Keysight Technologies

N5290/1A PNA Series 2-Port and 4-Port Microwave Network Analyzer System

(900 Hz - 110 GHz / 900 Hz - 120 GHz)

Use this manual in conjunction with the following documents:

- PNA Series Network Analyzer Embedded Help System
  (Online at: http://na.support.keysight.com/pna)

- PNA Series Network Analyzer Installation and Quick Start Guide
  Part Number E8356-90001

- PNA Series Network Analyzer Service Guide (For your PNA)
  (Online at: http://keysight.com/find/pna)
Notices

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Safety Notices

CAUTION

A CAUTION notice denotes a hazard. It calls attention to an operating procedure, practice, or the like that, if not correctly performed or adhered to, could result in damage to the product or loss of important data. Do not proceed beyond a CAUTION notice until the indicated conditions are fully understood and met.

WARNING

A WARNING notice denotes a hazard. It calls attention to an operating procedure, practice, or the like that, if not correctly performed or adhered to, could result in personal injury or death. Do not proceed beyond a WARNING notice until the indicated conditions are fully understood and met.
NOTICE: This document contains references to Agilent Technologies. Agilent’s former Test and Measurement business has become Keysight Technologies. For more information, go to www.keysight.com.
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# 1 Safety and Regulatory Information

## Information in This Chapter

This chapter provides safety information that will help protect you and your system's equipment. It also contains information that is required by various government regulatory agencies.

## Chapter One at-a-Glance

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<tr>
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<th>Summary of Content</th>
</tr>
</thead>
<tbody>
<tr>
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<td>Descriptions of CAUTION and WARNING symbols used throughout this manual.</td>
</tr>
<tr>
<td>“General Safety Considerations” on page 3</td>
<td>A list of safety points to consider when servicing your network analyzer.</td>
</tr>
<tr>
<td>“Electrostatic Discharge Protection” on page 7</td>
<td>A discussion of electrostatic discharge (ESD) and related recommendations and requirements for ESD protection. Also, includes a table of ESD equipment part numbers.</td>
</tr>
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</tr>
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<td>“Environmental Requirements” on page 13</td>
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</tr>
<tr>
<td>“Space Requirements” on page 15</td>
<td>Describes the N5290/1A System weight and dimensions</td>
</tr>
<tr>
<td>“Site Preparation” on page 17</td>
<td>Describes power requirement-related information for your N5290/1A System.</td>
</tr>
</tbody>
</table>
Safety Symbols

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

**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** 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.

**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.

**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.

**CAUTION**

Use Keysight supplied power cord or one with same or better electrical rating.

Before Applying Power

**WARNING**

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.

**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**

If an instrument handle is damaged, you should replace it immediately. Damaged handles can break while you are moving or lifting the instrument and cause personal injury or damage to the instrument.
Safety and Regulatory Information
General Safety Considerations

**WARNING**
Supply voltages which oscillate between the two normal input ranges of the autoranging line voltage input will damage the power supply. In rare cases, this damage has become a user safety concern. If unstable power levels are expected, the analyzer input power must be buffered by a line conditioner.

**CAUTION**
Before switching on this instrument, make sure
– the correct rating service breaker.
– the supply voltage is in the specified range

**CAUTION**
This instrument has auto-ranging line voltage input, be sure the supply voltage is within the specified range and voltage fluctuations do not to exceed 10 percent of the nominal supply voltage.

**CAUTION**
Do not operate the analyzer with the outer cover removed for more than 30 minutes, as this could cause the analyzer to overheat which could result in costly damage.

**CAUTION**
Ventilation Requirements: 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 instrument by 4 °C for every 100 watts dissipated in the cabinet. If the total power dissipated in the cabinet is greater than 800 watts, then forced convection must be used.
Servicing

**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**  Danger of explosion if battery is incorrectly replaced. Replace only with the same or equivalent type recommended. Discard used batteries according to local ordinances and/or manufacturer’s instructions.

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

**WARNING**  Cleaning connectors with alcohol shall only be done with the N5xxxB removed from the system, and in a well-ventilated area. Allow all residual alcohol moisture to evaporate and the fumes to dissipate prior to reconnecting the N5xxxB to the system.

**CAUTION**  Do not operate the analyzer with the outer cover removed for more than 30 minutes, as this could cause the analyzer to overheat which could result in costly damage.
There are no replaceable fuses in the mains input or within the power supply assembly.

**NOTE**

Keysight personnel: after calibration is completed, attach four “calibration void if seal broken” stickers to the PNA as shown in Figure 1-1.

**Figure 1-1** Example of a Calibration Sticker on a PNA

---

Install 4x calibration stickers where shown below

1. Place sticker over screw in strap handle on both sides of PNA
2. Place sticker over edge of outer cover and rear panel
3. Second sticker goes on handle on opposite side
Electrostatic Discharge Protection

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

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 in front of your test equipment.

— always wear a grounded wrist strap, connected to a grounded conductive table mat, having a 1 MΩ resistor in series with it, when handling components and assemblies or when 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 and remove the short from the cable.

Figure 1-2 shows a typical ESD protection setup using a grounded mat and wrist strap. Refer to “Electrostatic Discharge Protection” on page 1-7 for part numbers.
ESD Equipment Required for the Installation

<table>
<thead>
<tr>
<th>Description</th>
<th>Keysight Part Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>ESD grounding wrist strap</td>
<td>9300-1367</td>
</tr>
<tr>
<td>5-ft grounding cord for wrist strap</td>
<td>9300-0980</td>
</tr>
<tr>
<td>2 x 4 ft conductive table mat and 15-ft grounding wire</td>
<td>9300-0797</td>
</tr>
<tr>
<td>ESD heel strap (for use with conductive floors)</td>
<td>9300-1308</td>
</tr>
</tbody>
</table>
Regulatory Information

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

Instrument Markings

Familiarize yourself with these instrument markings and their meanings before operating the instrument.

**NOTE**

Some instrument markings may not appear on your analyzer.

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Marking Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>⚠️</td>
<td>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.</td>
</tr>
<tr>
<td>~</td>
<td>The AC symbol indicates the required nature of the line module input power.</td>
</tr>
<tr>
<td>🗑️</td>
<td>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).</td>
</tr>
<tr>
<td>🔌</td>
<td>This symbol indicates that the power line switch is ON.</td>
</tr>
<tr>
<td>⏳</td>
<td>This symbol indicates that the power line switch is in the STANDBY position.</td>
</tr>
<tr>
<td>🔴</td>
<td>This symbol indicates that the power line switch is in the OFF position.</td>
</tr>
<tr>
<td>🔍</td>
<td>This symbol is used to identify a terminal which is internally connected to the product frame or chassis.</td>
</tr>
<tr>
<td>🌐</td>
<td>The CE mark is a registered trademark of the European Community. (If accompanied by a year, it is when the design was proven.)</td>
</tr>
<tr>
<td>🇨🇦</td>
<td>The CSA mark is a registered trademark of the CSA International.</td>
</tr>
<tr>
<td>🇺🇸</td>
<td>This mark designates the product is an Industrial Scientific and Medical Group 1 Class A product (reference CISPR 11, Clause 5).</td>
</tr>
<tr>
<td>🇨🇦/US</td>
<td>This is a marking to indicate product compliance with the Canadian Interference-Causing Equipment Standard (ICES-001).</td>
</tr>
<tr>
<td>⚡</td>
<td>Direct Current.</td>
</tr>
<tr>
<td>IP 2 0</td>
<td>The instrument has been designed to meet the requirements of IP 2 0 for egress and operational environment.</td>
</tr>
</tbody>
</table>
Lithium Battery Disposal

If the battery on your network analyzer’s CPU board needs to be disposed of, dispose of it in accordance with your country’s requirements. If required, you may return the battery to Keysight Technologies for disposal. Refer to “Contacting Keysight” on page 2-7 for assistance.

DO NOT THROW BATTERIES AWAY BUT COLLECT AS SMALL CHEMICAL WASTE

EMC and Safety Information

**EMC Information**

Complies with European EMC Directive 2014/30/EU

- IEC/EN 61326-1
- CISPR Pub 11 Group 1, Class A
- AS/NZS CISPR 11
- ICES/NMB-001

This ISM device complies with Canadian ICES-001.
Cet appareil ISM est conforme à la norme NMB-001 du Canada.
South Korean Class A EMC declaration:
This equipment has been conformity assessed for use in business environments. In a residential environment this equipment may cause radio interference.

- This EMC statement applies to the equipment only for use in business environment.

Safety:
Complies with the essential requirements of the European Low Voltage Directive as well as current editions of the following standards (dates and editions are cited in the Declaration of Conformity):

- IEC/EN 61010-1
- Canada: CSA C22.2 No. 61010-1
- USA: UL std no. 61010-1

Acoustic Statement: (European Machinery Directive)

Acoustic noise emission
LpA <70 dB
Operator position
Normal operation mode per ISO 7779

To find a current Declaration of Conformity for a specific Keysight product, go to:
http://www.keysight.com/go/conformity
### N5292A Test Set Equipment Ratings

<table>
<thead>
<tr>
<th></th>
<th>N5292A Equipment Ratings</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nominal voltage and or range</td>
<td>100/120 or 220/240 VAC</td>
</tr>
<tr>
<td>Nominal frequency and or range</td>
<td>50/60 Hz</td>
</tr>
<tr>
<td>Power in watts, VA or current</td>
<td>210 W MAX</td>
</tr>
</tbody>
</table>
Environmental Requirements

**CAUTION**

Ventilation Requirements: 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 instrument by 4 °C for every 100 watts dissipated in the cabinet. If the total power dissipated in the cabinet is greater than 800 watts, then forced convection must be used.

**NOTE**

Samples of this product have been type-tested in accordance with the Keysight 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.

The environmental requirements shown below are characteristic for the system and are based on the limitations of the PNA network analyzer used.

**Table 1-2** N5290/1A Environmental Conditions (Operating)

<table>
<thead>
<tr>
<th>Environment</th>
<th>Temperature</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operation</td>
<td>0 °C to 40 °C (41 °F to 104 °F)</td>
</tr>
<tr>
<td>Storage</td>
<td>-40 °C to +65 °C (~-40 °F to 158 °F)</td>
</tr>
<tr>
<td>Measurement Calibration</td>
<td>20 °C to 26 °C (68 °F to 79 °F)</td>
</tr>
<tr>
<td>Performance Verification</td>
<td>Temperature must be within 1 °C (1.8 °F) of the temperature at which the measurement calibration was performed.</td>
</tr>
<tr>
<td>Relative Humidity</td>
<td>Type tested at 95%, +40 °C (non-condensing)</td>
</tr>
<tr>
<td>Pressure Altitude</td>
<td>Type tested 0 to 4600 meters (~15,000 feet)</td>
</tr>
</tbody>
</table>

**Table 1-3** N5292/3/5A Environmental Conditions (Operating)

<table>
<thead>
<tr>
<th>Environment</th>
<th>Temperature</th>
</tr>
</thead>
<tbody>
<tr>
<td>For indoor use only (unless specified otherwise.)</td>
<td></td>
</tr>
<tr>
<td>Altitude up to 4,600 meters</td>
<td>4,600 meters</td>
</tr>
<tr>
<td>Temperature</td>
<td>0 to 40 °C</td>
</tr>
<tr>
<td>Relative humidity</td>
<td>Type tested, 0 to 95% relative humidity, non-condensing up to 40°C</td>
</tr>
</tbody>
</table>
System Heating and Cooling

Install air conditioning and heating, if necessary, to maintain the ambient temperature within the appropriate range (as given in the table above). Air conditioning capacity must be consistent with the BTU ratings given in Table 1-1 on page 12 and Table 1-2 on page 13.

Required Conditions for Accuracy Enhanced Measurement

Accuracy-enhanced (error-corrected) measurements require the ambient temperature of the N5290/1A to be maintained within ± 1 °C of the ambient temperature at calibration.
Space Requirements

Standard installation of the N5290/1A system includes configuration and installation of the system on a customer provided lab bench or table top of adequate size and strength.

N5290/1A System Weight and Dimensions

Table 1-4  N5290/1A System Weight and Dimensions

<table>
<thead>
<tr>
<th>Model</th>
<th>Weight</th>
<th>Clearance Width</th>
<th>Depth</th>
<th>Width</th>
</tr>
</thead>
<tbody>
<tr>
<td>2-Port</td>
<td>60.1 kg (132 lb)</td>
<td>48 cm (19 in)</td>
<td>114 cm (45 in)</td>
<td>178 cm (70 in)</td>
</tr>
<tr>
<td>4-Port</td>
<td>83.5 kg (183.2 lb)</td>
<td>48 cm (19 in)</td>
<td>140 cm (55 in)</td>
<td>178 cm (70 in)</td>
</tr>
</tbody>
</table>

Component Weight and Dimensions

Table 1-4 shows the maximum weight and dimensions of the N5290/1A system components. Refer also to Table 1-5 on page 16 for test head module dimensions.
Safety and Regulatory Information
Space Requirements

### Table 1-5  N5290/1A System Components Weights and Dimensions

<table>
<thead>
<tr>
<th>Model</th>
<th>Weight</th>
<th>Height</th>
<th>Width</th>
<th>Depth</th>
</tr>
</thead>
<tbody>
<tr>
<td>N5222B, 2-Port PNA, Option 205</td>
<td>27 kg (60 lb) nominal</td>
<td>27.91 cm (11.0 in)</td>
<td>48.29 cm (19.0 in)</td>
<td>57.8 cm (22.7 in)</td>
</tr>
<tr>
<td>N5227B, 2-Port PNA, Option 205</td>
<td>42.2 kg (93 lb) nominal</td>
<td>27.91 cm (11.0 in)</td>
<td>48.29 cm (19.0 in)</td>
<td>64.96 cm (25.6 in)</td>
</tr>
<tr>
<td>N5242B, 4-Port PNA-X, Option 425</td>
<td>37 kg (82 lb) nominal</td>
<td>27.91 cm (11.0 in)</td>
<td>48.29 cm (19.0 in)</td>
<td>57.8 cm (22.7 in)</td>
</tr>
<tr>
<td>N5242B, 4-Port PNA-X, Option 425 with Option 029</td>
<td>38 kg (84 lb) nominal</td>
<td>27.91 cm (11.0 in)</td>
<td>48.29 cm (19.0 in)</td>
<td>57.8 cm (22.7 in)</td>
</tr>
<tr>
<td>N5247B, 4-Port PNA-X, Option 425</td>
<td>49 kg (108 lb) nominal</td>
<td>27.91 cm (11.0 in)</td>
<td>48.29 cm (19.0 in)</td>
<td>64.96 cm (25.6 in)</td>
</tr>
<tr>
<td>N5292A millimeter- head controller, Option 200 or Option 400</td>
<td>9 kg (20 lbs)</td>
<td>8.83 cm (3.47 inches)</td>
<td>42.56 cm (16.75 inches)</td>
<td>60.34 cm (23.75 inches)</td>
</tr>
<tr>
<td>N5293/95A Millimeter-wave test head module (each) – (cables not included)</td>
<td>1.69 kg (3.73 lbs)</td>
<td>9.00 cm (3.54 inches)</td>
<td>7.29 cm (2.87 inches)</td>
<td>16.73 cm (6.59 inches)</td>
</tr>
</tbody>
</table>
Site Preparation

Install the instrument so that the detachable power cord is readily identifiable and is easily reached by the operator. An externally installed switch or circuit breaker (which is readily identifiable and is easily reached by the operator) should be used as the disconnecting device. The detachable power cord can also be used to disconnect 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.

Power Requirements

Before installing the system, 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 system. This table can be used to determine both the electrical requirements and the air conditioning requirements of the system.

<table>
<thead>
<tr>
<th>Instrument</th>
<th>Maximum VA Rating</th>
<th>Maximum BTU/hour</th>
</tr>
</thead>
<tbody>
<tr>
<td>N5222/27/42/45/47B</td>
<td>350</td>
<td>1195</td>
</tr>
<tr>
<td>N5292A millimeter head controller</td>
<td>210</td>
<td>717</td>
</tr>
<tr>
<td>N5293A millimeter head (x2) (powered from controller)</td>
<td>(powered from controller)</td>
<td>(powered from controller)</td>
</tr>
<tr>
<td>N5295A millimeter head (x2) (powered from controller)</td>
<td>(powered from controller)</td>
<td>(powered from controller)</td>
</tr>
<tr>
<td>Total (N5222/27/42/45/47B)</td>
<td>560</td>
<td>1912</td>
</tr>
</tbody>
</table>

NOTE

Values are based on 120 Vac supplied to each instrument at 60 Hz. The N5292A millimeter head controller supplies power to the test head modules.
2 General Product Information

**NOTE** STOP! If you have a problem with your N5293A or N5295A millimeter-wave head, you must return it to the factory for repair. Refer to “Contacting Keysight” on page 2-7.

**NOTE** This service guide covers the N5292A millimeter-wave test set controller. For information on servicing your PNA vector network analyzer. Refer to the service guide for your PNA here: http://www.keysight.com/find/pna.

This chapter contains service information for a standalone 2-port and 4-port N5292A Test Set Controllers.

The following procedure verifies the test set without some system components. (i.e., This procedure does require a PNA with a minimum 10 MHz to 26.5 GHz frequency range.)

The instructions below generally assume a 4-Port N5292A. If you are using a 2-port N5292A, omit ports 3 and 4.

Information in This Chapter

**Chapter Two at-a-Glance**

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<thead>
<tr>
<th>Section Title</th>
<th>Summary of Content</th>
<th>Start Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>N5290/1A System Options, Accessories, and Upgrades</td>
<td>A hyperlink to the System Configuration Guide, which includes a list of options, accessories, and upgrades available for the system.</td>
<td>page 2-3</td>
</tr>
<tr>
<td>Required Service Test Equipment</td>
<td>A list of service equipment that is required to perform system verification, performance tests, adjustments, and troubleshooting.</td>
<td>page 2-3</td>
</tr>
<tr>
<td>Section Title</td>
<td>Summary of Content</td>
<td>Start Page</td>
</tr>
<tr>
<td>-----------------------------------</td>
<td>------------------------------------------------------------------------------------</td>
<td>------------</td>
</tr>
</tbody>
</table>
| Keysight Support, Services, and Assistance | The Internet address (URL) for on-line assistance.  
Service and support options available.  
Calibration options available.  
Important information about shipping your analyzer to Keysight for service or repair. | page 2-6   |
N5290/1A System Options, Accessories, and Upgrades Available

To see a list of the accessories and upgrades available for the N5290/1A Systems, including ordering information, refer to the Keysight Millimeter Wave Network Analyzers (N5290A/N5291A) Configuration Guide, available online at https://literature.cdn.keysight.com/litweb/pdf/5992-2179EN.pdf.

Only. Keysight approved accessories shall be used.

Required Service Test Equipment

<table>
<thead>
<tr>
<th>Equipment</th>
<th>Critical Specifications</th>
<th>Recommended Model or Part Number</th>
<th>Alternate Model or Part Number</th>
<th>Use</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Test Instruments and Software</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PNA</td>
<td>10 MHz to 26.5 GHz</td>
<td>N5242B</td>
<td>N5244/5/7B</td>
<td>P, A,T,V</td>
</tr>
<tr>
<td>Power meter</td>
<td>Accuracy: ±0.0068 dB</td>
<td>N1913A/14A</td>
<td>E4418A/B,</td>
<td>P, A,T</td>
</tr>
<tr>
<td>Power sensor</td>
<td>Freq: DC to 120 GHz Range: -35 to +20 dBm</td>
<td>U8489A</td>
<td>Equivalent or better</td>
<td>P, A, T</td>
</tr>
<tr>
<td>Power sensor (N5292A – LO Power)</td>
<td>Freq: DC to 33 GHz Range: -35 to +20 dBm</td>
<td>U8485A</td>
<td>8487A</td>
<td>P, A, T</td>
</tr>
<tr>
<td>Oscilloscope</td>
<td>1.5 GHz, 4 channels</td>
<td>DSOX4154A</td>
<td>Equivalent or better</td>
<td>P, A,T</td>
</tr>
<tr>
<td>Printer</td>
<td>N/A</td>
<td>Any printer with Microsoft Windows XP or Windows 7 driver</td>
<td>--</td>
<td></td>
</tr>
<tr>
<td>Mouse</td>
<td>N/A</td>
<td>Any</td>
<td>Any</td>
<td>--</td>
</tr>
<tr>
<td>Keyboard</td>
<td>N/A</td>
<td>Any</td>
<td>Any</td>
<td>--</td>
</tr>
</tbody>
</table>

a. Unless specified otherwise, equipment listed is required for all analyzer models.
b. P = Performance tests, A = Adjustments, T = Troubleshooting, V = System verification
c. If an accurate measurement of the dynamic accuracy specification is not required, the E4418A or E4419A can be used.
<table>
<thead>
<tr>
<th>Equipment&lt;sup&gt;a&lt;/sup&gt;</th>
<th>Critical Specifications</th>
<th>Recommended Model or Part Number</th>
<th>Alternate Model or Part Number</th>
<th>Use&lt;sup&gt;b&lt;/sup&gt;</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Calibration and Verification Tools</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.0 Precision Calibration Kit</td>
<td>--</td>
<td>85059B</td>
<td>n/a</td>
<td>PA,T,V</td>
</tr>
<tr>
<td>ECal module (300 kHz to 26.5 GHz)</td>
<td>Recommended, but not required.</td>
<td>N4691D 300 kHz to 26.5 GHz</td>
<td>Equivalent or better</td>
<td>V</td>
</tr>
<tr>
<td>Power supply load ET</td>
<td>--</td>
<td>ET57265</td>
<td>None</td>
<td>PA,T,V</td>
</tr>
<tr>
<td>LO Cal and RF Eterm ET</td>
<td>--</td>
<td>ET57259-1</td>
<td>None</td>
<td>PA,T,V</td>
</tr>
<tr>
<td>WBIF and LFE Eterm ET</td>
<td>--</td>
<td>ET57259-2</td>
<td>None</td>
<td>PA,T,V</td>
</tr>
<tr>
<td><strong>Cables</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>System Cable</td>
<td>--</td>
<td>N4011-21002</td>
<td>None</td>
<td>PA,T,V</td>
</tr>
<tr>
<td>Cables (x6)</td>
<td>--</td>
<td>N5240-60092&lt;sup&gt;c&lt;/sup&gt;</td>
<td>Equivalent or better</td>
<td>PA,T,V</td>
</tr>
<tr>
<td>3.5 mm (m) to 3.5 mm (m) Cables (x2 or x4) - Front Panel - (36 inches long)</td>
<td>--</td>
<td>Z5623-K20</td>
<td>Equivalent or better</td>
<td>PA,T,V</td>
</tr>
<tr>
<td>GPIB cable</td>
<td>4 foot</td>
<td>10833B</td>
<td>Equivalent or better</td>
<td>PA,T,V</td>
</tr>
<tr>
<td><strong>Adapters</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.0 mm (f) to 10 mm (f) (short thru)</td>
<td>Return Loss: ≥ 14 dB</td>
<td>11920-60002&lt;sup&gt;d&lt;/sup&gt;</td>
<td>None</td>
<td>PA,T</td>
</tr>
<tr>
<td>SMA (m) to SMA (f) elbow adapters&lt;sup&gt;e&lt;/sup&gt;</td>
<td>Return Loss: ≥ 14 dB</td>
<td>1250-2818</td>
<td>Equivalent or better</td>
<td>PA,T,V</td>
</tr>
<tr>
<td>SMA (m) to SMA (f) thru adapters (x8)&lt;sup&gt;f&lt;/sup&gt;</td>
<td>Return Loss: ≥ 14 dB</td>
<td>1250-3851</td>
<td>Equivalent or better</td>
<td>PA,T,V</td>
</tr>
</tbody>
</table>

---

<sup>a</sup> Unless specified otherwise, equipment listed is required for all analyzer models.

<sup>b</sup> P = Performance tests, A = Adjustments, T = Troubleshooting, R = Repair, V = System verification

<sup>c</sup> N5240-60092 is the longer cable that is used on the PNA LO OUT to N5292A test set’s LO IN (rear panel).

<sup>d</sup> This is a short thru that is not included in the 85059B calibration kit.

<sup>e</sup> Use x3 for front panel wideband IF and LFE Eterms.

