are installed and the system is working correctly. Ensure that your analyzer is calibrated by measuring the short on each port before connecting the test set.

NOTE	This section is written using the PNA-X as an example. It is valid for the PNA and PNA-L, simply adjust the settings accordingly.

Complete the following steps before beginning this procedure:

- Stack the PNA-X on top of the Test Set.

- Install the Test Set I/O cable on the rear panel.

- Install all of the RF interface cables on the front panel.

- Install the included female 3.5 mm short (85052-60007) to Port 1 on the analyzer.

Equipment Setup

- Turn on the test set and the analyzer.

- Preset the analyzer and make the following settings:

  — Set to Multi-Port Mode (refer to "Multiport Mode (Option 551)" on page 28)
  — Frequency range: 10 MHz to 26.5 GHz
  — IFBW: 1 kHz
  — Scale: 10 dB/Div
  — Set the PNA to measure S11
  — Ensure the RF path of the analyzer is in Default mode. Refer to "RF Path Configuration with Option 029" on page 32.

Verify Results

The 3.5 mm short will be relocated to each Test Port and an uncorrected Sxx reflection response trace should be displayed that resembles the following plots indicated in the table below. If you suspect an RF signal path problem, refer to the RF cable diagram and check the interface cables associated with this signal path for proper installation.

Table 9   Reflection Response Results

Reflection Port	Response Trace	Cable Path Diagram
Ports 1-4	Figure 19 on page 25	Figure 20 on page 25
Ports 5-8	Figure 21 on page 26	Figure 22 on page 26

NOTE	The trace ripple (peak-peak variation) will be higher when using an ECal Module due to variation in your short's performance. If response is in question perform *"Cal Kit Operational Check" on page 49*.

Figure 19   Typical Reflection Response Ports 1 to 4
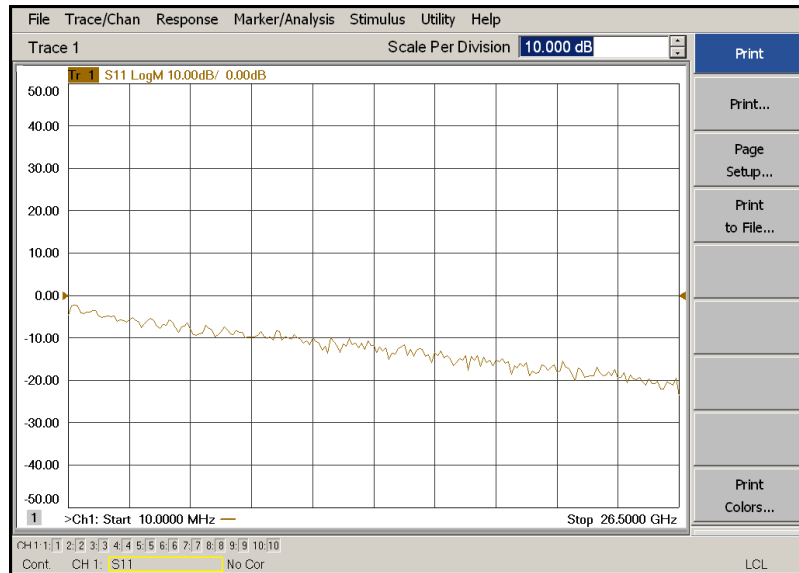
Figure 20   Reflection Response Signal Path Diagram Ports 1 to 4
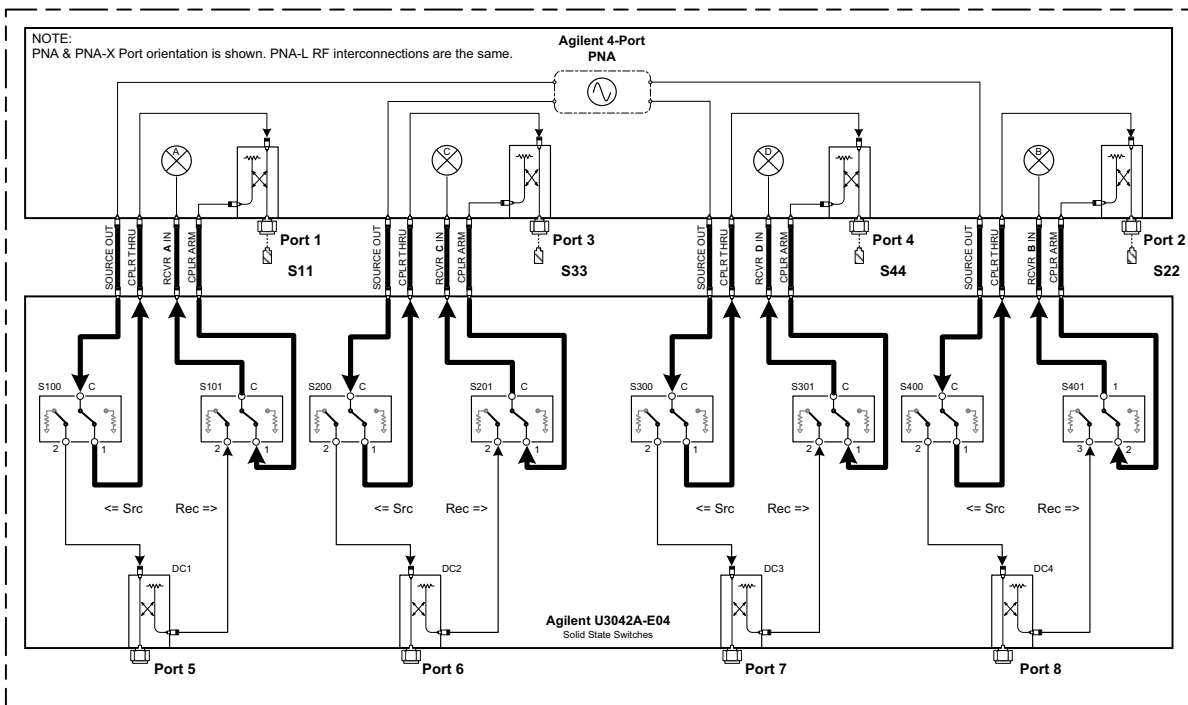
Figure 21   Typical Reflection Response Ports 5 to 8
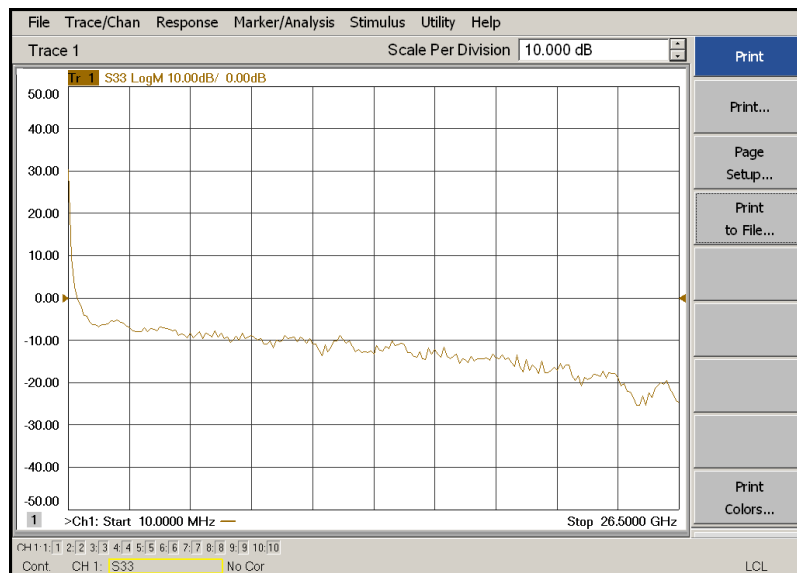
Figure 22   Reflection Response Signal Path Diagram Ports 5 to 8
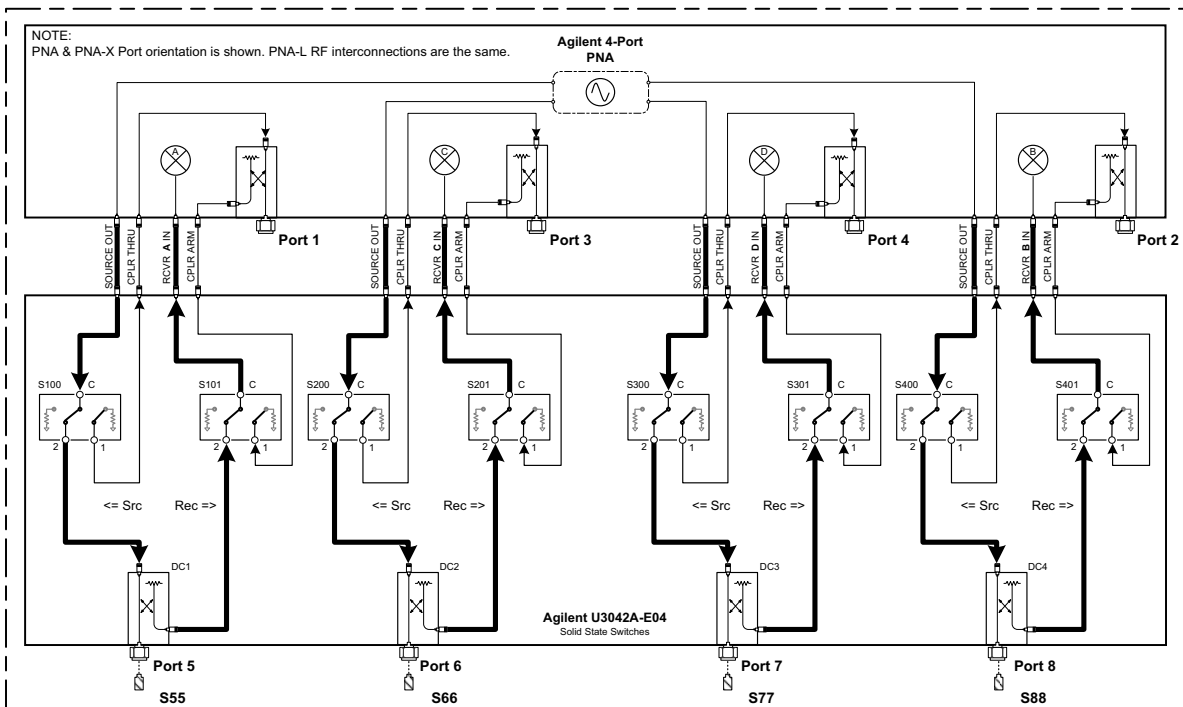
Controlling the Test Set with N5222A, N5230C, N5232A or N5242A

This section will describe how to operate the test set with the analyzer.

NOTE	The internal firmware of the analyzer has not been modified for this test set option. Power levels may differ from those indicated on the network analyzer when the test set is connected.

The test set is considered a "slave" instrument. A PNA, PNA-X or PNA-L must be used to control the test set. There are three methods to control the test set. Multiport mode is recommended due to calibration and ease of use.

Typeface Key Conventions

The following key conventions are used throughout this document.

- **[HARDKEYS]** are labeled front panel keys

- **SOFTKEYS** are indicated on the instrument display

Multiport Mode (Option 551)

Multiport mode selects the test set file that will enable the network analyzer to control the Test Set. Multiport mode allows you to complete a N-Port calibration using the Cal Wizard application in the network analyzer. Refer to the Help system for more information.

The following Test Set file must be installed into network analyzer file directory: c:\Program Files\Agilent\Network Analyzer\testsets

4-Port PNA-L requires Test Set: u3042ae04_p4.tsx
4-Port PNA or PNA-X requires Test Set: u3042ae04_pnax_p4.tsx

How to Access Multiport Mode

1. The Option 551 must be installed for multiport capability. To access the multiport application select **Utility** > **System** > **Configure** > **Multiport Capability**.

2. Select **U3042AE04** (8-Port System) from the drop-down menu and select **Restart as a multiport PNA with this testset** > **OK**. The analyzer will restart the network application with the test set interface features.

If the test set is not available in the drop-down list, it will be necessary for you to copy the required Test Set file to the analyzer's hard drive. The current version of the test set files are available on the web at *http://na.tm.agilent.com/multiport*. Copy the appropriate file to c:\program files\Agilent\Network Analyzer\testsets directory.

Figure 23   Selecting Multiport Mode
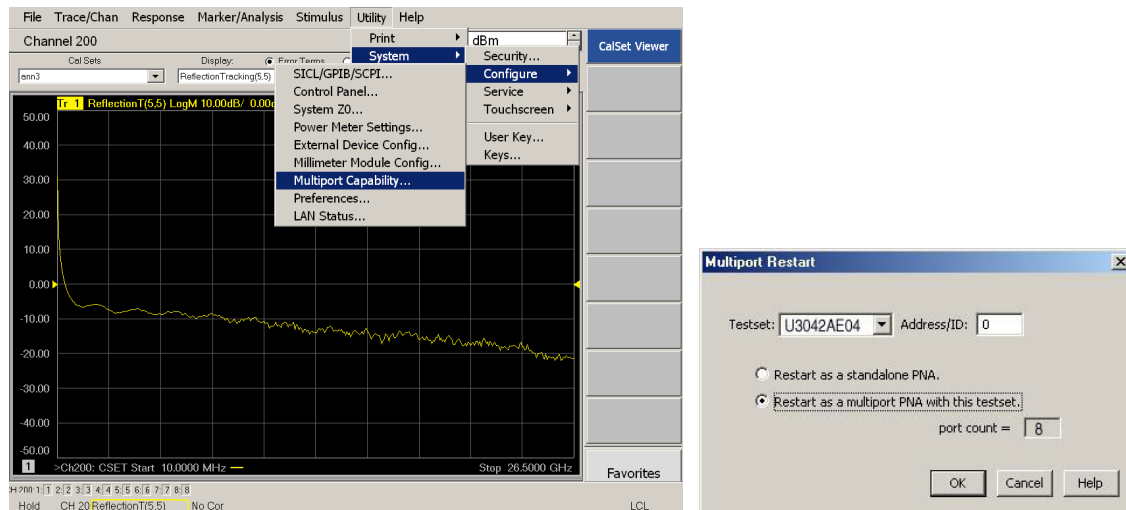
External Test Set Control Feature

To verify that the network application has the test set interface features, select **Trace/Chan** > **Channel** > **Hardware Setup** > **External Test Set** > **Other.** The test set will be displayed as **External Test Set Control-U3042AE04**.

Figure 24   External Test Set Control
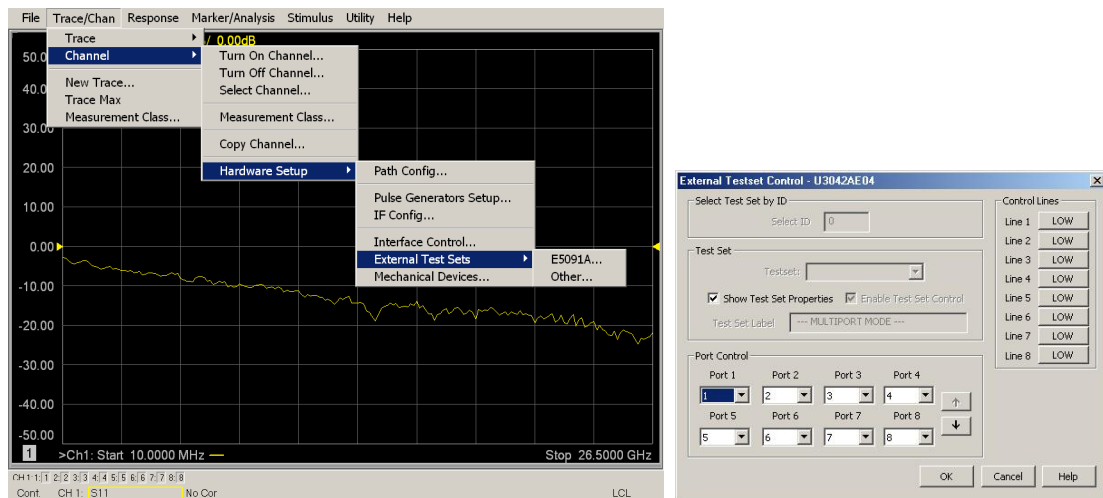
This menu will allow the physical Ports 1 thru 8 to be identified as any port for your convenience. For example; Port 5 can be re-named Port 2.

The **External Test Set Control-U3042AE04** also allows control of the DUT control lines, refer to "Control Lines" on page 43. To change the state from LOW to HIGH, select the graphical user interface (GUI) for the specific control (LINE 1 thru 8), click **OK**. Each line can be controlled separately.

Trace Measure S-Parameter

S-Parameter selection can be accomplished using **Response** > **Measure**. Use the drop-down menu to select 1 of 64 S-Parameters for the 8-Port system. The first number in the Sxx selection is the Receiver Port and the second number will be the Source Port. Any port can be selected to be the Receiver, Source or both, as in S11. The front panel R LED indicates the port is the Receiver and the S LED indicates the port is the Source.

Figure 25   S-Parameter Measurement
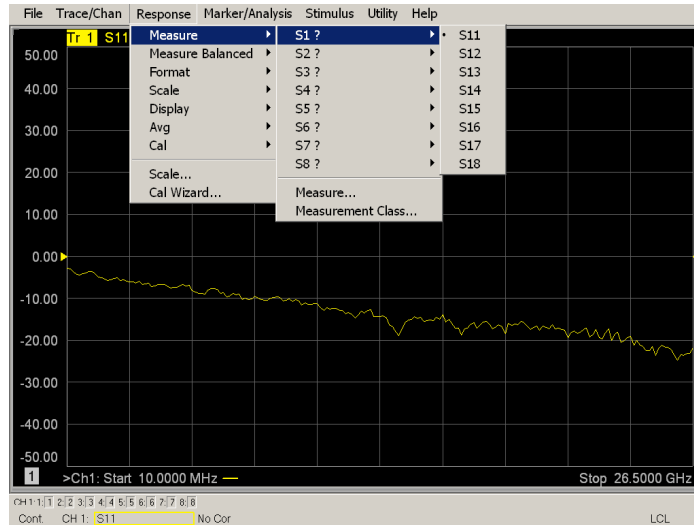
New Trace Measure S-Parameter

S-Parameter Tab: Multiple S-Parameters can be made from the **New Trace** menu. In the drop-down menu select **Trace/Chan** > **Trace** > **New Trace**. The dialog box allows the selection of any of the 64 S-Parameters.

