

# **Agilent Technologies**

## **U3042AM20**

### **User's and Service Guide**

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



Manufacturing Part Number: U3042-90009

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## 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.

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**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.**

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**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.

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## 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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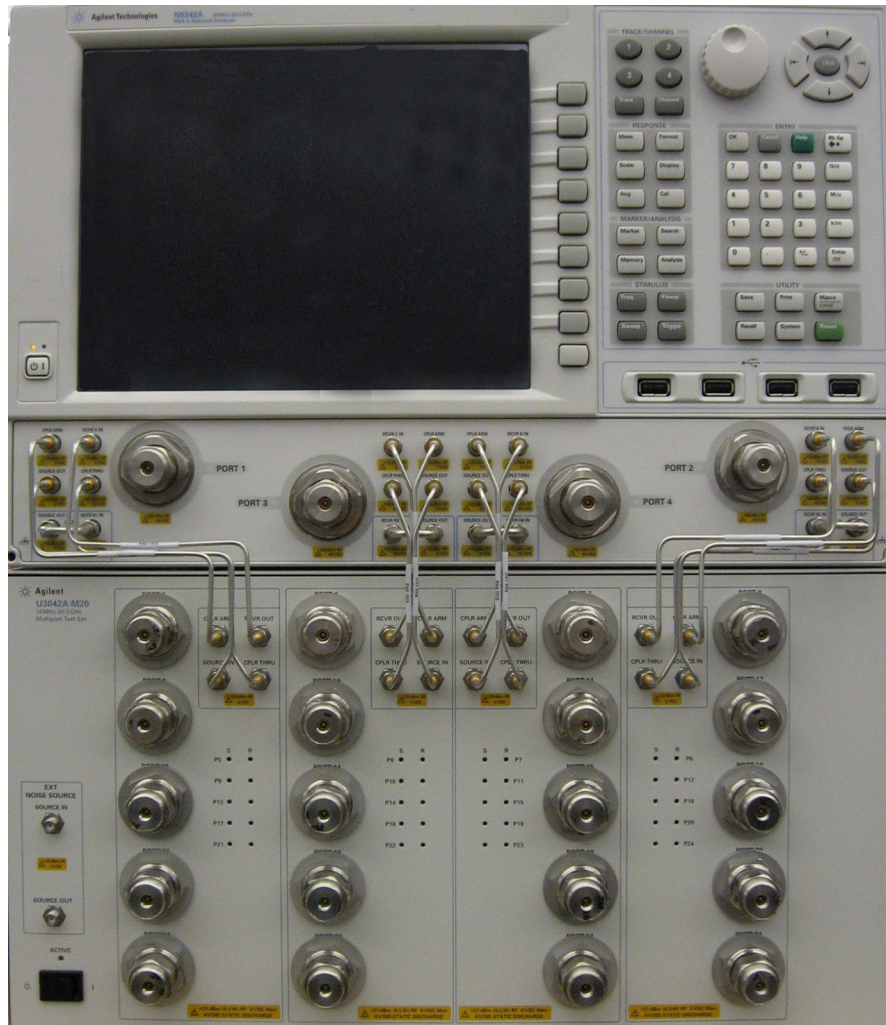
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# **U3042AM20**

# Introduction

This document describes how to use and service the U3042AM20 Multiport Test Set.

**Figure 1 N5242A with U3042AM20**



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## Description

The Agilent U3042AM20 is a multiport test set designed to be configured with a 4-Port network analyzer creating an 24-Port measurement system. The U3042AM20 has the following key features:

- 20 test ports (3.5 mm male connectors)
- Low loss mechanical RF switching
- Frequency range of operation:
  - 10 MHz to 26.5 GHz
- Agilent PNA compatibility with rear panel Test Set I/O interface for operational control. The PNA Option 551 is required and provides N-Port calibration capabilities.
- The U3042AM20 is directly controlled by the network analyzer, no external personal computer or software is required.

The N5222A PNA and N5242A PNA-X Network Analyzers will be referred to as the PNA and PNA-X throughout this document. Analyzers) refers to all series of PNA and PNA-X. The U3042M20 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 82](#). 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 multipoint 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	Option	Test Set File	System Figure
N5222A PNA or N5242A PNA-X	400	u3042am20_pnax_p4.tsx	<a href="#">Figure 1 on page 2</a>

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>
- U3042AM20 Test Set Files - <http://na.tm.agilent.com/multipoint> (see test set files)

## Available Options

### Test Set Options

The test set has three available options:

Refer to “[System Block Diagrams](#)” beginning on [page 56](#).

- Option 700 Standard (no Option 129 on the serial tag)
- Option 129 - external source path switch ports 1, 5, 9, 13, 17 and 21.

### Rack Mounting Kits

Installation instructions are included in the option package.

- U3042AM20-1CM - Rackmount Kit without Handles (5063-9216)
- U3042AM20-1CN - Front Handle Kit (5063-9229)
- U3042AM20-1CP - Rackmount with Front Handle Kit (5063-9223)

### Network Analyzer Interface Kit Options

1. The U3042AM20 requires 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 Interface Kit Options**

24-Port Network Analyzer System	Interface Kit Option	Hardware Lock-link	Cable Kit, Connector Type
N5222A PNA, Option 400	U3021PX3 Opt 442	U3021-60005 <sup>1</sup>	U3021-60077, SMA m/m <sup>2</sup>
N5242A PNA-X, Option 400	U3021PX3 Opt 442	U3021-60005 <sup>1</sup>	U3021-60077, SMA m/m <sup>2</sup>

1. “[Hardware Lock-link Installation \(U3021-60005\)](#)” on [page 13](#).
2. “[N5222A and N5242A RF Interface Cable Connections \(U3021-60077\)](#)” on [page 16](#).

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## 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 47](#) can be subtracted from the analyzers dynamic range to determine the approximate performance of the system.

---

**CAUTION** The life expectancy of the following switches are 5 million cycles. When making measurements using more than one port, single sweeps are recommended to minimize switch cycles.

- 87106-60009 (switch, x8)
  - N1811TL (N1811-60005 or N1811-60027) Option 129 only
- 

## Power Requirements

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

- 100/120/220/240 VAC (50/60Hz)
- The instruments can operate with mains supply voltage fluctuations up to  $\pm 10\%$  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.
- U3042AM20 maximum power is 350 W.

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**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.

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## 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  $\pm 1$  °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.

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

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**Table 3 Instrument Dimensions**

Model	Weight	Height	Width	Depth
U3042AM20	14 kg (30.8 lb)	22.15 cm (8.7 in)	42.5 cm (16.7 in)	50 cm (20 in)

## Frequency Range and Power Levels

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**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.

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**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.

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**Table 4 Maximum Power Levels**

<b>U3042AM20 Test Port RF Power Levels:</b>	
PORT 5-24	+27 dBm
<b>U3042AM20 Access Ports:</b>	
SOURCE OUT	+20 dBm
CPLR ARM	+20 dBm
CPLR THRU	+20 dBm
RCVR OUT	+20 dBm

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**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.

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

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## Typical Reflection Tracking

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

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**NOTE** Typical performance are based on 1 to 2 units performance, as shown in [Table 5](#).

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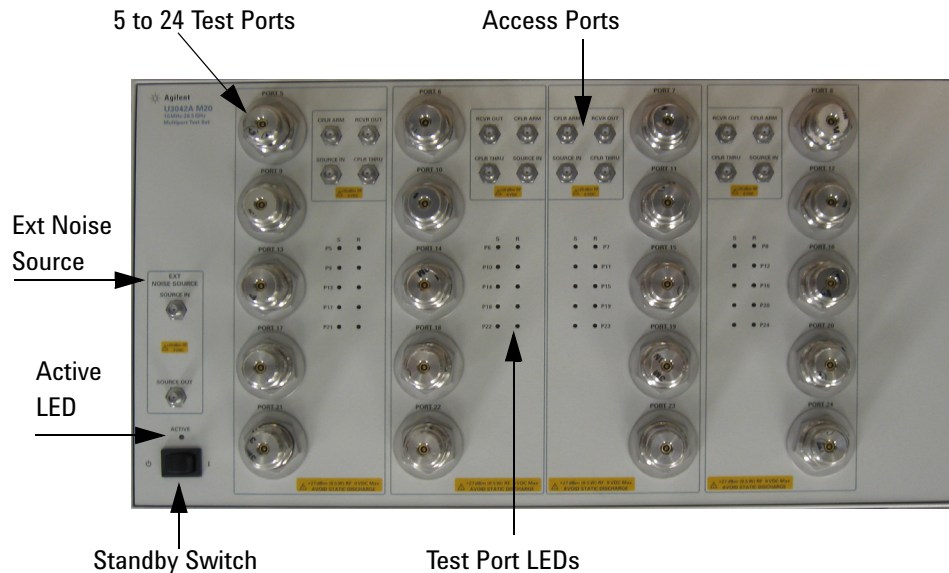
**Table 5** Typical Reflection Tracking PNA-X

Frequency	Ports 1 to 4	Ports 5 to 24
10 MHz to 50 MHz <sup>1</sup>	-0.5	> 20
50 MHz to 500 MHz <sup>1</sup>	-2	> 0
500 MHz to 3.2 GHz	-4	-5
3.2 GHz to 10 GHz	-7	-7
10 GHz to 16 GHz	-8	-8
16 GHz to 20 GHz	-10	-10
20 GHz to 24 GHz	-12	-12
24 GHz to 26.5 GHz	-13	-13

1. 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.

## Front and Rear Panel Features

Figure 2 U3042AM20 Front Panel



### Test Ports - 3.5 mm Bulkhead (male)

- Port 5 – 24

### Access Ports – SMA (female)

- CPLR ARM
- SOURCE IN
- CPLR THRU
- RCVR OUT

### 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.

### Standby Switch

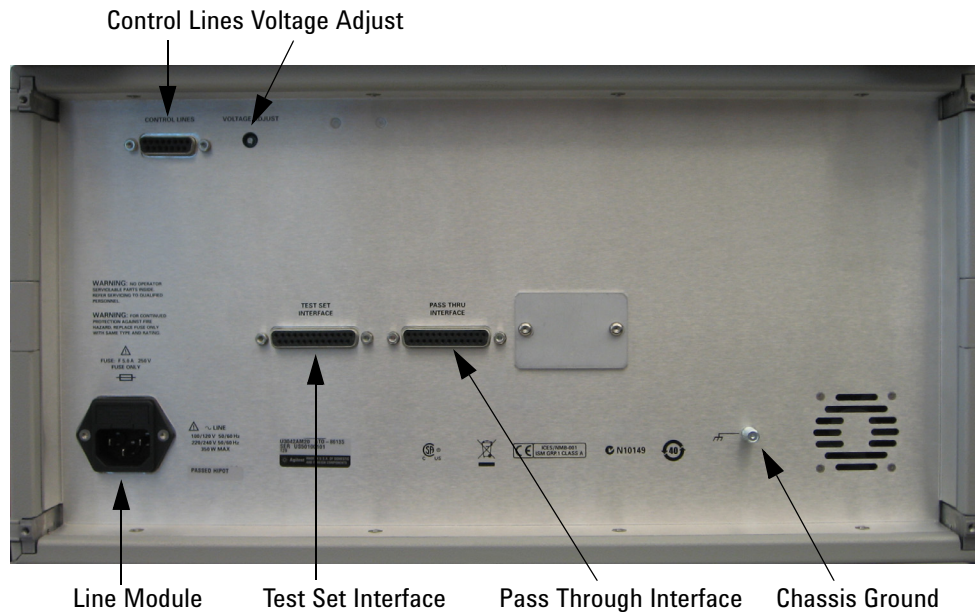
The switch is only a Standby switch, not a AC line power switch. The main power cord can be used as the system disconnecting device. It disconnects the mains circuits from the mains supply.

### 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.

### Ext Noise Source – SMA (female)

- SOURCE OUT
- SOURCE IN

**Figure 3 U3042AM20 Rear Panel**

### Control Lines and Voltage Adjust

For further information pertaining to control lines and voltage adjustments see “Control Lines” on page 42.

### 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.

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**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.

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**Figure 4** Line Module and Fuse



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

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## Hardware Lock-link Installation (U3021-60005)

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

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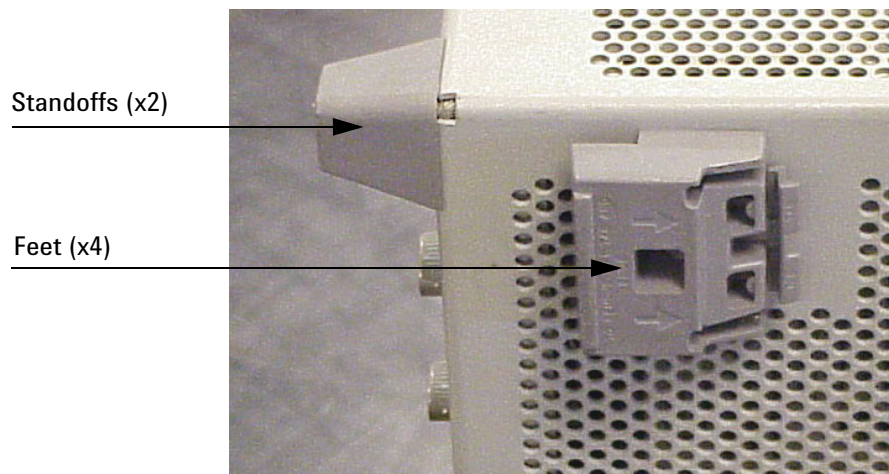
**WARNING**     **The opening of covers or removal of parts is likely to expose the user to dangerous voltages. Disconnect the instrument from all voltage sources before being opened.**

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### Locking the Test Set to the PNA or PNA-X

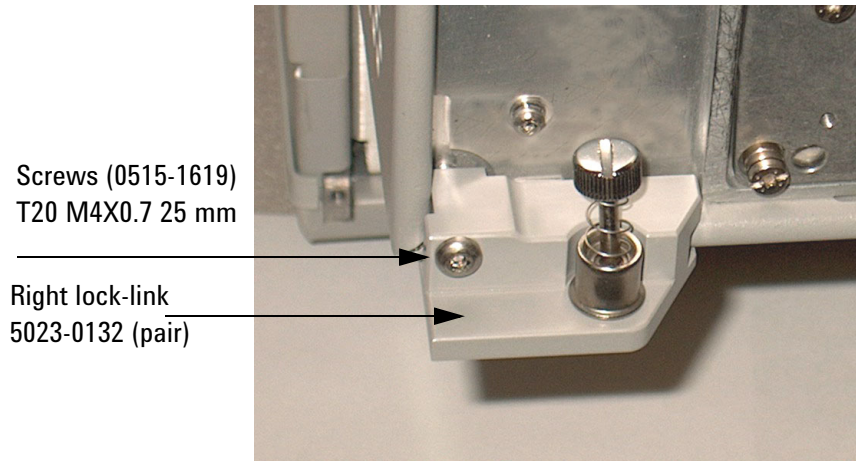
1. The lock-link kit (U3021-60005) includes the following components:
  - 0515-1619 – Screw T20 M4x0.7 25 mm
  - 0515-2317 – Screw T15 M3.5x0.6 12 mm
  - 5023-0132 – Lock-links kit (left, right pair and screws), Analyzer
  - N5242-20206 – Right Lock-link, Test Set
  - N5242-20207 – Left Lock-link, Test 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 5**     **Rear Bottom Feet & Standoffs**



4. Install the two lower rear lock-links (left not shown) onto the analyzer, as shown in [Figure 6](#).

**Figure 6 Install Lock-links to the Analyzer**



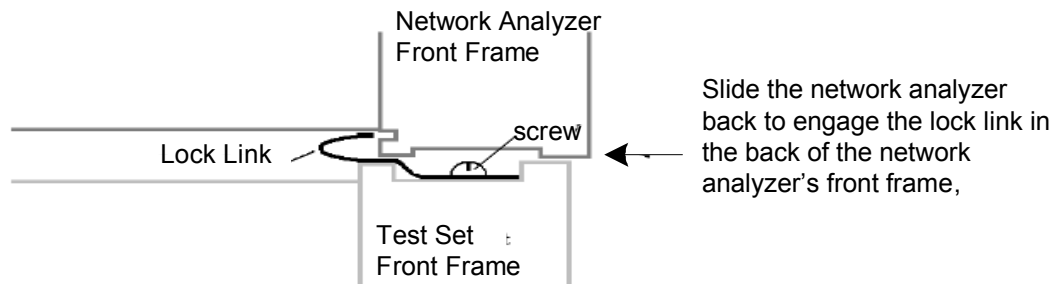
5. Remove the two upper standoffs from the rear panel of the test set using a T20 torx driver.
6. Install the left and right lock-links onto the test set, as shown in [Figure 7](#).

**Figure 7 Rear Lock-links to Test Set**



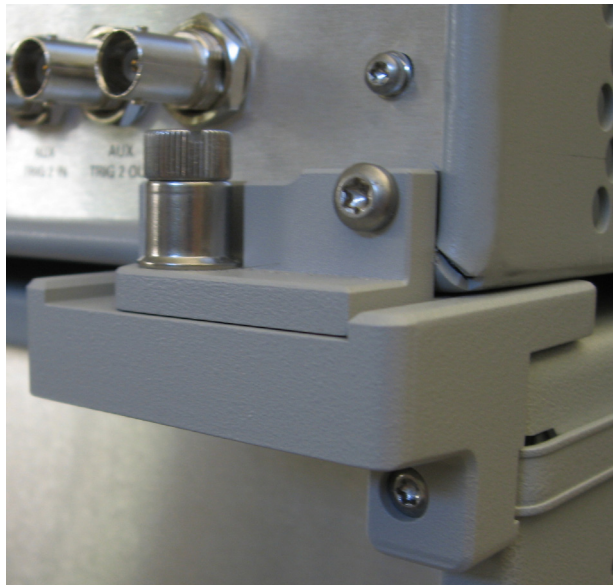
7. Place the analyzer on top of the test set and ensure that the front frame of the analyzer is positioned slightly forward of the locks that are attached to the test set. Slide the analyzer back so the locks engage the front frame of the analyzer.

**Figure 8** Locking the Analyzer



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 9** Locked



## N5222A and N5242A RF Interface Cable Connections (U3021-60077)

Figure 10 on page 17 illustrates the cable configuration of the Test Set to the analyzer. The cables have been supplied with the kit (U3021-60077).

