Keysight Technologies N5280A

User's and Service Guide

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KEYSIGHT TECHNOLOGIES

Notices

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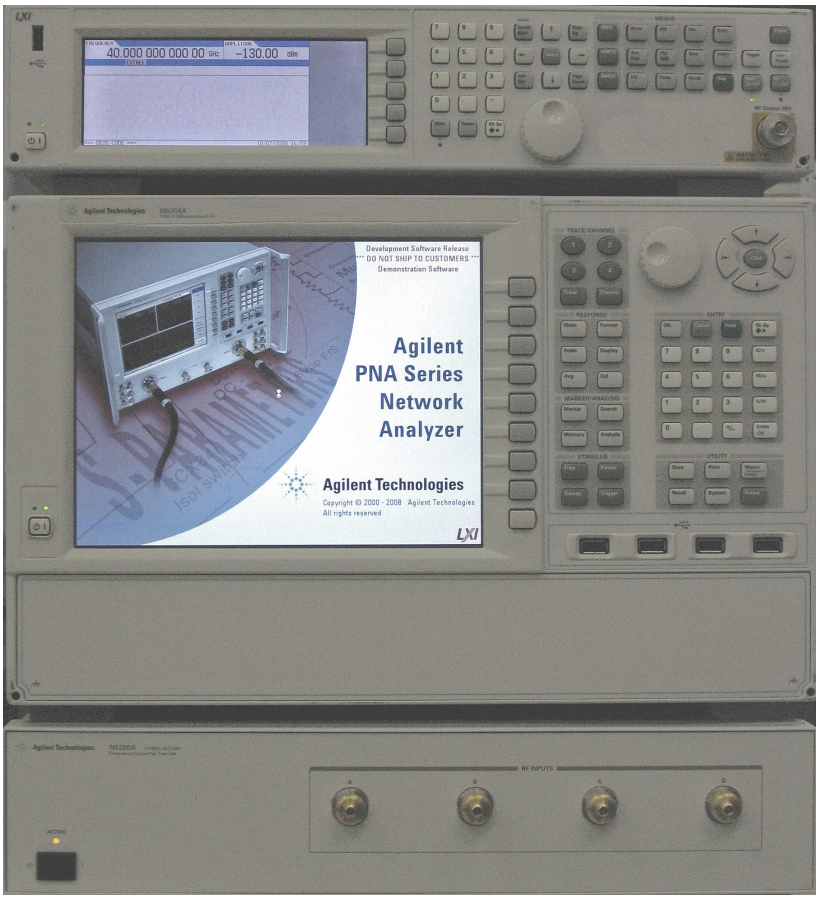
Introduction

The N5280A replaces the 8511A Four Channel Frequency Converter Test Set. This document describes how to use the N5280A Test Set with the Keysight N5242A 2-Port, or 4-Port PNA-X Network Analyzer and N5264A Measurement Receiver.

Figure 1 N5242A 2-Port PNA-X with N5280A

Figure 2 N5242A 4-Port PNA-X with N5280A

Figure 3 N5264A Measurement Receiver with N5280A



Description

The Keysight N5280A is a four channel frequency converter Test Set. This Test Set is used with the Keysight N5242A 2-Port or 4-Port PNA-X Network Analyzer, and a N5264A Measurement Receiver. It can be operated with other microwave accessories (couplers, power splitters). The N5280A provides a convenient means of customizing a test configuration for a variety of applications within a frequency range of 10 MHz to 26.5 GHz. In addition to configurations for measuring reflection and transmission parameters of one-port or two-port devices, you can build configurations to characterize antenna parameters, radar cross sections and frequency translation devices. Figure 4 on page 5 illustrates one possible measurement set-up configuration.

Network Analyzer Requirements

- The N5242A 2-Port or 4-Port PNA-X Network Analyzer (10 MHz to 26.5 GHz) requires Option 020, which adds IF inputs.
- The N5264A Measurement Receiver requires Option 108, which adds LO Source 26.5 GHz.

More PNA information is available on the following websites:

- Documentation - http://www.keysight.com/find/pna
- Network Analyzer Firmware - http://na.support.keysight.com/pna/firmware

Verifying the Shipment

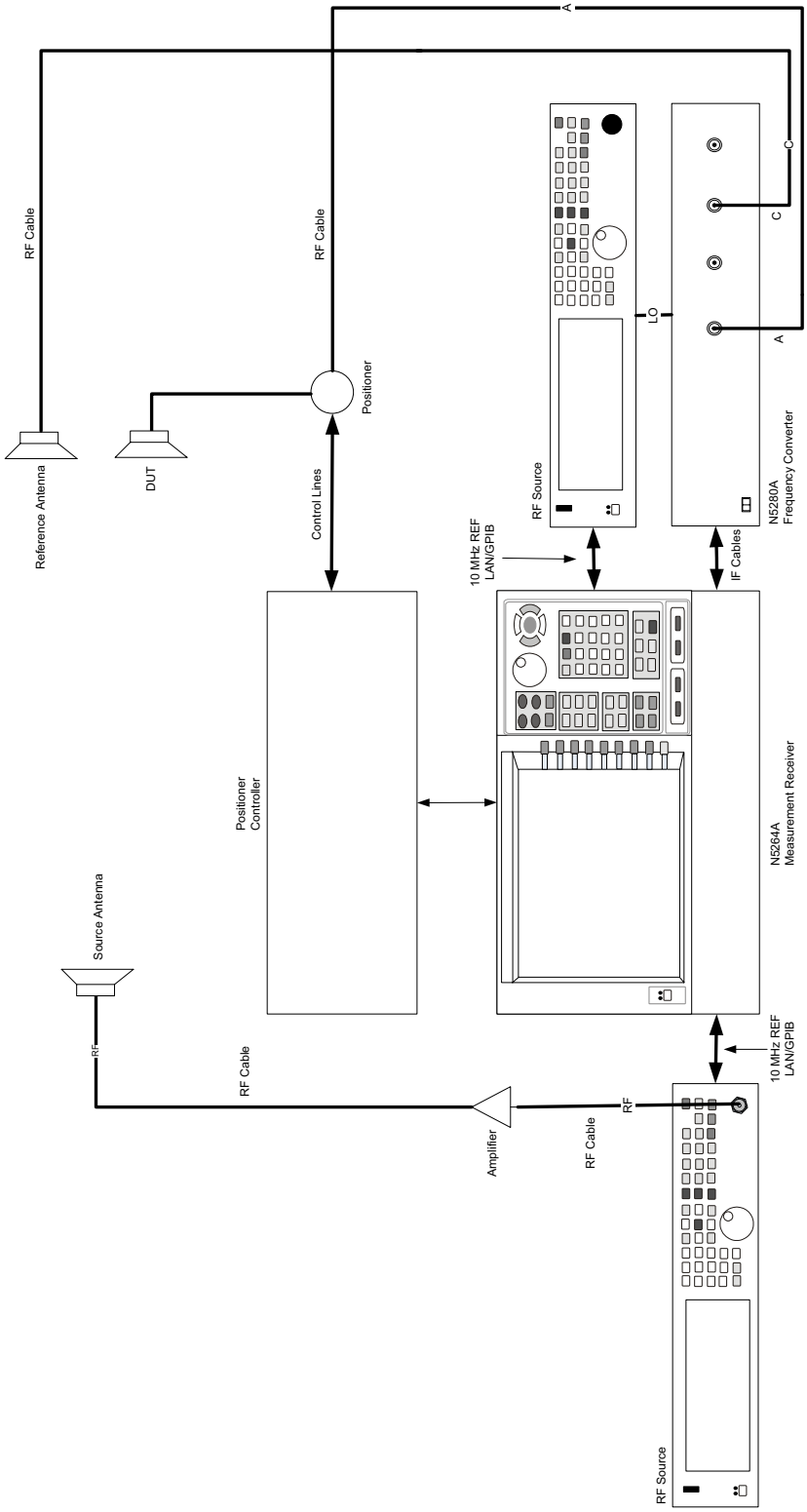
To verify the contents shipped with your product, refer to Table 1.

Inspect the shipping container. If the container or packing material is damaged, it should be kept until the contents of the shipment have been checked mechanically and electrically. If there is physical damage refer to “Contacting Keysight” on page 46. Keep the damaged shipping materials (if any) for inspection by the carrier and an Keysight Technologies representative.

Table 1 Content List

Keysight Part Number	Description	Qty
9320-6636	Functional Test Certificate	1
9320-0333	Envelope-Cal Certificate	1
5063-9232	Rack Mount Kit with Handles	1
5063-9226	Front Handle Kit	1
5061-9038	Cable Assembly	5
N5280-90001	User’s and Service Guide	1

Figure 4 Measurement Setup



Available Options

Test Set Options

The N5280A has two available Test Set options:
Refer to Figure 29 on page 38, Figure 30 on page 39 and Figure 31 on page 40.

- Standard (700) - There are no attenuators in the RF Input paths.
- Option 001 - There are four attenuators (0 to 35 dB) in the RF Input paths to reduce the power levels.
- Option 002 - There are four IF Channels (A, B, C and D) and LO Input on the front panel.

General Specifications

Specifications for the N5280A Frequency Converter Test Set (10 MHz to 26.5 GHz) are characteristic for the System performance of the PNA and Test Set. Actual performance of the system is based on the customers PNA that is used with the Test Set.

A functional certificate is supplied for the N5280A. The N5280A performance is based on external components such as the calibration kit, network analyzer, external sources, and measurement receiver. There are no internal adjustments in the N5280A, therefore an annual calibration is not required.

Frequency range and connectors are listed in Table 2 for specific ports.

Table 2 Frequency Range and Connectors

Port	Frequency Range	Connectors
RF Port	0.01 to 26.5 GHz	3.5 mm female
LO Port	0.01 to 26.5 GHz	3.5 mm female
IF Port	7 to 20 MHz (with jumper, LP OUT) 0.007 to 1.5 GHz (without jumper, Max BW)	SMA female

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 ± 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 PNA.
- Table 3 contains the maximum wattage for all instruments. This table can be use to determine the electrical and cooling requirements.

Table 3 Power Requirements

Standard Equipment	
Instrument	**Maximum Wattage**
N5242A	450
N5264A	450
N5280A	350

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

Environmental Requirements

The environmental requirements of the Test Set are listed in Table 4. Refer to the N5242A PNA-X and N5264A Measurement Receiver standard documentation for environmental requirements.

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.

Table 4 PNA Operating Environment

Operating Environmental Requirements:	
Temperature	0 °C to 40 °C (32 °F to 104 °F)
Measurement Calibration	20 °C to 26 °C (68 °F to 79 °F)
Performance Verification	Temperature must be within 1 °C (1.8 °F) of the temperature at which the measurement calibration was performed.
Pressure Altitude (Operating)	3000 meters (9,842 feet)

Environmental

The N5280A complies with all applicable safety and regulatory requirements for the intended location of use.