Figure 26   New S-Parameter Measurement
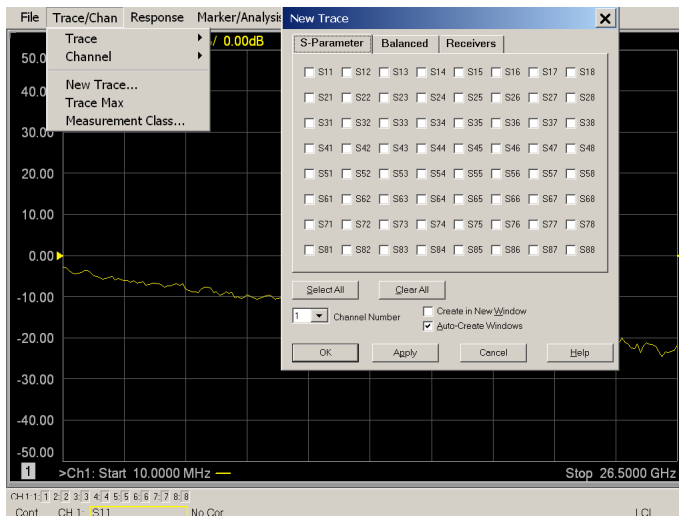
Balanced Tab:

Balanced Measurements can be configured by selecting the Balance tab in the New Trace menu.

For more information on balanced (differential) component measurement, refer to the Application Note 1373-1 and 1373-2 (5988-5634EN and 5988-5635EN) at *http://www.home.agilent.com*. In the search menu type "Multiport and Balanced."

Figure 27   Selecting Balanced Measurements
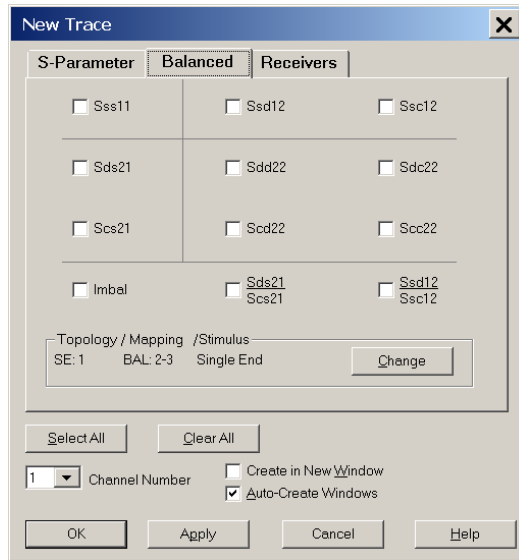
Receivers Tab:

The S-Parameter measurements can be ratioed with selectable Denominators for each port and receiver. Refer to the standard documentation for more information.

Figure 28   Receiver Measurements
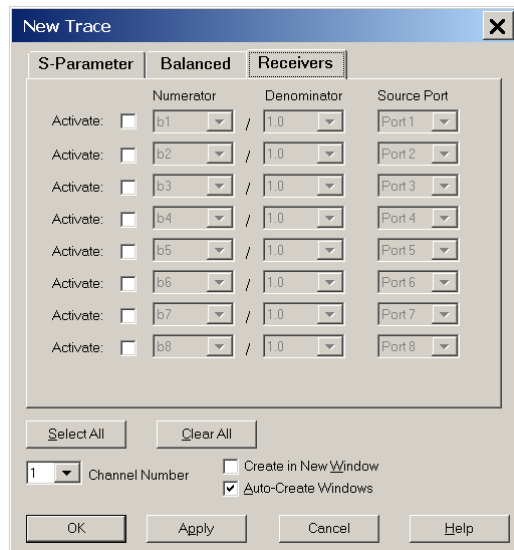
RF Path Configuration with Option 029

NOTE   If the analyzer has Option 029 or H29 (noise figure capability) verify that the path configuration is set to Default. If it is not in Default configuration, ports 5 and 9 will not operate correctly. Select **Trace/Chan > Channel** > **Hardware Setup > Path Cong**... and in the drop-down menu select **Default** > **OK**. Save this configuration as a User Preset by selecting **Save** > **User Preset** > **Save current state as User Preset**. Do not use the factory Preset (User Preset Off), the analyzer will return to Option 029 path configuration.

Figure 29   RF Path Configuration
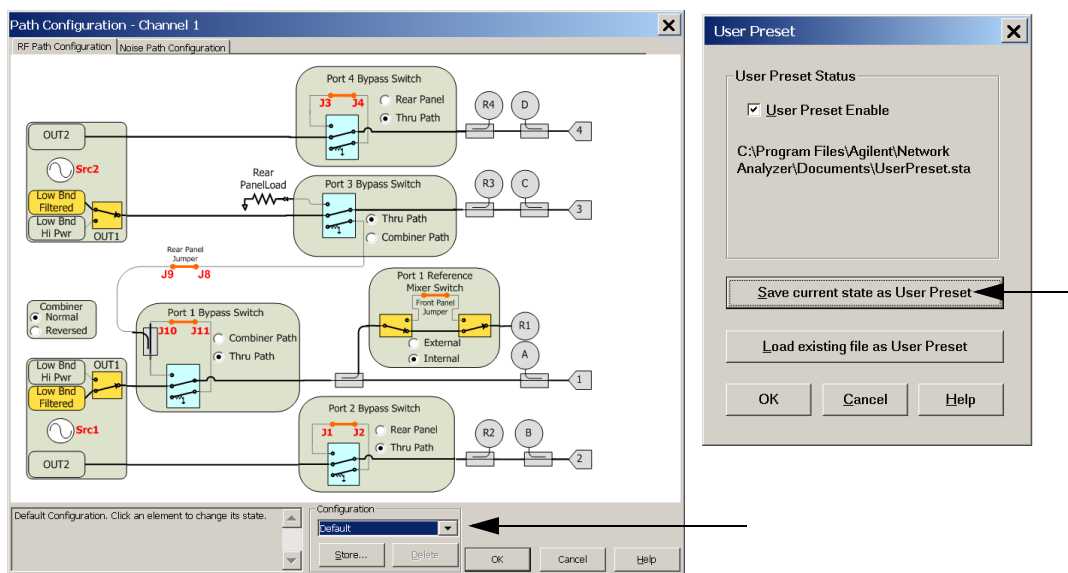
N-Port Calibration

It is recommended that you perform an ECal characterization to minimize the connections required for multiple port calibration. The N4691B Option M0F is recommended with cable (85131F) if you are calibrating at the analyzer and test set ports.

Characterize the ECal module with adapters that will not be used in the measurement of the DUT. To characterize the ECal module select **Response > Cal > More > ECal > Characterize ECal Module**.

Calibrate at the end of the test port RF cables and any adapters that are used to connect the DUT. This removes the effect on the measurement of the DUT. Failure to do this will create ripple and other measurement errors.

NOTE   If measurement errors occur, ensure the newest version of firmware is installed on the network analyzer. Measurement errors can be a result of firmware algorithms. Consult with Agilent Service or firmware web page for the latest PNA, PNA-L or PNA-X Option 551 firmware revisions and history. *http:\\na.tm.agilent.compna\firmware\firmware.htm*

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1. To perform an ECal characterization select **Response** > **Cal Wizard** > **Characterize ECal Module** and follow the prompts.

2. Save the ECal characterization file. Refer to the Help menu for characterizing information.

Figure 30   ECal Characterization and Calibration Wizard
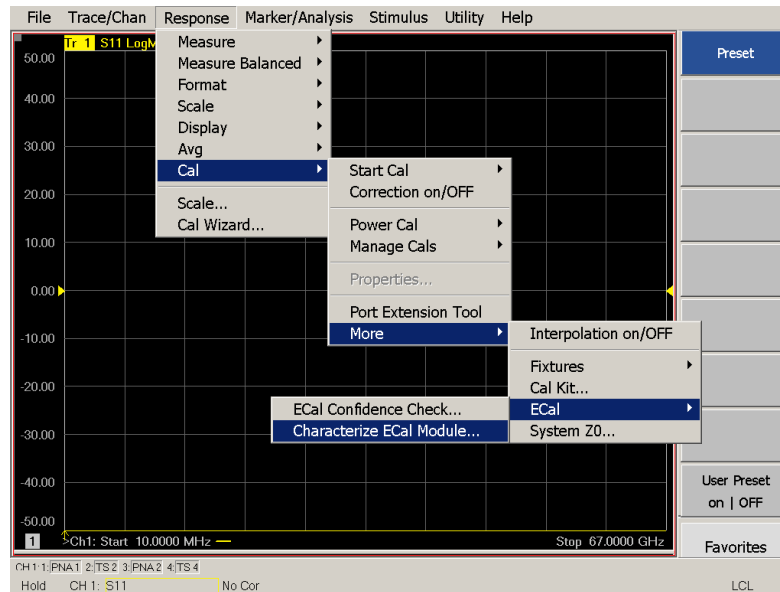
3. On the analyzer select **Response** > **Cal Wizard**.

    a. If using a mechanical cal kit, select **SmartCal (Guided Calibration)** > **Next**.

    b. If using an ECal module, connect the ECal to an available USB port and select **Use Electronic Calibration (ECal)** > **Next**.

Figure 31   Begin Calibration
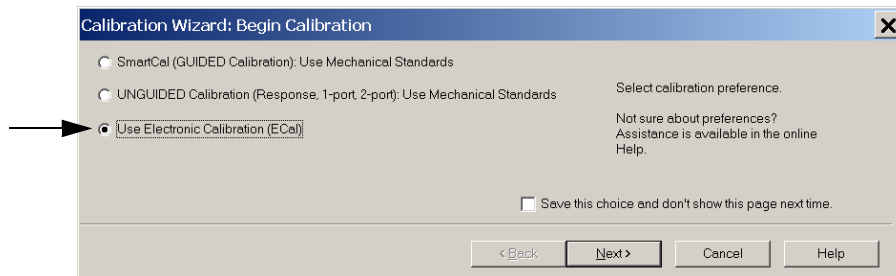
4. Continue following the Cal Wizard prompts. In the "Select Calibration Ports and ECal Module" dialog box press **Select All**, or select the ports you are calibrating and press **Next**. If an ECal characterization has been done, select **View/Select ECal Module** and select the previously saved user file from step 3.

Figure 32   8-Port Calibration
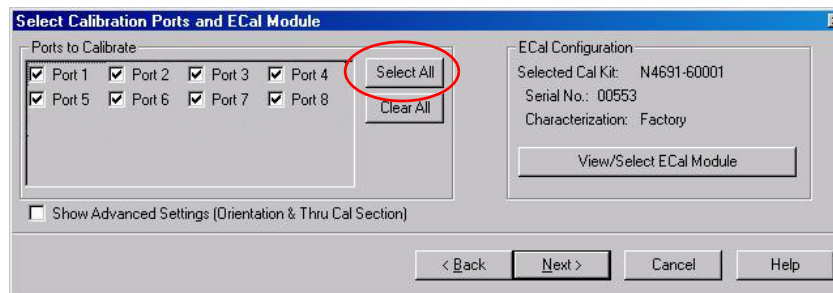
5. Connect the ECal or the mechanical cal kit to the ports you are calibrating following the Cal Wizard prompts and click **Measure** after each connection. The electrical delay value may be shown in the dialog box after the last measurement, click **OK**.

6. At the Calibration Completed prompt, select **Save As User Calset and** type the name desired and **Save**. See Figure 41 on page 52.

7. After calibrating Test Set ports, use a quality load and short to verify the calibration on each port or end of the test cable. Measure reflection and confirm the return loss is as expected. If the result is not as expected, repeat the calibration without the test set and ensure that the analyzer is in standard (non-multiport) mode.

NOTE   If measurement errors occur, ensure the newest version of firmware is installed on the analyzer. Measurement errors can be a result of firmware algorithms. Consult with Agilent Service or firmware web page for the latest   firmware revisions and history.
http:\\na.tm.agilent.com\pna\firmware\firmware.htm

Interface Control Mode

NOTE	Interface Control mode will not function properly when using multiport mode. Multiport mode will reset the switch path commands of the interface control. It is recommended that the network analyzer be restarted in stand-alone mode if the interface control is being used. Select **Utility** > **System** > **Configure** > **Multiport Capability**. In the dialog box select **Restart as a standalone PNA** > **OK.**

Overview of the Interface Control

The Interface Control feature allows you to send data and remote commands to control external equipment using the GPIB, Handler I/O, Test Set I/O, Dwell After Command and Aux I/O without the need of an external computer. Refer to analyzer's Help menu, "Rear Panel Tour" and "Interface Control."

• A unique set of control data can be sent for each channel. In addition, a unique set of control data can be sent before the channel sweep starts and after the sweep ends.

• Interface Control settings can be saved and recalled from the "Interface Control" dialog box or with Instrument State Save and Recall.

• Interface Control settings can be copied to other channels using Copy Channels.

• Control data can only be WRITTEN to the interfaces, NOT READ from the interfaces.

• Control data is sent in the following order and this order cannot be changed:
  Refer to the Help menu.

  1. GPIB Commands - BEFORE

  2. Handler I/O Control

  3. Test Set I/O Control (addr.data)

  4. Dwell After Command

  5. Aux I/O Output Voltage

How to Access Interface Control Settings

This section will describe how to setup and operate the test set with the analyzer.

1. To access the Interface Control mode, select **Trace/Chan** > **Channel** > **Hardware Setup** > **Interface Control** in the drop-down menu, and select **Enable Interface Control**.

NOTE   The analyzer includes the Interface Control application and rear panel connection. Please review this application before connecting the test set to the network analyzer. Information regarding this application can be found in the Help menu, Interface Control.
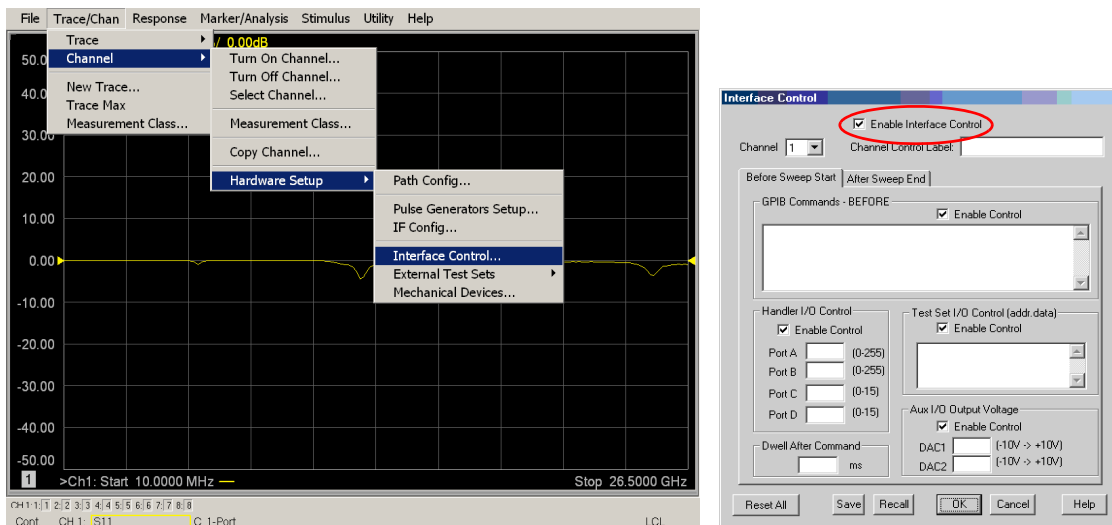
Using Interface Control Mode

An Instrument Preset will reset all of the fields to their default settings.

NOTE   If an error is encountered when sending Interface Control data, an error message is
                displayed on the analyzer's screen and the Channel Trigger State is set to Hold. You must fix
                the condition that caused the error, then change the Channel Trigger State to its original
                setting.

Figure 33   Interface Control
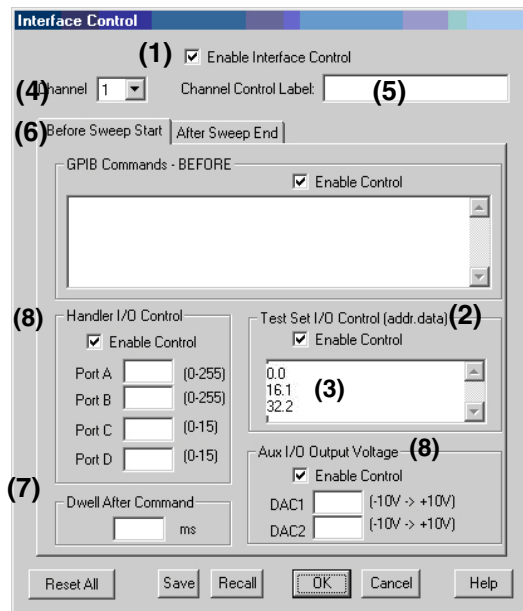
Enable Interface Control: (1)

Enables and disables ALL Interface Control communication. When cleared (default setting) Interface
Control is disabled and NO data is sent. To send data, the individual interfaces must also be enabled.

