Agilent N5500A
Phase Noise Test Set

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1
General Information

N5500A Overview

The Agilent N5500A Phase Noise Test Set is part of the E5505A Phase Noise Measurement System. The N5500A performs phase noise measurements with the addition of baseband analyzers and software. Carrier frequencies range from 50 kHz to 1.6 GHz with offset frequencies of 0.01 Hz to 100 MHz.

The phase detector input power at the SIGNAL input is specified at 0 to +23 dBm, and at the REF INPUT connection is +15 to +23 dBm. The NOISE input for noise sources or external detectors ranges in frequency from 0.01 Hz to 100 MHz with a 50 ohm input impedance and 1 Volt peak max.

There are three baseband analyzer outputs: (ANALYZER) <100 kHz, (ANALYZER) <100 MHz and RF ANALYZER. The MONITOR output is used for observing time domain phase noise on an oscilloscope. The TUNE VOLTAGE output is used for tuning a VCO in a phase-locked measurement.

The rear-panel TRACK GEN and CHIRP SOURCE inputs are used for verifying phase-lock-loop suppression. There are several available low pass filters: 100 MHz, 20 MHz, 2 MHz, 200 kHz and 20 kHz. The AM blocking filter is used for an external AM detector (or the internal AM detector for Option 001). The Decade spaced low pass and high pass filters range from 1 Hz to 100 kHz, and are used to limit the bandwidth of noise applied to the baseband analyzer.

Figure 1 N5500A test set

N5500A with Option 001

Option 001 adds an input attenuator, input switching, an AM detector, and a microwave phase detector to the test set. The input attenuation ranges from 0 to 35 dB in 5 dB steps.

The RF ANALYZER output can view either an input signal of up to 26.5 GHz or baseband noise. The SIGNAL input can be switched to AM detector, RF phase detectors, microwave phase detector, or an external microwave downconverter. The IF signal from the downconverter is switched to the RF phase detectors.

N5500A with Option 201

The N5500A Option 201 adds a microwave phase detector to extend the carrier frequency range to 26.5 GHz. The microwave phase detector frequency ranges from 1.2 GHz to 26.5 GHz. The microwave phase detector input power at the µW SIGNAL input ranges from 0 to +5 dBm and +7 to +10 dBm at the REF INPUT connections.

2
Front and Rear Panel Interfaces

Standard Front-Panel Interfaces

This section describes the front-panel interfaces on the standard N5500A test set. They appear alphabetically.

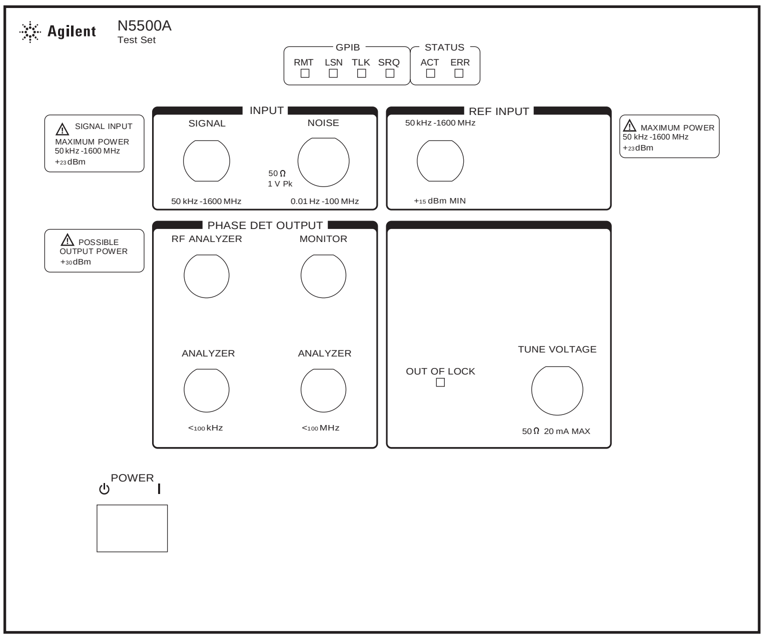

Figure 2 N5500A standard front panel

50 kHz-1600 MHz (REF INPUT)

This connector is a reference signal input to the RF phase detectors.

Limits

- Level range: +15 to +23 dBm
- Frequency: 50 kHz to 1600 MHz

Characteristics

- Input impedance: 50 Ω nominal
- AC coupled: +15 VDC Max

ACT (STATUS)

This LED is not used for phase noise measurement.

ANALYZER: <100 kHz (PHASE DET OUTPUT)

The signal at the <100 kHz phase detector output connector is a high impedance output to the FFT analyzer used for phase noise measurements.

ANALYZER: <100 MHz (PHASE DET OUTPUT)

The signal at the <100 MHz phase detector output connector is the output to the baseband spectrum analyzer used for phase noise measurements.

Characteristics

- Output impedance: 50 Ω nominal

ERR (STATUS)

The error message LED illuminates when a communication error occurs and indicates that an error message is available.

LSN (GPIB)

The listen LED illuminates when the system addresses the instrument to listen.

