Agilent Technologies
N5261A and N5262A

User's Guide

Millimeter Head Controller

Use this manual with the following documents:
PNA-X Series Network Analyzer On-line Help System and
Application Note 1408-15 Banded Millimeter Wave Measurements with PNA.

Agilent Technologies

Manufacturing Part Number: N5262-90001

Printed Date: March 2009
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Certification

Agilent Technologies, Inc. certifies that this product met its published specifications at the time of shipment from the factory. Agilent Technologies, Inc. further certifies that its calibration measurements are traceable to the United States National Institute of Standards and Technology, to the extent allowed by the Institute's calibration facility, and to the calibration facilities of other International Standards Organization members.

Assistance

Product maintenance agreements and other customer assistance agreements are available for Agilent Technologies, Inc. products. For information about these agreements and for other assistance, contact Agilent. Refer to “Agilent Support, Services, and Assistance” on page 1-8.

Safety and Regulatory Information

The safety and regulatory information pertaining to this product is located in Chapter, “Service, Safety and Regulatory Information”.

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.

Definitions

- *Specifications* describe the performance of parameters covered by the product warranty (temperature –0 to 55 °C, unless otherwise noted.)
- *Typical* describes additional product performance information that is not covered by the product warranty. It is performance beyond specification that 80% of the units exhibit with a 95% confidence level over the temperature range 20 to 30 °C. Typical performance does not include measurement uncertainty.
- *Nominal* values indicate expected performance or describe product performance that is useful in the application of the product, but is not covered by the product warranty.
- *Characteristic Performance* describes performance parameter that the product is expected to meet before it leaves the factory, but is not verified in the field and is not covered by the product warranty. A characteristic includes the same guard bands as a specification.

Contents

Contents

1 Service, Safety and Regulatory Information

Safety Notes

The following safety notes are used throughout this manual. Familiarize yourself with each of the symbols and its meaning before operating this instrument.

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 note until the indicated conditions are fully understood and met.

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.**

General Safety Considerations

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 instrument, will make the instrument dangerous. Intentional interruption is prohibited.**

CAUTION Always use the three-prong AC power cord supplied with this product. Failure to ensure adequate grounding by not using this cord may cause product damage.

Cleaning the Instrument

WARNING **To prevent electrical shock, disconnect the "Agilent Technologies N5261A and N5262A" from mains power 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.**

Before Applying Power

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

CAUTION If this product is to be energized via an autotransformer make sure the common terminal is connected to the neutral (grounded side of the mains supply).

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

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

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

Servicing

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	**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 may expose the user to dangerous voltages. Disconnect the instrument from all voltage sources while it is opened.**

WARNING	**Procedures described in this document may be performed with power supplied to the product while protective covers are removed. Energy available at many points may, if contacted, result in personal injury.**

WARNING	**The power cord is connected to internal capacitors that may remain live for 10 seconds after disconnecting the plug from its power supply.**

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

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).**

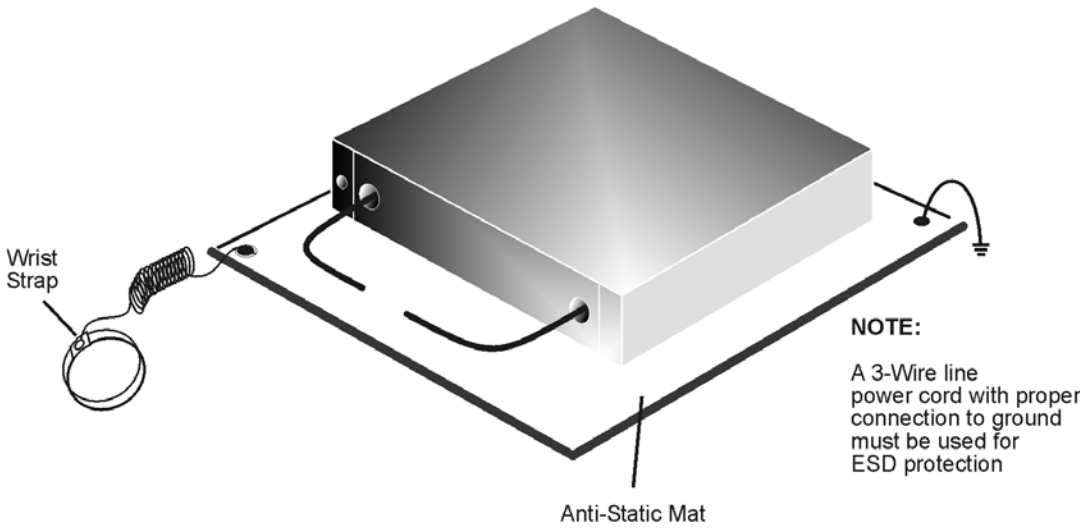
Electrostatic Discharge Protection

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

- *always* wear a grounded wrist strap having a 1 MΩ resistor in series with it when handling components and devices or when making connections to the test set.
- *always* use a grounded, conductive table mat while making connections.
- *always* wear a heel strap 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.
  4. Remove the short from the cable.

Figure 1-1 shows a typical ESD protection setup using a grounded mat and wrist strap.

Figure 1-1 ESD Protection Setup



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.

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.

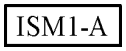
This symbol indicates that the power line switch is in the STANDBY position.

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 Canadian Standards Association. 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.

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.

China RoHS regulations include requirements related to packaging, and require compliance to China standard GB18455-2001.

This symbol indicates compliance with the China RoHS regulations for paper/fiberboard packaging.

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

Declaration of Conformity

For a copy of the manufacturer's Declaration of Conformity for this apparatus, contact your local Agilent Technologies office or sales representative. Refer to "Contacting Agilent" on page 1-8.

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
- ICES/NMB-001

Safety Information

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)

Compliance with Canadian EMC Requirements

This ISM device complies with Canadian ICES-001.
Cet appareil ISM est conforme a la norme NMB du Canada.

Compliance with German FTZ Emissions Requirements

This product complies with the German FTZ 526/527 Radiated Emissions and Conducted Emission requirements.

Agilent Support, Services, and Assistance

Service and Support Options

The N5261/62A Millimeter Head Controller has a *one-year return to Agilent Technologies* service warranty.

NOTE There are many 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. Refer to "Contacting Agilent" on page 1-8.

Contacting Agilent

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

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

NOTE In any correspondence or telephone conversation, refer to the Agilent product by its model number and full serial number. With this information, the Agilent representative can determine whether your product is still within its warranty period.

Shipping an Item to Agilent for Service or Repair

If you wish to send an item from your system 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 item using the original or comparable antistatic packaging materials.
- Contact Agilent for instructions on where to ship the item. Refer to "Contacting Agilent" on page 1-8.

2 General Product Information

Introduction

This document describes the N5261A and N5262A Millimeter Head Controller features and options, as well as connections to the N5242A PNA-X and Millimeter Head Modules. For further Banded Millimeter-Wave information, refer to Application Note 1408-15.

Typical System Configurations

Figure 2-1 2-Port Millimeter Wave Configuration (N5261A)

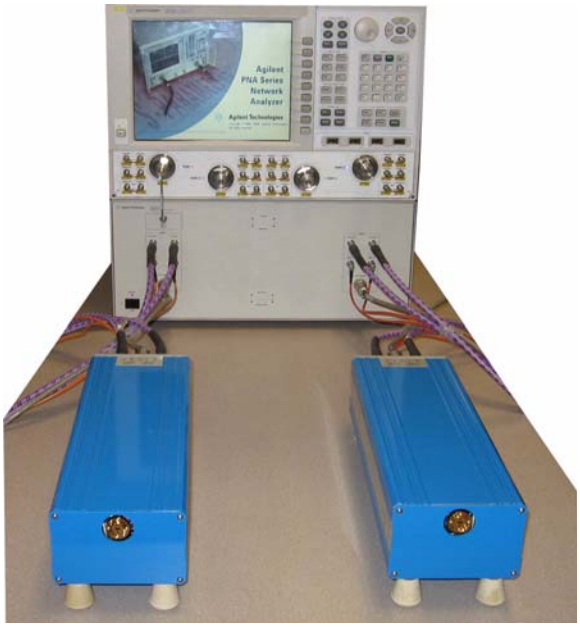
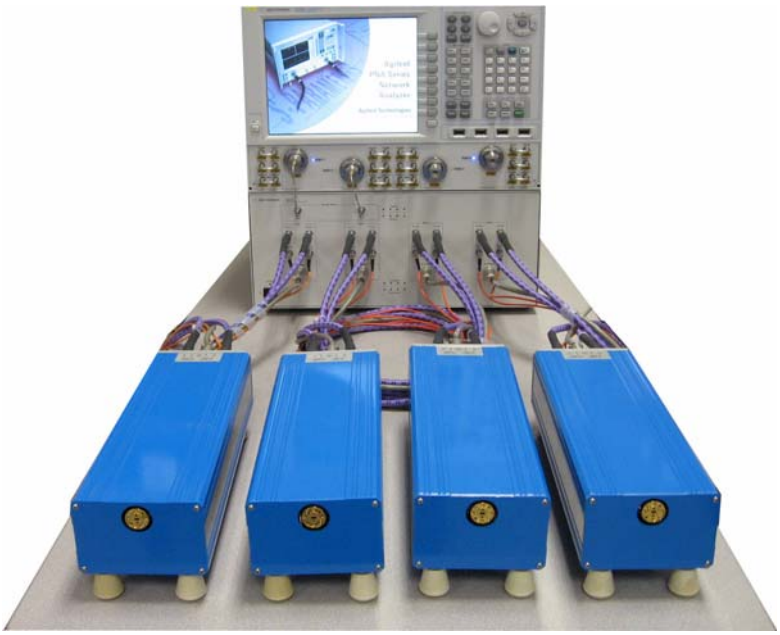


Figure 2-2 4-Port Millimeter Wave Configuration (N5262A)



Description

The N5261/62A Millimeter Head Controller provides the interface between the millimeter-wave test head modules and a PNA-X series network analyzer.

The Millimeter Head Controller, when used in conjunction with the millimeter-wave test head modules and the PNA-X, provides all of the features and functions of a full S-Parameter test set.

The Millimeter Head Controller supplies RF and LO signals to the millimeter-wave test head modules and returns the down converted reference and test IF signals to the PNA-X for process and display. The N5261/62A Millimeter Head Controller also supplies the +12 V bias to each millimeter-wave head module. Refer to the Figure 5-1 through Figure 5-4 beginning on Page 5-5.

A typical system configuration is illustrated in Figure 2-1 and Figure 2-2 on page 2-2.

Network Analyzer Requirements

The N5242A PNA-X requires the following option combinations for proper operation with the N5261/62A Millimeter Head Controller.

- PNA-X firmware revision: N5242A Option 020 ≥ A.08.20.04
- The N5261A with an N5242A Option 200 or 400 requires Option 020.
- The N5262A with an N5242A Option 200 requires Option 020 and 550 or 551 for 4-Port system.
- The N5262A with an N5242A Option 400 requires Option 020.
- The N5261A with an N5242A Option 219 or 224 requires Option 020.
- The N5262A with an N5242A Option 219 or 224 requires Option 020 and 550 or 551 for 4-Port system.
- The N5262A with an N5242A Option 419 or 423 requires Option 020.

Available Options

Accessory Options

Installation instructions are included in the option package.

- Option 1CM - Rackmount Kit (5063-9215).
- Option 1CN - Front Handle Kit (5063-9228).
- Option 1CP - Rackmount with front handle Kit (5063-9222).

Cable Options

An external amplifier is required for higher frequency millimeter wave modules with some cable option. Refer to Table 2-2, “Cable and Millimeter Module Combinations,” on page 2-8.

- Option 501 - 1-Port Millimeter Module Cable Set (48 in, 1.22 m)
- Option 502 - 1-Port Millimeter Module Cable Set (79 in, 2 m)
- Option 503 - 1-Port Millimeter Module Cable Set (118 in, 3 m)
- Option 505 - 1-Port Millimeter Module Cable Set (197 in, 5 m)
- Option 102 - Cable Set 2-Port PNA-X to Test Set
- Option 104 - Cable Set 4-Port PNA-X to Test Set

Verifying Your Shipment

Each N5261/62A Millimeter Head Controller product includes:

- The N5261/62A Millimeter Head Controller.
- Interconnection cables and adapters to interconnect the system components for the options ordered. Refer Table 2-1 on page 2-6. The N5242A PNA-X and Millimeter Heads must be ordered separately.
- The N5261/62A Millimeter Head Controller User's Guide (the document you are now reading). This document provides system connection and basic operation information, using an N5261/62A Millimeter Head Controller with banded millimeter-wave test head modules. Refer to Application Note 1408-15.

WARNING **The N5261/62A Millimeter Head Controller and the test head modules are sensitive to electrostatic discharge (ESD). Ground your work station before unpacking and installing the test head modules. See** "Electrostatic Discharge Protection" on page 1-5.

For a list of components shipped with your N5261/62A, refer to Table 2-1, "N5261/62A Contents," on page 2-6.

Keep the shipping containers until the N5261/62A component checklist has been completed, and the components have been checked for physical damage.

If the shipping container is damaged or the packaging material shows signs of stress, notify the carrier as well as the Agilent Technologies Field Engineer. Keep the shipping materials for the carrier's inspection. Agilent Technologies will arrange for repair or replacement of damaged equipment without waiting for a claim settlement from the carrier. Refer to "Contacting Agilent" on page 1-8.

Contents List

Use the table below to verify that the shipment is complete.

Table 2-1 N5261/62A Contents

✔	Agilent Part Number	Qty	Description
	N5261A or N5262A	1	Millimeter Head Controller
	N5242-20138	1	Right Foot
	N5242-20139	1	Left Foot
	5023-0132	1	Locking Feet Kit
	0515-2317	2	Screw
	8120-6818	1	Test Set Interface Cable (W7)
	1810-0118	1	50 Ohm Load Termination (N5261A)
	1810-0118	2	50 Ohm Load Termination (N5262A)
	9230-0333	1	Envelope (Calibration Certificate)
	9320-6636	1	Functional Certificate
	N5262-90001	1	Installation and Service Guide
	Option 1CM (Rackmount Kit)		
	5063-9251	1	Rackmount Kit
	Option 1CN (Rackmount Kit)		
	5063-9228	1	Front Handle Kit
	Option 1CP (Rackmount Kit)		
	5063-9222	1	Rackmount Kit with Front Handle Kit
	N5261A Option 102 (Cable Set 2-Port PNA-X to Test Set)		
	5061-9038	6	Rear Panel Cable Assembly (W2, W8)
	N5262-20016	1	RF Cable, SRC1 to 2-Port PNA-X (W3)
	N5261AOption 104 (Cable Set 4-Port PNA-XPNA-X to Test Set)		
	5061-9038	6	Rear Panel Cable Assembly (W2, W8)
	N5262-20018	1	RF Cable, SRC1 to 4-Port PNA-X (W1)
	N5262A Option 102 (Cable Set 2-Port PNA-X to Test Set)		
	5061-9038	7	Rear Panel Cable Assembly (W2, W8)
	N5262-20016	1	RF Cable, SRC1 to 2-Port PNA-X (W3)
	N5262-20017	1	RF Cable, SRC2 to 2-Port PNA-X (W4)
	N5262-20020	1	RF Cable, SRC2 to 2-Port PNA-X (W9)

Table 2-1 N5261/62A Contents (Continued)

	N5262A Option 104 (Cable Set 4-Port PNA-X to Test Set)		
	5061-9038	8	Rear Panel Cable Assembly (W2, W8)
	N5262-20018	1	RF Cable, SRC1 to 4-Port PNA-X (W1)
	N5262-20019	1	RF Cable, SRC2 to 4-Port PNA-X (W2)
	Option 501 (1-Port Millimeter Module Cable Set (48 inches = 1.2 meter)		
	8121-1221	2	RF 3.5 mm cable (RF Input and LO Input)
	85105-60030	1	Cable Assembly, DC Power (Bias)
	85105-60033	2	IF Cable Assembly (REF IF and TEST IF)
	Option 502 (1-Port Millimeter Module Cable Set (79 inches = 2 meter)		
	N5260-60023	2	RF 3.5 mm cable (RF Input and LO Input)
	N5260-60024	2	IF Cable Assembly (REF IF and TEST IF)
	N5260-60025	1	Cable Assembly, DC Power (Bias)
	Option 503 (1-Port Millimeter Module Cable Set (118 inches = 3 meter)		
	N5260-60026	2	RF 3.5 mm cable (RF Input and LO Input)
	N5260-60027	2	IF Cable Assembly (REF IF and TEST IF)
	N5260-60028	1	Cable Assembly, DC Power (Bias)
	Option 505 (1-Port Millimeter Module Cable Set (197 inches = 5 meter)		
	N5260-60029	2	RF 3.5 mm cable (RF Input and LO Input)
	N5260-60030	2	IF Cable Assembly (REF IF and TEST IF)
	N5260-60031	1	Cable Assembly, DC Power (Bias)

Compatible Millimeter Wave Modules

OML Millimeter Heads

The Olsen Microwave Lab (OML) Millimeter-Wave Modules can be ordered from Agilent. There are millimeter-wave modules available with frequency ranges up to 500 GHz. For further Banded Millimeter-Wave information, refer to Application Note 1408-15.