Test Set I/O Control (addr.data): (2)

Provides control of the test set I/O Interface on the rear panel of the analyzer. Used to control your test set.

Only positive integers are allowed to select switch positions or states of DUT control interface lines. Refer
to "Address and Data Values" on page 41.

Address and data integers must be separated by a period. Each set of entries should be separated by a new
line, or carriage return. The front panel Enter key can be used to insert a new line into the field. The
quantity of Test Set I/O entries that can be entered is limited by the available memory of the analyzer.

Address and Data example: **addr.data (3)**

0.0
16.1
32.2

Channel: (4)

Specifies the channel number for dialog settings. Each channel is configured individually. The drop-down list illustrates the channels that currently have measurements. There must be at least one displayed trace for the Test Set I/O Interface to function.

Channel Control Label: (5)

Specifies the label to be displayed on the analyzer's screen during the channel sweep.

Before Sweep Start – After Sweep End Tabs: (6)

Commands (GPIB, I/O's and Dwell) can be sent Before Sweep Start and After Sweep End. However, they are configured and enabled separately on the "Interface Control" dialog box. For example; to send a command before and after a PNA sweep, the "Enable Interface Control" check box must be selected and commands entered in both the Before Sweep Start and After Sweep End tabs. The **Before Sweep Start** data is sent before the first trace on the channel begins sweeping. The **After Sweep Start** data is sent after the last trace on the channel sweep is completed.

Dwell After Command: (7)

Specifies a wait time, in milliseconds, after all commands to all interfaces are sent. Any positive integer is allowed. This is used to allow all external devices to settle before beginning a measurement. An erratic trace could indicate that more settling time is necessary.

Handler I/O Control and Aux I/O Output Voltage: (8)

Provides I/O interface control through the rear panel of the PNA. Refer to the PNA Help menu for further information.

Reset All:

Sets all fields on all channels to their default values.

Save and Recall:

Saves and recalls the contents of the dialog box. If the "Interface Control" dialog box is populated with settings during an Instrument State Save, the settings are automatically recalled with the instrument state settings. Interface control uses an *.xml file type. An example file is stored on the PNA hard drive. You can recall it into the dialog, or you can open and edit it with a word processor, such as Word Pad.

OK:

Applies the settings and closes the dialog box.

Cancel:

Does not apply changes that were made and closes the dialog box.

Help:

Provides additional information for using the interface control application.

GPIB Control Mode

The GPIB Command Processor feature allows you to send remote commands and data to the analyzer's rear-panel GPIB connector and Test Set I/O connector. More information regarding the GPIB Command Processor can be found in the Help menu.

Overview of the GPIB Control

The GPIB Command Processor allows you to send address and data to control an external test set without creating a remote program. This allows you to control the test set without Option 551, or in non-standard measurement classes, such as Scalar Mixer/Converter, Swept IMD, Noise Figure Cold Source, etc. The user is required to manually input address and data using the GPIB Command Processor Console in the Help menu.

• GPIB Command Processor settings can not be saved or recalled.

• Address and data can be *written* from the GPIB Command Processor.

How to Access GPIB Command Processor

1. To access the GPIB Command Processor select **Utility** > **System** > **Configure** > **SICL/GPIB/SCPI**.

Figure 34   Utility Configure
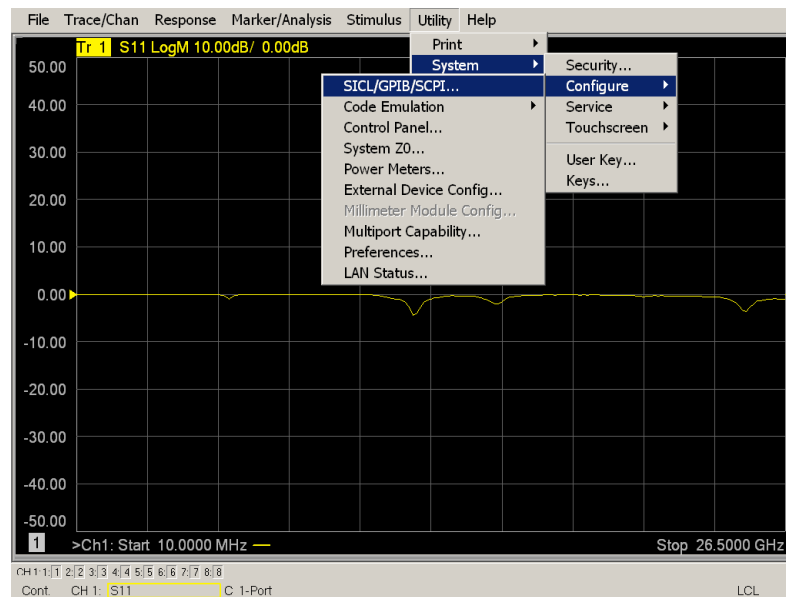
2. Select **GPIB Command Processor Console** > **OK**.

Figure 35   **GPIB Command Processor**
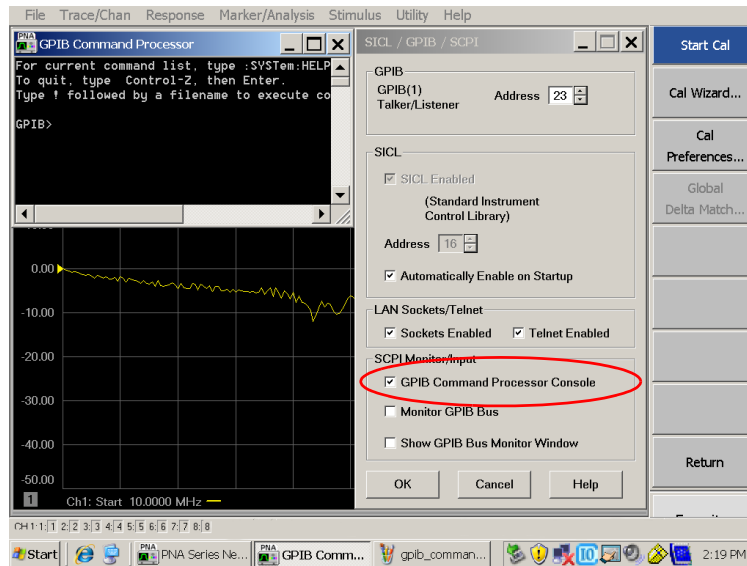
GPIB Command Processor Console

Write Commands Once the GPIB Command Processor Console is open, commands can remotely control the external Test Set I/O connector by sending the following:

  address: a integer number

  data: a integer number

Address and data are separated by a comma. Commands should be separated by a new line, or carriage return.

For example:

CONT:EXT:TEST:DATA <address>,<data>
CONT:EXT:TEST:DATA 0,0

Example: CONT:EXT:TEST:DATA 0,0
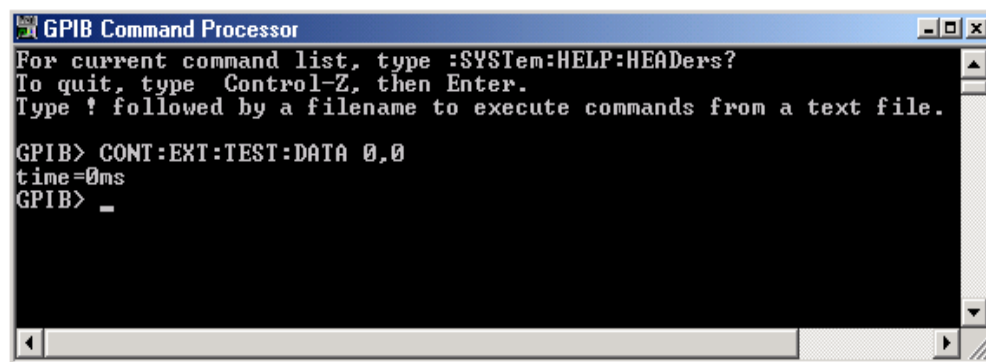
Refer to *"Address and Data Values" on page 41*.

Address and Data Values

Setting the Test Port Paths with Address and Data

Refer to Table 10, Table 11 on page 42 and Figure 36 on page 42 for information to set the internal switch paths of the test set.

The address is the first value in the Test Set I/O control or GPIB data command. The second value controls the source and receiver paths of the ports. To select a test set port configuration both switches must be set to complete the source and receiver paths. To do this you must add the data values together to determine the data command value for each port, which is the second number in the Test Set I/O or GPIB command. Refer to "Interface Control Mode" on page 35 and in "GPIB Control Mode" on page 39.

Example 1: Refer to Figure 36 on page 42.

If the ports have different addresses, two separate address data commands must be used.

Port 5 is the Source and Port 6 is the Receiver.

Source Port 5 = address 0, data 1 and Receiver Port 6 = address 16, data 16.
Two separate commands must to be sent, you may use the same dialog box. The entry will be 0.2 in one command line, and 16.32 in the second line.

Example 2:

If the ports have the same address, only one command is needed.

Port 1 is the Source and Ports 5 is the Receiver.

Source Port 1 = address 0, data 1 and Receiver Port 5 = address 0, data 16. The data values are added together, the entry will be 0.17.

Table 10   Port Address and Data Values

Address		PNA-L				PNA or PNA-X			
		Source Path		Receiver Path		Source Path		Receiver Path	
	Data	1	2	16	32	1	2	16	32
0	Ports	1	5	1	5	1	5	1	5
16	Ports	2	6	2	6	3	6	3	6
32	Ports	3	7	3	7	4	7	4	7
64	Ports	4	8	4	8	2	8	2	8

Refer to "System Block Diagrams" on page 61 for in-depth RF path information.

Figure 36   **Example 1; Address and Data (Port 5 and 6)**
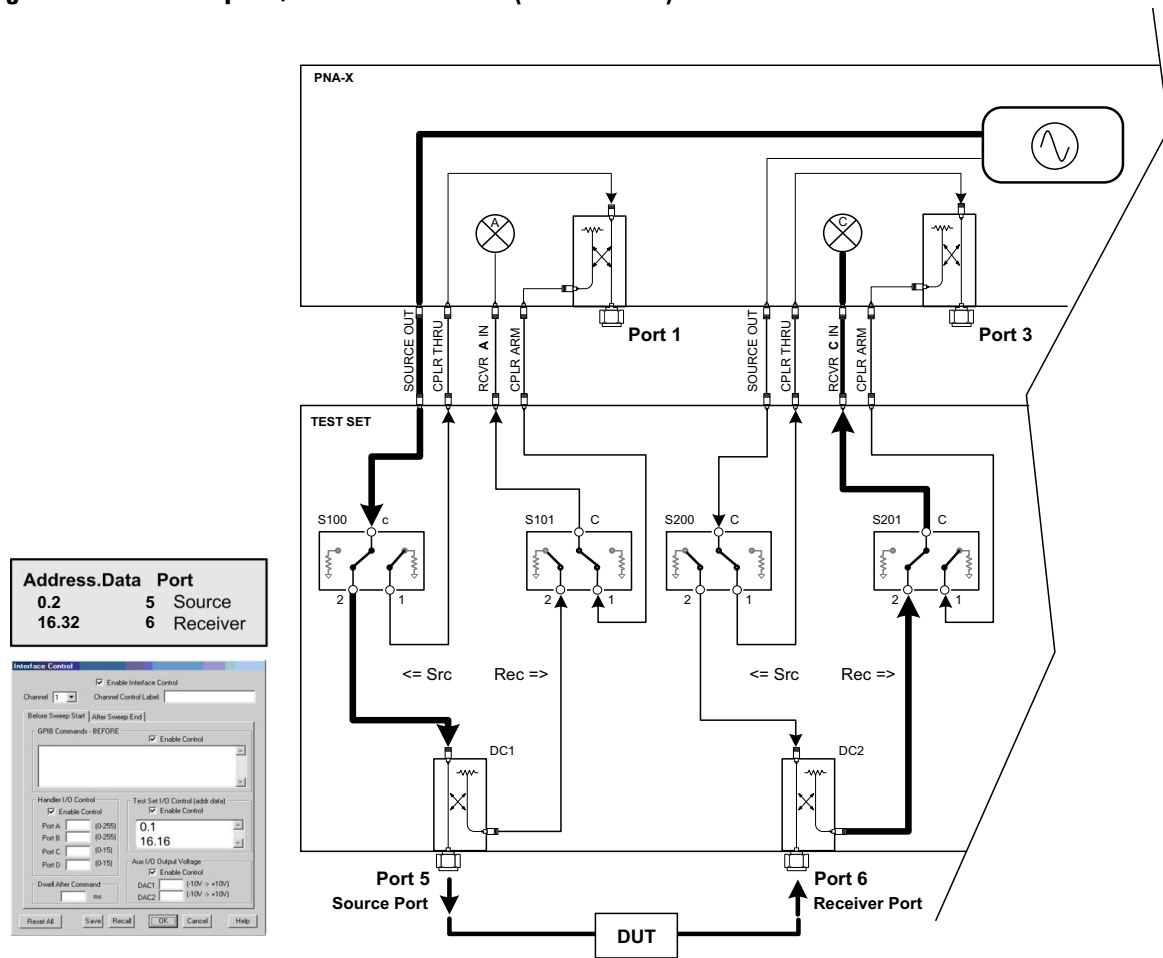
Table 11   **Example; Source and Receiver Path Values**

Ports	PNA-L		PNA or PNA-X	
	Source Path	**Receiver Path**	**Source Path**	**Receiver Path**
1	0.1	0.16	0.1	0.16
2	16.1	16.16	64.1	64.16
3	32.1	32.16	16.1	16.16
4	64.1	64.16	32.1	32.16
5	0.2	0.32	0.2	0.32
6	16.2	16.32	64.2	64.32
7	32.2	32.32	16.2	16.32
8	64.2	64.32	32.2	32.32

Control Lines

The 15 pin female D-Sub connector on the front panel provides 8 latched data lines that can be used to control your device under test (DUT). The lines can be controlled with the Multiport External Test Set control, or Test Set I/O commands. Refer to *"External Test Set Control Feature" on page 29* and *"Setting the Control Lines with Address and Data Values" on page 47*. See Table 12 for DUT control line specification.

The output voltage of the lines can be from the internal adjustable voltage source (+2 to +5 Vdc), or an external dc power supply depending on how the connection to the control line is configured. When using an external power supply a positive or negative voltage can be used. Refer to Figure 37 and Table 13 on page 44 for control line pin location and description. Refer to *"Internal Voltage Supply Configuration" on page 45* and *"External Voltage Supply Configuration" on page 46* for configurations.

Table 12   DUT Control Specifications

Item	Specifications
Connector Type	15–pin female,D–Sub
Max Output Line Current	100 mA (each line)
Control Line DC resistance	< 10 W (each line)
Voltage Range:	
Positive Input	0 to +5 V
Negative Input	–5 to 0 V
Internal Variable Voltage	+2 to +5 V

Figure 37   DUT Control Line Pin Assignment (rear panel view)
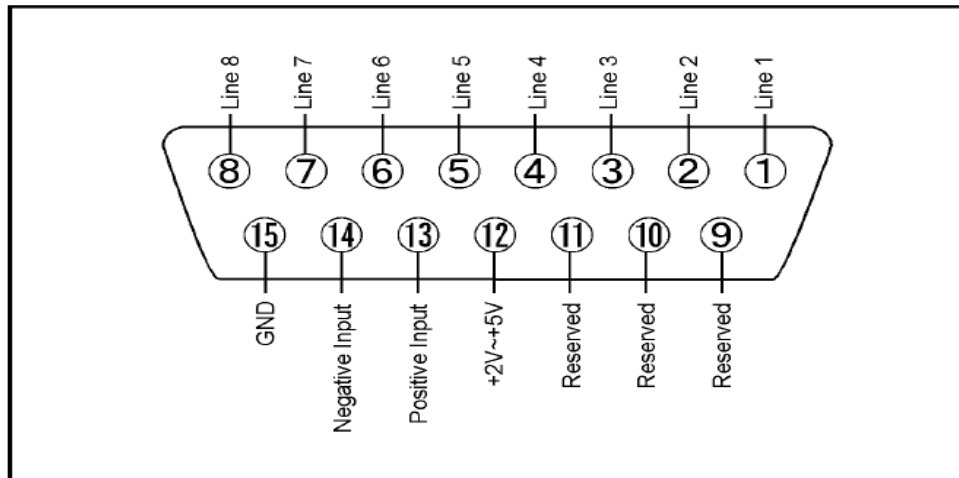
Table 13   DUT Control Line Interface Connector Pin Assignment

Pin	Signal Name	Description
1	Line 1	Control Line Output of the voltage from pin 13 or pin 14.
2	Line 2	Control Line Output of the voltage from pin 13 or pin 14.
3	Line 3	Control Line Output of the voltage from pin 13 or pin 14.
4	Line 4	Control Line Output of the voltage from pin 13 or pin 14.
5	Line 5	Control Line Output of the voltage from pin 13 or pin 14.
6	Line 6	Control Line Output of the voltage from pin 13 or pin 14.
7	Line 7	Control Line Output of the voltage from pin 13 or pin 14.
8	Line 8	Control Line Output of the voltage from pin 13 or pin 14.
9, 10 & 11		Not used
12	+2 V to +5 V	Internal voltage output, adjusted with the trimmer on the rear panel.
13	Positive Input	Connection for internal (pin 12) or external positive voltage supply.
14	Negative Input	Connection for ground (pin 15) or external negative voltage supply.
15	Gnd	ground terminal

Internal Voltage Supply Configuration

The output voltage of pin 12 can be adjusted from +2 to +5 V. Perform the following procedure to set the voltage:

1. Turn on the test set.

2. Measure the voltage between pin 12 and 15 using a multimeter.

3. Rotate the voltage adjustment trimmer on the rear panel until the multimeter indicates the selected voltage.

Figure 38 illustrates an example of the connection between the DUT and the test set using the internal dc power supply. Connect pin 12 to pin 13 and pin 14 to pin 15 to provide the ground path. Connect the control lines to the external DUT.