<sup>f</sup> Use x5 as connector savers on the rear panel IF ports (optional). Use x3 for front panel wideband IF and LFE Eterms.
## General Product Information

### Required Service Test Equipment

<table>
<thead>
<tr>
<th>Equipmenta</th>
<th>Critical Specifications</th>
<th>Recommended Model or Part Number</th>
<th>Alternate Model Number</th>
<th>Useb</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Tools</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1/4-inch and 5/16-inch open-end wrench</td>
<td>Thin profile</td>
<td>8710-0510</td>
<td>N/A</td>
<td>A,R</td>
</tr>
<tr>
<td>1/4-inch (14 mm), open-end torque wrench</td>
<td>0.5 N-m (4 lb-in) settings (for semi-rigid cables)</td>
<td>N/A</td>
<td>N/A</td>
<td>T,R</td>
</tr>
<tr>
<td>5/16-inch (8 mm) open-end torque wrench</td>
<td>1.3 N-m (10 lb-in) settings (for semi-rigid cables)</td>
<td>N/A</td>
<td>N/A</td>
<td>PA,T,R,V</td>
</tr>
<tr>
<td><strong>Static Safety Parts</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Adjustable antistatic wrist strap</td>
<td>N/A</td>
<td>9300-1367</td>
<td>None</td>
<td>PA,T</td>
</tr>
<tr>
<td>Antistatic wrist strap grounding cord (5 foot)</td>
<td>N/A</td>
<td>9300-0980</td>
<td>None</td>
<td>PA,T</td>
</tr>
<tr>
<td>Static control table mat and earth ground wire</td>
<td>N/A</td>
<td>9300-0797</td>
<td>None</td>
<td>PA,T</td>
</tr>
</tbody>
</table>

a. Unless specified otherwise, equipment listed is required for all analyzer models.
b. P = Performance tests, A = Adjustments, T = Troubleshooting, R = Repair, V = System verification
Keysight Support, Services, and Assistance

Information on the following topics is included in this section.

- “Service and Support Options”
- “Contacting Keysight”
- “Shipping an Item to Keysight for Service or Repair”

Service and Support Options

The N5290/1A system has a one-year service warranty which covers troubleshooting the system to an individual instrument, device, or cable. The service warranty includes repair or replacement of defective components. Most repairs require that the defective component be returned to Keysight.

RxxxxA extended warranties are required to be purchased with initial instrument purchase. If you have an existing system and would like to purchase a warranty, https://www.keysight.com/find/calibration.

Extended warranties are available in many geographical areas. Contact Keysight for additional information on available service agreements for this product. Refer to “Contacting Keysight” on page 2-7.

There are many other repair and calibration options available from the Keysight Technologies support organization. These options cover a range of service agreements with a variety of time frames. The following support products with their associated options are available for purchase with the initial product purchase.

- R1280A Return to Keysight Warranty and Service Plan
  Options are available to extend the warranty period to five years.

- R1282A Return to Keysight Calibration Plan
  The analyzer is delivered with a one-year calibration certificate. Options are available to have Keysight Technologies provide three or five year calibration coverage (perform the annual calibration two or four times). Options for basic calibration or SO/IEC 17025 or ANSI/NCSL Z540.3–2006 standards compliant calibrations are available. After calibration, the analyzer will be returned with a calibration label, a calibration certificate, and the calibration data.

- R1288A Return to Keysight On-Site Warranty and Service Plan
  Same as R1280A, but the service is provided at the customer site.

- R1298A Return to Keysight On-Site Calibration Plan
  Same as R1282A, but the service is provided at the customer site.
General Product Information
Keysight Support, Services, and Assistance

For more information on these and other service, please visit, https://www.keysight.com/find/calibration or refer to “Contacting Keysight” on page 2-7. If the warranty or calibration plan period has expired, these services are available on a per-incident basis. Visit this InfoLine web site or contact Keysight to obtain a quote.

Contacting Keysight

To contact Keysight for sales and technical support, refer to support links on the following Keysight websites: http://www.keysight.com/find (product specific information and support, software and documentation updates): http://www.keysight.com/find/assist (worldwide contact information for repair and service).

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

NOTE

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

To contact Keysight for sales and technical support, refer to support links on the following Keysight websites: http://www.keysight.com/find (product specific information and support, software and documentation updates) http://www.keysight.com/find/assist (worldwide contact information for repair and service).

Shipping an Item to Keysight for Service or Repair

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

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

– Contact Keysight to open a service order. Refer to “Contacting Keysight” on page 2-7.

– 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 packaging and antistatic materials. Shipping the analyzer in anything other than the original or comparable packaging and antistatic materials may result in non-warranted damage.

– Contact Keysight for instructions on where to ship your analyzer.
Product Selection and Configuration Assistance, Education and Training

http://www.keysight.com/main/contactInformation
3 System Tests and Adjustments

**CAUTION**

**IMPORTANT!** Before you begin any testing on a System or instrument, always inspect the connectors on the instrument, the calibration kit, cables and adapters.

**NOTE**

**STOP!** If you have a problem with your N5293A or N5295A millimeter-wave head, you must return it to the factory for repair. Refer to “Contacting Keysight” on page 2-7.

For network analyzer troubleshooting, see the Tests and Adjustments chapter in the service guide for your PNA. Refer to www.keysight.com.

Information in This Chapter

This chapter contains procedures to help you check, verify, and adjust your N5290/1A and N5292A test set controller.

– If required, these checks verify the operation of the N5292A-200 and N5292A-400 test set controller in your system.

The “N5292A Functional Verification Procedure” on page 3-16 should be performed whenever any active electronic part is replaced in the Test Set.
## Chapter Three at-a-Glance

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<thead>
<tr>
<th>Section Title</th>
<th>Summary of Content</th>
</tr>
</thead>
<tbody>
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<td><strong>Before You Begin</strong></td>
<td>Items to consider or procedures to perform before testing is begun:</td>
</tr>
<tr>
<td></td>
<td>- Verify the Operating Environment</td>
</tr>
<tr>
<td></td>
<td>- Protect Against Electrostatic Discharge (ESD)</td>
</tr>
<tr>
<td></td>
<td>- Review the Principles of Connector Care</td>
</tr>
<tr>
<td><strong>Non-Standards Compliant Verification</strong></td>
<td>The Non-Standards Compliant process of verifying your analyzer/test set.</td>
</tr>
<tr>
<td><strong>“The N5290/1A Millimeter Test System Preliminary Check” on page 7</strong></td>
<td>Performing the operator’s check N5290/1A and N5292A test set. Inspecting and checking your test cables. <strong>Perform these checks before performing system verification.</strong></td>
</tr>
<tr>
<td><strong>Test Management Environment (TME) Performance Tests (N5290/1A Millimeter System Only)</strong></td>
<td>A brief summary of the TME N5290/1A millimeter-wave test system performance test process.</td>
</tr>
<tr>
<td><strong>Adjustments</strong>&lt;sup&gt;b&lt;/sup&gt;</td>
<td>Setups and procedures for adjusting your analyzer:</td>
</tr>
<tr>
<td></td>
<td>- LO Adjustment for mm Mode</td>
</tr>
<tr>
<td></td>
<td>- IF Gain Adj for mm Mode</td>
</tr>
<tr>
<td></td>
<td>- Source and Receiver Adj.</td>
</tr>
<tr>
<td></td>
<td>- Receiver Characterization</td>
</tr>
<tr>
<td></td>
<td>- IF Response Adj. for mm Mode</td>
</tr>
</tbody>
</table>

---

<sup>a</sup> These performance tests are included in the analyzer’s firmware for Options S93898A.

<sup>b</sup> These adjustments are included in the analyzer’s firmware on all models and options.
Before You Begin

**IMPORTANT!** Before you begin any testing on a System or instrument, always inspect the connectors on the instrument, the calibration kit, cables and adapters.

Complete the Installation procedures in Chapter 3, "System Installation" of the N5292-90002 N5290/1/A Microwave Network Analyzer System Installation Guide to assemble and configure the system. After you press the Preset button, the PNA should display a frequency range of 900 Hz to 110 GHz (N5290A) or 900 Hz to 120 GHz (N5291A). Refer to https://literature.cdn.keysight.com/litweb/pdf/N5292-90002.pdf.

Before checking, verifying, or adjusting the analyzer, refer to the following paragraphs to:

- make sure the operating environment is within its requirements
- make sure that proper electrostatic discharge (ESD) protection is provided
- make sure the analyzer has warmed up properly to achieve system stability
- review the principles of connector care

**NOTE**

Keysight personnel: see Figure 1-1 on page 1-6 to review where the calibration stickers should be placed on the PNA.

**IMPORTANT!** Before you begin any testing on a System or instrument, always inspect the connectors on the instrument, the calibration kit, cables and adapters.

### Verify the Operating Environment

Due to their operating specifications, the verification and calibration kit devices determine the limits of your operating environment conditions. Open the calibration and verification kits and place all the devices on top of the foam inserts so they will reach room temperature. As the device dimensions change with temperature, their electrical characteristics change as well.

It is necessary to keep the environmental levels within the following limits:

- Temperature: +23 °C ± 3 °C (Error-corrected temperature range)
  
  Once the measurement calibration has been done, the ambient temperature must be maintained to within ± 1 °C of the calibration temperature.

- Humidity: 0% to 95% at 40 °C maximum, non-condensing

- Altitude: 0 to 4,600 meters (≈15,000 feet.)
Torquing Connections

All connections made during the System Check and System Performance Verification procedures should be carefully torqued using the tools provided in the 85059B kit.

**IMPORTANT!** For N5224/5B, N5244/5B, and N5267B PNAs When connecting the 5292-20014 semirigid cable it is critical that the 2.4 mm end is connected to the PNA’s REFn SOURCE OUT port and the SMA end is connected to the N5292A test set’s LO Band connector. Refer to Figure 3-1 on page 3-4.

![Image of PNA RF Port Connector to N5292A Test Set Lo Band Connector (2.4 mm)](image)

Long Term Storage of Test Results

It is recommended that you store results from the System Check and the System Performance Verification procedures for future reference. Prior results can be useful when evaluating changes in system performance. After completing a successful test process that accurately represents the system performance, store the test result files in the directory D:\sysver results. It may be necessary to create this directory if it does not already exist. Create a new subdirectory when a new set of test results is stored. Use the current date as the name for the subdirectory. Example: D:\sysver results\2020 Jan 31\.
System Tests and Adjustments
Before You Begin

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 1-7, for all of the procedures in this chapter.

**NOTE**
To achieve the maximum system stability, allow the analyzer to warm up for at least 90 minutes.

Review the Principles of Connector Care

**WARNING**
Cleaning connectors with alcohol shall only be done with the N5xxxB removed from the system, and in a well-ventilated area. Allow all residual alcohol moisture to evaporate and the fumes to dissipate prior to reconnecting the N5xxxB to the system.

Proper connector care and connection techniques are critical for accurate and repeatable measurements. Refer to Table 3-1 for tips on connector care.

Prior to making connections to your analyzer, carefully review the information about inspecting, cleaning, and gaging connectors. Refer to the calibration kit documentation for detailed connector care information.

For course numbers about additional connector care instruction, contact Keysight Technologies. Refer to “Contacting Keysight” on page 2-7.

Table 3-1 Connector Care Quick Reference Guide

<table>
<thead>
<tr>
<th>Handling and Storage</th>
<th>Do</th>
<th>Do Not</th>
</tr>
</thead>
<tbody>
<tr>
<td>Keep connectors clean</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>Extend sleeve or connector nut</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>Use plastic end-caps during storage</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>Touch mating-plane surfaces</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>Set connectors contact-end down</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>Store connectors or adapters loose</td>
<td>—</td>
<td>—</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Visual Inspection</th>
<th>Do</th>
<th>Do Not</th>
</tr>
</thead>
<tbody>
<tr>
<td>Inspect all connectors carefully</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>Look for metal particles, scratches, and dents</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>Use a damaged connector — ever</td>
<td>—</td>
<td>—</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Connector Cleaning</th>
<th>Do</th>
<th>Do Not</th>
</tr>
</thead>
<tbody>
<tr>
<td>Try compressed air first</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>Use any abrasives</td>
<td>—</td>
<td>—</td>
</tr>
</tbody>
</table>
Table 3-1  Connector Care Quick Reference Guide

**Gaging Connectors**

<table>
<thead>
<tr>
<th>Do</th>
<th>Do Not</th>
</tr>
</thead>
<tbody>
<tr>
<td>Clean and zero the gage before use</td>
<td>Use an out-of-specification connector</td>
</tr>
<tr>
<td>Use the correct gage type</td>
<td></td>
</tr>
<tr>
<td>Use correct end of calibration block</td>
<td></td>
</tr>
<tr>
<td>Gage all connectors before first use</td>
<td></td>
</tr>
</tbody>
</table>

**Making Connections**

<table>
<thead>
<tr>
<th>Do</th>
<th>Do Not</th>
</tr>
</thead>
<tbody>
<tr>
<td>Align connectors carefully</td>
<td>Apply bending force to connection</td>
</tr>
<tr>
<td>Make preliminary connection contact lightly</td>
<td>Over tighten preliminary connection</td>
</tr>
<tr>
<td>Turn only the connector nut</td>
<td>Twist or screw any connection</td>
</tr>
<tr>
<td>Use a torque wrench for final connection</td>
<td>Tighten past torque wrench “break” point</td>
</tr>
</tbody>
</table>

a. Cleaning connectors with alcohol shall only be done with the instruments power cord removed, and in a well-ventilated area. Allow all residual alcohol moisture to evaporate, and the fumes to dissipate prior to energizing the instrument.
ANSI/NCSL Z540.3–2006 and ISO/IEC 17025 Verification

To learn about the criteria for ANSI/NCSL Z540.3–2006 and ISO/IEC 17025 verification, refer to the service guide for your analyzer. Refer to https://www.keysight.com/find/pna or for your system, refer to http://na.support.keysight.com/mmwave/.

Non-Standards Compliant Verification

To meet the criteria for non-standards compliant verification, for your instrument, refer to https://www.keysight.com/find/pna or for your system, refer to http://na.support.keysight.com/mmwave/.

The N5290/1A Millimeter Test System Preliminary Check

IMPORTANT! Before you begin any testing on a System or instrument, always inspect the connectors on the instrument, the calibration kit, cables and adapters.

NOTE

To achieve the maximum system stability, allow the test set controller to warm up for at least 90 minutes before performing the Operator’s Check.

If you are testing an N5290/1A System, continue with following the procedures in this section. If the N5292A test set has been identified as the problem, then skip this section and refer to “N5292A Functional Verification Procedure” on page 3-16.

This chapter contains service information for a standalone N5292A-200 2-port and N5292A-400 4-port controller Test Sets and for the N5290/1A Millimeter Test System.

These initial Inspection and Operator’s Checks are found here:

– “N5290/1A Incoming Electrical Inspection” on page 3-8
– “N5292A Functional Verification Procedure” on page 3-16
– “N5290/1A Millimeter-wave Test System Operator’s Check” on page 3-41
N5290/1A Incoming Electrical Inspection

In this section the manual receiver display test is ran to check the general system integrity.

**IMPORTANT!** For N5224/5B, N5244/5B, and N5267B PNAs When connecting the 5292-20014 semirigid cable it is critical that the 2.4 mm end is connected to the PNA’s REF SOURCE OUT port and the SMA end is connected to the N5292A test set’s LO Band connector. Refer to Figure 3-2 on page 3-8.

**Figure 3-2** PNA RF Port Connector to N5292A Test Set Lo Band Connector (2.4 mm)

If the N5290/1A system is already installed and no changes have occurred to any of the instruments or cables, refer to “The Head Cable Checks” on page 3-11 / Head Cable Checks.

If a cable has been changed or disconnected reconnected or similar change, refer to “Running the Installation Calibration” on page 3-9.

**EXCEPTION:** If you swapped in a new head or swapped heads on the ports, refer to “The N5290/1A Millimeter Test System Preliminary Check” on page 3-7.

This section contains the following:

- “Initializing the N5290/1A Broadband System” on page 3-9
- “Running the Installation Calibration” on page 3-9
System Tests and Adjustments
The N5290/1A Millimeter Test System Preliminary Check

— “If the Head Check Fails” on page 3-15

Initializing the N5290/1A Broadband System

NOTE

If the N5290/1A system is already installed and no changes have occurred to any of the instruments or cables, refer to “The Head Cable Checks” on page 3-11.

If a cable has been changed or disconnected reconnected or similar change, refer to “Running the Installation Calibration” on page 3-9.

EXCEPTION: If you swapped in a new head or swapped heads on the ports refer to “Initializing the N5290/1A Broadband System” on page 3-9.

1. If required, assemble the system. Refer to Install the System, refer to
2. Clean the test ports, shorts, and adapters. Torque to specification.
3. On the PNA press Setup > External Hardware > Millimeter Config
4. Press Instrument > Setup > External Hardware > Millimeter Head Off to Millimeter Head On
5. Power down the PNA.
6. On the N5292A test set controller: verify the test set is powered down.
7. Power up the PNA.
8. Power up the N5292A.

The N5290/1A system should now initialize and recognize the mmW modules. The port 1 module LED should be blue (addressed by the PNA and active) and the other test port(s) should be green (no bias and on standby). See also, “If the Head Check Fails” on page 3-15.

Running the Installation Calibration

NOTE

If the N5290/1A system is already installed and no changes have occurred to any of the instruments or cables, refer to “The Head Cable Checks” on page 3-11.

This installation calibration should be ran when you first install your system and whenever you make any changes to your system’s configuration. See also, “If the Head Check Fails” on page 3-15.

1. On the PNA, verify your N5290/1A system is in the correct configuration:
   press Setup > External Hardware > Millimeter Config
2. The Millimeter Configuration window that opens should have N5290A Broadband or N5291A Broadband highlighted. Else, press N5290A Broadband or N5291A Broadband. Refer to Figure 3-3 on page 3-10.

3. Press Installation Cal. In the dialog box that opens, connect a load and press Measure. Refer to Figure 3-4 on page 3-10.

**CAUTION**

For best results use a load that extends to 50 GHz.

---

**Figure 3-3** Millimeter Configuration Window

**Figure 3-4** Millimeter Installation Cal – Dialog Box
4. When finished, the following dialog box is displayed. Remove the load and press Finish. Refer to Figure 3-5 on page 3-11.

![Figure 3-5](image)

Millimeter Installation Cal – Dialog Box Load Calibration "Finish"

5. The following dialog box is displayed until the calibration is finished (i.e., It is not necessary to connect a calibration kit open for this step. Refer to Figure 3-6 on page 3-11.

![Figure 3-6](image)

Millimeter Installation Cal – Dialog Box Open-circuit Calibration Ongoing/"Finish"

6. If prompted, repeat steps 3 through 5 for all of the other ports requiring calibration.

The Head Cable Checks

A faulty test port cable can cause a failure in the verification test. The following checks are not required, but are recommended to verify the performance of the test port cable. These checks verify the integrity of the head cables that connect to the N5292A test set.

– “Head Cable Stability Check” on page 3-12

Accessories Used in the Head Check
System Tests and Adjustments
The N5290/1A Millimeter Test System Preliminary Check

For more, refer to “Required Service Test Equipment” on page 2-3.

<table>
<thead>
<tr>
<th>Equipment Type</th>
<th>Model of Part Number</th>
<th>Alternate Model or Part Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Calibration kit, 1.0 mm</td>
<td>85059B</td>
<td>Equivalent or better</td>
</tr>
<tr>
<td>1.00 mm (f) to 1.00 mm (f) (short thru)</td>
<td>11920-60002a</td>
<td>n/a</td>
</tr>
</tbody>
</table>

a. This is a short thru that is not included in the 85059B calibration kit.

Head Cable Stability Check

For best results, instruments should be powered up for two hours. If instruments are not warmed up, the traces will be unstable.

1. Press UTILITY > Preset.
2. Connect short (f) to head.
3. Allow the analyzer and heads to warm up for two hours, before proceeding.
4. Setting analyzer for dual trace display showing both the reference and receiver traces (i.e., B2,2 and R2,2 for port 1 and port 2.):
   Example of Port 2 Setup:
   a. Set trace 1 to B2,2: Press Instrument > Trace > Trace Setup > Measure > Receivers > B,2 > OK
      Trace 1 should display a green LED in the Trace softkey Menu
   b. Change scale R,1 trace 2: Press Instrument > Trace > Trace Setup > Measure > Receivers > R2,2 > OK.
      Trace 1 and Trace 2 should display a green LED in the Trace softkey Menu.
   c. Change scale B2,2 trace 1: Press Response > Scale > Scale > 0.1 Enter.
   d. Change scale R2,2 trace 2: Press Response > Scale > Scale > 0.1 Enter.
   e. Narrow IF bandwidth: Press Response > Avg BW > IF Bandwidth > 100 > Enter.
   f. Normalize the traces: Press Response > Math > Normalize
      Repeat for the other trace.
System Tests and Adjustments
The N5290/1A Millimeter Test System Preliminary Check

**g.** If your instruments are not warmed up for two hours, repeat step f.

Else, skip to next step.

5. Both traces should track each other and look relatively flat. Refer to Figure 3-7 on page 3-13.

**Figure 3-7**
Typical Cable Return Loss Response (port 2 trace is displayed below)

6. While observing the traces, gently lift the cable (at or near where the cable bends) up and down a few times. Traces should remain stable and free from any major spikes or holes (≤0.1 dB p–p). Refer to Figure 3-8 on page 3-14.
System Tests and Adjustments
The N5290/1A Millimeter Test System Preliminary Check

Figure 3-8 Lifting the cable at the bend and watching for trace spikes/instability

7. Gently extend the head (exercising care to not overextend) and rotate side to side (less than 90 degree) making sure traces are relatively stable and still tracking each other. Refer to Figure 3-10 on page 3-19.

Figure 3-9 Gently extending the head and exercise carefully so as not to overextend

8. Repeat steps 1 through 7 as required for suspected faulty ports.
If the Head Check Fails

1. Clean the test ports, shorts and adapters. Torque to specification. Repeat the check.

2. If the head check still fails and the failure is one port only: Then swap the suspect head onto one of the other good ports (i.e., requires running the N5290/1A system adjustments. Refer to “Adjustments” on page 3-47). If the problem follows the head, return the head to the factory for repair. Refer to “Contacting Keysight” on page 2-7.

3. If the failure is on all of the ports, swap in a known good head to verify the problem is not the test set.

4. If the check still fails, and the test set is OK, the head should be repaired or replaced and is a return-to-factory repair. For more on troubleshooting the millimeter heads refer to “Procedure for identifying a faulty millimeter head:” on page 4-8.

5. If the head(s) are OK, but the PNA is suspected as the problem, remove all cables from the PNA to the test set and run the PNA Operator’s Check. Refer to the https://literature.cdn.keysight.com/litweb/pdf/E8356-90001.pdf.

   If the PNA fails the Operator's Check, refer to the PNA's Service Guide for https://www.keysight.com/find/pna or to “Contacting Keysight” on page 2-7.

   If the PNA fails the Operator's Check, repair the PNA or return the PNA to the factory for repair. Refer to the Service Guide for your PNA or to “Contacting Keysight” on page 2-7.

6. If the PNA passes the Operator's Check, and the heads are OK, then the N5292A is faulty. Refer to “N5292A Functional Verification Procedure” on page 3-16.
N5292A Functional Verification Procedure

STOP! This section assumes you have completed the N5290/1A Incoming Electrical Inspection and have isolated the problem to the N5292A test set. If you are not sure the system problem is in the N5292A and you have not completed the N5290/1A Incoming Electrical Inspection, refer to “The N5290/1A Millimeter Test System Preliminary Check” on page 3-7.

STOP! Before you begin this section, on your PNA, download and install the N5292A Test Set Functional Verification software (LaunchTest). Refer to http://na.support.keysight.com/pna/files/N5292A_TESTS.exe and “PNA Calibration (Pna Cal) and Loading the N5292A Test Set Functional Verification Software (Launch Test)” on page 3-22.

IMPORTANT! Before you begin any testing on a System or instrument, always inspect the connectors on the instrument, the calibration kit, cables and adapters.

IMPORTANT! For purchasing test set functional verification test fixtures, please contact Keysight. Refer to “Contacting Keysight” on page 2-7.

This procedure contains two main sections:

– “Initial Setup for the N5292A Test Set Functional Verification” on page 3-16
– “Performing the N5292A Test Set Functional Verification” on page 3-23

Initial Setup for the N5292A Test Set Functional Verification

The following procedure provides instructions for setting up equipment to verify the N5292A test set. The N5292A test set must pass the operator’s check, before the N5290/1A millimeter test system can be checked in the next section. For the N5290/1A system verify, refer to “N5290/1A Millimeter-wave Test System Operator’s Check” on page 3-41.

The following procedures use the N5292A Test Set Utility (LaunchTest) as part of the functional verification process. Refer to http://na.support.keysight.com/pna/files/N5292A_TESTS.exe and to “PNA Calibration (Pna Cal) and Loading the N5292A Test Set Functional Verification Software (Launch Test)” on page 3-22.