Figure 2-1 and Figure 2-2 are typical configurations, shown with the N5260W15 millimeter heads.

You may also refer to Banded Millimeter-wave Solutions up to 500 GHz, available on the Web at: *http://www.home.agilent.com* and search banded millimeter.

CAUTION Turn off the N5261/62A power when connecting or disconnecting the millimeter heads or permanent damage can occur to the millimeter modules.

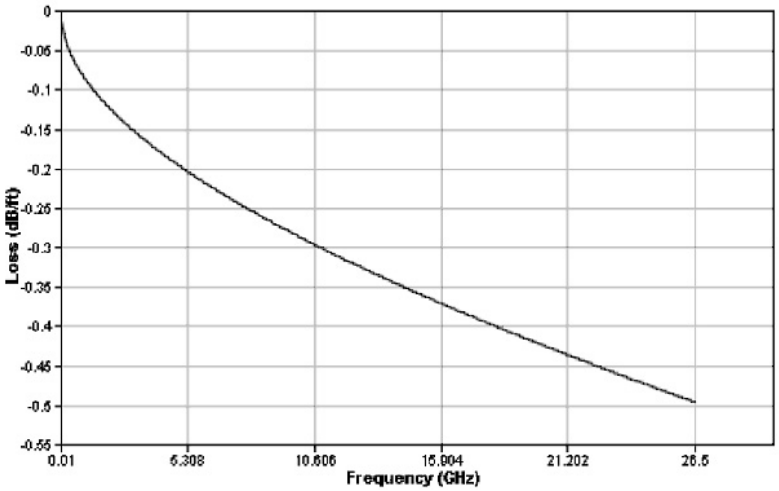
The test set can drive the following cable/head combinations. An external amplifier is required for higher frequency millimeter wave modules.

Table 2-2 Cable and Millimeter Module Combinations

Cable Option	Cable Length	RF OUT (compatible heads)	LO OUT (compatible heads)
501	4 ft. (1.22 m)	50 to 500 GHz	50 to 500 GHz
502	6.58 ft. (2 m)	50 to 500 GHz	50 to 500 GHz
503	9.83 ft. (3 m)	50 to 500 GHz	50 to 325 GHz
505	16.4 ft. (5 m)	50 to 110 GHz	None

To determine the required amplification for RF OUT or LO OUT, refer to Table 2-3 and Figure 2-3.

Figure 2-3 RF Cable Loss (dB loss per foot)



If you are installing an amplifier in the LO or RF path, ensure the amplifier's input is connected to the test set, and the output is connected to the millimeter head.

Table 2-3 LO and RF Power Requirements

Millimeter Head	RF INPUT	LO INPUT
WR-15 50 to 75 GHz	12.5 to 18.8 GHz +5 to 13 dBm	10 to 15 GHz +5 to 13 dBm
WR-12 60 to 90 GHz	10 to 15 GHz +5 to 13 dBm	12 to 18 GHz +5 to 13 dBm
WR-10 75 to 110 GHz	12.5 to 18.4 GHz +5 to 13 dBm	9.3 to 13.8 GHz +5 to 13 dBm
WR-08 90 to 140 GHz	7.5 to 11.2 GHz +7 dBm min	11.2 to 17.5 GHz +7 dBm min
WR-06 110 to 170 GHz	9.1 to 14.2 GHz +7 dBm min	11 to 17 GHz +7 dBm min
WR-05 140 to 220 GHz	11.6 to 18.4 GHz +7 dBm min	11.6 to 18.4 GHz +7 dBm min
WR-03 220 to 325 GHz	12.2 to 18.1 GHz +7 dBm min	12.2 to 18.1 GHz +7 dBm min
WR-02.2 325 to 500 GHz	10.8 to 16.7 GHz +10 dBm min	11.6 to 17.9 GHz +10 dBm min

Caring for Waveguide (WG) Interfaces

A clean surface at millimeter-wave frequencies is much more important than at lower frequencies because any debris on the waveguide surface can potentially distort the measurement results.

Caring for WG interfaces is not difficult. Dirt and dust can be removed using the following:

- Isopropyl alcohol 99.5%[1]
- Lint-free cloth
- Pressurized air (for dust removal)

To remove dirt on the waveguide surface, simply put a few drops of isopropyl alcohol on a lint-free cloth and gently wipe the surface.

To remove dust, simply spray the pressurized air on the waveguide surface.

1. Use isopropyl alcohol only in a well-ventilated area. Allow all residual alcohol moisture to evaporate, and the fumes to dissipate, prior to assembling waveguide interfaces.

Specifications

There are no specifications or typical specifications for the PNA-X + N5261/62A + OML banded millimeter wave configuration. There are some limited typical specifications for the OML millimeter wave modules which can be found on the OML website (http//www.omlinc.com). The only two OML typical specifications that apply for the field to perform are dynamic range and coupler directivity.

Supplemental Characteristics

The supplemental characteristics provide information useful in applying the instrument by giving typical, but non–warranted, performance parameters.

The connectors listed in Table 2-4 must be torqued to 57 N-cm (5 in-lb).

Table 2-4 N5261/62A Supplemental Characteristics

Front/Rear Panel Connector[a]	Power	Frequency Range
RF OUT	+12.5 dBm[b] (±0.5 dB)	7 to 20 GHz
LO OUT	+12.5 dBm (±0.5 dB)	8 to 19 GHz
TEST IF (out of the module)	–27 dBm	1 to 20 MHz
REF IF (out of the module)	–27 dBm	1 to 20 MHz
LO IN	+2 to –10 dBm	8 to 19 GHz
Test IF to AD IF OUT	0 dB[c] (±2 dB)	1 to 20 MHz
REF IF to AD IF OUT	0 dB[d] (±2 dB)	1 to 20 MHz
REF IF to R IF OUT	0 dB[c] (±2 dB)	1 to 20 MHz
SRC 1 RF IN	+15 dBm	7 to 20 GHz
SRC 2 RF IN	+15 dBm	7 to 20 GHz

a. All connectors are SMA.
b. Gain is 12 to 35 dB, ALC range > 40 dB.
c. Relative to the TEST IF power level.
d. Relative to the REF IF power level.

CAUTION The damage level for TEST IF and REF IF is +17 dBm and dc ±1 V. The damage level for SRC1 and SRC 2 RF IN is +15 dBm.

Environmental Requirements

The environmental requirements of the N5261/62A are listed in the table below. Note that these requirements are the same as those of the N5242A network analyzer with Option 020.

NOTE Samples of this product have been type-tested in accordance with the Agilent Environmental Test Manual and verified to be robust against the environmental stresses of storage, transportation and end-use; those stresses include but are not limited to temperature, humidity, shock, vibration, altitude and power-line conditions. Test methods are aligned with IEC 60068-2 and levels are similar to MIL-PRF-28800F Class 3.

Heating and Cooling in the Operating Environment

Install air conditioning and heating, if necessary, to maintain the ambient temperature within the appropriate range as given in Table 2-5.

Required Conditions for Accuracy Enhanced Measurement

Accuracy-enhanced (error-corrected) measurements require the ambient temperature of the N5261/62A to be maintained within ± 1 °C of the ambient temperature at calibration.

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

Table 2-5 N5261/62A Operating Environment

Temperature	
Operation	0 °C to 40 °C (32 °F to 104 °F)
Storage	–40 °C to +70 °C (–40 °F to +158 °F)
MeasurementCalibration	20 °C to 26 °C (68 °F to 79 °F)
PerformanceVerification	Temperature must be within 1 °C (1.8 °F) of the temperature at which the measurement calibration was performed.
Pressure Altitude (Operation or Storage)	0 to 3000 meters (9842 feet)
Enclosure Protection	IP 2 0
Power	100/120/220/240 V 50/60 Hz (200 Watt typical and 350 Watt maximum)

Component Weight and Dimensions

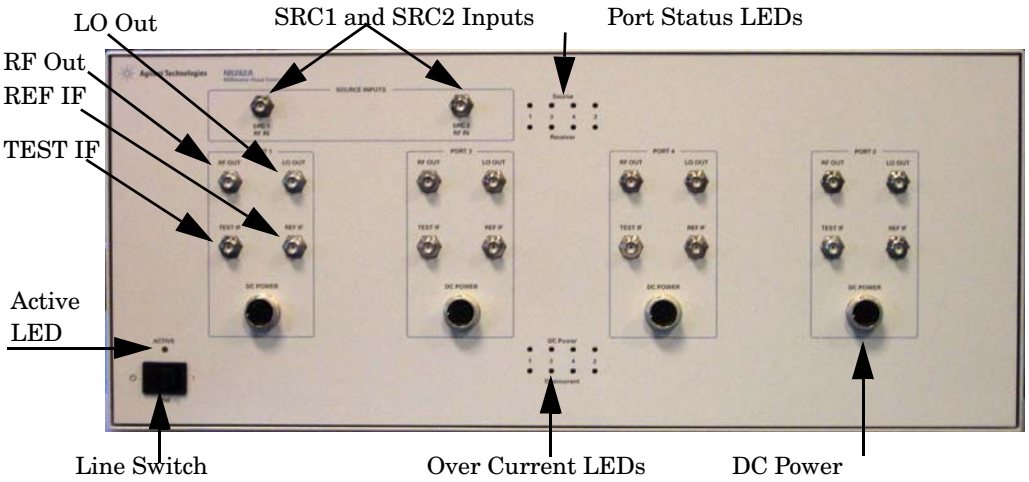
Table 2-6 illustrates the maximum weight and dimensions of the system components.

Table 2-6 Weights and Dimensions

Model	Weight	Height	Width	Depth
Millimeter-wave module (each)	3.5 kg (7.5 lb, ± 0.5 lb)	6.9 cm (2.7 in)	33.0 cm (12.9 in)	17.8 cm (6.9 in)
N5242A PNA-X	29 Kg (64 lb) nominal	26.7 cm (10.5 in)	42.5 cm (16.7 in)	42.6 cm (16.8 in)
N5261/62A millimeter-head controller	11 kg (24.2 lb)	18 cm (7.1 in)	42.5 cm (16.75 in)	42.5 cm (16.75 in)

Front Panel Features

Figure 2-4 N5262A Front Panel Features

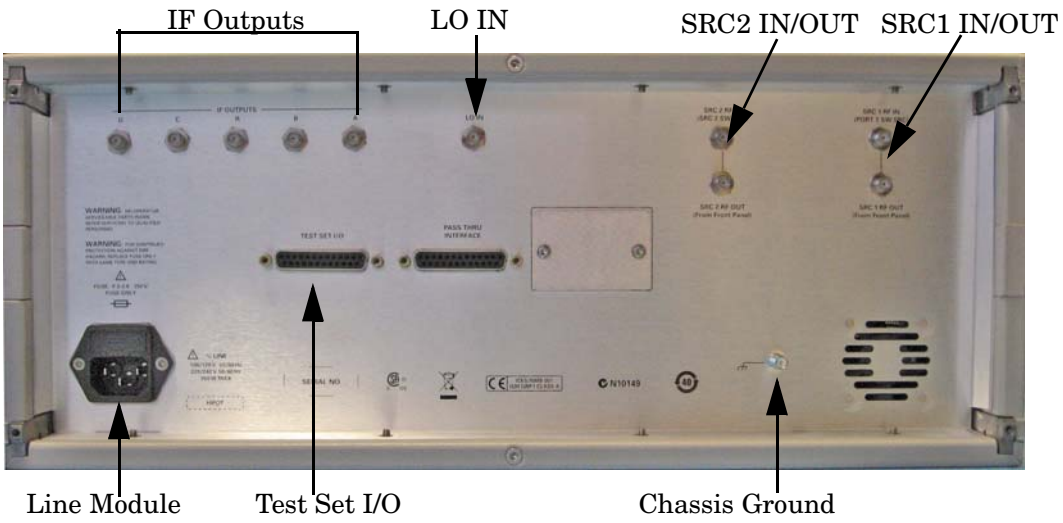


1. **Line Switch.** This switch turns the instrument ON or OFF. When the side of the switch labeled 0 is depressed, the instrument is OFF; when the side of the switch labeled 1 is depressed, the instrument is ON.
2. **Active LED.**
   - When the test set power switch is On and is connected and addressed by a PNA-X, the LED is On (illuminated).
   - The LED is Off (not illuminated) when the test set power switch is in Standby, or not addressed by a PNA-X.
3. **Port Source LED.** This LED indicates which port is selected when addressed by the PNA-X RF Source.
4. **RCVR Port LED.** This LED indicates which port is selected as the Receiver port.
5. **RF OUT.** Provides an amplified RF source signal to the millimeter-wave head module.
6. **LO OUT.** Provides amplified LO signal to the millimeter-wave head module.
7. **TEST IF.** IF signal input connection from the millimeter module.
8. **REF IF.** Reference IF signal input connection from the millimeter module.
9. **DC Power (Bias).** This bias supplies the +12.5 volts DC and ground lines to the millimeter wave head modules. Pins 1 and 3 are both +12.5 Vdc supplies. Pins 4 and 6 are the dc supply ground lines. Pins 2, 5, and 7 are unused.
10. **SRC1**. Connects to the front panel PNA-X test ports.
11. **SRC2.** Connects to the front panel PNA-X test ports.

NOTE The SRC2 Input and Ports 3 and 4 features are not present on the N5261A. Refer to Figure 2-1 on page 2-2.

Rear Panel Features

Figure 2-5 N5261/62A Rear Panel Features



1. **Chassis Ground**.
2. **LO IN.**This input is from the LO drive of the PNA-X. The signal is split and amplified then output to the front panel of the N5261/62A.
3. **D IF Output.** IF signal from the test set to the PNA-X IF D Input.
4. **C IF Output.** IF signal from the test set to the PNA-X IF C Input.
5. **R IF Output.** REF IF from the test set to the PNA-X IF R Input.
6. **A IF Output.** IF signal from the test set to the PNA-X IF A Input.
7. **B IF Output.** IF signal from the test set to the PNA-X IF B Input.
8. **Test Set Interface I/O.** The Test Set Interface connector is used to send address and data to the test set from the PNA-X.
9. **Pass Through Interface.** Connection to another test set.
10. **SRC 1 RF IN** and **SRC 2 RF OUT.** Jumpers are not shown (E8356-20072).
11. **SRC 2 RF IN** and **SRC 2 RF OUT.** Jumpers are not shown (E8356-20072).