CAUTION   You may only connect pin 12–13, and pin 14–15, damage may result if any other paths are short-circuited.

Figure 38   Internal DC Power Configuration (rear panel view)
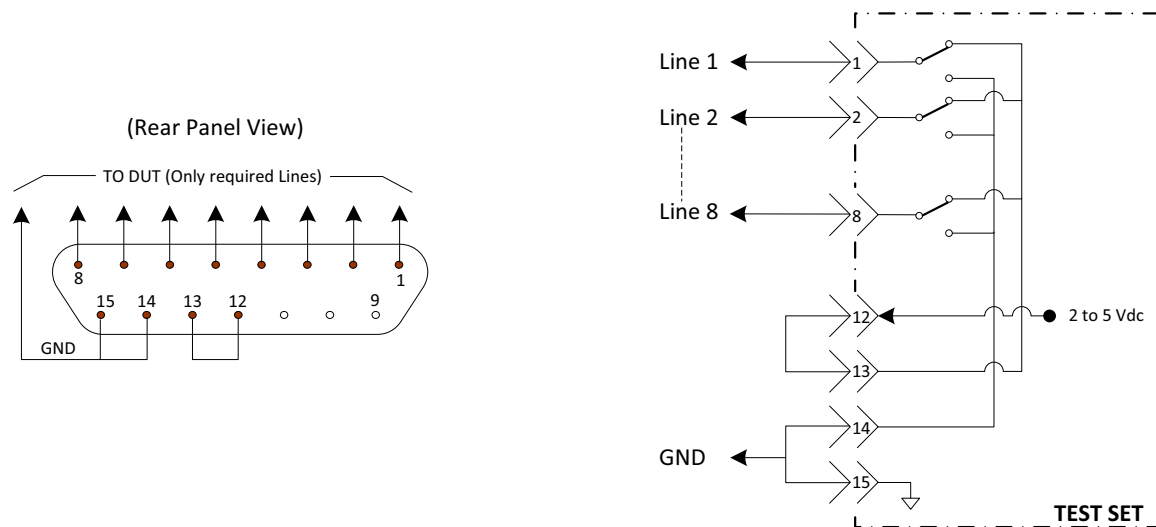
External Voltage Supply Configuration

Figure 39 illustrates an example of the connection with an external dc power supply. Connect the positive and negative voltage supply from the external power supply to the positive input (pin 13) and the negative input (pin 14). Connect the power supply dc ground to pin 15.

Turning On the Test Set using an External Power Supply

1. Turn on the test set.

2. Connect the DUT.

3. Turn on the external power supply.

Turning Off the Test Set using an External Power Supply

1. Turn off the power supply.

2. Turn off the test set.

3. Disconnect the DUT.

Figure 39   Test Set to the DUT and External DC Power Supply
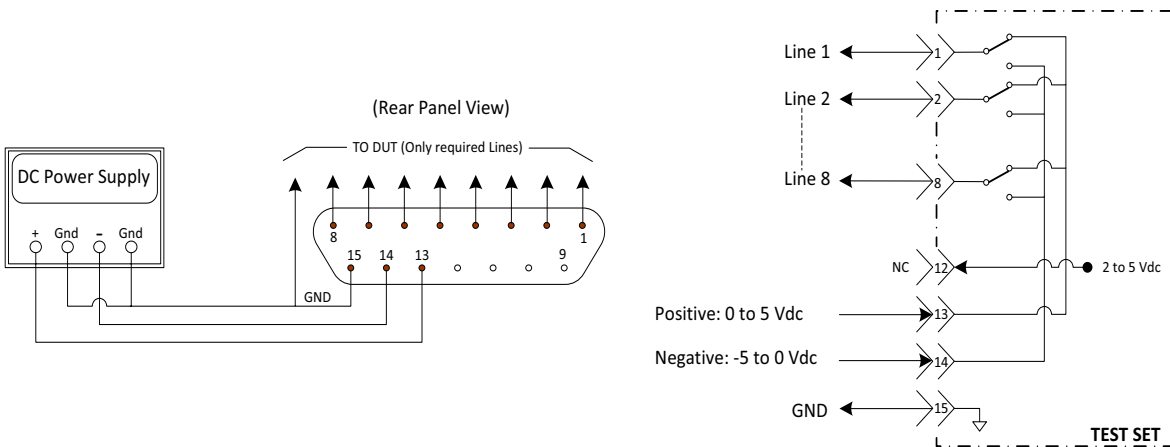
Setting the Control Lines with Address and Data Values

This section describes how to control the rear panel DUT control lines.

NOTE   The following control feature will function only while the PNA is in its Standalone Mode.

Setting the PNA to Standalone Mode

1. Select **Utility** > **System** > **Configure** > **Multiport Capability**. In the dialog box select **Restart as a standalone PNA** > **OK.**

As described in *"Setting the Test Port Paths with Address and Data" on page 41*, the <address>.<data> values are determined in a similar manor, with the following exceptions:

•   Table 14 will be used.

•   The <address> value is always = 112

Table 14   Test Set DUT Control Address and Data Logic Table

<Address>	<Data>	Description	Line/Pin
112	0	ALL DUT Control Lines set to logic high or connected to Pin 13	1-8
112	255	ALL DUT Control Lines set to logic low or connected to Pin 14	1-8
112	1	DUT Control Line 1 set to logic low or connected to Pin 14	1
112	2	DUT Control Line 2 set to logic low or connected to Pin 14	2
112	4	DUT Control Line 3 set to logic low or connected to Pin 14	3
112	8	DUT Control Line 4 set to logic low or connected to Pin 14	4
112	16	DUT Control Line 5 set to logic low or connected to Pin 14	5
112	32	DUT Control Line 6 set to logic low or connected to Pin 14	6
112	64	DUT Control Line 7 set to logic low or connected to Pin 14	7
112	128	DUT Control Line 8 set to logic low or connected to Pin 14	8

After a power reset all DUT control lines are initially configured to a logic high state or connected to Pin 13, refer to Figure 38 on page 45. To reset all control lines to logic high, without having to reset the power switch on the test set, make the following entry:

Front panel PNA Interface Control Mode line entry = **112.0** > **OK**.

Always determine which control lines you want set to a logic zero, the other remaining lines will automatically be set to a logic high. Note the <data> value of these lines and calculate the SUM of their <data> values.

Listed are two examples to illustrate this concept. Refer to Figure 28, shown with all lines = logic high.

Example 1: To change lines 1 & 8 to equal logic Low, all others logic high.

1. Line 1 (<address> = 112 and <data> = 1)

2. Line 8 (<address> = 112 and <data> = 128)

3. The SUM of the <data> values = 129

4. Front panel PNA Interface Control Mode line entry = 112.129 > OK.

Example 2: From Example 1 to only change Lines 2 & 3 to equal logic low, all others logic high.

1. Line 2 (<address> = 112 and <data> = 2)

2. Line 3 (<address> = 112 and <data> = 4)

3. The SUM of the <data> values = 6

4. Front panel analyzer Interface Control Mode line entry = 112.6 > OK.

NOTE   Since all control lines have the same <address>, only one "<address>.<data>" command
                 line is needed to control all 8 lines.

Cal Kit Operational Check

The following procedure can be used to confirm that the test set and analyzer are operational. The operation verification limits provided ensure that your test set and analyzer are operating properly within the limits. Refer to "General Specifications" on page 6.

Equipment Required

The test set requires that the user be familiar with the equipment and components listed in Table 15.

This section provides an equipment list and setup of the analyzer and test set.

Table 15   Equipment List

Description	Qty
N4691A 3.5 mm ECal Module 10 MHz to 26.5 GHz (Option 00F or M0F) *or* N4691B 3.5 mm ECal Module 300 kHz to 26.5 GHz (Option 00F or M0F) *or* Mechanical cal kit 85052B or 85052D	1
N5230C 4-Port Network Analyzer (Option 245 and 551) *or* N5222A, N5232A or N5242A Option 400 and 551	1
Set of interconnect cables (PNA and test set), see "N5230A/C and N5232A RF Interface Cable Connections (U3021-60045)" on page 19 or "N5222A and N5242A RF Interface Cable Connections (U3021-60047)" on page 21.	1

Verification Limits

Specifications for the test set are typical. System performance for the network analyzer and test set are only characteristic and intended as non-warranted information. Only a functional certificate is provided for the test set.

It is recommended that you return your instrument to Agilent Technologies for servicing or repair if the test set and network analyzer performance exceed the operational verification limits.

A periodic calibration is not required. The Operators Check should be performed after System Setup, or if performance is in question. An N-Port calibration should be performed before making a measurement.

NOTE   Typical performance is based on 1 to 2 units. Refer to Table 16 and Table 16.

Table 16   PNA-L Reflection Tracking Limits[1]

Frequency	Standard[2] Port 1-8	Option 001 or 002 Port 1-8
10 MHz to 4 GHz	−10.0 dB	0 dB
4 GHz to 6 GHz	−13.0 dB	−2.5 dB
6 GHz to 10 GHz	−16.0 dB	−5.0 dB
10 GHz to 15 GHz	−17.0 dB	−7.5 dB
15 GHz to 20 GHz	−25.0 dB	−15.0 dB

1. Reflection Tracking takes into account Source Loss, Receiver Loss, Margin, and PNA Mixer Cal.
2. A standard unit is one without Options 001 or 002.

Table 17   PNA or PNA-X Reflection Tracking Limits[1]

Frequency	Standard[2] Port 1-8	Options 001 or 002 Port 1-8
10 MHz to 4 GHz	−10.0 dB	0 dB
4 GHz to 6 GHz	−13.0 dB	−2.5 dB
6 GHz to 10 GHz	−16.0 dB	−5.0 dB
10 GHz to 15 GHz	−17.0 dB	−7.5 dB
15 GHz to 20 GHz	−25.0 dB	−15.0 dB
20 GHz to 26.5 GHz	−30.0 dB	−40 dB

1. Reflection Tracking takes into account Source Loss, Receiver Loss, Margin, and PNA Mixer Cal.
2. A standard unit is one without Options 001, 002.

Cal Kit Operational Check Procedure

The sequence of this procedure is very important and must be followed or the performance accuracy and results may vary from the reference plots provided. Ensure that the test set is not connected to the analyzer if you are performing the analyzer's Operator's Check. The analyzer will indicate false failures if the test set is connected.

Preparing the Network Analyzer

1. Connect the test set to the analyzer using the interconnect cables as shown in *"Hardware Lock-link Installation (U3021-60001)" on page 13* and *"Hardware Lock-link Installation (U3021-60002)" on page 16*.

2. Turn on the test set.

3. Select **Response** > **Cal** > **Manage Cals** > **Cal Set**. Delete or Rename any Cal Sets titled "999.1" thru "999.8" (8-Port), although it is unlikely that you will find Cal Sets with these names.

4. Verify that the network analyzer is in Multiport mode. See the bottom of the measurement window.

    a. If only four S-Parameters are listed, select **Utility** > **System** > **Configure** > **Multiport Capability**. Select **Restart as multiport PNA with this testset** and select **U3042AE04** (8-Port) from the drop-down menu > **OK**. Refer to *Figure 23 on page 28*.

5. Press **Preset.**

6. Verify that the **[Start Frequency]** is set to **[10 MHz]**.

7. Set the **[Stop Frequency]** to **[20 GHz or 26.5 GHz]**.

8. Select **[Power]** > **Power Level** and enter **[0 dBm]**.

9. Select **Response** > **Avg > IF Bandwidth** > **100 Hz** > **OK**.

10. Select **Stimulus** > **Sweep** > **Number of Points** > **401**.

11. Connect the ECal module to an available USB port on the front or rear panel. This procedure assumes you are using a ECal. If you are not, see *"1-Port Calibration and Verification Procedure" on page 52*, *step 2*.

12. Allow the ECal module, test set and analyzer to warm up for a minimum of 30 minutes.

1-Port Calibration and Verification Procedure

1. Connect the ECal or the mechanical cal kit to Port 1 or the port you are testing. Torque to 8 in-lb. For further information refer to the Help menu.

2. Perform a 1-Port Calibration on Port 1. On the analyzer, select **Response** > **Cal > Start Cal > Calibration Wizard**.

   a. If using a mechanical cal kit, select **SmartCal (Guided Calibration)** > **Next**.

   b. If using an ECal module, connect the ECal to a analyzer's USB port. Select **Use Electronic Calibration (ECal)** > **Next**.

3. Continue following the Cal Wizard prompts. In the "Select Calibration Ports and ECal Module" dialog box click **Clear All**, then select **Port 1** > **Next** > **Measure**.

4. Ensure the Cal Kit you are using is indicated on the right side of the dialog box.

Figure 40   1-Port Calibration
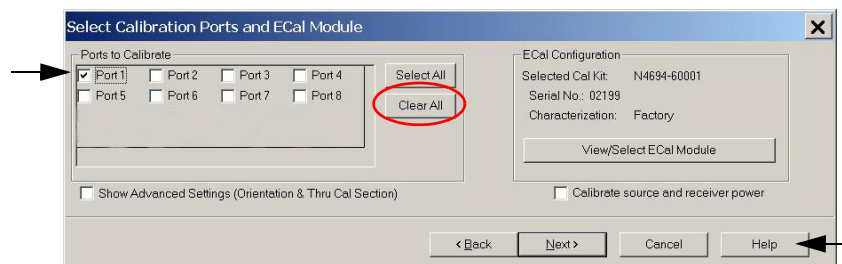
5. Continue to follow the prompts until the "Calibration Completed" dialog box appears.

6. At the Calibration Completed prompt, select **Save As User Calset**, type the name **999.1**. Overwrite the Calset if it already exists and **Save**.

NOTE   If you do not have a key board, select **Save As User Calset** > **Edit Name** and save as **999.x**. X is the port number you are calibrating. Use the numeric keypad on the analyzer front panel to enter "999.1."

---

7. Repeat step 1 thru step 6 for Ports 2 thru 8. When finished, there should be 8 Cal Sets saved with the titles "999.1" thru "999.8" (8-Port).

   If you are using an ECal module you can verify the individual port calibration by selecting **Response** > **CAL** > **More** > **ECAL** > **ECAL Confidence Check**. Select Change Measurement and select the test port S-Parameter > **Apply** > **OK** > **Read Module Data**. For further information refer to the Help menu.

Figure 41   Calibration Complete
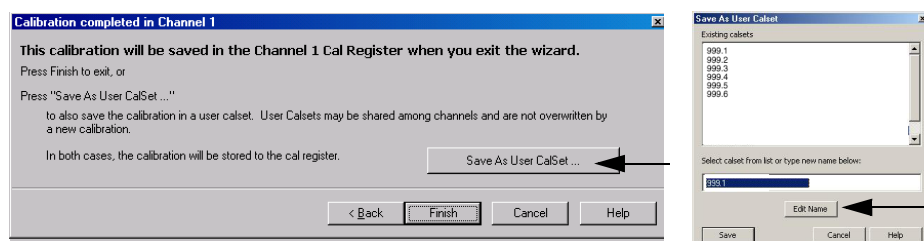
CalSet Verification

1. Select **Trace/Chan** > **Trace** > **Delete Trace**. There should be no traces on the screen.

2. To launch the Cal Set Viewer toolbar. Select **Response** > **Cal** > **Manage Cals** > **Cal Set Viewer**.

Figure 42   Calibration Cal Set Viewer
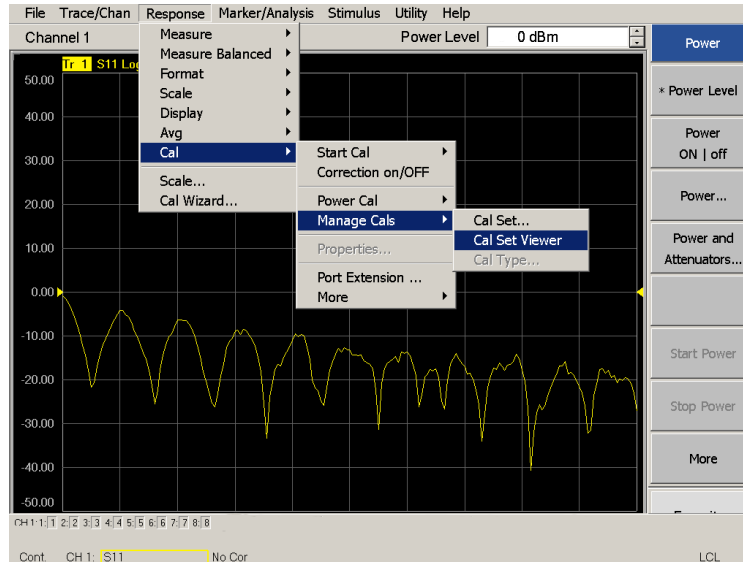
3. From the Cal Sets drop-down menu, select **999.1** and select **Enable**. Select the **Reflection Tracking(x,x)**, where x,x is the port being tested. Ensure that the **Enable** and **Error Terms** check boxes are selected.

4. Compare the Reflection Tracking (1,1) trace to the appropriate limits in Table 17 on page 50. This can be done using Limit Lines (press **Marker/Analysis** > **Analysis** > **Limit Test**). The trace should be above the limit. PASS will be displayed on the screen if the limit lines are used.