### 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 6 and Figure 10 on page 17.

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

**Table 6 PNA or PNA-X RF Interface Cable Connection (U3021-60077)**

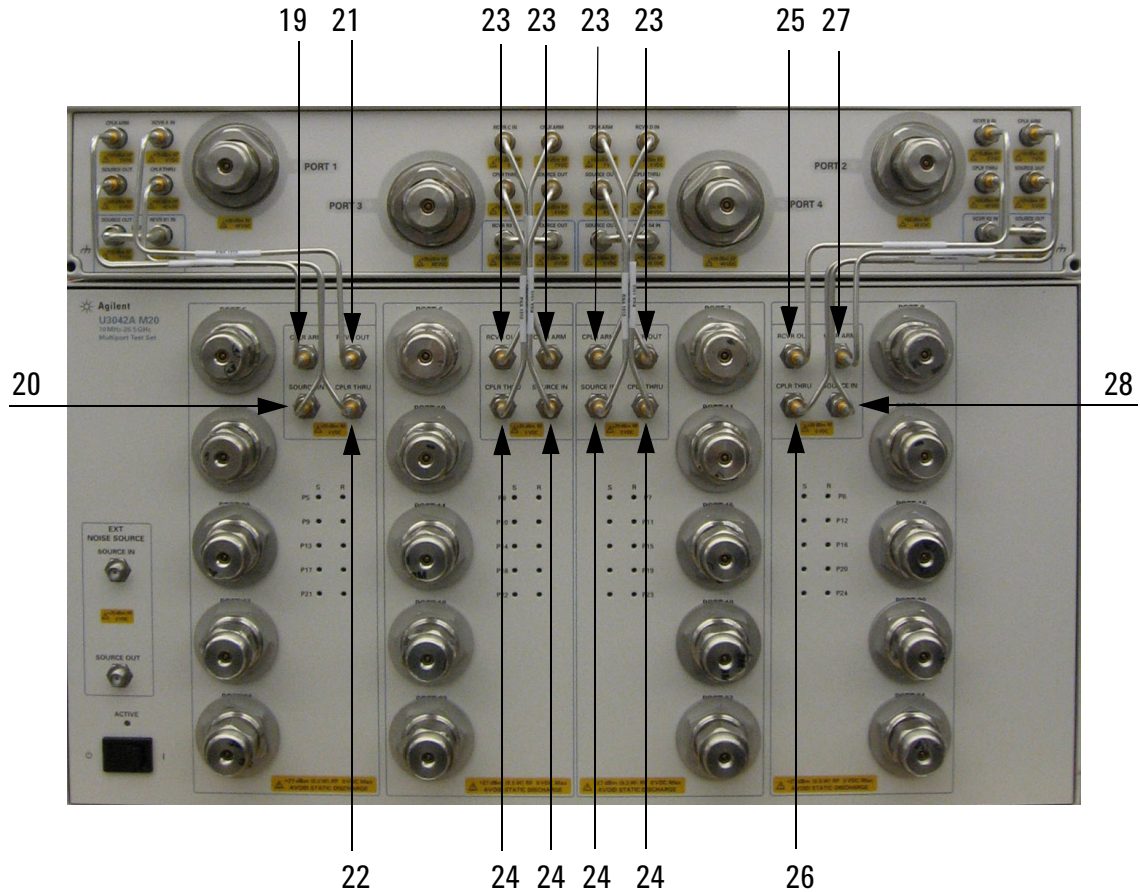
Numeric Order	RF Cables	From PNA-X	To Test Set
1	U3042-20122	Port 1 CPLR THRU	Port 5 CPLR THRU
2	U3042-20120	Port 1 SOURCE OUT	Port 5 SOURCE IN
3	U3042-20119	Port 1 CPLR ARM	Port 5 CPLR ARM
4	U3042-20121	Port 1 RCVR A IN	Port 5 RCVR OUT
5	U3042-20123	Port 3 CPLR ARM	Port 6 CPLR ARM
6	U3042-20123	Port 3 RCVR C IN	Port 6 RCVR OUT
7	U3042-20124	Port 3 SOURCE OUT	Port 6 SOURCE IN
8	U3042-20124	Port 3 CPLR THRU	Port 6 CPLR THRU
9	U3042-20123	Port 4 RCVR D IN	Port 7 RCVR OUT
10	U3042-20123	Port 4 CPLR ARM	Port 7 CPLR ARM
11	U3042-20124	Port 4 SOURCE OUT	Port 7 SOURCE IN
12	U3042-20124	Port 4 CPLR THRU	Port 7 CPLR THRU
13	U3042-20126	Port 2 CPLR THRU	Port 8 CPLR THRU
14	U3042-20128	Port 2 SOURCE OUT	Port 8 SOURCE IN
15	U3042-20125	Port 2 RCVR B IN	Port 8 RCVR OUT
16	U3042-20127	Port 2 CPLR ARM	Port 8 CPLR ARM

Refer to “Interconnect Cable Verification” on page 18.



Figure 10 illustrates the final two digits of the part number for each cable. The cables must be connected in the numeric order listed in Table 6 on page 16.

**Figure 10 RF Interface Cable Connections**



Refer to "Test Set I/O Cable Installation" on page 18.

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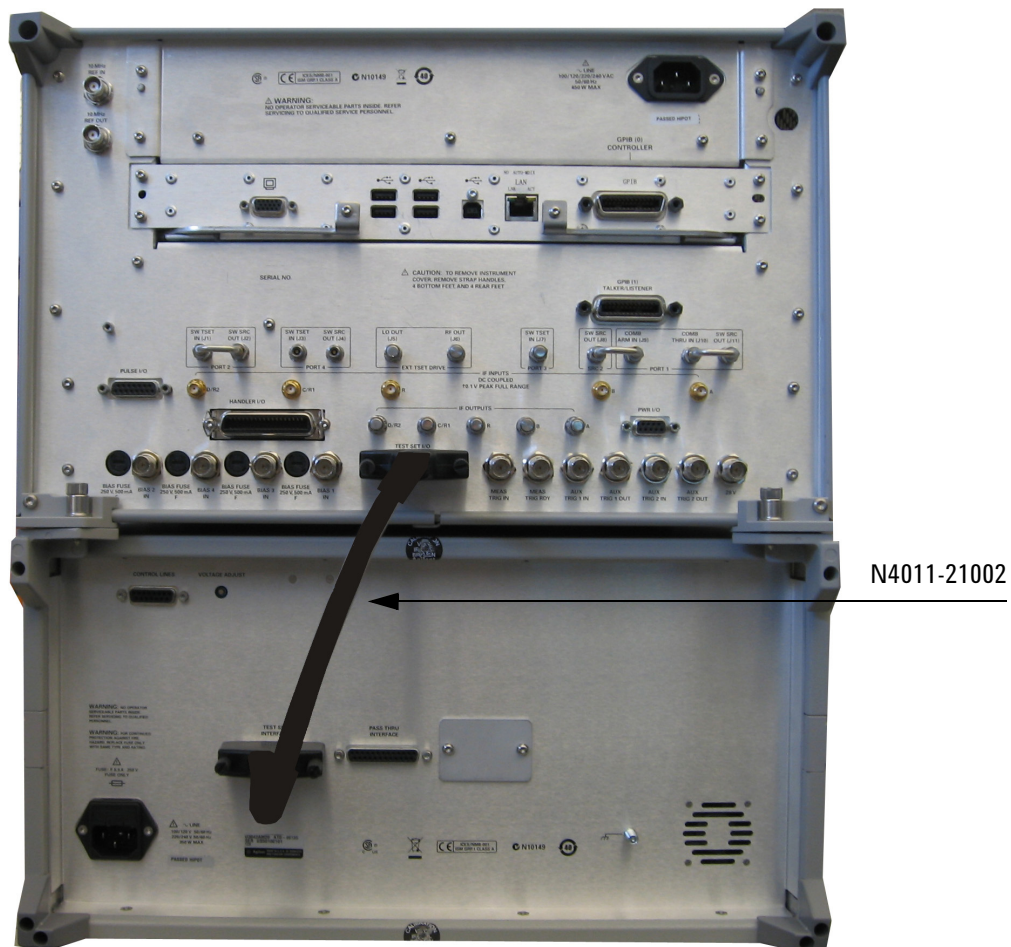
## Test Set I/O Cable Installation

3. Connect the Test Set I/O cable (N4011-21002) to the Test Set Interface connector on the rear panel, similar to [Figure 11](#).

### Interconnect Cable Verification

1. Perform the “[System Operational Check](#)” on page 19.
2. If the problem still exists, perform the “[RF Switching Failures](#)” on page 63.
3. If a power hole or other failure still exists, refer to “[Contacting Agilent](#)” on page 82.

**Figure 11** Test Set I/O Cable Connection



## System Operational Check

The following procedure will confirm that the RF interface cables between the test set and analyzer are installed and the system is working correctly. Ensure that your analyzer is operating before connecting the test set.

Before beginning this procedure complete the following steps:

- Stack the analyzer 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 female 3.5 mm short (85056-60007, included) to Port 1 on the analyzer.

### Equipment Setup

- Turn *on* the test set and analyzer.
- Preset the analyzer and make the following settings:
  - Set to Multi-Port Mode
  - Frequency range: 10 MHz to 26.5 GHz (depending on your analyzer)
  - IFBW: 1 kHz
  - Scale: 10 dB/Div
  - Set the analyzer to measure S11

### Verify Results

The 3.5 mm short will be relocated to each Test Port and an uncorrected 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 7 Reflection Response Results**

Reflection Port	Response Trace	Cable Path Diagram
Port 1 to 4	<a href="#">Figure 12 on page 20</a>	<a href="#">Figure 13 on page 20</a>
Ports 5 to 24	<a href="#">Figure 14 on page 21</a>	<a href="#">Figure 15 on page 21</a>

**NOTE** The trace ripple (peak-peak variation) will be higher than 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 47.

Figure 12 Typical Reflection Response Ports 1 to 4

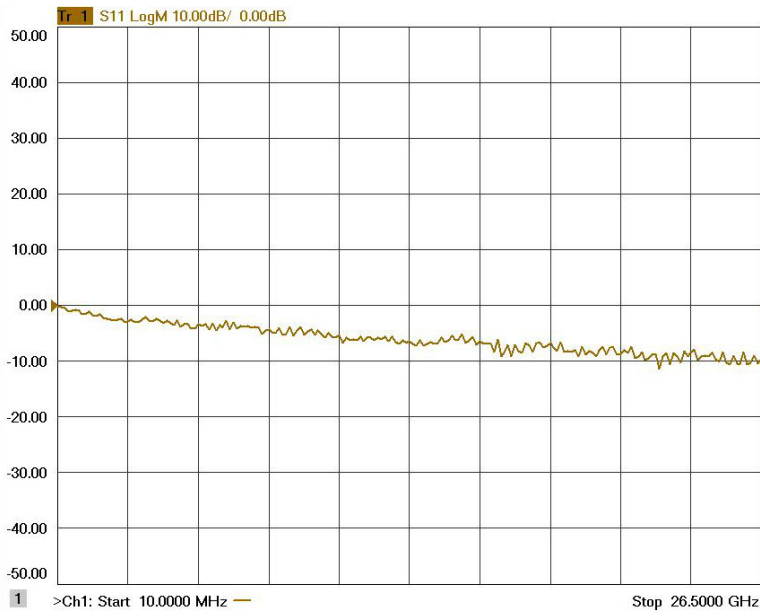


Figure 13 Reflection Response Signal Path Diagram Ports 1 to 4

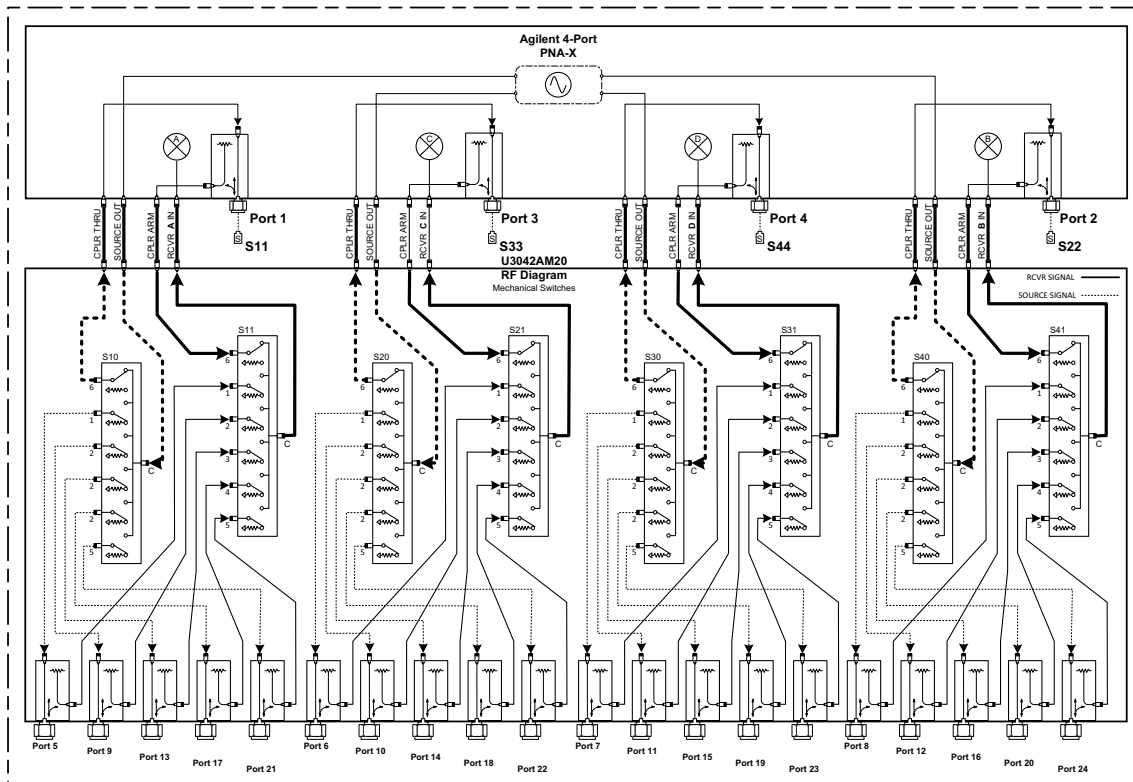


Figure 14 Typical Reflection Response Ports 5 to 24

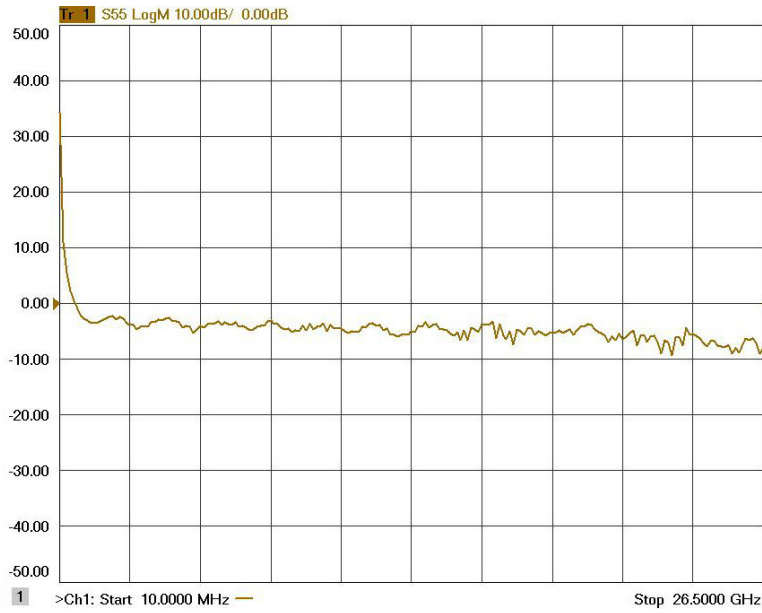
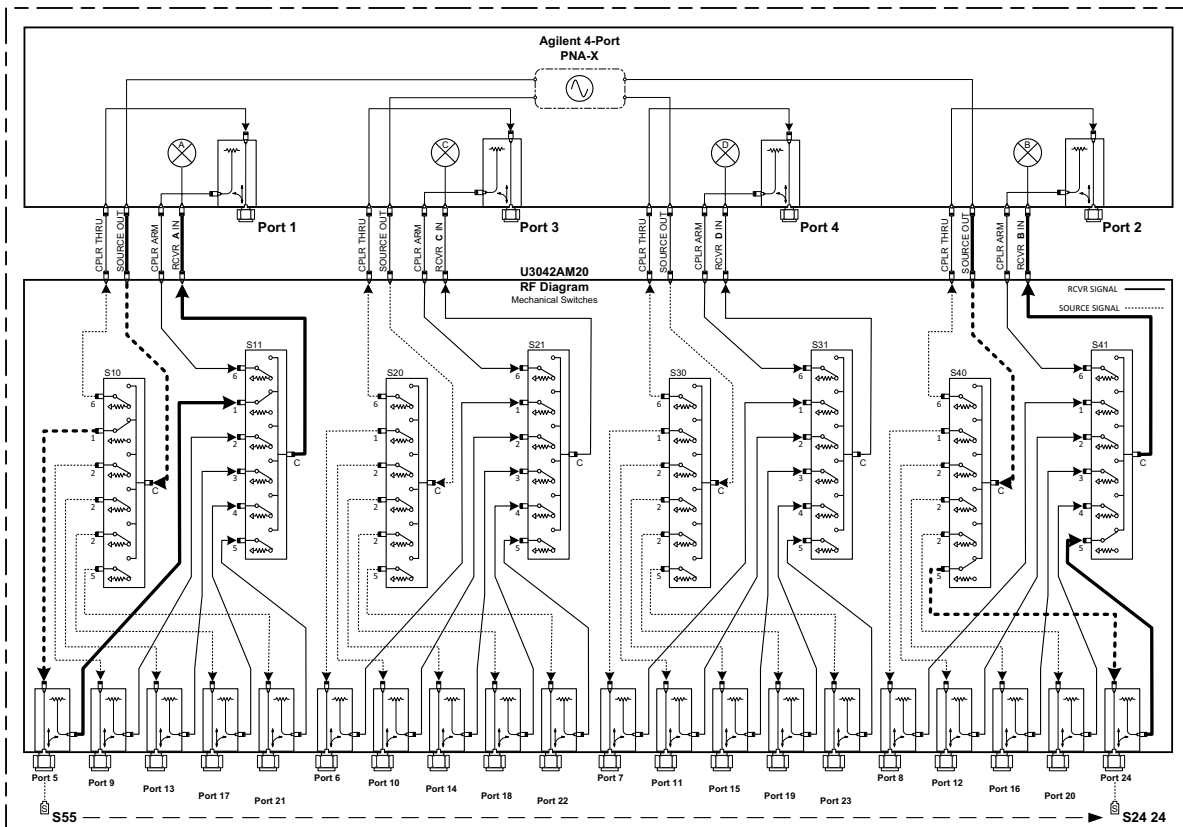


Figure 15 Reflection Response Signal Path Diagram Ports 5 to 24



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## Controlling the Test Set with N5222A 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.