- The instrument can safely operate in a relative humidity of 80% for temperatures to 31 °C, decreasing linearly to 50% relative humidity at 40 °C.

Equipment Heating and Cooling

If necessary, install air conditioning and heating to maintain the ambient temperature within the appropriate range. Air conditioning capacity must be consistent with the BTU ratings given in Table 3.

Required Conditions for Accuracy Enhanced Measurement

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

Dimensions and Space Requirements

Standard installation of the N5280A and PNA includes configuration and installation on a customer provided lab bench, or table top of adequate size and strength.

Table 5 Instrument Dimensions

Model	Weight	Height	Width	Depth
N5242A	37 kg 82 lb (±0.5 lb)	26.67 cm (10.5 in)	42.5 cm (16.75 in)	55.8 cm (21.97 in)
N5264A	22 kg 48 lb (±0.5 lb)	26.67 cm (10.5 in)	42.5 cm (16.75 in)	55.8 cm (21.97 in)
N5280A	9.1 kg (20 lb)	8.9 cm (3.5 in)	42.5 cm (16.75 in)	48.3 cm (19 in)

Maximum Power Levels

Table 6 Power Levels

RF Input Power Damage Levels	
RF Port	+18 dBm
LO Port	+5 dBm
Optimum LO Power	0 dBm (±1 dB)
RF Input @ 0.1 dB Typical Compression	
A- D Receiver	-10 dBm
IF Output Level[1]	
Ports A- D	-10 dBm

1. IF Output level is based on the RF Input @ 0.1 dB typical compression.

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

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

Front and Rear Panel Features

Figure 5 Front Panel N5280A (Option 700 and 001)

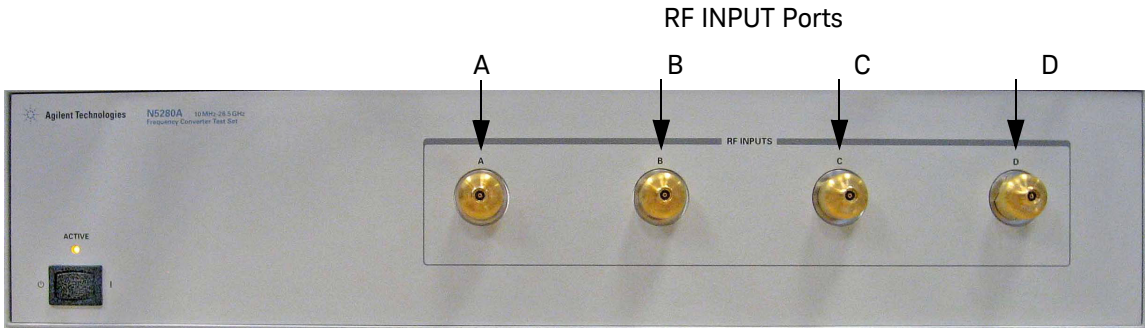
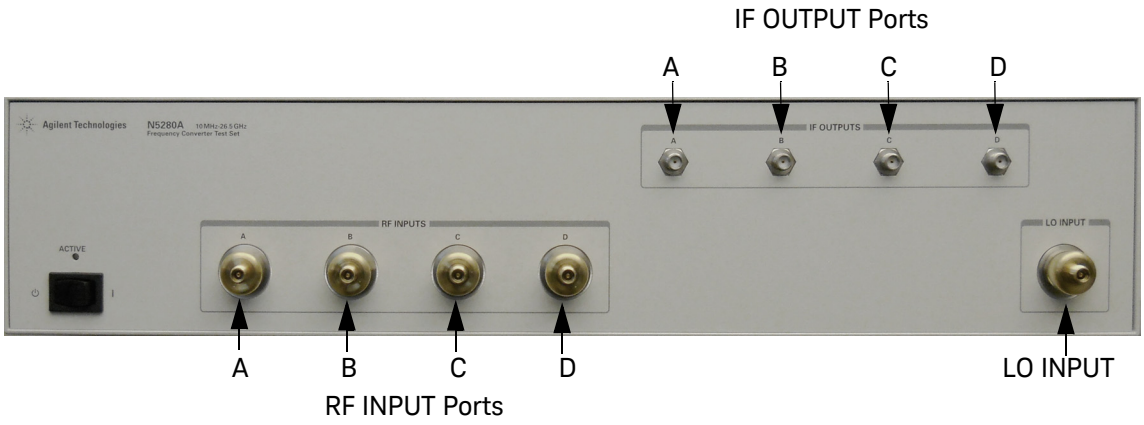


Figure 6 Front Panel N8280A (Option 002)



RF INPUTS (A, B, C and D) (all options)

These input signals (10 MHz to 26.5 GHz) will be downconverted and directed to the IF Outputs.

IF OUTPUTS (A, B, C and D) (Option 002)

These outputs transmit IF signals (10 MHz to 1.5 GHz) derived from the RF Inputs.

LO INPUT (Option 002)

This input signal (10 MHz to 26.5 GHz) is used as the LO to downconvert the RF Inputs and to provide a buffered LO Output.

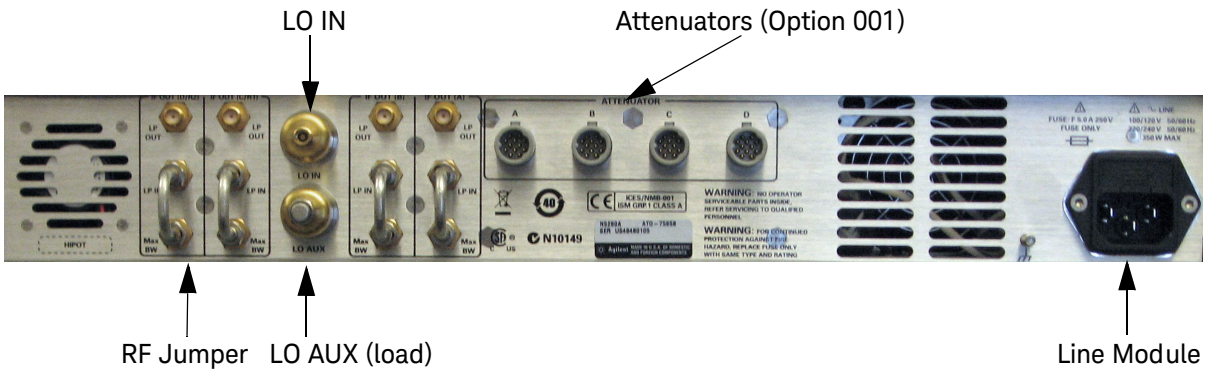
Line Switch

This switch turns the Test Set on and off.

⏻ – Standby

| – ON (Active LED On)

Figure 7 Rear Panel (Option 700 and 001)



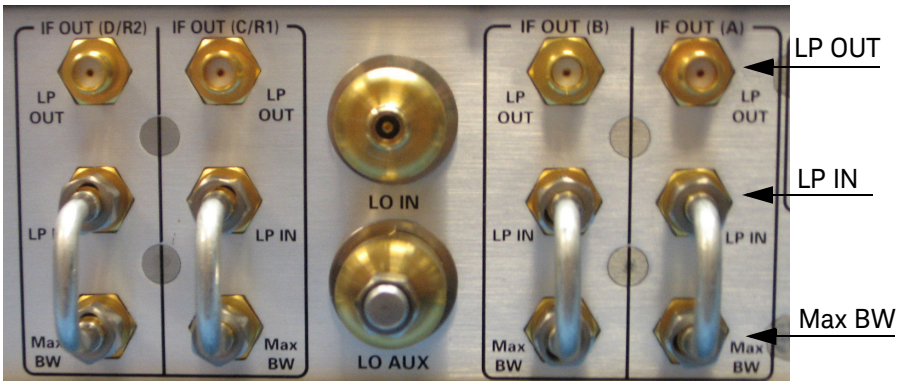


Figure 8 Rear Panel (Option 002)

IF OUT (A, B, C/R1 and D/R2) (Option 700 and 001)

LP OUT from the IF Outputs are connected to the IF Inputs on the PNA-X. The RF Jumper (E8356-20072) is connected between LP IN and Max BW. These connectors transmit the IF signal from the Test Set to the N5242A 2-Port or 4-Port PNA-X and N5264A Measurement Receiver.

LO IN (Option 700 and 001)

LO IN is connected to the LO OUT from the EXT TSET DRIVE on the PNA-X.

LO AUX (All Options)

The load (1810-0118) is connected to LO AUX.

Attenuators (A, B, C and D) (Option 001)

These connectors are used only in Test Sets with Option 001. The four Viking attenuator connectors are controlled by the 11713C Attenuator Switch Driver.

Line Module

The line fuse, as well as a spare, reside within the line module. Figure 9 illustrates where the fuses are located and how to access them.

Available Fuses

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

WARNING **For continued protection against fire hazard replace line fuse only with same type and rating: Fuse 5A/250V, Part Number 2110-0709. The use of other fuses or material is prohibited.**

Figure 9 Line Fuse

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

Controlling the Test Set with N5242A

This section will describe how to setup and operate the N5280A Frequency Converter Test Set with the N5242A 2-Port or 4-Port PNA-X Network Analyzer.

A PNA-X must be used to control the N5280A. The internal LO Source from the PNA-X can be used for testing. Refer to Figure 10 and Figure 11 for cable connections from the N5280A to the N5242A PNA-X.