The instructions in this section and in generally assume a 4-Port N5292A. If you are using a 2-Port N5292A, omit Ports 3 and 4.

– Millimeter head heater DAC values and power supply
– Millimeter head recognition
System Tests and Adjustments
N5292A Functional Verification Procedure

- LO power verification for LOPA/LODA/Phase compensation/Test set mother board (TSMB) PCA assemblies
- Test set cabling paths front panel connectors to Test set mother board (TSMB)

This section contains the following:
- “Accessories Used in the N5292A Test Set Operator’s Check” on page 3-17
- “Required Equipment” on page 3-18
- “Power Sensor and Power Meter Preparation (Required for LO Verify Only)” on page 3-22
- “PNA and Test Set Preparation” on page 3-22
- “PNA Calibration (Pna Cal) and Loading the N5292A Test Set Functional Verification Software (Launch Test)” on page 3-22

Accessories Used in the N5292A Test Set Operator’s Check

<table>
<thead>
<tr>
<th>Equipment Type</th>
<th>Part Number</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Calibration and Verification Tools</strong></td>
<td></td>
</tr>
<tr>
<td>1.0 mm calibration kit</td>
<td>85059B</td>
</tr>
<tr>
<td>ECal module</td>
<td>N4691B</td>
</tr>
<tr>
<td>Power supply load ET</td>
<td>ET57265</td>
</tr>
<tr>
<td>LO Cal and RF Eterm ET</td>
<td>ET57259–1&lt;sup&gt;a&lt;/sup&gt;</td>
</tr>
<tr>
<td>WBIF and LFE Eterm ET</td>
<td>ET57259–2&lt;sup&gt;b&lt;/sup&gt;</td>
</tr>
<tr>
<td><strong>Cables</strong></td>
<td></td>
</tr>
<tr>
<td>System cable</td>
<td>N4011-21002</td>
</tr>
<tr>
<td>Cables (x6)</td>
<td>N5240-60092&lt;sup&gt;c&lt;/sup&gt;</td>
</tr>
<tr>
<td>3.5 mm (m) to 3.5 mm (m)</td>
<td>Z5623A-K20</td>
</tr>
<tr>
<td>GPIB cable</td>
<td>10833B</td>
</tr>
<tr>
<td><strong>Adapters</strong></td>
<td></td>
</tr>
<tr>
<td>1.00 mm (f) to 1.00 mm (f)</td>
<td>Return Loss: ≥14 dB</td>
</tr>
<tr>
<td>SMA (m) to SMA (f) elbow</td>
<td>Return Loss: ≥14 dB</td>
</tr>
<tr>
<td>SMA (m) to SMA (f) thru</td>
<td>Return Loss: ≥14 dB</td>
</tr>
</tbody>
</table>

<sup>a</sup> Use x3 for front panel wideband IF and LFE Eterms.
b. Use x5 as connector savers on the rear panel IF ports (optional). Use x3 for front panel wideband IF and LFE Eterms.
c. N5240-60092 is the longer cable that is used on the PNA LO OUT to N5292A test set's LO IN (rear panel)

Required Equipment

- The following Keysight ET's are required for testing the N5292A test set:
  - Power Supply fixture (N5292-60130) – Use with Launch Test application (LaunchTest) to verify the power supplies at the port of the test set and mm head DAC function on the test set motherboard (TSMB). Refer to Figure 3-10 on page 3-19.

**IMPORTANT!** Ensure that:

- N5292A test set is powered down, before connecting the power supply fixture ET57265, to avoid damaging the N5292A test set or the power supply fixture ET57265.
- N5292A test set is powered down and the ET is removed immediately after the testing is complete.

**IMPORTANT!** For purchasing test set functional verification test fixtures, please contact Keysight. Refer to “Contacting Keysight” on page 2-7.
Figure 3-10  Power Supply fixture (ET57265, N5292-60130), mm Head Heater DAC, and TSMB verification
– RF Fixture, Test Set Port Cabling and TSMB Verification – N5292-60128. See Figure 3-11 on page 3-20.

Figure 3-11 S-Parameters fixture (N5292-60129), test set IF/RF port paths (from test set to test set mother board (TSMB)) verification
System Tests and Adjustments
N5292A Functional Verification Procedure

- LO Calibration and Verification – N5292-60127. See Figure 3-12 on page 3-21.

Figure 3-12 LO fixture – (N5292-60127), LO calibration/verification and TSMB verification

- S-Parameters fixture – RF verification. See Figure 3-13 on page 3-21.

Figure 3-13 RF fixture – (N5292-60128), RF cables and TSMB verification

- ECal module N4691D, N4692D, N4693D, or N4694D (DC/300 kHz/10 MHz to 26.5/40/50/67 GHz, depends on PNA used

- B model PNA, PNA-L, PNA-X capable of 26.5 GHz with Option 020. (The required Test Set I/O interface is included with all models). The PNA, PNA-L or PNA-X will be referred to as the PNA throughout this procedure.

- Two RF flexible cables with 3.5 mm male connectors (5062-6696 or equivalent). One cable must be long enough to comfortably connect between the PNA and the rear panel of the Test Set.
System Tests and Adjustments
N5292A Functional Verification Procedure

- Three SMA or 3.5 mm adapters (female to female)
- Voltmeter
- Power sensor and compatible power meter. The power sensor must be capable of measuring from -10 dBm to +15 dBm at a frequency of 8 GHz. A E4413A power sensor may be used.

Power Sensor and Power Meter Preparation (Required for LO Verify Only)
The power sensor and power meter must be prepared to make measurements at 8 GHz. This may include calibrating the power sensor with the meter and entering a calibration factor for 8 GHz.

Equipment required:
- 26.5 GHz PNA-B with Option 020
- Power sensor and power meter (with calibration factors for 8 GHz)

PNA and Test Set Preparation

Equipment setup:

1. Connect the Test Set 1/0 cable from the PNA to the Test Set.
2. Connect cables from PNA rear panel IF Out to Test set IF IN.
3. Turn on the PNA and the Test Set.
4. The PNA must be in "Standard PNA" mode. To check the mode, select Utility > System > Configure > Millimeter Module Configuration. The Millimeter Module Configuration window will be displayed. "Standard PNA" should be the Selected Configuration. If not, click on "Standard PNA" in the list of Available Configuration(s) then click OK.

PNA Calibration (Pna Cal) and Loading the N5292A Test Set Functional Verification Software (Launch Test)

STOP! Before you begin this section, contact Keysight for information on downloading the N5292A Test Set Verification software (LaunchTest). Refer to http://na.support.keysight.com/pna/files/N5292A_TESTS.exe and to "PNA Calibration (Pna Cal) and Loading the N5292A Test Set Functional Verification Software (Launch Test)" on page 3-22.

This procedure prepares the PNA for test set IF/RF insertion loss/Match path measurements. This procedure also includes how to download the Launch Test application to a PC. Refer to Figure 3-14 on page 3-23.
Equipment required:

- 26.5 GHz PNA-8 with Option 020
- Optional: USB stick (to download the N5292A Test Set Functional Verification Test software from Keysight.com to load into your PNA. Refer to http://na.support.keysight.com/pna/files/N5292A_TESTS.exe and to “PNA Calibration (Pna Cal) and Loading the N5292A Test Set Functional Verification Software (Launch Test)” on page 3-22. Else, download the N592A Test Set Functional software directly to your PNA's E:\Test Set Tests drive folder.

To download the N5292A Test Set Verification application, refer to http://na.support.keysight.com/pna/files/N5292A_TESTS.exe and to “PNA Calibration (Pna Cal) and Loading the N5292A Test Set Functional Verification Software (Launch Test)” on page 3-22.

Figure 3-14 Test Set Verification Window

Performing the N5292A Test Set Functional Verification

**NOTE**

If you know the test set is the faulty instrument, but the problem in the test set has not been identified, skip to the “Millimeter-wave (mmW) Heads Sense Voltage (Head Detect)” on page 3-28.

This section contains the following:
System Tests and Adjustments
N5292A Functional Verification Procedure

- “LO Power Calibration, Adjustment, and Verification” on page 3-24
- “Millimeter-wave (mmW) Heads Sense Voltage (Head Detect)” on page 3-28
- “Millimeter-wave (mmW) Heads Sense Voltage (Head Detect)” on page 3-28
- “S-Parameters (Insertion Loss/Match)” on page 3-31
- “Test Set Connector and Cable Verification” on page 3-40

LO Power Calibration, Adjustment, and Verification

STOP! This section assumes you have completed the PNA calibration. If you have not ran the PNA calibration, refer to “PNA Calibration (Pna Cal) and Loading the N5292A Test Set Functional Verification Software (Launch Test)” on page 3-22.

STOP!
If you know the test set is the faulty instrument, but the problem in the test set has not been identified, skip to the “Millimeter-wave (mmW) Heads Sense Voltage (Head Detect)” on page 3-28.

NOTE
This section assumes you have already downloaded the Launch Test application to your PNA. If not, refer to “PNA Calibration (Pna Cal) and Loading the N5292A Test Set Functional Verification Software (Launch Test)” on page 3-22.

Required when:
LOPA/LODA/Phase compensation/Test set mother board (TSMB) are changed.

NOTE
The LO calibration is required only to be performed on one N5292A test set port (e.g., the factory uses port 1). But, LO verify is required on all ports.

Equipment required:
- 26.5 GHz PNA-8 with Option 020
- ECal or Calibration kit with a minimum 26 GHz frequency
- LO Fixture (N5292-60127)
- PC with Launch Test application loaded

Calibrate the LO on port one and run and verify all of the ports. Refer to “PNA Calibration (Pna Cal) and Loading the N5292A Test Set Functional Verification Software (Launch Test)” on page 3-22.
Procedure:

1. On the PNA: Press Service > Service Menu > Adjustments > EE Adjust > LO Drive
   OR Run N5292A Launch Test software and click Insertion Loss/Match.
2. On the N5292A: Connect LO Fixture (N5292-60127) to port 1.
3. Follow the prompts.
4. Repeat steps 1 through 3 for the other ports, by clicking LO Verify.
5. Compare results to typical values shown in to Figure 3-15 on page 3-25 and Figure 3-15 on page 3-25.

Figure 3-15   Typical LO maximum power (without path corrections)
Millimeter (mm) Head Heater DAC and Power Supplies Check (Heater Dac/Voltage)

**IMPORTANT!** Ensure that:
- N5292A test set is powered down, before connecting the power supply fixture ET57265, to avoid damaging the N5292A test set or the power supply fixture ET57265.
- N5292A test set is powered down and the ET is removed immediately after the testing is complete.

**NOTE**
This section assumes you have already downloaded the Launch Test application to your PC. If not, refer to “PNA Calibration (Pna Cal) and Loading the N5292A Test Set Functional Verification Software (Launch Test)” on page 3-22.

For more on troubleshooting the millimeter heads refer to “Procedure for identifying a faulty millimeter head:” on page 4-8.

This Test also checks that the Heater DAC and related bias circuits works properly.

Required equipment:
- 26.5 GHz PNA-B with Option 020
System Tests and Adjustments
N5292A Functional Verification Procedure

- Power Supply fixture (N5292-60130)
- PC with Launch Test application loaded

Procedure:
Refer to Figure 3-14 on page 3-23 and to Figure 3-17 on page 3-27.

1. Press Header Dac/Voltage.

2. On the N5292A: Connect the power supply fixture (N5292-60130) to desired port on the test set.
   Refer to Figure 3-17 on page 3-27.

3. Follow the screen prompts.

Figure 3-17  Power supply fixture (N5292-60130) connected to N5292A front panel (used to verify millimeter head DACs and power supplies)
Millimeter-wave (mmW) Heads Sense Voltage (Head Detect)

This section assumes you have already downloaded the Launch Test application to your PC. If not, refer to “PNA Calibration (Pna Cal) and Loading the N5292A Test Set Functional Verification Software (Launch Test)” on page 3-22.

This test verifies the test set mother board (TSMB) is generating the correct voltages to drive the millimeter-wave (mmW) heads. Refer to Figure 3-18 on page 3-30.

Equipment:
- 26.5 GHz PNA-8 with Option 020
- Adjustment screw (SV 081-90-009)
- Adjustment tool.
- PC with Launch Test application loaded.

1. Verify the PNA is positioned bottom-side up.
2. Power up the N5292A test set.
3. Power up the PNA and if the Launch Test application is not open, open it or to learn how, refer to “PNA Calibration (Pna Cal) and Loading the N5292A Test Set Functional Verification Software (Launch Test)” on page 3-22.
4. Press Head Detect
5. In the Head Detection window, click on the port you want to verify.
6. Using the screwdriver adjustment tool, insert a test screw (SV 081-80-009), into the test set connector hole (right side of connector), starting at the zero-point (no threads screwed in), and follow the screen prompts.

   LED Port 1–4 reference designators:
   - Port 1: DS28
   - Port 2: DS30
   - Port 3: DS29
   - Port 4: DS31

**IMPORTANT!** Do not rotate the jack screw adjustment tool greater than ~5 clockwise (cw) rotations, because the detection circuit can become damaged.

If the port LED turns on with fewer than two turns, the fail-safe circuit is too sensitive. And, the connector needs to be replaced. Refer to Chapter 7, “Repair and Replacement Procedures.”
After port has been detected, the screen will display "Head Detected".

7. When done, remove the jack screw tool from the port.

8. Repeat steps 5 through 7 for the other ports.

   Else, press Exit.
Use test screw (SV 081-80-009) and screwdriver (cw) to adjust front panel screw ~2 to 5 turns from the zero-point (no threads screwed in). In the application verify the voltages are detected (i.e., "Bias Detected" is displayed. Do not exceed ~5 clockwise turns.
S-Parameters (Insertion Loss/Match)

This section assumes you have already downloaded the Launch Test application to your PC. If not, refer to “PNA Calibration (Pna Cal) and Loading the N5292A Test Set Functional Verification Software (Launch Test)” on page 3-22.

Equipment required:

- 26.5 GHz PNA-B with Option 020
- ECal or Calibration kit with a minimum 26.5 GHz frequency
- RF Fixture (ET57259-1, N5292-60128)
- S-Parameters fixture (ET57259-2, N5292-60129)
- PC with Launch Test application loaded

1. N5292A Test Set Calibration (using Launch Test application) - S-parameter Testing: Connect ECal module between ports 1 and 2. Using an ECal or calibration kit and Pna Cal button in the Launch Test application, do a 2-port cal to verify cabling and PNA integrity.

2. When 2-port calibration has been completed, proceed to the test set insertion loss/transmission measurements done after the N5290/91A system calibration. Refer to Figure 3-20 on page 3-32.
3. Verify Test Set S-Parameters (Using the Launch Test application): Fixtures that are used are shown in Figure 3-21 on page 3-34 along with a typical ET setup. This will check for potential failures between the test set's adapters and port connectors all the way to the TSMB in the following cabling paths:

- Low band path Transmission and Match
- REF IF path transmission and match
- TEST IF path transmission and match
- RF path transmission and match
When a defective cable or connector has been replaced and the test set has been repaired, the following tests are required:

- Test set and N5290A/91 A system calibration
- Insertion Loss/Match–S-parameters (verify PNA Cal has been completed). (Refer to Figure 3-27 on page 3-38 through Figure 3-30 on page 3-39.)
- LO Verify (Run after Insertion Loss/Match are verified.)

**IMPORTANT!** LO power verification is only required on the port that the connector or and cabling was replaced.
Figure 3-21  ECal Connected to Ports 1 and 2 for 2-port Calibration and Insertion Loss/Transmission Measurements

S-Parameters Fixture (aka LO Band ET)  
(N5292-60129, ET57259-2)

RF Fixture  
(N5292-60128, ET57259-1)
System Tests and Adjustments
N5292A Functional Verification Procedure

Figure 3–22  90–degree Adapters Connected

Figure 3–23  Low-Band ET (ET57259–2) Connected
Figure 3-24  Low Band (LFE) Eterm Test Connections: PNA port 1 (left) connected to ET Ref IF. PNA port 2 (right) Connects to Test Set Ref IF out.
System Tests and Adjustments
N5292A Functional Verification Procedure

Figure 3-25  Low Band (LFE) Eterm Test Connections: PNA port 1 connects to the ET LO (Low) Band. PNA port 2 (bottom) connects to the Test Set NA Port.

Figure 3-26  Low Band (LFE) Eterm Test Connections: Verifies ~60 ohms with DVM from ground to center conductor.
System Tests and Adjustments
N5292A Functional Verification Procedure

Figure 3-27  Test IF Path

Figure 3-28  REF IF Path
Figure 3-29 RF Path

Figure 3-30 Low Band Extension (LFE) Path
Test Set Connector and Cable Verification

When a defective cable or connector has been replaced and the test set has been repaired, the following tests are required:

- Test set and N5290A/91 A system calibration
- Insertion Loss/Match-S-parameters (Refer to Figure 3-27 on page 3-38 through Figure 3-30 on page 3-39.)
- LO Verify (Run after Insertion Loss/Match are verified.)

**IMPORTANT!** LO power verification is only required on the port that the connector or and cabling was replaced.

Equipment required:

- RF Fixture - Refer to Figure 3-21 on page 3-34.
- S-Parameters Fixture - Refer to Figure 3-21 on page 3-34.
- N5292A Test Set and Cable verification Launch Test application (PNA Cal)

Refer to step 3 on page 3-28 and Figure 3-27 on page 3-38 through Figure 3-30 on page 3-39.

Procedure:

1. On the PNA: Using test cables, connect ECal module between ports 1 and 2. Refer to Figure 3-20 on page 3-32.

2. Perform base line 2-port calibration using Launch Test application (PNA CAL) and ECal module. Follow the prompts.

3. On the N5292A Test Set: Connect the S-Parameters fixture to the port under test. Refer to Figure 3-21 on page 3-34.

4. Using the Launch Test application (Insertion Loss/Match), perform follow prompts and compare results to the typical plots shown in Figure 3-27 on page 3-38 through Figure 3-30 on page 3-39.
N5290/1A Millimeter-wave Test System Operator's Check

**STOP!** This section assumes you have completed the N5292A test set Operator's Check. If you have not completed the N5292A test set Operator's Check, refer to “N5292A Functional Verification Procedure” on page 3-16.

**CAUTION**

IMPORTANT! Before you begin testing on a System or instrument, always inspect the connectors on the instrument, the calibration kit, cables and adapters.

Performing the N5290/1A System Operator's Check

The N5290/1A System Operator's Check is done to verify the system to isolate the problem instrument or after the N5292A test set has been repaired and the N5292A test Operator's Check has been completed. Refer to “N5292A Functional Verification Procedure” on page 3-16.

**NOTE**

To achieve the maximum system stability, allow the analyzer to warm up for at least 15 minutes before performing the Operator's Check.

The operator's check is a software driven test that checks the basic operation of the assemblies in all of the measurement port signal paths. By performing the operator's check, the following are tested:

- attenuation ranges of all installed attenuators
- calibration of the receivers
- frequency response of the receivers
- phase lock and leveling
- basic functional test of noise floor and trace noise

**Accessories Used in the Operator's Check**

For more, refer to “Required Service Test Equipment” on page 2-3.

<table>
<thead>
<tr>
<th>Equipment Type</th>
<th>Part Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Female short, 1.0 mm</td>
<td>(any short from the 85059B calibration kits)</td>
</tr>
<tr>
<td>Female open, 1.0 mm</td>
<td>(any open from the 85059B calibration kits)</td>
</tr>
</tbody>
</table>
Performing the Operator's Check

1. Press **UTILITY > System > Service > Verification > Operator's Check**.

2. In the PNA Operator's Check dialog box (refer to Figure 3-32 on page 3-43), under Configure, select either:
   - **Prompt for attachment of Short/Open**, to pause at each step in the process to allow moving the short/open to the appropriate port
   - **Shorts/Opens are attached to ALL ports**, to run through the test without stopping. Shorts and opens can be mixed on the test ports
   - Additionally, you can choose:
     - Pause on Failure
     - Use unique log, to create a log file for this Operator's Check

3. Click **Begin**.

4. If shorts and opens are not connected to all ports, you will be prompted to connect them as needed.

5. The result of the operator's check will be shown as a PASS or FAIL next to each test (refer to Figure 3-32 on page 3-43). The PNA Operator's Check dialog box will look different for different PNA model numbers and installed options. Some of the tests are performed only if the appropriate options are installed in the PNA.
Figure 3-32  Operator’s Check Dialog Boxes

[Image of Operator’s Check Dialog Boxes]
If the N5290/1A Operator’s Check Fails

1. Clean the test ports, shorts, and adapters. Torque to specification. Repeat the check.

2. Run the adjustment tests and repeat the Operator’s Check. Refer “Adjustments”.

3. If the check still fails, suspect a faulty component. Refer to Chapter 4, “N5290/91A Troubleshooting,” to begin troubleshooting to determine the faulty component.

4. Also, refer to “The N5290/1A Millimeter Test System Preliminary Check” on page 3–7.
System Tests and Adjustments
Test Management Environment (TME) Performance Tests (N5290/1 A Millimeter System Only)

Test Management Environment (TME) Performance Tests (N5290/1 A Millimeter System Only)

The performance tests verify the electrical performance of your N5290/1 A Millimeter System. For more information, refer to the TME webpage at http://cal.software.keysight.com (N7840A) and to http://cal.software.keysight.com/PNA/Help/N7840AWebHelp.htm.

This section lists the test equipment needed to run performance tests. Models for each test equipment category are given in order of preference. Alternate models are also listed but should be considered a lower priority. All equipment is Keysight, Agilent, or Hewlett Packard unless otherwise specified. Refer to each individual test for specific setup configurations. The computer and all test equipment are connected to the unit under test (UUT) using GPIB.

**NOTE**
Requires a PC controller to run the (TME) Performance Tests.

**NOTE**
For a list of the equipment required for your system, refer to the N7840A Calibration Application Help for PNA-X Series Network Analyzer Help and to the “Test Equipment” topic.

Guidelines for Ordering Power-Sensor Calibration Service

**NOTE**
Power sensor calibrations services:
"Keysight Cal + Measurement Uncertainty + GB" that follows ISO 17025/ILAC-G8 standards.
(http://cal.software.keysight.com/PNA/Help/N7840AWebHelp.htm)

Use the following guidelines to ensure power sensors used by the N7800A application receive the correct calibration service:

1. Order Option 1A7 when ordering new power sensors that will be used as working standards in N7800A TME calibrations.
2. Order the Keysight Cal+ Measurement Uncertainty + GB for power sensor recalibration.
3. When ordering periodic calibration for instruments used as lab standards in the N7800A software, we recommend using "Keysight calibration + uncertainties" for power sensors, and "Keysight calibration + uncertainties + guardbanding" for all other items (please visit Selecting the Right Calibration Services). The N7800A software incorporates the ISO GUM Uncertainty in point-to-point uncertainty calculations. The special "H-series" calibration options in this table provide lower measurement uncertainties through use of direct comparison to devices directly
characterized by NPL or NIST (or another NMI). Please order Option H99 to get electronic data for easy import into the N7800A (avoids manual entry). The overall resulting N7800A measurement uncertainties then reflects these lower device uncertainties. The equipment requirements of each N7800A calibration application are summarized in the specials calibration matrix which can be found at the Recommended Lab Standards and Special Cal Options website.

4. The Keysight Option H99 is a special option for the Roseville Service Center [only] which provides electronic calibration data available as a *.csv file in TME N7800A format for all power sensors used with the N7800A TME application. N7800A TME is SSU calibration software used across Keysight SSU and by many self-maintainers. H99 must be requested from the Roseville SSU upon re-calibration only of any previously purchased power sensor and not for new purchases of BID Power Sensors. This option provides for adding the calibration data to a CD and may be ordered in addition to any other required or requested Std Lab Calibration option (must also be ordered in addition to H99).
Adjustments

These adjustments are firmware-driven tests that are used to adjust your N5290/1A mmW System or N5292A after PCA, cable, or connector has been replaced.

If multiple adjustments are to be performed, perform them in the order listed.

N5290/1A System Only

Run these tests after the PNA, heads, or N5292A test set have been repaired and the system is ready for final testing.

- LO Adjustment for mm Mode
- IF Gain Adj for mm Mode
- Source and Receiver Adj.
- Receiver Characterization
- IF Response Adj. for mm Mode
System Tests and Adjustments
Adjustments

Accessories Used in the Adjustments
For more, refer to “Required Service Test Equipment” on page 2-3.