- [“Multiport Mode \(Option 551\)” on page 23.](#)
- [“Interface Control Mode” on page 30.](#)
- [“GPIB Control Mode” on page 34.](#)

### 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

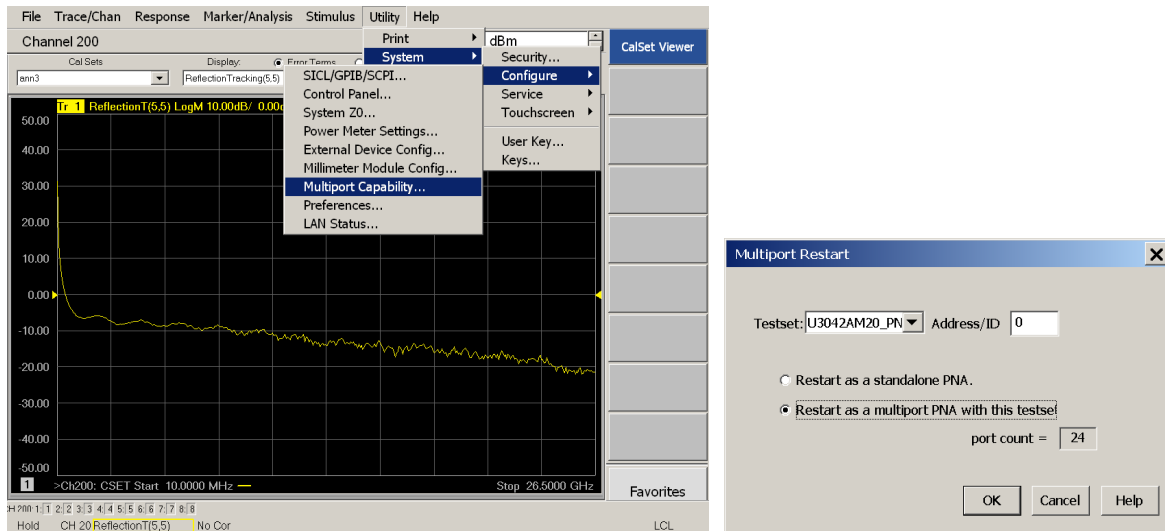
4-Port PNA or PNA-X requires Test Set: u3042am20\_pnax\_p4.tsx

### 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 **U3042AM20** (24-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.

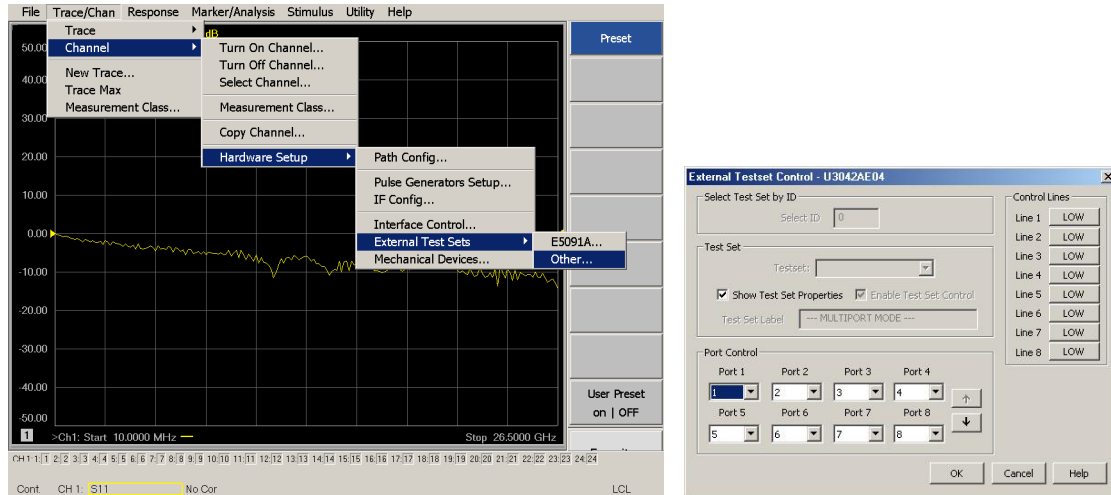
**Figure 16** Selecting Multiport Mode



## 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-U3042AM20**.

**Figure 17 External Test Set Control**



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

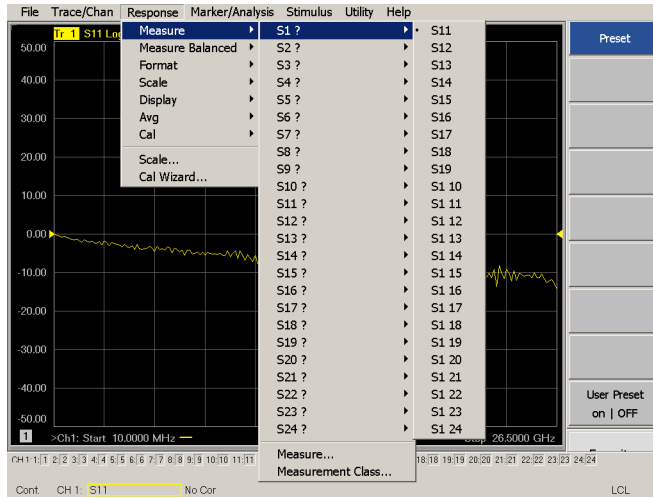
The **External Test Set Control-U3042AM20** also allows control of the DUT control lines, refer to [“Control Lines” on page 42](#). To change the state from LOW to HIGH, select the graphical user interface (GUI) for the specific control (LINE 1 thru 8), click **OK**. Each line can be controlled separately.



**Trace Measure S-Parameter**

S-Parameter selection can be accomplished using **Response > Measure**. Use the drop-down menu to select 1 of 567 S-Parameters for the 24-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.

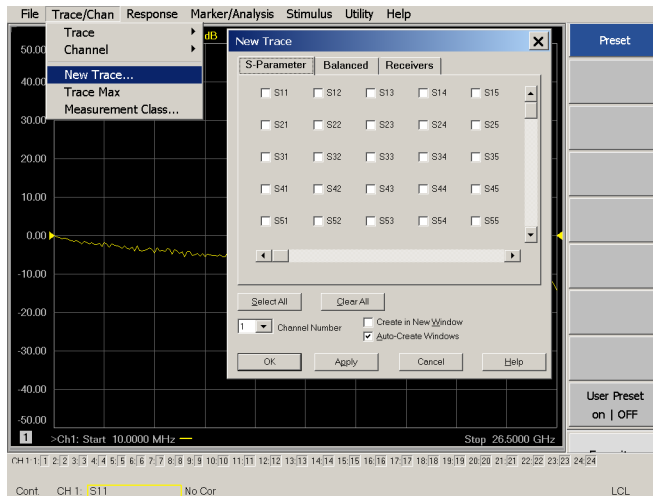
**Figure 18 S-Parameter Measurement**



**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 144 S-Parameters.

**Figure 19 New S-Parameter Measurement**

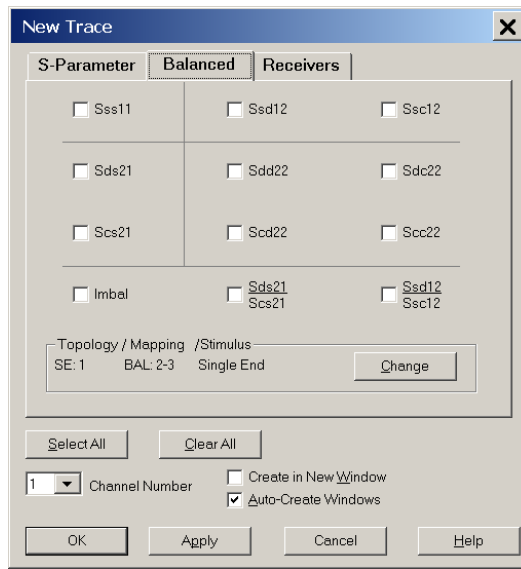


**Balanced Tab**

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.”

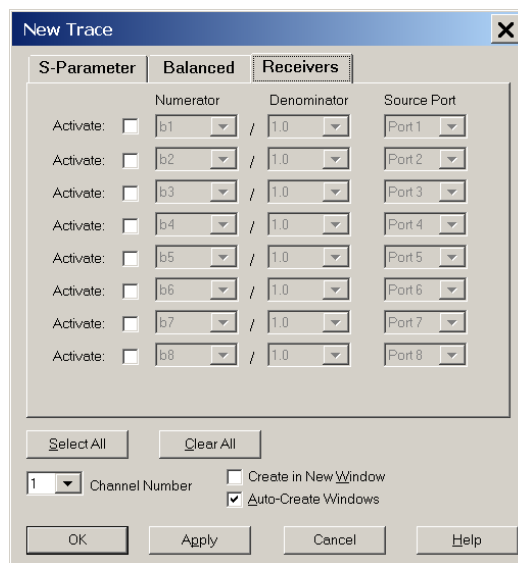
**Figure 20 Selecting Balanced Measurements**



**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 21 Receiver Measurements**

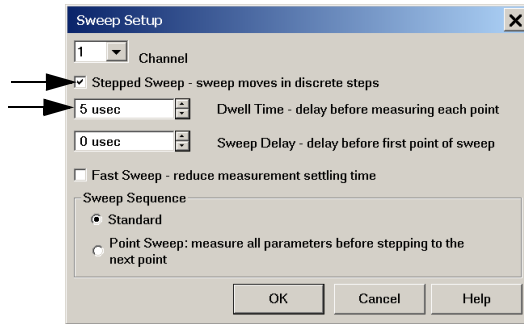


### Sweep Setup for Multiport and Standalone Modes

When the Test Set is connected to the network analyzer, it is recommended that the analyzer's Sweep Setup be configured to Stepped Sweep before calibrating. This is slower than the Analog Sweep, but is more accurate due to the extra electrical length of the Test Set and test port cables. Stepped Sweep is available on all models.

1. On the analyzer select **STIMULAS > Sweep > Sweep Setup**.
2. Select **Stepped Sweep-sweep moves in discrete steps**.
3. Set the **Dwell Time** to **5 ms > OK**.

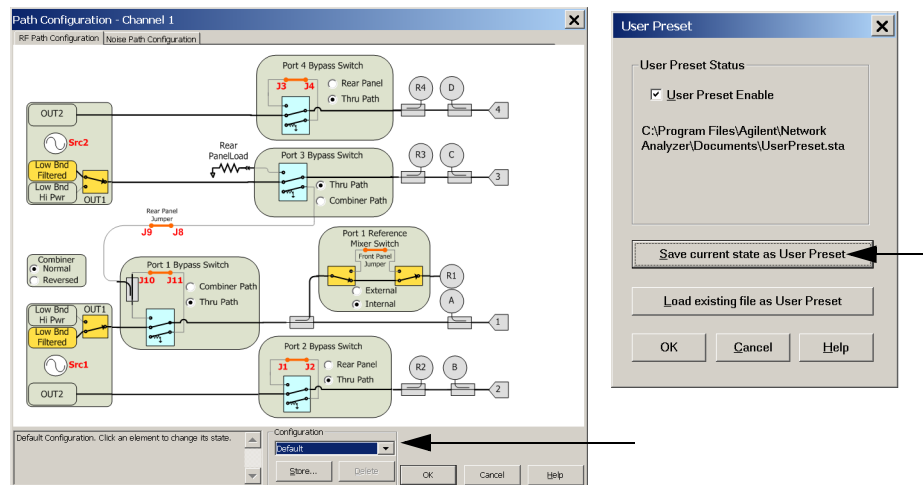
**Figure 22 Sweep Setup**



### 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 23 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.

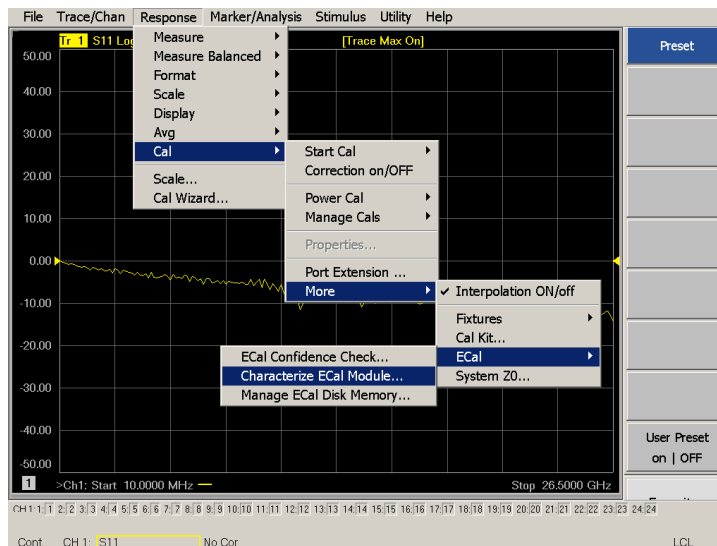
---

**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-X Option 551 firmware revisions and history. <http://na.tm.agilent.com/pna/firmware/firmware.htm>

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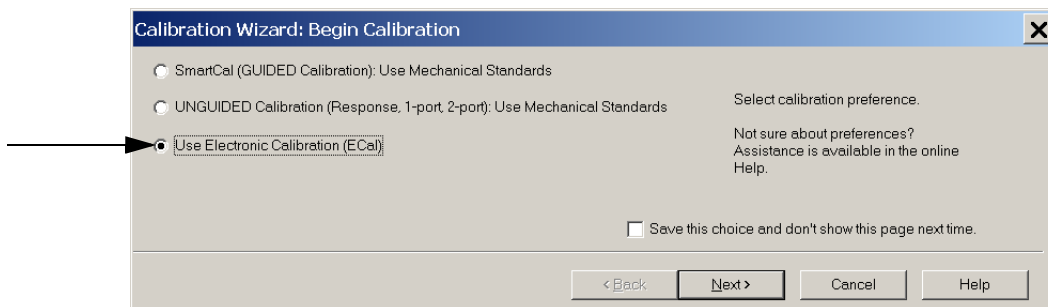
1. To perform an ECal characterization select **Response > Cal Wizard > Characterize ECal Module**.
2. Follow the prompts and save the ECal characterization file. Refer to the Help menu for characterizing information.

**Figure 24** ECal Characterization and Calibration Wizard



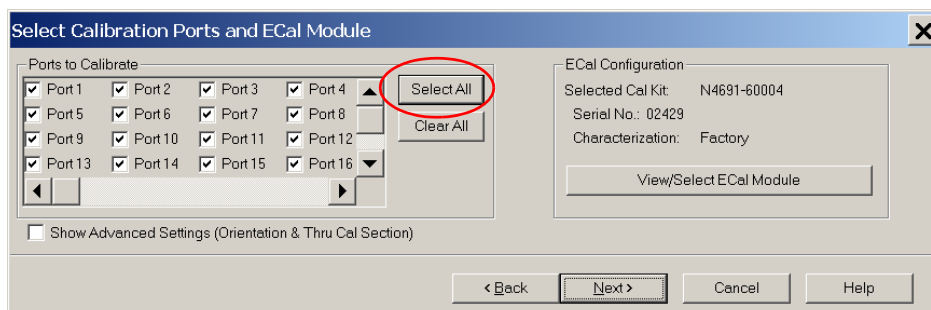
3. On the analyzer select **Response > Cal Wizard**.
  - a. If using a mechanical cal kit, select **SmartCal (Guided Calibration) > Next**.
  - b. If using an ECal module, connect the ECal to an available USB port and select **Use Electronic Calibration (ECal) > Next**.

**Figure 25**      **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 26**      **24-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 38 on page 50](#).
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 multipoint mode. Multipoint 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 > Multipoint 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 needing to create a remote program. Refer to PNA Help menu, "Rear Panel Tour."

- 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 PNA 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.

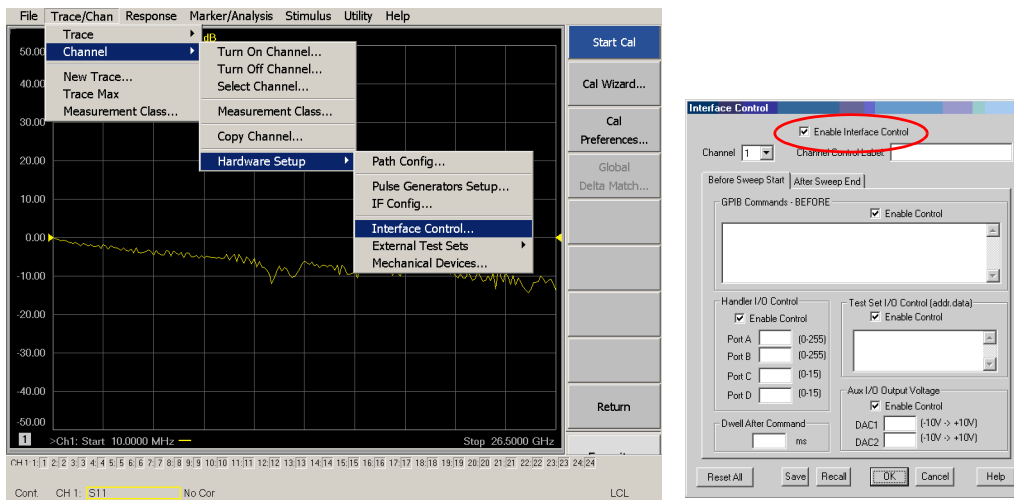
1. To access the Interface Control mode, select **Trace/Chan > Channel > Hardware Setup > Interface Control** in the drop-down menu, and select **Enable Interface Control**.

