

Agilent Technologies U3020AY03

User's Guide

Use this manual with the following documents:
U3020AY04 User's Guide (U3020-90009)
PNA Series Network Analyzer On-line Help System



Agilent Technologies

Manufacturing Part Number: U3020-90008

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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.

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

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

Definitions

- *Specifications* describe the performance of parameters covered by the product warranty (temperature 0 to 50 °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.

Contents

U3020AY03

Introduction	2
Description	3
Verifying the Shipment	3
Network Analyzer Requirements	3
Available Options	4
Specifications	5
Power Requirements	5
Environmental Requirements	6
Maximum Power Levels	7
Local Converter Performance	8
Front and Rear Panel Features	9
System Setup with N5242A	12
Preparing the Network Analyzer	12
RF Interface Cable Connections	15
System Setup with N5245A	16
Preparing the Network Analyzer	16
RF Interface Cable Connections	19
USB Cable Connections	20
Using the U3020AY03 with PNA-X	21
Setup of Port 1 REF RCVR for Remote Mode	21
Operational Check	22
Verification Limits	22
Equipment Required	23
Operational Check Procedure	24
Laser Safety Information	31
Class 1	31
Class 3R	31
Service Information	33
Theory of Operation	34
Electrical to Optical (E/O) Path	34
Optical to Electrical (O/E) Path	34
Optical Modulator	34
Optical Detector	34
Laser	34
Power Supply	34
Interface Board	35
Laser Board	35
Modulator Bias Board	35
LED Board	35
Option USB	35
Troubleshooting	39
Non-RF Failures	39
Safety and Regulatory Information	40
Introduction	40
Before Applying Power	40
Safety Earth Ground	40
Declaration of Conformity	40
Statement of Compliance	40
General Safety Considerations	41
Regulatory Information	43

Contents

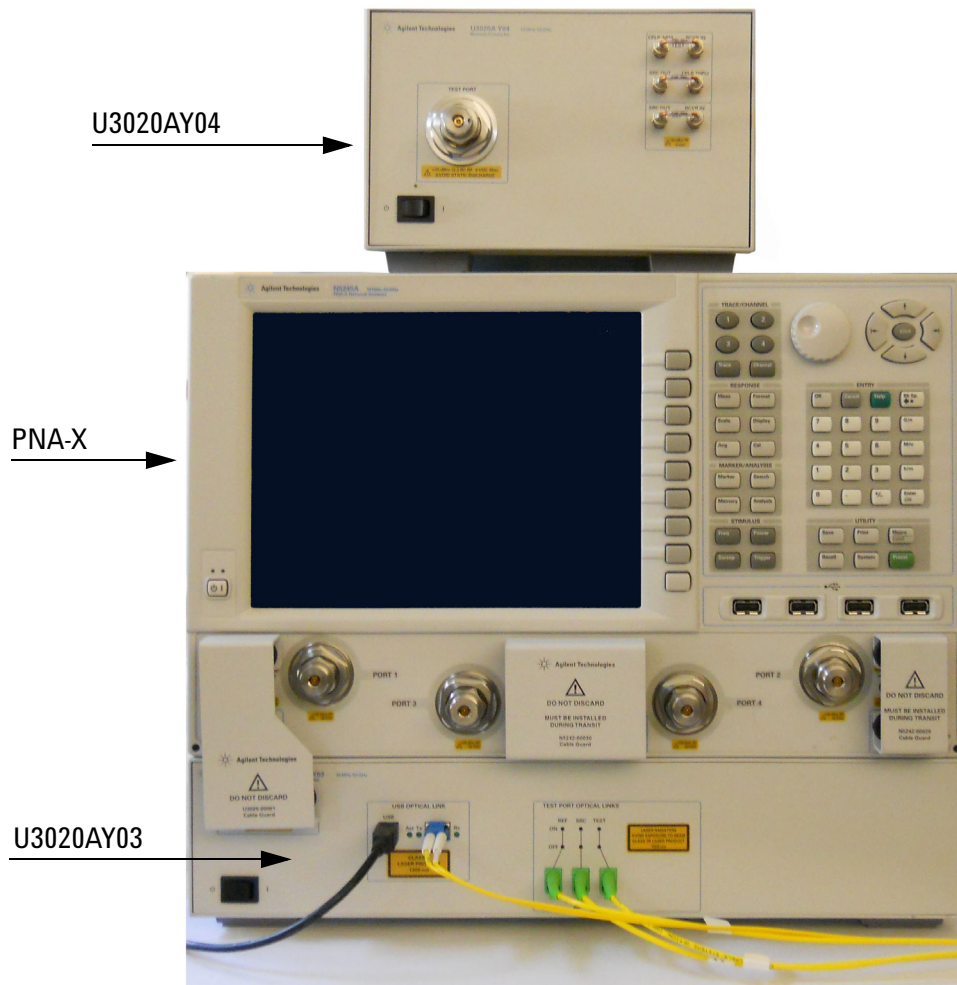
- Electrostatic Discharge Protection 45
- Agilent Support, Services, and Assistance 46
 - Service and Support Options 46
 - Contacting Agilent 46
 - Shipping Your Instrument to Agilent for Service or Repair 46

U3020AY03

Introduction

This document describes how to use the U3020AY03 Local Convertor. Network analyzer measurements up to 1000 meters from the PNA-X can be made with the U3020AY03 configured with an Agilent N5242A or N5245A (PNA-X) and a U3020AY04 Remote Optical module.

Figure 1 PNA-X with U3020AY03 and U3020AY04



Description

The U3020AY03 Local Converter converts the electrical PNA-X REF, TEST and SRC signals to optical signals (E/O). The U3020AY03 must be connected to a U3020AY04 Remote Microwave Optical Module with three single mode E2000/APC fiber optic cables to allow the user to extend remote measurement capability to 1,000 meters (3,280 ft). U3020AY03 Option F1P allows the use of one U3020AY04 module for a 1-Port network analyzer system. Option F2P requires two U3020AY04 modules to complete a 2-Port network analyzer system. For further information refer to the U3020AY04 User's Guide (U3020-90009).

The U3020AY03 requires no external control.

The N5242/45A PNA-X Network Analyzers will be referred to throughout this document as the PNA-X. The U3020AY03 will be referred to as the Local Converter. The U3020AY04 will be referred to as the Remote Converter.

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 46. Keep the damaged shipping materials (if any) for inspection by the carrier and an Agilent Technologies representative.

Network Analyzer Requirements

- The U3020AY03 is compatible with all N5242A or N5245A options and firmware.

More PNA information is available on the following website:

- Documentation - <http://www.agilent.com/find/pna>
- Network Analyzer Firmware - <http://na.tm.agilent.com/pna/firmware/firmware.htm>

Available Options

Local Converter Options

- U3020AY03-026 10 MHz to 26.5 GHz
- U3020AY03-050 10 MHz to 50 GHz
- U3020AY03-1SR Port 1 Optical Source and Reference Receiver
- U3020AY03-2TR Port 1 Optical Tx and Rx, Port 2 Optical Rx
- U3020AY03-F1P 1-Port Configuration, Port 1 Optical Tx and 2 Rx
- U3020AY03-F1P 1-Port Configuration, Port 1 Optical Tx and 2 Rx
- U3020AY03-F2P 2-Port Configuration, Port 1 and Port 2 Optical Tx and 2 Rx
- U3020AY03-USB Add USB Optical Port

Mounting Kits

- U3020AY03-ICM Rack Mount Kit without handles
- U3020AY03-ICN Front Handle Kit
- U3020AY03-ICP Rack Mount Kit with handles
- U3020AY03-042 Lock Link Kit N5242A (U3021-60004)
- U3020AY03-045 Lock Link Kit N5245A (U3021-60005)

Specifications

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.

Specifications for the Local Converter are nominal. System performance of the PNA-X and the Local Converter are based on the customer's PNA-X and measurement configuration. A functional certificate is offered for the Local Converter only.

When connected to a PNA-X, this Local Converter will degrade the performance. The internal O/E and E/O paths reduce source power and power to the receivers. This affects the PNA-X dynamic range, noise floor, and trace noise.

Power Requirements

Verify that the required ac power is available before installing the Local Converter to the PNA-X.

- 100/120/220/240 VAC (50/60Hz)
- The instrument 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 Local Converter and PNA-X.
- [Table 1](#) contains the maximum wattage for all instruments. This table can be use to determine the electrical and cooling requirements.

Table 1 **Power Requirements**

Standard Equipment	
Instrument	Maximum Wattage
N5242/45A	450
U3020AY03	350
U3020AY04	160

WARNING **This is a Safety Class 1 product (provided with a protective earth ground incorporated in the power cord). The mains plug shall be inserted only into a socket outlet provided with a protective earth contact. Any interruption of the protective conductor, inside or outside the instrument, is likely to make the instrument dangerous. Intentional interruption is prohibited.**

Environmental Requirements

Refer to the PNA-X standard documentation for environmental requirements.

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.

WARNING For continued protection against fire hazard, replace fuses, and or circuit breakers only with same type and ratings. The use of other fuses, circuit breakers or materials is prohibited.

Environmental Tests

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

- Temperature 0 to 50 °C
- Altitude 2000 meters (~6,561 feet)
- 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.

This product is designed for use in Installation Category II and Pollution Degree 2, per IEC 61010 Second Edition and 664 respectively.

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 1](#).

Required Conditions for Accuracy Enhanced Measurement

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

Dimensions and Space Requirements

Standard installation of the Local Converter and PNA-X 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 Local Converter.

Table 2 Instrument Dimensions

Model	Weight	Height	Width	Depth
U3020AY03	8.4 kg (18.5 lb)	10.1 cm (4 in)	42.9 cm (16.9 in)	58.4 cm (23 in)

Maximum Power Levels

CAUTION It is recommended that you do not operate components near damage levels. The power levels must be 3 dB below maximum level to ensure no damage, see [Table 3](#).

CAUTION Power into SRC OUT should not exceed the optimum RF power level. The power levels above the optimum power level will cause measurement instability, see [Table 3](#). It is recommended that a user define a PNA-X User State to not exceed the optimum RF power levels.

Table 3 Power Levels

Optimum RF Power into Access Ports:	
SRC OUT	+5 dBm 0 Vdc
All RCVR IN	0 dBm 0 Vdc
Maximum RF into Access Ports:	
SRC OUT	+20 dBm 0 Vdc
All RCVR IN	+20 dBm 0 Vdc
Maximum Optical into Access Ports:	
Test (IN)	+16 dBm
REF (IN)	+16 dBm
Maximum Reverse Power:	
SRC OUT	+17 dBm

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

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

Local Converter Performance

Specifications for the Local Converter are nominal and are intended as non-warranted information. This information is provided as reference material only.

NOTE Nominal specifications are based on 1 to 2 unit's performance. Refer to [Table 4](#), [Table 5](#) and [Table 8](#), "Operation Verification Limit," on page 22.