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<thead>
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<th>Equipment Type</th>
<th>Part Number</th>
</tr>
</thead>
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<tr>
<td><strong>Calibration and Verification Tools</strong></td>
<td></td>
</tr>
<tr>
<td>1.0 mm calibration kit</td>
<td>85059B</td>
</tr>
<tr>
<td>ECal module (Recommended, but not required)</td>
<td>N4691B</td>
</tr>
<tr>
<td>Power supply load ET</td>
<td>ET57265</td>
</tr>
<tr>
<td>LO Cal and RF Eterm ET</td>
<td>ET57259–1</td>
</tr>
<tr>
<td>WBIF and LFE Eterm ET</td>
<td>ET57259–2</td>
</tr>
<tr>
<td><strong>Cables</strong></td>
<td></td>
</tr>
<tr>
<td>System cable</td>
<td>N4011-21002</td>
</tr>
<tr>
<td>Cables (x6)</td>
<td>N5240-60092</td>
</tr>
<tr>
<td>3.5 mm (m) to 3.5 mm (m)</td>
<td>Z5623A-K20</td>
</tr>
<tr>
<td>GPIB cable</td>
<td>10833B</td>
</tr>
<tr>
<td><strong>Adapters</strong></td>
<td></td>
</tr>
<tr>
<td>Female short, 1.0 mm</td>
<td>(any short from the 85059B calibration kit)</td>
</tr>
<tr>
<td>Female open, 1.0 mm</td>
<td>(any open from the 85059B calibration kit)</td>
</tr>
<tr>
<td>Female to Male thru, 1.0 mm</td>
<td>(from the 85059B calibration kit) LO ET</td>
</tr>
<tr>
<td>1.00 mm (f) to 1.00 mm (f) (short thru)</td>
<td>11920–60002(^a)</td>
</tr>
<tr>
<td>SMA (m) to SMA (f) elbow adapters(^b)</td>
<td>1250-2818</td>
</tr>
<tr>
<td>SMA (m) to SMA (f) thru adapters (x8)(^c)</td>
<td>1250-3851</td>
</tr>
</tbody>
</table>

- \(^a\) This is a short thru that is not included in the 85059B calibration kit.
- \(^b\) Use x3 for front panel wideband IF and LFE Eterms.
- \(^c\) Use x5 as connector savers on the rear panel IF ports (optional). Use x3 for front panel wideband IF and LFE Eterms.
Figure 3-33 Select Desired Adjustment Menu

LO Adjustment for mm Mode
This adjustment is used for the N5292A and for the N5290/1 A system. Refer to “LO Power Calibration, Adjustment, and Verification” on page 3-24.

IF Gain Adj for mm Mode
Run test and follow the prompts.

Source and Receiver Adj.
Run test and follow the prompts.

Receiver Characterization
Run test and follow the prompts.

IF Response Adj. for mm Mode
Run test and follow the prompts.
System Tests and Adjustments
Adjustments
4 N5290/91A Troubleshooting

**IMPORTANT!** Before you begin any testing on a System or instrument, always inspect the connectors on the instrument, the calibration kit, cables and adapters.

**NOTE**

STOP! If you have isolated the faulty instrument to the N5292A, by performing the N5290/1A system checks in Chapter 3, “System Tests and Adjustments,” then refer to “N5292A Test Controller Troubleshooting” on page 4-6. Else, refer to “N5290/1A Millimeter-Wave System Troubleshooting” on page 4-5.

STOP! If you have a problem with your N5293A or N5295A millimeter-wave head, you must return it to the factory for repair. Refer to “Contacting Keysight” on page 2-7.

For network analyzer troubleshooting, see the "Troubleshooting" chapter in the service guide for your PNA. Refer to www.keysight.com.

**Information in This Chapter**

The information in this chapter helps you:

- Identify the portion of the system at fault. Refer to Chapter 3, “System Tests and Adjustments.” If additional help is required, refer to “N5290/1A Millimeter-Wave System Troubleshooting” on page 4-5.

- Locate the specific troubleshooting procedure to identify the assembly or peripheral at fault.

The sections in this chapter are arranged in a logical troubleshooting order. The following table lists the sections and a brief summary of what to look for in that section.

For assistance refer to “Keysight Support, Services, and Assistance” on page 2-6.

If the N5290/1A or the N5292A Test Set is not operating properly, use the following procedures to aid in isolating the problem. Refer to the “Troubleshooting Organization Flowchart” on page 4-4.
# Chapter Four at-a-Glance

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<td>– Checking the A, B, R1, and R2 signals.</td>
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<tr>
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<td>– Checking the source group.</td>
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<tr>
<td>Test Set Diagrams and Graphics</td>
<td>Block diagrams for the analyzer including all options.</td>
<td>page 4-29</td>
</tr>
</tbody>
</table>
Getting Started with Troubleshooting

NOTE

STOP! If you have a problem with your N5293A or N5295A millimeter-wave head, you must return it to the factory for repair. Refer to “Contacting Keysight” on page 2-7.

For network analyzer troubleshooting, see the "Troubleshooting" chapter in the service guide for your PNA. Refer to www.keysight.com.

Where you begin troubleshooting depends upon the symptoms of the failure. Start by checking the basics as outlined in the following section. Also review the flowchart in Figure 4-1 on page 4-4. You should then be able to determine where in the troubleshooting procedure to begin, to locate the failed assembly.

Troubleshooting Organization

Follow the flowgraph in Figure 4-1 on page 4-4 to help direct you to the correct section for troubleshooting the system.
Figure 4-1  Troubleshooting Organization Flowchart

Go to “N5290/1A Millimeter-Wave System Troubleshooting” on page 4-5.

Go to “N5292A Test Controller Troubleshooting” on page 4-6 and to “No DC Power for Millimeter-wave Modules” on page 4-8.

Go to “No DC Power for Millimeter-wave Modules” on page 4-8.

Go to “N5292A Test Controller Troubleshooting” on page 4-6.

Go to “No DC Power for Millimeter-wave Modules” on page 4-8.
N5290/1A Millimeter-Wave System Troubleshooting

**NOTE**

STOP! This chapter assumes you have performed the N5290/1A system checks in Chapter 3, “System Tests and Adjustments,” and have isolated the N5292A test set as the problem instrument. If you have not isolated the N5292A test set as the problem, then go back and perform the checks in Chapter 3.

STOP! If you have a problem with your N5293A or N5295A millimeter-wave head, you must return it to the factory for repair. Refer to “Contacting Keysight” on page 2-7.

For network analyzer troubleshooting, see the "Troubleshooting" chapter in the service guide for your PNA. Refer to www.keysight.com.

This section assumes you have run the Operator Checks in “Performing the N5290/1 A System Operator’s Check” on page 3-41. If the Operator Check indicates the N5292A Test Set is the problem, please refer to “N5292A Test Controller Troubleshooting” on page 4-6. For information on servicing your PNA vector network analyzer. Refer to the service guide for your PNA here: http://www.keysight.com/find/pna.

Procedure:

- Separate the millimeter-wave heads from the test set. Remove all of the semirigid cables from the PNA to the test set.
N5292A Test Controller Troubleshooting

STOP! This chapter assumes you have performed the N5290/1A system checks in Chapter 3, “System Tests and Adjustments,” and have isolated the N5292A test set as the problem instrument. If you have not isolated the N5292A test set as the problem, then go back and perform the checks in Chapter 3.

NOTE

N5292A test set controller troubleshooting can only be done by Keysight-trained personal for procedures such as S-Parameters and voltage checks and are not intended for N5290/1A system troubleshooting.

If the Test Set is not operating properly, use the following procedures to aid in isolating the problem. Refer to the “N5292A Functional Verification Procedure” on page 3-16.

Power Supplies and Fans

1. Verify the front panel switch is operational:
   a. When the front panel switch is off, the LED should be amber.
   b. When on the front panel DC Power LED should be on (white) when the front panel switch is in the on position.

2. AC Line voltage checks:
   a. Ensure the proper AC line voltage is present at the instrument line cord.
   b. Remove the AC power cord from the instrument.

3. Internal DC Power checks.
   a. Set the front panel power switch to OFF (LED is amber).
   b. Remove the cover and connect the AC power cord. No fans should be on. Some DC LEDs should be on the test set mother-board (TSMB).
   c. Set the power switch to the on position (LED is white). Both internal power supply fans should be operational; the front panel DC Power LED should be on. If the DC Power LEDs are off, measure the +3.35Ds VDC pin on F6 and the+3.35Ds VDC pin on J11. Refer to “Verifying the A5 Test Set Motherboard (TSMB)” on page 4-9 and to “Verifying the A1 power supply” on page 4-17.
d. Ensure the TSMB DC Supply indicator LEDs are on. If not, suspect power supply (0950-0516) or front panel Standby switch. Using a DVM measure the power supply terminal connections. Refer to the label on the power supply for voltages on the terminals screws. Refer to “Verifying the A1 power supply” on page 4-17.

e. If the voltages on the power supply voltages are not correct:
   i. Turn off the power switch.
   ii. Then lift the TSMB.
   iii. If the DC Supply LEDs were on, disconnect bias cables (J60 & J61) and amp cables (J10, 11, 12 and 14) to the TSMB and re-install the board.
   iv. If the indicator LEDs are on, suspect the A3 LODA. “Verifying the A2 LOPA, A3 LODA, and A4 Phase Compensation Boards” on page 4-22.

f. If the fan is not working and all +3.3V are OK and the DC Supply LEDs are on, replace fan. Refer to TP20, F6, and Table 4-1 on page 4-11, Figure 4-3 on page 4-12, and Figure 4-4 on page 4-13.
No DC Power for Millimeter-wave Modules

This section isolates a faulty millimeter-wave module or a faulty N5292A test set.

This section contains the following procedures:

- “Procedure for identifying a faulty millimeter head:”
- “Verifying the A5 Test Set Motherboard (TSMB)”
- “Verifying the A1 power supply”
- “Verifying the A2 LOPA, A3 LODA, and A4 Phase Compensation Boards”
- “Head Stability Check”
- “Front Panel Active LED”
- “RF OUT Failures”
- “LO Out Failure”
- “REF IF or Test IF”
- “Test Set Diagrams and Graphics”

Equipment required:

- Power supply fixture – Refer to Figure 3-10 on page 3-19
- PNA 10 MHz to 26.5 GHz (minimum)
- Millimeter-wave head(s)

Procedure for identifying a faulty millimeter head:

1. Power down the test set and remove the top and bottom covers. Refer to Chapter 7 and “Removing the Outer Cover” on page 7-8.

2. Connect the suspect millimeter-wave head to the test set.

3. Power up the N5292A test set.

**NOTE**

A photo sensor is mounted behind the integrated (SV) cable connector for each port. There is a special jack screw which tightens the SV cable to the N5292A Test Set. When the jack screw is fully tightened, the head is securely connected to the test set and enables the TSMB to receive a digital signal to indicate that it is safe to turn on the critical power supplies, namely +4.4V, +6.4V and +9.2V. These supplies power many expensive power-sensitive components in the head, which it is important to protect from hot plug or hot unplug.
4. On the test set head, check to see if the head LEDs are working correctly (LEDs illuminated red). If yes, run mm Mode Operations Check. Refer to Chapter 3 and to “The N5290/1A Millimeter Test System Preliminary Check” on page 3-7.

5. If a millimeter-wave module (head) is not powered on (LEDs illuminated red), power down the test set, and move the head to another port to isolate the faulty port or head. Refer to Figure 4-2 on page 4-10.

6. If the head is still acting faulty, power down the test set and swap in a known working head. If the swapped head does fix the problem, power down the test set and return the faulty head to the Keysight factory for repair.

Else, proceed to “Verifying the A5 Test Set Motherboard (TSMB)” and to “Verifying the A1 power supply” on page 4-17.

Verifying the A5 Test Set Motherboard (TSMB)

This section describes the process for verifying that the TSMB is distributing the proper voltages and signals to the A1 power supply, A2 LO preamplifier (LOPA), A3 LO distribution amplifier (LODA), A4 phase compensation PCA, and to the front panel ports.

Overview of the TSMB Voltages and LED Behavior

Power down the N5292A test set, remove the covers, and visually verify the LED behavior using the descriptions below. Refer to Figure 4-2 on page 4-10.

- There are 4 identical power supply fault detection circuits, one for each port. The inputs to the circuit are +4.4V, +6.4V, +9.2V, -9.2V and -7V, and the output is the color of LED indicator.
- Green LED represents the tested power supplies are alive and healthy.
- Red LED means at least one of the 5 listed power supplies is bad.
- When Magenta LED is illuminated the FPGA has not enabled +4.4V, +6.4V and +9.2V. Refer to Figure 4-2 on page 4-10.
Figure 4-2  TSMB LEDs and the status of the FPGAs. When the magenta LED(s) is illuminated the FPGA(s) are not enabled (i.e., verify +4.4V, +6.4V, and 9.2V).

TSMB FPGA fault detection LEDs illuminating magenta (i.e., when the magenta LED is illuminated the FPGA has not been enabled—need to verify: +4.4V, +6.4V, and +9.2V.)
Table 4-1  Test Set Motherboard (TSMB) DC Test Point Values

<table>
<thead>
<tr>
<th>Test Point (TP)a</th>
<th>Test Point (Other)b</th>
<th>Voltage (+/-0.2V)</th>
<th>Fuse #</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Group 1</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>TP13</td>
<td>--</td>
<td>15 VF</td>
<td>F1</td>
</tr>
<tr>
<td>TP14</td>
<td>--</td>
<td>-15VF</td>
<td>F8</td>
</tr>
<tr>
<td>TP16</td>
<td>--</td>
<td>5.2 VF</td>
<td>F4</td>
</tr>
<tr>
<td>TP17</td>
<td>--</td>
<td>12 VF</td>
<td>F2</td>
</tr>
<tr>
<td>TP18</td>
<td>--</td>
<td>-7 VF</td>
<td>F7</td>
</tr>
<tr>
<td>TP19</td>
<td>--</td>
<td>5.1 VD</td>
<td>F5</td>
</tr>
<tr>
<td>TP20</td>
<td>--</td>
<td>3.3 VF</td>
<td>F6</td>
</tr>
<tr>
<td>TP43</td>
<td>--</td>
<td>-5 VF</td>
<td>F4</td>
</tr>
<tr>
<td>TP57</td>
<td>--</td>
<td>7 VF</td>
<td>F7</td>
</tr>
<tr>
<td>--</td>
<td>TP31</td>
<td>5V STBY</td>
<td>--</td>
</tr>
<tr>
<td>--</td>
<td>--</td>
<td>--</td>
<td>F9 (Spare)</td>
</tr>
<tr>
<td><strong>Group 2</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>TP44</td>
<td>--</td>
<td>1.0V</td>
<td>--</td>
</tr>
<tr>
<td>TP45</td>
<td>--</td>
<td>1.5V</td>
<td>--</td>
</tr>
<tr>
<td>TP46</td>
<td>--</td>
<td>1.8 V</td>
<td>--</td>
</tr>
<tr>
<td>TP47</td>
<td>--</td>
<td>1.8 PLL</td>
<td>--</td>
</tr>
<tr>
<td>TP49</td>
<td>--</td>
<td>1.8 VF</td>
<td>--</td>
</tr>
<tr>
<td>--</td>
<td>TP41</td>
<td>3.3 VF</td>
<td>--</td>
</tr>
<tr>
<td><strong>Group 3</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>TP15</td>
<td>--</td>
<td>9.0V</td>
<td>--</td>
</tr>
<tr>
<td>TP29</td>
<td>--</td>
<td>6.0V</td>
<td>--</td>
</tr>
<tr>
<td>TP30</td>
<td>--</td>
<td>4.5 VR</td>
<td>--</td>
</tr>
<tr>
<td>TP56</td>
<td>--</td>
<td>1.25 VREF</td>
<td>--</td>
</tr>
<tr>
<td>TP28</td>
<td>--</td>
<td>8.2 VR</td>
<td>--</td>
</tr>
</tbody>
</table>

a. All of the main test points (TP) are bordered in red.
b. Some of the supplemental (other) test points are bordered in blue.
Figure 4-4  Group 1 Test Point Details, including F1–F8
Figure 4-5  Test Set Head DC Volts (e.g., is for port 3
(i.e., Other ports Port 1 (A), Port 2 (B), and Port 4 (D), are similar).
Figure 4-6  Group 2 Test Point Details
Verifying A5 Test Set Motherboard Connectors, Cables, and Voltages

1. Power down the test set and remove the top and bottom covers. Refer to Chapter 7 and “Removing the Outer Cover” on page 7-8.

2. If not previously done, verify the continuity of the F1–F8 fuses. If necessary, use the "Spare" fuse (F9). Refer to Table 4-1 on page 4-11.

   If the fuse was faulty was replaced, proceed to step 7.

3. If the fuses are OK, inspect that the J3–J6 DC cables and J7–J11 head digital control cables are installed properly. If not, power down the test set, and re-seat the connectors. Then power up the test set, and recheck the operation of the head(s) and test set. Refer to 7.

4. If the fuses are OK, verify the voltages at the corresponding port's TSMB connector pins (J3–J6). (I.e., Port 1 (A), port 2 (B), port 3 (C), and port 4 (D).) Refer to Figure 4-8 on page 4-18 and Figure 4-10 on page 4-21.

   If no problem found or only one connector pin is failing the voltage check, continue to step 5.

   Else, refer to “Verifying the A1 power supply” on page 4-17 and then to step 6.
5. If the J3–J6 voltages are OK, and only one port is failing, and the head(s) are working OK on other ports, then swap out a known good J3–J6 cable and retest that port. Refer to Figure 4-8 on page 4-18 and to step 7.

Else, refer to “Verifying the A1 power supply” on page 4-17.

6. Replace the defective cable or TSMB. Refer to Chapter 7, “Repair and Replacement Procedures.”

7. If the power supply fixture voltages are OK, proceed to “N5292A Functional Verification Procedure” on page 3-16. If the N5292A test set passes the Operation Check, then reinstall the top and bottom covers. Refer to Chapter 7 and “Removing the Cover” on page 7-8.

Verifying the A1 power supply

If the power supply fixture volts have already been verified, skip to step 4.

1. Connect the power supply fixture to the suspect port and tighten finger tight.

2. Power up the test set.

3. Probe each of the J3–J6 power supply fixture test points, verifying that each voltage is within +/-0.2V of the values shown in Figure 4-8 on page 4-18. See also, Figure 4-3 on page 4-12.

   If the voltages are ≥+/-0.2V of the values shown, then step 4.
Figure 4-8 Using the Power Supply Fixture to Check the Test Set Motherboard (TSMB) J3 (Port 1)–J6 (Port 4) Connector’s DC Test Point Values – Verifies the mm Heads Have the Correct Voltages (i.e., J3 (Port 1) is shown, the other ports are similar)

Example of Test Set Motherboard (TSMD) J3-J6 pin-outs.

Note: Port 1 pin voltage values have an "A" suffix, Port 2 has a "B" suffix, etcetera.
4. Power down the test set and remove the cover. Refer to Chapter 7 and “Removing the Cover” on page 7-8.

5. On the test set motherboard (TSMB), verify the continuity of the F1–F8 fuses. If necessary, use the "Spare" fuse (F9). Refer to Table 4-1 on page 4-11 and Figure 4-9. See also, Figure 4-3 on page 4-12.

If the fuse was faulty was replaced, repeat steps 1 and 3 and if the power supply fixture voltages are OK, proceed to “N5292A Functional Verification Procedure” on page 3-16. If the N5292A test set passes the Operation Check, then reinstall the cover. Refer to Chapter 7 and “Removing the Cover” on page 7-8.

Figure 4-9   Group 1 Test Point Details, including F1–F8
6. Verify the test set is powered down: On the A1 power supply, verify the wires are correctly seated. Refer to Figure 6-18 on page 6-35.

   If the wires were not connected correctly, reconnect, power up the TSMB, and recheck the power supply test fixture voltages shown in Figure 4-8 on page 4-18.

7. If the power supply cables are seated correctly: Power down the test set and connect the power supply fixture (ET57256, N5292-60130). Power up the test set and perform the voltage checks in Chapter 5, “Theory of Operation.” And, then refer to, “Millimeter (mm) Head Heater DAC and Power Supplies Check (Heater Dac/Voltage)” on page 3-26.

8. If the power supply voltages are OK, but the power supply fixture test points are incorrect, proceed to “Verifying A5 Test Set Motherboard Connectors, Cables, and Voltages” on page 4-16

   Else, if the A1 power supply is determined to be faulty replace it. Refer to Chapter 7 and “Removing the Cover” on page 7-8.
Figure 4-10  Test Set Head DC Volts (e.g., is for port 3 
(i.e., Other ports Port 1 (A), Port 2 (B), and Port 4 (D), are similar).
Verifying the A2 LOPA, A3 LODA, and A4 Phase Compensation Boards

Refer to Figure 4-13 on page 4-23, for the following sections:

- “Verifying the A2 LOPA (LO Preamplifier)” on page 4-23
- “Verifying the A3 LODA (LO Distribution Amplifiers)” on page 4-24
- “Verifying the A4 Phase Compensation Board” on page 4-25
Verifying the A2 LOPA (LO Preamplifier)
This procedure verifies the LO preamplifier PC’s port 1 through port 4 behavior.

1. Power down the test set and remove the outer cover. Refer to Chapter 7 and “Removing the Cover” on page 7-8.

2. Verify, if the LOPA J61 the cable connector is seated correctly, else power down, and reconnect the J61 cable.

3. Verify the LOPA port 1 thru port 4 (4-port only) LEDs are OK.

4. Verify the power out one of the LOPA ports. It should measure ~0 dB out of either port. If the power is not correct, replace the LOPA board. Refer to “Removing and Replacing the A2–A4 Boards” on page 7-14.
5. If one or more LEDs is faulty, verify the power out one of the LOPA ports. The power should measure ~0 dB out of either port. If the power is not correct, replace the LOPA board. If the power is correct, but the LED is faulty, replace the LOPA board. Refer to “Removing and Replacing the A2–A4 Boards” on page 7-14.

Else, if the J61 connector was re-seated and the LEDs are OK, proceed to “N5292A Functional Verification Procedure” on page 3-16. If the N5292A test set passes the Operation Check, then reinstall the outer cover.

6. If the LOPA board is working OK, but the test set is still faulty, proceed to “Verifying the A3 LODA (LO Distribution Amplifiers)” on page 4-24.

Verifying the A3 LODA (LO Distribution Amplifiers)

1. If the LODA LED is red indicating no power/unleveled (green LED indicates LODA power is OK), verify J60 connector is seated correctly.

Else, power down the test set and reconnect the J60 cable. Power up the test set and recheck the LEDs. If the LEDs are OK after re-seating the J60 connector, then refer to “N5292A Functional Verification Procedure” on page 3-16.

If the J60 cable is seated and one or more of the LODA LEDs is red or and one or more of the A5 TSMB LEDs are red, then verify the A5 TSMB voltages. Refer to “Verifying A5 Test Set Motherboard Connectors, Cables, and Voltages” on page 4-16. If the A5 TSMB voltages are OK, then the LODA board is faulty and needs to be replaced. Refer to “Removing and Replacing the A2–A4 Boards” on page 7-14.

2. Else, if the LEDs are OK, but the test set is still faulty, continue to “Verifying the A4 Phase Compensation Board” on page 4-25.
Verifying the A4 Phase Compensation Board

1. Verify J54 cable connector is seated correctly, else power down and reconnect.

2. Disconnect the suspect semi-rigid cable from suspect port (J5, J6, J7, or J8). Connect a thru cable on the suspect port and verify the change in power level. If power is now correct or better (>1 dB increase in power). The A4 phase board is faulty and should be replaced. Refer to Figure 4-13 on page 4-23.

A nominal change in power of ≤1 dB is expected, when a thru cable is installed and when the A4 phase compensation board is working correctly.

**NOTE**

Head Stability Check

Use this check to verify the stability of a millimeter head.
Equipment required:

- Freeze spray
- PNA 10 MHz to 26.5 GHz (minimum)
- Millimeter-wave head(s)

Setup up system for the head stability check. Refer to Figure 4-15 on page 4-26. **3 short blasts** of freeze spray on screw—wait a second or two between bursts to avoid damaging the module—which is located on the outside cover which is in close proximity of the connector on the head can uncover issues with the head. Traces will drift but should track each other and finally settle. If traces do not track (i.e., separate from each other (greater than +/-0.1 dB pk-pk) or fail to settle and display power suck-outs or spikes that are large. This type of behavior indicates a bad head.)

**NOTE**

System service calibrations (source, if gain etc) are not typically done when a system is assembled. Only an installation calibration is required, because these calibrations are done at the factory and the calibration data should be stored in the heads. It is up to the FE or customer to determine if these additional calibrations are required, because the system performance warrants them to be performed (i.e., head drift over time, etcetera).