---

**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.

---

**Figure 27 Enable Interface Control**

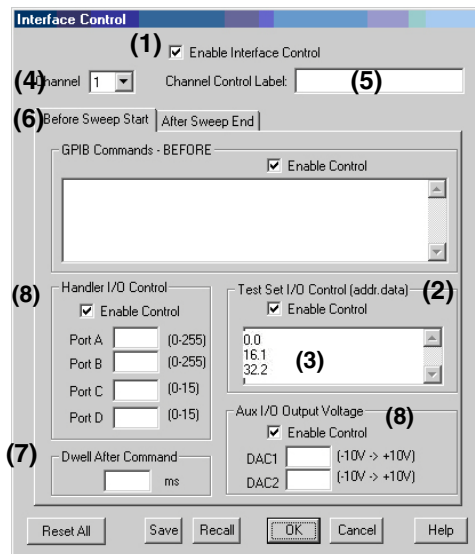


## Using Interface Control Mode

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 28 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 36](#).

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

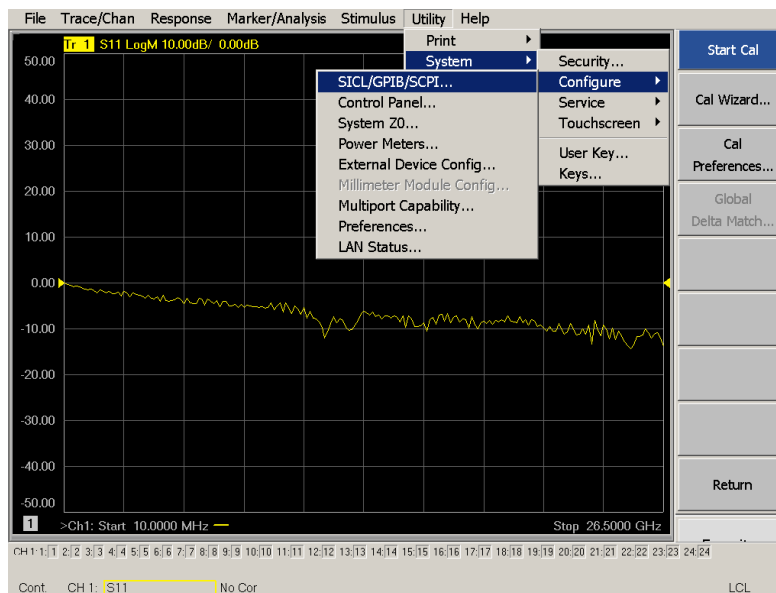
The GPIB Command Processor allows you to send address and data to control an external test set without creating a remote program. This allows you to control the test set without Option 551, or in non-standard measurement classes, such as Scalar Mixer/Converter, Swept IMD, Noise Figure Cold Source, etc.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

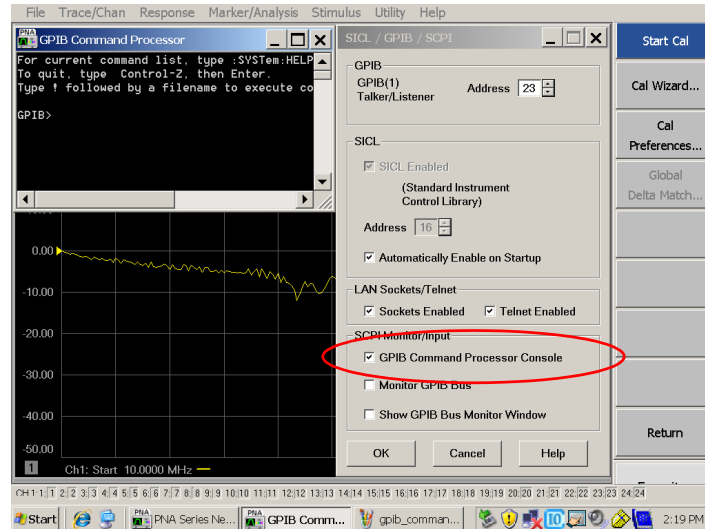
1. To access the GPIB Command Processor select **Utility > System > Configure > SICL/GPIB/SCPI**.

**Figure 29** Utility Configure



2. Select **GPIB Command Processor Console** > **OK**.

**Figure 30 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

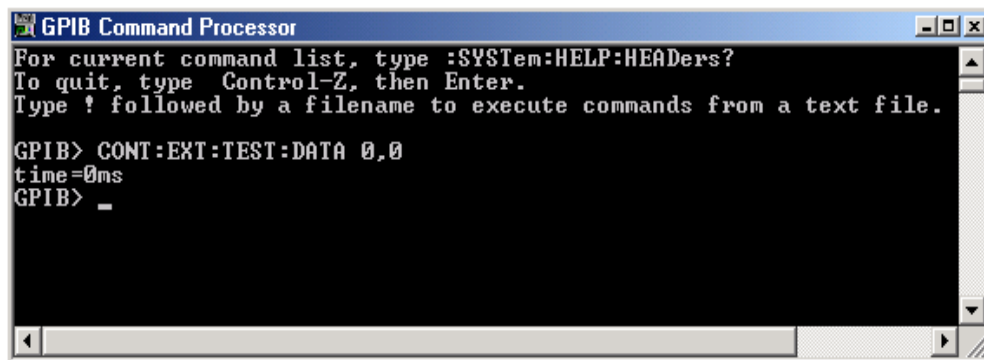
**data:** a integer number

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 36.

---

## Address and Data Values

### Setting the Test Port Paths with Address and Data

Refer to [Table 8](#), [Table 9 on page 37](#) and [Figure 31 on page 38](#) 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 30](#) and in [“GPIB Control Mode” on page 34](#).

*Example 1:* Refer to [Figure 31 on page 38](#).

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 be sent, you may use the same dialog box. The entry will be 0.1 in one command line, and 16.16 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 0 and Receiver Port 5 = address 0, data 16. The data values are added together, the entry will be 0.17.

*Example 3: (Option 129)* Refer to [Figure 32 on page 39](#).

Port 9 is the Source and Ports 5 is the Receiver.

Noise Source Port 5 = address 0, data 9, and Receiver Port 9 = address 0, data 16.

Two separate commands must be sent, you may use the same dialog box. The entry will be 0.9 in one command line, and 16.16 in the second line.

**Table 8 N52x2A Port Address and Data Values for STD.**

Address		Source Path						Receiver Path					
		Data	0	1	2	3	4	5	0	16	32	48	64
0	Ports	1	5	9	13	17	21	1	5	9	13	17	21
16	Ports	3	6	10	14	18	22	3	6	10	14	18	22
32	Ports	4	7	11	15	19	23	4	7	11	15	19	23
64	Ports	2	8	12	16	20	24	2	8	12	16	20	24

**Table 9 N52x2A Port Address and Data Values for Option 129**

Address	Data	Description
0	0	Selects STD Source Path to Port 1 <sup>1</sup>
0	8	Selects Noise Source IN and OUT paths for Port 1 (Sx1)
0	9	Selects Noise Source IN and OUT paths for Port 5 (Sx5)
0	10	Selects Noise Source IN and OUT paths for Port 9 (Sx9)
0	11	Selects Noise Source IN and OUT paths Port 13 (Sx13)
0	12	Selects Noise Source IN and OUT paths for Port 17 (Sx17)
0	13	Selects Noise Source IN and OUT paths for Port 21 (Sx21)
0	8	Selects Noise Source IN and OUT paths and Receiver for Port 1 (S11)
0	25	Selects Noise Source IN and OUT paths and Receiver for Port 5 (S55)
0	42	Selects Noise Source IN and OUT paths and Receiver for Port 9 (S99)
0	59	Selects Noise Source IN and OUT paths and Receiver for Port 13 (S1313)
0	76	Selects Noise Source IN and OUT paths and Receiver for Port 17 (S1717)
0	93	Selects Noise Source IN and OUT paths and Receiver for Port 21 (S2121)

1. See standard Source Paths in [Table 8](#) for Ports 5, 9, 13, 17 and 21.

Refer to “[System Block Diagrams](#)” on page 56 for in-depth RF path information.

Figure 31 Example 1; U3042AM20 Standard Block Diagram

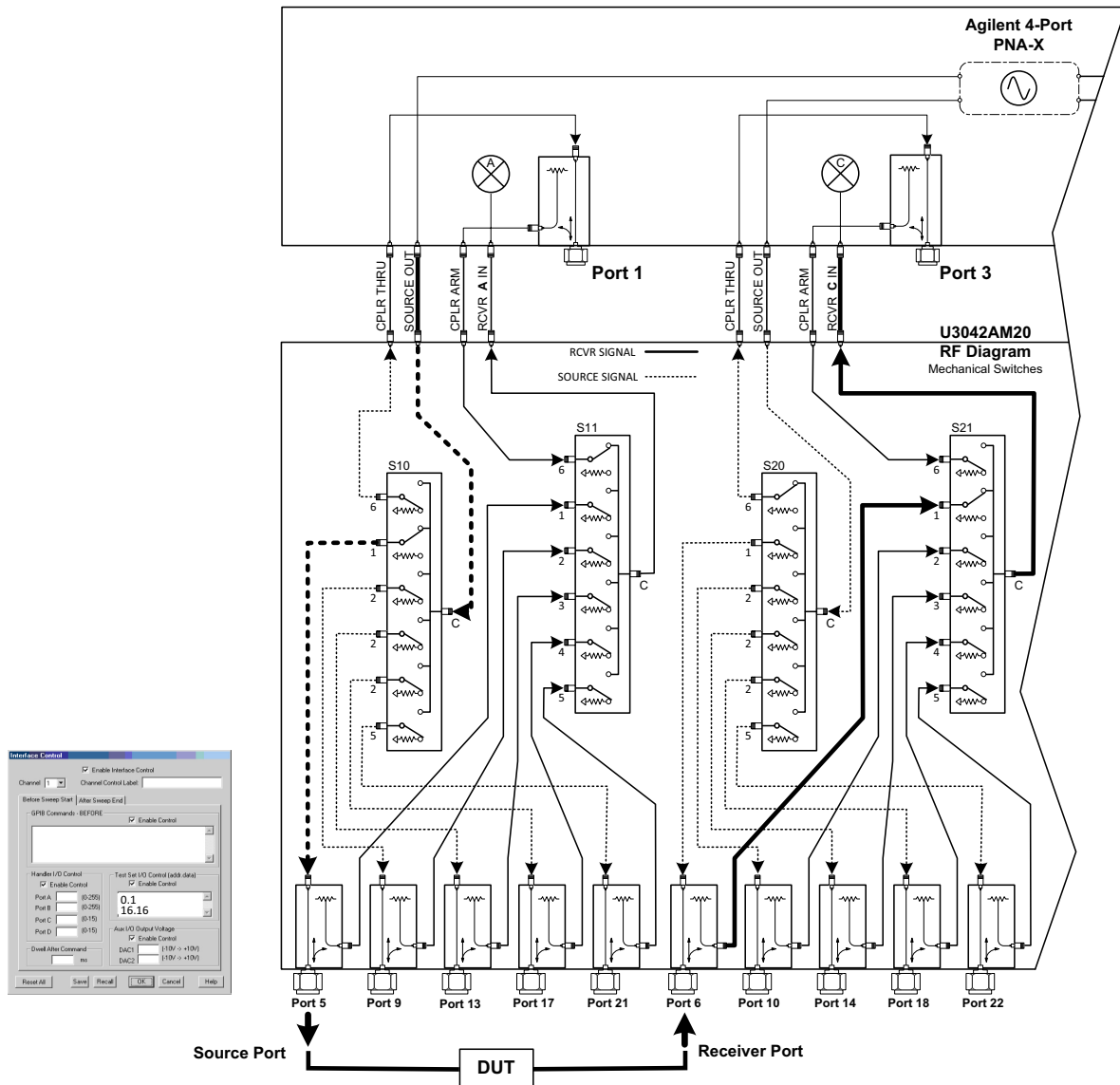
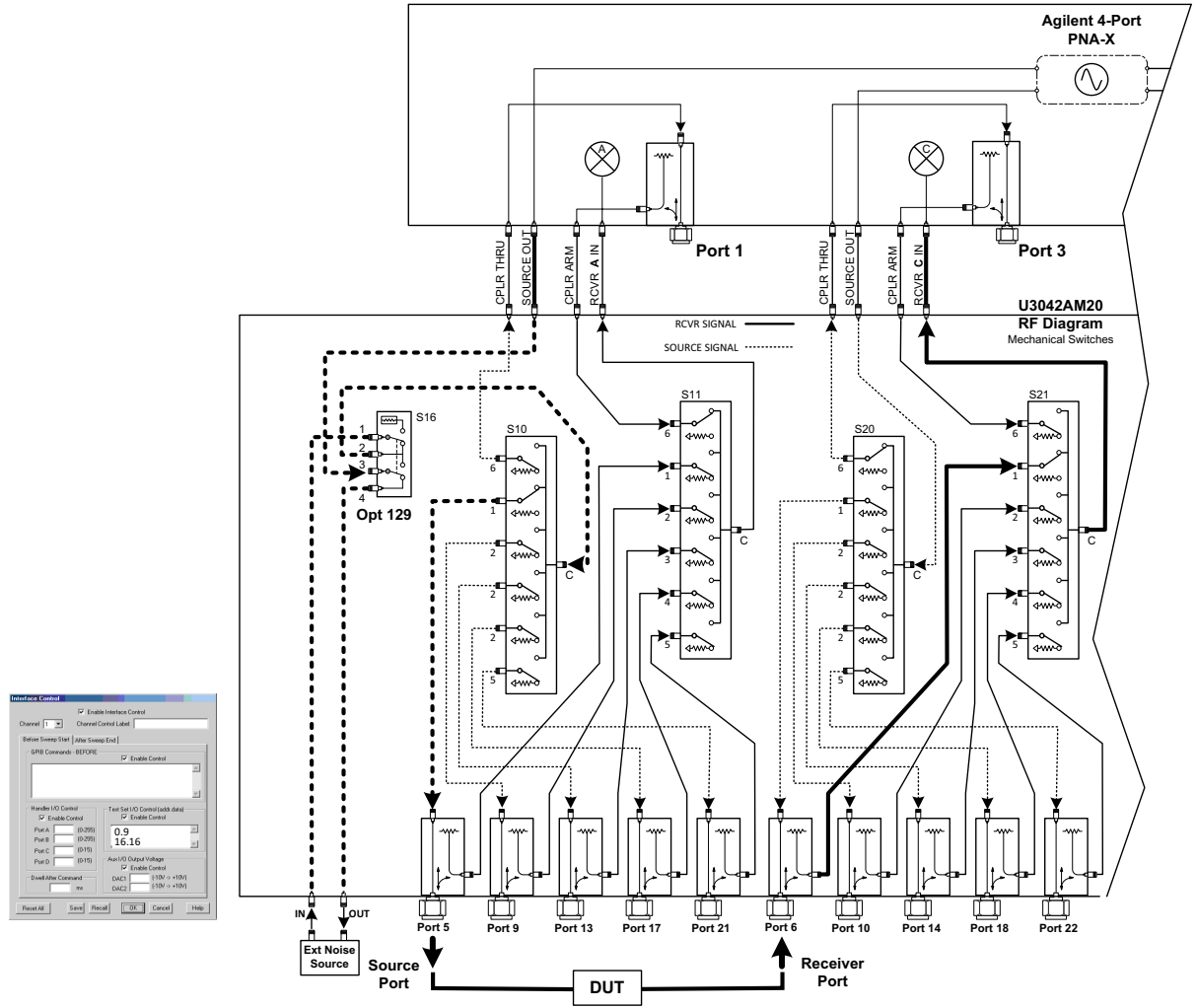


Figure 32 Example 3; U3042AM20 Option 129 Block Diagram



## Option 129 External Noise Source

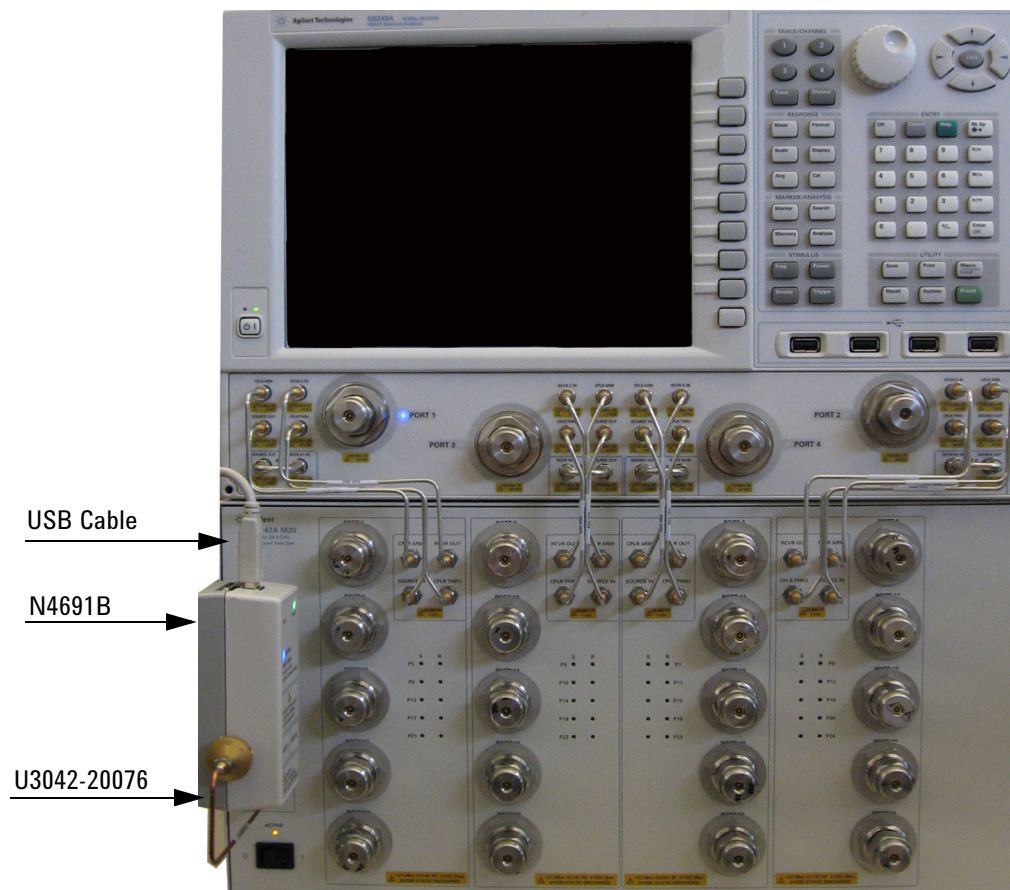
The U3042AM20 with Option 129 allows an external ECal module, or noise source to be switched into the Source path of Ports 1, 5, 9, 13, 17 or 21. Only one port can be the active source. The front panel EXT NOISE SOURCE IN is switched to the Output port, and the front panel EXT NOISE SOURCE OUT is switched to the Test Set SOURCE IN (connected to the PNA-X SOURCE OUT with a jumper cable) when the command is sent. Refer to [Table 9 on page 37](#) and [Figure 32 on page 39](#).