12. **Line Module.** This assembly houses the line cord connection, line fuse, and line voltage selector. Pull out the topside of the line module cover to replace or change the fuse. Line voltage selection is automatic and no setting is required. Recommended fuse values are printed on the rear panel of the N5261/62A.

WARNING **For continued protection against fire hazard replace line fuse only with same type and rating:**
• F 5A/250V, Part Number 2110-0709

The use of other fuses or material is prohibited.

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

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

3 System Configuration and Operation

Site Preparation

Protect Against Electrostatic Discharge (ESD)

This is important. If not properly protected against, electrostatic discharge can seriously damage your analyzer, resulting in costly repair.

CAUTION To reduce the chance of electrostatic discharge, follow all of the recommendations outlined in "Electrostatic Discharge Protection" on page 1-5.

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

Power Requirements

Before installing the PNA-X and N5261/62A, be sure that the required AC power is available at all necessary locations.

- Three-wire power cables (which provide a safety ground) must be used with all instruments.
- Air-conditioning equipment (or other motor-operated equipment) should not be placed on the same ac line that powers the system.
- The table below lists the maximum VA ratings and BTU/hour ratings for all instruments in the configuration. This table can be used to determine both the electrical requirements and the air conditioning requirements of the system.

Table 3-1 Power Requirements of a Standard Configuration

Standard Equipment	
Instrument	**Maximum Watt**
N5242A with Option 020	270
N5261/62A Millimeter Head Controller	350
Millimeter-wave modules	(powered from controller)
Total	620

System Setup with N5242A

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 **This is a Safety Class 1 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.**

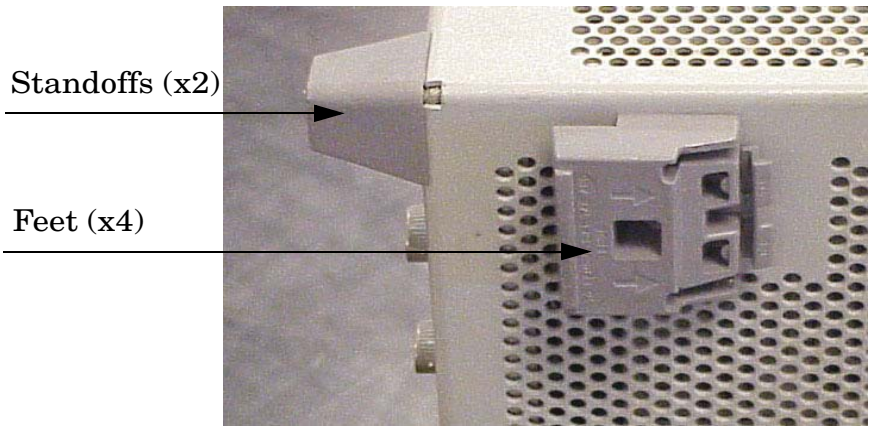
WARNING **The opening of covers or removal of parts is likely to expose dangerous voltages. Disconnect the instrument from all voltage sources while it is being opened.**

Preparing the N5242A Network Analyzer

The main power cord can be used as the system disconnecting device. It disconnects the mains circuits from the mains supply.

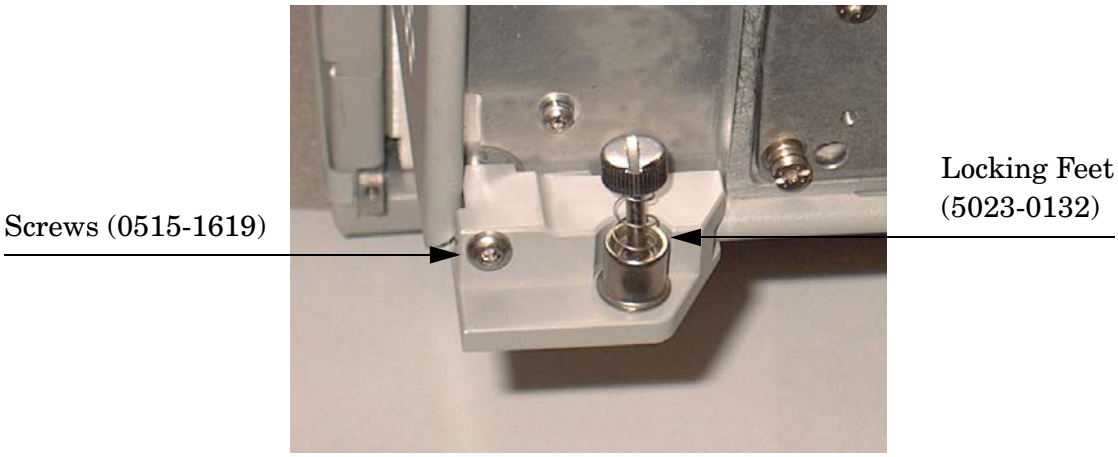
1. Remove the feet from the bottom of the network analyzer. Refer to Figure 3-1.
2. Remove the 2 lower standoffs and screws (0515-1619) from the rear panel on the network analyzer.

Figure 3-1 Rear Bottom Feet



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

Figure 3-2 Install Locking Feet on N5242A

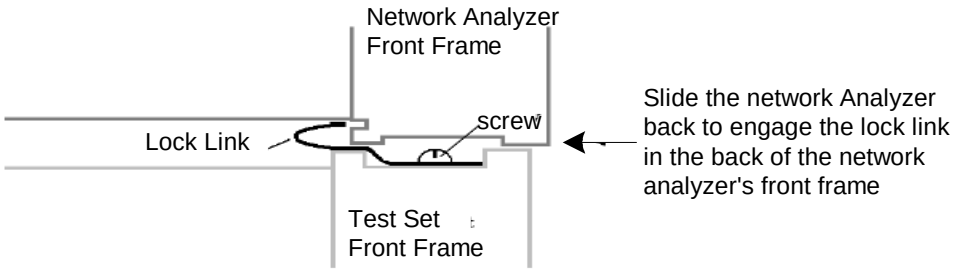


4. Install the two rear locking feet onto the N5261/62A. Looking at the front panel, the N5242-20138 is the right foot and the N5242-20139 is the left foot. Two screws (0515-2317) are included with this option.

Figure 3-3 Install Locking Feet on N5261/62A

5. Place the network analyzer on top of the Test Set and ensure that the front frame of the network analyzer is positioned slightly forward of the locks that are attached to the Test Set. Slide the network analyzer back so the locks engage the front frame of the analyzer.

Figure 3-4 Locking the Analyzer's



6. Secure the network analyzer's lower locking feet to the Test Set upper locking feet, using the spring–loaded screws on the locking feet. Refer to Figure 3-5. If the network analyzer's lower locking feet are not aligned with the screw holes in the Test Set's upper locking feet, loosen the screws securing the feet to the instrument slightly to align.

Figure 3-5 Locking Feet Screws

NOTE There are two Lock-Feet kits available. Refer to "Contacting Agilent" on page 1-8 for ordering information.

- PNA-X – 5023-0132 (Kit includes locking feet and screws)
- Test Set – N5242-20138 is the right foot and the N5242-20139 is the left foot.
- Screw – 0515-2317

Front Panel Cabling

The test head modules are placed on the work surface in front of the PNA-X and head controller as shown. Figure 2-1 and Figure 2-2 on page 2-2.

Connect the front panel interconnect cables from the PNA-X to the N5261/62A Millimeter Head Controller. The rear panel jumper (SCR1 and SCR2) must be installed if you are using a front panel SRC cable (W1 - W4). Refer to Table 2-1 on page 2-6 for your specific option cable part numbers. Refer to Figure 3-6 and Figure 3-7.

Figure 3-6 N5261A System RF Cable

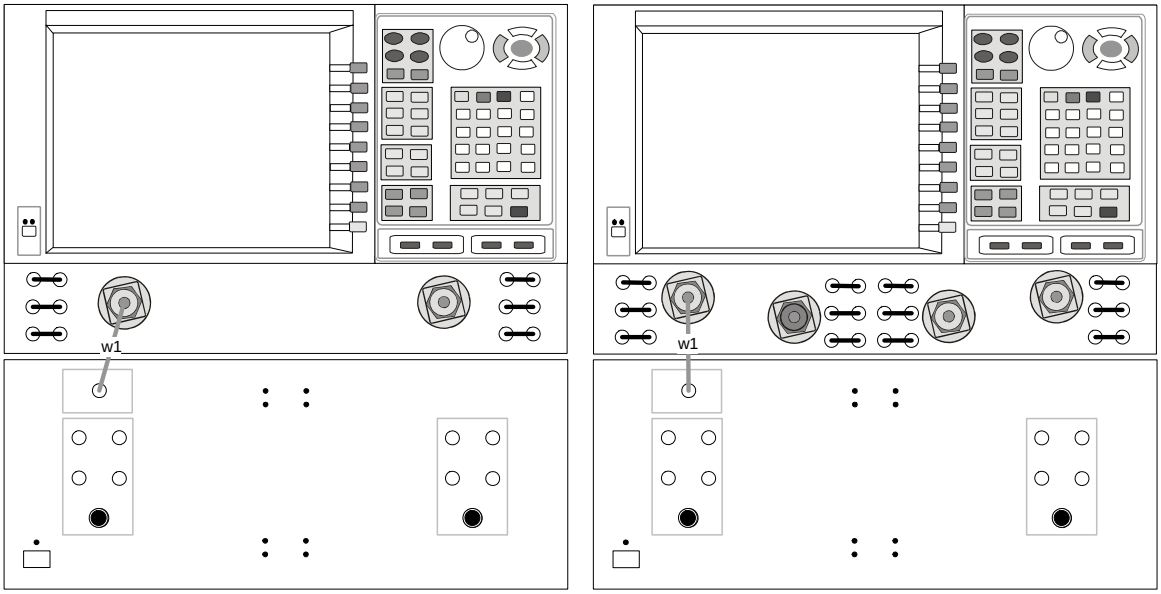
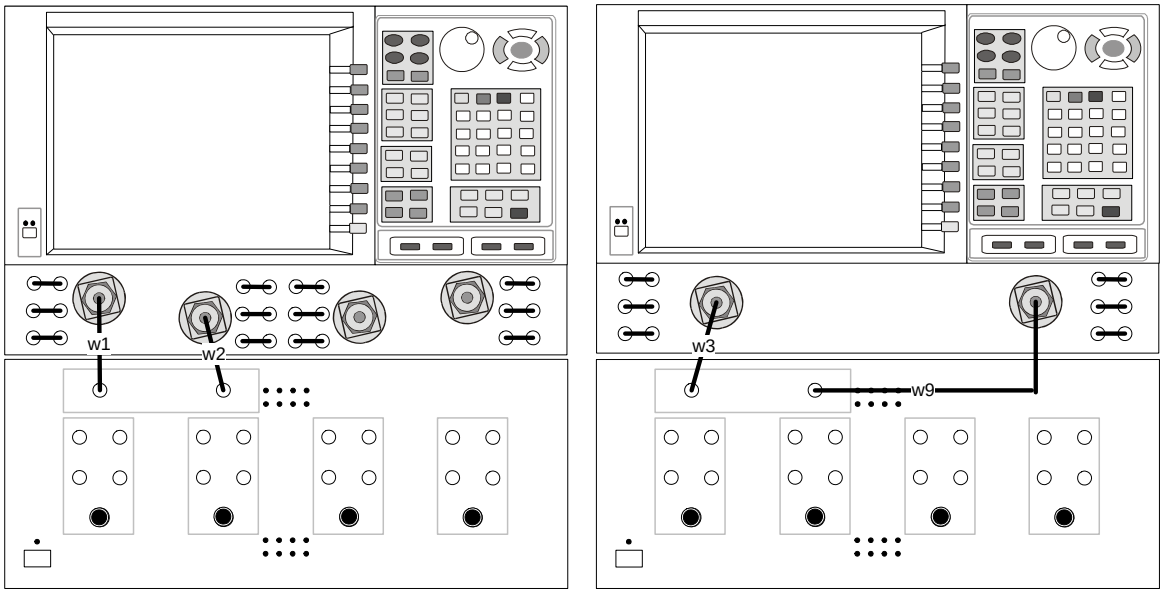


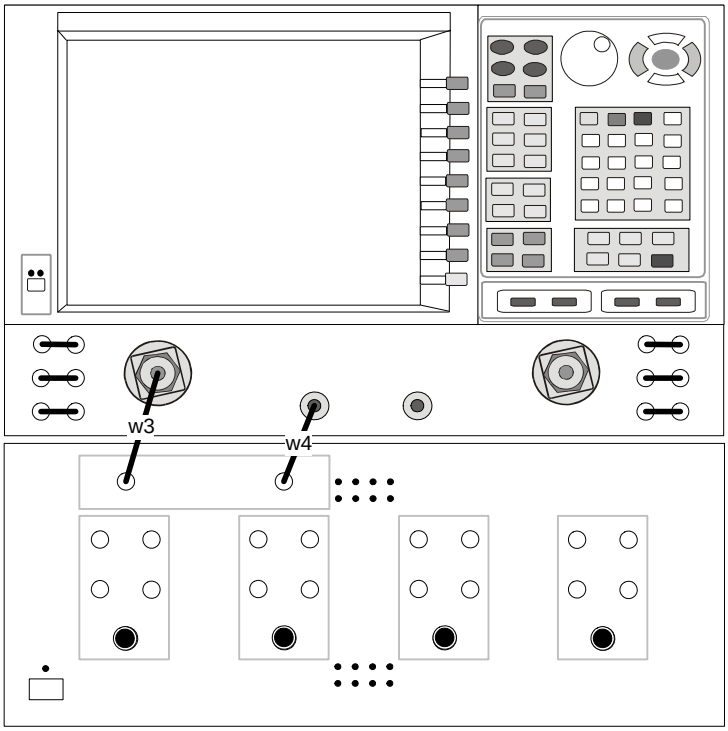
Figure 3-7 N5262A System RF Cables (Options 200 & 400)



N5242A with Opt 400

N5242A with Opt 200

Figure 3-8 N5262A System RF Cables (Options 219 & 223)



N5242A with Opt 219, 223

Test Head Module Connections

Install the front-panel interconnections between the N5261/62A Millimeter Head Controller and the modules as shown in Figure 3-9. Refer to Table 2-1 on page 2-6 for your specific option cable part numbers.

If a millimeter head is not installed on a port, a 50 Ohm termination (1810-0118) must be installed on the N5261A or N5262A LO OUT connector.

CAUTION Turn off the N5261/62A power when connecting or disconnecting the millimeter heads or permanent damage can occur to the millimeter modules.