Figure 10 Front Panel N5280A and N5242A PNA-X

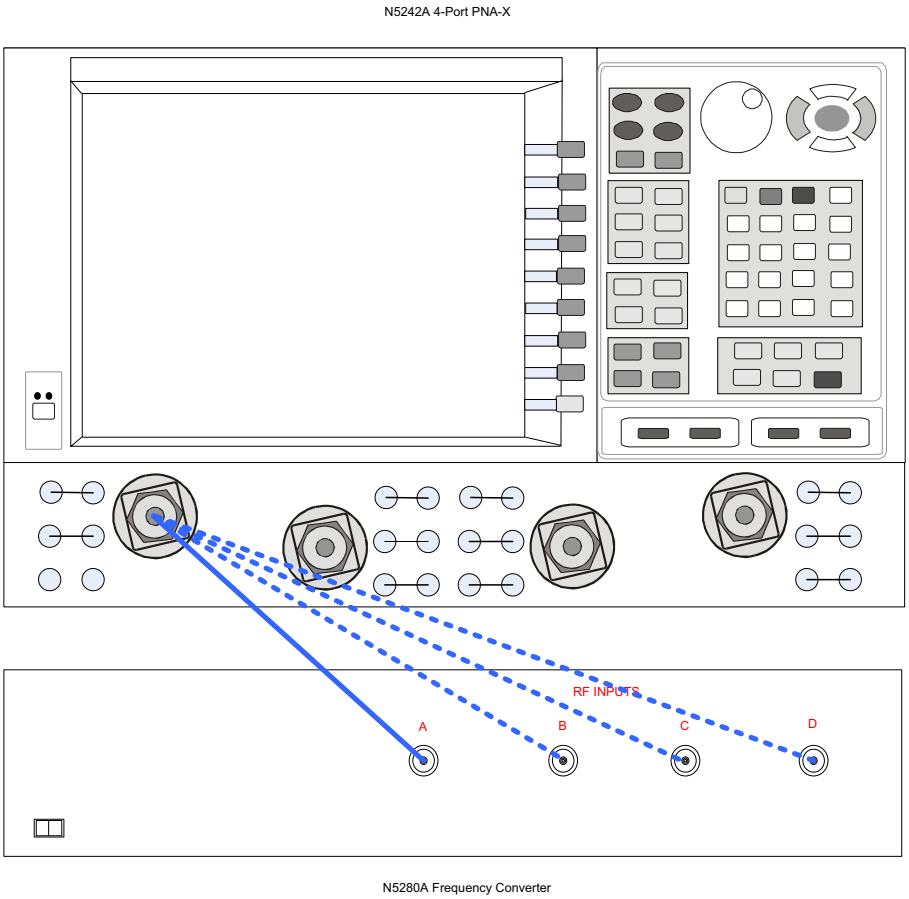
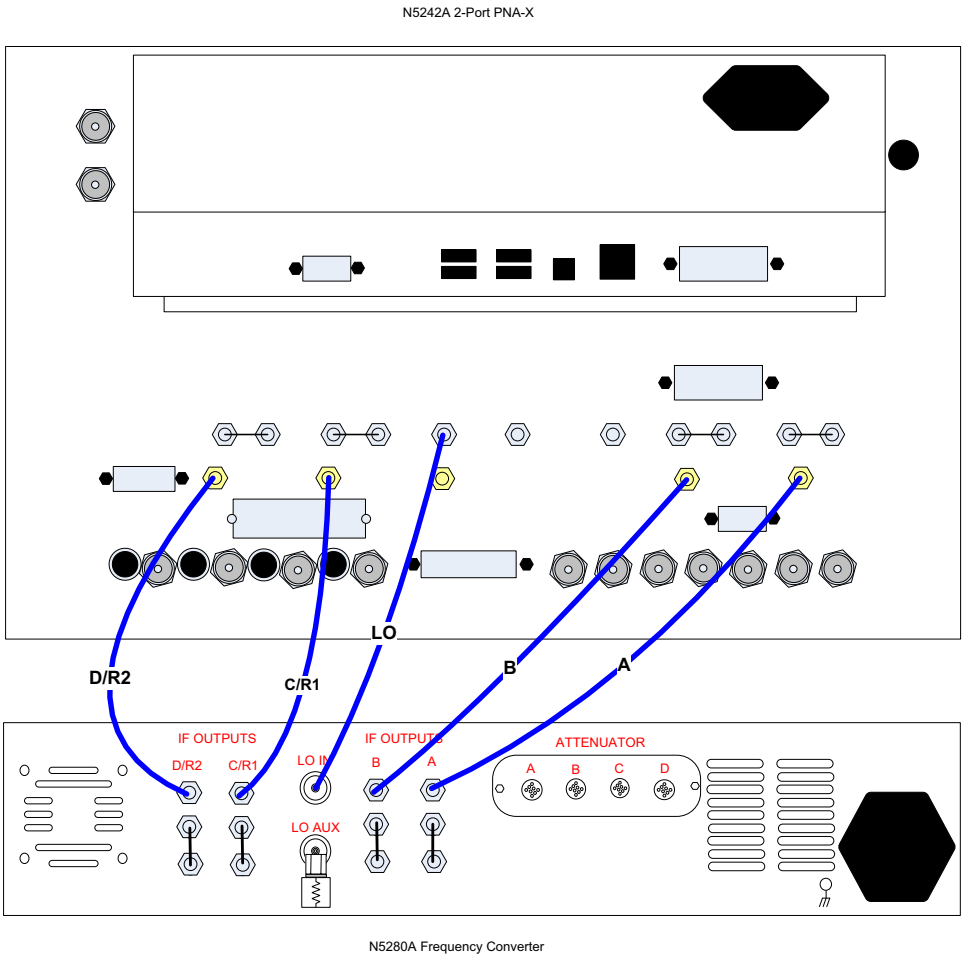


Figure 11 Rear Panel N5280A and N5242A PNA-X



Controlling the Test Set with N5264A

This section will describe how to setup and operate the N5280A Frequency Converter Test Set with the N5264A Measurement Receiver.

A N5264A must be used to control the N5280A. The N5264A Option 108 adds an internal LO Source 26.5 GHz for testing. Refer to Figure 12 and Figure 16 on page 20 for cable connections.

You may also use an external LO Source for testing. Refer to Figure 14 on page 18 and Figure 15 on page 19 for cable connections.