### System Configuration

[Figure 33](#) illustrated the PNA-X with the Test Set and N4691B Option MOF (ECal module) installed. The cable (U3042-20076) provided with Option 129 is intended to be used with the N46xx series ECal modules. The ECal module with Option MOF is recommended.

1. Connect the ECal module to the Test Set EXT NOISE SOURCE IN.
2. Connect the cable (U3042-20076) from the Test Set EXT NOISE SOURCE OUT to the ECal module.
3. Connect the ECal modules USB cable to one of the PNA-X USB ports.

**Figure 33** N5242A System with ECal Module





### Setting Option 129 Source Path

1. Restart the PNA to Standalone Mode, if it is in Multiport Mode. Refer to [Figure 16 on page 23](#).
2. Send command **0.0** and [**Preset**] the PNA-X.
3. Refer to “[Interface Control Mode](#)” on page 30. Use the values listed in [Table 10](#) to set Port 1, 5, 9, 13, 17 or 21 as the noise source path.

---

**NOTE** The Test Set will not operate in multiport mode. Interface or GPIB control is required to set the Noise Source Path.

---

**Table 10** Option 129 Source Path Test Set I/O Commands

Address.Data	Source Path
0.0	Standard Port 1 (Option 129 is not enabled)
0.8	Noise Source Port 1
0.9	Noise Source Port 5
0.10	Noise Source Port 9
0.11	Noise Source Port 13
0.12	Noise Source Port 17
0.13	Noise Source Port 21

---

**NOTE** An 8 is added to the Data Value to activate the Option 129 switch, as indicated in [Table 10](#).

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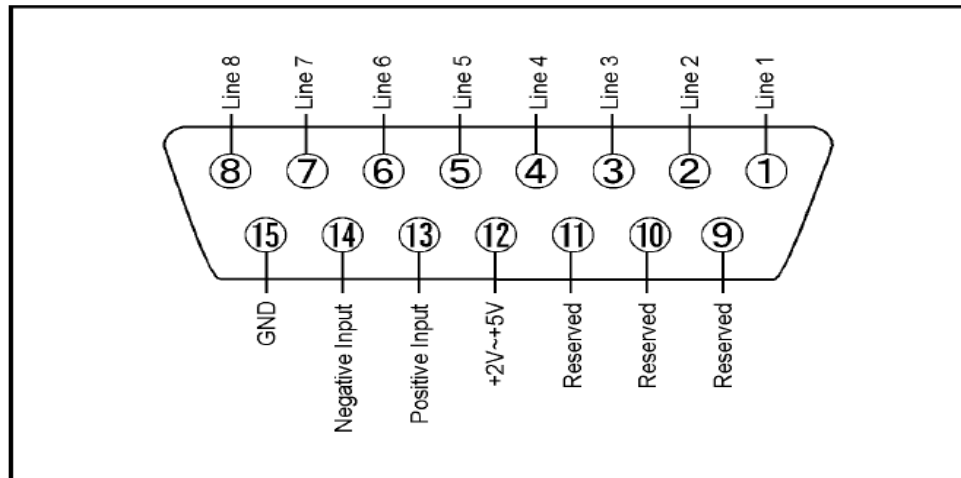
## Control Lines

The 15 pin female D-Sub connector on the rear 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 24](#) and [“Setting the Test Port Paths with Address and Data” on page 36](#). See [Table 11](#) 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 34](#) and [Table 12 on page 43](#) for control line pin location and description. Refer to [“Internal Voltage Supply Configuration” on page 44](#) and [“External Voltage Supply Configuration” on page 45](#) for configurations.

**Table 11 DUT Control Specifications**

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

**Figure 34 DUT Control Line Pin Assignment (rear panel view)****Table 12 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.

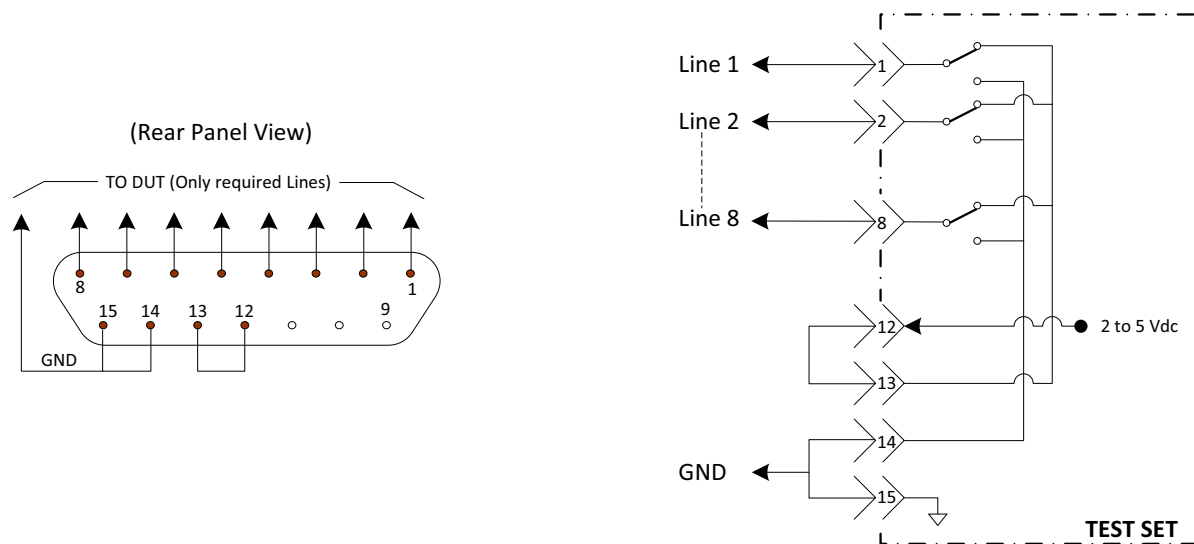
**Figure 35** illustrates an example of the connection between the DUT and the test set using the internal dc power supply. Connect pin 12 to pin 13 and pin 14 to pin 15 to provide the ground path. Connect the control lines to the external DUT.

---

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

---

**Figure 35** Internal DC Power Configuration (rear panel view)



## External Voltage Supply Configuration

Figure 36 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.

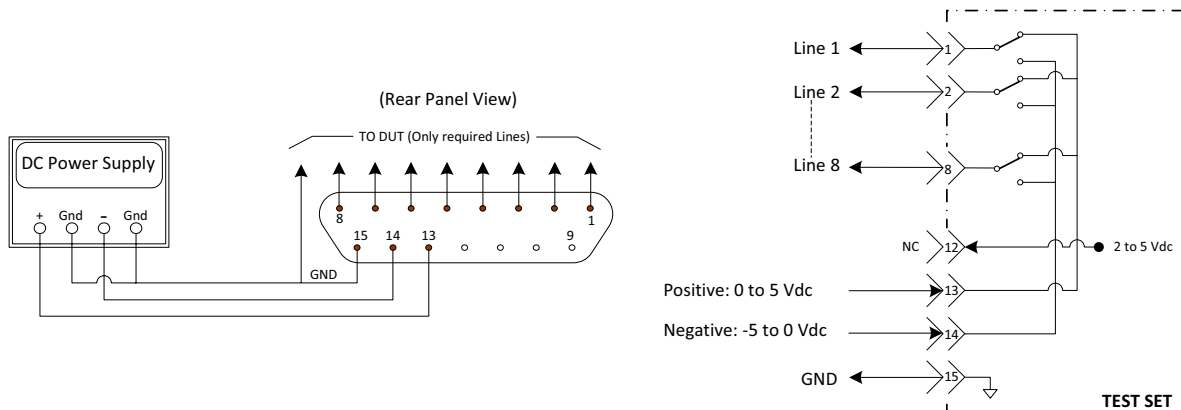
### Turning On the Test Set using an External Power Supply

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 36** 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 DUT control lines. Refer to “Control Lines” on page 42.

All DUT control lines remain in a high logic state until set by the address data  
0 = logic high. All control lines are set by the sum of the data sent to the Test Set.

Example: To set control line 1 and 8 to a low state send command 112.129 (1 + 128).  
All other lines remain in a high state.

**Table 13 Test Set DUT Control Address and Data Logic Table**

Address	Data	Description	Pin
112	0	ALL the Control Lines set to logic high	13
112	255	ALL the Control Lines set to logic low	14
112	1	DUT Control Line 1 set to logic low	1
112	2	DUT Control Line 2 set to logic low	2
112	4	DUT Control Line 3 set to logic low	3
112	8	DUT Control Line 4 set to logic low	4
112	16	DUT Control Line 5 set to logic lowe	5
112	32	DUT Control Line 6 set to logic low	6
112	64	DUT Control Line 7 set to logic low	7
112	128	DUT Control Line 8 set to logic low	8

## Cal Kit Operational Check

The following procedure can be used to confirm that the test set and network analyzer are operational. The operation verification limits provided ensure that your test set and network analyzer is operating properly. Refer to [“General Specifications” on page 6](#).

### Equipment Required

The U3042AM20 requires that the user be familiar with the equipment and components listed in [Table 14](#). This section provides an equipment list and configuration of the analyzer and test set.

**Table 14**      **Equipment List**

Description	Qty
N4691A 3.5 mm ECal Module 10 MHz - 26.5 GHz (Option 00F or M0F) <i>or</i> N4691B 3.5 mm ECal Module 300 kHz - 26.5 GHz (Option 00F or M0F) <i>or</i> Mechanical cal kit 85052B or 85052D	1
N5242A Option 400 and 551	1
Set of interconnect cables (PNA-X and Test Set), see <a href="#">“N5222A and N5242A RF Interface Cable Connections (U3021-60077)” on page 16</a> .	1

### Verification Limits

Specifications for the Test Set are typical. System performance for the 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 PNA-X 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.

**Table 15 N5242A Operation Verification Limits for Reflection Tracking<sup>1</sup>**

Frequency	Port 1-24
10 MHz to 4 GHz	-8 dB
4 GHz to 6 GHz	-9 dB
6 GHz to 10 GHz	-10 dB
10 GHz to 15 GHz	-12 dB
15 GHz to 20 GHz	-14 dB
20 GHz to 26.5 GHz	-15 dB

1. Reflection Tracking takes into account Source Loss, Receiver Loss, Margin, and PNA-X Mixer Cal.

---

**NOTE** If you suspect that your 24-Port configuration is not operating properly, ensure that all front RF jumper interconnect cables are correctly attached.

---



## 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 PNA-X if you are performing a analyzer's Operator's Check. The PNA-X will indicate false failures if the test set is connected.

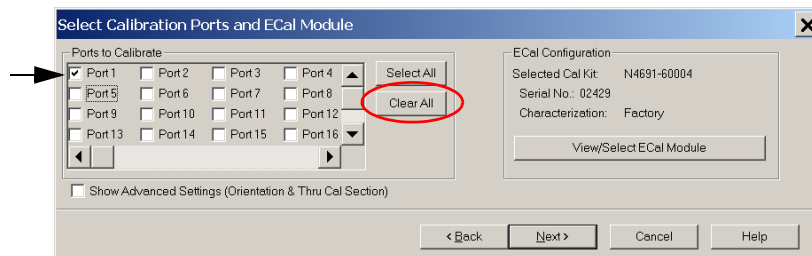
### Preparing the N5242A

1. Connect the Test Set to the 4-Port PNA-X using the interconnect cables as shown in [Figure 10 on page 17](#) and [Table 6 on page 16](#).
2. Turn On the Test Set.
3. On the PNA-X, select **Response > Cal > Manage Cals > Cal Set**. Delete or Rename any Cal Sets titled "999.1" thru "999.24" (24-Port), although it is unlikely that you will find Cal Sets with these names.
4. Verify that the PNA-X is in 24-Port. 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 **U3042AM20** (24-Port) from the drop-down menu > **OK**. Refer to [Figure 16 on page 23](#).
5. Press **Preset**.
6. Verify that the **[Start Frequency]** is set to **[10 MHz]**.
7. Verify that the **[Stop Frequency]** is set to **[26.5 MHz]**.
8. Verify that the **[Power]** is to set to **[-5 dBm]**. If not, select **[Power] > Power Level** and enter **[-5 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 PNA-X USB port on the front or rear panel. Refer to [Figure 10 on page 17](#). This procedure assumes you are using a ECal. If you are not, see ["1-Port Calibration and Verification Procedure" on page 50, step 2](#).
12. Allow the ECal module, Test Set and PNA-X 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 press **Clear All**, then select **Port > Next > Measure**.
4. Ensure the Cal Kit you are using is indicated on the right side of the dialog box.

**Figure 37** 1-Port Calibration



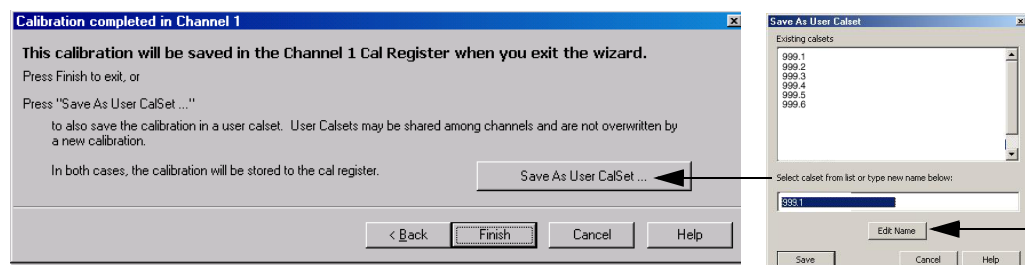
5. Continue to follow the prompts until the "Calibration Completed" dialog box appears.
6. At the Calibration Completed prompt, select **Save As User Calset** and type the name **999.1**. Overwrite the Calset if it already exists and **Save**.

**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 PNA-X front panel to enter "999.1."

7. Repeat **step 1** thru **step 6** (1-Port Calibration Procedure) for Ports 2 thru 24. When finished, there should be 24 Cal Sets saved with the titles "999.1" thru "999.24" (24-Port).

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

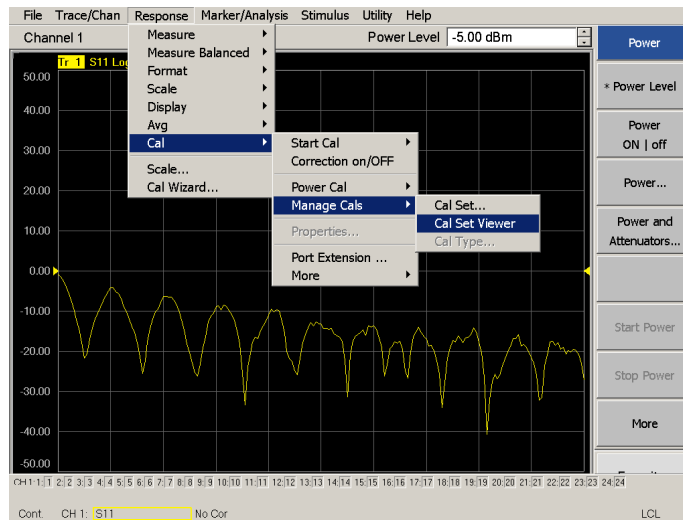
**Figure 38** Calibration Complete



## CalSet Verification

1. Select **Trace/Chan > Trace > Delete Trace**. There should be no traces on the PNA-X screen.
2. To launch the Cal Set Viewer toolbar. Select **Response > Cal > Manage Cals > Cal Set Viewer**.

**Figure 39 Calibration, Cal Set Viewer**



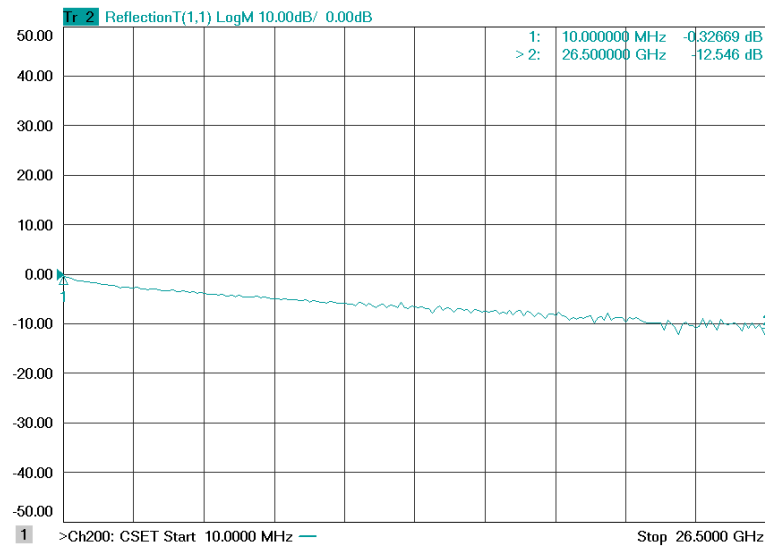
3. From the Cal Sets drop-down menu, select **999.1** and select **Enable**. Select the **Reflection Tracking(x,x)**, where x,x is the port being tested, term in the center drop-down menu and ensure that the **Enable** and **Error Terms** are selected.
4. Compare the Reflection Tracking (1,1) trace to the appropriate limits in [Table 15 on page 48](#). Use the Marker function to measure trace values.
5. Repeat [step 3](#) and [step 4](#) for Cal Sets “999.1” thru “999.24” (24-Port).

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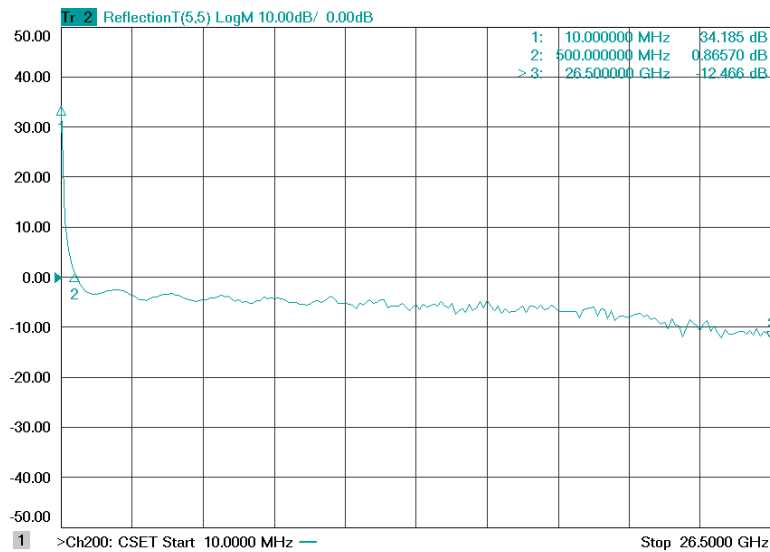
**NOTE** Response from 10 MHz to 500 MHz is normal due to the PNA-X couplers in comparison to the Test Set bridges. The bridges have more gain in the coupled RF path.