**Figure 4-15**  Head Stability Check
Front Panel Active LED

Front Panel power switch LED check. If the power switch LED indicator is not operating, verify the power switch cable connection on both the front panel and the test set motherboard (TSMB) is connected securely. Proceed to the next section for further troubleshooting before replacing the power switch keypad board. Refer to Chapter 7 and to “Removing and Replacing the Front Panel Power Switch Board” on page 7-28.

– Verify the TSMB LEDs are on. Refer to “Verifying the A5 Test Set Motherboard (TSMB)” on page 4-9.

RF OUT Failures

If the test ports are not switching, or fail the Operational Check the following procedures can be used to verify the failure. The procedures assume power supplies, test set motherboard, and front panel LEDs are working. Suspect the LOPA, LODA, phase compensation board, and ribbon cable connections to the test set motherboard (TSMB). Refer to Figure 4-3 on page 4-12, Figure 4-13 on page 4-23, and Figure 4-14 on page 4-25.

1. Swap millimeter-wave heads.

2. Inspect the ribbon cable connections from the LOPA, LODA, phase compensation boards to the TSMB. If necessary re-seat the connector(s). Refer to Figure 4-3 on page 4-12, Figure 4-13 on page 4-23, and Figure 4-14 on page 4-25.

3. Start by measuring the power at A2 LOPA, A3 LODA, or A4 phase compensation board. If you find incorrect power levels and suspect a component has failed verify the DC voltages in Table 4-1 on page 4-11 and Figure 4-3 on page 4-12 thru Figure 4-7 on page 4-16. If the DC voltages are OK, then refer to “Verifying the A2 LOPA, A3 LODA, and A4 Phase Compensation Boards” on page 4-22. Replace the failed component.

LO Out Failure

If the LO Out fails the Operation Verification test the following procedure can be used to verify the failure. The procedures assume power supplies, TSMB, and the front panel LEDs are working. Suspect the bias cables. Refer to “Verifying the A2 LOPA, A3 LODA, and A4 Phase Compensation Boards” on page 4-22.

1. If one or more of the LO ports are working, suspect the LODA.
2. If none of the port are working, verify the output of the LOPA. It is only necessary to verify the output of one port on the LOPA. If you find incorrect power levels and suspect a component has failed verify the DC voltages referencing Table 2-3 on page 2-16 and Figure 2-7 on page 2-16. Replace the failed component.

REF IF or Test IF

If the REF IF or Test IF fails the Operation Verification test the following procedure can be used to verify the failure. The procedures assumes power supplies and front panel LEDs are working. Suspect the A5 test set mother-board (TSMB) or coaxial cables. Refer to “Verifying the A5 Test Set Motherboard (TSMB)” on page 4-9.

1. **N5292A 2-port** - Verify that the front panel Port 1 & 2 REF and IF coax cables are properly connected to the rear panel (A, B, C and D) and insertion loss is not >−2.5 dB. Replace the coax cable if damaged. If damaged, refer to “Removing the N5292A Option 200/400 from the System” on page 7-6.

Verify the front panel integrated connector pins are not damaged. If damaged refer to “Removing and Replacing the Subpanel PCA Sensor Boards” on page 7-29 and “Removing and Replacing the Front Panel Integrated Connectors/Cables” on page 7-31. See also “N5292A Front Panel Integrated Port Connector” on page 3-40.

Verify the blue wires supplying power to the integrated connectors are not damaged. If damaged, refer to “Removing and Replacing the Front Panel and Subpanel Assemblies” on page 7-10 and “Removing and Replacing the Front Panel Integrated Connectors/Cables” on page 7-31.

2. **N5292A 4-port** - Verify that the front panel Port 1 & 4 REF and IF coax cables and rear panel coax cables (A, B, C, D and R) are properly connected to the TSMB. Verify that the insertion loss is not >−2.5 dB. Replace the coax cable if defective. Refer to “Removing the N5292A Option 200/400 from the System” on page 7-6.

Verify the front panel integrated connector pins are not damaged. If damaged refer to “Removing and Replacing the Subpanel PCA Sensor Boards” on page 7-29 and “Removing and Replacing the Front Panel Integrated Connectors/Cables” on page 7-31.

Verify the blue wires supplying power to the integrated connectors are not damaged. If damaged, refer to “Removing and Replacing the Front Panel and Subpanel Assemblies” on page 7-10 and “Removing and Replacing the Front Panel Integrated Connectors/Cables” on page 7-31.

3. If the coax cables are properly connected and the insertion loss is correct, replace the A5 TSMB. Refer to “Removing and Replacing the A5 Test-Set Motherboard” on page 7-20.
Figure 4-16  N5290A Option 201, 205 System Level Block Diagram
Figure 4-17   N5290A Option 202, 205 System Level Block Diagram
Figure 4-18 N5290A Option 401 System Block Level Diagram
Figure 4-19  N5290A Option 402 System Block Level Diagram
5 Theory of Operation

**IMPORTANT!** Before you begin any testing on a System or instrument, always inspect the connectors on the instrument, the calibration kit, cables and adapters.

**NOTE**
For network analyzer theory of operation, see the testing Theory chapter in the service guide for your PNA. Refer to www.keysight.com.

Information in This Chapter

This chapter provides a general description of the operating theory of the N5290/1A systems and the N5292A millimeter head controller Option 200 and Option 400 Series 2-Port and 4-Port Microwave Network Analyzer Systems.

- Theory of operation is explained to the assembly level only.
- Component-level circuit theory is not provided.
- Simplified block diagrams are included for each functional group.
- More detailed block diagrams are located at the end of Chapter 4, “N5290/91A Troubleshooting.”
- See also https://literature.cdn.keysight.com/litweb/pdf/5992-1465EN.pdf

**NOTE**
Some paragraphs of this chapter reference your analyzer’s DSP version. Click Help > About Network Analyzer and note the DSP version shown.
## Chapter Seven at-a-Glance

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Theory of Operation

Overview

Refer to the block diagram in Figure 5-3 on page 5-6 through Figure 5-6 on page 5-9 for the following paragraphs.

The N5292A Option 200 or N5292A Option 400 millimeter head controller routes the LO and RF signals from the PNA to the test set millimeter head. The millimeter heads separate the incident from the reflected RF signal, up convert those signals to 110/120 GHz and then separate and down convert those reflected signals to an IF signal.

The millimeter heads do not have their own power supplies; each head receives dc power from the N5292A-200 or N5292A-400 millimeter head controller, by way of a multi-pin interface cable.

LO Behavior without LFE (Low Frequency Extension):

The LO signal is sent directly to the mixers in the receiver group. The incident signals are routed to the front panel test ports and then to the device under test (DUT). A portion of each incident signal is coupled off (in the signal separation group) and sent to the mixers in the receiver group as reference signals. These reference signals are compared (mixed) with the LO signal in the receiver group to produce the 7.438 MHz (or 0.826 MHz at frequencies below 53 MHz) IF signal.

LO Behavior with Low Frequency Extension (LFE) Operation

On the synthesizer board, there is a LFE output that is limited by the C-R filter and by the 250 MHz low pass filter.

Below 20 MHz, the LFE is signal is directly converted. Exceptions are shown in Figure 5-1 on page 5-4. See also, the Service Guide for your PNA on www.keysight.com.
The incident signal output power is leveled by an internal automatic leveling control (ALC) circuit. The maximum output power level of the network analyzer at the test ports can be found in the Data Sheet and Technical Specifications documents, available online at: http://literature.cdn.keysight.com/litweb/pdf/N5221-90003.pdf and http://literature.cdn.keysight.com/litweb/pdf/N5221-90004.pdf.1

10 MHz to 19 GHz Operation

The RF signal from the PNA SOURCE OUT of each of the four ports is 10 MHz to 19 GHz. And, is input into the Source In connector of the N5292A test set. The RF signal is then input into the corresponding millimeter head for each port and switched into a series of frequency multipliers.

The signal received at the test port of the combiner (either transmitted from another millimeter head or reflected from a device under test) is routed to the RCVR connector via the combiner and coupled arm of the coupler. This output goes to the RCVR IN connector on the appropriate port of the PNA.

DC Power

The power supply generates the following supply voltages: +15V, +12C, +9V, +5.2V, +5.1D, +3.5D, –7V.

Each supply voltage will have its own LC filter, the size of the inductor used depends on how much current is drawn from a supply. Each supply will have its own fuse situated in a socket for easy replacement when needed. All fuses from F1 to F9 are rated at 3.5A, except F6, which is rated at 5A for the +3.5V supply.

1. For frequency ranges and maximum output power levels, refer to the section "Test Port Output" in the Data Sheet and Technical Specifications documents (see hyperlinks above).
Overview – N5292A Test Set

The N5292A Test Set is the contains multiple assemblies, Power Supply, Test Set mother board, LOPA, LODA, Phase Correction Board, fans, cables and connectors.

The N5292A test set can simultaneously drive 4 ports fully loaded with multiple millimeter heads, up to 120 GHz frequency coverage.

Power Supplies

The power supply generates the following supply voltages, +12V, +9V, +5.2V, +5.1D, +3.5D, -7V and -15V, +15V, -9V, +9V, +6.2V, +6.2V, +4.2V, +4.2V, +3.3V.

Each filter has its own LC filter and fuse (with socket for ease of replacement).

Figure 5-2 TSMB LEDs and the status of the FPGAs. When the magenta LED(s) is illuminated the FPGA(s) are not enabled (i.e., verify +4.4V, +6.4V, and 9.2V).

LO Distribution Amplifiers (LODA)

Provides the LO signals to the LODA. A power splitter supplies both output ports.

LO Preamplifiers (LOPA)

Provides the RF power for the test set mother-board (TSMB).
System Level Block Diagrams

Figure 5-3  N5290/91A Option 201 System Level Block Diagram (N5222B with Option 205)
Figure 5-4  N5290/91A Option 401 System Level Block Diagram (N5242B with Option 425)
Figure 5-5  N5290/91A Option 402 System Level Block Diagram (N5242B with Option 425 and 029)
Figure 5-6    N5290/91A Option 403 System Level Block Diagram (N547B with Option 425 and 029)
6 Replaceable Parts

**IMPORTANT!** Before you begin any testing on a System or instrument, always inspect the connectors on the instrument, the calibration kit, cables and adapters.

**CAUTION**

**IMPORTANT!** For N5224/5B, N5244/5B, and N5267B PNAs When connecting the 5292-20014 semirigid cable it is critical that the 2.4 mm end is connected to the PNA's REF SOURCE OUT port and the SMA end is connected to the N5292A test set's LO Band connector. Refer to Figure 6-1 on page 6-2.

**NOTE**

There are no replaceable parts in the N5293A or N5295A millimeter-wave heads. If there is a problem with your N5293A or N5295A, return them to factory for repair. Refer to “Keysight Support, Services, and Assistance” on page 2-6.

For network analyzer replacement parts of operation, see the "Replacement Parts" chapter in the service guide for your PNA. Refer to www.keysight.com.
This chapter:

- identifies the replaceable parts for the N5292A Option 200 and Option 400 Test Controller.
- includes several tables and illustrations to assist you in identifying the correct part for your analyzer.
- contains ordering information for new assemblies and rebuilt-exchange assemblies.

There are many other repair and calibration options available from the Keysight Technologies support organization. These options cover a range of service agreements with varying response times. Contact Keysight for additional information on available service agreements for this product. Refer to https://www.keysight.com/find/calibration.
## Replaceable Parts

### Information in This Chapter

## Chapter Six at-a-Glance

<table>
<thead>
<tr>
<th>Section Title</th>
<th>Summary of Content</th>
<th>Start Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ordering Information</td>
<td>How to order a replaceable part from Keysight Technologies.</td>
<td>page 6-4</td>
</tr>
<tr>
<td>Assembly Replacement Sequence</td>
<td>The correct sequence for replacing a defective assembly.</td>
<td>page 6-5</td>
</tr>
</tbody>
</table>
| Replaceable Parts Listings    | Tables that list the assemblies by reference designator with their associated part number and description. Illustrations that indicate the location of each of the replaceable parts in your analyzer:  
  - Assemblies (front-panel, top, bottom, and rear-panel)  
  - Cables (top and bottom)  
  - Hardware (top, bottom, internal, and external.)  
  - Miscellaneous replaceable parts | page 6-6 |
Ordering Information

To order a part listed in the replaceable parts lists:

- include the part number
- indicate the quantity required
- Contact Keysight Technologies for instructions on where to send the order. Refer to “Contacting Keysight” on page 2-7.

To order a part that is not listed in the replaceable parts lists:

- include the instrument model number and complete instrument serial number
- include the description and function of the part
- indicate the quantity required
- Contact Keysight Technologies for instructions on where to send the order. Refer to “Contacting Keysight” on page 2-7.
Assembly Replacement Sequence

The following steps describe how to replace an assembly in the network analyzer.

**Step 1.** Identify the faulty group. Begin with Chapter 4, “N5290/91A Troubleshooting.” Follow up with the appropriate troubleshooting chapter that identifies the faulty assembly.

**Step 2.** Order a replacement assembly. Refer to this chapter.

**Step 3.** Replace the faulty assembly and determine what adjustments are necessary. Refer to Chapter 7, “Repair and Replacement Procedures.”

**Step 4.** Perform the necessary adjustments. Refer to Chapter 3, “System Tests and Adjustments.”

**Step 5.** Perform the necessary performance tests. Refer to Chapter 3, “System Tests and Adjustments.”

**Step 6.** Keysight personnel: see Figure 1-1 on page 1-6 to review where the calibration stickers should be placed on the N5292A Test Controller.
Replaceable Parts Listings

**IMPORTANT!** Before you begin any testing on a System or instrument, always inspect the connectors on the instrument, the calibration kit, cables and adapters.

**NOTE**

STOP! If you have a problem with your N5293A or N5295A millimeter-wave head, you must return it to the factory for repair. Refer to “Keysight Support, Services, and Assistance” on page 2-6.

For network analyzer replaceable parts, see the Replaceable Parts chapter in the service guide for your PNA. Refer to www.keysight.com.

This section contains the N5292A-200 and N5292A-400 replacement part numbers and their descriptions for your Keysight N5292A Option 200 and Option 400 Test Controllers. You can find the locations of replaceable parts in this section:

– listed by reference designator in Table 6-1, or

– listed by the type of part in Table 6-2.

Table 6-1  N5292A Part Number Listing by Reference Designator

<table>
<thead>
<tr>
<th>Reference Designator</th>
<th>Description</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>N/A</td>
<td>Front panel</td>
<td>“Front Panel Assembly, Back Side, All Options” on page 6-13</td>
</tr>
<tr>
<td></td>
<td></td>
<td>“Front Panel Assembly, Back Side, All Options” on page 6-13</td>
</tr>
<tr>
<td>A1</td>
<td>Power supply, switching, 210W Output</td>
<td>“Top Assemblies and Cables, All Options” on page 6-18</td>
</tr>
<tr>
<td>A2</td>
<td>LO Preamplifier (LOPA)</td>
<td>Your option set determines which assemblies are in your PNA. Refer to “Bottom Assemblies and Cables by Option Set:” in Table 6-2 on page 6-7</td>
</tr>
<tr>
<td>A3</td>
<td>LO Distribution Amplifier (LODA)</td>
<td></td>
</tr>
<tr>
<td>A4</td>
<td>Phase Compensation PCA</td>
<td></td>
</tr>
<tr>
<td>A5</td>
<td>Test set motherboard (TSMB)</td>
<td></td>
</tr>
</tbody>
</table>
## Table 6-2  Part Number Listing by Type of Part

### Assemblies and Cables
- “Front Panel Assembly, Front Side, All Options” on page 6-9
- “Front Panel Assembly, Back Side, All Options” on page 6-13
- Top Assemblies and Cables, All Options:
  - “Top Assemblies, All Options” on page 6-18
  - “Top Cables, All Cables, All Options” on page 6-19
- Bottom Assemblies and Cables by Option Set:
  - “N5292A 2-Port Configuration, Option 200” on page 6-21
  - “N5292A 4-Port Configuration, Option 400” on page 6-26
- “Rear-Panel Assembly, All Options” on page 6-32

### Hardware
- “Fan Assemblies, All Options” on page 6-33
- “Top Hardware and Miscellaneous Parts, All Options” on page 6-35
- “Bottom Hardware and Miscellaneous Parts, All Options” on page 6-36
- “Internal Hardware and Miscellaneous Parts, All Options” on page 6-40
- “External Hardware and Miscellaneous Parts, All Options” on page 6-42
- “Miscellaneous Part Numbers” on page 6-43
- “Replaceable Parts” on page 6-45

### Miscellaneous
- Service Tools on page 6-43
- Documentation on page 6-43
- GPIB Cables/GPIB Adapter on page 6-43
### Table 6-2 Part Number Listing by Type of Part

<table>
<thead>
<tr>
<th>Miscellaneous (Continued)</th>
</tr>
</thead>
<tbody>
<tr>
<td>➤ USB Accessories on page 6-44</td>
</tr>
<tr>
<td>➤ ESD Supplies on page 6-44</td>
</tr>
<tr>
<td>➤ Rack Mount Kits and Handle Kits on page 6-44</td>
</tr>
<tr>
<td>➤ Rack Mount Kits and Handle Kits on page 6-44</td>
</tr>
<tr>
<td>➤ Rack Mount Kits and Handle Kits on page 6-44</td>
</tr>
</tbody>
</table>
Front Panel Assembly, Front Side, All Options

For this parts table, refer to Figure 6-2 on page 6-10, Figure 6-3 on page 6-11, and Figure 6-4 on page 6-12.

**NOTE**
Some of the parts indicated in the figures are shown for clarification purposes only. Refer to the specific section or figure referenced for details.

<table>
<thead>
<tr>
<th>Reference Designator</th>
<th>Part Number</th>
<th>Qty</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>➀</td>
<td>N5292-20001</td>
<td>1</td>
<td>Front frame, machined, 1-piece (frame only, not the assembly)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>(Requires: Lower front panel overlay. See below.)</td>
</tr>
<tr>
<td></td>
<td>8160-0660</td>
<td>0.991 m (39”)</td>
<td>RFI gasket material, 0.991 meters (39 inches) in length</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>(Not shown. Must be ordered separately from front frame.) See Figure 6-4 on page 6-12.</td>
</tr>
<tr>
<td>➁</td>
<td>0515-2044</td>
<td>6</td>
<td>Machine screw, M4.0 x 12 flat head (To attach front subpanel to chassis.)</td>
</tr>
<tr>
<td>➂</td>
<td>5041-8425</td>
<td>2</td>
<td>Trim strip, filler (For analyzers without handles.)</td>
</tr>
<tr>
<td>➃</td>
<td>1250-3805</td>
<td>16</td>
<td>SMA Adapters, washers, and nuts (For subpanel)</td>
</tr>
<tr>
<td>➄</td>
<td>N5292-80001</td>
<td>1</td>
<td>Front panel overlay, 2-port (Option 200) – Not shown in Figure 6-2 on page 6-10.</td>
</tr>
<tr>
<td></td>
<td>N5922-80002</td>
<td></td>
<td>Front panel overlay, 4-port (Option 400)</td>
</tr>
<tr>
<td>➅</td>
<td>N5292-00002</td>
<td>1</td>
<td>Front subpanel – 4-port</td>
</tr>
<tr>
<td></td>
<td>N5292-00007</td>
<td></td>
<td>Front subpanel – 2-port – Not shown in Figure 6-2 on page 6-10.</td>
</tr>
<tr>
<td>➆</td>
<td>0515-1101</td>
<td>12</td>
<td>Machine screw, 90-DEG-flat-HD, M4.0 x 8 mm (To attach integrated connectors to subpanel ((x8) 4-port and (x4) 2-port) and Front panel to chassis (x4).) Refer to Figure 6-2 on page 6-10 and to Figure 6-3 on page 6-11.</td>
</tr>
<tr>
<td>➇</td>
<td>0515-1946</td>
<td>5</td>
<td>Machine screw, M3.0 x 6 mm flat head (To attach front panel to chassis.) – Refer to Figure 6-2 on page 6-10 and to Figure 6-3 on page 6-11.</td>
</tr>
<tr>
<td>Not Shown</td>
<td>N5242-00048</td>
<td>2</td>
<td>Guard, jumper cables, side—2-Port &amp; 4-Port</td>
</tr>
<tr>
<td>Not Shown</td>
<td>N5242-00049</td>
<td>1</td>
<td>Guard, jumper cables, center—4-Port</td>
</tr>
<tr>
<td>Not shown</td>
<td>5023-3074</td>
<td>2</td>
<td>Front handle</td>
</tr>
</tbody>
</table>
Figure 6-2 Front Panel Assembly, Front Side, All Options (Option 400 shown. Option 200 is similar. For Option 200, ignore Ports 3 and 4 assemblies.)
Figure 6-3  Front Panel Assembly, Connect Front Panel to Chassis (Option 400 shown. Option 200 is similar.) – Bottom View of N5292A Test Set (0511-1101 (x4 – 2-port), (x8 – 4-port)) and 0515-1946 (x5))

1. Install Front Frame assembly onto deck using screws 0515-1101 X4. Torque to 21 in-lbs.

2. Add screws 0515-1946 X5. Torque to 9 in-lbs. as shown.
Figure 6-4  Front Panel Assembly, Attach Gasket – 8160-0660 (Option 400 shown. Option 200 is similar.)

1. Gather and Inspect Front Frame N5292-20001.
2. Add RFI Round Strip Gasket 8160-0660. Use roller T-316254. Start and end gasket close to the #2 arrow.

PART SEQUENCE:
1. 2.
### Front Panel Assembly, Back Side, All Options

For this parts table on p., refer to Figure 6-5 on page 6-15, Figure 6-6 on page 6-15, Figure 6-7 on page 6-16, Figure 6-8 on page 6-16, and Figure 6-9 on page 6-17.

<table>
<thead>
<tr>
<th>Reference Designator</th>
<th>Part Number</th>
<th>Qty</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>➀</td>
<td>N5292-60018 (Bundled Cable Set)</td>
<td>2 (4)</td>
<td>Integrated front panel connectors. This connector includes an integrated data cable bundle with various cable types. An N5292A-200 test set has two N5292-60018 bundled cables and an N5292A-400 uses four N5292-60018 sets. (The cable descriptions are listed here for reference, but the detailed cable reference designators and connections are shown in “Bottom Assemblies and Cables, All Options by Option Set” on page 6-21.</td>
</tr>
<tr>
<td>[1B]</td>
<td></td>
<td></td>
<td>4 Blue short wires (Part of integrated connector assembly. Connect free end to ports 1 through 4 LOW BAND). Refer to Figure 6-5 on page 6-15 and Figure 6-6 on page 6-15.</td>
</tr>
<tr>
<td>Refer to Bottom Cables for 2-Port and 4-Port Figure 6-13 on page 6-2 5 and Figure 6-15 on page 6-3 1</td>
<td></td>
<td></td>
<td>Set Cable, data cable bundle, port 1 Red/Black-data cable to J7 TSMB</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Cable, data cable bundle, port 1 Black-power cable to J3 TSMB</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Cable, data cable bundle, port 1 Blue-Test cable to J15 TSMB</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Cable, data cable bundle, port 1 Blue-Reference cable to J18 TSMB</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Set Cable, data cable bundle, port 2 Red/Black-data cable to J8 TSMB</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Cable, data cable bundle, port 2 Black-power cable to J4 TSMB</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Cable, data cable bundle, port 2 Blue-Test cable to J20 TSMB</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Cable, data cable bundle, port 2 Blue-Reference cable to J23 TSMB</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Set Cable, data cable bundle, port 3 Red/Black-data cable to J9 TSMB</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Cable, data cable bundle, port 3 Black-power cable to J5 TSMB</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Cable, data cable bundle, port 3 Blue-Test cable to J25 TSMB</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Cable, data cable bundle, port 3 Blue-Reference cable to J28 TSMB</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Set Cable, data cable bundle, port 4 Red/Black-data cable to J10 TSMB</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Cable, data cable bundle, port 4 Black-power cable to J6 TSMB</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Cable, data cable bundle, port 4 Blue-Test cable to J30 TSMB</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Cable, data cable bundle, port 4 Blue-Reference cable to J33 TSMB</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>4 Cable, data cable bundle, port 1 Blue- Spare for Test/Reference TSMB</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Cable, data cable bundle, port 2 Blue- Spare for Test/Reference TSMB</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Cable, data cable bundle, port 3 Blue- Spare for Test/Reference TSMB</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Cable, data cable bundle, port 4 Blue- Spare for Test/Reference TSMB</td>
</tr>
</tbody>
</table>
### Replaceable Parts Listings

<table>
<thead>
<tr>
<th>Reference Designator</th>
<th>Part Number</th>
<th>Qty</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>N5292-63010</td>
<td>2</td>
<td>(4) Fail safe sensor PCA. An N5292A-200 test set has two N5292-63010 PCA sensors and an N5292A-400 uses four PCA sensors. Refer to Figure 6-6 on page 6-15.</td>
</tr>
<tr>
<td>3</td>
<td>0515-0365</td>
<td>4</td>
<td>Screw-Machine W/Crest-Cup-Con-Washer Pan-HD TORX-T6 M2 x 4mm-LG SST-300 Passivated (to attach Fail Safe Sensors to integrated connectors (x1) for each port)</td>
</tr>
<tr>
<td>4</td>
<td>N5292-60002</td>
<td>2</td>
<td>(4) Cable, fail safe sensor PCA. An N5292A-200 test set has two N5292-60002 cables and an N5292A-400 uses four cables.</td>
</tr>
<tr>
<td>5</td>
<td></td>
<td></td>
<td>Not used</td>
</tr>
<tr>
<td>6</td>
<td></td>
<td></td>
<td>Not used</td>
</tr>
<tr>
<td>7</td>
<td>0515-0430</td>
<td>2</td>
<td>Screw-Machine W/Crest-Cup-Con-Washer Pan-HD Torx-T10 M3 x 6mm-LG SST-300 Passivated (To attach to power switch to front panel). Refer to Figure 6-5 on page 6-15 and Figure 6-9 on page 6-17.</td>
</tr>
<tr>
<td>8</td>
<td>N5292-60003</td>
<td>1</td>
<td>Power switch cable. Refer to Figure 6-8 on page 6-16.</td>
</tr>
<tr>
<td>9</td>
<td>N5242-40014</td>
<td>1</td>
<td>Power switch keypad. Refer to Figure 6-5 on page 6-15 and Figure 6-8 on page 6-16.</td>
</tr>
<tr>
<td>10</td>
<td>N5240-63084</td>
<td>1</td>
<td>Power switch board (PCA for Power button keypad). Refer to Figure 6-5 on page 6-15 and Figure 6-8 on page 6-16.</td>
</tr>
<tr>
<td>--</td>
<td>1400-0249</td>
<td>4</td>
<td>Tie wraps. Refer to Figure 6-6 on page 6-15.</td>
</tr>
<tr>
<td>11</td>
<td></td>
<td></td>
<td>Not used</td>
</tr>
</tbody>
</table>

- **a.** Spare blue cable for each port’s integrated connector cable bundle (p/o: N5292-60018) is connected to the front panel, but is connected to an unmarked TSMB connector. This cable is only used, when one of the blue test or reference cables goes bad.
Figure 6-5  Front Panel Assembly, Back Side, All Options (Option 400 shown. Option 200 is similar. For Option 200, ignore the ports 3 and 4 hardware.)