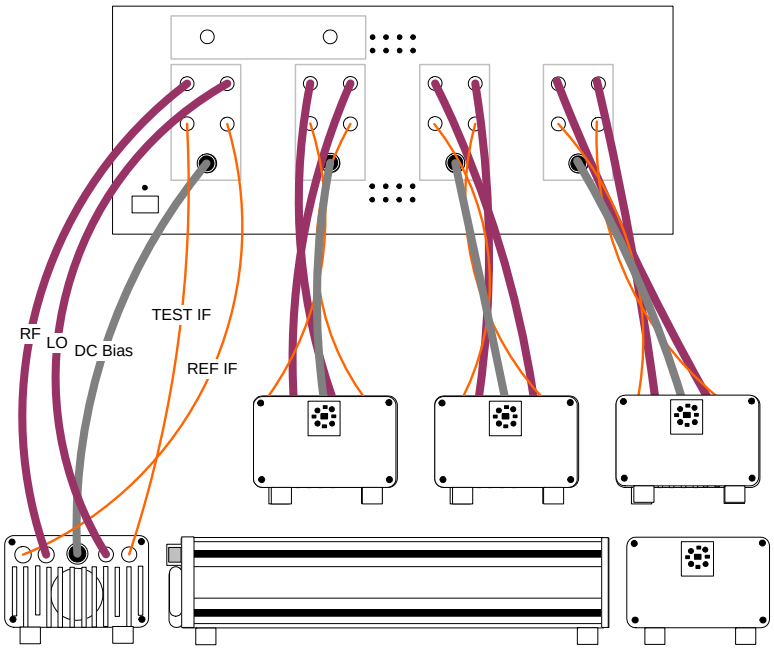
Attaching cables to the connectors is easiest if they are attached in the following sequence:

Table 3-2 Millimeter Head Controller Connections

Sequence	From: Millimeter Head	To: N5261A or N5262A
1	DC Power; +12V @ 1.5A (Bias)	DC Power
2	RF INPUT; SMA connector	RF Out[a]
3	LO INPUT; SMA connector	LO Out[a]
4	Ref IF; SMA connector	REF IF
5	Test IF; SMA connector	TEST IF

a. Option 505 or 503 cable sets require external amplifiers, due to the RF insertion loss of the LO and RF signals into the module. Refer to “Compatible Millimeter Wave Modules” on page 2-8.

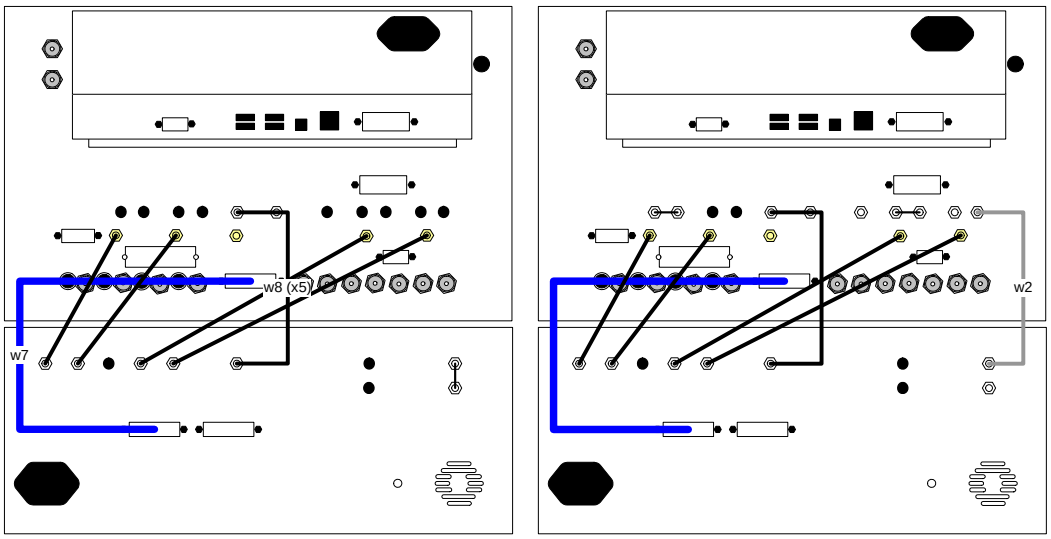
Figure 3-9 N5262A System Millimeter Head Connections



Rear Panel Cabling

1. Connect the PNA-X rear panel IF INPUTS to the test set IF OUTPUTs (D, C, R, B and A), using cables (5061-9038).
2. Connect the test set LO IN to the PNA-X LO OUT (J5), using cables (5061-9038).
3. Connect the test set I/0 cable (8120-6818) from the PNA-X to the N5261/62A Millimeter Head Controller.
4. If you are not using the front panel connections. Connect the PNA-X SW SRC Out (J11) to SRC1 IN using cable (W2, 5061-9038). IF you are using the front panel cables, ensure that the jumpers (E8356-20072) are installed. Refer to Figure 3-10 and Figure 3-11.

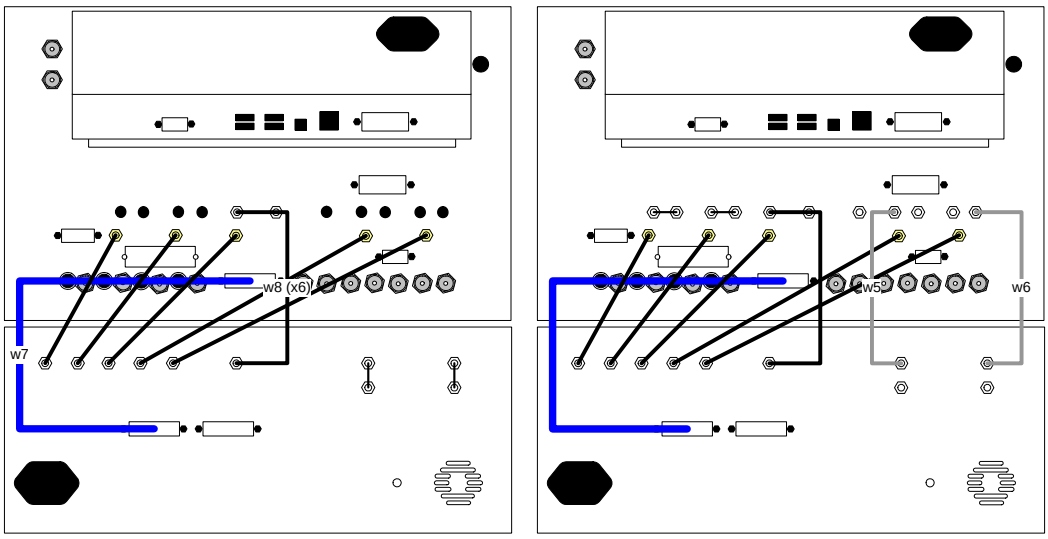
Figure 3-10 2-Port Rear View Cabling



N5261/62A with N5242A with Opt 200

N5261/62A with N5242A with Opt 219, 224

Figure 3-11 4-Port Rear View Cabling



N5262A with N5242A Opt 400

N5262A with N5242A Opt 419 and 423

Controlling the N5261/62A with the N5242A

This section will describe how to setup and operate the N5261/62A Millimeter Head Controller with the N5242A.

The N5261/62A Millimeter Head Controller is considered a “slave” instrument. An N5242A must be used to control the Test Set.

- PNA-X firmware revision:
  N5242A Option 020 ≥ A.08.20.04

Visit our website for firmware revision and downloads.
http://na.tm.agilent.com/pna/firmware/firmware.htm

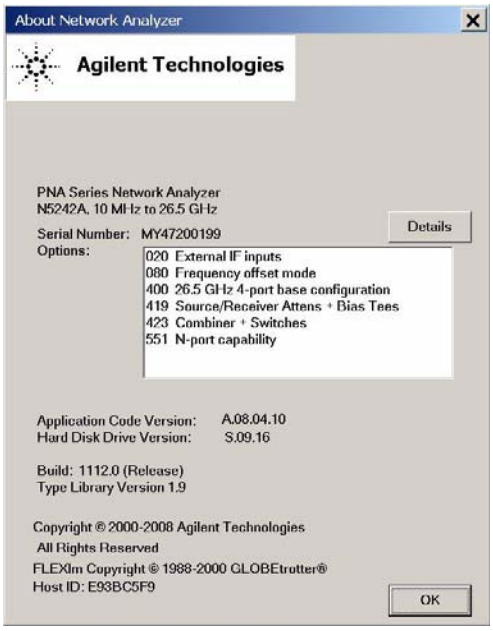
CAUTION Before switching on this instrument, make sure the supply voltage is in the specified range.

PNA-X Millimeter Mode

The PNA-X multiport mode selects the application that will enable the PNA-X to control the N5261/62A Millimeter Head Controller. The PNA-X millimeter mode allows you to configure the system for the millimeter head you are using. Refer to the PNA-X Help system for more information.

The N5242A Option 020 (IF Input) is required for in the PNA-X for the Millimeter mode of operation.

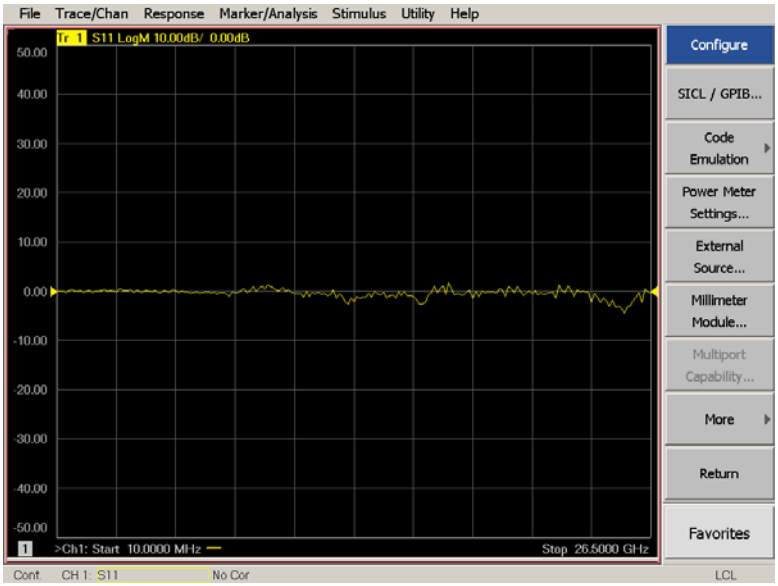
Figure 3-12 N5242A Options



How to Access Millimeter Mode

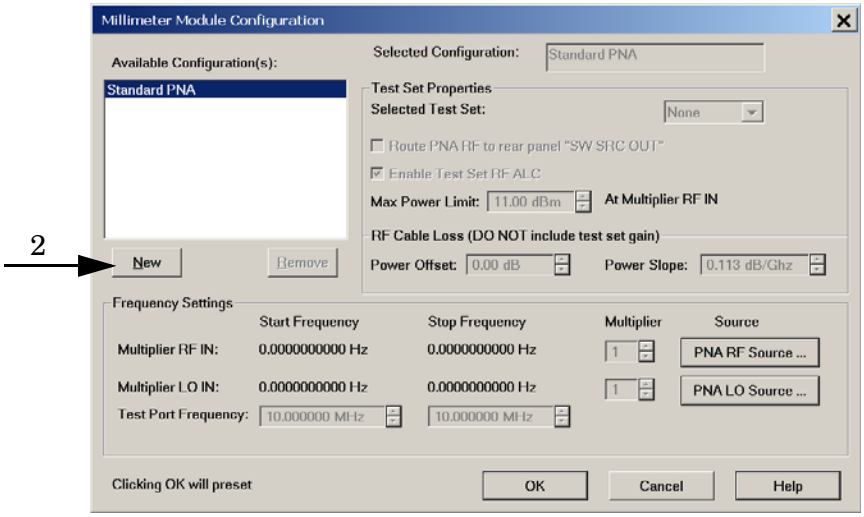
1. The Option 020 must be installed for Millimeter capability. To access the millimeter application select **[System]** > **Configure > Millimeter Module**. See Figure 3-13.

Figure 3-13 Selecting Millimeter Mode



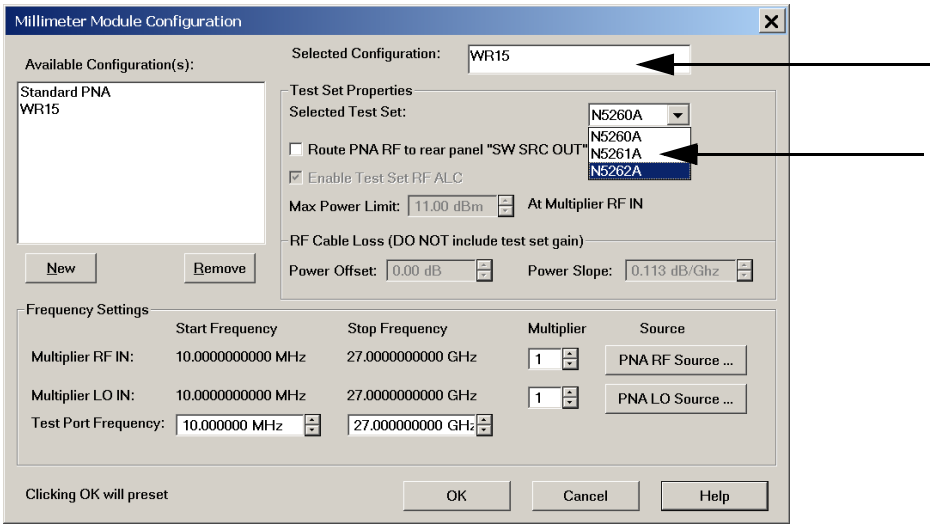
2. Select **New**. See Figure 3-14.

Figure 3-14 Millimeter Module Configuration



3. In the **"Selected Configuration"** dialog enter a title, such as WR15 or Millimeter PNA-X. See Figure 3-15.
4. Select the test set you are using from the drop down menu (N5261A or N5262A).

Figure 3-15 Select Test Set



5. Select **"Route PNA RF to rear panel "SW SRC OUT"** if you are using a PNA-X with Option 223 or 423 (rear panel RF OUT) and have connected the PNA-X SW SRC OUT (J11) to the test set rear panel SRC IN.
6. If you are not using the front panel connections. Connect the PNA-X SW SRC Out (J11) to the test set SRC1 IN using cable (W2, 5061-9038). IF you are using the front panel cables, ensure that the jumpers (E8356-20072) are installed.
7. Clear **"Enable Test Set RF ALC"** if you would like to set the power level into the millimeter head. This would be useful to test amplifiers and other devices that require lower than the maximum power delivered by the millimeter head module.

   If the box is not checked the power will be set at +11 dBm, the default maximum power limit. You may adjust the power in the **"Max power Limit"** dialog box.

   The ALC mode is normally turned on to ensure that the module is operating at the proper level. The ALC is turned off when in pulse mode. Use care when ALC mode is off to prevent the module from being over-driven.

8. Enter the **Multiplier RF IN** number. (WR15 = 4), (WR10 = 6) Table 3-3.
9. Enter the **Multiplier LO IN** number. (WR15 = 5), (WR10 = 8) Figure 3-16..
10. In the **"Test Port Frequency"** dialog box enter the **Start** and **Stop Frequency** of the millimeter head. (WR15 = 50 GHz/75 GHz), (WR10 = 67 GHz/110 GHz)
11. Press **Ok**. The PNA will preset for millimeter operation.

The Millimeter Head Modules are now the source and receiver ports of the system. The PNA-X ports 1 thru 4 are no longer enabled.