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**Figure 40 Standard Reflection Tracking Trace (Port 1 to 4) with PNA-X**



**Figure 41 Standard Reflection Tracking Trace (Port 5 to 24) with PNA-X**



## Verifying Cal Kit Operational Check Failures

If your test results fail the Operational Check limits, see [Table 5 on page 9](#) and verify following:

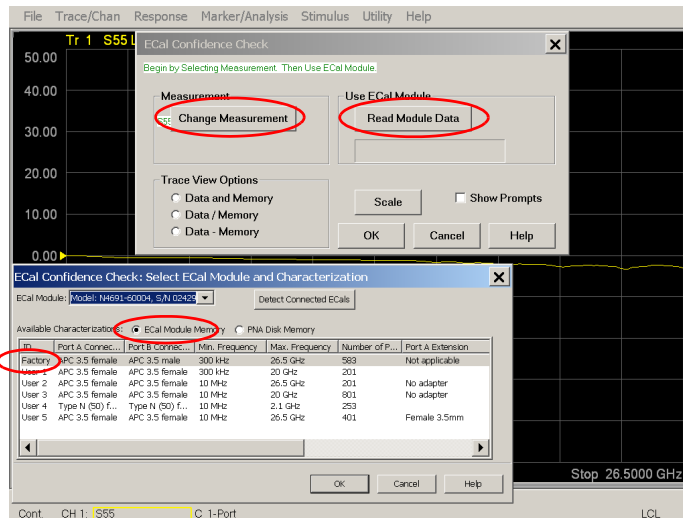
1. Ensure that the test set is turned on and connected properly to the analyzer.
2. Check all appropriate connectors for damage, cleanliness, and proper torques.
3. Repeat the relevant 1-Port calibrations using another ECal or mechanical standard.
4. Verify that the analyzer is operating properly and 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 to 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 42 ECal Confidence Check**



## Service Information

Refer to “Contacting Agilent” on page 82.

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

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**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.**

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## Replaceable Parts

The following replaceable parts are available from Agilent Technologies “Find-A-Part” system on the web at [www.parts.agilent.com](http://www.parts.agilent.com).

**Table 16**     **Available Replacement Parts (SPO)**

Description	Agilent Part Number
4-Port Terminated Latching Coax Switch with Opt 124, 026, 201, 302 and 403	N1811-60005 <sup>1</sup>
Fuse (5 A 250 V non-time delay Socket)	2110-0709
Fuse (8 A 250 V non-time delay 0.0146 Ohm)	2110-0342
PWR Supply (AC/DC SWG 650W 9- Output)	0950-4729
PNA-X Locking Feet	5023-0132
Coupler Bridge	5087-7716
Test Set I/O Cable	N4011-21002
Fan (rear panel)	87050-60027
Switch, Multiport, SP6T, DC - 26.5 GHz	87106-60065
DUT Control Board	E5091-66503

1. Instrument Option 129 only, non RoHs.

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

**Table 17 Replaceable Parts (M20)**

Description	Agilent Part Number
Front Panel LED Board (programmed)	N5261-60005
Test Set Control Board (programmed)	N5261-60006
4-Port Terminated Latching Coax Switch with Opt 124, 026, 201, 302 and 403	N1811-60027 <sup>1</sup>
SW Interface Board, programmed	U3025-60062
PNA or PNA-X Lock-link kit	U3021-60005 <sup>2</sup>
PNA or PNA-X Cable kit	U3021-60077 <sup>3</sup>
User's and Service Guide (Option M20)	U3042-90009

1. Instrument Option 129 only, RoHs.
2. Refer to ["Hardware Lock-link Installation \(U3021-60005\)"](#) on page 13.
3. For individual cables refer to [Table 6](#) on page 16.

# System Block Diagrams

Figure 43 U3042AM20 RF Block Diagram

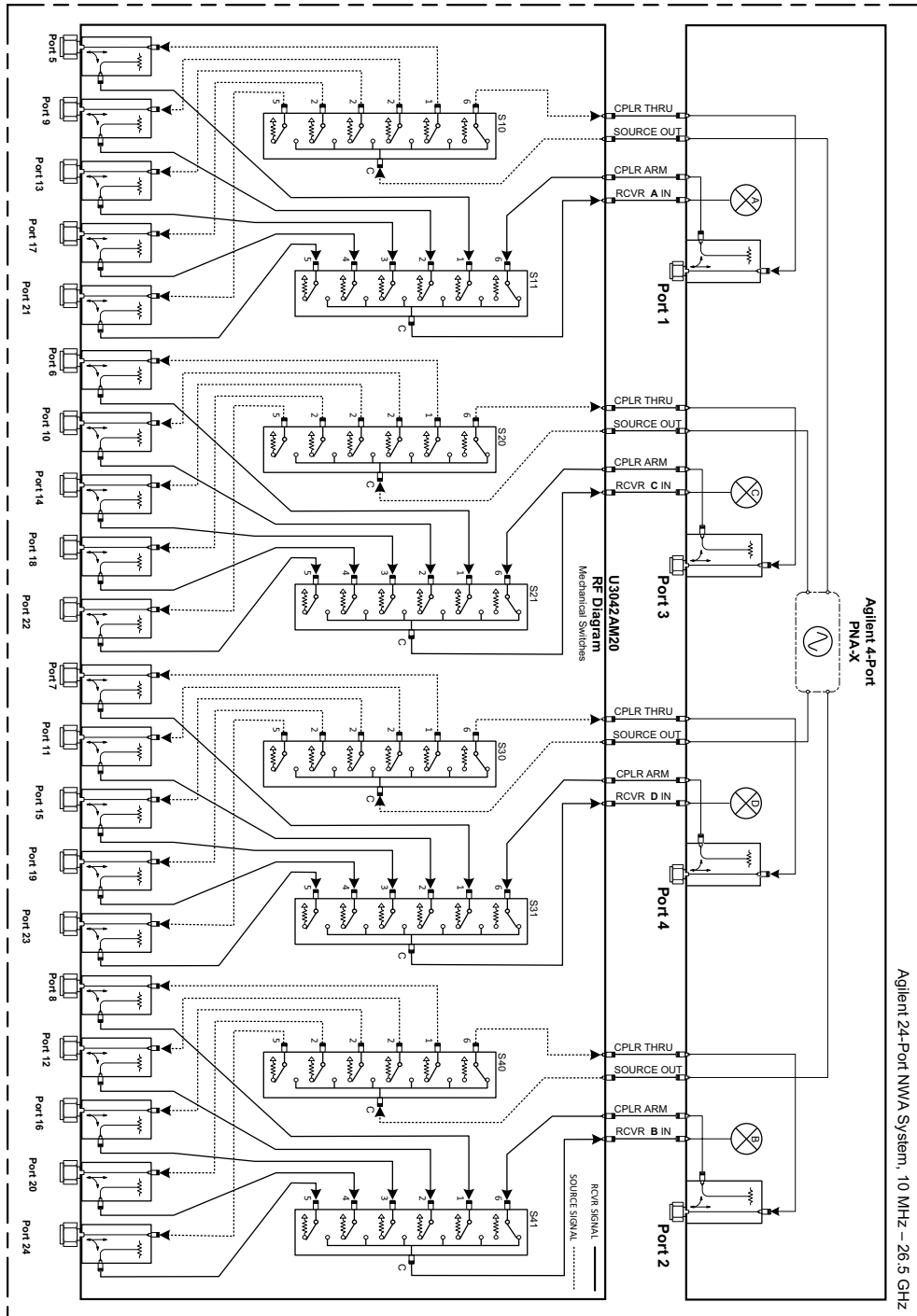
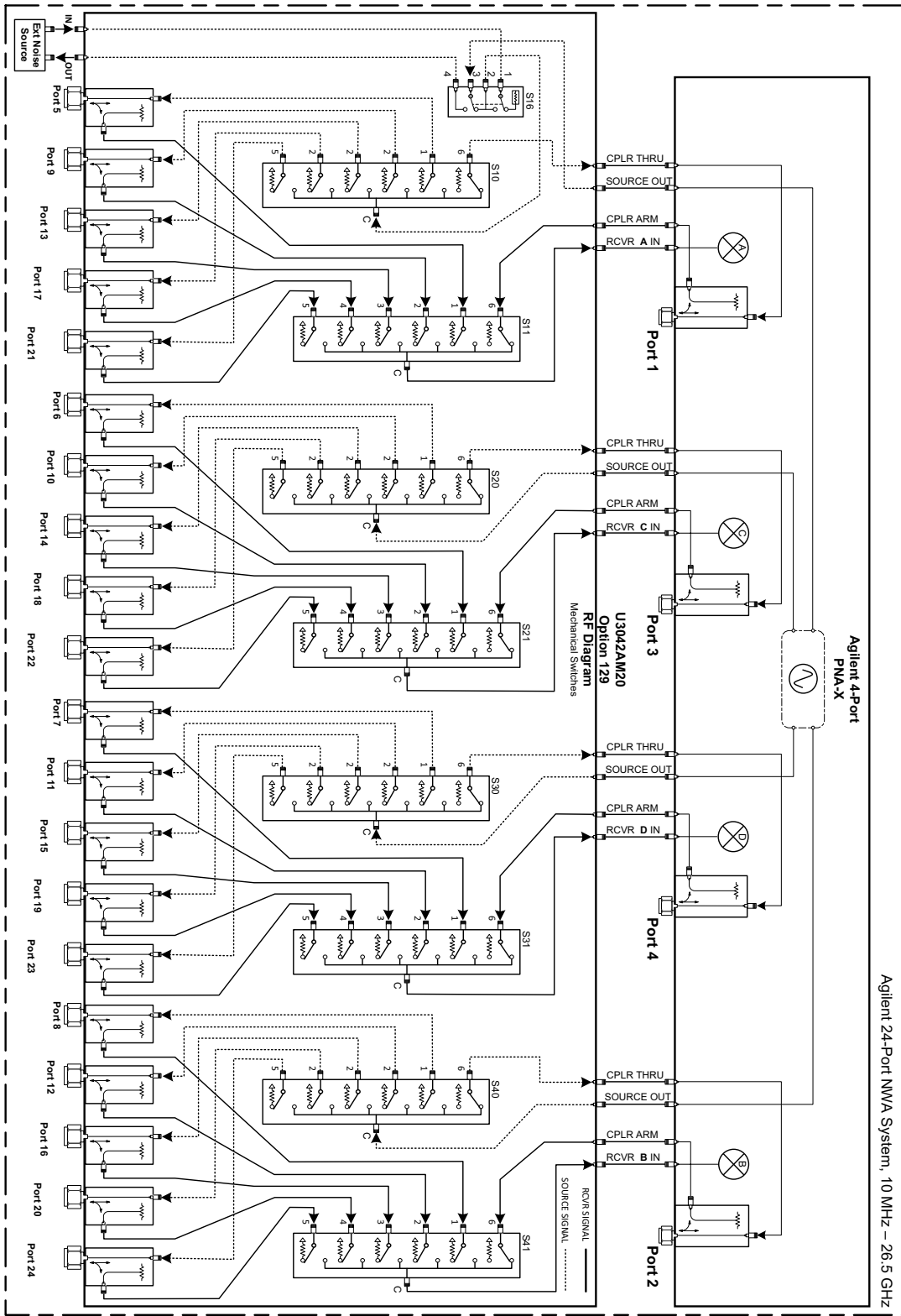




Figure 44 U3042AM20 Option 129 RF Block Diagram



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## Theory of Operation

The following is a description of the operation of the Test Set. Reference the Test Set block diagrams shown in [Figure 31 on page 38](#). This section assumes the user has a general understanding of couplers, switches, and network analyzers.

The module is a set of switches controlling source and receiver paths of the PNA port and five couplers in the column under the PNA port. There are four modules, one for each of the PNA ports and Test Set ports.

### RF Coupler/Bridges

The Test Set uses twenty coupler/bridges (5087-7716) on the front panel for RF Test Ports 5 - 24. 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 mechanical switches that have internal  $50 \Omega$  termination. The switches select the RF paths from the PNA-X source and receiver through interconnect cables to the Test Set. PNA-X Ports 1 thru 4 and Test Set Ports paths 5 thru 24. If your Test Set includes Option 129 an additional switch has been installed to provide the Ext Noise Source path to Port 1, 5, 9, 13, 17 or 21.

### PNA-X Switch Paths

**S10 - Source to Ports (1, 5, 9, 13, 17 and 21)** Switch 10 provides control of the Source Output path to PNA-X Port 1 and Test Set Ports 5, 9, 13, 17 and 21. In the state shown in the block diagram, switch 10 routes the RF Source back to the PNA-X Port 1, and the Test Set Source path to Port 5, 9, 13, 17 and 21 are terminated.

**S20 - Source to Ports (3, 6, 10, 14, 18 and 22)** Switch 20 provides control of the Source Output path to PNA-X Port 3 and Test Set Port 6, 10, 14, 18 and 22. In the state shown in the block diagram, switch 20 routes the RF Source back to the PNA-X Port 3, and the Test Set Source path to Ports 6, 14, 18 and 22 are terminated.

**S30 - Source to Ports (4, 7, 11, 15, 19 and 23)** Switch 30 provides control of the Source Output path to PNA-X Port 4 and Test Set Port 7, 11, 15, 19 and 23. In the state shown in the block diagram, switch 30 routes the RF Source back to the PNA-X Port 4, and the Test Set Source path to Ports 7, 11, 15, 19 and 23 are terminated.

**S40 - Source to Ports (2, 8, 12, 16, 20 and 24)** Switch 40 provides control of the Source Output path to PNA-X Port 2 and Test Set Port 8, 12, 16, 20 and 24. In the state shown in the block diagram, switch 40 routes the RF Source back to the PNA-X Port 2, and the Test Set Source path to Ports 8, 12, 16, 20 and 24 are terminated.

**S11 - Receiver to Ports (1, 5, 9, 13, 17 and 21)** Switch 11 provides control of the Receiver Input path to PNA-X Port 1 and Test Set Port 5, 9, 13, 17 and 21. In the state shown in the block diagram, switch 11 routes the Port 1 Coupler Arm to the Receiver, and Test Set Ports 5, 9, 13, 17 and 21 Coupler Arm path is terminated.

**S21 - Receiver to Ports (3, 6, 10, 14, 18 and 22)** Switch 21 provides control of the Receiver Input path to PNA-X Port 3 and Test Set Ports 6, 10, 14, 18 and 22. In the state shown in the block diagram, switch 21 routes the Port 3 Coupler Arm to the Receiver, and Test Set Ports 6, 10, 14, 18 and 22 Coupler Arm path is terminated.

**S31 - Receiver to Ports (4, 7, 11, 15, 19 and 23)** Switch 31 provides control of the Receiver Input path to PNA-X Port 4 and Test Set Ports 7, 11, 15, 19 and 23. In the state shown in the block diagram, switch 31 routes the Port 4 Coupler Arm to the Receiver, and Test Set Ports 7, 11, 15, 19 and 23 Coupler Arm path is terminated.

**S41 - Receiver to Ports (2, 8, 12, 16, 20 and 24)** Switch 41 provides control of the Receiver Input path to PNA-X Port 2 and Test Set Port 8, 12, 16, 20 and 24. In the state shown in the block diagram, switch 41 routes the Port 2 Coupler Arm to the Receiver, and Test Set Ports 8, 12, 16, 20 and 24 Coupler Arm path is terminated.

**S16 - Option 129 Ext Noise Source** Switch 16 provides control of the Ext Source Noise path to Port 1, 5, 9, 13, 17 and 21.

---

## 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](http://www.agilent.com/find/service).

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

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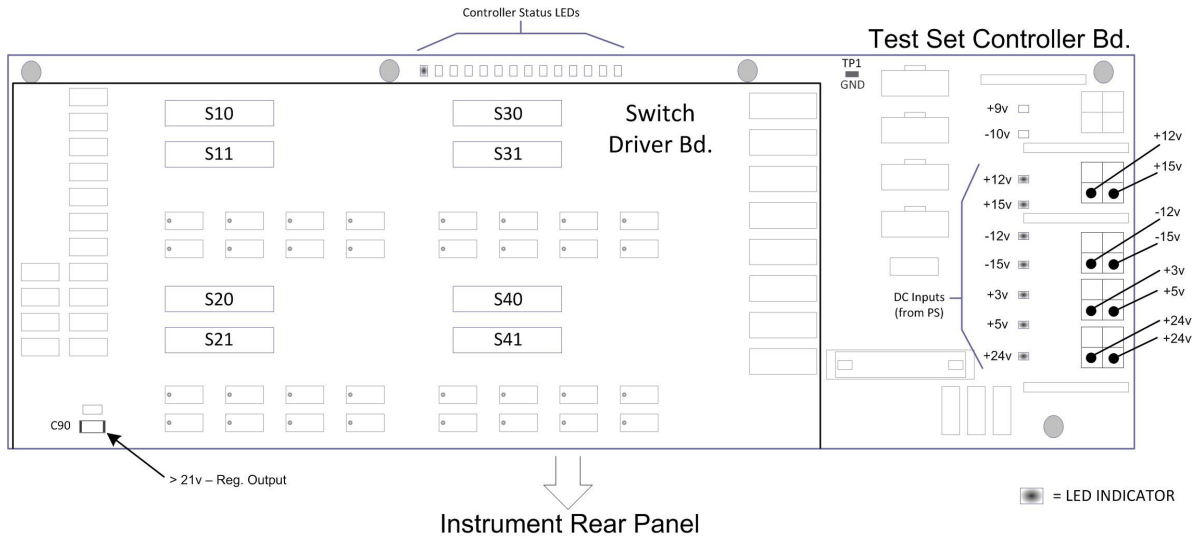
### Non-RF Failures

Non RF failures are; Power Supply, Fans, Control Lines, Status LEDs or Interface not operating. Refer to [Figure 46 on page 61](#).