Table 4 RF Performance

Description	10 MHz to 26.5 GHz	26.5 GHz to 50 GHz
SRC OUT to REF RCVR IN S21 THRU Gain	≤ -5 dB	≥ -13 dB
SRC OUT to TEST RCVR IN S21 THRU Gain	≤ -5 dB	≥ -13 dB
REF<> TEST RCVR S21 THRU ISOLATION	≤ 80 dB	≤ 65 dB
SRC OUT MATCH S11	≤ 10 dB	≤ 8 dB
REF RCVR IN MATCH S22	≤ 8 dB	≤ 5 dB
TEST RCVR IN MATCH S22	≤ 8 dB	≤ 5 dB

Table 5 Optical Performance

Description	Response
SRC Optical Link Power	≥ 3.0 mW
SRC Optical Link Wavelength	1540 nm (SMF)
REF Optical Link Wavelength	1480 to 1620 nm (SMF)
TEST Optical Link Wavelength	1480 to 1620 nm (SMF)
USB Optical Link Power	≥ 0.1 mW
USB Optical Link Power	1300 nm (SMF)

Front and Rear Panel Features

Figure 2 U3020AY03 Front Panel (F1P & 1SR)

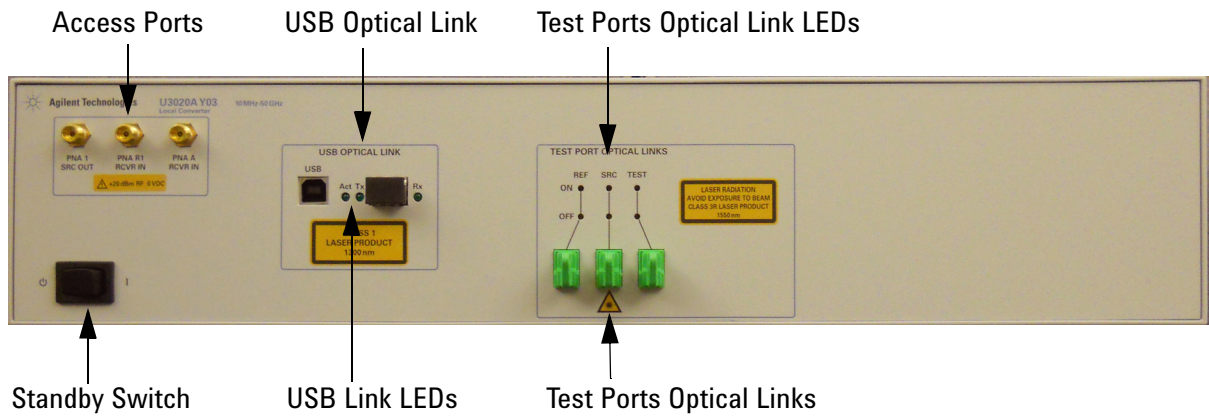
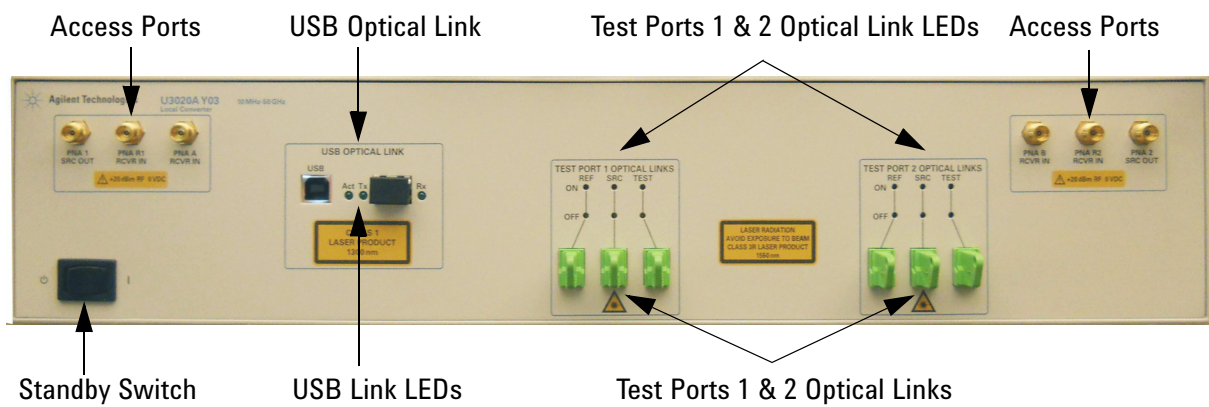


Figure 3 U3020AY03 Front Panel (F2P)



Option F1P & 1SR Access Ports – SMA (female)

- PNA 1 SRC OUT
- PNA R1 RCVR IN
- PNA A RCVR IN, Option 1SR delete A RCVR port

Option F2P Access Ports – SMA (female)

- PNA 1 SRC OUT
- PNA R1 RCVR IN
- PNA A RCVR IN
- PNA 2 SRC OUT
- PNA R2 RCVR IN
- PNA B RCVR IN

Test Port 1 & 2 Optical Links - E2000/APC - Class 3R Laser

- REF (IN)
- SRC (OUT)
- TEST (OUT), Option 1SR delete Test Optical link

USB Optical Links - DUAL LC/PC - Class 1 Laser**USB Optical Link LEDs**

- **Act** - USB optical port is active.
- **Tx** - USB optical port is transmitting.
- **Rx** - USB optical port is receiving.

Standby Switch

The switch is only a Standby switch, not a AC line power switch.

USB Optical Links - USB Type B**Test Port Optical Link LEDs**

- **REF** - Optical port Status, On or Off.
- **SRC** - Optical port Status, On or Off (8 second time delay).
- **TEST** - Optical port Status, On or Off.

Figure 4 U3020AY03 Rear Panel**Chassis Ground**

A threaded terminal post for connecting the Local Converter to a conductive object, cabinet or structure to ensure a common potential and reduce leakage current in a system. Requires a metric M4 nut (0535-0023) with lock washer (2190-0646) or M4 nut with an integrated washer (0535-0082).

Line Module

The line fuse, as well as a spare, reside within the line module's fuse panel.

WARNING **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.**

Power Cords

A line power cord is supplied in one of several configurations, depending on the destination of the original shipment. Agilent can supply additional certified power cords to meet region electrical supply and receptacle configurations. Please contact Agilent at: www.agilent.com for assistance in power cord selection.

Available Fuse

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

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

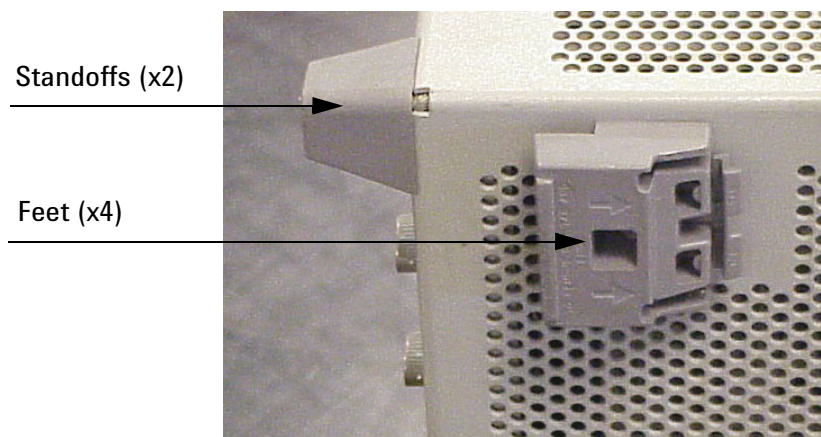
System Setup with N5242A

Preparing the Network Analyzer

Refer to the following kit for your specific analyzer.

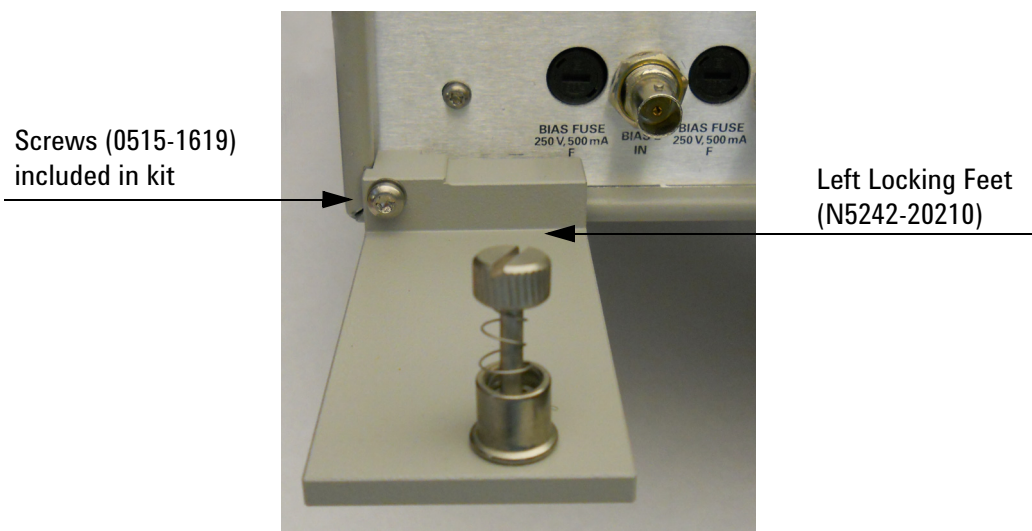
- The kit (U3021-60004) includes item to interface the Local Converter to a N5242A.
1. Remove the feet from the bottom of the network analyzer.
 2. Remove the 2 lower standoffs and screws (0515-1619) from the rear panel on the network analyzer.

Figure 5 Rear Bottom Feet



3. Install the two rear locking feet (N5242-20210 left foot, N5242-20211 right foot) onto the PNA-X, using the screws (0515-1619) where the standoffs were removed.

Figure 6 Install Locking Feet on PNA-X



4. Remove the two upper feet from the Local Converter and install the two locking feet N5242-20208 (right foot) and the N5242-20209 (left foot) using two screws (0515-2317) as shown in [Figure 7](#).
5. Place the PNA-X on top of the Local Converter. Ensure that the front frame of the PNA-X is positioned slightly forward of the locks that are attached to the Local Converter. Slide the PNA-X back so the locks engage the front frame of the analyzer as shown in [Figure 8](#).