5. Repeat step 3 and step 4 for Cal Sets "999.1" thru "999.8" (8-Port).

Figure 43   Option 001 or 002 Reflection Tracking with PNA or PNA-X (Ports 1 to 4)
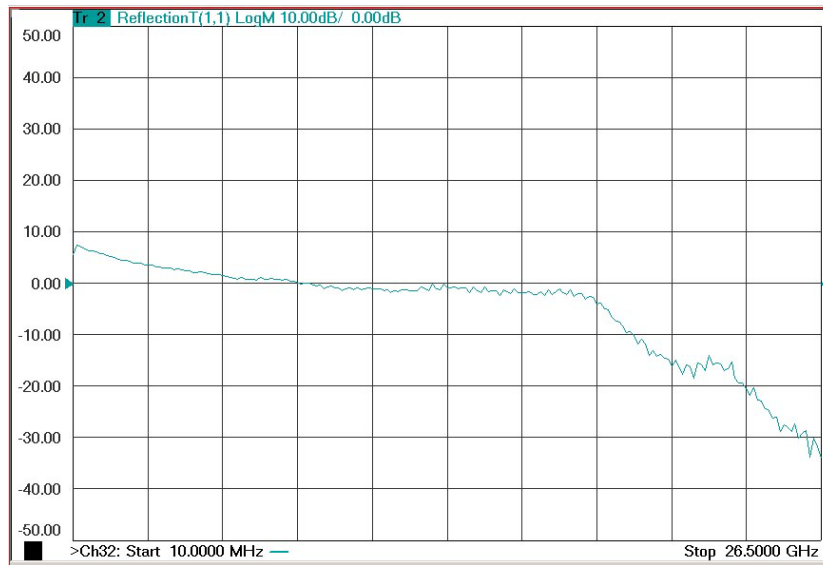
Figure 44   Option 001 or 002 Reflection Tracking with PNA or PNA-X (Ports 5 to 8)
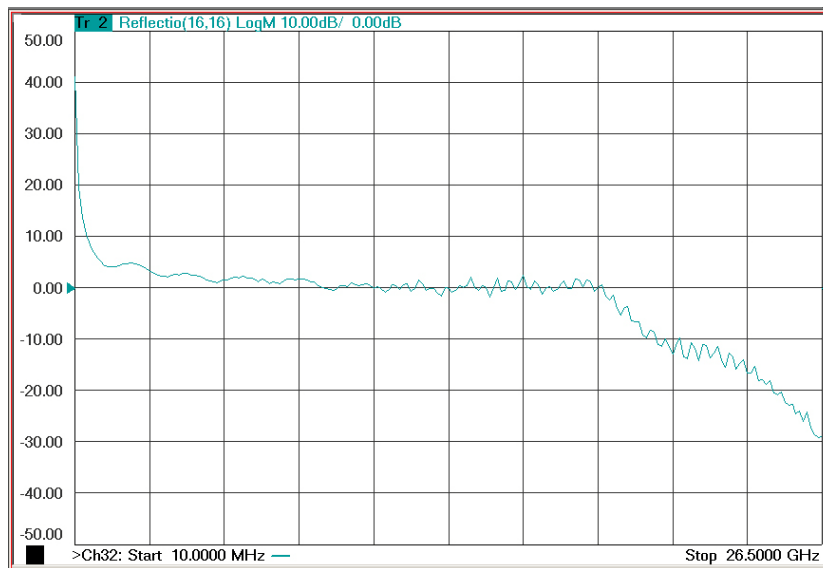
NOTE   Response from 10 MHz to 500 MHz is normal due to the PNA-X couplers in comparison to the test set bridges. The bridges have more gain in the coupled RF path.

Figure 45   **Standard Reflection Tracking Trace with PNA or PNA-X (Ports 1 to 4)**

Figure 46   **Standard Reflection Tracking Trace with PNA or PNA-X (Ports 5 to 8)**
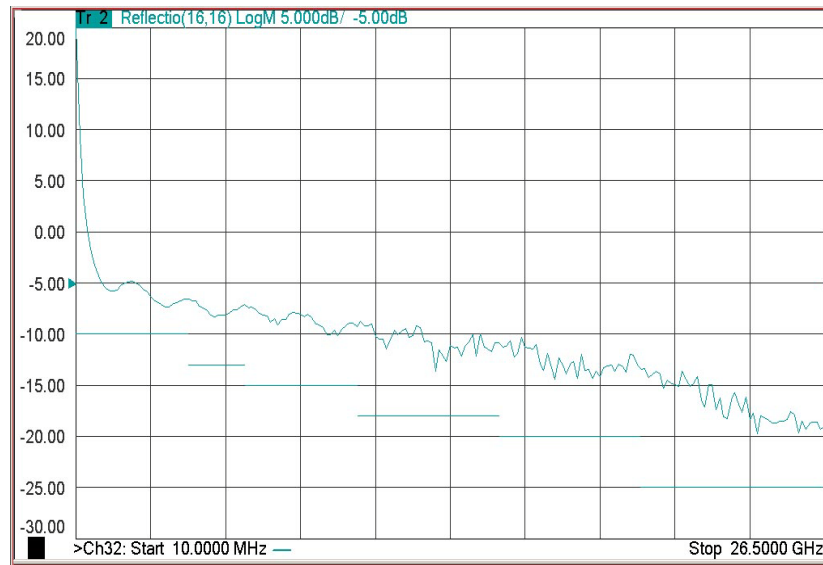
NOTE   Response from 10 MHz to 500 MHz is normal due to the PNA-X couplers in comparison to the test set bridges. The bridges have more gain in the coupled RF path.

Figure 47   Option 001 or 002 Reflection Tracking with PNA-L (Ports 1 to 8)
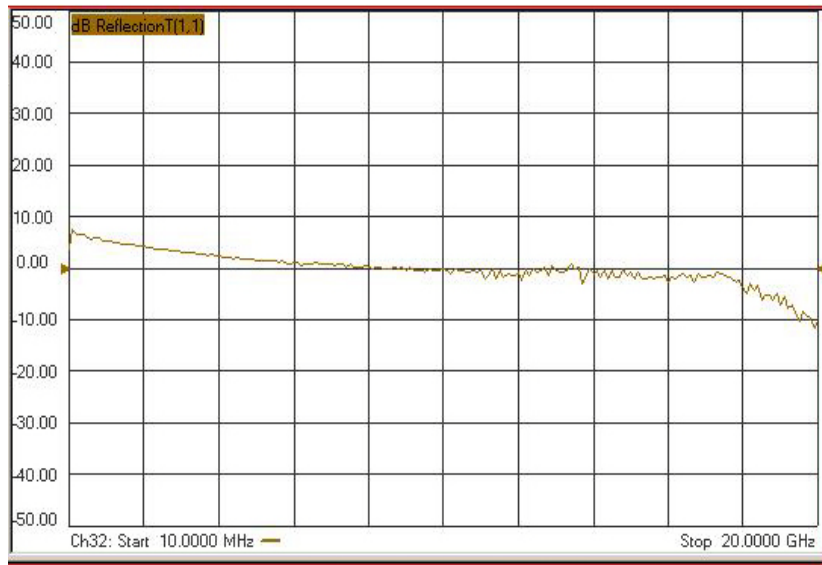
Figure 48   Standard Reflection Tracking with PNA-L (Ports 1 to 8)
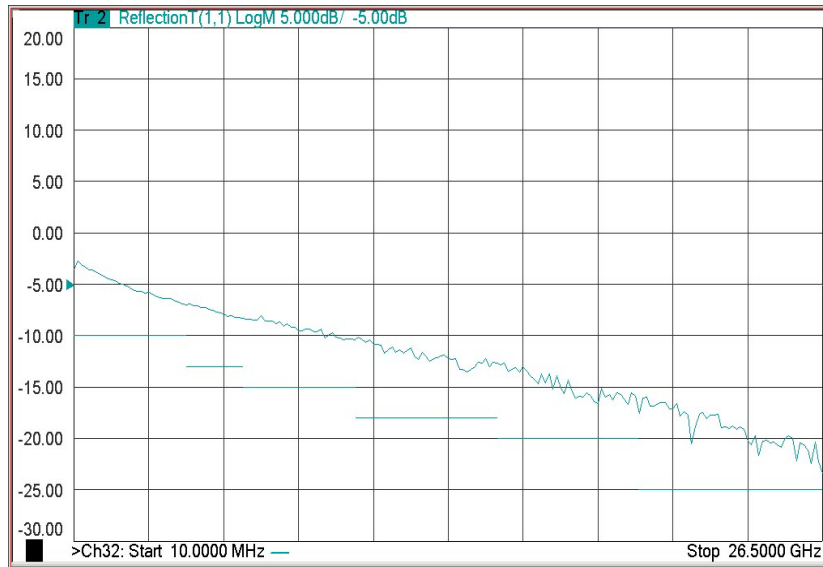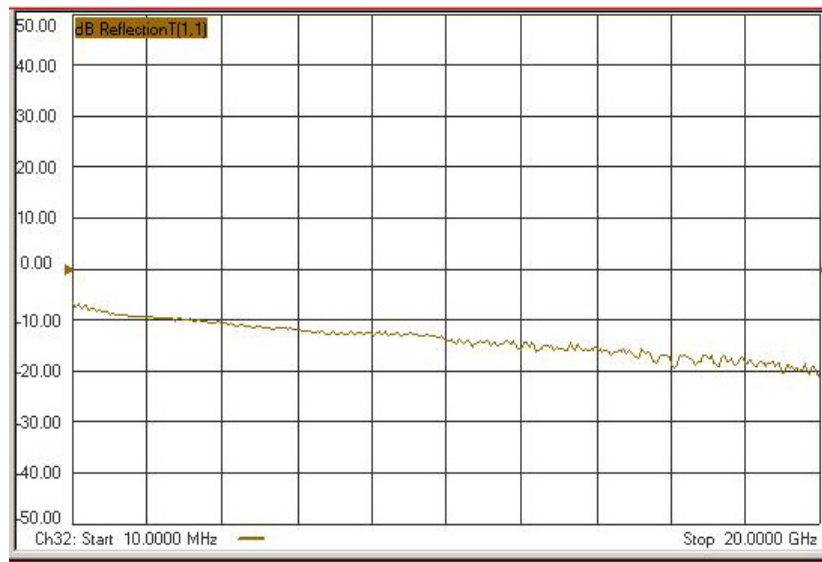
Verifying a Cal Kit Operational Check Failure

If your test results fail the Cal Kit Operational Check Reflection Tracking limits, see Table 5 and Table 6 on page 9 and verify the following:

1. Ensure the test set is turned on and connected properly to the analyzer.

2. Check all appropriate connectors for damage, cleanliness, and proper torques.

3. Repeat the relevant 1-Port calibrations using another ECal or mechanical standard.

4. Verify that the analyzer is operating properly and meeting its published specifications. If the analyzer is connected to the test set it will fail the Operational Check. Refer to "Network Analyzer Requirements" on page 4.

ECal Confidence Check

The following ECal Confidence Check is a method the verify the accuracy of a 1-Port calibration performed with mechanical standards or an ECal module. To perform this check, the test port of the ECal module must connect directly to the Test Port being verified (without adapters).

1. Perform an 1-Port Cal of the test set port being tested.

2. Connect the ECal Module to the Port being verified. Terminate any remaining ports on the ECal module.

3. Select the Cal Set to be verified. Select **[Cal]** > **Cal Set...** > **Cal_File** > **Apply Cal** > **Close.** If the "Choose Stimulus Settings..." prompt appears, select **Change the active channel's stimulus...** > **OK** > **Close**.

4. Select **Response > Cal** > **More** > **ECal** > **ECal Confidence Check**.

5. Click **Change Measurement** and select the test port S-Parameter **Apply** > **OK.** Click **Read Module Data**.

6. Select the ECal module you are using, and select **ECal Module Memory** > **Factory** > **OK**.

Figure 49   ECal Confidence Check
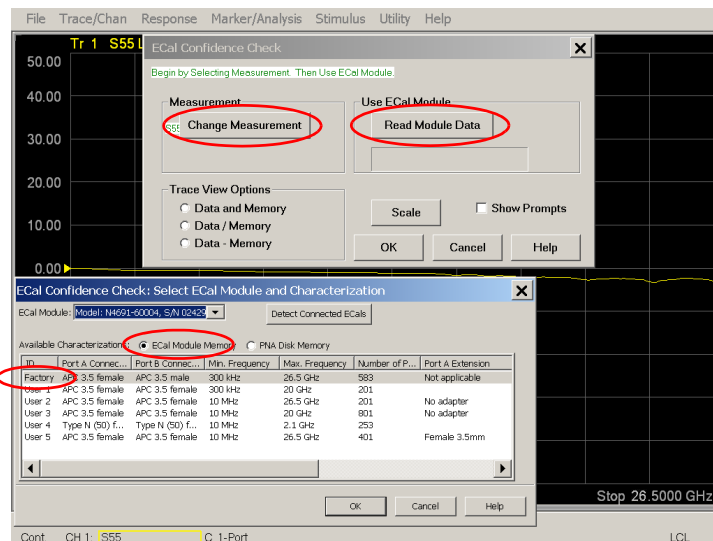
Service Information

Refer to "Contacting Agilent" on page 84.

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

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.

Replaceable Parts

The following replaceable parts are available from Agilent Technologies "Find-A-Part" system on the web at *www.parts.agilent.com*.

Table 18   Available Replacement Parts (SPO)

Description	Agilent Part Number
Solid State Switch	5087-7306
Coupler/Bridge	5087-7716
Amplifier (Option 001 & 002)	5087-7290 *or* 5087-7750
Bias Tee (Option 002)	5087-7239
Fuse (5 A 250 V non-time delay (20 mm)	2110-0709
Fuse (8 A 250 V non-time delay (1.25 inch)	2110-0342
PWR Supply (AC/DC SWG 650W 9- Output	0950-4729
RF Cable, Port 1 CPLR ARM to CPLR ARM	U3042-20029
RF Cable, Port 1 RCVR A IN to RCVR OUT	U3042-20030
RF Cable, Port 1 SOURCE OUT to SOURCE IN	U3042-20031
RF Cable, Port 1 CPLR THRU to CPLR THRU	U3042-20032
RF Cable, Port 3 CPLR ARM to CPLR ARM	U3042-20033
RF Cable, Port 3 RCVR C IN to RCVR OUT	U3042-20034
RF Cable, Port 3 SOURCE OUT to SOURCE IN	U3042-20035
RF Cable, Port 3 CPLR THRU to CPLR THRU	U3042-20036
RF Cable, Port 4 CPLR ARM to CPLR ARM	U3042-20037
RF Cable, Port 4 RCVR D IN to RCVR OUT	U3042-20038
RF Cable, Port 4 SOURCE OUT to SOURCE IN	U3042-20039
RF Cable, Port 4 CPLR THRU to CPLR THRU	U3042-20040

Table 18   Available Replacement Parts (SPO)

Description	Agilent Part Number
RF Cable, Port 2 CPLR ARM to CPLR ARM	U3042-20041
RF Cable, Port 2 RCVR B to RCVR OUT	U3042-20042
RF Cable, Port 2 SOURCE OUT to SOURCE IN	U3042-20043
RF Cable, Port 2 CPLR THRU to CPLR THRU	U3042-20044
Test Set Rear Lock-link (right)	N5242-20138
Test Set Rear Lock-link (left)	N5242-20139
RF Cable, Semi-rigid Interface (refer to Table 7 on page 19)	Z5623-20418
RF Cable, Semi-rigid Interface (refer to Table 7 on page 19)	Z5623-20419
PNA, PNA-L & PNA-X Locking Feet	5023-0132
Test Set Locking kit	5063-9253
Screw, Torx-T15 M3.5X0.6 12 mm	0515-2317
Screw, Torx-T20 M4X0.7 25 mm	0515-1619
Screw, Lock-Washer Pan-HD Pozidrive M3.5X0.6 12 mm	0515-1244
Test Set I/O Cable	N4011-21002
DUT Control Board	E5091-66503
Fan (rear panel)	87050-60027
Fan (Deck)	87075-60021

The following replaceable parts may be ordered by sending an e-mail request to
ctd-soco_support@agilent.com. Be sure to include test set model, options and serial number.
Some parts may have long lead times.