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 4 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 55 on page 75](#).
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 bottom 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 45 on page 61](#).

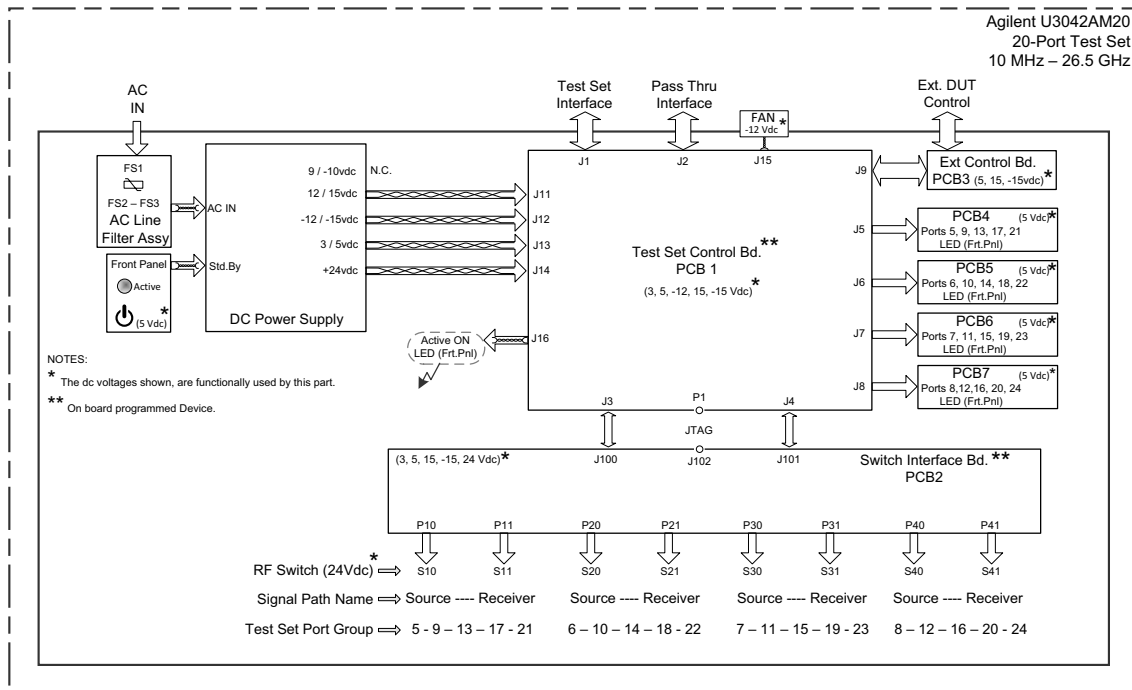
**NOTE** LEDs indicators for +9 and -10 Vdc are off.

**Figure 45 DC Power Status LEDs**



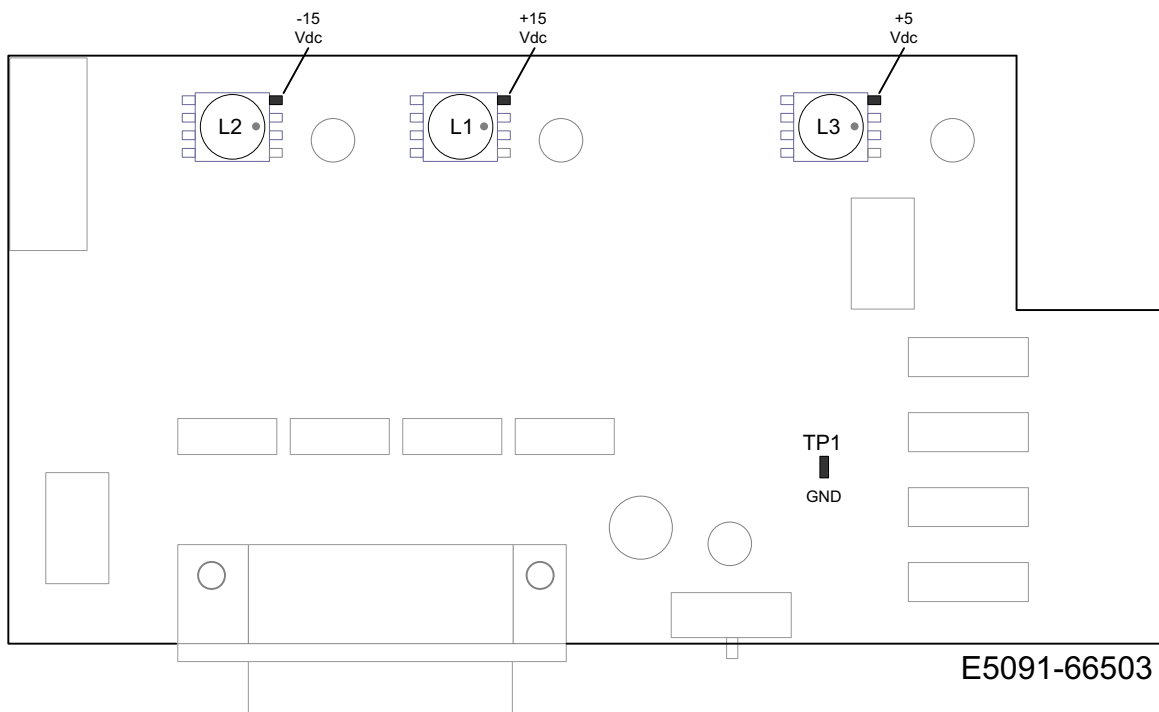
- d. If the DC Indicator LEDs are not on, suspect the main power supply module or front panel switch. The power supply (0950-4729) terminal connections should also be verified with a DVM. Verify the voltages on the power supply label.
- e. If rear panel or deck fans is not operating and the DC Indicator LEDs are *on*; replace fan.

**Figure 46 Test Set Diagram**



6. Front Panel R and S indicator LED Check.
  - a. Verify the test set Controller board Controller Status LEDs, shown in [Figure 45 on page 61](#).
  - b. If none are on remove the Switch Driver board and recheck, if still no indication, replace the Controller board.
  - c. 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 42](#).
  - b. Verify that the rear panel DC voltage control adjustment can be set to 5 Vdc. Refer to [Figure 3 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 47](#).
  - 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 47 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 RF internal mechanical switches used in this instrument are biased with the +24 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 3 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 36](#).
4. 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 is 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 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 <addr>.<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.

---

**Table 18 RF Signal Path Insertion Loss (S21)**

RF Path Description	Signal	Insertion Loss (typical)
Source IN to Ports 5-24	Source	<a href="#">Figure 48 on page 66</a>
RCVR OUT to Ports 5-24	Receiver	<a href="#">Figure 49 on page 68</a>
Source IN to CPLR THRU	Source	<a href="#">Figure 50 on page 69</a>
RCVR OUT to CPLR ARM	Receiver	<a href="#">Figure 50 on page 69</a>



### Source and Receiver Path Tests

Refer to [Table 19](#) 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.

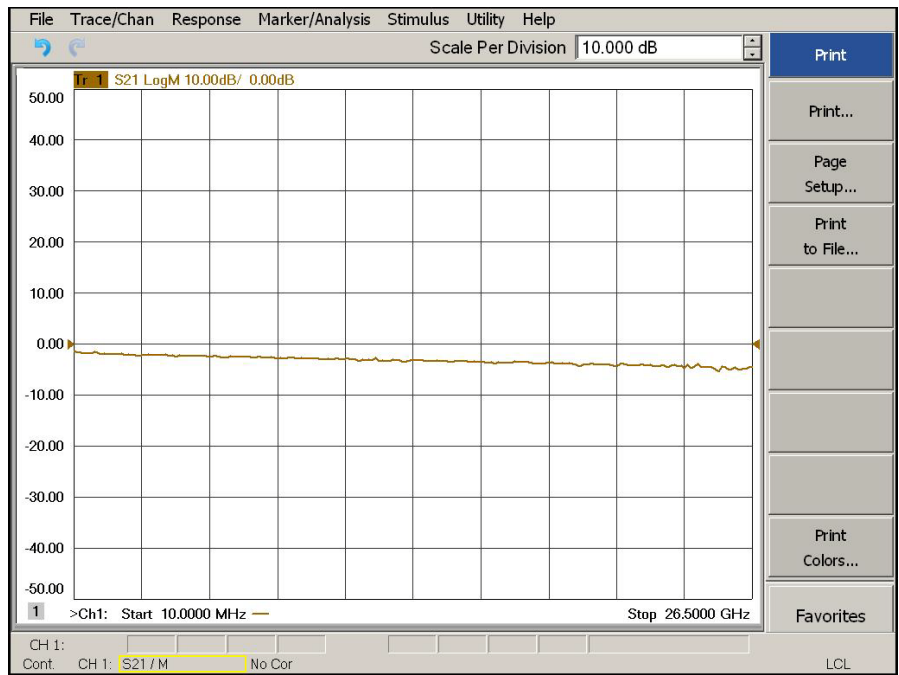
Connect the RF cables as indicated in the tables. The expected results should be similar to [Figure 48](#) and [Figure 49](#) on [page 68](#).

**Table 19** Source Signal Path Test Instructions (see [Figure 48](#) on [page 66](#))

Path #	RF Path Description	Control Mode <Address>.<Data>	Path Components
1	Source IN to Port 5 <sup>1</sup>	0.1	P5 CPLR, S10
2	Source IN to Port 9	0.2	P9 CPLR, S10
3	Source IN to Port 13	0.3	P13 CPLR, S10
4	Source IN to Port 17	0.4	P17 CPLR, S10
5	Source IN to Port 21	0.5	P21 CPLR, S10
6	Source IN to Port 6	16.1	P6 CPLR, S20
7	Source IN to Port 10	16.2	P10 CPLR, S20
8	Source IN to Port 14	16.3	P14 CPLR, S20
9	Source IN to Port 18	16.4	P18 CPLR, S20
10	Source IN to Port 22	16.5	P22 CPLR, S20
11	Source IN to Port 7	32.1	P7 CPLR, S30
12	Source IN to Port 11	32.2	P11 CPLR, S30
13	Source IN to Port 15	32.3	P15 CPLR, S30
14	Source IN to Port 19	32.4	P19 CPLR, S30
15	Source IN to Port 23	32.5	P23 CPLR, S30
16	Source IN to Port 8	64.1	P8 CPLR, S40
17	Source IN to Port 12	64.2	P12 CPLR, S40
18	Source IN to Port 16	64.3	P16 CPLR, S40
19	Source IN to Port 20	64.4	P20 CPLR, S40
20	Source IN to Port 24	64.5	P24 CPLR, S40

1. Use the Source IN port associated with this group of test ports.

**Figure 48 Source IN to Ports 5 to 24 Path Response (Std)**

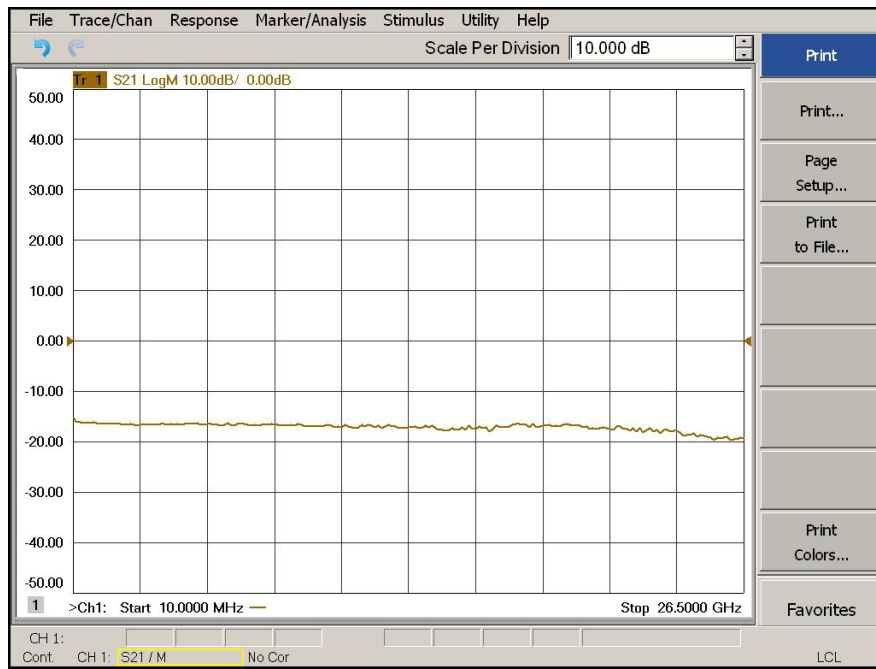


**Table 20 Receiver Signal Path Test Instructions** (see [Figure 49](#) on page 68)

Path #	RF Path Description	Control Mode <Address>.<Data>	Path Components
1	RCVR OUT to Port 5 <sup>1</sup>	0.16	P5 CPLR, S11
2	RCVR OUT to Port 9	0.32	P9 CPLR, S11
3	RCVR OUT to Port 13	0.48	P13 CPLR, S11
4	RCVR OUT to Port 17	0.64	P17 CPLR, S11
5	RCVR OUT to Port 21	0.80	P21 CPLR, S11
6	RCVR OUT to Port 6	16.6	P6 CPLR, S21
7	RCVR OUT to Port 10	16.32	P10 CPLR, S21
8	RCVR OUT to Port 14	16.48	P14 CPLR, S21
9	RCVR OUT to Port 18	16.64	P18 CPLR, S21
10	RCVR OUT to Port 22	16.80	P22 CPLR, S21
11	RCVR OUT to Port 7	32.16	P7 CPLR, S31
12	RCVR OUT to Port 11	32.32	P11 CPLR, S31
13	RCVR OUT to Port 15	32.48	P15 CPLR, S31
14	RCVR OUT to Port 19	32.64	P19 CPLR, S31
15	RCVR OUT to Port 23	32.80	P23 CPLR, S31
16	RCVR OUT to Port 8	64.16	P8 CPLR, S41
17	RCVR OUT to Port 12	64.32	P12 CPLR, S41
18	RCVR OUT to Port 16	64.48	P16 CPLR, S41
19	RCVR OUT to Port 20	64.64	P20 CPLR, S41
20	RCVR OUT to Port 24	64.80	P24 CPLR, S41

1. Use the Source IN port associated with this group of test ports.

**Figure 49 RCVR OUT to Ports 5 to 24 Path Response (Std)**



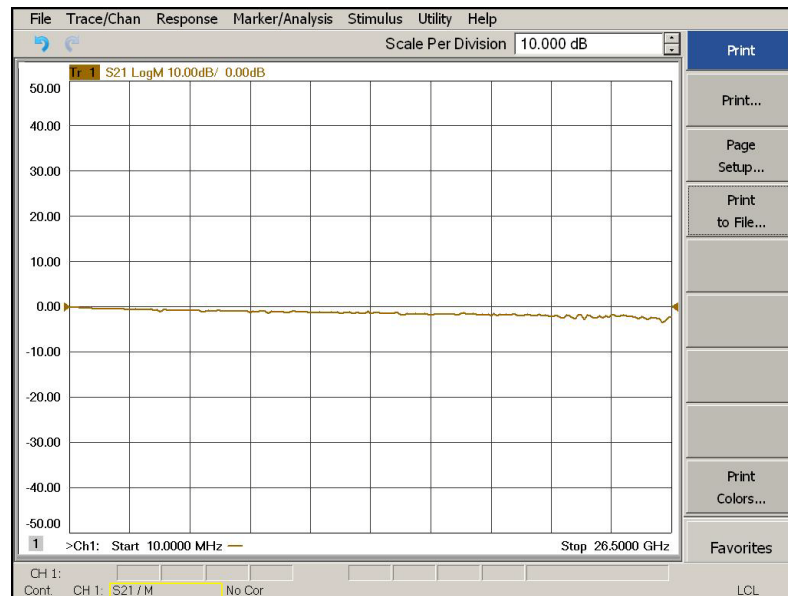
**Table 21 Source Bypass Signal Path Test Instructions (see Figure 50)**

Path #	Test Port Group	RF Path Description	Control Mode <Address>.<Data>	Path Components
1	Port 5	Source IN to CPLR THRU	0.0	S10
2	Port 6	Source IN to CPLR THRU	16.0	S20
3	Port 7	Source IN to CPLR THRU	32.0	S30
4	Port 8	Source IN to CPLR THRU	64.0	S40

**Table 22 Receiver Bypass Signal Path Test Instructions (see Figure 50)**

Path #	Test Port Group	RF Path Description	Control Mode <Address>.<Data>	Path Components
1	Port 5	RCVR OUT to CPLR ARM	0.0	S11
2	Port 6	RCVR OUT to CPLR ARM	16.0	S21
3	Port 7	RCVR OUT to CPLR ARM	32.0	S31
4	Port 8	RCVR OUT to CPLR ARM	64.0	S41

**Figure 50 Source IN to CPLR THRU or RCVR OUT to CPLR ARM Path Response (Std)**



## Option 129 Path Test

This test will verify the RF paths of Option 129 in standard mode. This measures the insertion loss of the Noise Source In to Port 1, 5, 9, 13, 17 or 21 and the Noise Source Out to CPLR THRU.

### Noise Source In Test

#### Ext Noise Source In to CPLR THRU

1. Set the PNA to **Standalone Mode**.
2. Remove all of the interface cables.
3. Connect two RF test cables to the Ports 1 and 2 on the analyzer, and connect the two cables together using an adapter.
4. Perform a **Response Calibration** to normalize and remove the loss created by the test cables.
5. Move the adapter to Port 5.
6. Connect the cable from Port 1 to Noise Source In.
7. Connect the cable from Port 2 to CPLR THRU (near Port 5).
8. Send the Test Set I/O command 0.8.
9. Set trace S21 and verify that the trace is similar to [Figure 51 on page 71](#).