Figure 3-16. New Configuration System Name

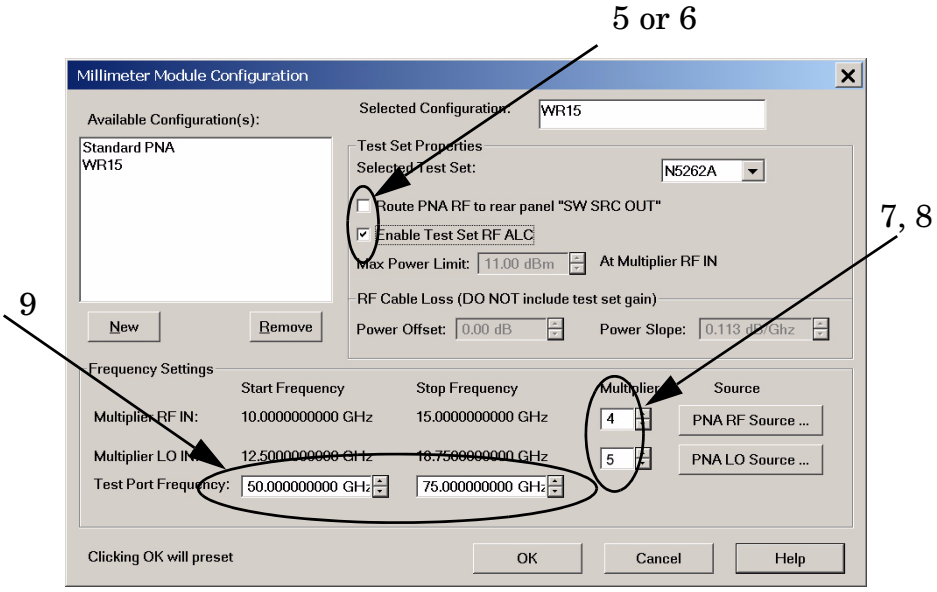


Table 3-3 RF and LO Harmonic Multipliers

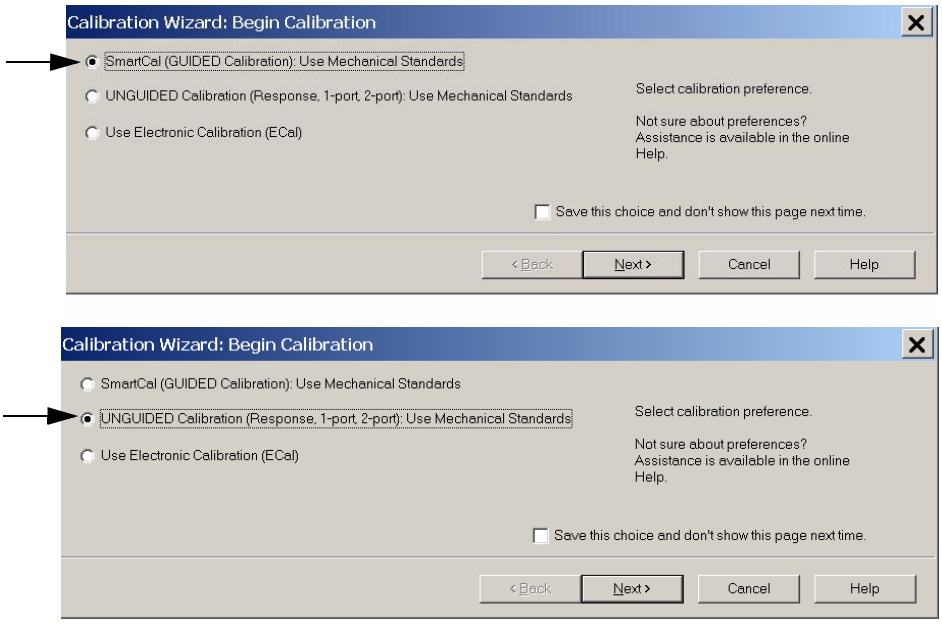
Band	Freq Range of Operation (GHz)	RF Freq Range (GHz)	RF Harmonic Multiplier	LO Freq Range ± IF Offset (GHz)	LO Harmonics Multiplier
WR-15	50 to 75	12.5 to 18.8	N=4	10.0 to 15.0	M=5
WR-12	60 to 90	10.0 to 15	N=6	12.0 to 18.0	M=5
WR-10	75 to 110	12.5 to 18.4	N=6	9.3 to 13.8	M=8
WR-08	90 to 140	7.5 to 11.7	N=12	11.2 to 17.5	M=8
WR-06	110 to 170	9.1 to 14.2	N=12	11.0 to 17.0	M=10
WR-05	140 to 220	11.6- to 18.4	N=12	14.7 to 18.0	M=12
WR-04	170 to 260	8.5 to 13	N=20	12.1 to 18.6	M=14
WR-03	220 to 325	12.2 to 18.1	N=18	12.2 to 18.1	M=18

Calibrating the System

This section will provides information to calibrate the Network Analyzer millimeter-wave system, using waveguide mechanical standards. Refer to the PNA-X **Help** menu for further information.

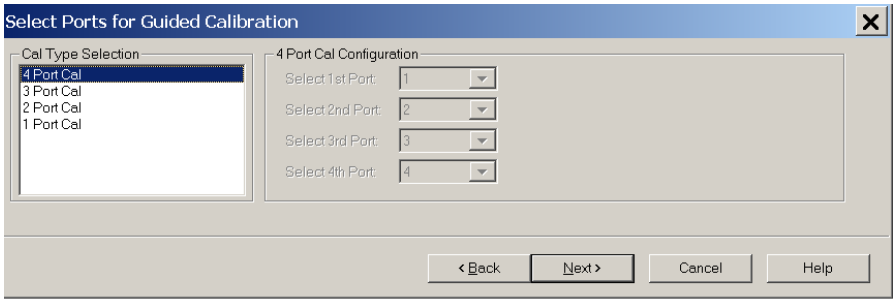
1. Set the systems **Frequency Range, IF Bandwidth** and **Number of Points** to be used in your measurements.
2. Press **[CAL]** > **CAL Wizard** on the PNA-X.
3. Select **SmartCal (GUIDED Calibration),** or **UNGUIDED Calibration** > **Next.**

Figure 3-17 Cal Method



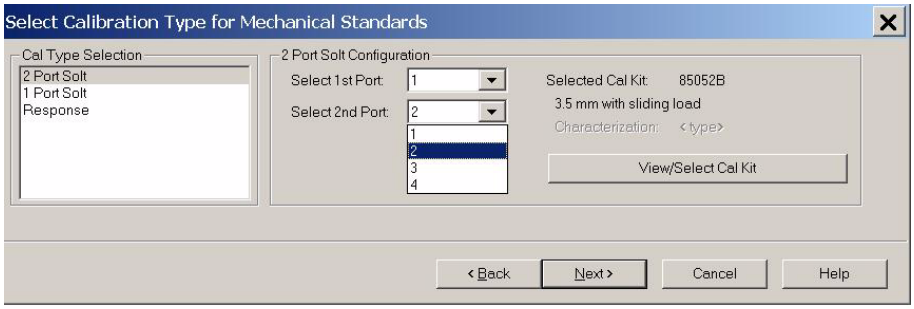
4. Select the ports to be calibrated > **Next**.

Figure 3-18 Select Ports for Smart Cal



5. Press **View/Select Cal Kit** for an Unguided Cal.

Figure 3-19 Select Ports for Unguided Cal



6. Select the required Cal Kit from the drop-down menu for the waveguide band you are using. If you are performing an unguided Cal, select **SOLT** or **TRL** in "Choose class type".
7. Press **Ok** > **Next**.

Figure 3-20 Unguided Cal Kit List

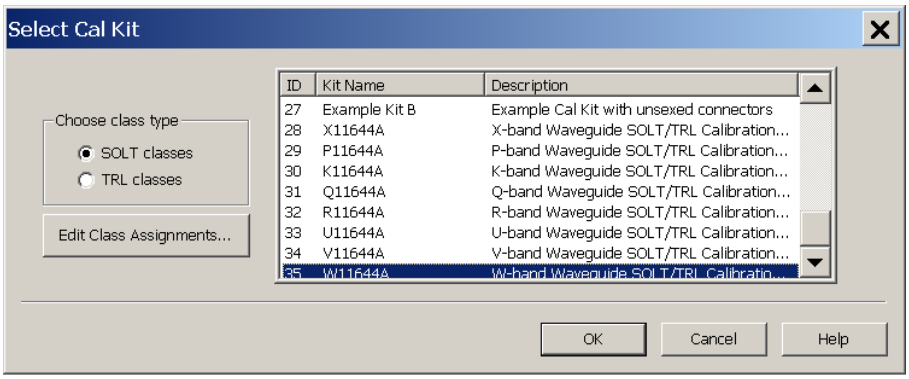
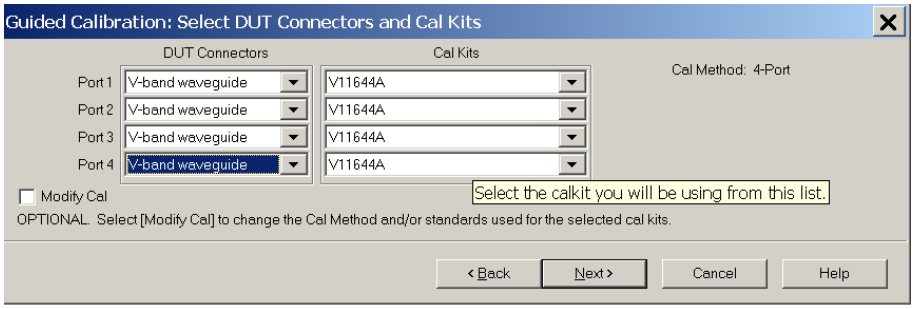


Figure 3-21 Guided Cal Kit List (SmartCal)



8. Press the individual keys to measure each Mechanical Standard or Thru. Follow the prompts for Smart Cal.
9. Press **Next** when all of the Mechanical Standards have been measured.

Figure 3-22 Unguided Cal Mechanical Standards

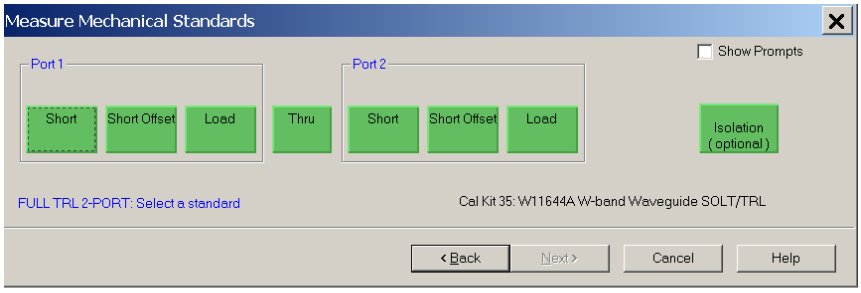
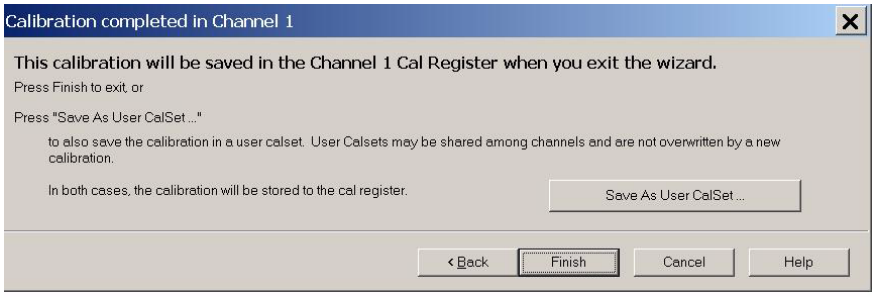


Figure 3-23 Smart Cal Prompt

10. Press **Save As User CalSet** to save the calibration.

Figure 3-24 Save Cal



4 Operational Check

Test Methods

There are two methods to verify your system.

- Individual operational check for the N5261A or N5262A (non-system).
- Operational check for the system.

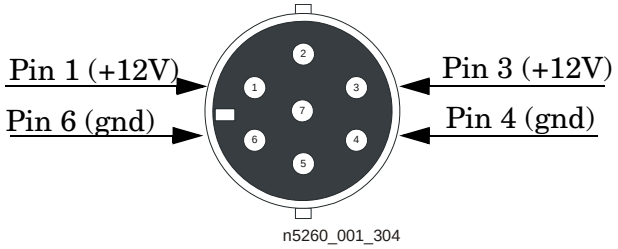
Non-System Operation Check

The following procedure verifies the N5261/62A without system components.

Required Equipment (not included with

- A PNA with a 20 GHz frequency range. N5230A, N5242A, E8362B, or equivalent network analyzer with test set I/O interface.
- Two RF flexible cables with 3.5 mm connectors (5062-6696 or equivalent).
- Three SMA adapters (female to female).
- Volt meter.

1. Turn on the PNA-X and N5261/62A.
2. Verify that the PNA-X is in “Standard PNA” mode.
3. Verify DC voltage supplies on each of the front panel DC power connectors.
   Pins 1 and 3 = +12 V, Pins 4 and 6 = ground



4. Measure the LO OUT and SRC1 & SRC2 RF paths:
   a. Connect the test set I/O cable from the PNA to the N5261A or N5262A.
   b. Press **[Preset]**.
   c. Press **[Freq]** > **Start** > **[7 GHz].**
   d. Press **Stop** > **[20 GHz].**
   e. Press **[Power]** > **[–30]** > **[Enter].**
   f. Press **[Meas]** > **S12.**
   g. Connect the RF cables with adapters to the PNA-X Port 1 and Port 2.
   h. Connect the two RF cables together with adapter.
   i. Normalize the trace. Press **[Memory]** > **Normalize**. You will see a flat line at 0 dB.

j. Remove the adapter from the cables and connect the Port 2 cable to the rear panel LO IN.

k. Connect the PNA-X Port 1 to test set port LO OUT and verify the LO Output power. Refer to Table 4-1 and Figure 4-1. Repeat this step for each LO OUT Port.

l. Remove the SRC1 IN to SRC1 OUT rear panel jumper.

m. Connect the PNA-X Port 1 to the test set SRC1 IN.

n. Connect Port 2 to the rear panel SRC1 OUT.

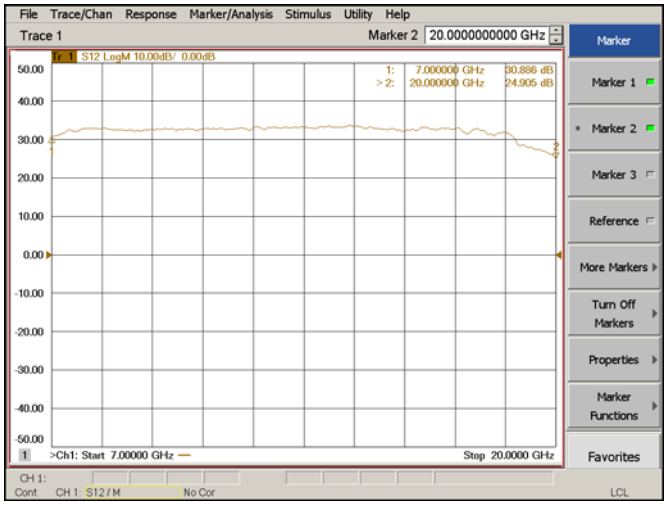
o. Verify the power loss. The trace typically slopes down at –1 dBm to –2 dBm. Refer to Table 4-1.

p. Remove the SRC2 IN to SRC2 OUT rear panel jumper and repeat for SRC2 IN and SRC2 OUT.

Table 4-1 SRC1/2 and LO RF Path Measurement

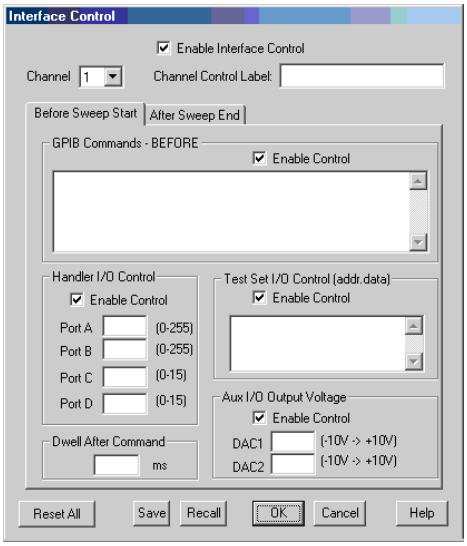
From the Rear Panel	To the Front Panel	Measure Gain/Loss
SRC1 OUT	SCR1 IN	–1 dB (±1 dB)
SRC2 OUT (N5262A)	SCR2 IN (N5262A)	–1 dB (±1 dB)
LO IN	LO OUT	+30 dB (±5 dB)

Figure 4-1 LO Output Power



5. Measure RF OUT.
   a. Re-install the SRC1 IN to SRC1 OUT rear panel jumper.
   b. Press **[Preset]**.
   c. Press **[Freq]** > **Start** > **[7 GHz].**
   d. Press **Stop** > **[20 GHz].**
   e. Press **[Power]** > **[–20]** > **[Enter].**
   f. Press **[Meas]** > **S12.**
   g. Connect the two RF cables together with adapter.
   h. Normalize the trace. Press **[Memory]** > **Normalize**.
   i. Remove the adapter and connect Port 2 to SRC1 IN.
   j. Connect the PNA-X Port 1 to the test set RF OUT.
   k. Select **Trace/Chan** > **Channel** > **Hardware Setup** > **Interface Control** in the drop-down menu. Select "Enable Interface Control" and send the I/O command **0.1** in the "Test Set I/0 Control (addr.data)" window > **OK**. Verify the power level using Table 4-2 on page 4-5 and Figure 4-2 on page 4-5.