Table 19   Replaceable Parts (E04)

Description	Agilent Part Number
U3042AE04 User's Guide	U3042-90008
LED Status Board	Z5623-63463
LED Status Ribbon Cable	Z5623-60213
Switch Interface Board	Z5623-63647
Controller Board	Z5623-63646
PNA-L Lock-link kit	U3021-60001
PNA or PNA-X Lock-link kit	U3021-60002
PNA-L Cable kit	U3021-60045
PNA or PNA-X Cable kit	U3021-60047
Power Switch and LED	Z5623-60221

System Block Diagrams

Figure 50   **U3042AE04 Standard Configuration**
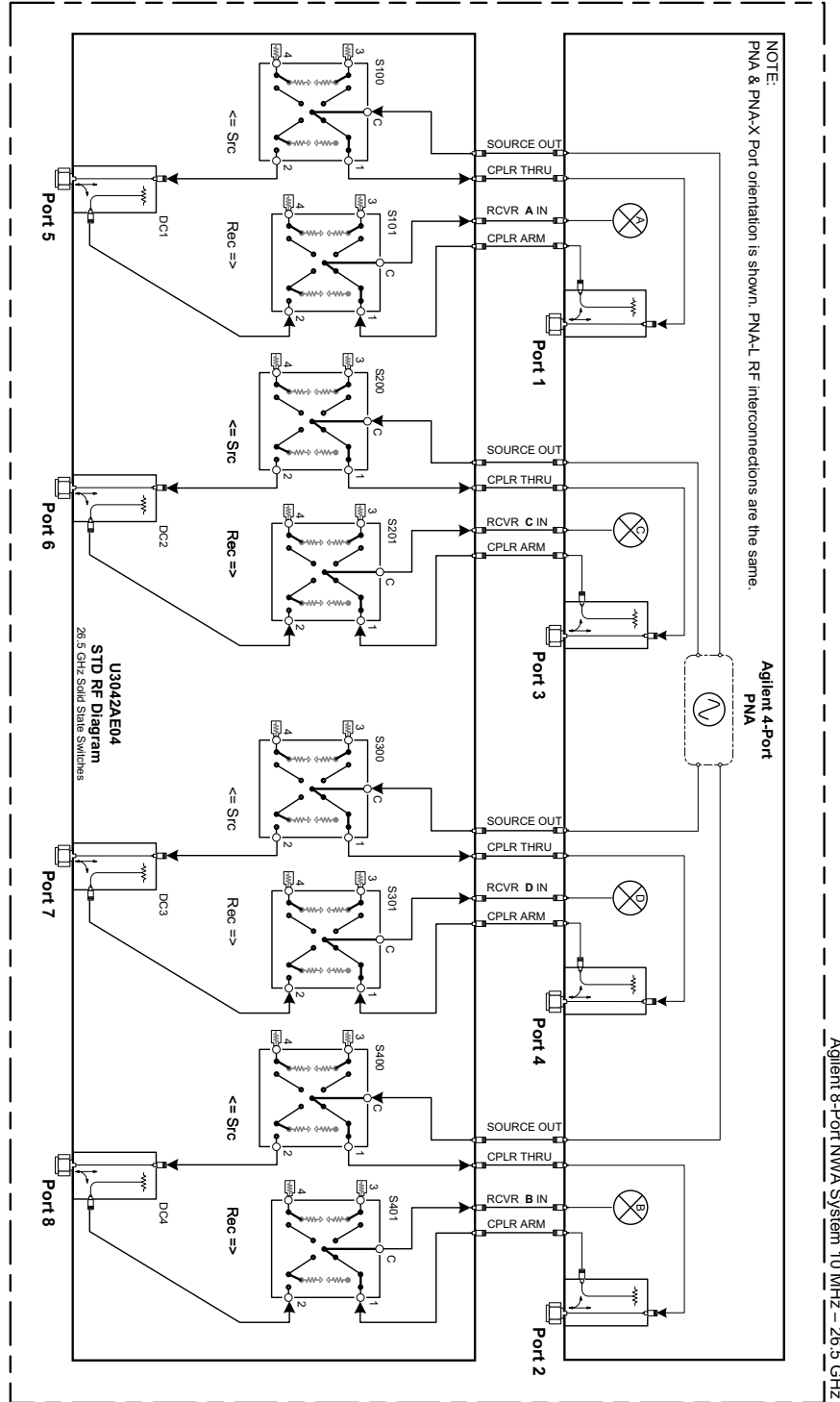
Figure 51 U3042AE04 Option 001 Configuration
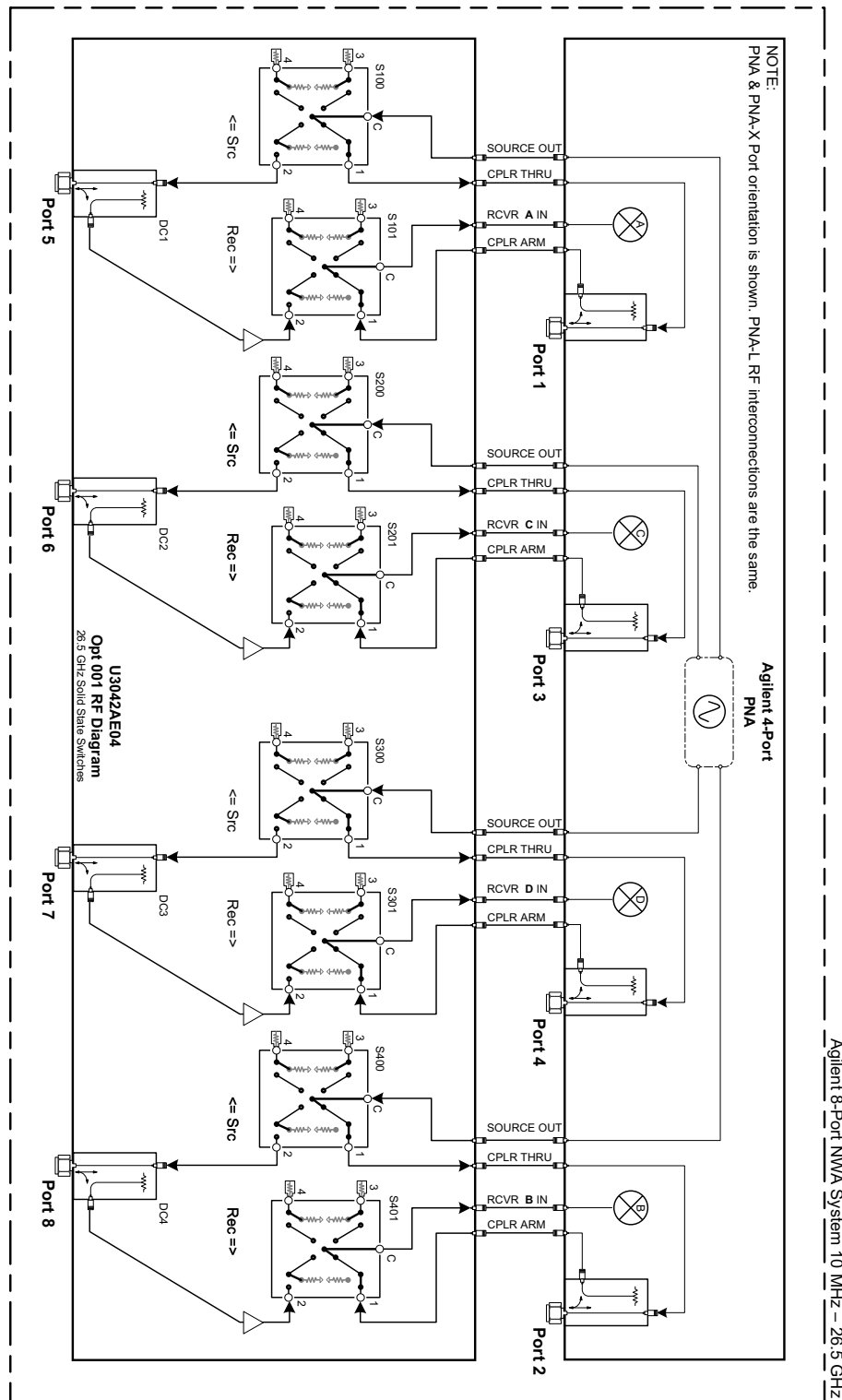
Figure 52   U3042AE04 Option 002 Configuration
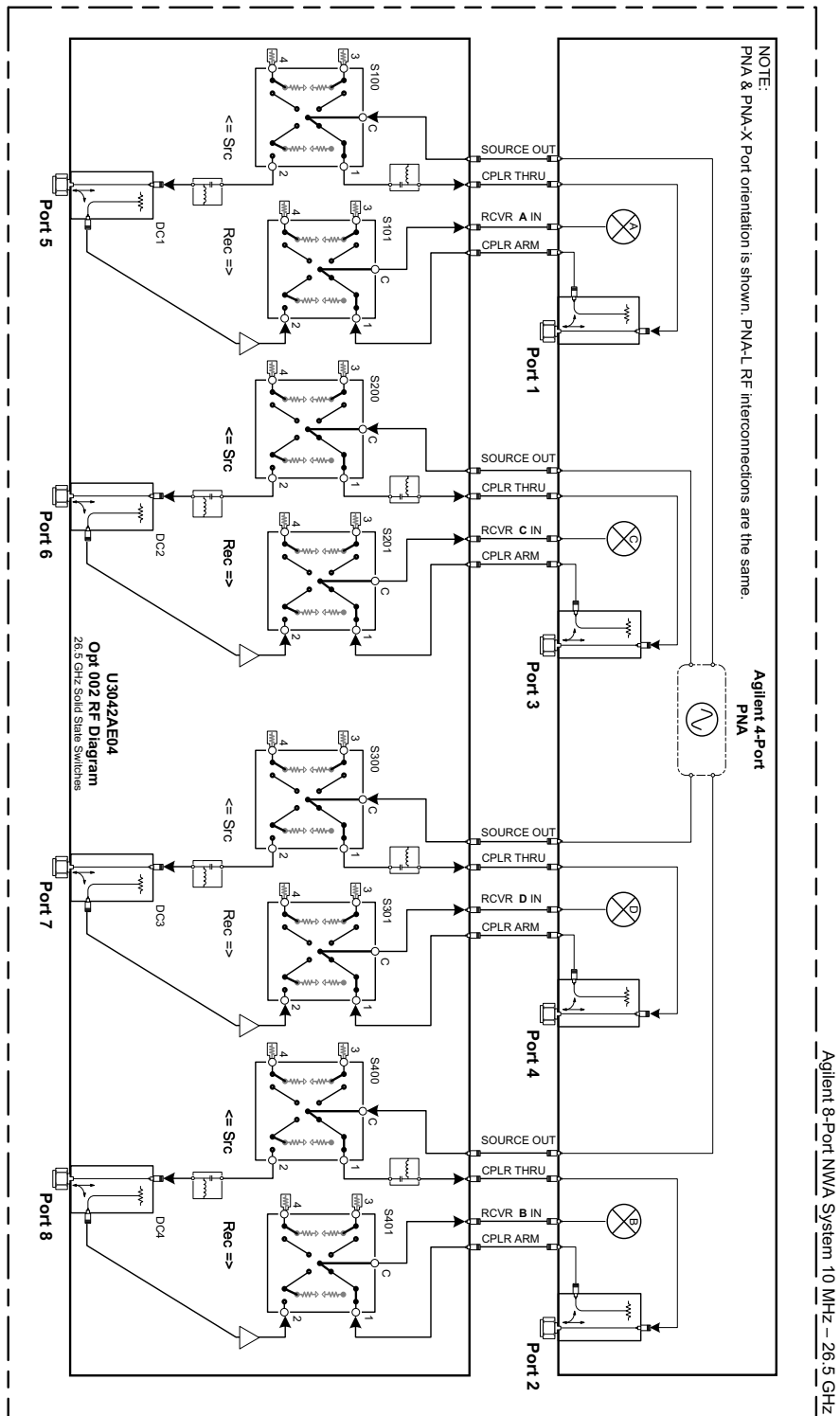
Theory of Operation

The following is a description of the operation of the test set. Reference the test set block diagrams shown in "System Block Diagrams" on page 61. This section assumes the user has a general understanding of couplers, switches, and network analyzers.

RF Coupler/Bridges

The test set uses four coupler/bridges (5087-7716) on the front panel for RF Test Ports 5 - 8. The coupler/bridges provide the signal separation of the source and receiver paths, using resistor networks. The test set ports can receive from or stimulate a signal to the DUT.

The RF Test Port connectors are male 3.5 mm. The coupling factor is approximately −16 dB for the Coupled Arm (minimum −22 dB and max −12 dB at 26.5 GHz). The insertion loss through the CPLR THRU path is typically < 4 dB at 26.5 GHz. Do not use excessive RF power or DC voltage, or damage may occur to the internal resistors.

RF Switch Components

The test set uses eight solid-state switches (5087-7306) that have internal 50 Ohm termination for each path. The switches select the RF paths from the analyzer's source and receiver through interconnect cables to the test set. Network analyzer Ports 1 thru 4 and test set ports paths 5 thru 8.

Figure 53   Switch
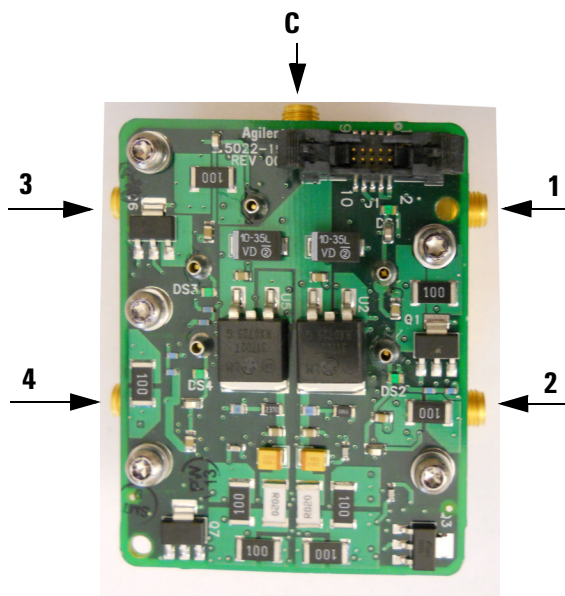
PNA-L Switch Paths

S100 - Source Output to Ports (1 and 5)

Switch 100 provides control of the Source Output path to PNA Port 1 and test set Port 5. In the state shown in the block diagram, switch 100 routes the RF Source back to the PNA Port 1, and the test set Source path to Port 5 is terminated.

S200 - Source to Ports (2 and 6)

Switch 200 provides control of the Source Output path to PNA Ports 2 and test set Port 6. In the state shown in the block diagram, switch 200 routes the RF Source back to the PNA Port 2, and the test set Source Output path to Port 6 is terminated.

S300 - Source to Ports (3 and 7)

Switch 300 provides control of the Source Output path to PNA Port 3 and test set Port 7. In the state shown in the block diagram, switch 300 routes the RF Source back to the PNA Port 3, and the test set Source path to Port 7 is terminated.

S400 - Source to Ports (4 and 8)

Switch 400 provides control of the Source Output path to PNA Port 4 and test set Port 8. In the state shown in the block diagram, switch 400 routes the RF Source back to the PNA Port 4, and the test set Source path to Port 8 is terminated.

S101 - Receiver to Ports (1 and 5)

Switch 101 provides control of the Receiver Input path to PNA Port 1 and test set Port 5. In the state shown in the block diagram, switch 101 routes the Port 1 Coupler Arm to the Receiver, and test set Port 5 Coupler Arm path is terminated.

S201 - Receiver to Ports (2 and 6)

Switch 201 provides control of the Receiver Input path to PNA Port 2 and test set Port 6. In the state shown in the block diagram, switch 201 routes the Port 2 Coupler Arm to the Receiver, and test set Port 6 Coupler Arm path is terminated.

S301 - Receiver to Ports (3 and 7)

Switch 301 provides control of the Receiver Input path to PNA Port 3 and test set Port 7. In the state shown in the block diagram, switch 301 routes the Port 3 Coupler Arm to the Receiver, and test set Port 7 Coupler Arm path is terminated.

S401 - Receiver to Ports (4 and 8)

Switch 401 provides control of the Receiver Input path to PNA Port 4 and test set Port 8. In the state shown in the block diagram, switch 401 routes the Port 4 Coupler Arm to the Receiver, and test set Port 8 Coupler Arm path is terminated.

PNA-X Switch Paths

S100 - Source to Ports (1 and 5)

Switch 100 provides control of the Source Output path to PNA Port 1 and test set Port 5. In the state shown in the block diagram, switch 100 routes the RF Source back to the PNA Port 1, and the test set Source path to Port 5 is terminated.

S200 - Source to Ports (3 and 6)

Switch 200 provides control of the Source Output path to PNA Port 3 and test set Port 6. In the state shown in the block diagram, switch 200 routes the RF Source back to the PNA Port 3, and the test set Source path to Port 6 is terminated.

S300 - Source to Ports (4 and 7)

Switch 300 provides control of the Source Output path to PNA Port 4 and test set Port 7. In the state shown in the block diagram, switch 300 routes the RF Source back to the PNA Port 4, and the test set Source path to Port 7 is terminated.

S400 - Source to Ports (2 and 8)

Switch 400 provides control of the Source Output path to PNA Port 2 and test set Port 8. In the state shown in the block diagram, switch 400 routes the RF Source back to the PNA Port 2, and the test set Source path to Port 8 is terminated.

S101 - Receiver to Ports (1 and 5)

Switch 101 provides control of the Receiver Input path to PNA Port 1 and test set Port 5. In the state shown in the block diagram, switch 101 routes the Port 1 Coupler Arm to the Receiver, and test set Port 5 Coupler Arm path is terminated.

S201 - Receiver to Ports (3 and 6)

Switch 201 provides control of the Receiver Input path to PNA Port 3 and test set Port 6. In the state shown in the block diagram, switch 201 routes the Port 3 Coupler Arm to the Receiver, and test set Port 6 Coupler Arm path is terminated.

S301 - Receiver to Ports (4 and 7)

Switch 301 provides control of the Receiver Input path to PNA Port 4 and test set Port 7. In the state shown in the block diagram, switch 301 routes the Port 4 Coupler Arm to the Receiver, and test set Port 7 Coupler Arm path is terminated.

S401 - Receiver to Ports (2 and 8)

Switch 401 provides control of the Receiver Input path to PNA Port 2 and test set Port 8. In the state shown in the block diagram, switch 401 routes the Port 2 Coupler Arm to the Receiver, and test set Port 8 Coupler Arm path is terminated.

Troubleshooting the Test Set

If the test set is not operating properly, use the following procedures to aid in isolating the problem.

Refer to the Agilent PNA Series: Service & Support Home Page at: *http://na.tm.agilent.com/pna* for further information.

To request service, please contact your local service center. In the US, call 800-829-4444. For a listing of service centers worldwide, please visit us at *www.agilent.com/find/service*.

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

Non-RF Failures

Non RF failures are; Power Supply, Fans, Control Lines, Status LEDs or Interface not operating. Refer to Figure 55 on page 68.

1. Verify that the front panel Power Switch is operational.The front panel Active LED will be *off* unless the test set interface cable is connected and the test set is addressed by the network analyzer.