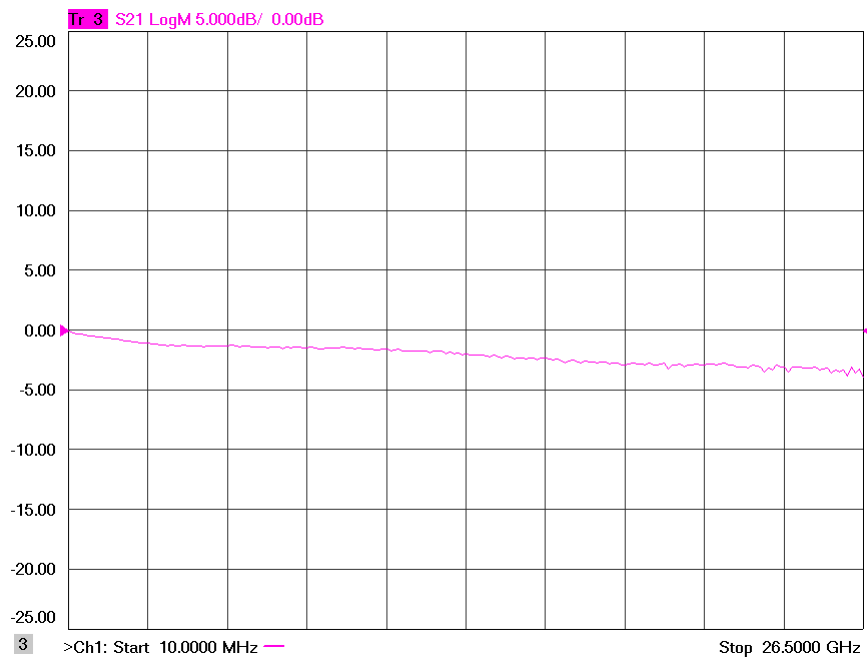
#### Ext Noise Source In to Ports 5, 9, 13, 17 and 21

10. Repeat for Port 5, 9, 13, 17 and 21. Refer to [Table 23](#) for Test Set I/O command to be sent. Verify that the LED for the port being tested is illuminated. Verify that the trace is similar to [Figure 52 on page 71](#).

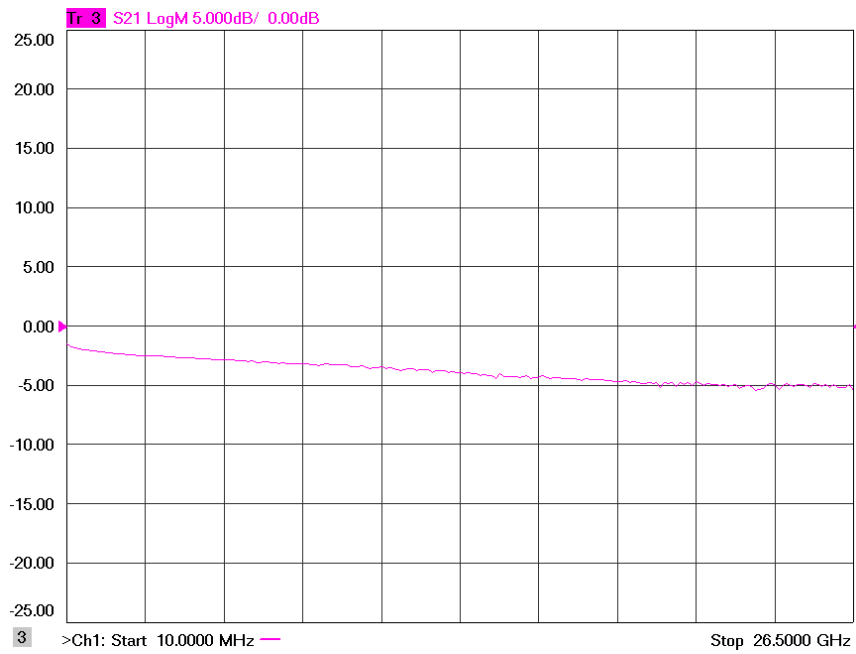
**Table 23 Address and Data Port Commands**

Command	Port
0.8	CPLR THRU
0.25	Port 5
0.42	Port 9
0.59	Port 13
0.76	Port 17
0.93	Port 21

**Figure 51** Ext Noise Source In to CPLR THRU Path Response



**Figure 52** Ext Noise Source In to Ports 5, 9, 13, 17 or 21 Path Response

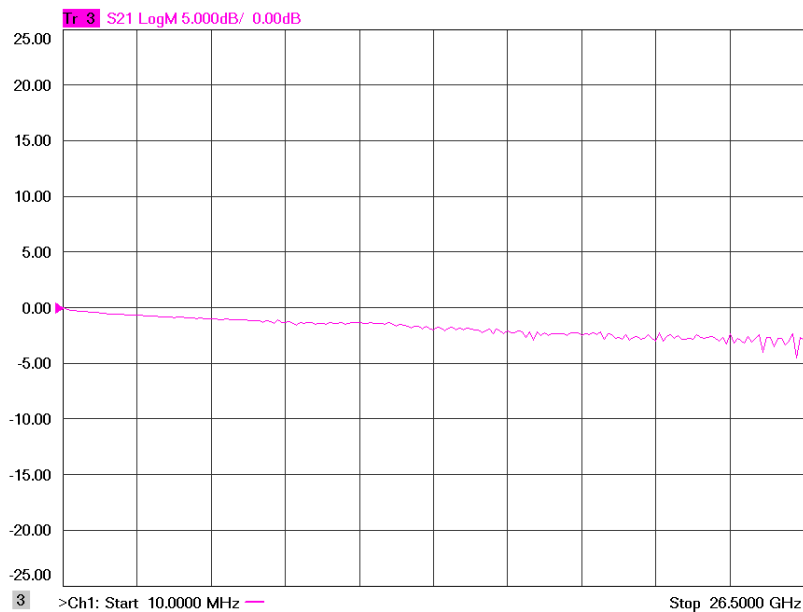


## Noise Source Out Test

### Ext Noise Source Out to Source In (near Port 5)

1. Set the PNA to **Standalone Mode**.
2. Connect two RF test cables to the PNA-X Ports 1 and 2. Connect the two cables together using an adapter.
3. Perform a response calibration to normalize and remove the loss created by the test cables.
4. Remove the adapter.
5. Connect the cable from Port 1 to Ext Noise Source Out.
6. Connect the cable from Port 2 to the Test Set Source In.
7. Send the Test Set I/O command 0.8. Verify that the Ext Noise Source front panel LED is On.
8. Set trace S21 and verify that the trace is similar to [Figure 53](#).

**Figure 53 Noise Source Out to Source In Path Response**





## Connection Tables and Diagrams

**Table 24 Controller Board Connections**

Controller Board Connection	Connection
<b>LED Ribbon Cables From the LED Board</b>	
J5	Ports 5, 9, 13, 17 and 21
J6	Ports 6, 10, 14, 18 and 22
J7	Ports 7, 11, 15, 19 and 23
J8	Ports 8, 12, 16, 20 and 24
<b>Wire harness Active LED</b>	
P16	Active LED
<b>DUT Control Ribbon Cable</b>	
J9	DUT Controller Board
<b>Power Supply Wire Harness</b>	
J11- 14	Power Supply

**Table 25 Switch Interface Board**

Switch #	Interface Bd Connection	Ports	Path
10	P10	Ports 5, 9, 13, 17 and 21	Source
11	P11	Ports 5, 9, 13, 17 and 21	Source
20	P20	Ports 6, 10, 14, 18 and 22	Receiver
21	P21	Ports 6, 10, 14, 18 and 22	Receiver
30	P30	Ports 7, 11, 15, 19 and 23	Source
31	P31	Ports 7, 11, 15, 19 and 23	Source
40	P40	Ports 8, 12, 16, 20 and 24	Receiver
41	P41	Ports 8, 12, 16, 20 and 24	Receiver
16	J16	Option 129 (Ext Noise Source)	Source

**Figure 54**    **Top View**

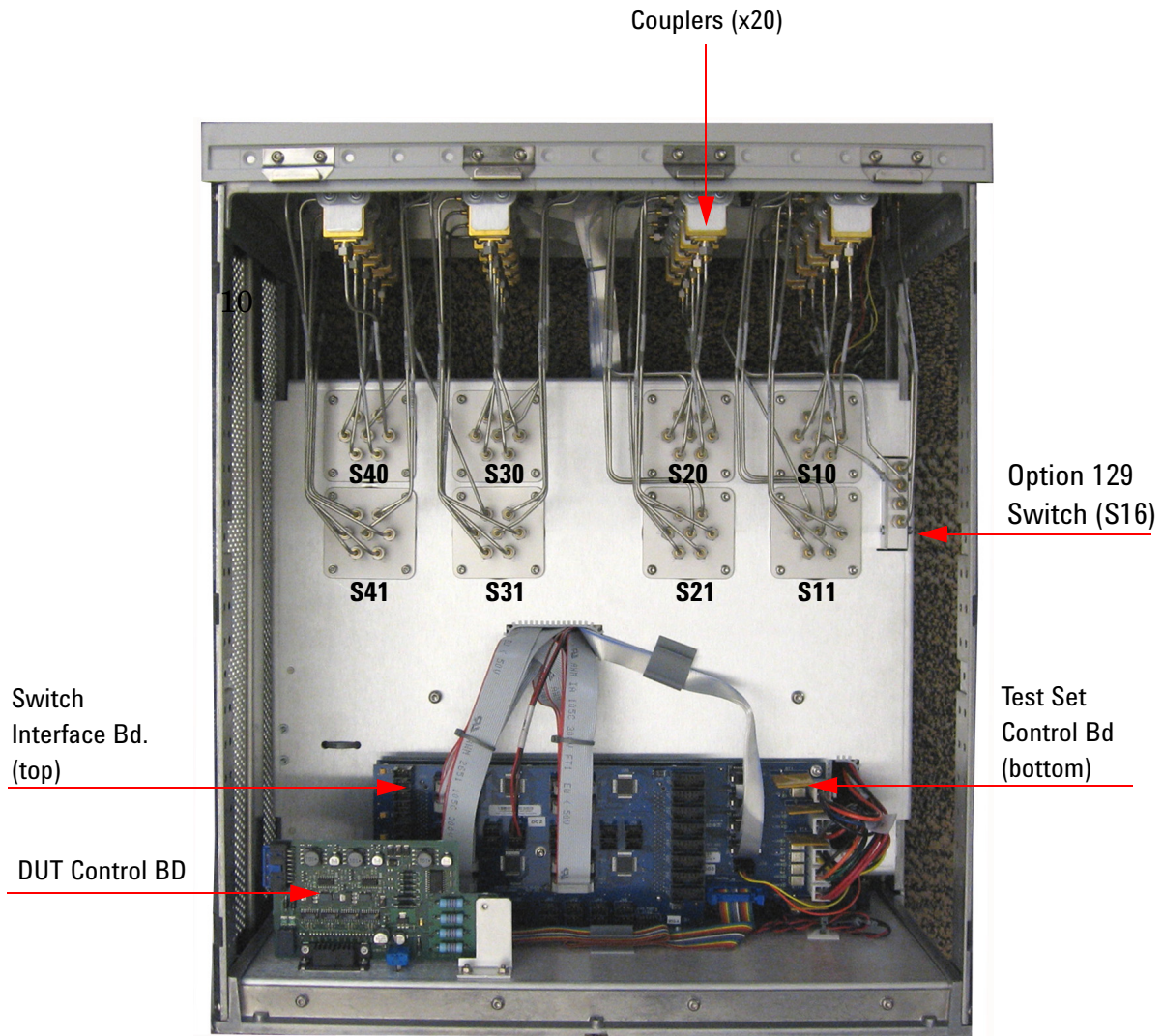
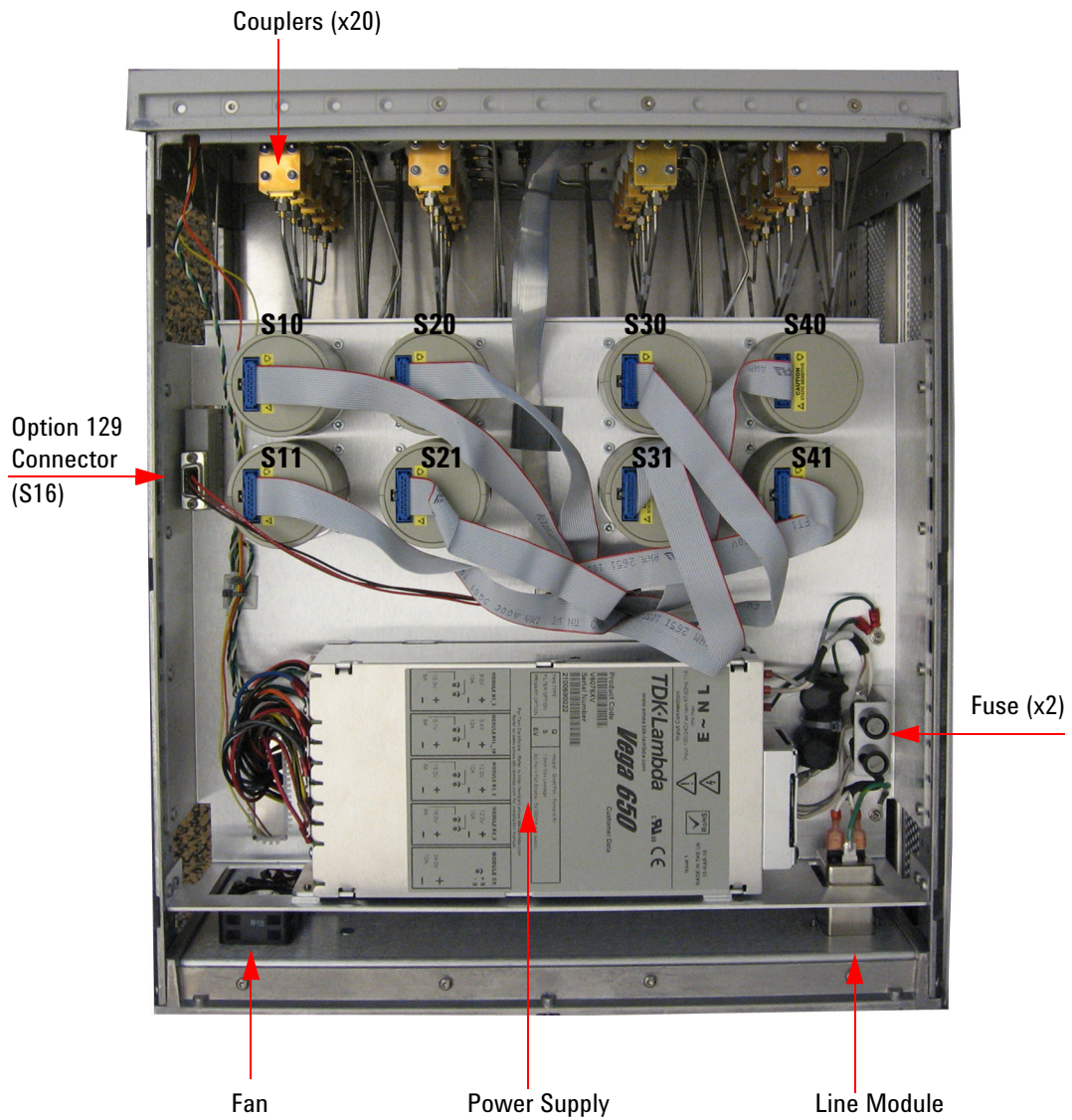


Figure 55 Bottom View



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## 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.

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

## Before Applying Power

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

---

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

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**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.

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

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

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

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**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.

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

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## Servicing

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**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.**

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**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.**

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**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.**

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

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**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).**

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

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### 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.

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**WARNING**     **To prevent electrical shock, disconnect the ["Agilent Technologies U3042AM20"](#) 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.**

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**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.**

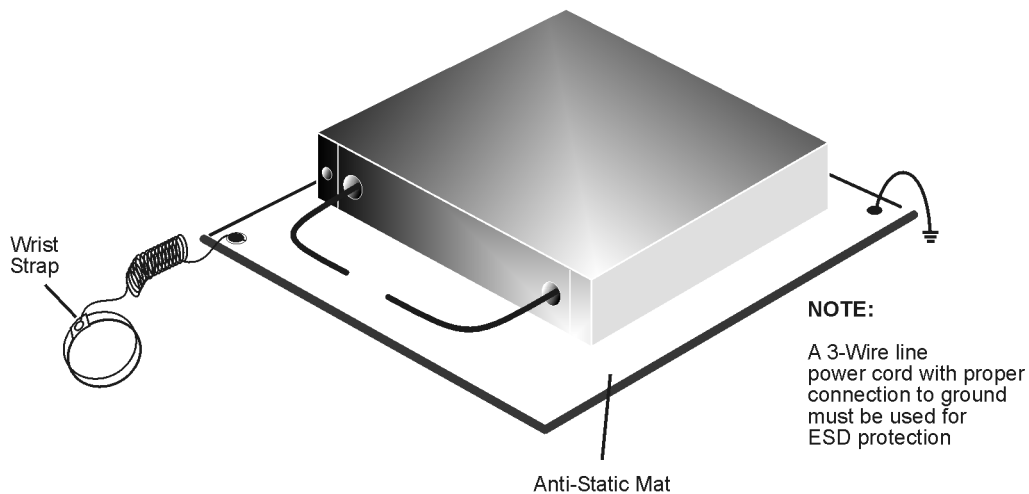
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## Electrostatic Discharge Protection

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 M $\Omega$  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 56** 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.



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



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



This symbol indicates that the power line switch is ON.



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



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



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



The CE mark is a registered trademark of the European Community. (If accompanied by a year, it is when the design was proven.)



The CSA mark is a registered trademark of the CSA International. This instrument complies with Canada: CSA 22.2 No. 61010-1-04.



This is a symbol of an Industrial Scientific and Medical Group 1 Class A product (CISPR 11, Clause 54)



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.



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.



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



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



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



## 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 82](#) for assistance.

## Electrical Safety Compliance

### SAFETY

Complies with European Low Voltage Directive 2006/95/EC

- IEC/EN 61010-1, 2<sup>nd</sup> Edition
- Canada: CSA C22.2 No. 61010-1-04
- USA: UL std no. 61010-1, 2<sup>nd</sup> Edition
- Acoustic statement (European Machinery Directive 2022/42/EC, 1.7.4.2U)  
 Accoustical noise emission  
 L<sub>pA</sub><70 dB  
 Operator position  
 Normal operation mode  
 Per ISO 7779

## EMI and EMC Compliance

### EMC

Complies with European EMC Directive 2004/108/EC

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

A 급 기기 ( 업무용 방송통신기자재 ) 이 기기는 업무용 ( A 급 ) 전자파적합기기로서 판매자 또는 사용자는 이 점을 주의하시기 바라 며 , 가정외의 지역에서 사용하는 것을 목적으로 합니다 .

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## 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.

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**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.

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### Shipping Your Product to Agilent for Service or Repair

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**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.

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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.