Figure 7 Rear Panel PNA-X with U3020AY03

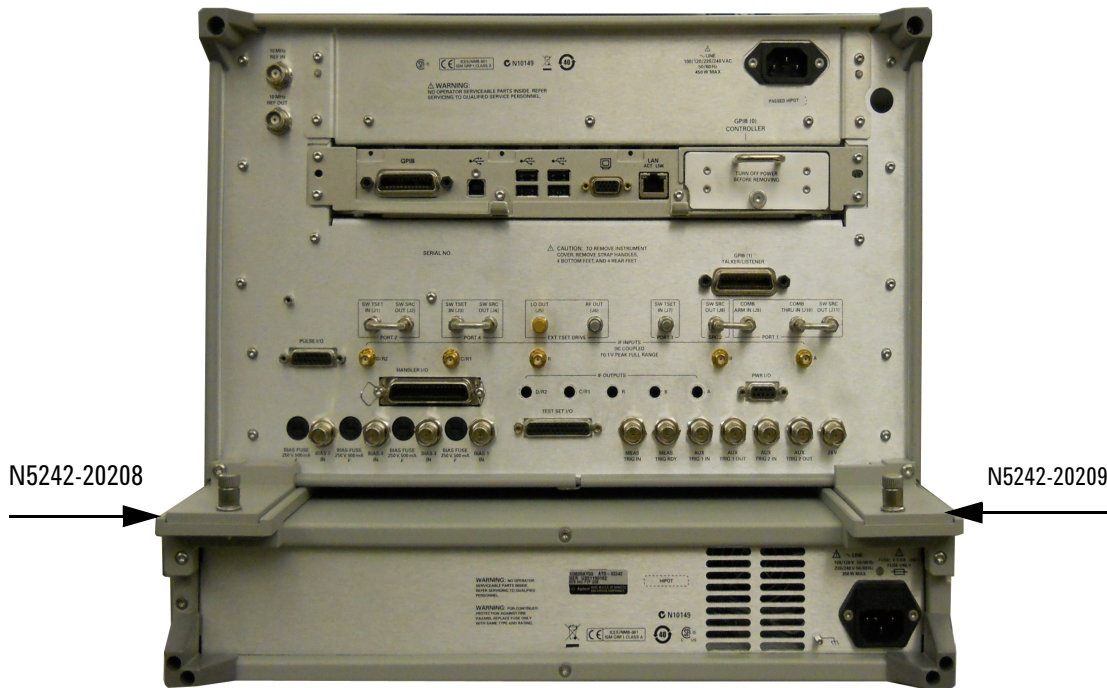
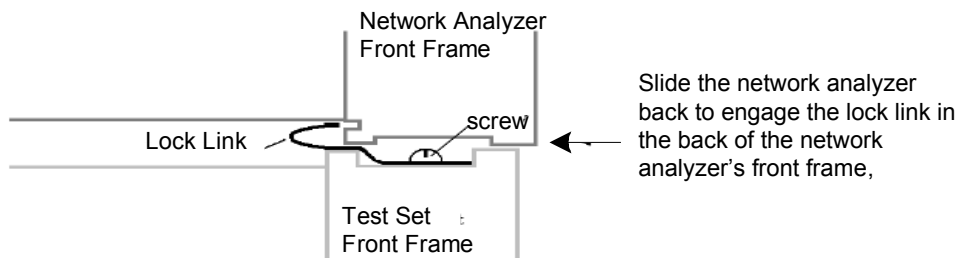
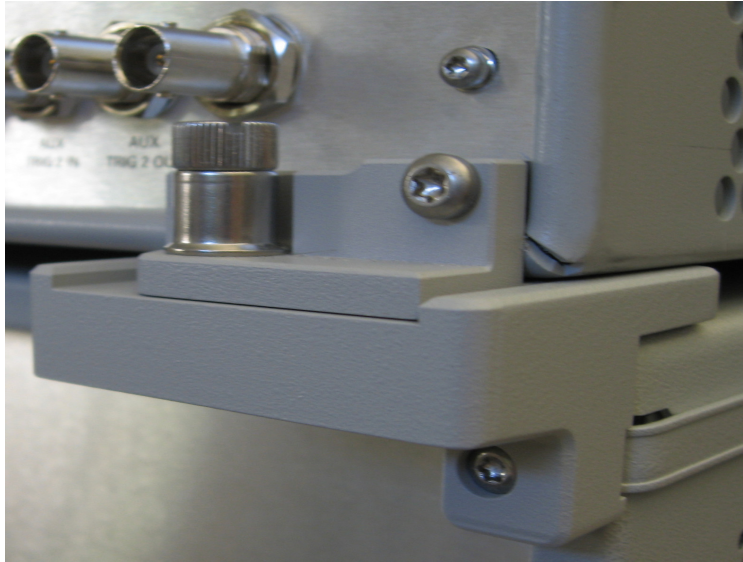


Figure 8 Locking the Analyzers



- Secure the PNA-X's lower locking feet to the Local Converter upper locking feet, using the spring-loaded screws. If the network analyzer's lower locking feet are not aligned with the screw holes in the Local Converter's upper locking feet, loosen the screws securing the feet to the instrument slightly to align and tighten.

Figure 9 **Locking Feet Screws**



NOTE The Lock-Feet kit (U3021-60004) includes hardware to attached the network analyzer to the Local Converter. Refer to [“Mounting Kits” on page 4](#) and [“Contacting Agilent” on page 46](#) for ordering information.

- PNA-X - N5242-20211 (right foot), N5242-20210 (left foot) and 0515-1619 (screw).
- Local Converter - N5242-20208 (right foot), N5242-20209 (left foot) and 0515-2317 (screw) for use with N5242A.

RF Interface Cable Connections

Figure 16 illustrates the Local Converter configuration and cable connections to the PNA-X. Refer to the U3020AY04 User’s Guide (U3020A-90009) for connection of the Remote Converter module to the U3020AY03.

1. Remove the following three jumpers on the PNA-X Port 1 access ports.
2. Connect the RF interconnect cables from the PNA-X to the Local Converter front panel. As you are connecting each cable, torque to 8 in-lb. Refer to Table 6 and Figure 16.

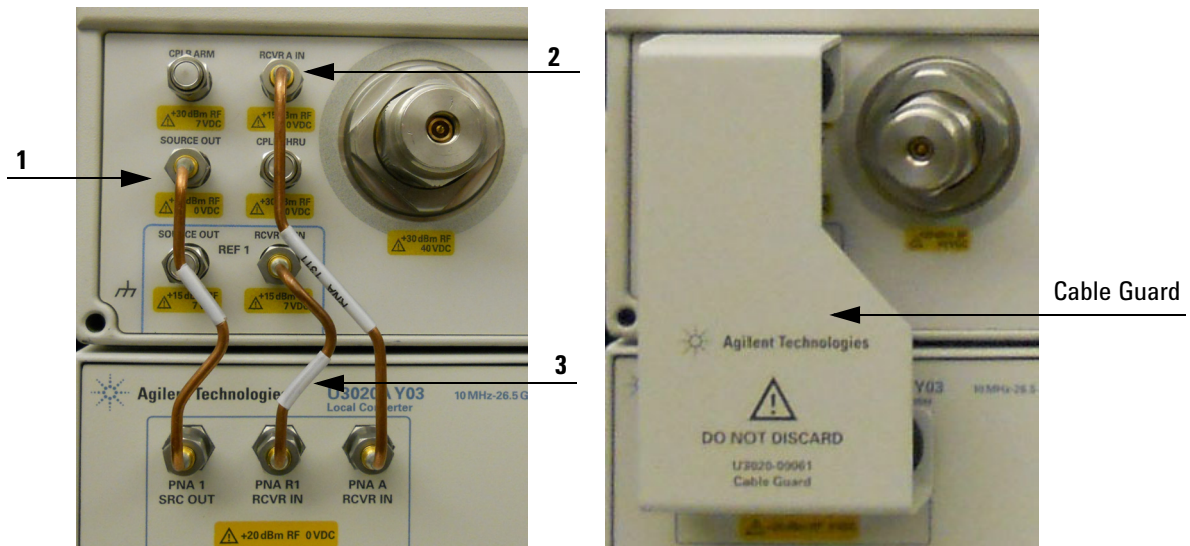
CAUTION Over torque will cause damage to the Local Converter and may cause connectors to spin or become loose.

Table 6 N5242A RF Interface Cable Connection (Option F1P & 1SR)

Numeric Order	RF Cables (Opt 026)	From: PNA-X	To: Local Converter
1	U3020-20140	Source Out	PNA 1 SRC Out
2 ¹	U3020-20142	RCVR A IN	PNA A RCVR IN
3	U3020-20141	RCVR R1 IN	PNA R1 RCVR IN

1. RF cable (U3020-20142) is not used with Option 1SR.

Figure 10 PNA-X RF Interface Cable Connection (Option F1P)



3. Attach Port 1 cable guard (U3020-00061) to the PNA-X and Local Converter.

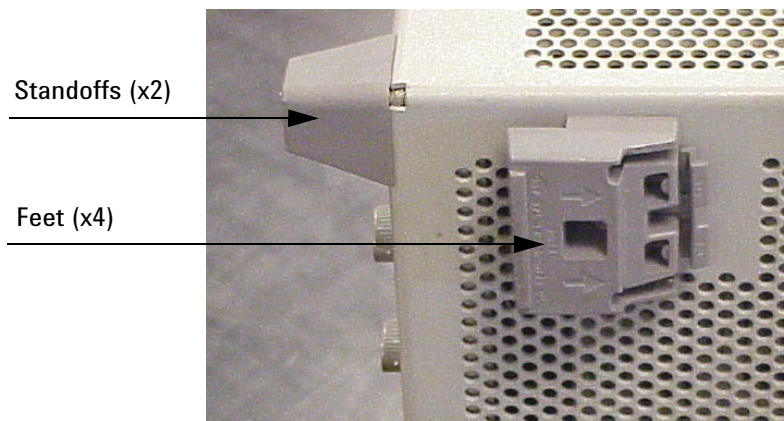
System Setup with N5245A

Preparing the Network Analyzer

Refer to the following kit for your specific analyzer.

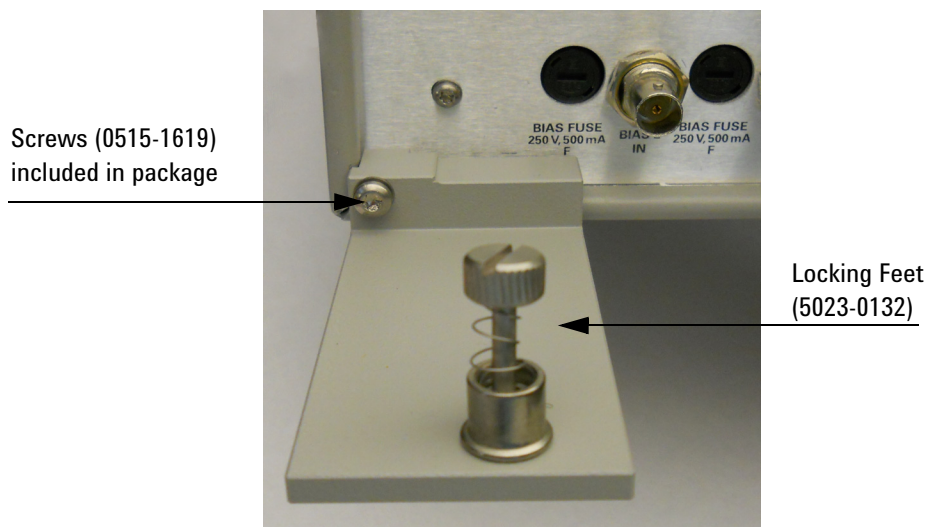
- The kit (U3021-60005) includes to interface the Local Converter to a N5245A.
1. Remove the feet from the bottom of the network analyzer.
 2. Remove the 2 lower standoffs and screws (0515-1619) from the rear panel on the network analyzer.

Figure 11 Rear Bottom Feet



3. Install the two rear locking feet (5023-0132) onto the PNA-X, using the screws (0515-1619), where the standoffs were removed.

Figure 12 Install Locking Feet on PNA-X



4. Remove the two upper feet from the Local Converter and install the two locking feet N5242-20206 (right foot) and the N5242-20207 (left foot) using two screws (0515-2317) as shown in [Figure 13](#).
5. Place the PNA-X on top of the Local Converter. Ensure that the front frame of the PNA-X is positioned slightly forward of the locks that are attached to the Local Converter. Slide the PNA-X back so the locks engage the front frame of the analyzer as shown in [Figure 14](#).