Figure 6-6  Subpanel Assembly with Fail Safe Sensor PCAs (N5291-63010, N5292-60002, 0515-0365 (x4) and 1400-0249)

- Install N5291-63010 Fail Safe Sensor PCA to ports as shown.
- Install Cables N5292-60002 X4 to PCA's, drape over side for now. Tie wrap fail safe cable bundle using tie wrap 1400-0249.

Note: Fail-safe PCA needs to be centered in its cutout.
Figure 6-7  Subpanel Assembly with short and long cables respectively (N5292-60019 (x2) and N5292-60020 (x2)). For Option 200, ignore the ports 3 and 4 hardware.

1. Install yellow long cables N5292-60020 (x2) to ports 1 and 2 as shown. Torque to 10 in-lbs.

2. Install yellow short cables N5292-60019 (x2) to port 3 and 4 as shown. Torque to 10 in-lbs.

Figure 6-8  Power Button and PCA Assembly (N5242-40014, N5240-63084, and N5292-60003)

3. Attach Power Switch Keypad N5242-40014 to Power switch Board N5240-63084 by pulling 2 tabs through board holes.

4. Install Power Switch Cable N5292-60003 to power switch board connector.
Figure 6-9  Front Panel with Power Button and PCA Assembly (0515-0430 (x2))

Note: Be sure LED light tube fits in hole on front frame.

Install Switch/Keypad Board assembly using screws 0515-0430 X2. Torque to 9 in-lbs.
Replaceable Parts
Top Assemblies and Cables, All Options

Top Assemblies and Cables, All Options

Top Assemblies, All Options

<table>
<thead>
<tr>
<th>Reference Designator</th>
<th>Part Number</th>
<th>Qty</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>A1</td>
<td>0950-0516</td>
<td>1</td>
<td>Power supply, switching, 210W Output</td>
</tr>
</tbody>
</table>

Figure 6-10  N5292A Top Assemblies, All Options (Port 4 shown. Port 2 is similar.)
Top Cables, All Cables, All Options

<table>
<thead>
<tr>
<th>Reference Designator</th>
<th>Type^a</th>
<th>Part Number</th>
<th>Qty</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>W31</td>
<td>N5292-20004</td>
<td>1</td>
<td></td>
<td>Cable Assy RF, RP LO to LOPA (See Figure 6-10 on page 6-18)</td>
</tr>
</tbody>
</table>

^a. SR = semirigid coaxial cable, F = Flexible coaxial cable, nR = n wires in ribbon (flat) cable, nW = wires in wire harness
Figure 6-11   N5292A Top Cables, All Cables–All Options (Port 4 shown. Port 2 is similar.)
### Bottom Assemblies and Cables, All Options by Option Set:

#### N5292A 2-Port Configuration, Option 200

**Bottom Assemblies, 2-Port, Option 200**

<table>
<thead>
<tr>
<th>Reference Designator</th>
<th>Part Number</th>
<th>Qty</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>A2</td>
<td>5087-7388</td>
<td>1</td>
<td>LO Preamplifier (LOPA)</td>
</tr>
<tr>
<td>A3</td>
<td>5087-7844</td>
<td>1</td>
<td>LO Distribution Amplifier (LODA)</td>
</tr>
<tr>
<td>A4</td>
<td>N5291-63003</td>
<td>1</td>
<td>Phase Compensation PCA</td>
</tr>
<tr>
<td>A5</td>
<td>N5291-63002</td>
<td>1</td>
<td>Motherboard</td>
</tr>
</tbody>
</table>
Figure 6-12  Bottom Assemblies, 2-Port Configuration, Option 200
Replaceable Parts
Bottom Assemblies and Cables, All Options by Option Set:

### Bottom Cables, 2-Port, Option 200

<table>
<thead>
<tr>
<th>Reference Designator</th>
<th>Typea</th>
<th>Part Number</th>
<th>Qty</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>W1</td>
<td>F</td>
<td>N5292-60019</td>
<td>2</td>
<td>Flex cable–short, port 1 to Front Panel Source In</td>
</tr>
<tr>
<td>W4</td>
<td></td>
<td></td>
<td></td>
<td>Flex cable–short, port 2 to Front Panel Source In</td>
</tr>
<tr>
<td>W7</td>
<td>F</td>
<td>N5292-60018</td>
<td>2</td>
<td>Blue cable, port 1 to Front Panel Low Band</td>
</tr>
<tr>
<td>W10</td>
<td></td>
<td></td>
<td></td>
<td>Blue cable, port 2 to Front Panel Low Band</td>
</tr>
<tr>
<td>W11</td>
<td>F</td>
<td>N5292-60020</td>
<td>2</td>
<td>Flex cable–long, port 1 to J1 Phase Comp PCA</td>
</tr>
<tr>
<td>W12</td>
<td></td>
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<td></td>
<td>Flex cable–long, port 2 to J2 Phase Comp PCA</td>
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<tr>
<td>W15</td>
<td>F</td>
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<tr>
<td>W16</td>
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</tr>
<tr>
<td>W19</td>
<td></td>
<td></td>
<td></td>
<td>Cable Assy–Gray coaxial 50 ohm, SMB–Female–RA SMA-Male 485 mm–LG, Port 2–Test to J22 TSMB</td>
</tr>
<tr>
<td>W20</td>
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<td></td>
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<td>Cable Assy–Gray coaxial 50 ohm, SMB–Female–RA SMA-Male 485 mm–LG, Port 2–Reference to J24 TSMB</td>
</tr>
<tr>
<td>W21</td>
<td>6R</td>
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<td>1</td>
<td>Cable Assy, Phase Comp PCA to J54 Test Set Motherboard</td>
</tr>
<tr>
<td>W22</td>
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</tr>
<tr>
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<tr>
<td>W26</td>
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<td>N5292-20005</td>
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<td>Cable Assy–RF, J5 Phase Comp PCA to LODA</td>
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<tr>
<td>W27</td>
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<td>Cable Assy–RF, J6 Phase Comp PCA to LODA</td>
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<tr>
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<td>N5292-60003</td>
<td>1</td>
<td>Power switch cable to J52 TSMB</td>
</tr>
<tr>
<td>W33</td>
<td>3W</td>
<td>N5292-60002</td>
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<td></td>
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<td>Cable, power, port 2 fail safe sensor PCA, J45 TSMB</td>
</tr>
<tr>
<td>W37</td>
<td>14W</td>
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<td>1</td>
<td>Cable, data cable bundle, port 1 Red/Black-data cable to J7 TSMB</td>
</tr>
<tr>
<td>W38</td>
<td>18W</td>
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<td>1</td>
<td>Cable, data cable bundle, port 1 Black-power cable to J3 TSMB</td>
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<tr>
<td>W39</td>
<td>F</td>
<td></td>
<td>1</td>
<td>Cable, data cable bundle, port 1 Blue-Test cable to J15 TSMB</td>
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<tr>
<td>W40</td>
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<td>1</td>
<td>Cable, data cable bundle, port 1 Blue-Reference cable to J18 TSMB</td>
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### Replaceable Parts

**Bottom Assemblies and Cables, All Options by Option Set:**

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<th>Type&lt;sup&gt;a&lt;/sup&gt;</th>
<th>Part Number</th>
<th>Qty</th>
<th>Description</th>
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<tr>
<td>W41</td>
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<td>Cable, data cable bundle, port 2 Red/Black-data cable to J8 TSMB</td>
</tr>
<tr>
<td>W42</td>
<td>18W</td>
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<td>1</td>
<td>Cable, data cable bundle, port 2 Black-power cable to J4 TSMB</td>
</tr>
<tr>
<td>W43</td>
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<td>W44</td>
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<td>Cable, data cable bundle, port 2 Blue-Reference cable to J23 TSMB</td>
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<tr>
<td>W53</td>
<td>F</td>
<td>P/O: N5292-60018</td>
<td>2</td>
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</tr>
<tr>
<td>W54</td>
<td></td>
<td></td>
<td></td>
<td>Cable, data cable bundle, port 2 Blue- Spare for Test/Reference TSMB</td>
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<sup>a</sup> SR = semirigid coaxial cable, F = Flexible coaxial cable, nR = n wires in ribbon (flat) cable, nW = wires in wire harness
N5292A 4-Port Configuration, Option 400

Bottom Assemblies, 4-Port, Option 400

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<td>A2</td>
<td>5087-7388</td>
<td>1</td>
<td>LO Preamplifier (LOPA)</td>
</tr>
<tr>
<td>A3</td>
<td>5087-7844</td>
<td>1</td>
<td>LO Distribution Amplifier (LODA)</td>
</tr>
<tr>
<td>A4</td>
<td>N5291-63003</td>
<td>1</td>
<td>Phase Compensation PCA</td>
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<tr>
<td>A5</td>
<td>N5291-63002</td>
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<td>Motherboard</td>
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Replaceable Parts
Bottom Assemblies and Cables, All Options by Option Set:

Figure 6-14 N5292A Bottom Assemblies, Standard 4-Port Configuration, Option 400
## Bottom Cables, 4-Port, Option 400

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<td>6</td>
<td>Flex cables–short, port 1 to Front Panel Source In</td>
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<tr>
<td>W2</td>
<td>F</td>
<td>N5292-60019</td>
<td>6</td>
<td>Flex cables–short, port 3 to Front Panel Source In</td>
</tr>
<tr>
<td>W3</td>
<td>F</td>
<td>N5292-60019</td>
<td>6</td>
<td>Flex cables–short, port 4 to Front Panel Source In</td>
</tr>
<tr>
<td>W4</td>
<td>F</td>
<td>N5292-60019</td>
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<td>Flex cables–short, port 2 to Front Panel Source In</td>
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<tr>
<td>W5</td>
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<td>N5292-60019</td>
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<td>Flex cables–short, port 3 to J3 Phase Comp PCA</td>
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<td>Flex cables–short, port 4 to J4 Phase Comp PCA</td>
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<tr>
<td>W8</td>
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<td>Blue cable, port 3 to Front Panel Low Band</td>
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<td>4</td>
<td>Blue cable, port 4 to Front Panel Low Band</td>
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<td>W10</td>
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<td>P/O: N5292-60018</td>
<td>4</td>
<td>Blue cable, port 2 to Front Panel Low Band</td>
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<td>W11</td>
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<td>N5292-60020</td>
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<td>Flex cables–long, port 1 to J1 Phase Comp PCA</td>
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<tr>
<td>W12</td>
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<td>N5292-60020</td>
<td>2</td>
<td>Flex cables–long, port 2 to J2 Phase Comp PCA</td>
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<tr>
<td>W13</td>
<td>F</td>
<td>8121-2860</td>
<td>8</td>
<td>Cable Assy-Gray coaxial 50 ohm, SMB–Female–RA SMA-Male 485 mm–LG, Port 3–Test to J29 TSMB</td>
</tr>
<tr>
<td>W14</td>
<td>F</td>
<td>8121-2860</td>
<td>8</td>
<td>Cable Assy-Gray coaxial 50 ohm, SMB–Female–RA SMA-Male 485 mm–LG, Port 3–Reference to J27 TSMB</td>
</tr>
<tr>
<td>W15</td>
<td>F</td>
<td>8121-2860</td>
<td>8</td>
<td>Cable Assy-Gray coaxial 50 ohm, SMB–Female–RA SMA-Male 485 mm–LG, Port 1–Reference to J19 TSMB</td>
</tr>
<tr>
<td>W16</td>
<td>F</td>
<td>8121-2860</td>
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<td>Cable Assy-Gray coaxial 50 ohm, SMB–Female–RA SMA-Male 485 mm–LG, Port 1–Test to J17 TSMB</td>
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<tr>
<td>W17</td>
<td>F</td>
<td>8121-2860</td>
<td>8</td>
<td>Cable Assy-Gray coaxial 50 ohm, SMB–Female–RA SMA-Male 485 mm–LG, Port 4–Test to J32 TSMB</td>
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<tr>
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<td>8121-2860</td>
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<td>Cable Assy-Gray coaxial 50 ohm, SMB–Female–RA SMA-Male 485 mm–LG, Port 4–Reference to J34 TSMB</td>
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<tr>
<td>W19</td>
<td>F</td>
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<td>8</td>
<td>Cable Assy-Gray coaxial 50 ohm, SMB–Female–RA SMA-Male 485 mm–LG, Port 2–Test to J22 TSMB</td>
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<tr>
<td>W20</td>
<td>F</td>
<td>8121-2860</td>
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<td>Cable Assy-Gray coaxial 50 ohm, SMB–Female–RA SMA-Male 485 mm–LG, Port 2–Reference to J24 TSMB</td>
</tr>
<tr>
<td>W21</td>
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<td>N5292-60004</td>
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<td>Cable Assy, Phase Comp PCA to J54 Test Set Motherboard</td>
</tr>
<tr>
<td>W22</td>
<td>16R</td>
<td>N5292-60005</td>
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<td>Cable Assy, LODA to J60 Test Set Motherboard</td>
</tr>
<tr>
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<td>10R</td>
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</tr>
<tr>
<td>W24</td>
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## Replaceable Parts

### Bottom Assemblies and Cables, All Options by Option Set:

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<th>Qty</th>
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<td>Cable Assy–RF, J5 Phase Comp PCA to LODA</td>
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<tr>
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</tr>
<tr>
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</tr>
<tr>
<td>W32</td>
<td>6R</td>
<td>N5292-60003</td>
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<td>Power switch cable to J52 TSMB</td>
</tr>
<tr>
<td>W33</td>
<td>3W</td>
<td>N5292-60002</td>
<td>4</td>
<td>Cable, power, port 1 fail safe sensor PCA, J36 TSMB</td>
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<tr>
<td>W34</td>
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<tr>
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<tr>
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<td>Cable, data cable bundle, port 2 Black-power cable to J4 TSMB</td>
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<tr>
<td>W43</td>
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<td>Cable, data cable bundle, port 2 Blue-Test cable to J20 TSMB</td>
</tr>
<tr>
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<td>1</td>
<td>Cable, data cable bundle, port 2 Blue-Reference cable to J23 TSMB</td>
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<tr>
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<td>W50</td>
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### Replaceable Parts

**Bottom Assemblies and Cables, All Options by Option Set:**

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<th>Part Number</th>
<th>Qty</th>
<th>Description</th>
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<td>Cable, data cable bundle, port 4 Blue- Spare for Test/Reference TSMB</td>
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<sup>a</sup> SR = semirigid coaxial cable, F = Flexible coaxial cable, nR = n wires in ribbon (flat) cable, nW = wires in wire harness
Replaceable Parts
Bottom Assemblies and Cables, All Options by Option Set:

Figure 6-15  N5292A Bottom, RF Cables, Option 400
## Replaceable Parts

### Rear-Panel Assembly, All Options

### Rear Panel Assembly, All Options

<table>
<thead>
<tr>
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<th>Qty</th>
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<td>Panel, rear</td>
</tr>
<tr>
<td>➁</td>
<td>1250-3805</td>
<td>1</td>
<td>Adapter-Coaxial Straight Bulkhead Female-Female PC 3.5 50-Ohm 26.5GHz – (Includes washer and nut)</td>
</tr>
<tr>
<td>➂</td>
<td>1250-0372</td>
<td>4</td>
<td>Screw-Machine W/Crest-Cup-Con-Washer Pan-HD Torx-T10 M3X0.5 8mm-LG SST-300 Passivated</td>
</tr>
<tr>
<td>➃</td>
<td>Foot, rear, carbon black and screw (Refer to “External Hardware and Miscellaneous Parts, All Options” on page 6-42)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>➄</td>
<td>3050-2330</td>
<td>5</td>
<td>Washer-Lock internal-tooth 0.267-in-ID 0.408-in-OD 0.025-in-THK Phosphor Bronze Au-plated – (Install on motherboard connectors (x5))</td>
</tr>
<tr>
<td>➅</td>
<td>2950-0414</td>
<td>5</td>
<td>Nut-HEX Double-Chamfer 1/4-36 THD .312-in-HEX .094-in-THK Brass – (Install on motherboard connectors (x5))</td>
</tr>
<tr>
<td>➆</td>
<td>1250-7812</td>
<td>2</td>
<td>Jackscrew Male-Female Hex-HD 4-40-THD 0.5-in-LG Steel</td>
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<tr>
<td>➇</td>
<td>2190-0584</td>
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<td>Washer-Lock Helical 3.1mm-ID 6.2mm-OD 0.8mm-THK SST Passivated</td>
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<tr>
<td>➈</td>
<td>Foot, bottom, phantom gray (Refer to “External Hardware and Miscellaneous Parts, All Options” on page 6-42)</td>
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**Figure 6-16** Rear Panel Assemblies, All Options

![Rear Panel Assembly Diagram](image-url)
Fan Assemblies, All Options

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<th>Qty</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>B1</td>
<td>W1312-60014</td>
<td>2</td>
<td>Fan assembly</td>
</tr>
<tr>
<td>①</td>
<td>3160-4411</td>
<td>2</td>
<td>Fan guard (Position is indicated, but parts now shown)</td>
</tr>
<tr>
<td>②</td>
<td>0361-1892</td>
<td>16</td>
<td>Fan rivets</td>
</tr>
<tr>
<td>③</td>
<td></td>
<td></td>
<td>Chassis (Refer to “Internal Hardware and Miscellaneous Parts, All Options” on page 6-40.)</td>
</tr>
</tbody>
</table>
Figure 6-17  Fan Assemblies, Bottom View, All Options
Top Hardware and Miscellaneous Parts, All Options

<table>
<thead>
<tr>
<th>Reference Designator</th>
<th>Part Number</th>
<th>Qty</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>①</td>
<td>0515-1715</td>
<td>6</td>
<td>Screw-Machine W/Crest-Cup-Con-Washer Pan-HD Torx-T10 M3 x 0.5 40mm-LG SST – (To attach A6 power supply to chassis)</td>
</tr>
<tr>
<td>②</td>
<td>1400-1334</td>
<td>1</td>
<td>Cable clamp – (Secure: fan wires to chassis near power supply; semi-rigid cable to deck (x1))</td>
</tr>
</tbody>
</table>

Figure 6-18  Top Hardware and Miscellaneous Parts, Top View, All Options
**Bottom Hardware and Miscellaneous Parts, All Options**

<table>
<thead>
<tr>
<th>Reference Designator</th>
<th>Part Number</th>
<th>Qty</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>📌</td>
<td>1400-0249</td>
<td>--</td>
<td>Tie wrap – (Attach tie wrap spare blue cable to each of the port’s cable bundles, power switch cable N5292-60003 to port 1 cable bundle),</td>
</tr>
<tr>
<td>📌</td>
<td>1400-1334</td>
<td>1</td>
<td>Cable clamp (with adhesive backing)</td>
</tr>
<tr>
<td>📌</td>
<td>0515-0372</td>
<td>26</td>
<td>Machine screw, M3.0 x 8, pan head (To attach: A2 LO preamp (LOPA) – (x4), A5 test set motherboard to deck assembly (chassis) (x16), A4 LODA to deck (x2); A3 Phase Compensation PCA to bracket (x4))</td>
</tr>
<tr>
<td>📌</td>
<td>0515-0375</td>
<td>4</td>
<td>Machine screw, M3.0 x 16, pan head (To attach: LODA to deck (x4))</td>
</tr>
<tr>
<td>📌</td>
<td>1810-0118</td>
<td>6</td>
<td>Microwave Plug SMA Male Straight 50-Ohm. 2-port only, refer to Figure 6-20 on page 6-38.</td>
</tr>
</tbody>
</table>
Figure 6-19  Bottom Hardware and Miscellaneous Parts

Note: Cable clamp is mounted on chassis, before the cable mounting bracket.
Replaceable Parts
Bottom Hardware and Miscellaneous Parts, All Options

Figure 6-20  Bottom Hardware and Miscellaneous Parts (2-port Only)
Replaceable Parts
Bottom Hardware and Miscellaneous Parts, All Options

This page intentionally left blank.
## Internal Hardware and Miscellaneous Parts, All Options

<table>
<thead>
<tr>
<th>Reference Designator</th>
<th>Part Number</th>
<th>Qty</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>➀</td>
<td>N5292-00001</td>
<td>1</td>
<td>Deck assembly (chassis)</td>
</tr>
<tr>
<td>➁</td>
<td>N5292-00004</td>
<td>1</td>
<td>PCB bracket</td>
</tr>
<tr>
<td>➂</td>
<td>0515-0372</td>
<td>7</td>
<td>Machine screw, M3.0 x 8, pan head – (To attach PCB bracket to (x4) and cable routing bracket to deck assembly (x3))</td>
</tr>
<tr>
<td>➃</td>
<td>N5292-00008</td>
<td>1</td>
<td>Cable routing bracket</td>
</tr>
</tbody>
</table>
Replaceable Parts
Internal Hardware and Miscellaneous Parts, All Options

Figure 6-21  Internal Hardware and Miscellaneous Parts, All Options
## External Hardware and Miscellaneous Parts, All Options

<table>
<thead>
<tr>
<th>Reference Designator</th>
<th>Part Number</th>
<th>Qty</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>➀</td>
<td>N5292-00005</td>
<td>1</td>
<td>Instrument cover</td>
</tr>
<tr>
<td>➁</td>
<td>5041-7903</td>
<td>4</td>
<td>Rear foot</td>
</tr>
<tr>
<td>➂</td>
<td>0515-1619</td>
<td>--</td>
<td>Machine screw M4.0 x 25, pan head (To attach rear foot.)</td>
</tr>
<tr>
<td>➃</td>
<td>N5247-60030</td>
<td>2</td>
<td>Strap handle assembly (Includes item ➋)</td>
</tr>
<tr>
<td>➄</td>
<td>0515-0710</td>
<td>--</td>
<td>Machine screw T10 M5.0 x 18, flat head (To attach strap handle.)</td>
</tr>
<tr>
<td>➅</td>
<td>5041-7906</td>
<td>4</td>
<td>Bottom foot</td>
</tr>
<tr>
<td>➆</td>
<td>5021-2840</td>
<td>4</td>
<td>Key lock (for bottom foot) – (Not shown)</td>
</tr>
<tr>
<td>Not shown</td>
<td>1600-1423</td>
<td>4</td>
<td>Lock-link, vertical</td>
</tr>
<tr>
<td>Not shown</td>
<td>5064-3868</td>
<td>2</td>
<td>Front handle</td>
</tr>
<tr>
<td>Not shown</td>
<td>5042-8425</td>
<td>2</td>
<td>Side trim for front handle</td>
</tr>
<tr>
<td>Not shown</td>
<td>0515-0896</td>
<td>--</td>
<td>Machine screw, M4.0 x 12 flat head (To attach front handle to chassis.)</td>
</tr>
</tbody>
</table>