NOTE The PNA-X Series Network Analyzer comes with the Interface Control application. Information regarding this application can be found in the PNA's **Help** System Menu, **InterfaceControl**. The application is shown below.



l. Repeat step j and step k for Ports 2, 3 and 4 TEST IF ports. When verifying Ports 3 and 4 move the Port 2 cable to SRC 2 IN. Refer to Table 4-2 for the I/O command.

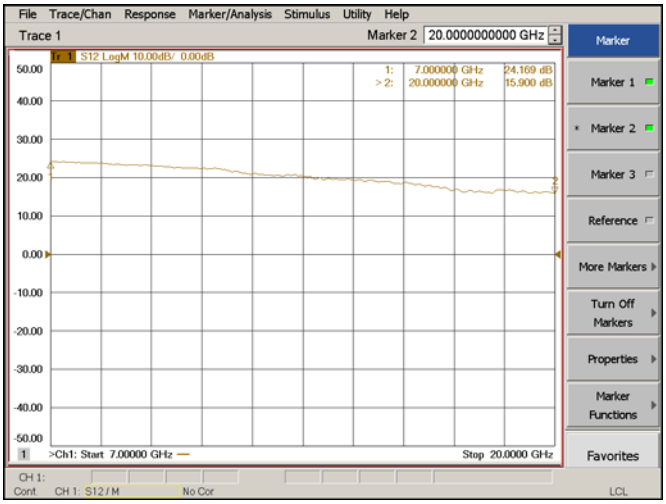
m. Measure S11 on Port 1. Press **[Meas]** > **S11**. Send command for Port 2. This measures the solid state load for RF Output Port 1 (< –10 dB).

n. Measure S11 on Ports 2, 3, and 4. Send the command for Port 1. This measures the solid state loads for RF Outputs 2, 3 and 4 (< –10 dB).

Table 4-2 RF Path Measurement Table

From the Front Panel	To the Front Panel	Command	Gain
SRC1 IN	Port 1 RF OUT	0.1	20 dB (±5 dB)
SRC1 IN	Port 2 RF OUT	0.2	20 dB (±5 dB)
SRC2 IN (N5262A)	Port 3 RF OUT	0.16	20 dB (±5 dB)
SRC2 IN (N5262A)	Port 4 RF OUT	0.32	20 dB (±5 dB)

Figure 4-2 RF Output Power



6. Measuring the TEST IF and REF IF Inputs to A, B, C, D and R Outputs. Refer to Table 4-3 on page 4-7.
   a. Connect the test set I/O cable from the PNA to the N5261A or N5262A.
   b. Press **[Preset]**.
   c. Press **[Freq]** > **Start** > > **[10 MHz].**
   d. Press **Stop** > **[20 MHz].**
   e. Press **[Power]** > **[–20]** > **[Enter].**
   f. Press **[Measure]** > **S21.**
   g. Connect the two RF cables together with adapter.
   h. Normalize the trace. Press **[Memory]** > **Normalize**.
   i. Remove the adapter and connect the PNA-X Port 1 to the front panel test set Port 1, TEST IF.
   j. Connect Port 2 to the test set A IF OUT on the rear panel.
   k. Select **Trace/Chan** > **Channel** > **Hardware Setup** > **Interface Control**. Select **Enable Interface Control** and send the I/O command **16.8** in the "Test Set I/0 Control (addr.data)" window > **OK**. Verify the power level using Table 4-3.
   l. Repeat step j and step k for each TEST IF port.
   m. Connect the PNA Port 1 to the front panel Port 1 REF IF.
   n. Connect Port 2 to the rear panel D IF OUT.
   o. Send the I/O command 16.8 and verify the power level. Refer to Table 4-3.
   p. Repeat step m, step n and step o for each REF IF port.

Table 4-3 IF Path Measurement

From the TEST IF Front Panel	To the Rear Panel IF OUT	Command	Gain
Port 1 TEST IF	A	16.8	0 dB (±2 dB)
Port 2 TEST IF	B	16.4	0 dB (±2 dB)
Port 3 TEST IF	C	16.2	0 dB (±2 dB)
Port 4 TEST IF	D	16.1	0 dB (±2 dB)
Port 1 REF IF	D	16.8	0 dB (±2 dB)
Port 1 REF IF	R	16.33	0 dB (±2 dB)
Port 2 REF IF	C	16.4	0 dB (±2 dB)
Port 2 REF IF	R	16.2	0 dB (±2 dB)
Port 3 REF IF	A	16.2	0 dB (±2 dB)
Port 3 REF IF	R	16.56	0 dB (±2 dB)
Port 4 REF IF	B	16.1	0 dB (±2 dB)
Port 4 REF IF	R	16.20	0 dB (±2 dB)

7. Verifying front panel LEDs.
   a. Connect the test set I/O cable from the PNA to the N5261A or N5262A.
   b. Send the TEST I/O command 64.17 and verify the Active LED (amber) and Port 1 Source (amber) & Receiver (green) Status LEDs are on.
   c. Send the TEST I/O command 64.34 and verify Port 2 S & R Status LEDs are on.
   d. Send the TEST I/O command 64.68 and verify Port 3 S & R Status LEDs are on.
   e. Send the TEST I/O command 64.136 and verify Port 4 S & R Status LEDs are on.
   f. Verify that the DC power LEDs are on.

System Operation Check

The operator's check procedure confirms that the system functions normally. There are no hard specifications for the system measurement performance, only general guidelines are provided for evaluating the operator's check results.

Technical judgment is required when evaluating the results. The purpose of the operator's check is to detect significant degradations in the system that make the performance unacceptable. The calibration kit and test environment can affect the operation check results. Refer to "Site Preparation" on page 3-2 and Table 2-5.

When any part of the operator's check provides unsatisfactory results, troubleshoot the system to determine the cause of the problem.

Required Equipment

- A calibration kit compatible with the millimeter wave heads.
- Two waveguide extension sections (provided as accessories for the heads or as part of a calibration kit).

Information Required for the Operator's Check

- From the OML Web site:
  - ❏ Note the specification for Coupler Directivity on the specifications page for the particular model head at http://www.omlinc.com/vector/vmodules.htm.
- From the data pages provided by OML for individual heads:
  - ❏ Reference the Dynamic Range and Ref Port/Test Port pages for each OML head for use in the operator's check process defined below.

    OML ships three pages of data with each head: Power curve, Dynamic Range, and Ref Port/Test Port. If this data is not available, contact OML at 408-779-2698 and provide your model and serial numbers and OML will fax the page to you.
- From the calibration kit information:
  - ❏ Note the lower cut-off frequency for the wave guide ("TE 1.0" or "Min").
  - ❏ Note the length (in mm) of 1/4 wave offset shim.
  - ❏ Note the delay time for a waveguide section (50 mm = 167 picoseconds).

Preparing the PNA-X

1. Connect the PNA-X, the N5261/62A, and the OML banded millimeter-wave heads as described in “System Setup with N5242A” on page 3-3.
2. Turn On the N5261/62A and the PNA-X.
3. Configure the PNA-X for operation with the OML heads. Refer to “Controlling the N5261/62A with the N5242A” on page 3-11. For further information use the Help menu in the PNA-X. Search the Help index for the keyword “N5261/62A” to find the appropriate information. The multiplier factors for the OML heads may be read from the labels near the connectors on the heads or from the OML Web site at: http://www.omlinc.com/vector/vmodules.htm

Operator’s Check Procedure

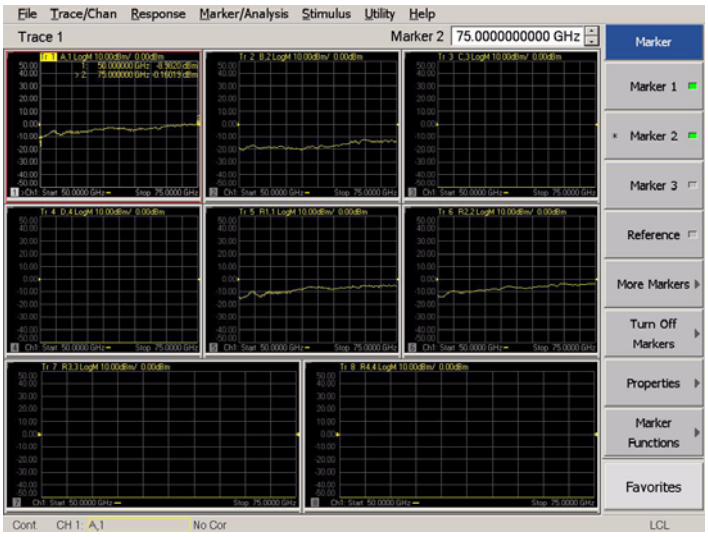
An Agilent or an OML calibration kit may be used with the system. The Agilent calibration kit definition is included with the PNA-X firmware. If an OML calibration kit is used with the heads, the calibration kit definition must be entered in the PNA-X. To enter it, use the PNA-X function “Import Cal Kit” to import the .ckt file from a floppy disk or USB pen drive. (Search the Help index for the keywords “modify calibration kit.”) Include the calibration kit serial number in the calibration kit definition name/description.

Initial System Verification

This procedure verifies that the system is connected correctly and the modules, test set and PNA-X are operating properly. To verify the measurement accuracy refer to “Calibrated Performance Measurements” on page 4-14.

1. Allow the system to warm up for at least 30 minutes.
2. Attach a waveguide extension section to each module’s waveguide flange port.
3. Verify that the PNA-X is in Millimeter Mode.
4. To verify the port as a receiver, perform the following steps:
   a. Connect a short to module Port 1.
   b. Press **[Avg]** > **IF Bandwidth** > **1000** > **[Enter]**.
   c. Display all four receivers on the PNA-X screen using the following menu selections: **[System]** > **Service** > **Utilities** > **Receiver Display**.
   d. Compare the A,1 and R1,1 traces to the traces on the RefPort/TestPort page from OML for the head on Port 1. The general level and shape should be similar but not necessarily identical.
   e. Move the short to module Port 2.
   f. Compare the B,2 and R2, 2 traces to the traces on the RefPort/TestPort page from OML for the head on Port 2. The general level and shape should be similar, but not necessarily identical.
   g. Repeat step e and step f for Port 3 and compare trace 3 C,3 and R3, 3.
   h. Repeat step e and step f for Port 4 and compare trace 4 D,4 and R4, 4.

Figure 4-3 Receiver Display



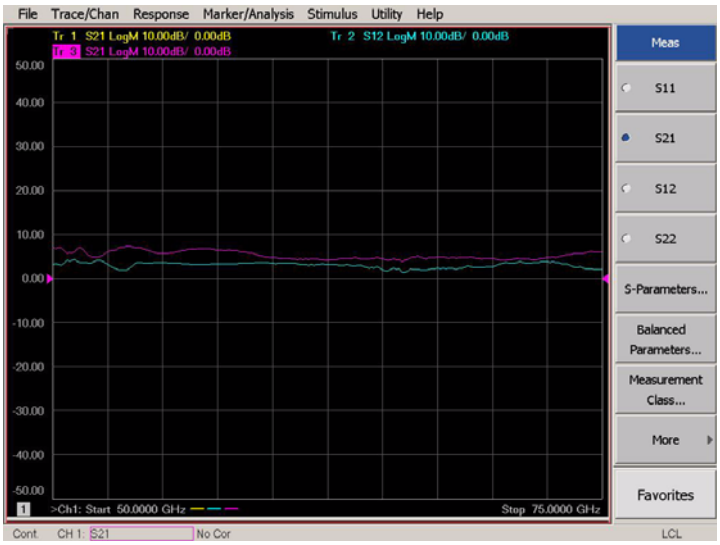
i. Remove the short from the module.

j. Connect the waveguide extension flanges of Port 1 module to Port 2, and Port 3 module to Port 4 (N5262A) to form through connection. Adjust the feet on the modules to insure the mating surfaces are properly aligned before connecting the waveguide flanges.

k. Delete the trace 1, S11. Press **Trace/Chan** > **Trace** > **Delete Trace.**

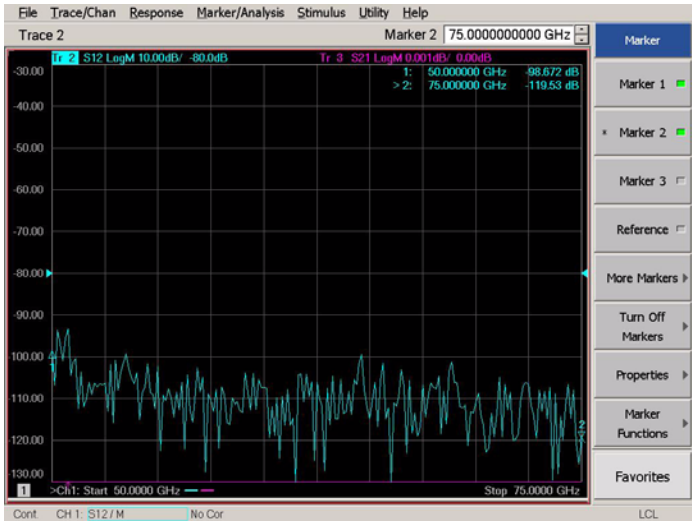
l. Press **[Preset]** > **Trace/Chan** > **Trace** > **New Trace**. Select S12 and S21. (Select S34 and S43 for a N5262A 4-Port system). The traces should be within 10 dB of zero. See Figure 4-4.

Figure 4-4 Initial S12 and S21 Example



5. Check the dynamic range of each head.
   a. Set the PNA-X for 10 Hz IFBW, display S_{12}, S_{21},S_{34} and S_{43} traces. Press **[Avg]** > **IF Bandwidth [10]** > **[Enter]**.
   b. Verify that both modules ports are connected together to form a through connection.
   c. Normalize each trace. Select the trace and press **[Memory]** > **Normalize.**
   d. Press **[Scale]** > **Reference Level** > **[–80]** > **[Enter]**. (each trace)
   e. Disconnect the two module ports.
   f. Connect a load to module Port 1.
   g. Compare the S_{12} trace to the dynamic range data for the OML millimeter head. The PNA-X trace should be within 5 dB of the dynamic range data. Refer to the OML webpage for your module specifications. Refer to Figure 4-5 on page 4-12.