Figure 13 Rear Panel N5245A with U3020AY03

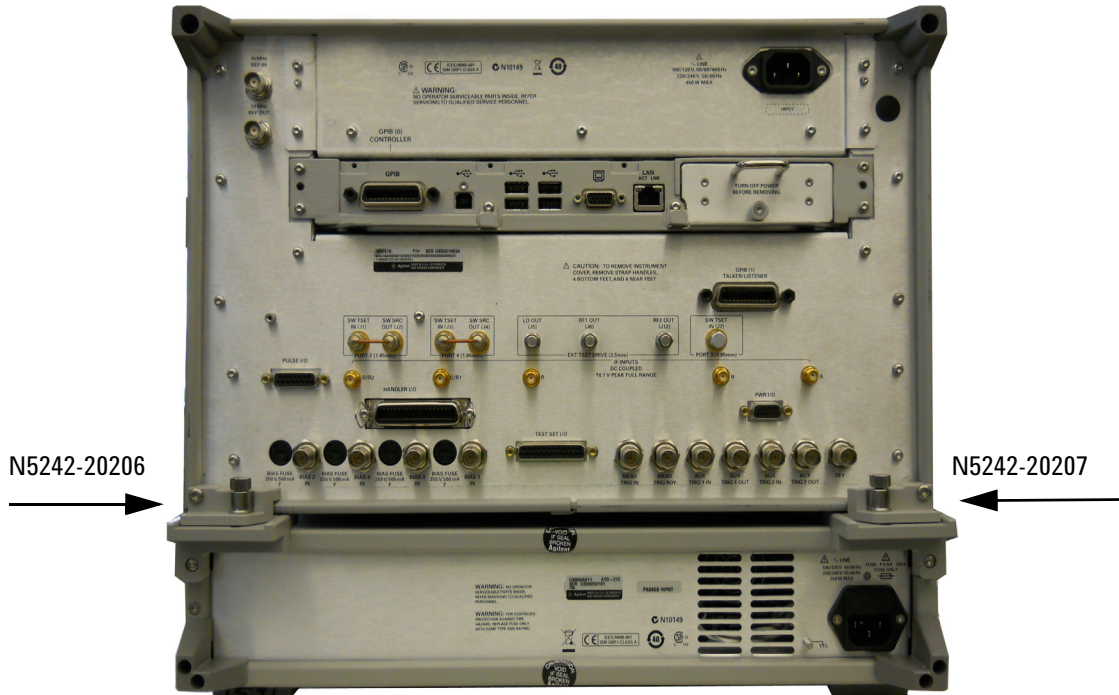
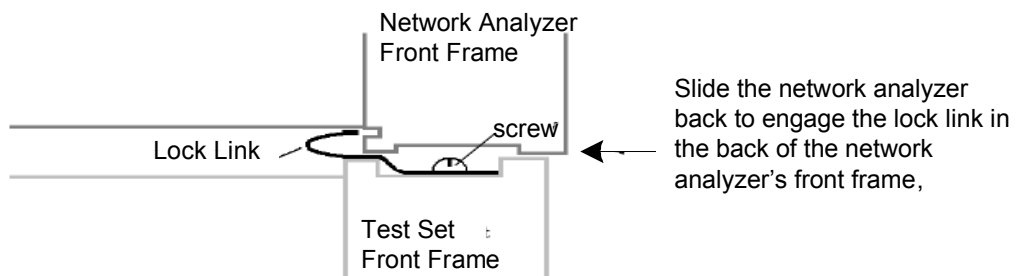


Figure 14 Locking the Analyzers



- Secure the PNA-X's lower locking feet to the Local Converter upper locking feet, using the spring-loaded screws. If the network analyzer's lower locking feet are not aligned with the screw holes in the Local Converter's upper locking feet, loosen the screws securing the feet to the instrument slightly to align and tighten.

Figure 15 **Locking-Link Screws**



NOTE

The Lock-Feet kit (U3021-60005) includes hardware to attached the PNA-X to the Local Converter. Refer to [“Mounting Kits” on page 4](#) and [“Contacting Agilent” on page 46](#) for ordering information.

- PNA-X - 5023-0132 (kit includes locking feet and screws)
 - Local Converter - N5242-20206 (right foot), N5242-20207 (left foot) and 0515-2317 (screw) for use with N5242A.
-

RF Interface Cable Connections

Table 7 and Figure 16 illustrate the Local Converter cable connections and configuration to the PNA-X. Refer to the U3020AY04 User’s Guide (U3020A-90009) for connection of the Remote Converter module to the Local Converter.

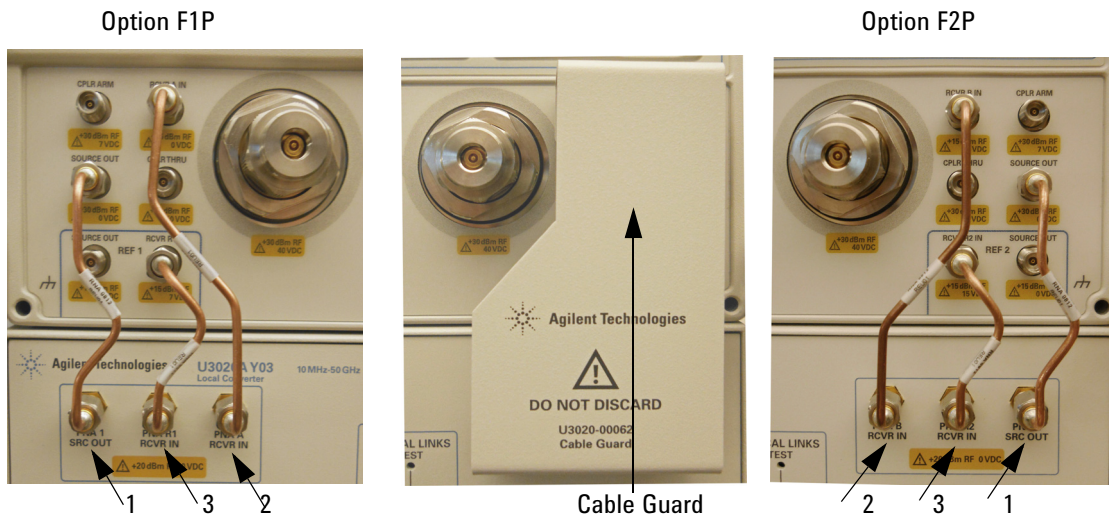
1. Remove the following three jumpers on the PNA-X Port 1 access ports. If your instrument has Option F2P, remove the jumpers from the PNA-X Port 2 access ports.
2. Connect the RF interconnect cables from the PNA-X to the Local Converter front panel in order listed. As you are connecting each cable, torque to 8 in-lb.
3. Attach Port 1 (U3020-00061) and Port 2 cable guards (U3020-00062) to the PNA-X and Local Converter.

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

Table 7 N5245A RF Interface Cable Connection

Numeric Order	RF Cables (Opt 050)	From: PNA-X	To: Local Converter
Option F1P			
1	U3020-20183	Source Out	PNA 1 SRC Out
2	U3020-20185	RCVR A IN	PNA A RCVR IN
3	U3020-20184	RCVR R1 IN	PNA R1 RCVR IN
Option F2P			
1	U3020-20183	Source Out	PNA 2 SRC Out
2	U3020-20184	RCVR B IN	PNA B RCVR IN
3	U3020-20186	RCVR R2 IN	PNA R2 RCVR IN

Figure 16 PNA-X RF Interface Cable Connection

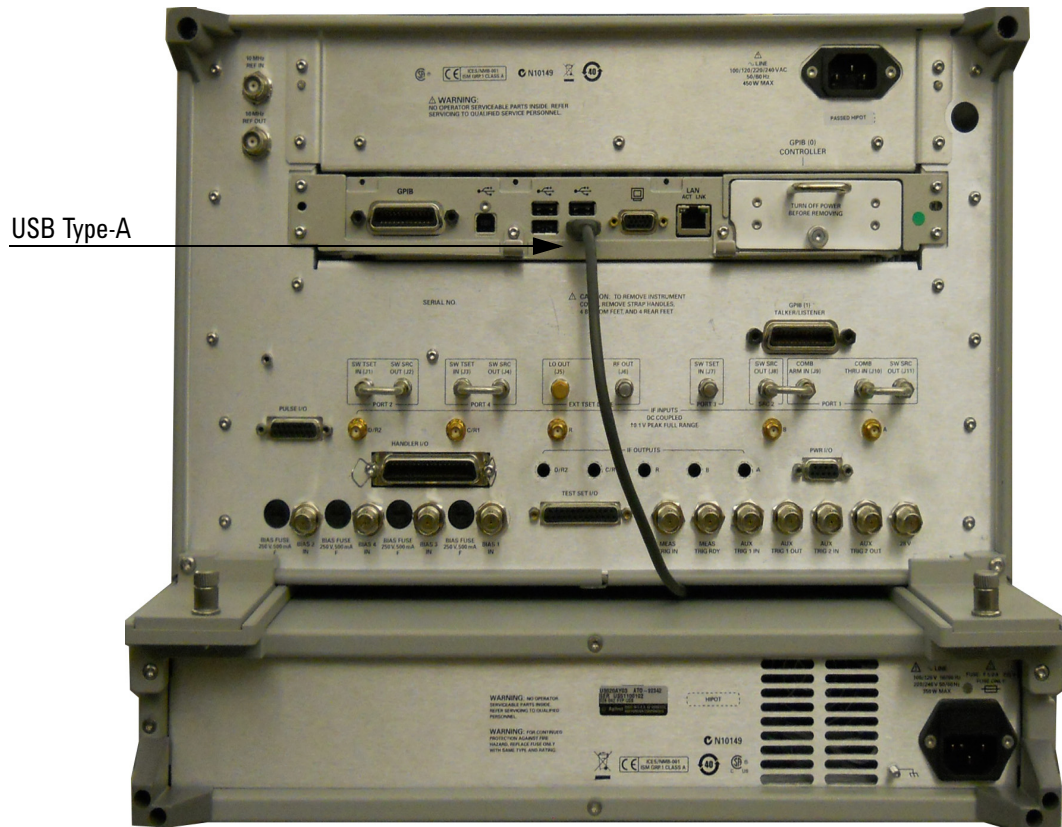


USB Cable Connections

Figure 1 on page 2 and Figure 17 illustrates the cable configuration of the Local Converter to the rear panel of the PNA-X. The PNA-X has front panel USB connections that can be used as well.

1. Connect the USB Type-A connector from the PNA-X to the USB Type-B on the Local Converter.

Figure 17 Rear Panel PNA-X with U3020AY03



Using the U3020AY03 with PNA-X

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

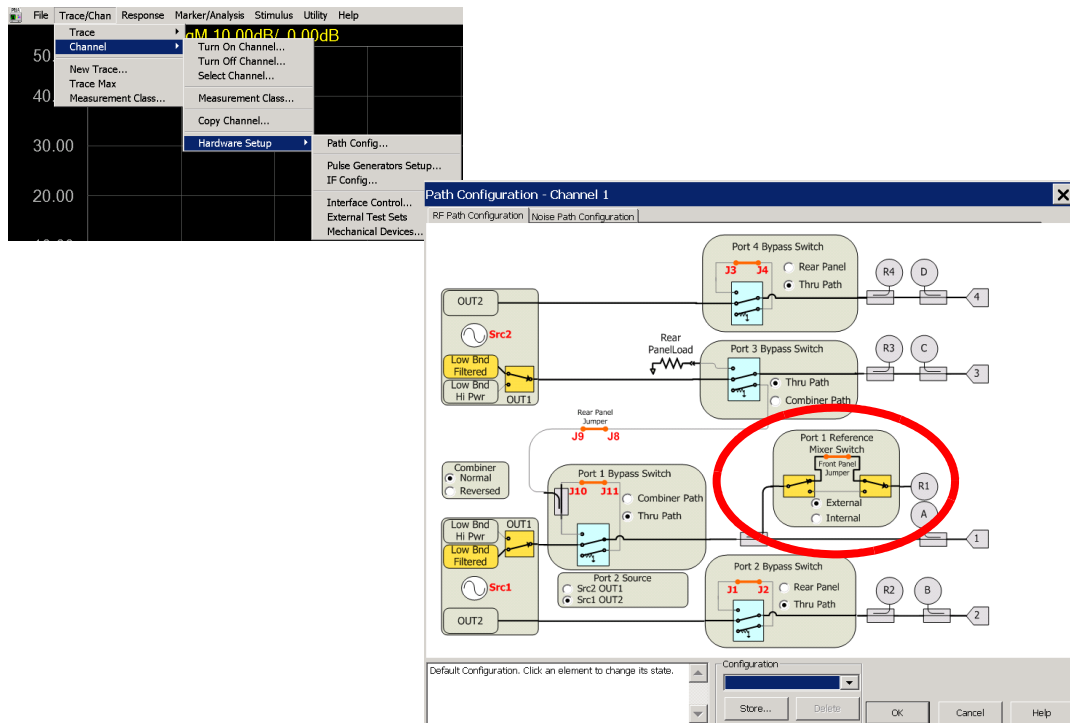
CAUTION This instrument has auto-ranging line voltage input, be sure the supply voltage is within the specified range.