**Figure 6-22**  
External Hardware and Miscellaneous Parts, All Options
## Miscellaneous Part Numbers

### Table 6-3  Part Numbers for Miscellaneous Parts and Accessories

<table>
<thead>
<tr>
<th>Description</th>
<th>Model or Part Number</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Service Tools</strong></td>
<td></td>
</tr>
<tr>
<td>1/4 inch and 5/16 inch open-end wrench, thin profile</td>
<td>8710-0510</td>
</tr>
<tr>
<td>Open end wrench, small 5.5mm</td>
<td>8710-1260</td>
</tr>
<tr>
<td>T-10 TORX driver</td>
<td></td>
</tr>
<tr>
<td>T-20 TORX driver</td>
<td></td>
</tr>
<tr>
<td>5/16 inch (8 mm), open-end wrench</td>
<td>8710-2174</td>
</tr>
<tr>
<td>1/2 inch to 9/16 inch (8 mm), open-end wrench</td>
<td>8710-1770</td>
</tr>
<tr>
<td>14 mm open-end wrench</td>
<td></td>
</tr>
<tr>
<td>20 mm open-end torque wrench; 0.9 N·m (8 in-lb)</td>
<td>8710-1764</td>
</tr>
<tr>
<td>Spanner wrench</td>
<td>08513-20014</td>
</tr>
<tr>
<td><strong>Documentation</strong></td>
<td></td>
</tr>
<tr>
<td>Installation and Quick Start Guide (for all N5290/1A mmWave Systems) (Cannot be ordered. Part number is for reference only. Must be printed from the Keysight Web site.)</td>
<td>N5292-90002</td>
</tr>
<tr>
<td>Service Guide. (Not available in printed form. Part number is for reference only. Must be printed from the Keysight Web site.)</td>
<td>N5292-90026</td>
</tr>
<tr>
<td><strong>GPIB Cables/GPIB Adapter</strong></td>
<td></td>
</tr>
<tr>
<td>GPIB cable, 0.5 meter (1.6 feet)</td>
<td>10833D</td>
</tr>
<tr>
<td>GPIB cable, 1 meter (3.3 feet)</td>
<td>10833A</td>
</tr>
<tr>
<td>GPIB cable, 2 meter (6.6 feet)</td>
<td>10833B</td>
</tr>
<tr>
<td>GPIB cable, 4 meter (13.2 feet)</td>
<td>10833C</td>
</tr>
<tr>
<td>GPIB cable to GPIB cable adapter</td>
<td>10834A</td>
</tr>
<tr>
<td><strong>Connector Caps</strong></td>
<td></td>
</tr>
<tr>
<td>Cap, test side</td>
<td>N5293-40002</td>
</tr>
<tr>
<td>Dust cover, subminiature</td>
<td>1252-1935</td>
</tr>
<tr>
<td>Cap, protective, 0.240-ID</td>
<td>1401-0245</td>
</tr>
</tbody>
</table>
Replaceable Parts
Miscellaneous Part Numbers

<table>
<thead>
<tr>
<th>Description</th>
<th>Model or Part Number</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>USB Accessories</strong></td>
<td></td>
</tr>
<tr>
<td>Mouse, optical</td>
<td>0960-3248</td>
</tr>
<tr>
<td></td>
<td>Was 1150-7799</td>
</tr>
<tr>
<td>Keyboard (U.S. style)</td>
<td>0960-3245</td>
</tr>
<tr>
<td></td>
<td>Was 1150-7896</td>
</tr>
<tr>
<td>USB to GPIB adapter</td>
<td>82357B</td>
</tr>
<tr>
<td><strong>ESD Supplies</strong></td>
<td></td>
</tr>
<tr>
<td>Adjustable antistatic wrist strap</td>
<td>9300-1367</td>
</tr>
<tr>
<td>Antistatic wrist strap grounding cord (6 foot length)</td>
<td>9300-0980</td>
</tr>
<tr>
<td>Static control table mat and earth ground wire</td>
<td>9300-0797</td>
</tr>
<tr>
<td>ESD heel strap</td>
<td>9300-1308</td>
</tr>
<tr>
<td><strong>Rack Mount Kits and Handle Kits</strong></td>
<td></td>
</tr>
<tr>
<td>Rack mount kit for N5292A test sets without handles (Option 1CM)</td>
<td>ICM110A</td>
</tr>
<tr>
<td>Option 1CM includes the following separately orderable items:</td>
<td></td>
</tr>
<tr>
<td>Rack mount kit (rack mount flanges and hardware)</td>
<td>5022-9650</td>
</tr>
<tr>
<td>Rack mount rail set</td>
<td>E3663AC</td>
</tr>
<tr>
<td>Rack mount kit for N5292A test sets with handles (Option 1CP)</td>
<td>1CP104A</td>
</tr>
<tr>
<td>Option 1CP includes the following separately orderable items:</td>
<td></td>
</tr>
<tr>
<td>Rack mount kit (rack mount flanges and hardware)</td>
<td>5023-3105</td>
</tr>
<tr>
<td>Rack mount rail set</td>
<td>E3663AC</td>
</tr>
<tr>
<td>Front handle kit (two classic® handles and hardware)</td>
<td>5064-3868</td>
</tr>
</tbody>
</table>

a. For rack mount use, you must replace factory installed ruggedized handles (thick aluminum, no trim) with classic handles (thin aluminum with plastic trim), included with Option 1CP.

The options described in Chapter 2, “General Product Information.” can be ordered as upgrades. Refer to “Service and Support Options” on page 2-6 and to the Keysight Millimeter Wave Network Analyzers (N5290A/N5291A) Configuration Guide, available online at https://literature.cdn.keysight.com/litweb/pdf/5992-2179EN.pdf, for information on upgrades that are available for the N5290/1A system.
Replaceable Parts

**IMPORTANT!** For N5224/5B, N5244/5B, and N5267B PNAs When connecting the 5292-20014 semirigid cable it is critical that the 2.4 mm end is connected to the PNA’s REF SOURCE OUT port and the SMA end is connected to the N5292A test set’s LO Band connector. Refer to Figure 6-1 on page 6-2.

**NOTE**

There are no replaceable parts in the N5293A or N5295A millimeter-wave heads. If there is a problem with your N5293A or N5295A, return them to factory for repair. Refer to “Keysight Support, Services, and Assistance” on page 2-6.

For network analyzer replacement parts of operation, see the "Replacement Parts" chapter in the service guide for your PNA. Refer to www.keysight.com.

Figure 6-23  PNA RF Port Connector to N5292A Test Set Lo Band Connector (2.4 mm)
<table>
<thead>
<tr>
<th>Keysight Part Number</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>System Front Cables:</strong></td>
<td></td>
</tr>
<tr>
<td>N5292-20006</td>
<td>Semi-rigid cables – part of: N5290/1A-201 (Interconnect Kit N5292-60012) or N5290/1A Option 401 or N5290/1A Option 402 (Interconnect Kit N5292-60016). Cable Assy-RF, Source Out to Test Set, SMA-SMA.</td>
</tr>
<tr>
<td>N5292-20007</td>
<td>Cable Assy-RF, 4P Test Port 3/4 to Test Set, SMA-SMA</td>
</tr>
<tr>
<td>N5292-20008</td>
<td>Semi-rigid cables – part of: N5290/1A Option 401 or N5290/1A Option 402 (Interconnect Kit N5292-60016). Cable Assy-RF, 4P Test Port 1/2 to Test Set, SMA-SMA</td>
</tr>
<tr>
<td>N5292-20009</td>
<td>Semi-rigid cables – part of: N5290/1A-201 (Interconnect Kit N5292-60012) or N5290/1A Option 401 or N5290/1A Option 402 (Interconnect Kit N5292-60016). Cable Assy-RF, 2P Test Port 1/2 to Test Set, SMA-SMA.</td>
</tr>
<tr>
<td>N5292-20014</td>
<td><strong>IMPORTANT!</strong> One end of this cable is 2.4 mm that connects to the PNA the other end connects to the test set. Figure 6-22 on page 6-44. Semi-rigid cables – part of: N5290/1A Option 202 (Interconnect Kit N5292-60013) or N5290/1A Option 403 (Interconnect Kit N5292-60017). Cable Assy-RF, Source Out to Test Set, SMA-2.4mm.</td>
</tr>
<tr>
<td>N5292-20015</td>
<td><strong>NOTE</strong> IMPORTANT! One end of this cable is 2.4 mm that connects to the PNA the other end connects to the test set. Figure 6-22 on page 6-44. Semi-rigid cables – part of: N5290/1A Option 403 (Interconnect Kit N5292-60017). Cable Assy-RF, 4P Test Port 1/2 to Test Set, SMA-2.4mm.</td>
</tr>
</tbody>
</table>
Table 6-4 Replaceable Parts

<table>
<thead>
<tr>
<th>Keysight Part Number</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>N5292-20016</td>
<td>IMPORTANT! One end of this cable is 2.4 mm that connects to the PNA the other end connects to the test set. Figure 6-22 on page 6-44. Cable Assy-RF, 4P Test Port 3/4 to Test Set, SMA-2.4mm</td>
</tr>
<tr>
<td></td>
<td><strong>NOTE</strong></td>
</tr>
<tr>
<td>N5292-20017</td>
<td>IMPORTANT! One end of this cable is 2.4 mm that connects to the PNA the other end connects to the test set. Figure 6-22 on page 6-44. Semi-rigid cables – part of: N5290/1A Option 202 (Interconnect Kit N5292-60013) or N5290/1A Option 403 (Interconnect Kit N5292-60017). Cable Assy-RF, 2P Test Port 1/2 to Test Set, SMA-2.4mm.</td>
</tr>
<tr>
<td></td>
<td><strong>NOTE</strong></td>
</tr>
<tr>
<td>1818-0118</td>
<td>50 ohm load</td>
</tr>
<tr>
<td><strong>System Rear Cables:</strong></td>
<td></td>
</tr>
<tr>
<td>8121-2970</td>
<td>Cable Assembly-Coaxial 50-Ohm SMA-Male to SMA-Male 12-in-LG</td>
</tr>
<tr>
<td>N4011-21002</td>
<td>XT Cable Assembly 25-Way D-Sub</td>
</tr>
<tr>
<td>N5240-60092</td>
<td>Cable Assy-RF, SMA/SMA 16 in 26.5 GHz</td>
</tr>
<tr>
<td><strong>Millimeter System Optional Parts:</strong></td>
<td></td>
</tr>
<tr>
<td>N5290A301</td>
<td>Frequency extender bias tee adapter kit</td>
</tr>
<tr>
<td>N5290A302</td>
<td>Frequency extender desktop positioner</td>
</tr>
<tr>
<td><strong>Millimeter Heads:</strong></td>
<td></td>
</tr>
<tr>
<td>N5293AX03</td>
<td>N5293A 1 kHz to 110 GHz Millimeter head with 1.2 (4 foot) miter cable.</td>
</tr>
<tr>
<td>N5293AX53</td>
<td>N5293A 1 kHz to 110 GHz Millimeter head with 1.5 (5 foot) miter cable.</td>
</tr>
<tr>
<td>N5295AX03</td>
<td>N5295A 1 kHz to 120 GHz Millimeter head with 1.2 (4 foot) miter cable.</td>
</tr>
<tr>
<td>N5295AX53</td>
<td>N5295A 1 kHz to 120 GHz Millimeter head with 1.5 (5 foot) miter cable.</td>
</tr>
<tr>
<td><strong>Interconnect Kit:</strong> See also, <a href="https://literature.cdn.keysight.com/litweb/pdf/N5292-90002.pdf">https://literature.cdn.keysight.com/litweb/pdf/N5292-90002.pdf</a>.</td>
<td></td>
</tr>
<tr>
<td>Keysight Part Number</td>
<td>Description</td>
</tr>
<tr>
<td>---------------------</td>
<td>-----------------------------------------------------------------------------</td>
</tr>
<tr>
<td>N5292-60016 (3.5 mm)</td>
<td>N5295A 1 kHz to 120 GHz Millimeter head with 1.2 (4 foot) miter cable.</td>
</tr>
<tr>
<td>N5292-60016 (3.5 mm)</td>
<td>N5295A 1 kHz to 120 GHz Millimeter head with 1.5 (5 foot) miter cable.</td>
</tr>
<tr>
<td>N5292-60017 (2.4 mm to 3.5 mm)</td>
<td>N5292A-224 and N5292A-424 (2.4 mm 2-port test set/VNA or 4-port test set with 2-port VNA)</td>
</tr>
<tr>
<td>N5292-60012</td>
<td>N5292A-222 and N5292A-422 (3.5 mm 2-port test set/VNA or 4-port test set with 2-port VNA)</td>
</tr>
<tr>
<td>N5292-60013</td>
<td>N5292A-224 and N5292A-424 (2.4 mm 2-port test set/VNA or 4-port test set with 2-port VNA)</td>
</tr>
<tr>
<td>N5292-60016</td>
<td>N5292A-442 (3.5mm 4-port test set/VNA)</td>
</tr>
<tr>
<td>N5292-60017</td>
<td>N5292A-444 (2.4 mm 4-port test set/VNA)</td>
</tr>
</tbody>
</table>
7 Repair and Replacement Procedures

Information in This Chapter

This chapter contains procedures for removing and replacing the major assemblies of your Keysight Technologies N5292A test set controller.

**IMPORTANT!** Before you begin any testing on a System or instrument, always inspect the connectors on the instrument, the calibration kit, cables and adapters.

The N5292A contains extremely sensitive components that can be ruined if mishandled. Follow instructions carefully when making cable connections, especially wire harness connections.

The person performing the work accepts responsibility for the full cost of the repair or replacement of damaged components.

**CAUTION**

**IMPORTANT!** For N5224/5B, N5244/5B, and N5267B PNAs When connecting the 5292-20014 semirigid cable it is critical that the 2.4 mm end is connected to the PNA’s RFn SOURCE OUT port and the SMA end is connected to the N5292A test set's LO Band connector. Refer to Figure 7-1 on page 7-2.

There are no replaceable parts in the N5293A or N5295A millimeter-wave heads. If there is a problem with your N5293A or N5295A, return them to factory for repair. Refer to “Keysight Support, Services, and Assistance” on page 2-6.

For network analyzer repair and replacement procedures, see the "Repair and Replacement" chapter in the service guide for your PNA. Refer to www.keysight.com.
Figure 7-1  PNA RF Port Connector to N5292A Test Set Lo Band Connector (2.4 mm)

Chapter Seven at-a-Glance

<table>
<thead>
<tr>
<th>Section Title</th>
<th>Summary of Content</th>
<th>Start Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Personal Safety Warnings</td>
<td>Warnings and cautions pertaining to personal safety.</td>
<td>page 7-3</td>
</tr>
<tr>
<td>Electrostatic Discharge (ESD) Protection</td>
<td>Information pertaining to ESD protection.</td>
<td>page 7-4</td>
</tr>
<tr>
<td>Table of Removal and Replacement Procedures</td>
<td>The actual procedures for removing and replacing the major assemblies in your test set.</td>
<td>See Table 7-1 on page 7-5 for specific procedures.</td>
</tr>
<tr>
<td></td>
<td><strong>The procedures occur in assembly reference designator numerical order.</strong></td>
<td></td>
</tr>
<tr>
<td>Post-Repair Procedures</td>
<td>A table for the proper tests, verifications, and adjustments to perform on your test set after repair.</td>
<td>page 7-36</td>
</tr>
</tbody>
</table>

**CAUTION**

The N5292A contains extremely sensitive components that can be ruined if mishandled. Follow instructions carefully when making cable connections, especially wire harness connections.

The person performing the work accepts responsibility for the full cost of the repair or replacement of damaged components.
Personal Safety Warnings

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

WARNING The opening of covers or removal of parts is likely to expose dangerous voltages. Disconnect the test set from all voltage sources while it is being 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 assembly. Wait at least 10 seconds, after disconnecting the plug, before removing the covers.

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

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

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

**CAUTION**

Many of the assemblies in this instrument are very susceptible to damage from electrostatic discharge (ESD). Perform the following procedures only at a static-safe workstation and wear a grounded wrist strap.

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

To reduce the chance of electrostatic discharge, follow all of the recommendations outlined in “Electrostatic Discharge Protection” on page 1-7, for all of the procedures in this chapter.
### Table 7-1 List of Procedures

<table>
<thead>
<tr>
<th>Reference Designator</th>
<th>Assembly Description</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>--</td>
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Removing the N5292A Option 200/400 from the System

Tools Required

- T-10 TORX driver (set to 9 in-lb)
- T-20 TORX driver (set to 21 in-lb)
- 5/16-in torque wrench (set to 8 in-lbs)
- 5/16-in torque wrench (set to 10 in-lbs)
- 5/16-in torque wrench (set to 21 in-lbs)
- 14 mm open-end wrench (set to 4 in-lbs)
- 20 mm open-end wrench (set to 8 in-lbs)

IMPORTANT!
The N52xxB interconnect kits contain 2.4 mm to 3.5 mm cables. It is important to connect the 2.4 mm end to the PNA and to connect the 3.5 mm end to the N5292A test set controller. Improper connections will result in damage to your instruments.

It is important to use two wrenches when disconnecting or connecting the semirigid cables to the 1/2/3/4 port 1.85 mm outputs front ports of the PNA to avoid stressing the connectors and causing damage to your PNA (i.e., the 2.4 mm cable end is compatible with the 1.85 mm connector of the PNA).

Figure 7-2
To avoid damaging your RF ports 1/2/3/4, always use two wrenches

![Image of two wrenches used on RF ports]
Repair and Replacement Procedures
Removing the N5292A Option 200/400 from the System

Test Set Removal Procedure

1. Remove the N5293X03/95X03/OML/VDI heads from the system.
2. Using a 5/16-in wrench, remove any flexible cables from the rear panel of the system.
3. Remove the TEST SET I/O cable.
4. Using a 5/16-in wrench (and for the port connectors, use with a 20 mm open end wrench), remove all of the semi-rigid cables from the analyzer to the N5292A front panels.
5. Using a 5/16-in wrench, remove any 50 ohm terminations from the front panels.
6. Using a T-20 TORX, remove the upper and lower locking feet.
7. Slide the analyzer forward to disengage from the lock link on top of the N5292A test set's front panel.

Replacement Procedure

IMPORTANT!
The N52xxB interconnect kits contain 2.4 mm to 3.5 mm cables. It is important to connect the 2.4 mm end to the PNA and to connect the 3.5 mm end to the N5292A test set controller. Improper connections will result in damage to your instruments.

It is important to use two wrenches when connecting the semirigid cables to the 1/2/3/4 port 1.85 mm outputs front ports of the PNA to avoid stressing the connectors and causing damage to your PNA (i.e., the 2.4 mm cable end is compatible with the 1.85 mm connector of the PNA).

1. On the top side of the N5292A, carefully position the grey flex cables so they can't be pinched between the covers and the rails.
2. On the bottom side of the N5292A, carefully fold or push down the ribbon cables and wires so they can't be pinched between the hardware and the outer cover. Ribbon cables and wires must never be positioned on top of hardware.
3. Reverse the order of the removal procedures above.
Removing the Cover

Tools Required
- T-10 TORX driver (set to 9 in-lb)
- T-20 TORX driver (set to 21 in-lb)

Removing the Outer Cover

This procedure is best performed with the test set resting on its front handles in the vertical position. Do not place the test set on its front panel without the handles. This will damage the front panel assemblies.

Refer to Figure 7-3 for this procedure.

1. Disconnect the power cord.

2. Remove the strap handles (item ④) by loosening the screws (item ⑤), with a T-20 TORX driver, on both ends until the handle is free of the test set.

3. Remove the foot locks (item ⑦) from the four bottom feet (item ⑥) and then remove the four bottom feet from the outer cover.

4. Remove the four rear panel feet (item ②) by removing the center screws (item ③) with a T-20 TORX driver.

5. Slide the outer cover (item ①) toward the rear of the test set and remove it.

Replacement Procedure

1. On the bottom side of the N5292A, carefully fold or push down the ribbon cables and wires so they can't be pinched between the hardware and the outer cover. Ribbon cables and wires must never be positioned on top of hardware.

2. Reverse the order of the removal procedures above.
Repair and Replacement Procedures
Removing the Cover

Figure 7-3  Outer Cover Removal
Removing and Replacing the Front Panel and Subpanel Assemblies

Tools Required
- T-10 TORX driver (set to 9 in-lb)
- T-20 TORX driver (set to 21 in-lb)
- 5/16 inch open-end torque wrench (set to 10 in-lb)
- ESD grounding wrist strap

Front Panel Removal Procedure
Refer to Figure 7-4 on page 7-12 and Figure 7-5 on page 7-13 for this procedure.

1. Power down the test set.
2. Disconnect the power cord.
3. Remove the outer cover. Refer to “Removing the Cover” on page 7-8.
4. With a 5/16 inch torque wrench, remove all the semi-rigid jumpers (item ①) from the front panel.
5. With a T-10 TORX driver, remove the 4 screws (2-Port) and 5 screws (4-Port) – (item ②) from the front panel.
6. With a T-20 TORX driver, remove the 4 screws (item ③) from the sides of the front panel.
7. Disconnect the power switch cable (item ④) from the power switch PCA.

8. Slide the front panel over the test port connectors.

Subpanel Removal Procedure
This procedure assumes you have already removed the front panel assembly. Refer to Figure 7-4 on page 7-12 for this procedure.

1. With a 5/16 inch torque wrench, remove the ends of the port 1 and port 2 N5292-60020 ((x2) long, item ①) from the where they connect to the back of the subpanel.

2. 4-Port only: With a 5/16 inch torque wrench, remove the ends of the port 3 and port 4 N5292-60019 ((x2) short cables (item ②) from the back of the subpanel (i.e., these are the short cables that connects to the phase compensation PCA).
3. With a 5/16 inch torque wrench, remove all the 8121-2860 (x4) 2-port or (x8) 4-port gray flexible cables (item ③) from subpanel).

4. Carefully remove the N5292-60002 cables from each of the fail-safe PCAs.

5. With a T-20 TORX, remove the 0515-1101 (4-port (x8)) and (2-port (x6)) screws (item ④) from both sides of each of the integrated connectors.

Before removing the subpanel from the test set, lift and support the front of the test set frame.

6. Carefully separate the subpanel from the integrated connectors, by pressing each of the integrated connectors towards the chassis, as you slide the subpanel off of the chassis (deck assembly).

Replacement Procedure

When reconnecting the front-panel jumpers, torque the connectors to 8 in-lb.

1. Reverse the order of the removal procedure.

2. Perform the post-repair adjustments, verifications, and performance tests that pertain to this removal procedure. Refer to Table 7-2 on page 7-36.
Removing and Replacing the Front Panel and Subpanel Assemblies

Figure 7-4  Front Panel Assembly Removal

1. Remove screws 0515-1946 (x5).
2. Remove Front Frame screws 0515-1101 (x4).
3. Remove Power Switch Cable N5292-60003 from the power switch board connector.
Figure 7-5  Subpanel Assembly Removal (N5292-60002, N5292-60019, N5292-60020, & 8121-2860)

Note: Your N5290-60019 and N5290-60020 cables may not be yellow.

- Disconnect the yellow long cables N5292-60020 (x2) from ports 1 and 2 as shown.

- 4-Port Only: Disconnect the yellow short cables N5292-60019 (x2) from ports 3 and 4.

Remove gray cables (8121-2860) from subpanel (x4) 2-port and (x8) 4-port.

Disconnect fail safe sensor cables N5292-60002 ((x4) 4-port) and ((x2) 2-port) from fail-safe PCAs.
Removing and Replacing the A2–A4 Boards

Tools Required

- T-10 TORX driver (set to 9 in-lb)
- 5/16 inch open-end torque wrench (set to 10 in-lb)
- ESD grounding wrist strap

Removal Procedure

Refer to “Bottom Assemblies, 2-Port, Option 200” on page 6-21, “Bottom Assemblies, 4-Port, Option 400” on page 6-26, and “Bottom Hardware and Miscellaneous Parts, All Options” on page 6-36 for this procedure.