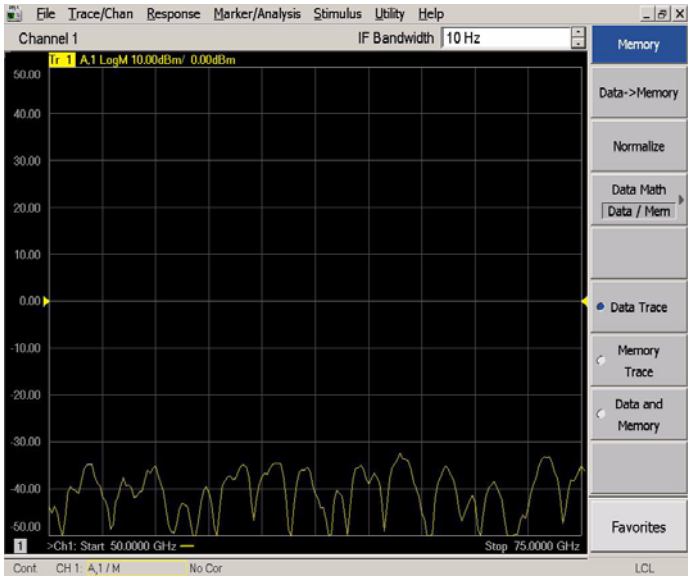
Figure 4-5 Dynamic Range Trace Example



   h. Repeat step f and step g for Port 2, 3 and 4.
   i. Remove the load.

6. Verify the coupler directivity of each head.
   a. Set the PNA-X for 10 Hz IFBW. Press **[Avg]** > **IF Bandwidth [10]** > **[Enter].**
   b. Display receiver A trace. Select **[System]** > **Service** > **Utilities** > **Receiver Display.** Refer to Figure 4-3 on page 4-10.
   c. Double click on the A1 window for a full display.
   d. Connect a short to module Port 1.
   e. Normalize the trace. Press **[Memory]** > **Normalize**.
   f. Remove the short and connect a load to module Port 1.
   g. Observe the response. This is the “rough” coupler directivity. The trace should be no greater than 10 dB above the directivity specification for the module. Refer to the OML webpage for your module.
   h. Repeat step 6 for Ports 2 (B,2), 3 (C,3) and 4 (D,4).

Figure 4-6 Directivity Trace Example

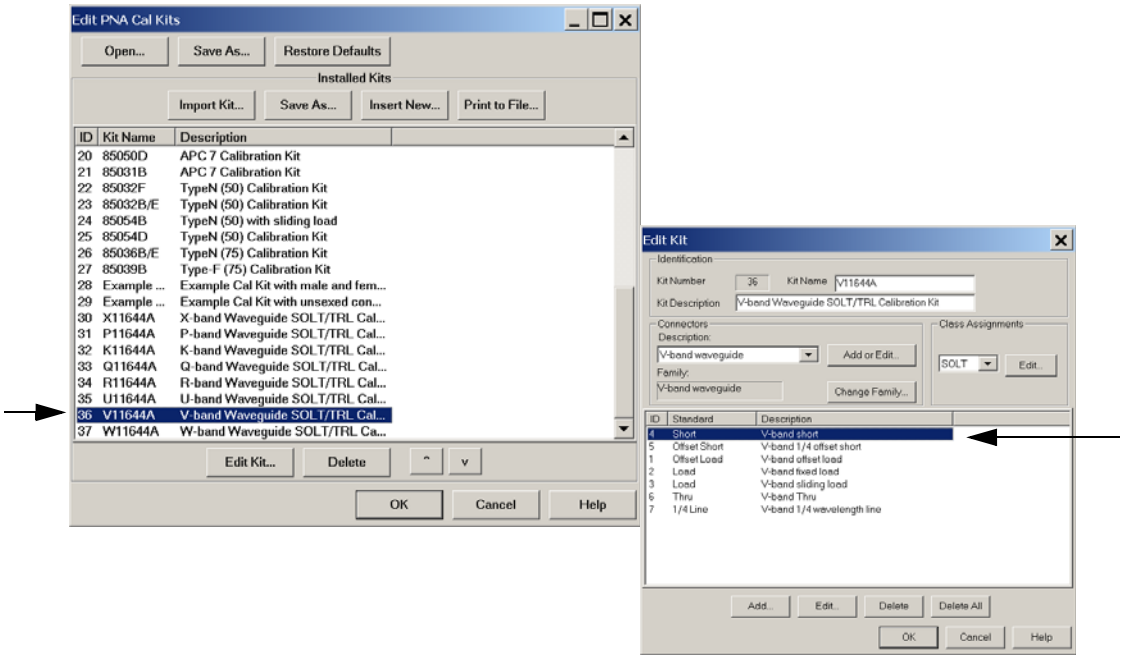


Calibrated Performance Measurements

This procedure verifies that the performance accuracy of the system.

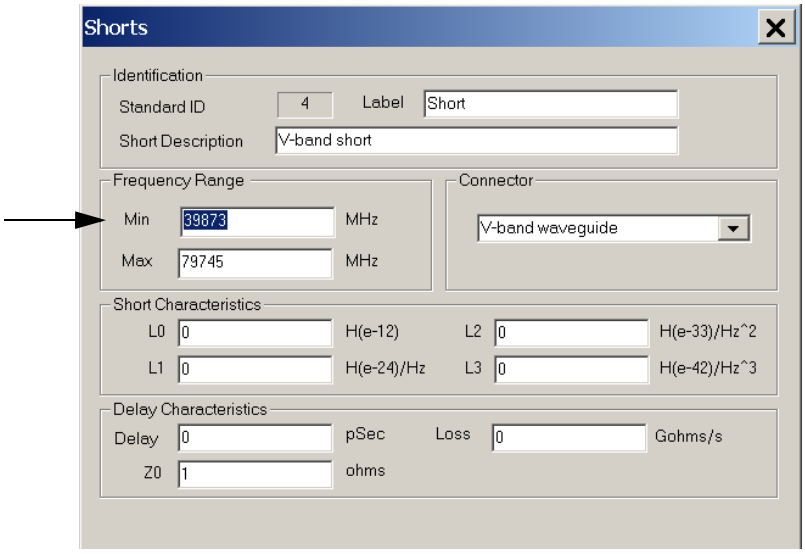
1. Attach a waveguide extension section to each module's port.
2. Allow the system to warm up for at least 30 minutes.
3. Perform a calibration, using the waveguide Cal kit for your module(s).
   a. Press **[Preset]**.
   b. Press **[Avg]** > **IF Bandwidth [1000]** > **[Enter].**
   c. Set the media to "Waveguide". Press **[Scale]** > **More** > **Media coax/WAVGD**. (Waveguide will be upper case, coax will be lower case).
   d. Select **[Cal]** > **Start Cal** > **Cal Wizard**. Select **SmartCal (GUIDED Calibration)** > **Next** feature to perform the TRL calibration. Select the number of ports to be calibrated and the calibration kit you are using. Save the Cal for future use, if desired. The calibration software will guide you through the TRL calibration procedure.
4. Verifying the calibrated system performance.
   a. Verify waveguide minimum cut-off frequency of your Cal kit. Select **Response > Cal > More > Cal Kit.**
   b. Select your Cal kit > **Edit Kit**.
   c. Select the short or another standard from the list > **Edit**.

Figure 4-7 Select Cal Kit



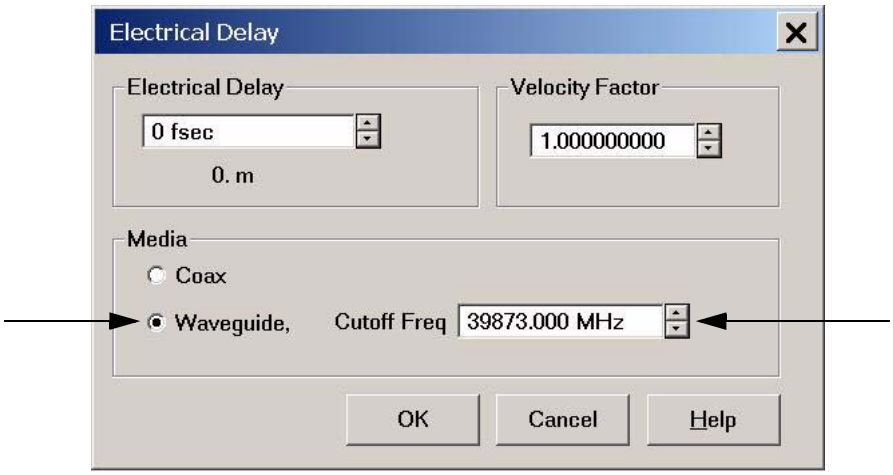
d. Write down the “Min frequency” for use in step e, press **OK**.

Figure 4-8 Select Standard



e. Select **Response > Scale > Electrical Delay** and enter the “Min frequency” for the Cutoff freq. Select **Waveguide** > **OK.**

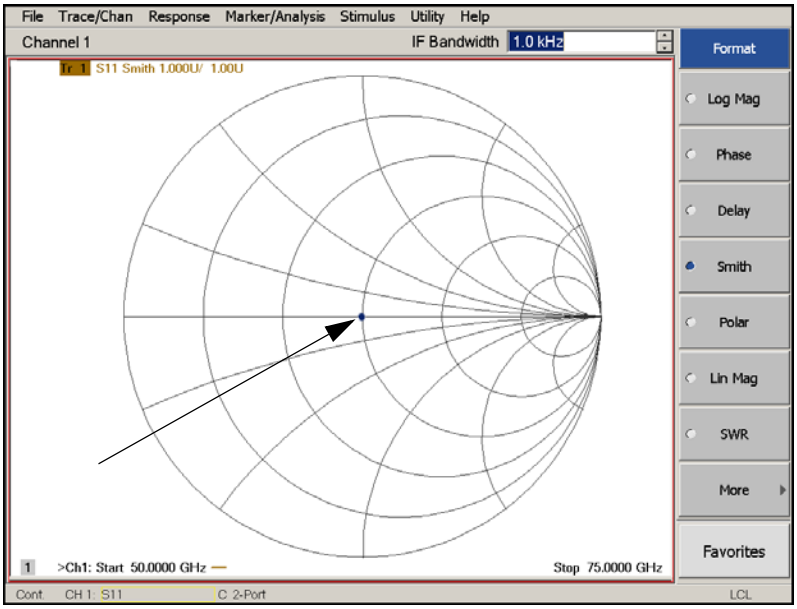
Figure 4-9 Electrical Delay



f. Disconnect the modules and install the load from the Cal Kit onto module Port 1.

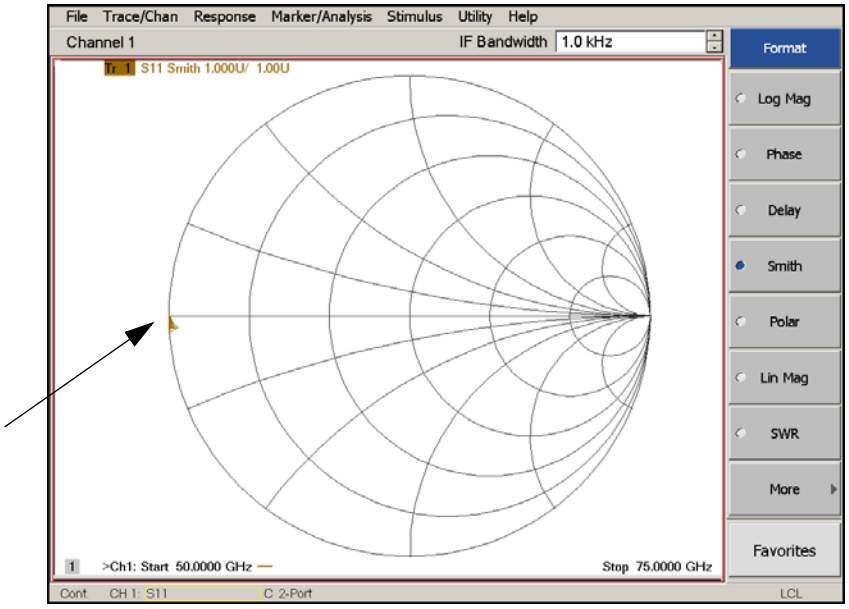
g. Display the Smith Chart for S11. Press **[Format] > Smith**. Verify that the response is in the middle of the smith chart.

Figure 4-10 Calibrated Load



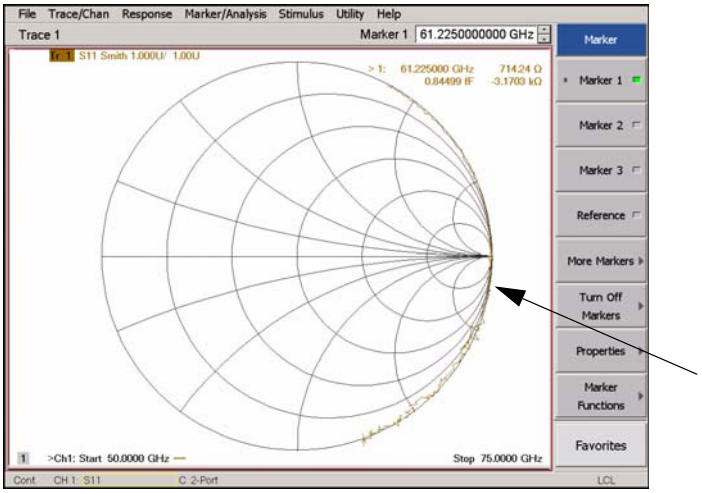
h. Connect a short to module Port 1 and verify that the point has moved to the left side of the smith chart.

Figure 4-11 Calibrated Short



i. Connect the 1/4 wave and a short to module Port 1. Verify the response (arc) on the right side.

Figure 4-12 1/4 Wave with Short Response



j. Remove the 1/4 wave & short and connect the airline (or standard section) to Port 1.

k. Connect the airline (or standard section) to Port 1.

l. Connect a short to the open end of the airline.

m. Press **[Marker] > Marker**1. The frequency of the marker should be approximately in the middle of the displayed frequency range.

n. Adjust electrical delay using the following menu selections:

- Select **Response > Scale > Electrical Delay** and increase the electrical delay until the trace is a small cluster on the left side of the Smith Chart's X-axis.
- Read the electrical and physical delay values. The physical delay should be approximately twice the length of the airline waveguide section in millimeters.