This section describes how to operate the Local Converter with the PNA-X. The Local Converter does not require any control signals. Power levels are controlled by the PNA-X.

Setup of Port 1 REF RCVR for Remote Mode

1. On the PNA-X select **Channel > Hardware Setup > Path Config...**
2. This configuration can be saved by selecting **Store** and naming the configuration.

Figure 18 Port 1 Reference Mixer Switch



Operational Check

This operational check is to confirm the Local Converter's performance. The operation verification limits provided ensure that your Local Converter and PNA-X are operating properly. Refer ["Non-RF Failures" on page 39](#) to ensure the Local Converter is working correctly before returning it for repairs.

Verification Limits

Specifications for the Local Converter are typical. System performance for the Local Converter and PNA-X are only characteristic and intended as non-warranted information. A functional certificate is provided for the Local Converter only.

It is recommended that you return your instrument to Agilent Technologies for servicing or repair if the Local Converter 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 8 **Operation Verification Limit**

Connections	10 MHz to 26.5 GHz	26.5 GHz to 50 GHz
SCR OUT to REF/TEST RCVR IN S21 THRU Gain	≥ -5 dB	≥ -13 dB
REF <> TEST RCVR S21 THRU ISOLATION	≤ -80 dB	≤ -65 dB
SRC OUT MATCH S11	≤ 10 dB	≤ 8 dB
REF RCVR IN MATCH S22	≤ 8 dB	≤ 5 dB
TEST RCVR IN MATCH S22	≤ 8 dB	≤ 5 dB

Equipment Required

The Agilent U3020AY03 requires that the user be familiar with the equipment and how to perform a full 2-Port calibration with the PNA-X.

Table 9 Equipment List

Description	Qty
N5242A or E8364B Network Analyzer (50 GHz analyzer)	1
RF cables (2.4 mm male connectors)	2
2.4 mm adapter (female to female)	3
Fiber Optic cable (E2000/APC/SM)	1

Table 10 Equipment List

Description	Qty
Option 026:	
N5242A or E8362C Network Analyzer (26.5 GHz)	1
N4691B 3.5 mm Ecal Module (female to female)	1
RF Cables (3.5 mm male connectors)	2
3.5 mm Short (female)	1
Option 050:	
N5242A or E8364C Network Analyzer (50 GHz)	1
N4693A 2.4 mm Ecal Module (female to female)	1
RF Cables (2.4 mm male connectors)	2
2.4 mm Adapter (female to female)	1
All Options:	
E2000/APC to E2000/APC Single Mode Optical Cable	1
N1914A EMP Power Meter	1
E4413A E Series Power Sensor	1

Operational Check Procedure

Install the instrument so that the detachable power cord is readily identifiable and is easily reached by the operator.

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 Local Converter is not connected to the PNA-X if you are performing a PNA-X Operator's Check. The PNA-X will indicate false failures if the Local Converter is connected.

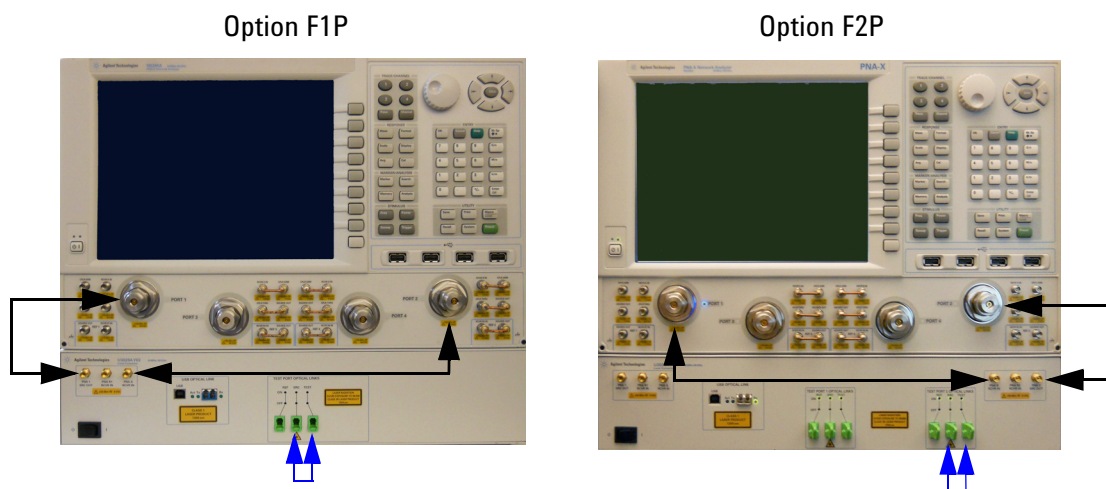
Preparing the PNA-X

1. Turn on the Local Converter.
2. Select [**Preset**].
3. Select **Response > Avg > IF Bandwidth > 100 Hz > OK**.
4. Select **Stimulus > Power > Power**, enter **-5 dBm**.
5. Select **Stimulus > Sweep > Number of Points, 401**.
6. Connect the ECal module to an available PNA-X USB port on the front or rear panel.
7. Allow the Local Converter and PNA-X to warm up for a minimum of 30 minutes.
8. Perform a power calibration at the end of the reference cable on Port 1 of the PNA-X. Select **Cal > Power Cal > Source Cal**.
9. Perform a Full 2-Port calibration.

Procedure

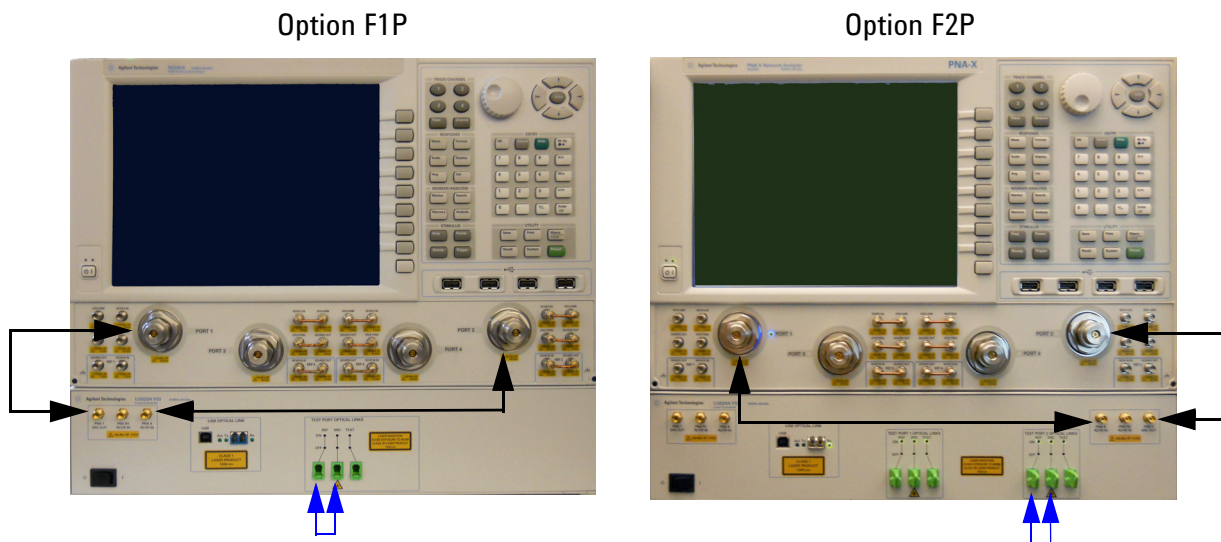
- Option F1P & 1SR connect the PNA-X Port 1 to the Local Converter's PNA 1 SRC OUT, and Port 2 to the Local Converter's PNA A RCVR IN. If your instrument includes Option F2P, connect PNA Port 1 to the Local Converter's PNA 2 SRC OUT and PNA Port 2 to the Local Converter's PNA B RCVR IN. Refer to [Figure 19](#). For Option 1SR proceed to [step 7](#).
- Connect the E2000/APC fiber optic cable from the SRC and TEST optical ports on the front panel of the Local Converter.
- Measure the S21 S-Parameter for SRC to TEST. Refer to [Table 8, "Operation Verification Limit,"](#) on [page 22](#) for specifications.
 - S21 - SRC OUT to TEST RCVR IN S21 THRU Gain, refer to [Figure 23 on page 29](#).
 - S11 - SRC OUT MATCH S11. See [Figure 24 on page 29](#).
 - TEST RCVR IN MATCH S22. See [Figure 25 on page 30](#).

Figure 19 SRC to TEST S-Parameter



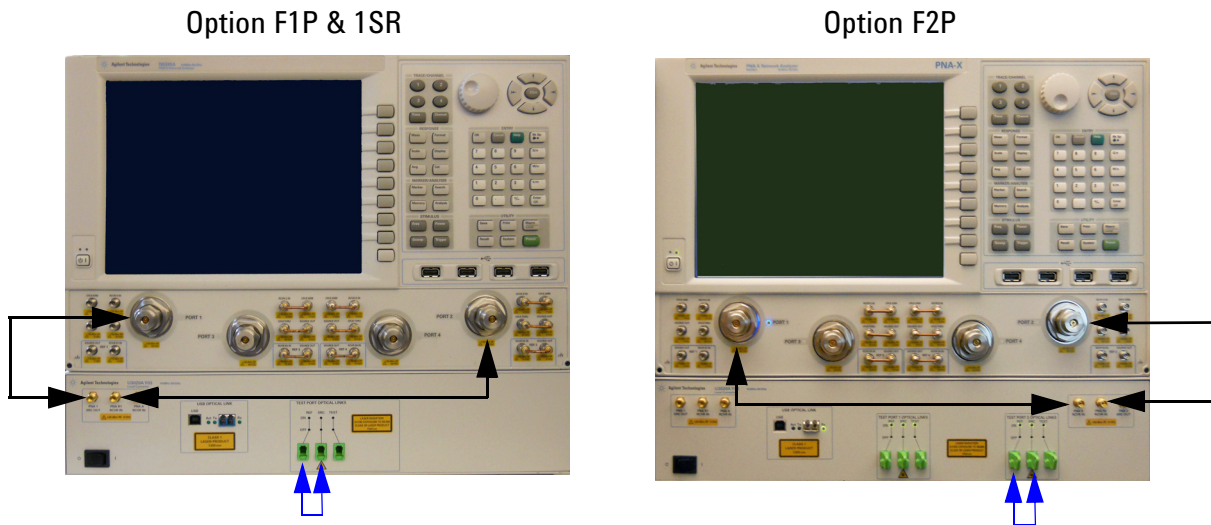
4. Normalize the S21 response.
5. Reconnect the E2000/APC fiber optic cable from the Local Converter's SRC and REF optical ports. If your instrument includes Option F2P, connect the Local Converter's Port 2 as shown in [Figure 20](#).
6. Measure the following S-Parameters for SRC to TEST. Refer to [Table 8, "Operation Verification Limit,"](#) on page 22.
 - S21 - REF <> TEST RCVR S21 THRU ISOLATION, see [Figure 26](#) on page 30.