2. Turn on the Standby Switch.

3. The rear panel Deck and Internal power supply fans should be operational. If not continue with step 4.

4. AC Line voltage checks (remove AC power from the instrument).

    a. Ensure the proper AC Line voltage is present at the instrument line cord.

    b. Remove the AC power cord from the instrument. Verify the instrument AC Line Module fuse (2119-0709) and replace if necessary. Refer to Figure 5 on page 12.

    c. Verify the Internal AC lines fuse (2110-0342). Remove the instrument bottom cover. Near the rear panel are two fuse holders, verify the fuses and replace if necessary. See Figure 62 on page 77.

5. Internal DC Power checks.

    a. Set the front panel switch to the Standby position. No fans or indicator lights should be operational.

    b. Remove the top cover.

    c. Set the Standby switch to the *on* position. Both the rear panel and internal power supply fans should be operational. Verify that the DC indicator LEDs are *on* as shown in Figure 55 on page 68.

NOTE	LEDs indicators for +9, −10 and +24 Vdc are off.

Figure 54   DC Power Status LEDs
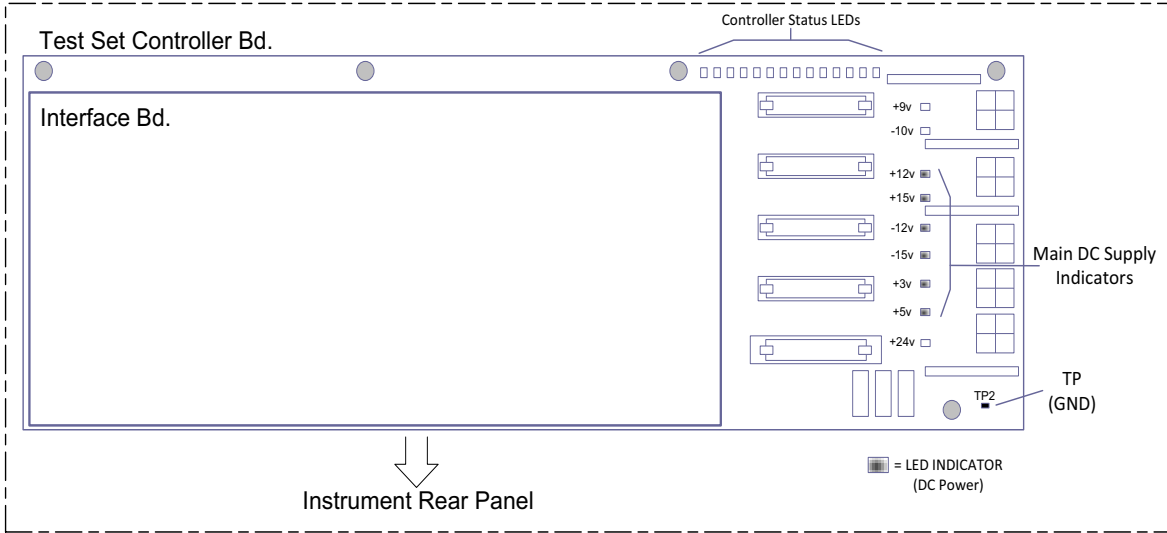
d. If the DC Indicator LEDs are not on, suspect the main power supply module or front panel switch. The power supply (0950-4729) terminal connections should also be verified with a DVM. Verify the voltages on the power supply label.

e. If rear panel or deck fans is are not operating and the DC Indicator LEDs are *on*; replace fan.

Figure 55   Test Set Diagram
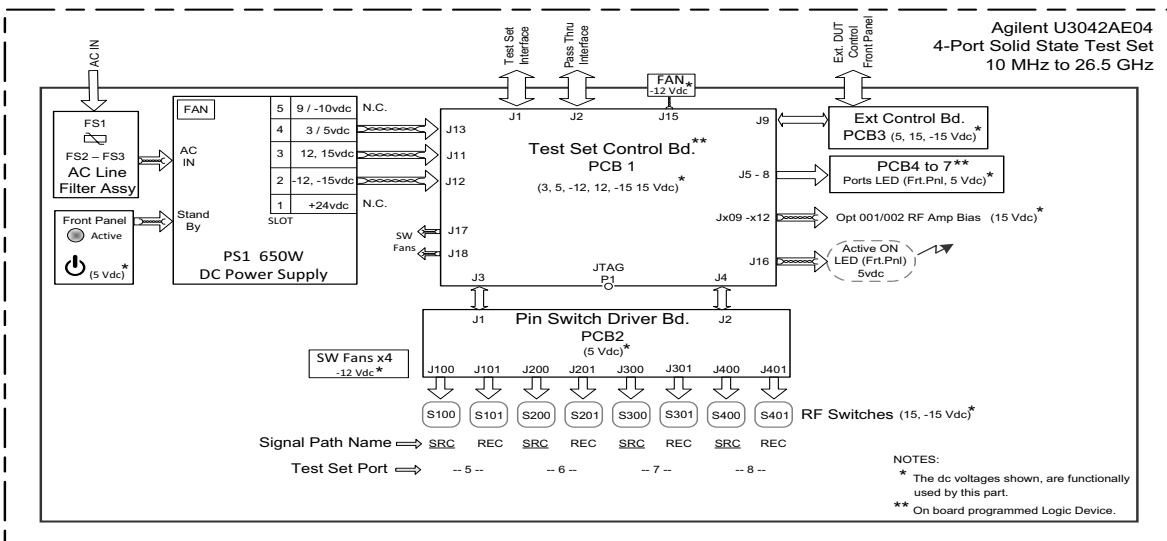
6. Front Panel R and S indicator LED Check.

Verify the test set Controller board Controller Status LEDs, shown in Figure 55 on page 68.

   a. If none are on remove the Switch Driver board and recheck, if still no indication, replace the Controller board.

   b. If the Controller Status LEDs are *on* and the front panel Active LED is *on*, suspect the front panel LED boards or the ribbon cables. Replace as needed.

7. Control Lines are not working.

   a. Verify that the control voltage pin connections to the DUT control lines are connected properly. Refer to "Control Lines" on page 43.

   b. Verify that the rear panel DC voltage control adjustment can be set to 5 Vdc. Refer to Figure 4 on page 11.

   c. Remove the instrument top cover. Using a DVM, verify that the three DC voltage inputs are present on the DUT control board (E5091-66503). Refer to Figure 56.

   d. If the DC voltages are normal, then replace the DUT control board. If the voltages are not present, check the ribbon cable and its connections at both ends. Suspect the test set Control board as the possible problem.

Figure 56   DUT Control Board DC Voltage Locations
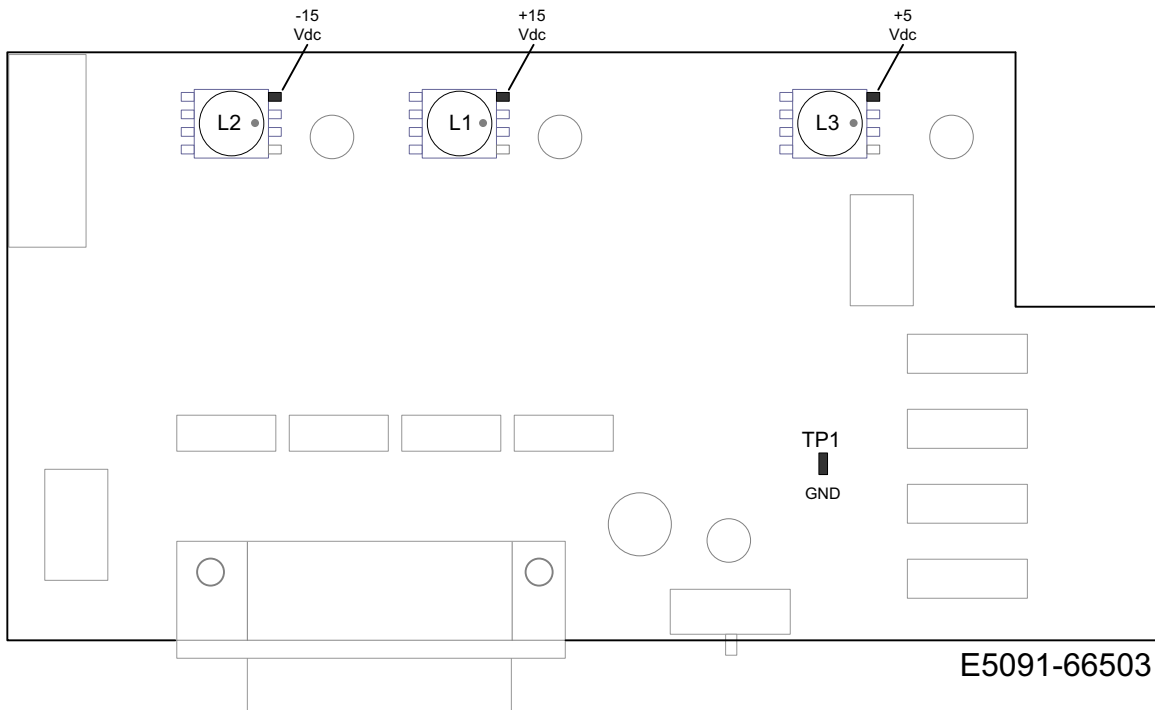
RF Switching Failures

If the test set's RF signal functionality is not operating properly, use the following procedure to aid in isolating the source of problem. The internal RF solid state switches used in this instrument are biased with the +15 Vdc supply voltage and controlled logic signals coming from the test set Controller board and Switch Interface board.

1. Place the network analyzer and test set side by side (not stacked) and connect the I/O cable (N4011-21002). See Figure 4 on page 11.

2. Ensure that the network analyzer is *not* in Multiport Mode.

3. Using the Test Set I/O Data command values, confirm the correct address and data values are used, refer to "Address and Data Values" on page 41.

    a. Each RF solid state switch has a Bias/Logic control board. This board has four port status LEDs. When a switch control signal is created, the switch port status LED will indicate which switch port is being selected. Refer to "RF Switching Path Test" on page 70.

    b. If the LEDs *on* the Switch are *off* when that switch is selected, verify that the ribbon cable is installed on the correct connector on the Switch Interface board. If the connection is correct, substitute a working switch or ribbon cable. Swapping can be performed in this situation.

RF Switching Path Test

If you suspect an RF signal path problem with the test set and have verified that the problem in not the front panel RF interface cables, the following procedure will check all of the RF signal paths through the test set.

*   Install the Test Set I/O cable from the analyzer to the test set's rear panel.

*   Remove the front panel RF interface cables and reinstall the analyzer's front panel jumper cables.

Equipment Required

*   PNA, PNA-L or PNA-X Network Analyzer

*   Two RF Flex Cables (3.5 mm male)

*   3.5 mm Adapters (female to female)

*   Test Set I/O Cable

Equipment Setup

1. Turn on the test set and the analyzer.

2. **Preset** the analyzer and set it to **Standalone Mode**. Select **Utility** > **System** > **Configure** > **Multiport Capability**. In the dialog box select **Restart as a standalone PNA** > **OK**.

3. Confirm the frequency range is set to 10 MHz to 26.5 GHz.

4. Connect the RF cables to the analyzer's Ports 1 and 2. Connect the cables together using a 3.5 mm adapter.

5. Configure the analyzer to measure S21 and normalize the response trace.

6. Set the analyzer to **Interface Control Mode**: Select **Channel > Hardware Setup > More > Interface Control...** and click **Enable Interface Control box**.

NOTE	The <addrs>.<data> entries noted in the following Test Instructions table will be used to configure the RF switches for this testing. After making your entry select <OK> to execute the command, to return back for further entries, select Interface Control on the PNA display.

Source and Receiver Path Tests

Refer to Table 20 for measuring the S21 response of the Source and Receiver signal paths. The tables indicates RF cable connections as well as Address and Data command for each path test.

Connect the RF cables as indicated in the tables. The expected results should be similar to Figure 57 and Figure 58 on page 73.

Table 20   Signal Path Connections and Commands

PNA Port-2 to Test Set	PNA Port-1 to Test Set	<Addr>.<Data>	Path Components	Res ponce (typical)
PNA-L Ports 1 & 5 or PNA/PNA-X Ports 1 & 5				
Source IN	Port 5	0.2	P5 CPLR, S100	Figure 57 on page 73
Source IN	CPLR THRU	0.1	S100	Figure 58 on page 73
RCVR OUT	Port 5	0.32	P5 CPLR, S101	Figure 59 on page 74
RCVR OUT	CPLR ARM	0.16	S101	Figure 60 on page 74
PNA-L Ports 2 & 6 or PNA/PNA-X Ports 3 & 6				
Source IN	Port 6	0.2	P6 CPLR, S200	Figure 57 on page 73
Source IN	CPLR THRU	0.1	S200	Figure 58 on page 73
RCVR OUT	Port 6	0.32	P6 CPLR, S201	Figure 59 on page 74
RCVR OUT	CPLR ARM	0.16	S201	Figure 60 on page 74
PNA-L Ports 3 & 7 or PNA/PNA-X Ports 4 & 7				
Source IN	Port 7	0.2	P7 CPLR, S300	Figure 57 on page 73
Source IN	CPLR THRU	0.1	S300	Figure 58 on page 73
RCVR OUT	Port 7	0.32	P7 CPLR, S301	Figure 59 on page 74
RCVR OUT	CPLR ARM	0.16	S301	Figure 60 on page 74
PNA-L Ports 4 & 8 or PNA/PNA-X Ports 2 & 8				
Source IN	Port 8	0.2	P8 CPLR, S400	Figure 57 on page 73
Source IN	CPLR THRU	0.1	S400	Figure 58 on page 73
RCVR OUT	Port 8	0.32	P8 CPLR, S401	Figure 59 on page 74
RCVR OUT	CPLR ARM	0.16	S401	Figure 60 on page 74

Figure 57   Source IN to Ports 5-8 Path Response (Std)
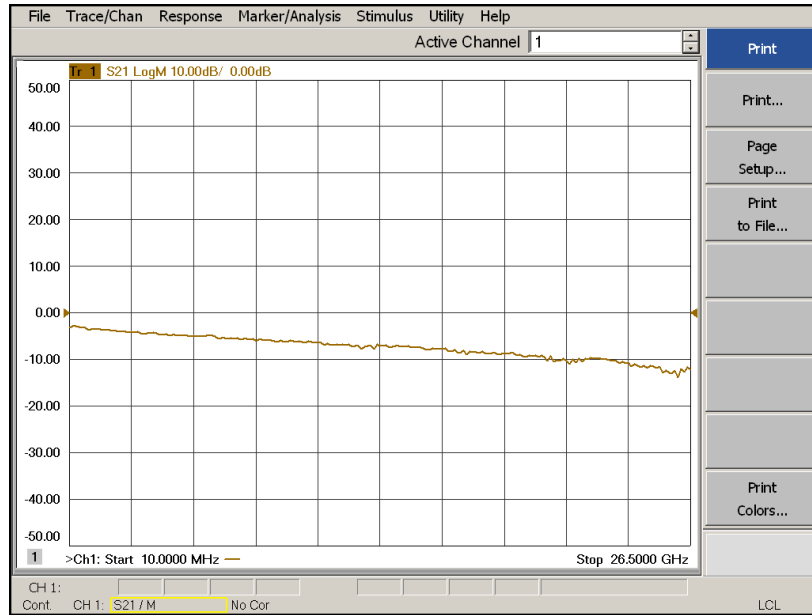
Figure 58   Source IN to CPLR THRU Path Response (Std)
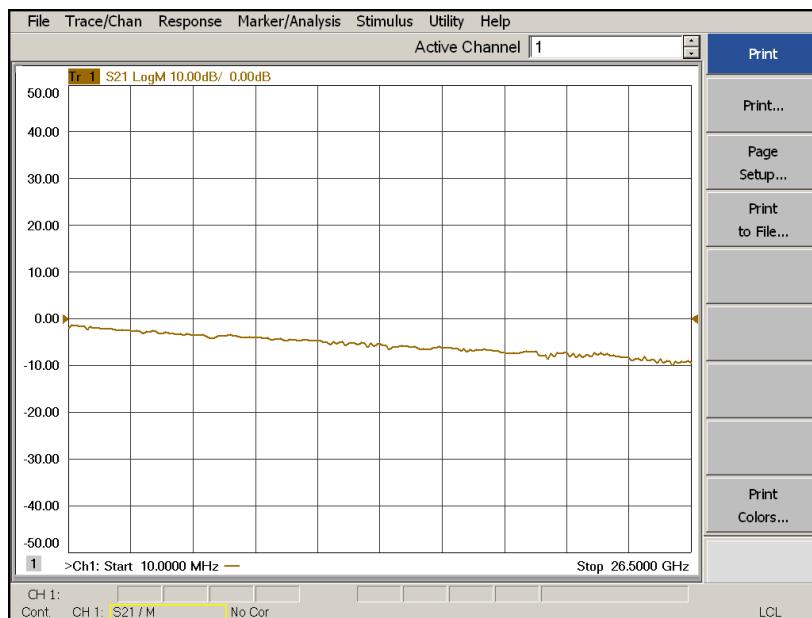
Figure 59   RCVR OUT to Ports 3-8 Path Response (Std)
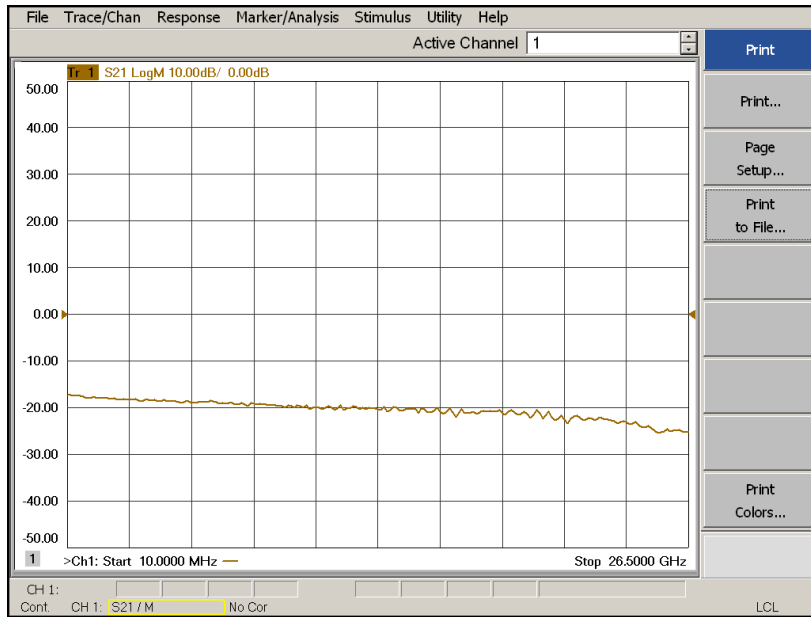
Figure 60   RCVR OUT to CPLR ARM Path Response (Std)
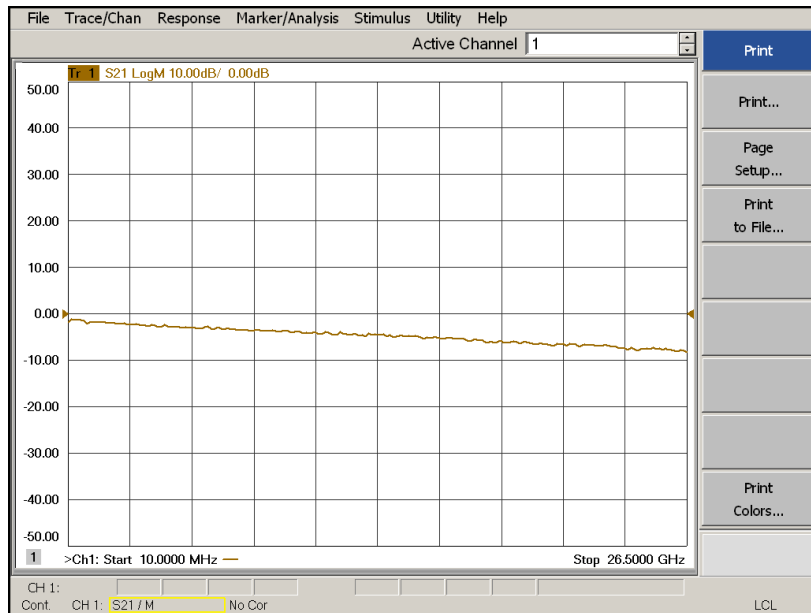
Connection Tables and Diagrams