Figure 12 Front Panel N5280A and N5264A with Option 108

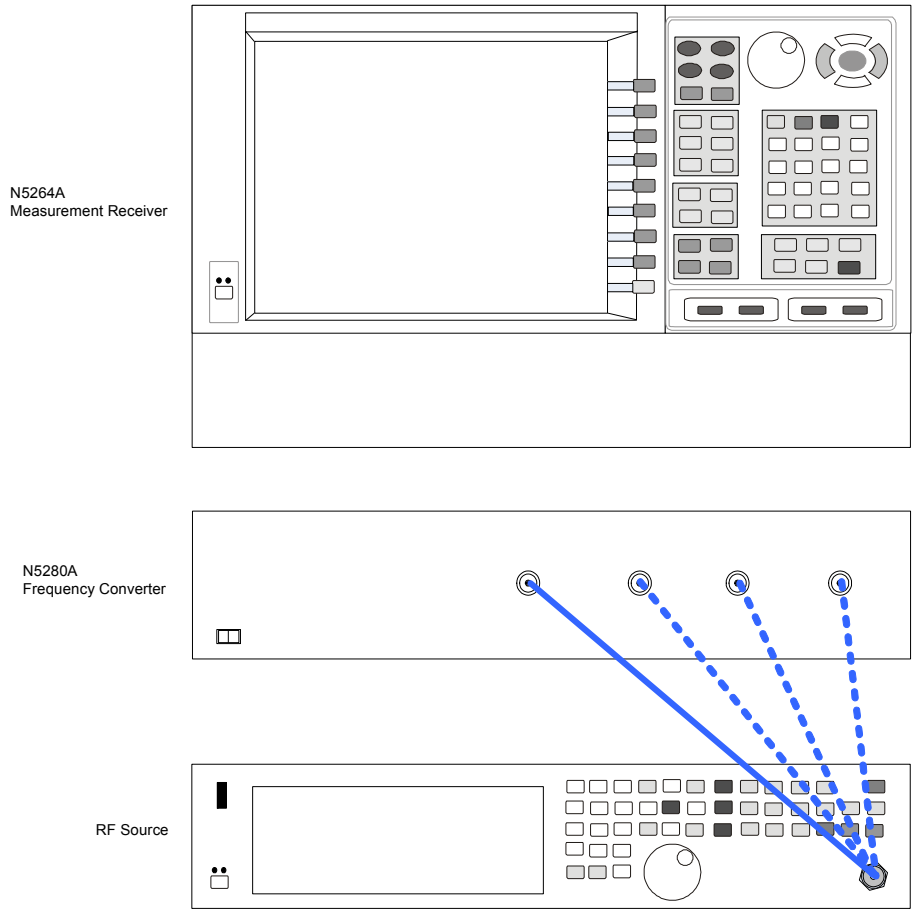


Figure 13 Rear Panel N5280A and N5264A with Option 108

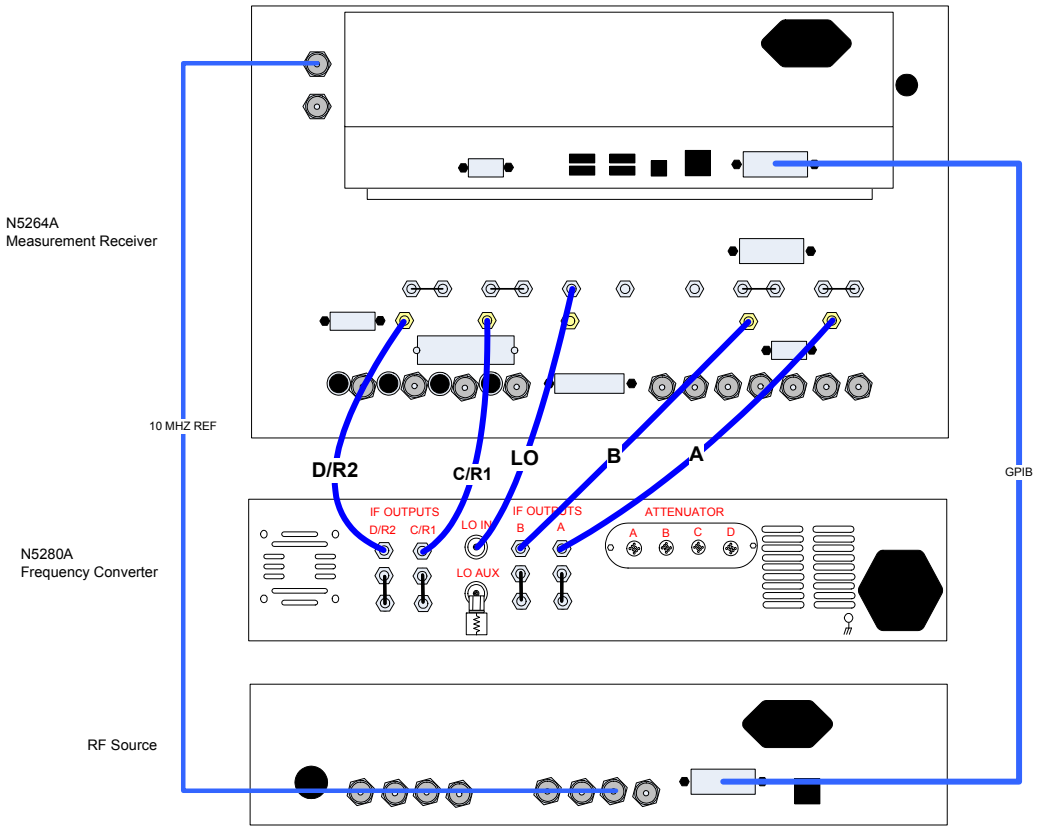


Figure 14 Front Panel N5280A and N5264A without Option 108

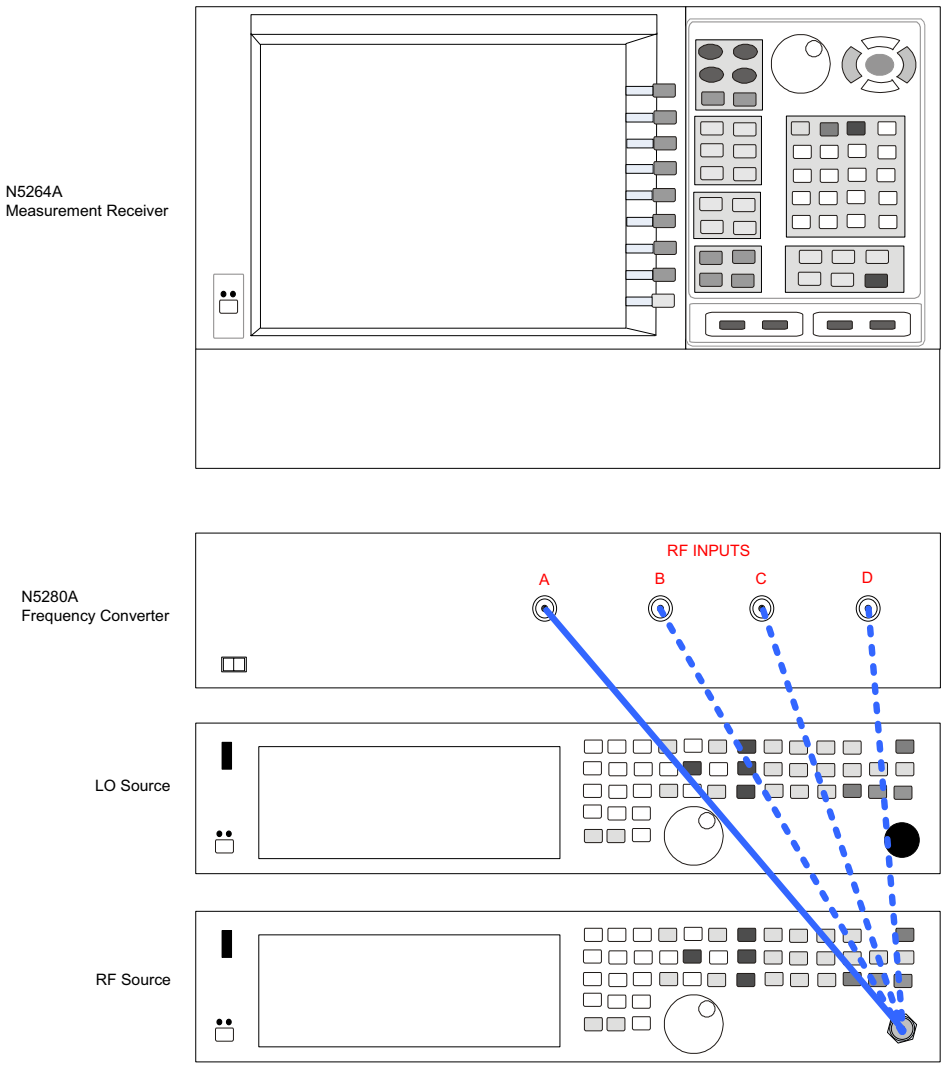
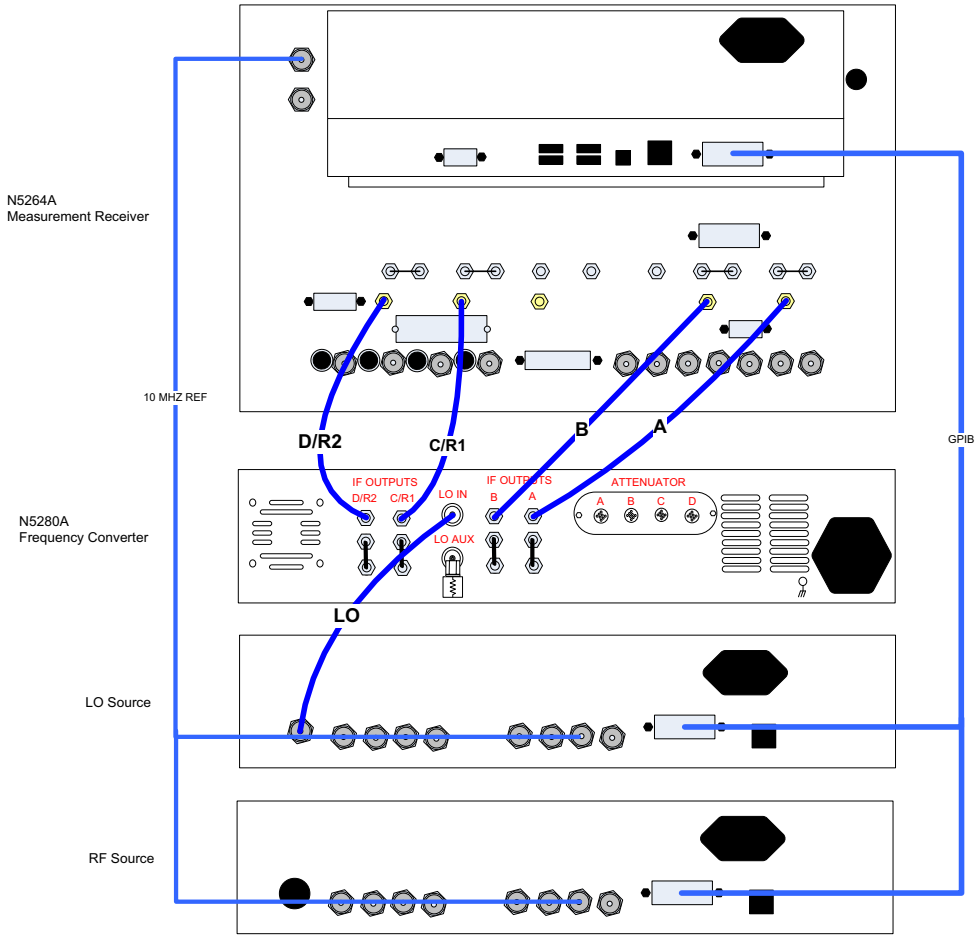
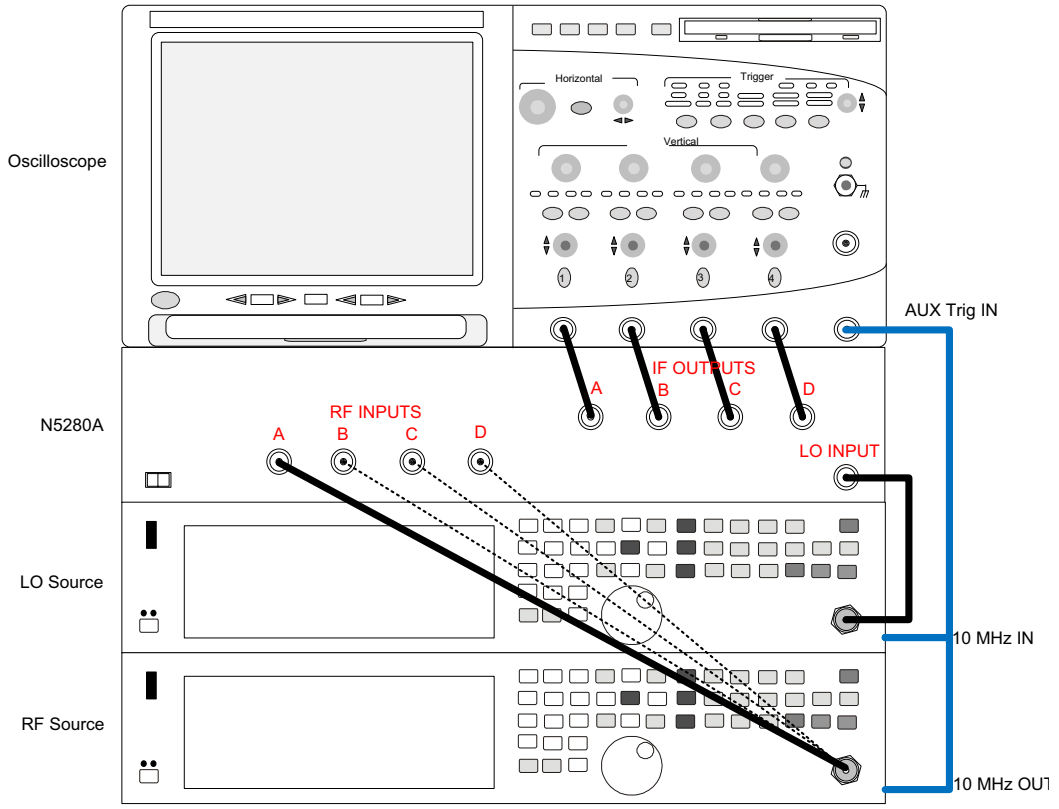


Figure 15 Rear Panel N5280A and N5264A without Option 108



Controlling the N5280A Option 002 using an Oscilloscope

Figure 16 Front Panel N5280A and Oscilloscope



Controlling the RF Receiver Attenuators

The 11713C attenuator switch driver controls the Test Set through the Viking connector on the rear panel.

Figure 17 Rear Panel N5280A Option 001 and 11713C

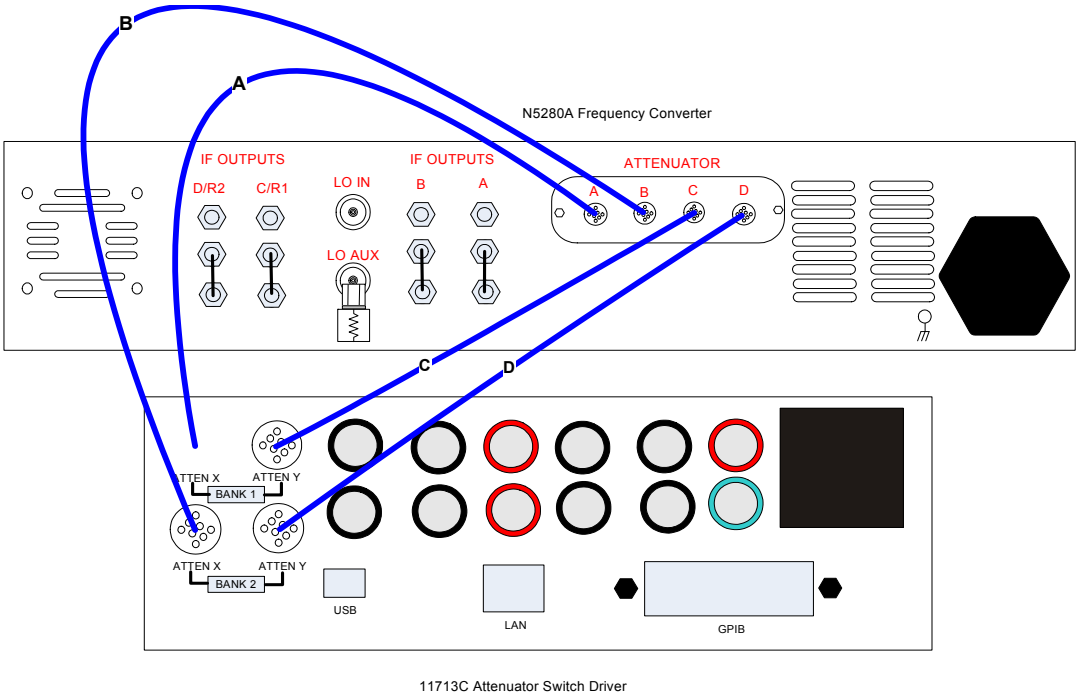


Table 7 illustrates the key combinations that are required to set the attenuation.