Figure 20 Test to REF Isolation



7. Connect PNA-X Port 1 to the Local Converter's PNA 1 SRC OUT and Port 2 to the Local Converter's PNA A RVCR IN. If your instrument includes Option F2P, connect PNA Port 1 to the Local Converter's PNA 2 SRC OUT, and PNA Port 2 to the Local Converter's PNA B RCVR IN as shown in [Figure 21](#).
8. Connect the E2000/APC fiber optic cable from the REF and TEST optical ports on the front panel of the Local Converter.
9. Measure the following S-Parameters for SRC to TEST. Refer to [Table 8, "Operation Verification Limit,"](#) on [page 22](#) for specifications. This completes the verification procedure for Option 1SR.
 - S21 - SRC OUT to TEST RCVR IN S21 THRU Gain, see [Figure 23 on page 29](#).
 - S11 - SRC OUT MATCH S11, see [Figure 24 on page 29](#).
 - REF RCVR IN MATCH S22, see [Figure 25 on page 30](#).

Figure 21 SRC to REF S-Parameter



10. Normalize the S21 response.
11. Reconnect the E2000/APC fiber optic cable from the Local Converter's SRC and TEST Optical ports. If your instrument includes Option F2P connect the Local Converter's Port 2 as shown in [Figure 22](#).
12. Measure the following S-Parameters for SRC to TEST. Refer to [Table 8, "Operation Verification Limit,"](#) on [page 22](#) for specifications.
13. S21 to REF <> TEST RCVR S21 THRU Isolation, see [Figure 26 on page 30](#).

Figure 22 REF <> TEST Isolation

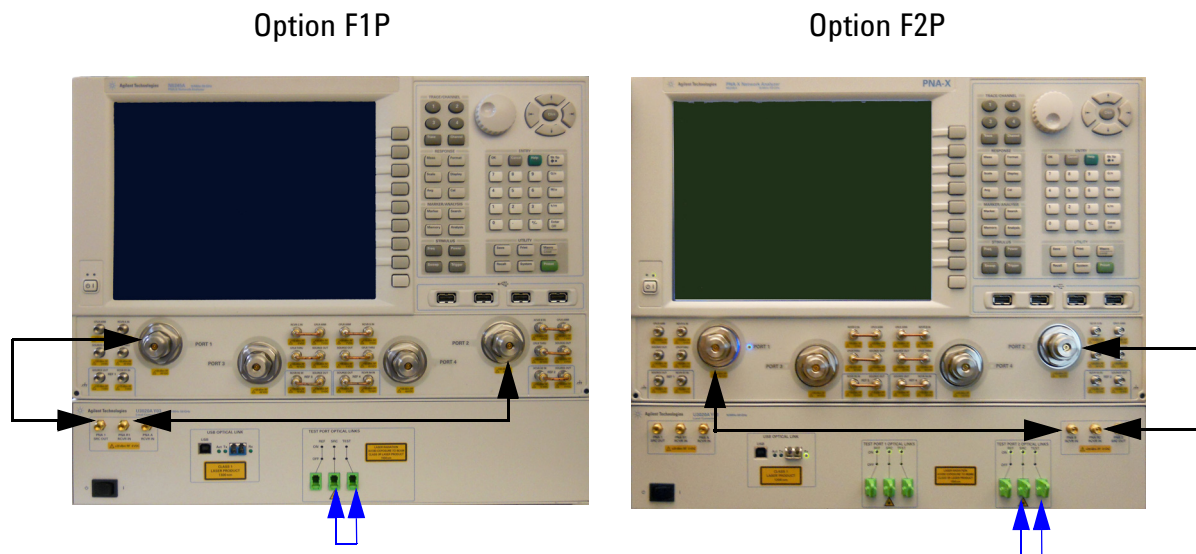


Figure 23 SRC OUT to REF/TEST RCVR IN S21 THRU Gain

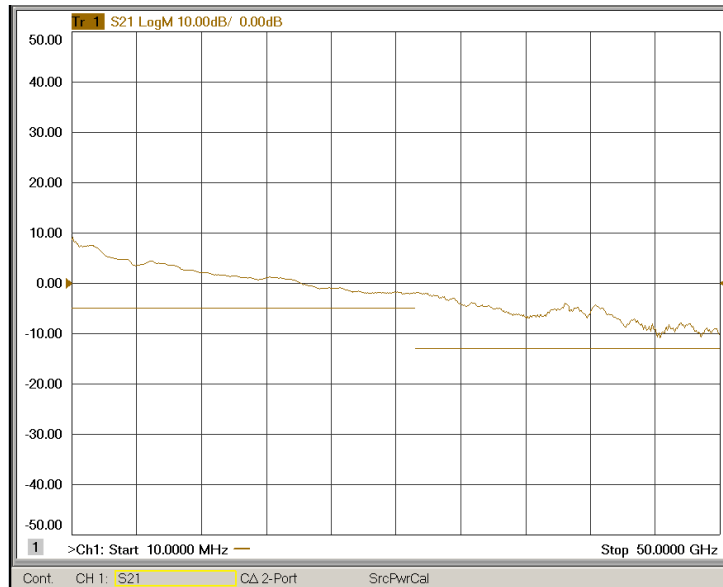


Figure 24 SRC OUT MATCH S11

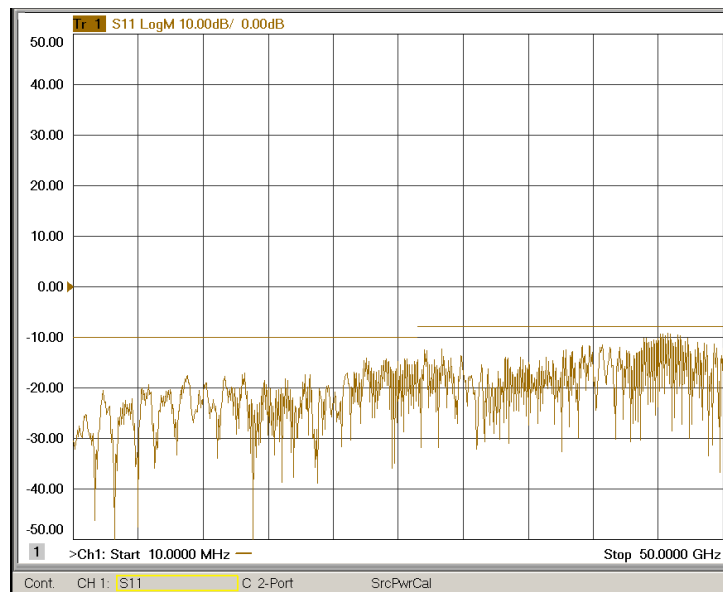


Figure 25 REF/TEST RCVR MATCH S22

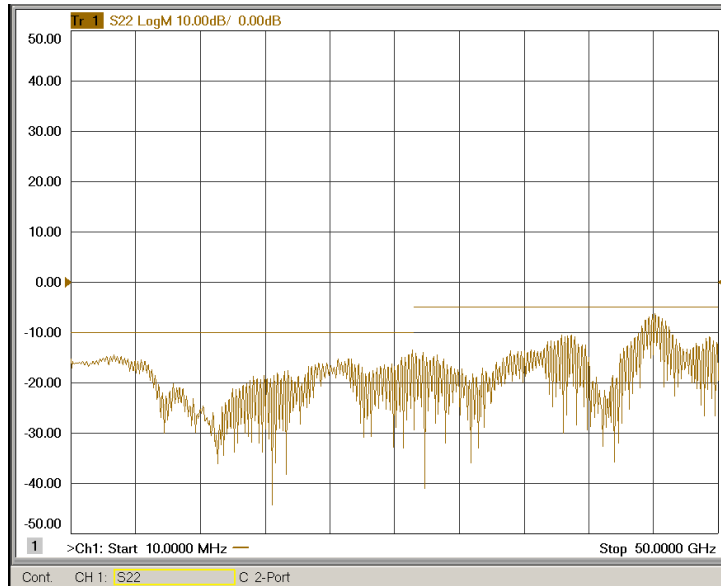
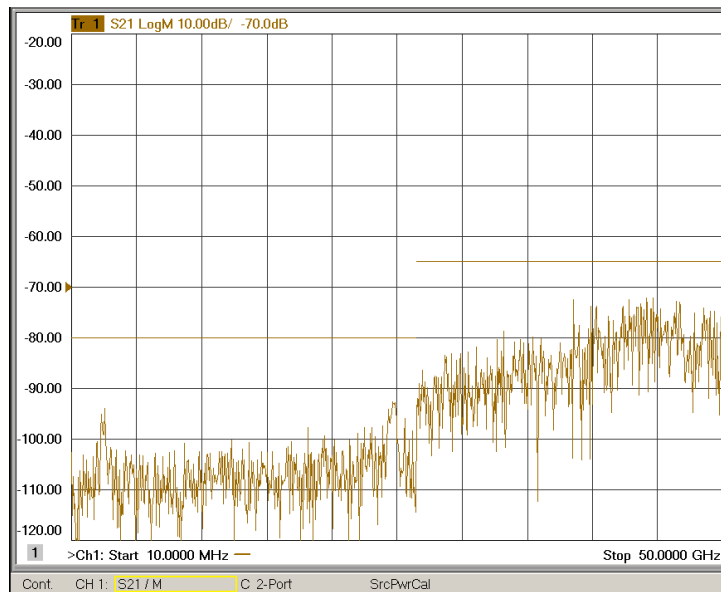


Figure 26 REF <> TEST RCVR S21 Isolation



Laser Safety Information

Class 1

- Wavelength: 1300 nm
- Power: < 1.0 mW Max

The Class 1 Laser produces invisible radiation in the 1300 nm range. The power level and classification are in compliance to IEC 60825-1:2007.

NOTE The Class 1 Laser is safe to operate under reasonably foreseeable conditions. The user of this instrument is expected to have experience in safely operating products containing lasers. The FDA has certified this laser to be “eye safe.”

Figure 27 Class 1 Laser Label



Class 3R

The operation of the Class 3R laser takes place after an 8 second time delay when the front panel Standby switch is placed from Standby to ON. After 8 seconds, the SRC LED on the TEST PORT OPTICAL LINKS will switch from OFF (amber) to ON (green), the REF and TEST LEDs are ON (green). Should the indicating light fail to either energize ON or OFF the instruments should be removed from service and returned to Agilent for repair. The indicating lights are used to advise the operator that power has been applied to the laser and is now operable.

- Wavelength: 1550 nm
- Power: < 25 mW Max

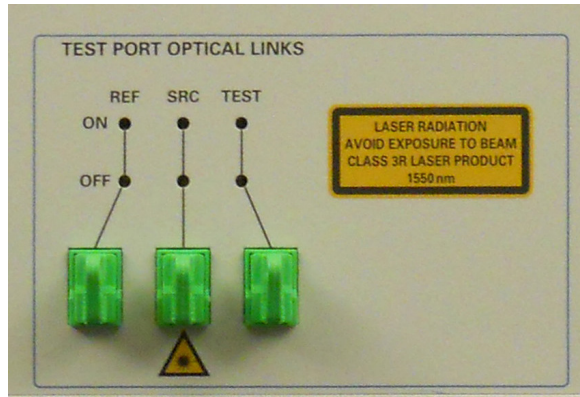
The Class 3R Laser produces invisible radiation in the 1550 nm range. The power level and classification are in compliance to IEC 60825-1:2007.

Figure 28 Class 3R Laser Label



The Class 3R laser utilizes spring loaded attenuator, or shutter stops to effectively terminate laser radiation when the optical interface cables are inserted and removed. When the interface cables are removed the attenuators stop are designed to snap into the closed position, effectively terminating the laser radiation. Should a spring fail the shutter is designed to gravity close. In the event the attenuator, or shutter stop fails to snap into the closed position, the instrument should be removed from service and immediately repaired by a qualified individual, or return to Agilent for service.