Table 21   Controller Board Connections

Controller Board	Connection
LED Ribbon Cables From the LED Board:	
J5	Ports 5
J6	Ports 6
J7	Ports 7
J8	Ports 8
Wire harness Active LED:	
P1	Active LED
DUT Control Ribbon Cable:	
J9	DUT Controller Board
Power Supply Wire Harness:	
J11- 14	Power Supply

Table 22   Switch Interface Board

Switch Interface Board	Connection
Switch Interface Board Connection:	
J100	Ports 5 (Source)
J101	Ports 5 (Receiver)
J200	Ports 6 (Source)
J201	Ports 6 (Receiver)
J300	Ports 7 (Source)
J301	Ports 7 (Receiver)
J400	Ports 8 (Source)
J401	Ports 8 (Receiver)

Figure 61   Top View

DUT Control Bd

Coupler/
Bridge (x4)

10

41

Quad
Switch (x4)

401   301   201   101

Switch
Interface Bd.
(top Bd)

Control Bd (bottom Bd.)

Figure 62   Bottom View

Safety and Regulatory Information

Introduction

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

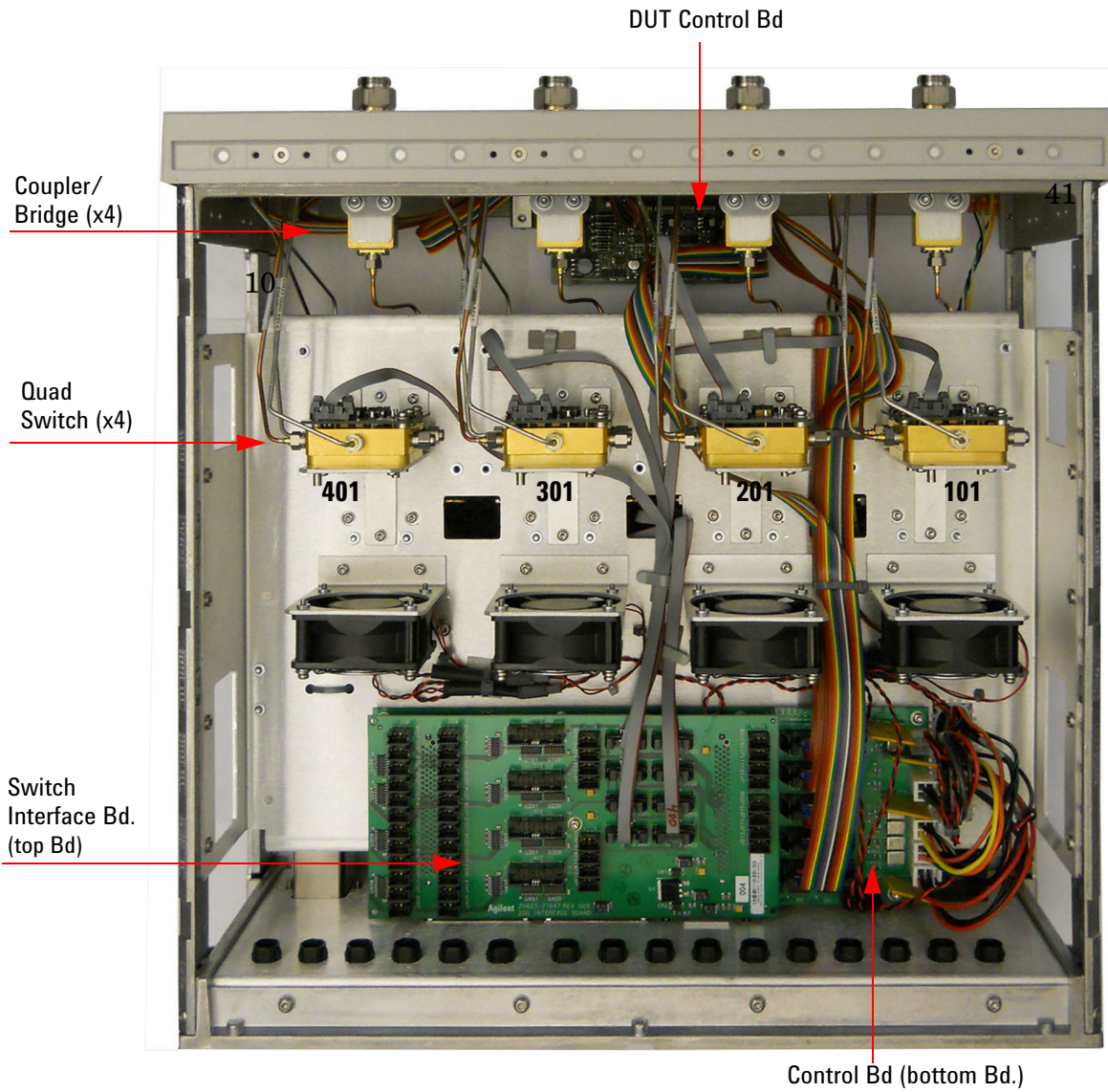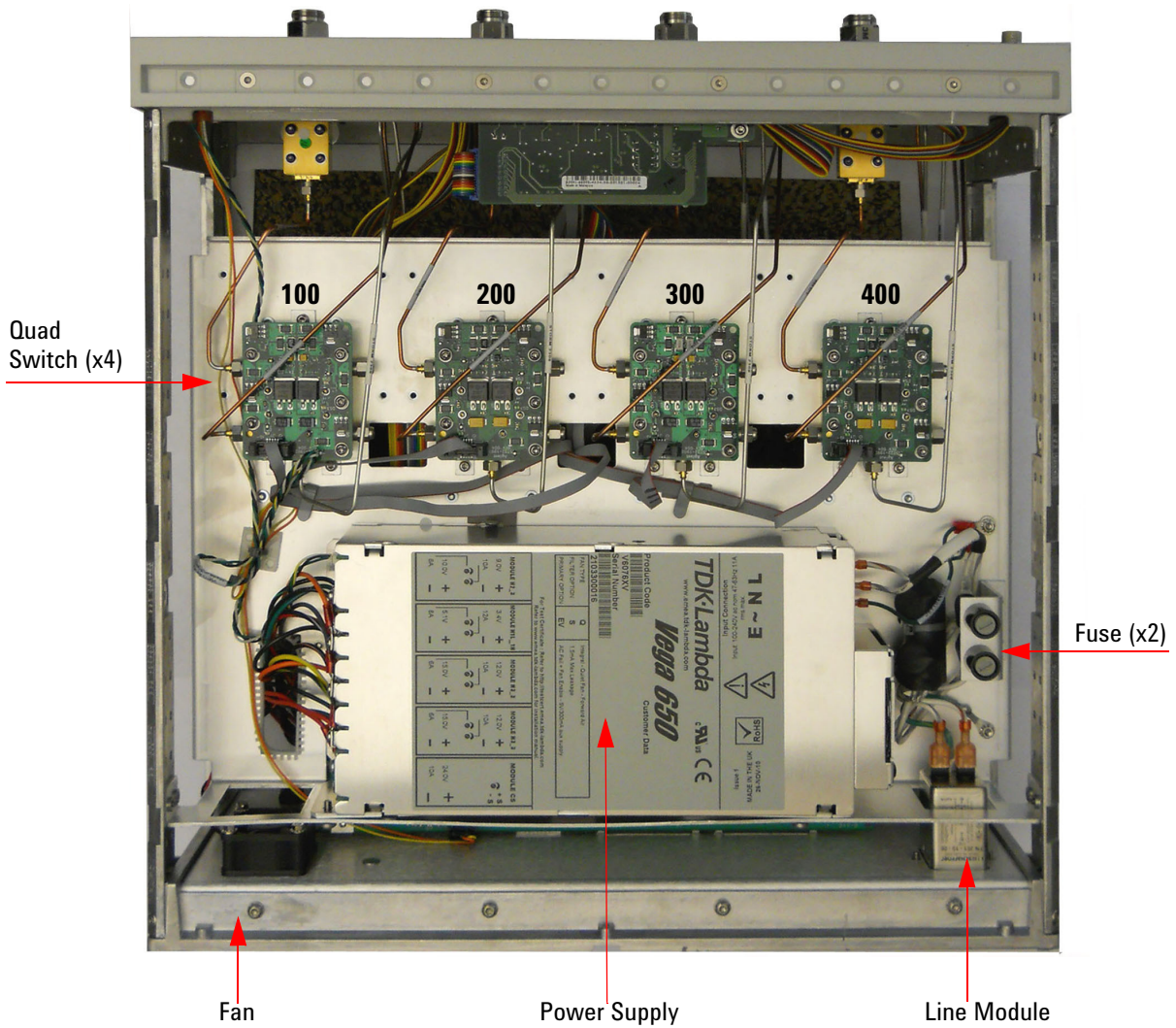|	
WARNING	**This is a Safety Class I product (provided with a protective earthing ground incorporated in the power cord). The mains plug shall be inserted only into a socket outlet provided with a protective earth contact. Any interruption of the protective conductor, inside or outside the product is 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 Agilent Technologies web site at *http://regulations.corporate.agilent.com/DoC/search.htm*

Statement of Compliance

This instrument has been designed and tested in accordance with CAN/CSA 22.2 No. 61010-1-04, UL Std. 61010-1 (2nd Edition), and IEC 61010-1 (Second Edition).

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	This product is designed for use in Installation Category II and Pollution Degree 2.

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.

CAUTION	This instrument has auto-ranging line voltage input, be sure the supply voltage is within the specified range.

Servicing

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	**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).**

WARNING	**The power cord is connected to internal capacitors that may remain live for 5 seconds after disconnecting the plug from its power supply.**

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 "Agilent Technologies U3042AE04" 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.**

Electrostatic Discharge Protection

Protection against electrostatic discharge (ESD) is essential while removing assemblies from or connecting cables to the instrument. Static electricity can build up on your body and can easily damage sensitive internal circuit elements when discharged. Static discharges too small to be felt can cause permanent damage. To prevent damage to the instrument:

• *always* have a grounded, conductive table mat in front of your test equipment.

• *always* wear a grounded wrist strap with grounding cord, connected to a grounded conductive table mat, having a 1 MW resistor in series with it, when handling components and assemblies or when making connections.

• *always* wear a heel strap (9300-1126) when working in an area with a conductive floor. If you are uncertain about the conductivity of your floor, wear a heel strap.

• *always* ground yourself before you clean, inspect, or make a connection to a static-sensitive device or test port. You can, for example, grasp the grounded outer shell of the test port or cable connector briefly.

• *always* ground the center conductor of a test cable before making a connection to the analyzer test port or other static-sensitive device. This can be done as follows:

   1. Connect a short to one end of the cable to short the center conductor to the outer conductor.

   2. While wearing a grounded wrist strap, grasp the outer shell of the cable connector.

   3. Connect the other end of the cable to the test port and remove the short from the cable.

Figure 63   ESD Protection Setup
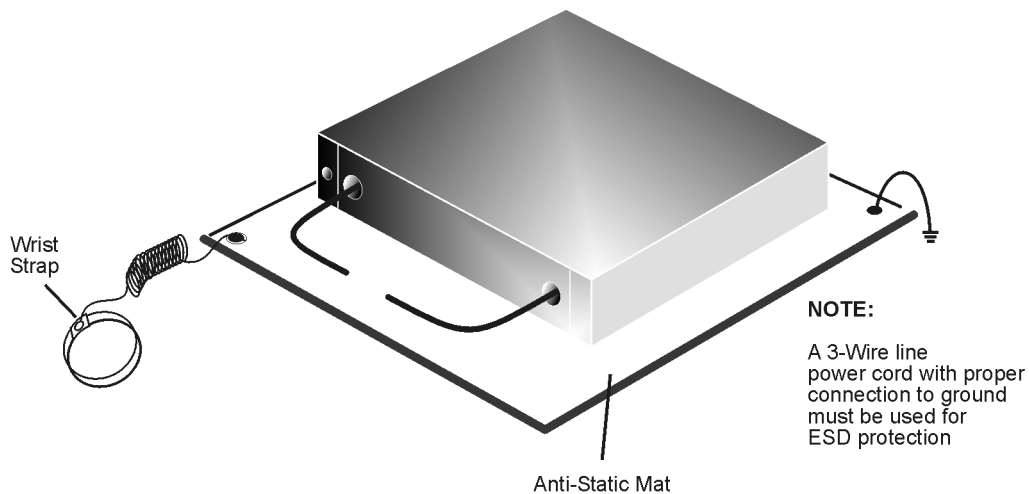
ku310b

Regulatory Information

Instrument Markings

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

⚠	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.
♻	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 instrument requires alternating current (ac) input.
│	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.
CE	The CE mark is a registered trademark of the European Community.
CSA	The CSA mark is a registered trademark of the CSA International. This instrument complies with Canada: CSA 22.2 No. 61010-1-04.
ISM1-A	This is a symbol of an Industrial Scientific and Medical Group 1 Class A product. (CISPR 11, Clause 4)
ICES/NMB-001	This is a marking to indicate product compliance with the Canadian Interference-Causing Equipment Standard (ICES-001).
▬▬▬	Direct Current.
IP 2 0	The instrument has been designed to meet the requirements of IP 2 0 for egress and operational environment.
N10149	This is a required mark signifying compliance with an EMC requirement. The C-Tick mark is a registered trademark of the Australian Spectrum Management Agency.
40	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.
KC	Korean Certification (KC) mark. Must include the marking's identifier code (Agilent product specific) as follows: KCC-REM-ATi-WNANALYZERF01

Battery Collection

Do not throw batteries away but collect as small chemical waste, or in accordance with your country's requirements. You may return the battery to Agilent Technologies for disposal. Refer to "Contacting Agilent" on page 84 for assistance.

EMC Information

Complies with European EMC Directive 2004/108/EC

- IEC/EN 61326-1
- CISPR Pub 11 Group 1, class A
- AS/NZS CISPR 11
- This ISM device complies with Canadian ICES-001
  Cet appareil ISM est conforme a la norme NMB du Canada

Acoustic Noise Emission

- LpA<70 dB
- Operator Position
- Normal Operation
- Acoustic Per ISO 7779

Safety

Complies with European Low Voltage Directive 2006/95/EC

- IEC/EN 61010-1, 2nd Edition
- Canada: CSA C22.2 No. 61010-1-04
- USA: UL std no. 61010-1, 2nd Edition
- Acoustic statement (European Machinery Directive 2022/42/EC, 1.7.4.2U)

Agilent Support, Services, and Assistance

Service and Support Options

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

Contacting Agilent

Assistance with test and measurements needs and information or finding a local Agilent office are available on the Web at:
http://www.agilent.com/find/assist

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

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

Shipping Your Product to Agilent for Service or Repair

IMPORTANT   Agilent 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 Agilent for repair.

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

- To improve turn-around time, return the analyzer and cables used with your test set to Agilent to verify operation of the complete system.

- 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 Agilent in the same configuration as it was originally shipped.

- Ship the analyzer using the original or comparable antistatic packaging materials.

- Contact Agilent for instructions on where to ship your analyzer.