Example: In the Attenuator X panel, press 1 & 3 to set A, RF INPUTS to 15 dB.

Table 7 Attenuators

	Attenuator X (A, RF INPUTS)	**Attenuator Y (C, RF INPUTS)**	**Attenuation (dB)**
Bank 1	1 2 3	5 6 7	10 20 5
	Attenuator X (B, RF INPUTS)	**Attenuator Y (D, RF INPUTS)**	**Attenuation (dB)**
Bank 2	1 2 3	5 6 7	10 20 5

Figure 18 Front Panel

Operational Check

This section provides operational check to confirm the N5280A and PNA-X operational performance. The operation verification limits provided ensure that your N5280A and PNA-X are operating properly.

Equipment Required

The Keysight N5280A requires that the user be familiar with the equipment and components listed in Table 8.

This section provides an equipment list and setup of the PNA-X and Test Set.

Table 8 Equipment List

Description	Qty
N5242A 2-Port or 4-Port PNA-X Network Analyzer (Option 020) *or*	1
N5264A Measurement Receiver (Option 108)	1

Verification Limits

Specifications for the N5280A Multiport Test Set are typical. System performance for the PNA-X and Test Set are only characteristic and intended as non warranted information. Only a functional certificate is provided for the N5280A.

It is recommended that you return your instrument to Keysight Technologies for servicing or repair if the Test Set and PNA-X performance exceed the operational verification limits.

NOTE Typical specifications are based on 1 to 2 units performance.

Table 9 RF Receiver Tracking

RF Port Magnitude Tracking	
Frequency	**Value**
10 MHz to 20 GHz	±2.0 dB
20 GHz to 22 GHz	±3.0 dB
22 GHz to 26.5 GHz	±4.0 dB

Table 10 Noise Floor

Direct Receiver Access Input Noise Floor[1] IF Bandwidth equal to 10 Hz	
Frequency	**Receiver Access Input**
10 MHz to 100 MHz	-128 dBm
100 MHz to 500 MHz	-132 dBm
500 MHz to 2 GHz	-133 dBm
2 GHz to 20 GHz	-129 dBm
20 GHz to 24 GHz	-122 dBm
24 GHz to 26.5 GHz	-119 dBm

1. Noise floor measured with a 50 Ohm load at port, and measured as the mean value of a 801 point trace.

Table 11 Trace Noise

Trace Noise Magnitude (dB, rms)[1,2,3] 1 kHz IF Bandwidth	
Frequency	**Typical**
10 MHz to 100 MHz	0.02
100 MHz to 13.5 GHz	0.02
13.5 GHz to 16 GHz	0.02
16 GHz to 22.5 GHz	0.04
22.5 GHz to 24 GHz	0.04
24 GHz to 26.5 GHz	0.04
Trace Noise Phase (deg, rms)[1,4] 1 kHz IF Bandwidth	
10 MHz to 100 MHz	0.15
100 MHz to 13.5 GHz	0.15
13.5 GHz to 16 GHz	0.15
16 GHz to 22.5 GHz	0.25
22.5 GHz to 26.5 GHz	0.25

1. Trace Noise, sweep to sweep variation.
2. Measured linear magnitude CW Frequency at 201 points.
3. Trace Noise in dB = 20 * Log 10 (1+ standard deviation).
4. Trace Noise in degrees = standard deviation.

Table 12 Port Match

RF/LO Port Match	
Frequency	**Value**
10 MHz to 10 GHz	< -9 dB
10 GHz to 26.5 GHz	< -4 dB

Table 13 Dynamic Range

Dynamic Range @ 10 Hz IF Bandwidth			
Frequency	**Typical (dB) Direct Receiver Access Input**	**Typical (dBm) Low-Level Noise Floor**	**Typical (dBm) Max Power[1]**
10 MHz to 50 MHz	117	130	-13
50 MHz to 100 MHz	115	128	-13
100 MHz to 500 MHz	119	132	-13
500 MHz to 2 GHz	120	133	-13
2 GHz to 20 GHz	116	129	-13
20 GHz to 24 GHz	109	122	-13
24 GHz to 26.5 GHz	106	119	-13

1. RCVR IN @ 0.1 dB typical compression at max power.

The receiver access input dynamic range is calculated as the difference between the receiver access input low-level noise floor, and the source maximum power to the receiver that results with a typical 0.1dB compression level.

Low-level noise floor measured with 50 Ohm load at the port.

The effective dynamic range must take measurement uncertainties and interfering signals into account. This set-up should only be used when the receiver input will not exceed its compression or damage level.

Typical Plots

Figure 19 CE Response at 10 MHz IF Outputs

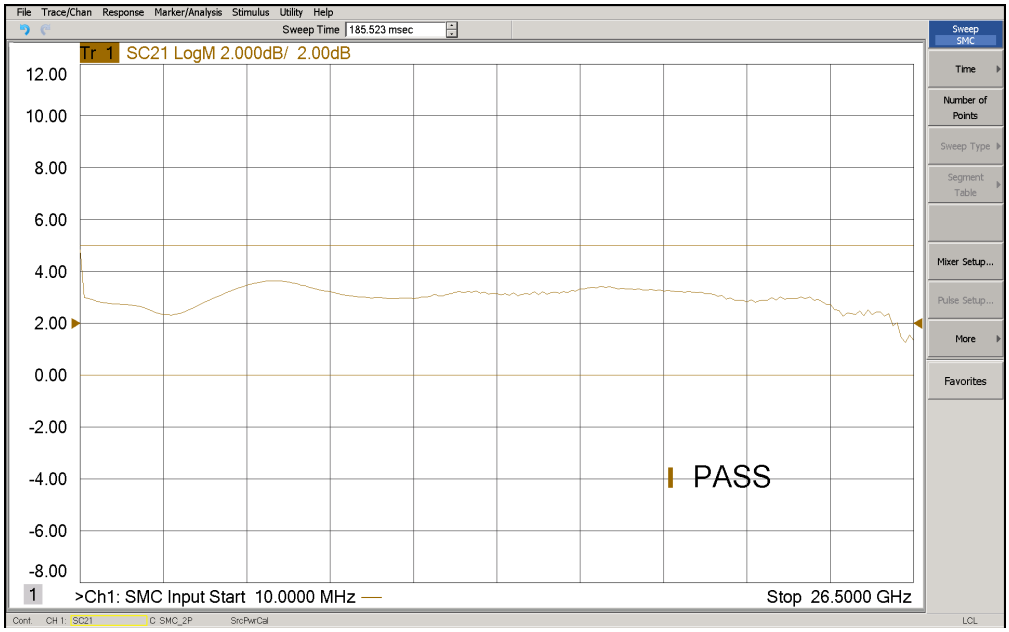


Figure 20 IF Band wid th at 10 MHz to 1.5 GHz

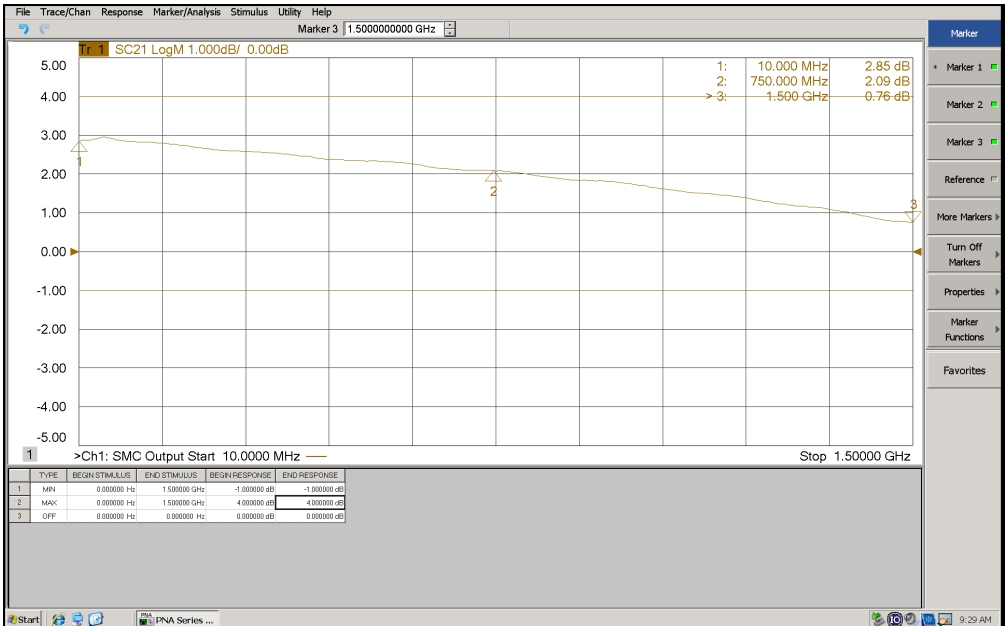
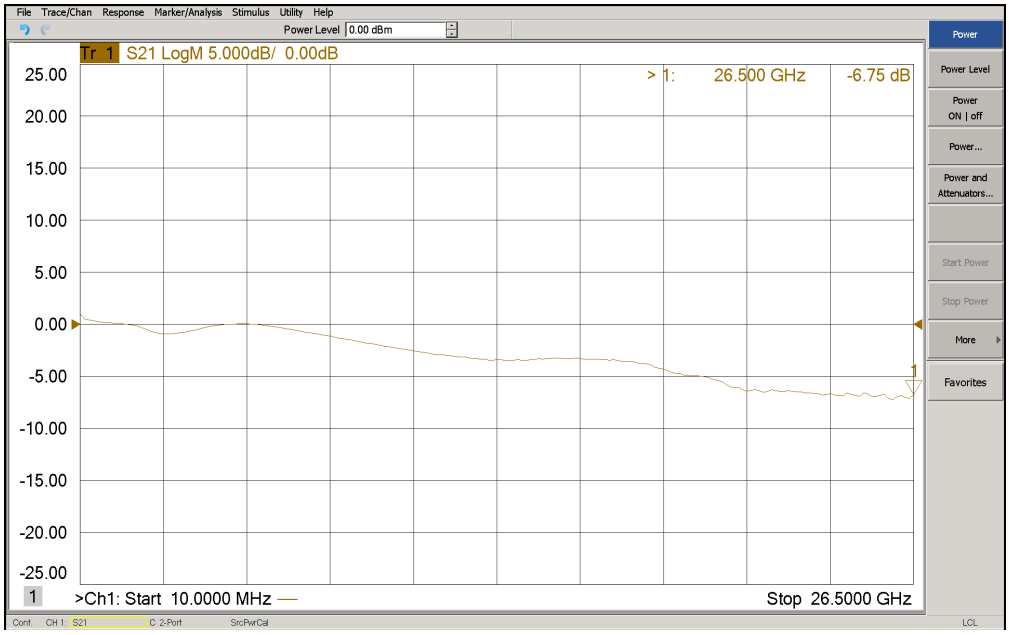


Figure 21 LO AUX Output



Operational Check Procedure (Option 700 and 001)

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.