Figure 29 Shutter Stop

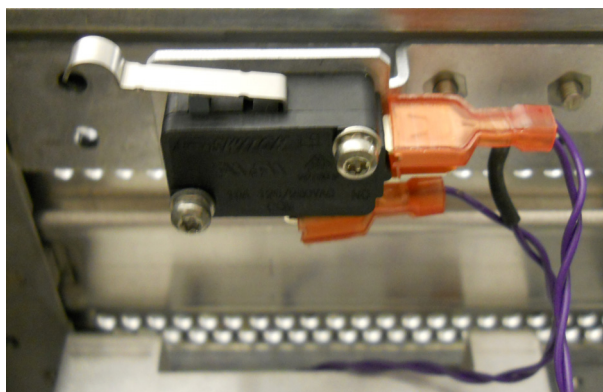


The U3020AY03 contains an interlock attached to the inside of the top cover to protect the user in the event the fiber were to become severed from the connector or attenuator stop. Removal of the top cover will de-energize the instrument to standby and remove power from the Class 3R Laser.

Figure 30 Class 3R Interlock Label



Figure 31 Interlock - Top and Bottom Covers



Service Information

The U3020A Y03 Local Converters contain a safety interlock to prevent removal of an instrument panel or cover, and allow the Class 3 laser to remain in operation should a fiber connection fail internal to the instrument. The interlock is arranged internal to the instrument chassis and in positive contact with the instrument's top cover. Should the top cover be removed while the instrument's front panel switch is in the ON position the laser will be ENERGIZED. If the front panel switch is in the Standby position the Class 3 Laser will remain Off. The interlock switch is a positive engagement switch. In the event the spring loading is lost, the switch will remain in the "failed" position and the Class 3 laser de-energized. Refer to [Table 11, "Instrument Markings,"](#) on page 43.

The U3020A Y03 which contains a single Class 3R Laser that require that the top cover be equipped with the required interlock switch. Defeating the interlock and placing the front panel switch from Standby to ON will result in the Class 3R Laser becoming energized.

Refer to ["Contacting Agilent"](#) on page 46.

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

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

WARNING **For continued protection against fire hazard, replace fuses, and or circuit breakers only with same type and ratings. The use of other fuses, circuit breakers or materials is prohibited.**

Theory of Operation

The following is a description of the operation of the Local Converter. Reference the Local Converter block diagrams beginning on [page 34](#). This section assumes the user has a general understanding of RF/microwave components.

Electrical to Optical (E/O) Path

The Local Converter PNA 1/2 SRC OUT amplifies and then modulates the PNA-X access port, Port 1 or Port 2 microwave/RF Source Out by a electrical to optical (E/O) modulator. The modulator connects to a CW 1540 nm laser that provides the optical carrier signal for transmission (Tx) over optical fiber. The PNA-X microwave/RF source is then modulated on to the optical carrier signal at the 1540 nm wavelength. The modulator is biased so that modulated signal produces a non-distorted sinewave for transmission and provides the optical SRC Source Output for remote operation.

Optical to Electrical (O/E) Path

The Local Converter also receives an optical signal through the TEST and REF (Rx) ports. These optical signal is routed to optical detector that demodulates the optical signal back to microwave/RF. These are signals amplified, then returned to the PNA-X A/B and REF 1/2 access port receivers.

Optical Modulator

The optical modulator (U3020-80017) modulates a microwave/RF signal onto an optical carrier.

Optical Detector

The optical detector (U3020-80018) demodulates the microwave/RF signal from the optical carrier.

Laser

The laser (U3020-80015) provides the optical carrier.

Power Supply

The power supply (0950-5376) converts the AC line voltages to DC. The AC line voltage (100 to 240 V @ 50/60 Hz) is provided from the line module on the rear panel. The power supply ± 12 Vdc will be used to bias the two amplifiers used in the Local Converter.

Interface Board

The Interface board (U3020-63139) provides the biasing for the amplifiers, optical modulators, lasers, optical detectors, and modulator, laser, and LED PCAs.

Laser Board

The Modulator Bias board (U3020-80016) provides the bias to the Laser (U3020-80015).

Modulator Bias Board

The Modulator Bias board (U3020-80017) provides the bias to the optical modulator (U3020-80014).

LED Board

The LED board provides the indicator status of the Optical Ports.

Option USB

The Option USB provides the PNA-X USB to fiber bit driver. Through the Local Converter the USB to fiber bit driver transmits and receives optical signals from a remote USB HUB to fiber bit driver to connect USB peripherals. The remote USB HUB to fiber bit driver is not provided with the Local Converter.