1. Disconnect the power cord.
2. Remove the outer cover. Refer to “Removing the Cover” on page 7-8.
3. Instructions for A2 LO Preamplifier board, A3 phase compensation PCA, and A4 LODA board (Refer to Figure 7-6 on page 7-15 through Figure 7-11 on page 7-18. For more on cable locations, see also Figure 6-13 on page 6-25 and Figure 6-15 on page 6-31):
   a. A2 LOPA and A4 LODA boards only:
      i. Remove the semi-rigid N5292-20002 cable (item ①) from A4 LODA board to A2 LOPA board.
      ii. Remove the semi-rigid N5292-20003 cable (item ②) from the A4 LODA board to A2 LOPA board.
   b. A2 LOPA board only:
      i. Disconnect the LO OUT semi-rigid cable N5292-20004 (item ③) from the LOPA board (i.e., The other end of this cable is connected to the rear panel's LO OUT connector).
      ii. Disconnect the N5292-60006 ribbon cable from the LOPA board (i.e., the other end goes to the A5 test set motherboard).
      iii. Remove the 0515-0372 (x4) screws (item ④).
      iv. Remove the A2 LOPA board.
   c. A3 phase compensation PCA and A4 LODA boards only: Remove the semi-rigid N5292-20005 (2-ports (x2) and 4-ports (x4)) cables (item ⑤) from both boards. Note the location of the cable labels before removing the cables (i.e., cable labels should be closest to the A3 phase compensation PCA).
   d. A3 phase compensation PCA only:
      i. 4-port only: Disconnect the port 3 and port 4 N5292-60019 short flex cables (item ⑥) from the A3 board.
      ii. Disconnect the port 1 and port 2 N5292-60020 long flex cables (item ⑦) from the A3 board.
ii. Disconnect the N5292-60004 bias cable from the A3 phase comp PCA to the A5 test set motherboard.

iv. Remove the 0515-0372 (x4) screws (item ➇).

v. Remove the A3 phase compensation board.

e. A4 LODA board only:

i. Disconnect the N5292-60005 ribbon cable from the LODA board (i.e., the other end goes to the A5 test set motherboard).

ii. Remove the 0515-0372 (x2) screws (item ➈) and the 0515-0375 (x4) screws (item ➉).

iii. Remove the A4 LODA board.

Replacement Procedure

1. Reverse the order of the removal procedure.
   Be sure to orient these cables the same as they were on the old board.

2. Perform the post-repair adjustments, verifications, and performance tests that pertain to this removal procedure. Refer to Table 7-2 on page 7-36.

Figure 7-6 Disconnect the semi-rigid cables from the A2 LOPA and A4 LODA boards

1. Disconnect semi-rigid cable N5292-20002 from LODA to LOPA as shown.

2. Disconnect semi-rigid cable N5292-20003 from LODA to LOPA as shown.

3. Disconnect Semi-Rigid Cable N5292-20004 from LOPA circuit.
Repair and Replacement Procedures
Removing and Replacing the A2–A4 Boards

Figure 7-7  Remove the A2 LO Preamplifier Board

Remove the screws 0515-0372 (x4) from the phase comp PCA N5291-63003.

Figure 7-8  Remove the Semi-rigid Cables (N5292-20005) from the A3 Phase Compensation and A4 LODA Boards

Semi-Rigid Cable N5292-20005 (x4) from LODA to Phase Comp PCA as shown.

Note: The "Cable labels should be toward the Phase Comp Board"
Repair and Replacement Procedures
Removing and Replacing the A2–A4 Boards

Figure 7-9
Remove the Short and Long Cables From the A3 Phase Compensation Board (N5292-60019 and N5292-60020)

Remove the end of yellow short cables N5292-60019 (x2) port 3 & 4 PCA connectors on Phase Comp Board as shown.
Remove the end of yellow long cables N5292-60020 (x2) port 1 & 2 to PCA connectors on A2 phase comp board N5291-63003 as shown.

Note: orient cable connectors as shown in this photo.

Figure 7-10
Remove the 0515-0372 Screws From the A3 Phase Compensation Board

Remove the screws 0515-0372 (x4) from the phase comp PCA N5291-63003.
Figure 7-11  Remove the 0515-0372 Screws From the A4 LODA Board

1. Remove the 0515-0375 (x4) from the LODA board (5087-7844).
2. Remove the screws 0515-0372 (x2).
Repair and Replacement Procedures
Removing and Replacing the A2–A4 Boards

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Removing and Replacing the A5 Test-Set Motherboard

**Tools Required**

- T-10 TORX driver (set to 9 in-lb)
- T-20 TORX driver (set to 21 in-lb)
- 5/16 inch open-end torque wrench (set to 10 in-lb)
- Soft tool – similar to T-387026 (to remove motherboard from chassis)
- 5/8 inch nutsetter (set to 21 in-lb)
- ESD grounding wrist strap

**Removal Procedure**

Refer to Figure 7-12 on page 7-21, Figure 7-13 on page 7-22, and Figure 7-14 on page 7-23.

1. Disconnect the power cord.
2. Remove the outer cover. Refer to “Removing the Cover” on page 7-8.
3. Remove the rear panel. Refer to “Removing and Replacing the Rear Panel” on page 7-26.
4. Remove the screws 0515-0372 (x16). (i.e., older units have (x15) screws.)
5. Remove all of the cables connected to the test set motherboard. Note positions and label for reuse.
6. Carefully lift the test set motherboard at connector J11.
7. Remove the test set motherboard.
Replacement Procedure

**IMPORTANT!**

On the test set motherboard (TSMB), before reinstalling the TSMB ensure that the DIP switches are set as shown in Figure 7-12 on page 7-21.

Scan or note the test set motherboard serial number. **Before**, you power up the N5292A enter the N5292A Option 200/400 and the TSMB serial number using software. This TSMB serial number software is only available at Keysight Service Centers or the factory. Refer to “Contacting Keysight” on page 2-7.

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Figure 7-12  Set Motherboard DIP Switches (S4 = 0001 and S5 = 00)

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1. Reverse the order of the removal procedure.

2. Perform the post-repair adjustments, verifications, and performance tests that pertain to this removal procedure. Refer to Table 7-2 on page 7-36.
Repair and Replacement Procedures
Removing and Replacing the A5 Test-Set Motherboard

Figure 7-13  A5 Test Set Motherboard Removal

For re-assembly, inspect the Mother Board N5291-63002. Scan the motherboard for the serial number.

Remove screws 0515-0372 (x16) and slide the test set motherboard away from under bosses in rear corner.

Note: When re-assembling, the top screw on the left edge is tightened first and left screw on the top edge is tightened 2nd. (Circled in Yellow) This helps to engage the power supply connector.
Figure 7-14  A5 Test Set Motherboard Removal – J11 Location
Removing and Replacing the A1 Power Supply Assembly

Tools Required
- T-10 TORX driver (set to 9 in-lb)
- T-20 TORX driver (set to 21 in-lb)
- ESD grounding wrist strap

Removal Procedure
Refer to Figure 7-15 for this procedure.

1. Disconnect the power cord.
2. Remove the outer and inner covers. Refer to “Removing the Cover” on page 7-8.
3. Using a T-10 TORX, remove the six pan head screws (item ①) from the power supply.
4. Using a T-20 TORX, remove the pan head screw as indicated (item ②) from the test set rear panel.
5. Lift the A6 power supply assembly from the top of the instrument.

Replacement Procedure
1. Reverse the order of the removal procedure.
2. Perform the post-repair adjustments, verifications, and performance tests that pertain to this removal procedure. Refer to Table 7-2 on page 7-36.
Figure 7-15  A1 Power Supply Assembly Removal
Removing and Replacing the Rear Panel

Tools Required

- T-10 TORX driver (set to 9 in-lb)
- T-20 TORX driver (set to 21 in-lb)
- 5/16 inch nutsetter (set to 10 in-lb)
- 5/16 inch nutsetter (set to 21 in-lb)
- 5/8 inch nutsetter (set to 21 in-lb)
- 9/32 inch nutsetter (set to 9 in-lb)
- 3/16 inch nutsetter (set to 6 in-lb)
- 9/16 inch nutsetter (set to 21 in-lb)
- 9 mm nutsetter (set to 21 in-lb)
- ESD grounding wrist strap

Removal Procedure

Refer to Figure 7-16 for this procedure.

1. Disconnect the power cord.
2. Remove the outer cover. Refer to “Removing the Cover” on page 7-8.
   (Note: Removing the outer cover includes removing the 4 screws (item ④) that attach the rear feet to the chassis) and the 4 bottom feet (item ⑨).
3. If installed, remove all flex cables from the rear panel (item ①).
4. If installed, remove the protective ESD caps from the connectors (not shown).
5. Remove the connector hardware (item ⑦ and ⑧) from the TEST SET I/O connector.
6. Remove the connector hardware (item ②, ⑤, and ⑥) from each of the RF connectors. The hardware is not the same on each connector so note which hardware goes with which connector.
7. Remove the 5 screws (item ③) that attach the rear panel to the chassis.
8. Slide the rear panel over the cable connectors and off of the test set.

Replacement Procedure

1. Reverse the order of the removal procedure.
2. Perform the post-repair adjustments, verifications, and performance tests that pertain to this removal procedure. Refer to Table 7-2 on page 7-36.
Repair and Replacement Procedures
Removing and Replacing the Rear Panel

Figure 7-16  Rear Panel Removal
Removing and Replacing the Front Panel Power Switch Board

Tools Required
- T-10 TORX driver (set to 9 in-lb)
- T-20 TORX driver (set to 21 in-lb)
- 5/16 inch open-end torque wrench (set to 10 in-lb)
- ESD grounding wrist strap

Removal Procedure

Be careful not to damage the center pins of the semirigid cables. Some flexing of the cables is necessary to remove the assembly. However, do not over-bend the semirigid cables.

1. Disconnect the power cord.
2. Remove the outer covers. Refer to “Removing the Cover” on page 7-8.
3. Remove the front panel and subpanel. Refer to “Removing and Replacing the Front Panel and Subpanel Assemblies” on page 7-10, “Front Panel Assembly, Front Side, All Options” on page 6-9, and “Front Panel Assembly, Back Side, All Options” on page 6-13.
4. Disconnect the power switch cable from the power switch board. Refer to Figure 6-8 on page 6-16 and to Figure 6-9 on page 6-17.
5. Remove the two screws from the power switch board and remove the LED board from the test set. For the location of the screws, see Figure 6-8 on page 6-16.
6. Remove the power switch board from the power switch board base tabs.

Replacement Procedure

1. Reverse the order of the removal procedure.
2. Perform the post-repair adjustments, verifications, and performance tests that pertain to this removal procedure. Refer to Table 7-2 on page 7-36.
Removing and Replacing the Subpanel PCA Sensor Boards

Tools Required

– T-10 TORX driver (set to 9 in-lb)
– T-20 TORX driver (set to 21 in-lb)
– 5/16 inch open-end torque wrench (set to 10 in-lb)
– ESD grounding wrist strap

Removal Procedure

1. Disconnect the power cord.
2. Remove the outer covers. Refer to “Removing the Cover” on page 7-8.
3. Remove the front panel. Refer to “Front Panel Assembly, Front Side, All Options” on page 6-9 and “Front Panel Assembly, Back Side, All Options” on page 6-13.
4. Disconnect the power switch cable from the power switch board. Refer to Figure 6-8 on page 6-16 and to Figure 6-9 on page 6-17.
5. Remove the front panel and set aside test set. For the location of the screws, see Figure 6-8 on page 6-16.
6. Subpanel: Remove the cables for the port(s) that require the port sensor PCA to be replaced by referring to “Removing and Replacing the Front Panel and Subpanel Assemblies” on page 7-10. See also “Front Panel Assembly, Front Side, All Options” on page 6-9 and “Front Panel Assembly, Back Side, All Options” on page 6-13.
7. Remove the screw securing the port sensor PCA to the subpanel. Refer to Figure 7-5 on page 7-13.

Replacement Procedure

1. Reverse the order of the removal procedure.
2. Perform the post-repair adjustments, verifications, and performance tests that pertain to this removal procedure. Refer to Table 7-2 on page 7-36.

Be careful not to damage the center pins of the semirigid cables. Some flexing of the cables is necessary to remove the assembly. However, do not over-bend the semirigid cables.
Repair and Replacement Procedures
Removing and Replacing the Subpanel PCA Sensor Boards

Figure 7-17 Subpanel Assembly Removal (N5292-60002, N5292-60019, N5292-60020, & 8121-2860)

- Disconnect the yellow long cables N5292-60020 (x2) from ports 1 and 2 as shown.
- 4-Port Only: Disconnect the yellow short cables N5292-60019 (x2) from ports 3 and 4.

Remove gray cables (8121-2860) from subpanel (x4) 2-port and (x8) 4-port.

- Disconnect fail safe sensor cables N5292-60012 ((x4) 4-port) and ((x2) 2-port) from fail-safe PCA's.
Removing and Replacing the Front Panel Integrated Connectors/Cables

Tools Required

- T-10 TORX driver (set to 9 in-lb)
- T-20 TORX driver (set to 21 in-lb)
- 5/16 inch open-end torque wrench (set to 10 in-lb)
- ESD grounding wrist strap

Removal Procedure

Be careful not to damage the center pins of the semirigid cables. Some flexing of the cables is necessary to remove the assembly. However, do not over-bend the semirigid cables.

1. Disconnect the power cord.
2. Remove the outer covers. Refer to “Removing the Cover” on page 7-8.
3. Remove the front panel. Refer to “Front Panel Assembly, Front Side, All Options” on page 6-9 and “Front Panel Assembly, Back Side, All Options” on page 6-13.
4. Disconnect the power switch cable from the power switch board. Refer to Figure 6-8 on page 6-16 and to Figure 6-9 on page 6-17.
5. Remove the front panel and set aside test set. For the location of the screws, see Figure 6-8 on page 6-16.
6. Subpanel: Remove the front cables for the port(s) that are connected to the port’s integrated connector/cable assembly to be replaced by referring to “Removing and Replacing the Front Panel and Subpanel Assemblies” on page 7-10. See also “Front Panel Assembly, Front Side, All Options” on page 6-9 and “Front Panel Assembly, Back Side, All Options” on page 6-13.
7. Using a T-20 TORX, remove the 0515-1101 (4-port (x8)) and (2-port (x6)) screws (item ④) from both sides of each of the integrated connectors to be replaced.
8. Disconnect the integrated connector/cables from the A4 test set motherboard.
9. Gently push the integrated connector/cable assembly towards the rear of the instrument (away from the face of the subpanel. Refer to Figure 7-17 on page 7-30.
Replacement Procedure

1. Reverse the order of the removal procedure.

2. Perform the post-repair adjustments, verifications, and performance tests that pertain to this removal procedure. Refer to Table 7-2 on page 7-36.
Removing and Replacing the Fans

Tools Required
- T-10 TORX driver (set to 9 in-lb)
- T-20 TORX driver (set to 21 in-lb)
- Pozidriv screw driver
- 5/16 inch open-end torque wrench (set to 10 in-lb)
- Flat-head screwdriver (to remove fan rivets)
- Soft hammer (to install fan rivets)
- ESD grounding wrist strap

Removal Procedure
Refer to Figure 7-18 for this procedure.

1. Disconnect the power cord.
2. Remove the outer covers. Refer to “Removing the Cover” on page 7-8.
3. Remove the front panel assembly. Refer to “Removing and Replacing the Front Panel and Subpanel Assemblies” on page 7-10.
4. N5292A Top Side: Disconnect the fan wires (x2) from the power supply. It is not necessary to remove the entire power supply. Refer to “Removing and Replacing the A1 Power Supply Assembly” on page 7-24.
5. N5292A Bottom Side: Using a flat-head screw driver, remove rivets (x8) (item ➁) on both sides that attach the fans to the chassis.
6. Remove the fans from the test set.
7. To remove a fan or fan guard from the chassis:
   a. Before removing a fan (item B1) or fan guard (item ➁), note the orientation of each fan and fan guard for reinstallation. Red arrows indicate the correct direction of the flow of air towards the rear of the instrument.
   b. Pull up the center pin of each of the fan rivets as shown by (item ➁) in the illustration.
   c. Pull out the rivet completely (as shown by (item ➁) in the illustration) to release the fan and fan guard.
Replacement Procedure

1. **Reverse the order of the removal procedure.**

2. **Perform the post-repair adjustments, verifications, and performance tests that pertain to this removal procedure.** Refer to Table 7-2 on page 7-36.
Post-Repair Procedures

After the replacement of an assembly, you must perform the service procedures in the order listed in Table 7-2.

Procedures referenced in this table are located in Chapter 3, “System Tests and Adjustments,” unless specified otherwise.

**STOP!** Before returning the repaired instrument to the customer, it is critical to ensure the product is safe for use. Before powering on the instrument, verify there is ground continuity between the ground terminal on the AC Inlet and the metal frame of the product. It is also critical to perform a voltage test on the outer surfaces of the product to confirm the instrument does not present an electric shock hazard.

**IMPORTANT!** Before you begin any testing on a System or instrument, always inspect the connectors on the instrument, the calibration kit, cables and adapters.

**NOTE**

Keysight personnel: see Figure 1-1 on page 1-6 to review where the calibration stickers should be placed on the N5292A.

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<td>A5 test set motherboard</td>
<td>Reinstall the serial number. (Refer to “Installing or Changing a Serial Number” in Chapter 8.)</td>
<td>LO Verify (with corrections) Eterm</td>
</tr>
<tr>
<td></td>
<td>Re-enable all hardware options. (Refer to “Software Entitlement Certificate” in Chapter 8.)</td>
<td>“N5292A Functional Verification Procedure” on page 3-16 and if it passes, run the N “If the N5290/1A Operator’s Check Fails” on page 3-44 and “Test Management Environment (TME) Performance Tests (N5290/1A Millimeter System Only)” on page 3-45.</td>
</tr>
<tr>
<td></td>
<td>LO Adjustments for mm Mode Heaters Dac/Voltage Heater Detect Pna Cal Insertion Loss/Match</td>
<td></td>
</tr>
<tr>
<td>RF path cables</td>
<td>No adjustment needed</td>
<td>‘Eterm’</td>
</tr>
<tr>
<td>B1 fan</td>
<td>No adjustment needed</td>
<td>Check for fan operation</td>
</tr>
</tbody>
</table>

### N5290/1A System

Reconnect the N5292A test set and millimeter-wave heads. Run the N5290/1A Operations Check and the Test Management Environment (TME) Performance Testing. (N5290/1A Millimeter System Only). Refer to Chapter 3.
8 General Purpose Maintenance Procedures

**CAUTION** IMPORTANT! For N5224/5B, N5244/5B, and N5267B PNAs When connecting the 5292-20014 semirigid cable it is critical that the 2.4 mm end is connected to the PNA’s REFn SOURCE OUT port and the SMA end is connected to the N5292A test set’s LO Band connector. Refer to Figure 8-1 on page 8-1.

**CAUTION** IMPORTANT! Before you begin any testing on a System or instrument, always inspect the connectors on the instrument, the calibration kit, cables and adapters.

Figure 8-1 PNA RF Port Connector to N5292A Test Set Lo Band Connector (2.4 mm)
Information in This Chapter

Chapter Eight at-a-Glance

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Maintenance

**WARNING**

To prevent electrical shock, disconnect the analyzer from the mains source 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**

To prevent electrical shock, disconnect the Keysight Technologies Model N5292A, from mains 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**

This is a Safety Class 1 Product (provided with a protective earth 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.

Physical Maintenance

Clean the cabinet, including the front panel, using a dry or slightly damp cloth only.

Electrical Maintenance

Refer to “Review the Principles of Connector Care” on page 3-5.

Refer to “Keysight Support, Services, and Assistance” on page 2-6.

Error Terms

**NOTE**

For network analyzer error terms, refer to the Service Guide for your PNA. Refer to [www.keysight.com](http://www.keysight.com).
Keysight License Manager

Accessing the Keysight License Manager

To start the Keysight License Manager:

— Press **Start > Keysight License Manager > Keysight License Manager**. A Keysight License Manager dialog box will appear.

Figure 8-2 Keysight License Manager Window

Software Entitlement Certificate

If you have received an “Software Entitlement Certificate”, follow the instructions on the certificate, under “HOW TO USE THIS CERTIFICATE:”, to obtain license key file(s) for the option(s) listed on the certificate. See the important note below.

**NOTE**

When upgrading from one model number to another, a new software entitlement certificate will be issued. When the new certificate is redeemed for a license key file, the automated system will ask for the instrument's Host ID. Be sure to use the old Host ID that is associated with the old model number.
Enabling or Removing Options

There are two types of options:

- **Hardware**: Hardware options involve adding additional hardware to the analyzer. After the proper hardware has been installed in the analyzer, the appropriate license can be installed using the Keysight License Manager.

  It is necessary to re-enable all installed hardware options, if the test set mother-board is replaced.

- **Software**: Software options add features or functionality to the analyzer without the need for additional hardware. These options are enabled by installing the appropriate licenses using the Keysight License Manager (KLM). Refer to http://literature.cdn.keysight.com/litweb/pdf/N5242-90024.pdf

Some applications require a license key file that is provided by Keysight. If you do not have the required license key file, contact Keysight for assistance. Refer to “Contacting Keysight” on page 2-7.

To enable or remove an option:

1. Start the Keysight Software Manager. Refer to “Accessing the Keysight License Manager” on page 8-4.

2. In the Keysight License Manager window that opens, in the left hand column, press local host > Local Licenses. A list of available options, similar to the list below, will appear. Refer to Figure 8-2 on page 8-4.

   - S93015A - Dynamic uncertainty for S-parameters
   - S93025A - Basic pulsed-RF measurements
   - 029 - Noise figure measurements
   - S93086A - Gain Compression Application
   - S93087A - IMD Measurements
   - 029 - Full Noise Measurements
   - 219 - Src/Rcvr Atten & Bias Ts 2-Port
   - 419 - Src/Rcvr Atten & Bias Ts 4-Port
   - 224 - 2nd Src w/Combiner & Switches
   - 423 - Combiner & Switches

3. Press and hold (or right click with a mouse) the option that you wish to either enable or remove, and then click Install or Delete, whichever is appropriate.
General Purpose Maintenance Procedures
Keysight License Manager

Repairing and Recovering Option Data
For information on repairing or recovering option data, refer to Keysight License Manager help on your instrument.

Installing or Changing a Serial Number
It is necessary to reinstall the system serial number if the test set mother-board is replaced.

NOTE
To change an incorrect serial number, it is necessary for your instrument to be connected directly to the LAN and to a Keysight IP network. Refer to “Contacting Keysight” on page 2-7.
Firmware Upgrades

How to Check the Current Firmware Version

1. Press UTILITY [System], then Help, then About NA...

   A dialog box showing the current installed Application Code Version is displayed.

2. To determine if a firmware update is available, proceed to “Downloading from the Internet.”

Downloading from the Internet

If your network analyzer is connected to the Internet, there are two methods available for checking the availability of, and downloading, new firmware:

- Download directly from: http://na.support.keysight.com/pna/upgrades.html. (Select your analyzer’s model number in this web site to view available upgrades.)

- Press UTILITY [System], then Service, then AgileUpdate.

   AgileUpdate compares the firmware revision currently installed in your network analyzer to the latest version available and assists you in downloading and installing the most recent version.
Operating System Recovery

NOTE
For information on network analyzer operating system recovery, refer to the Service Guide for your PNA. Refer to www.keysight.com.

Recovering from Solid State Drive Problems

If you suspect that you have a solid state drive problem, go to the “Hard Drive Recovery” link on the Keysight PNA Series: Service & Support Home Page on the Internet.

The URL for the Keysight PNA Series: Service & Support Home Page is:
http://na.support.keysight.com/pna/

The URL for the Hard Drive Recovery page is:
http://na.support.keysight.com/pna/hdrecovery.html
Correction Constants

For information on network analyzer correction constants, refer to the Service Guide for your PNA. Refer to www.keysight.com.

The analyzer stores many correction constants in non-volatile EEPROM memory. These constants enable the analyzer to produce accurate, leveled source signals and receive clean test signals.

Storing Correction Constants

After performing any adjustment listed on page 3-47 in this manual, store the correction constants to a backup file on the analyzer solid state drive by performing these steps:

- Navigate to the EEPROM Backup Utility, located at:
  C:\Program Files (x86)\Keysight\Network Analyzer\Service\eebackup.exe
- Run the program.
- Click Backup EEPROM.
- Click Backup TSMB Mem.
- Click Exit when the program has finished.
General Purpose Maintenance Procedures
Correction Constants