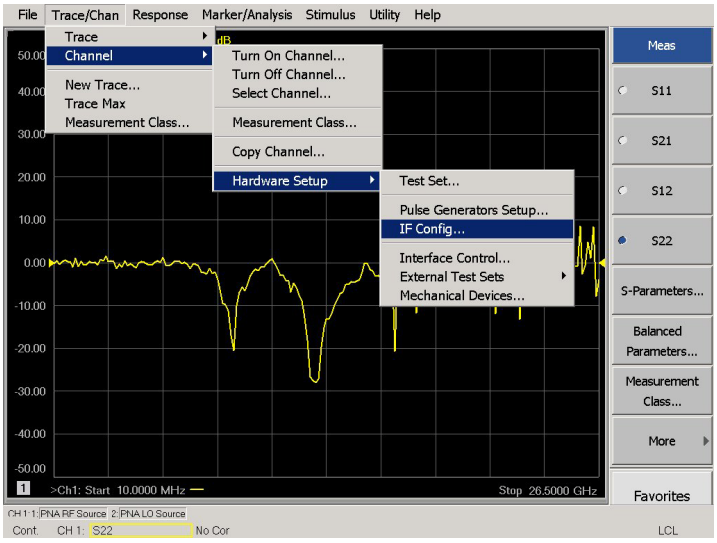
The following procedures are used with the N5242A 4-Port PNA-X.

NOTE If you are using a N5242A 2-Port PNA-X, channels C and D will be replaced with R1 and R2.

Preparing the N5242A

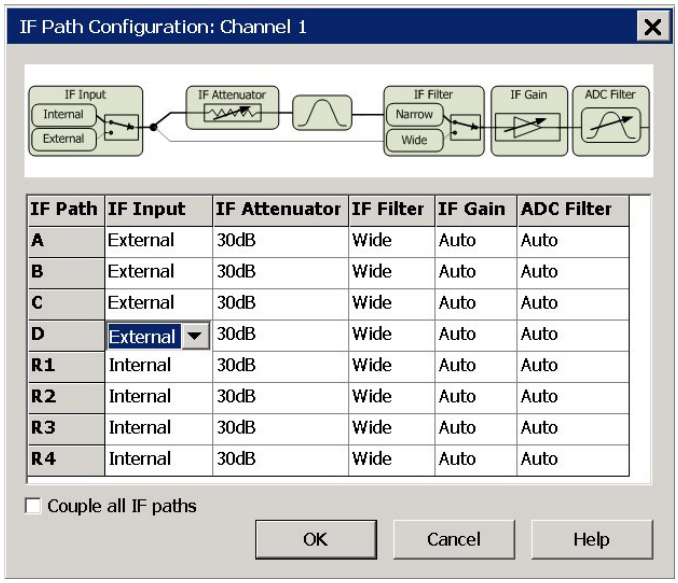
1. Connect the Test Set to the N5242A 4-Port PNA-X using the cables as shown in Figure 10 on page 14 and Figure 11 on page 15.
2. Connect the 10 dB attenuator to the PNA-X Reference port cable.
3. Turn On the Test Set.
4. Press **[Preset]**.
5. Verify that the Stop Frequency is set to the maximum of the PNA-X and Test Set. If not, press **[Freq]** > **Stop**.
6. Verify that the Start Frequency is set to 10 MHz. If not, press **[Freq]** > **Start** > **[10 MHz]**.
7. Verify that the Power is to set to -10 dBm. If not, press **[Power]** > **Power Level** and enter **[-10 dBm]**.
8. Select **[Avg]** > **IF Bandwidth** > enter **1 kHz**.
9. Select **[Sweep]** > **Number of Points** > enter **401**.
10. Allow the Test Set and the PNA-X to warm up for a minimum of 30 minutes.
11. Set the IF Config On. **Trace/Chan** > **Channel** > **Hardware Setup** > **IF Config**.

Figure 22 IF Config



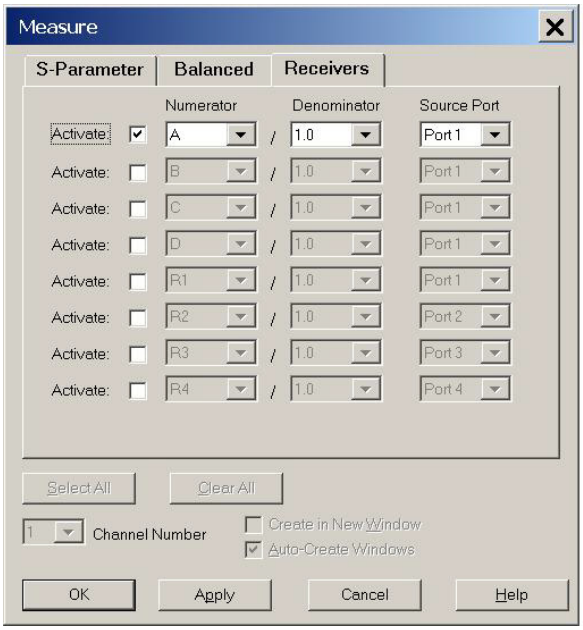
12.Select all of the IF Inputs **External A, B, C and D** > **OK**.

Figure 23 IF Input



13.Connect the cable to **A, RF INPUTS** on the Test Set and select **[Meas]** > **More** > **Receivers**, select **A** > **Apply** > **OK**.

Figure 24 Receiver A



14.Set the Reference level to -20 dBm. Press **[Scale]** > **Reference level** > **[-20 dBm]**.

NOTE All of the observed traces should decrease from -17 dB (± 5 dB) at 10 MHz to -34 dB
(± 5 dB) at 26.5 GHz.

Figure 25 Typical Receiver A

15.Connect the cable to **B, RF INPUTS** on the Test Set. Select **[Meas]** > **More** > **Receivers**, select **B** > **Apply** > **OK** to observe the power level trace.

16.Connect the cable to **C, RF INPUTS** on the Test Set. Select **[Meas]** > **More** > **Receivers**, select **C** > **Apply** > **OK** to observe the power level trace.

17.Connect the cable to **D, RF INPUTS** on the Test Set. Select **[Meas]** > **More** > **Receivers**, select **D** > **Apply** > **OK** to observe the power level trace.

Attenuator Element Verification Procedure

The Attenuator Element Verification Procedure is a functional test only. This test verifies the functionality of the variable attenuator in each channel RF path. The following procedures are used with the 11713C attenuator switch driver.

1. Connect the cables from the Test Set to the 11713C as shown in Figure 17 on page 21.
2. Press **[Preset]**.
3. Set the IF Config On. Select **Trace/Chan > Channel > Hardware Setup > IF Config**. Refer to Figure 22 on page 29.
4. Select all of the IF Inputs **External A, B, C and D > OK**. Refer to Figure 23 on page 30.
5. Select **[Analysis] > Statistics On**.
6. Select **[Meas] > More > Receivers**, select **A > Apply > OK**. Refer to Figure 24 on page 30.
7. Select **[Memory] > Normalize**.
8. Select **[1]** on the 11713C. The mean value should read -10 dB (± 1 dB). Select **[1]** again, it should read 0 dB.
9. Select **[2]** on the 11713C. The mean value should read -20 dB (± 1 dB). Select **[2]** again, it should read 0 dB.
10. Select **[3]** on the 11713C. The mean value should read -5 dB (± 1 dB). Select **[3]** again, it should read 0 dB.
11. Repeat See “Select [Meas] > More > Receivers, select A > Apply > OK. Refer to Figure 24 on page 30.” on page 32. through See “Select [3] on the 11713C. The mean value should read -5 dB (± 1 dB). Select [3] again, it should read 0 dB.” on page 32. for **B, C** and **D RF INPUTS**.

Operational Check Procedure (Option 002)

The N5280A operational check can be verified using two Sources with a Power Meter and Power Sensor.

Requirements for Operational Check

The N5280A operational check measures the signal paths from the LO INPUT to the LO OUTPUT (LO AUX) and each of the four internal mixers, using a power divider. Internally, the LO signal is mixed with RF input signals supplied through each of the RF INPUTS (A, B, C, and D) and measured at each of the IF OUTPUTS (A, B, C, and D). The following process demonstrates that all associated switches, connectors, cables and circuitry are operational.

Required Hardware

To demonstrate that the N5280A is operating properly requires external equipment - the same equipment that would be used to perform a field calibration of the N5280A in a system. This external equipment includes two precision signal generators and a power meter with a power sensor and power sensor cable. The module interconnect cables are not used when performing this operational check; instead, two high-quality flexible 3.5 mm cables are needed along with adapters.

Please refer to the following table for recommended equipment.

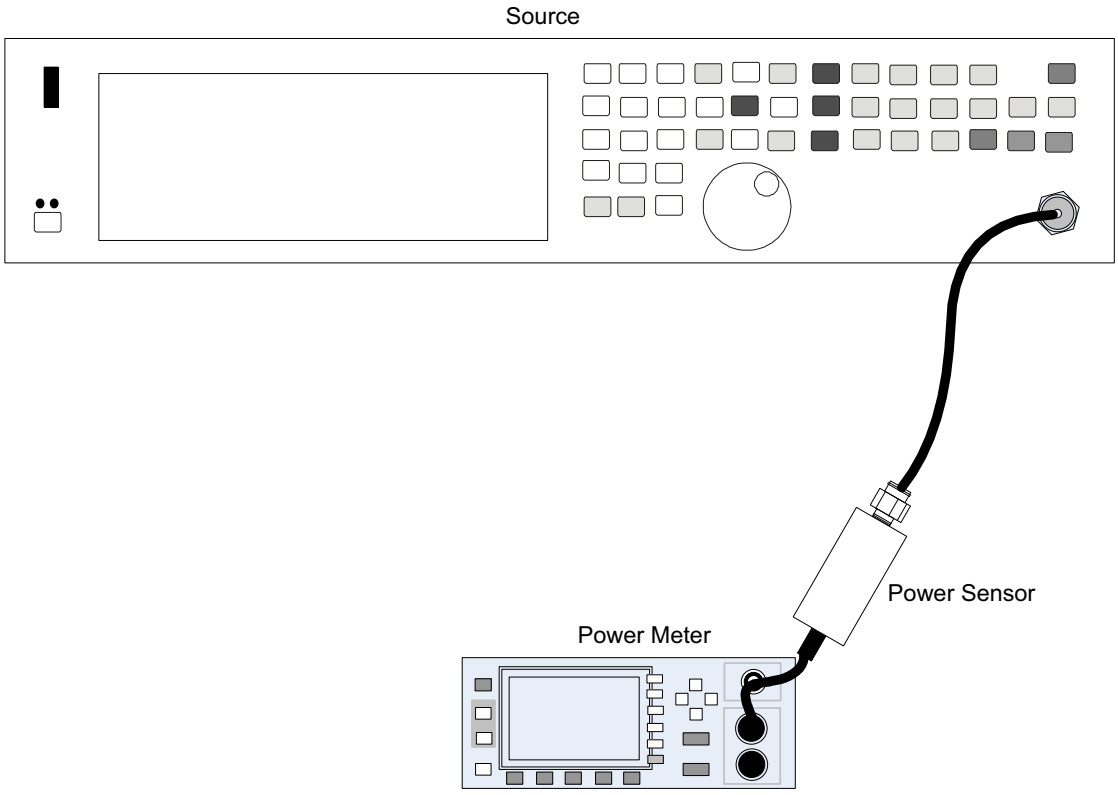
Table 14 Keysight Recommended Equipment

Equipment	Description
E8257D-532 or E8267D-532 or equivalent	PSG #1 and PSG #2 Precision Signal Generator (250 kHz to 31.8 GHz)
N1913A or N1914A or equivalent	Single/Dual Channel Power Meter
N8485A Option 100 or equivalent	10 MHz to 26.5 GHz Power Sensor
11730A or equivalent	Power Sensor Cable