Figure 32 Options Y04 & Y03 with N5242A F2P System Block Diagram

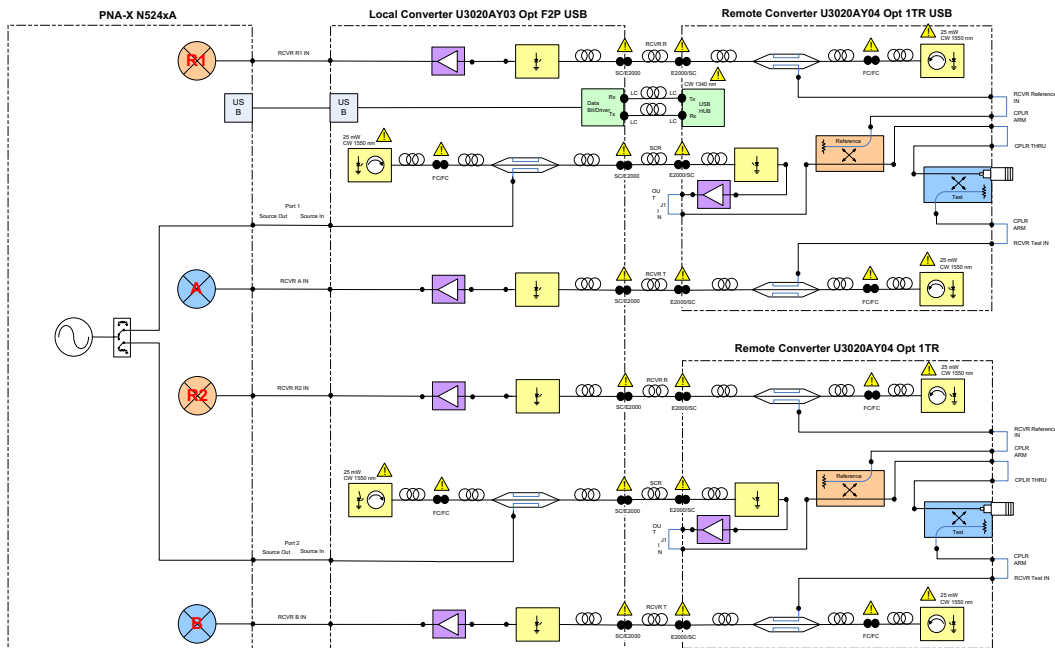


Figure 33 Options Y03 F2P System Block Diagram

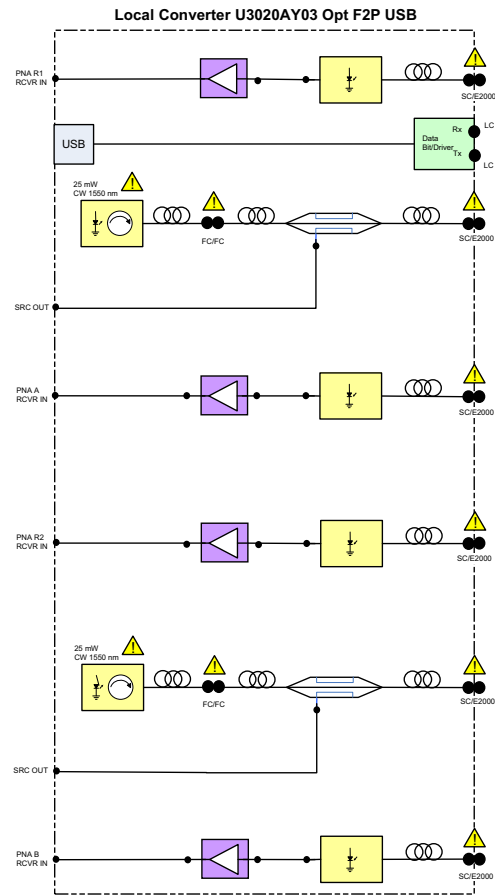


Figure 34 Options Y04 & Y03 with N5242A F1P System Block Diagram

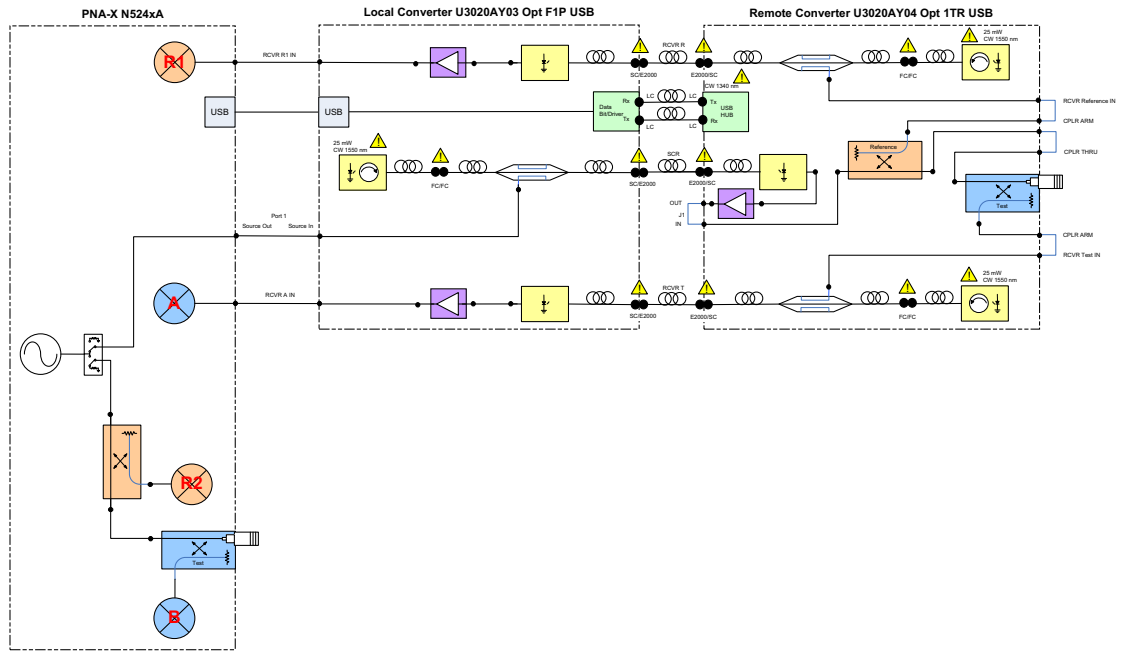


Figure 35 U3020AY03 F1P Block Diagram

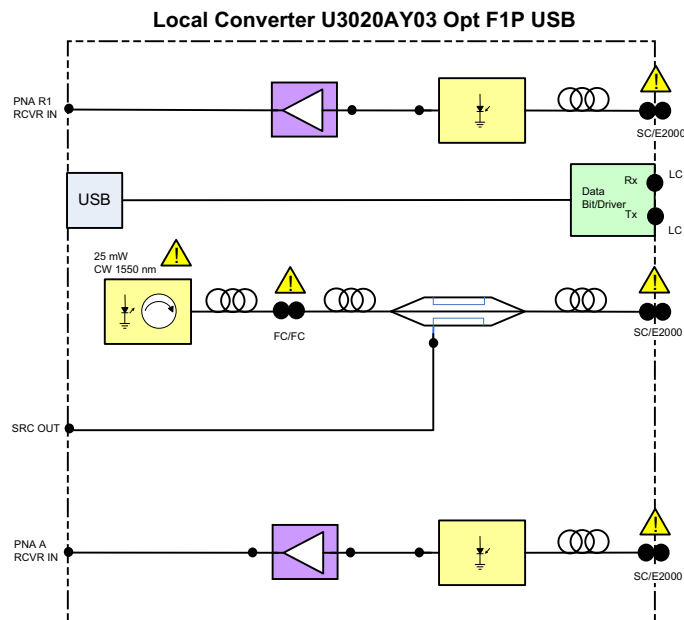


Figure 36 Options Y04 & Y03 with N5242A 2TR System Block Diagram

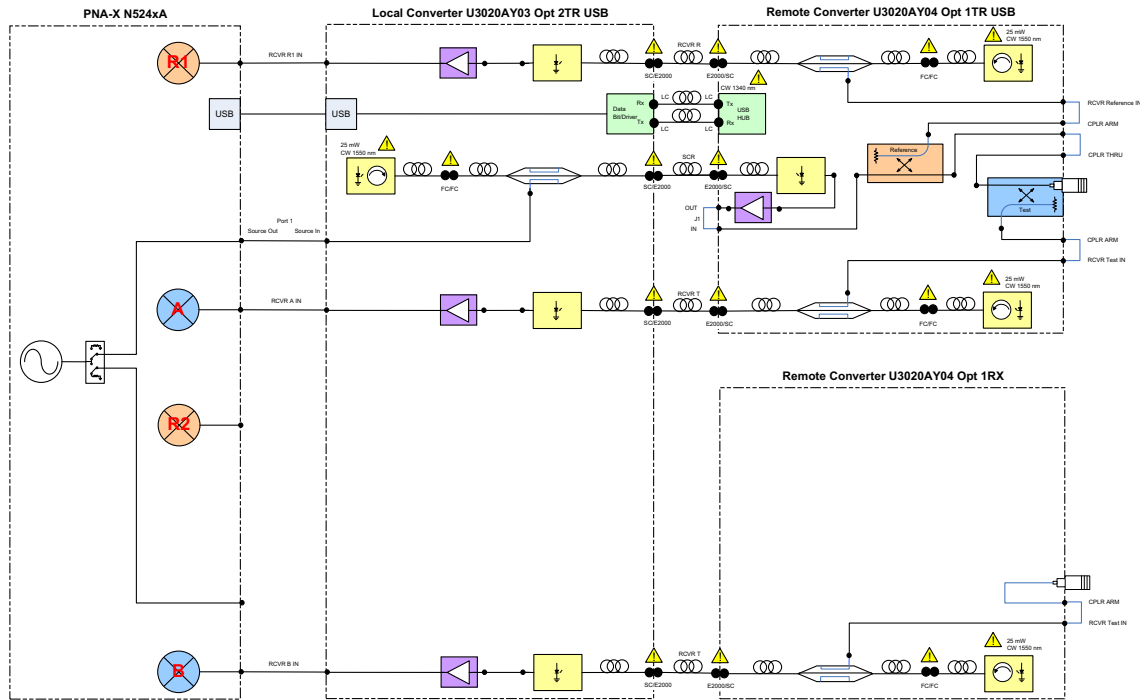
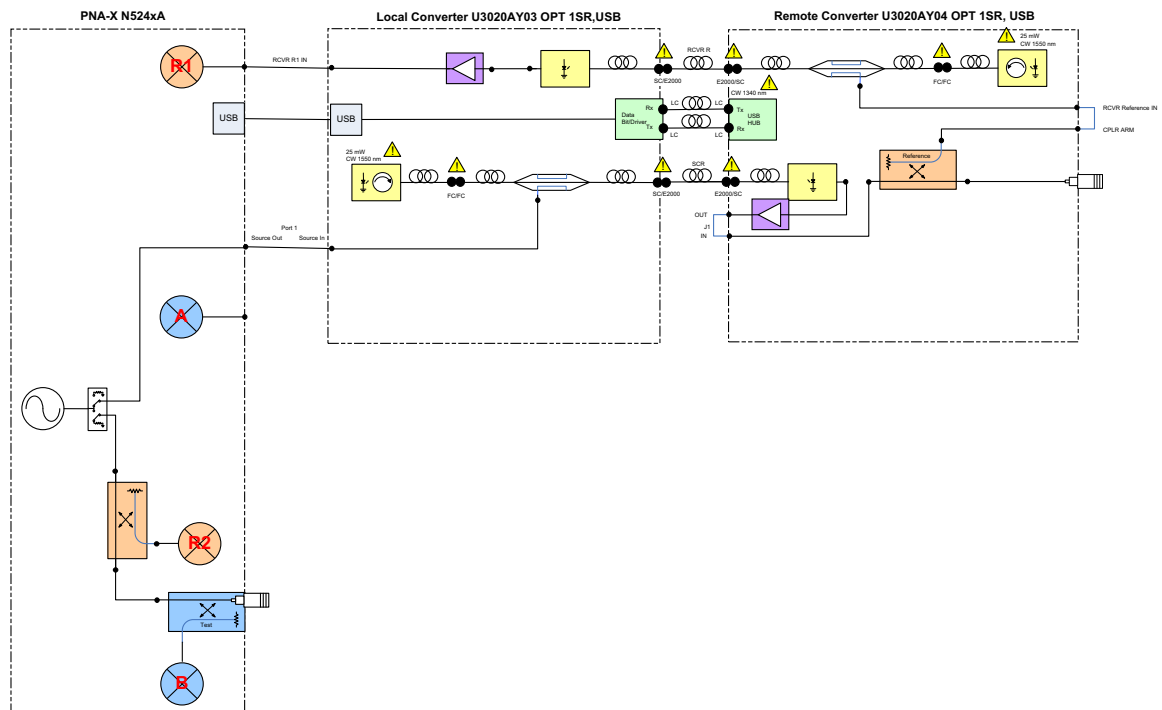


Figure 37 Options Y04 & Y03 with N5242A 1SR System Block Diagram



Troubleshooting

If the U3020AY03 is not operating properly, use the following procedures to isolate and repair the failure.

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. Refer to “[Shipping Your Instrument to Agilent for Service or Repair](#)” on page 46.

Refer to the following procedures for type of problem encountered. It is recommended that a qualified service technician perform the following procedures.

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

Non-RF Failures

1. Verify that the front panel Power Switch is operational.
2. 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. Confirm the instrument AC line module fuse is operational. See [Figure 4 on page 11](#).
 - c. AC line fuses; remove the bottom cover of the instrument. Near the rear panel are two fuse holders, remove the fuses and verify that they are operational.
 - d. Set the front panel switch to the Standby position. The fans (power supply and instrument) are Off.
 - e. Set the Standby Switch to the On position. The fans (power supply and instrument) are operational.

Safety and Regulatory Information

Introduction

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

This product has been designed and tested in accordance with 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.

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 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 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.

General Safety Considerations

Cautions

Cautions applicable to this instrument.

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 2.

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

Connector Care and Cleaning Precautions

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

WARNING To prevent electrical shock, disconnect the “Agilent Technologies U3020AY03” 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.

Warnings

Warnings applicable to this instrument.

WARNING **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.**

WARNING **This is a Safety Class 1 product (provided with a protective earth 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.**

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

WARNING **No user serviceable parts. The opening of covers or removal of parts is likely to expose the user to hazardous voltages. Refer all servicing to qualified personnel.**

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.**

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).**

Regulatory Information

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

Table 11 Instrument Markings










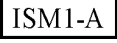










	The instruction documentation symbol. The product is marked with this symbol when it is necessary for the user to refer to the instructions in the documentation.
	This symbol indicates that the instrument requires alternating current (ac) input.
	This symbol indicates separate collection for electrical 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.
	This is a marking to indicate product compliance with the Canadian Interference-Causing Equipment Standard (ICES-001).
	Direct Current
	Laser Class 1 label denoting the wavelength.
	Class 3R Laser warning label. Denoting invisible laser radiation and wavelength.
	Laser Class 3R warning interlock label. Do not defeat interlock.
	Laser Radiation
IP 2 0	The instrument has been designed to meet the requirements of IP 2 0 for egress and operational environment.

Table 11 Instrument Markings

 N10149	This is a required mark signifying compliance with an EMC requirement. The C-Tick mark is a registered trademark of the Australian Spectrum Management Agency.
	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.
	Korean Certification (KC) mark. Must include the marking's identifier code (Agilent product specific) as follows: KCC-REM-ATi-WNANALYZERF01

EMC Information

Complies with European EMC Directive 2004/108/EC

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

Acoustic Noise Emission

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

Safety

Complies with European Low Voltage Directive 2006/95/EC

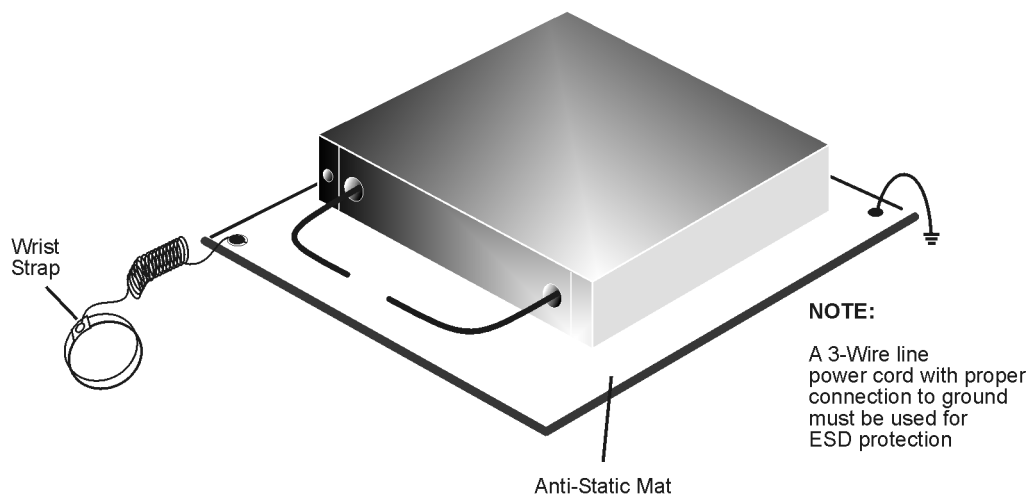
- IEC/EN 61010-1, 2nd Edition
- Canada: CSA C22.2 No. 61010-1-04
- USA: UL std no. 61010-1, 2nd Edition
- Acoustic statement (European Machinery Directive 2022/42/EC, 1.7.4.2U)

Electrostatic Discharge Protection

Protection against electrostatic discharge (ESD) is essential while removing assemblies from or connecting cables to the network analyzer. 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 (9300-0797) in front of your test equipment.
- *always* wear a grounded wrist strap (9300-1367) with grounding cord (9300-0980), connected to a grounded conductive table mat, having a 1 MW resistor in series with it, when handling components and assemblies or when making connections.
- *always* wear a heel strap (9300-1126) when working in an area with a conductive floor. If you are uncertain about the conductivity of your floor, wear a heel strap.
- *always* ground yourself before you clean, inspect, or make a connection to a static-sensitive device or test port. You can, for example, grasp the grounded outer shell of the test port or cable connector briefly.
- *always* ground the center conductor of a test cable before making a connection to the analyzer test port or other static-sensitive device. This can be done as follows:
 1. Connect a short (from your calibration kit) 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 38 **ESD Protection Setup**



ku310b

Agilent Support, Services, and Assistance

Service and Support Options

Refer to the standard product for the service warranty information. The warranty includes repair or replacement of defective components. Most repairs require that the defective component be returned to Agilent.

NOTE 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>

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

Shipping Your Instrument to Agilent for Service or Repair

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

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

- Include a complete description of the service requested or of the failure and a description of any failed test and any error message.
- Ship the analyzer using the original or comparable antistatic packaging materials.
- Contact Agilent for instructions on where to ship your analyzer.