Figure 4-13 Waveguide Cutoff Frequency

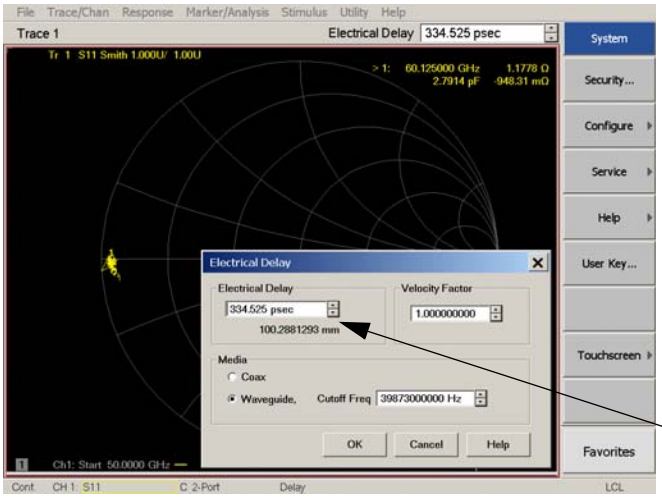
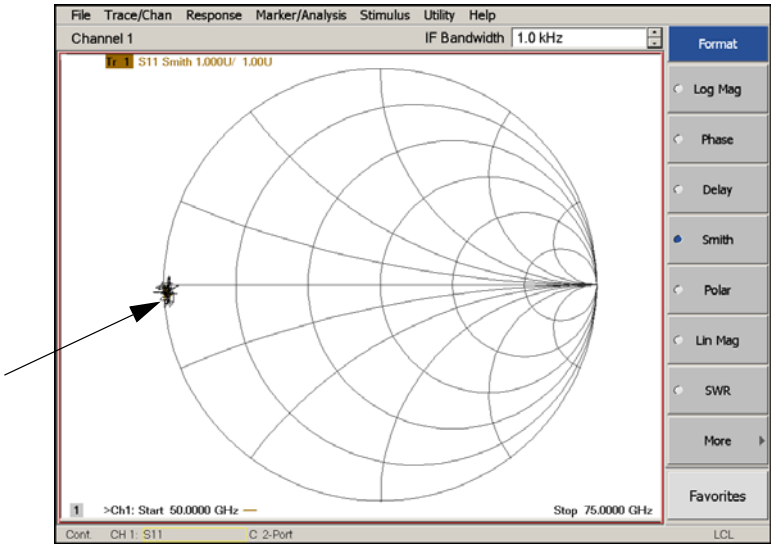


Figure 4-14 Small Cluster



o. Add a 1/4 offset shim (with the short) to the airline. The Smith Chart trace should be an arc on the right side.

p. Increase the electrical delay to minimize the length of the ark on the left side of the Smith Chart. Read the electrical and physical delay values. The physical delay should be approximately twice the length of the airline waveguide section + the 1/4 offset shim in millimeters.

q. Remove the airline and install the short on module Port 1.

r. Verify the trace is approximately 0 dB. Press **[Meas]** > **S11** > **[Format] > Log Mag.**

s. Remove the short and connect the load.

t. Compare the trace to the return loss specification of the load (> –10 dB). Refer to the information in your Cal Kit.

u. Repeat step f through step t for Ports 2, 3 and 4.

v. Connect Port 1 module to Port 2, and Press **[Meas]** > **S11** and **S22.** The test set solid state switch loads will have a return loss of < –10 dB.

w. Connect Port 3 module to Port 4. Press **[Meas]** > **S33** and **S44.** The test set solid state switch loads will have a return loss of > –10 dB.

5 Theory of Operation

Functional Block and Assembly Information

The N5261A/62A routes PNA-X LO and RF signals to a millimeter head module. This allows the PNA-X to up-convert for a millimeter-wave source and down-convert a received millimeter-wave frequency to an IF frequency < 20 MHz. It also provides the DC power for the millimeter heads. The following components are used in the N5261/62A. Refer to the block diagrams, Figure 5-1 through Figure 5-4 beginning on Page 5-5.

Test Set Controller Board (N5261-60006)

The Test Set Control Board (N5261-60006) is a surface mount, printed circuit assembly (PCA) that provides a connection to the power supply, and the PNA-X Test Set I/O. The PNA-X sends address and data commands which are read by the Test Set Controller for selecting the switch paths of the SRC1 and SRC2 RF and IF switch paths. The Test Set Controller board has a programmed FPGA and memory (NovRam) with model number and gain correction values for the Amplifiers and ALC circuits. Switch S1 is set to lock the memory after calibration is been loaded.The front panel “Active” and port LEDs are only on when the PNA-X has addressed the N5261/62A Millimeter Head Controller. The rear panel fan is on when the controller board supplies are operational.

Interface Board (N5261-60001)

The Interface board is installed on top of the Test Set Controller Board. It provides switch drive signals and voltage for the solid-state switches that select RF Inputs (SRC1 or SRC2) to one of the front panel RF Outputs ports. It provides switching from the front panel TEST IF and REF IF Inputs to the rear panel IF Outputs D/R2 C/R1, R, A, B. The Interface board also provides DC voltage and ALC control of the Amplifiers. The Interface board has a FPGA programmed device that enables N5261/62A Millimeter Head Controller operation.

LED Board (N5261-60005)

Two LED board assemblies are mounted to the front panel. The top LED board indicates the Source Path (amber/yellow color), or Receiver Path (green colored) shown as “S” and “R” for each Port. The bottom LED Board indicates when the Millimeter Heads (green) DC Power is on, or if a over-current condition occurs (amber/yellow), which could be a result of a shorted interface cable or damaged Millimeter Head module. The LED board assemblies are connected to the Test Set Controller board by ribbon cables.

DC Power Board (N5261-63002)

The DC Power board provides connection to the power supply and self recovering fuses for each Millimeter Head supply (+12 volt) on the front panel. The fuses are reset when the N5261/62A is turned off.

Power Supply (0950-4729)

The power supply (0950-4729) coverts the AC line voltages to DC. This is an automatic line voltage selecting power supply. The DC supplies are connected to the test set control board through five wire harnesses to connectors J10, J11, J12, J13 and J14. The DC Power board is connected to connectors J5 and J8. The AC line voltage (100 to 240 V @ 50/60 Hz) is provided from the line module located on the rear panel.

Isolators (0955-1595)

Isolators are installed in the LO Output RF path for each port. These 10 watt isolators maximizes the LO power input to the Millimeter heads over a frequency range of 8 to 19 GHz.

AMP, LO Power (5087-7290)

An amplifier installed in the LO Input path provides RF power required for the LO Out to the Millimeter Head Modules. This amplifier has an attenuator on its input to provide a good match and ensure the amplifiers output does not exceed +15 dBm.

MOD AMP, RF and LO (5086-7523)

The Mod/Amp has adjustable gain that provides ALC leveling for the front panel RF and LO Outputs. Adjustments are made on each Mod/Amp to set the maximum output power to +12.5 dBm (R3). The output of each amplifier is connected to a coupler, and with a detector for ALC, the mod/amps provide RF and LO leveling. Gain values stored on the Test Set Controller board are used to provide a set RF and LO level when the ALC is turned off in the PNA-X Millimeter mode. Each Mod Amp has a Bias board (N5261-63003) installed on top that provides the power supply connection and circuitry for setting the gain of the amplifier (R3) and an SMB Input to the modulator.

Attenuator, 6 dB (0955-0243)

The 6 dB attenuators are used to attenuate the RF and LO power to the ALC detector to set the RF level for linear operation.

Attenuator, 3 dB (0955-0246)

The 3 dB attenuators are used in the SRC1 or SRC2 Mod/Amp Inputs to provide a good match and ensure it does not exceed +15 dBm.

Coupler (0955-0148)

Directional couplers with 10 dB coupling factor are used for ALC feedback for RF and LO Output leveling.

Power Divider (N5262-80003)

A four-way power divider provides each Port LO Output from the LO amplifier with approximately 7.2 dB attenuation for each LO Out. Two 50 ohm terminators are installed on the unused N5261A divider paths. If a system is configured with a unused port (a 1 port reflection system for example) the front panel LO Output ports are to be terminated with a 50 ohm load (1810-0118). This keeps the power divider balanced and prevents an “open” reflective signal from entering the power divider and mixing with the RF signal.

Solid State Switch (5087-7238)

A solid-state switch with internal 50 ohm termination is used for switching the RF Output path for Ports 1 and 2, or Ports 3 and 4. These switches are controlled by the Test Set Controller and Interface Boards.

Figure 5-1 N5261A Block Diagram

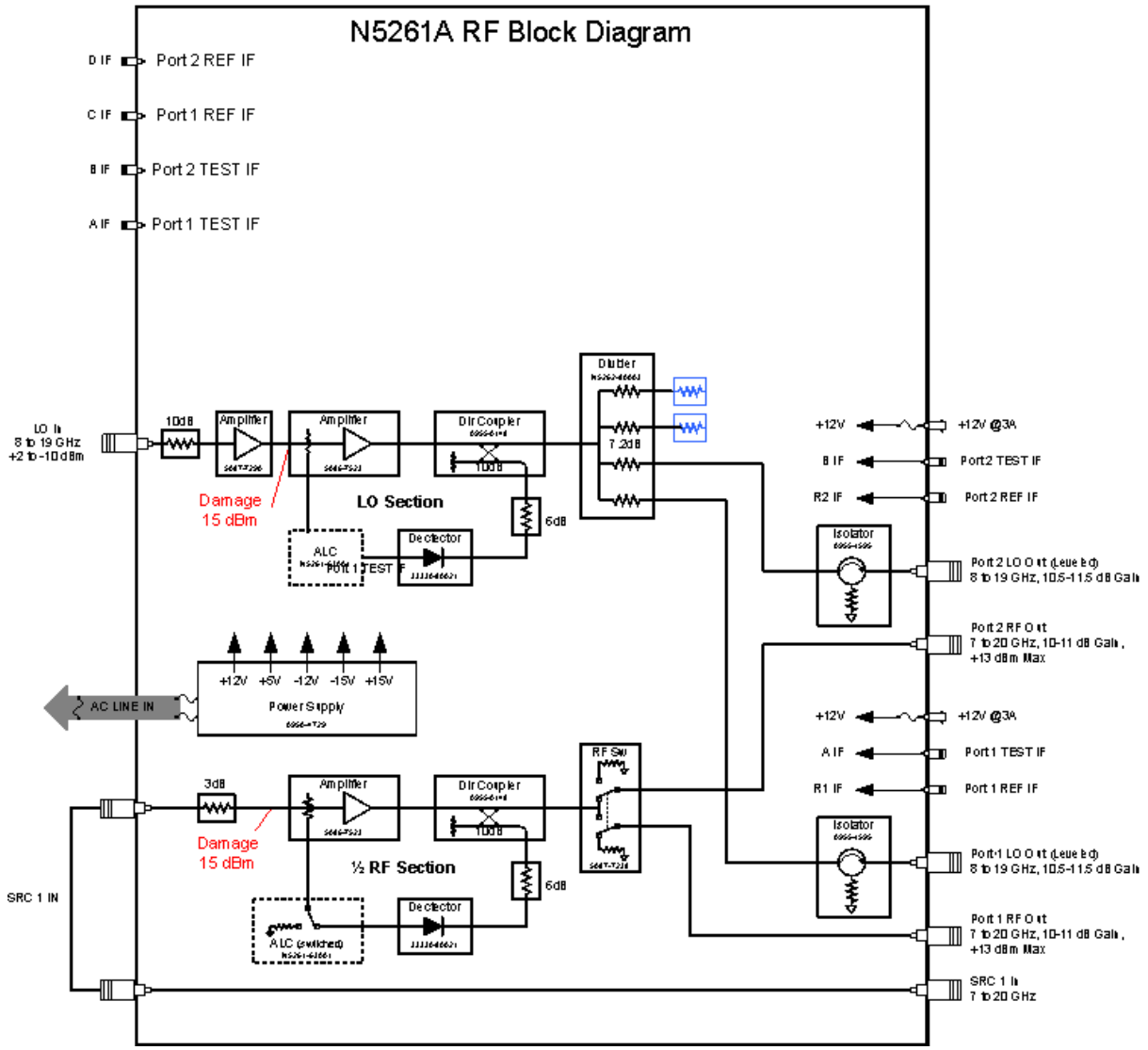


Figure 5-2 N5262A Block Diagram

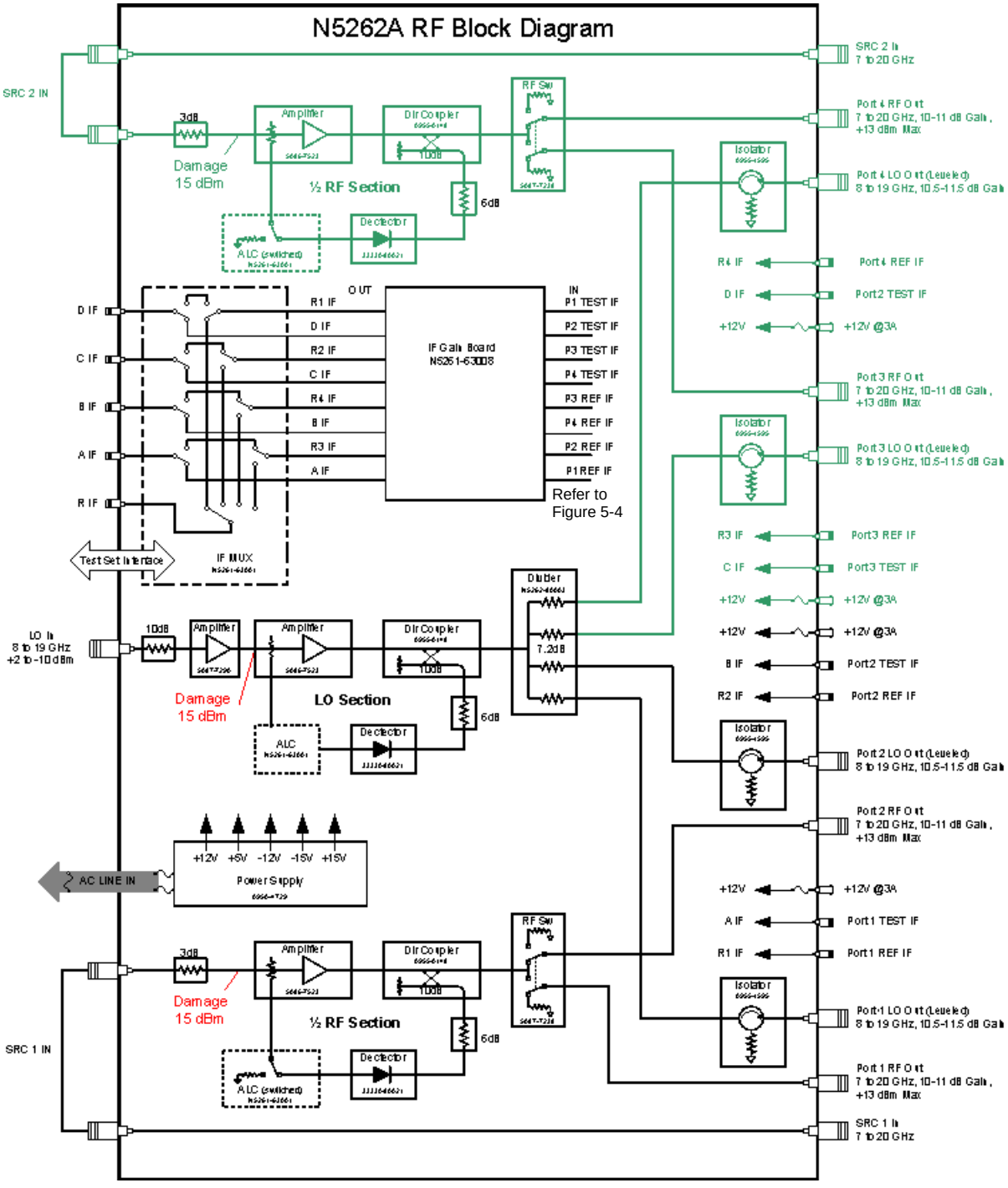


Figure 5-3 IF Routing 2-Port

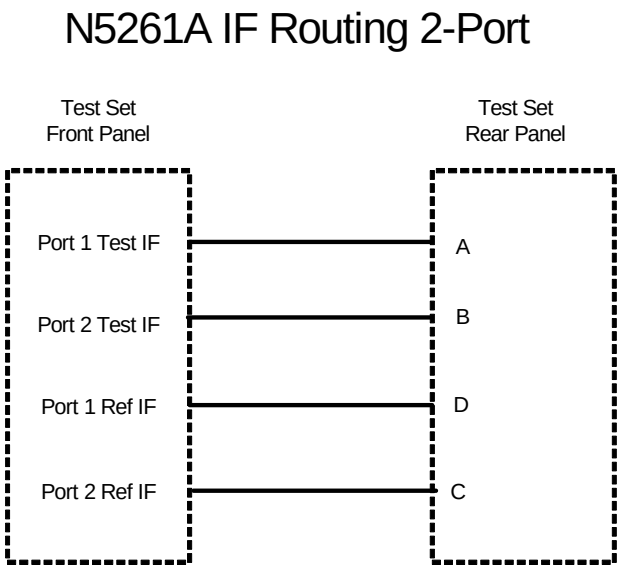


Figure 5-4 IF Routing 4-Port