Instrument Setup (Source Calibration)

Using the power meter and power sensor, measure the PSG #1 (RF Source) and PSG #2 (LO Source) power levels at the frequencies listed in the Table 15 on page 35 at the end of test port cables. Record The RF and LO values in the table.

Figure 26 Source and Power Meter Setup



Check IF Output A

1. On the PSG #1 connect RF OUT using a high-quality flexible cable to RF INPUT A on the N5280A.
2. On the PSG #2 connect RF OUT using a high-quality flexible cable to LO INPUT on the N5280A.
3. Connect the power meter to IF OUTPUT A on the N5280A.
4. Use the output frequencies and power levels from the Table 15, set PSG #1 and PSG #2. Record the result in table for the measure IF OUTPUT A.
5. Repeat See “On the PSG #1 connect RF OUT using a high-quality flexible cable to RF INPUT A on the N5280A.” on page 35. to See “Use the output frequencies and power levels from the Table 15, set PSG #1 and PSG #2. Record the result in table for the measure IF OUTPUT A.” on page 35. for IF Outputs B, C, and D.

Figure 27 IF Output Channel A Setup

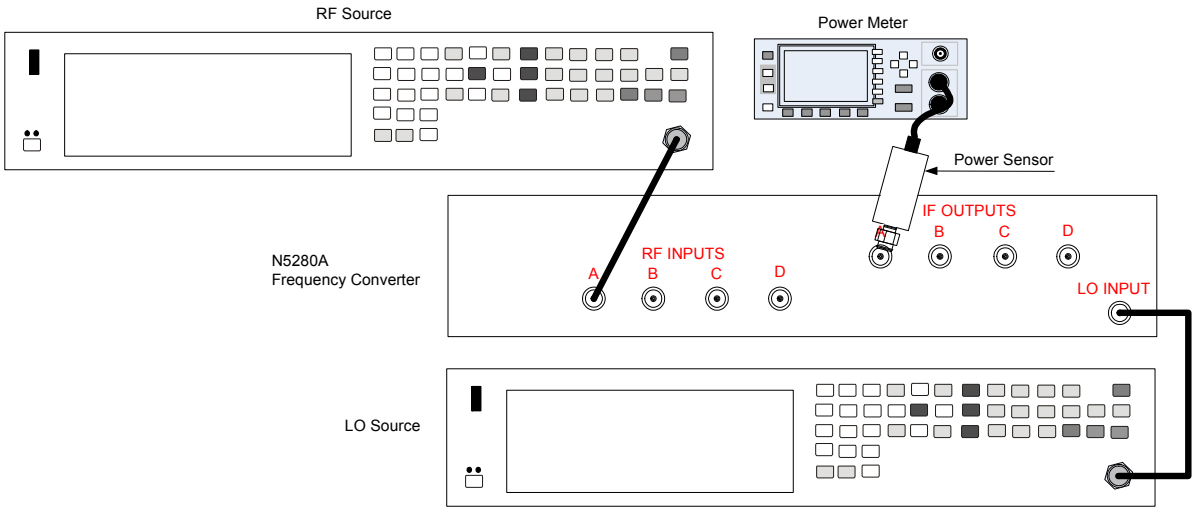


Table 15 Measured IF OUT Power Levels

PSG #1 Output Freq to RF IN A (GHz)	RF IN Power Level (dBm)	PSG #2 Output Freq to RF IN A (GHz)	LO IN Power Level (dBm)	Power Level Range Expected at IF OUT A (dBm)	Power Meter Reading Measured for IF OUtputs and LO AUX (dBm)				
	-10 dBm		0 dBm		A	B	C	D	LO AUX
3.5		4		-5 to -11					
8.5		9		-5 to -11					
17.5		18		-5 to -11					
26.0		26.5		-5 to -11					

Check LO AUX

1. Connect the power meter to the LO AUX on the N5280A.
2. Use the output frequencies and power levels from the Table 15 on page 35. Record the result in table for the measure LO AUX. The LO AUX specification is greater than -10 dBm.

Figure 28 IF LO AUX Setup

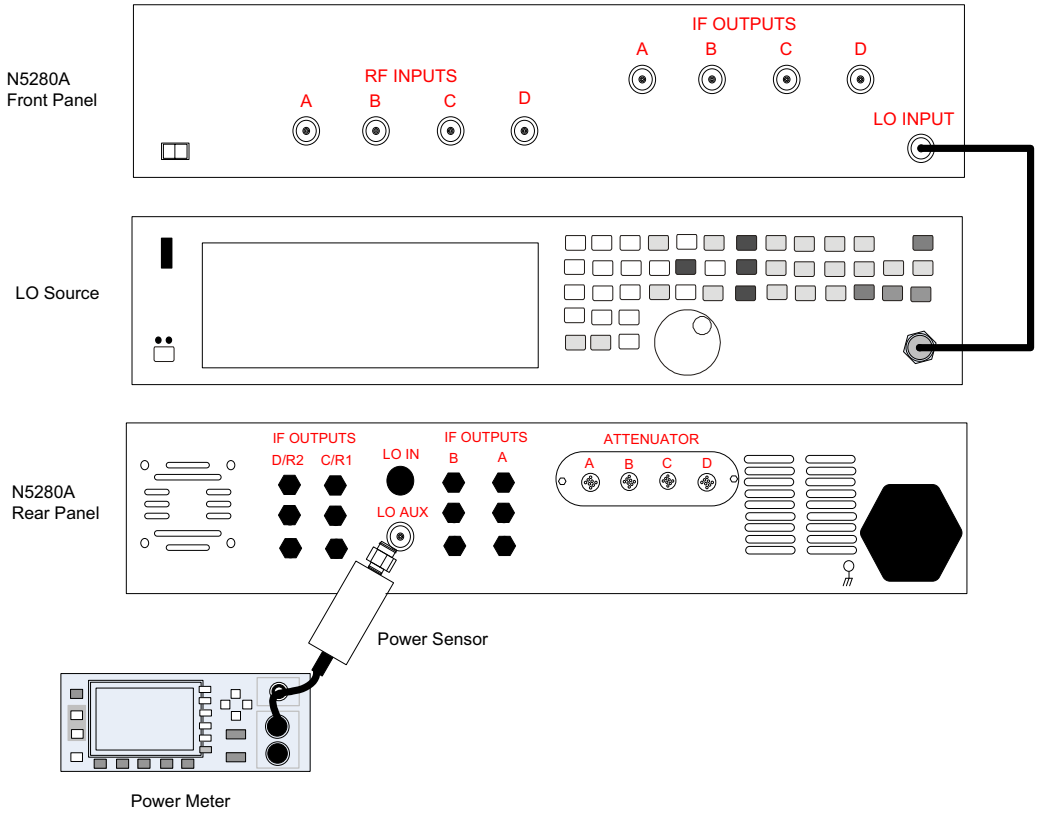


Figure 29 N5280A Block Diagram (Standard 700)

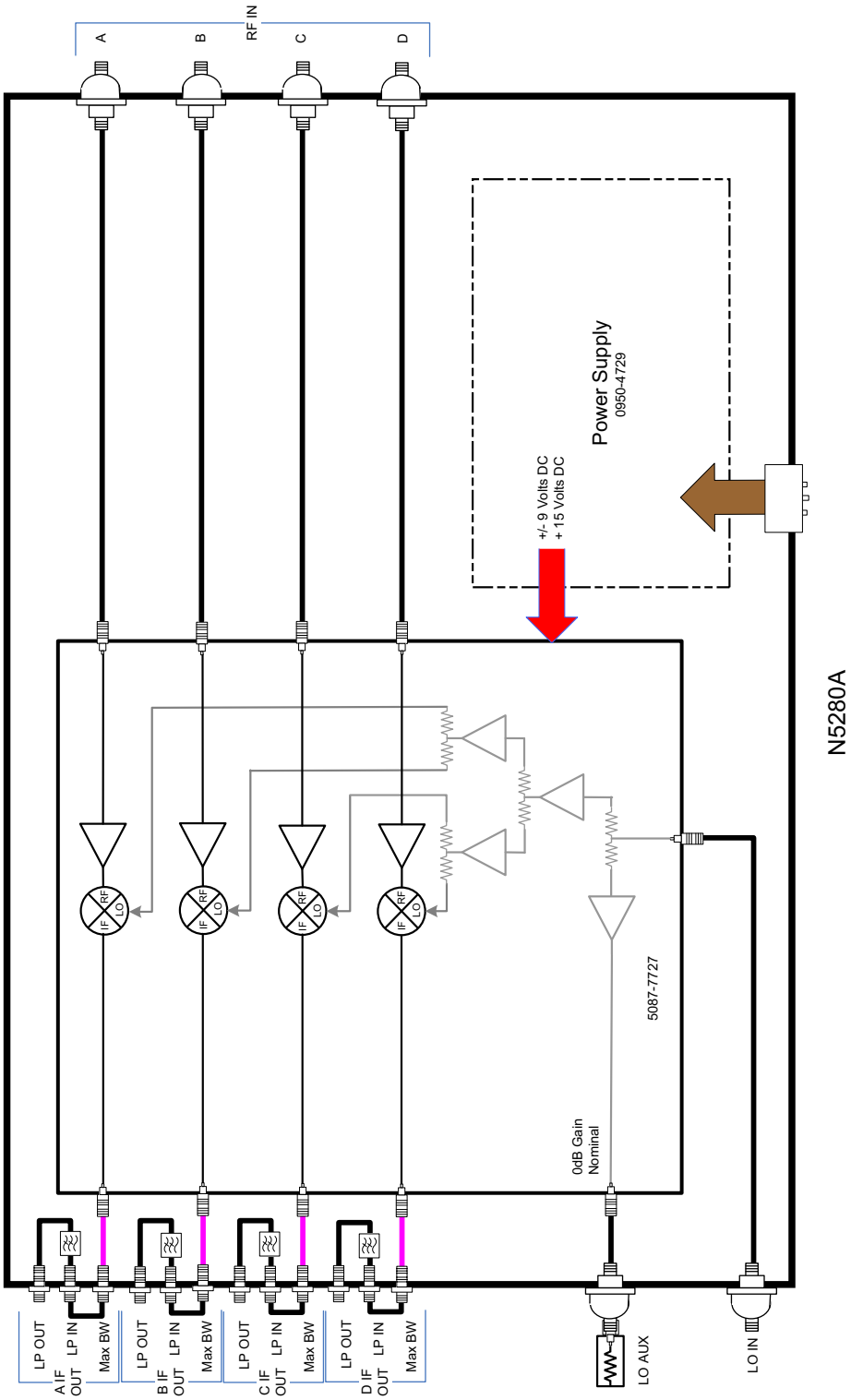


Figure 30 N5280A Block Diagram (Option 001)

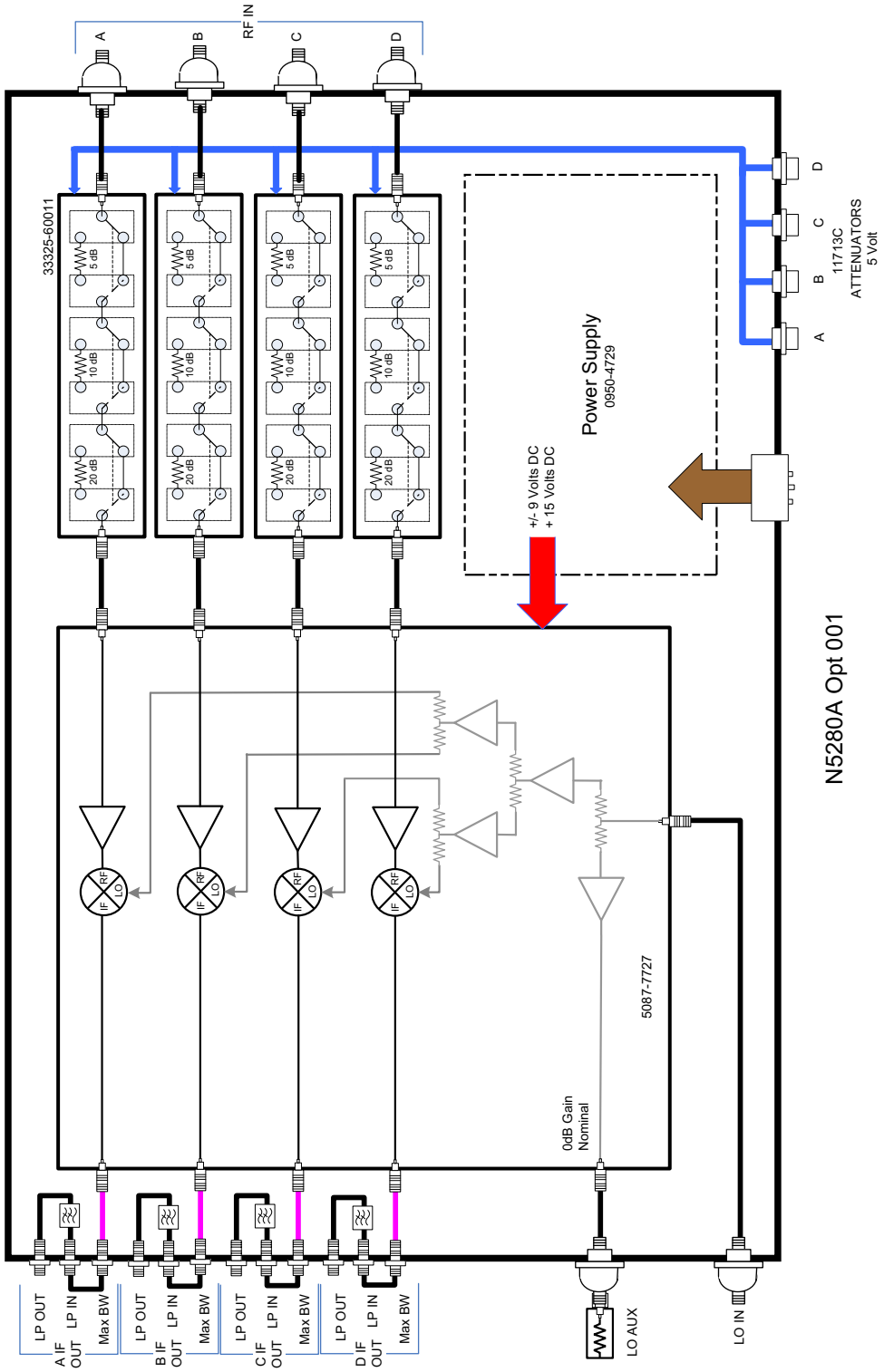
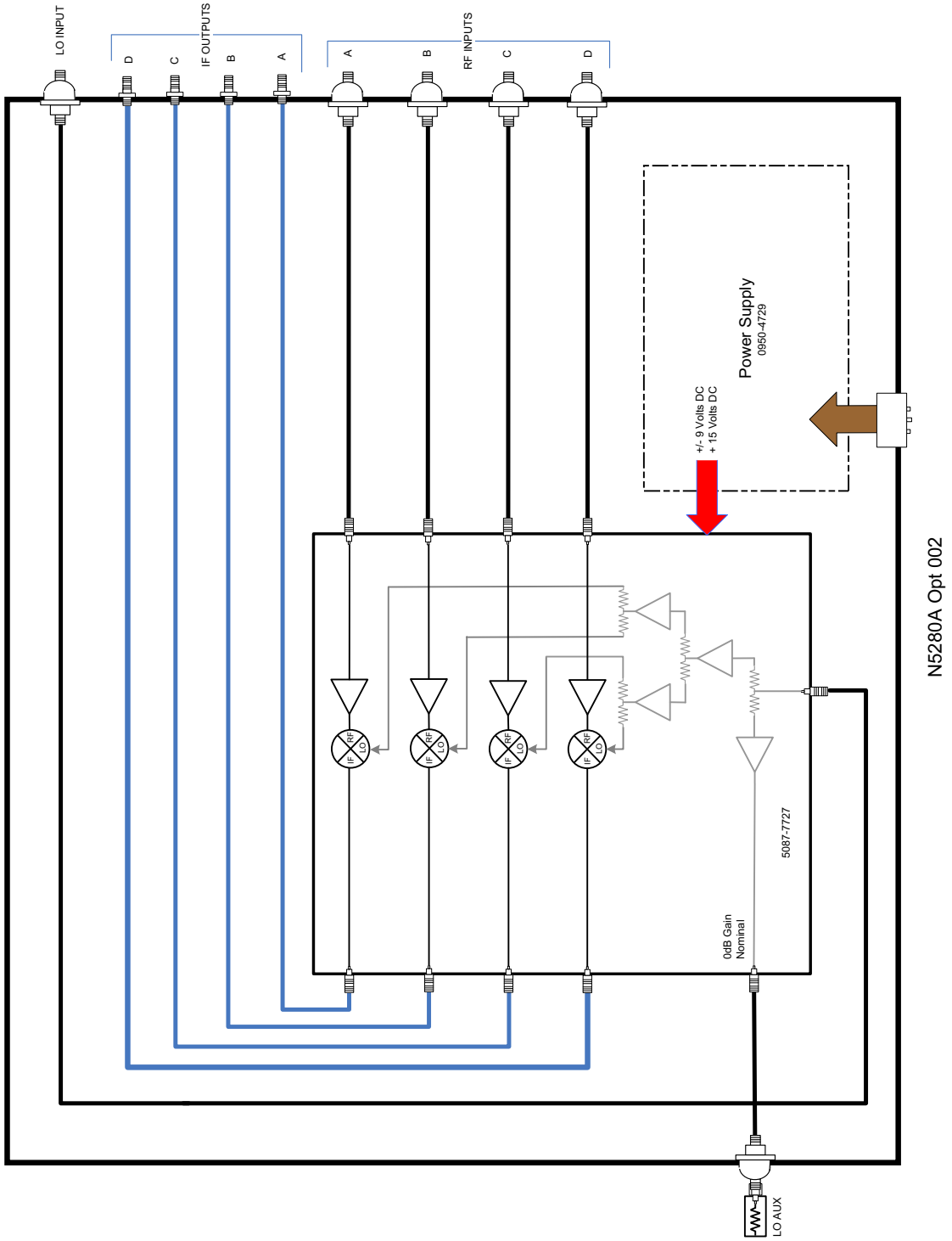


Figure 31 N5280A Block Diagram (Option 002)



Safety and Information

Introduction

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

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

Safety Earth Ground

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

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

Declaration of Conformity

A copy of the Declaration of Conformity is available upon request, or a copy is available on the Keysight Technologies web site at http://regulations.corporate.keysight.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.**

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

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

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

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

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

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

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

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

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

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

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

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

Connector Care and Cleaning Precautions

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

WARNING	**To prevent electrical shock, disconnect the Keysight N5280A from mains electrical supply before cleaning. Use a dry cloth or one slightly dampened with water to clean the external case parts. Do not attempt to clean internally.**

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

Regulatory Information

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

Instrument Markings

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

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

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

This symbol indicates that the power line switch is ON.

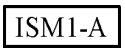
This symbol indicates that the power line switch is in the STANDBY position.

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

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

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

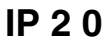
The CSA mark is a registered trademark of the CSA International.



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

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

Direct Current.



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

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

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

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

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

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 Keysight Technologies for disposal. Refer to "Contacting Keysight" on page 46 for assistance.

Electrical Safety Compliance

SAFETY

Complies with European Low Voltage Directive 2014/35/EU

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

EMI and EMC Compliance

EMC

Complies with European EMC Directive 2014/30/EU

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

A 급 기기 (업무용 방송통신기자재)이 기기는 업무용 (A 급) 전자파적합기기로서 판 매자 또는 사용자는 이 점을 주 의하시기 바라 며 , 가정외의 지역에서 사용하는 것을 목적으 로 합니다 .

Keysight Support, Services, and Assistance

Service and Support Options

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

Contacting Keysight

Assistance with test and measurement needs, and information on finding a local Keysight office are available on the Internet at:
http://www.keysight.com/find/assist

You can also purchase accessories or documentation items on the Internet at:
http://www.keysight.com/find

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

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

Shipping Your Product to Keysight for Service or Repair

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

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

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