MONITOR (PHASE DET OUTPUT)

A baseband signal from the detector and LNA in use is available at this port. It may be useful to observe this signal on an oscilloscope to help troubleshoot the phase noise measurement process, or to observe the noise characteristics of a device under test in the time domain.

Characteristics

- The source impedance is 50 Ω, but the port is intended to drive a load impedance much greater than 50 Ω.
- The voltage level may range from 1 mV to 2 V p-p.

NOISE (INPUT)

The noise input connector accepts the following inputs:

- Millimeter measurements using an external millimeter wave mixer
- AM noise measurements using an external AM detector
- Baseband noise measurements (using a DC block).

The input bypasses all of the internal phase detectors and routes the signal directly to the input filters and low noise amplifiers.

Limits

- Frequency: 0.01 Hz - 100 MHz

Characteristics

- Input impedance: 50 Ω, nominal

OUT OF LOCK

This LED illuminates if the internal comparators detect either an excessive peak voltage from the phase detector or an excessive change in the tune voltage.

POWER

This switch puts the instrument in active operation or standby mode. It is a standby switch and not a LINE switch. The detachable power cord is the test set's disconnecting device. It disconnects the mains circuits from the mains supply before other parts of the instrument or system.

RF ANALYZER (PHASE DET OUTPUT)

The signal at the RF analyzer phase detector output connector is the output to the RF swept spectrum analyzer used for phase noise measurements.

Characteristics

- Output impedance: 50 Ω

RMT (GPIB)

The remote indicator LED illuminates when the instrument is enabled for GPIB control.

SIGNAL (INPUT)

This connector accepts the input (device under test) signal.

Limits

- Frequency: 50 kHz to 1600 MHz Characteristics

Characteristics

- Input impedance: 50 Ω Nominal
- AM noise: dc coupled to 50 Ω load

SRQ (GPIB)

The service request LED illuminates when the instrument requests service.

TLK (GPIB)

The talk indicator LED illuminates when the system addresses the instrument to talk.

TUNE VOLTAGE

The signal at this connector is the ouput to the VCO's (voltage controlled oscillator's) tune port connector.

Characteristics

- Input impedance: 50 Ω, 20 mA max

Option 001 Front-Panel Interfaces

This section describes the function of the front-panel interfaces on the N5500A test set with Option 001. The interfaces appear in alphabetical order.

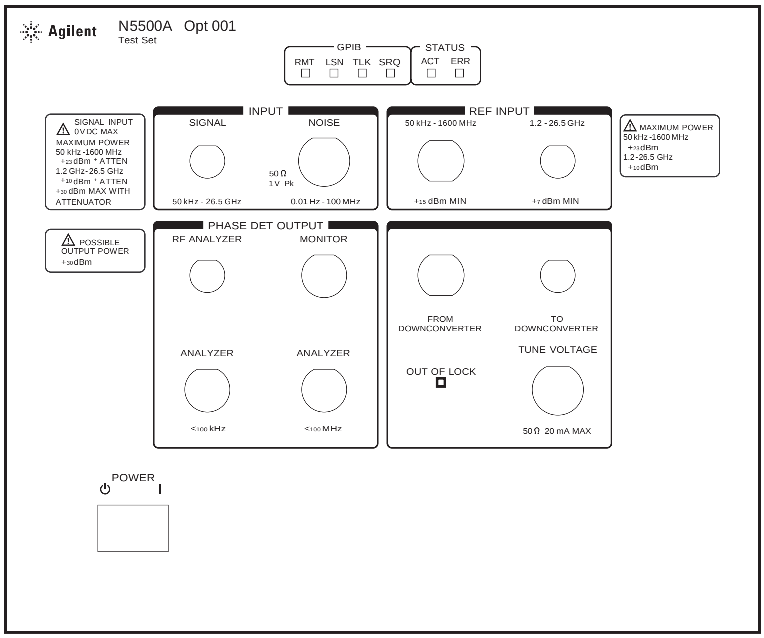

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Figure 3 N5500A Option 001 front panel

NOTE Some interfaces on the front and rear panels are not used for phase noise measurement, as their descriptions indicate. Their primary function is for factory testing and troubleshooting.

50 kHz-1600 MHz (REF INPUT)

This connector is a reference signal input to the RF phase detectors.

Limits

- Level range: +15 to +23 dBm
- Frequency: 50 kHz to 1600 MHz

Characteristics

- Input impedance: 50 Ω nominal
- AC coupled: +15 VDC Max

1.2 - 26.5 GHz (REF INPUT)

This connector is a reference signal input to the microwave phase detector.

Limits

- Level range: +7 to +10 dBm
- Frequency: 1.2 to 26.5 GHz

ACT (STATUS)

This LED is not used for phase noise measurement.

ANALYZER: <100 kHz (PHASE DET OUTPUT)

The signal at the <100 kHz phase detector output connector is a high impedance output to the FFT analyzer used for phase noise measurements.

ANALYZER: <100 MHz (PHASE DET OUTPUT)

The signal at the <100 MHz phase detector output connector is the output to the baseband spectrum analyzer used for phase noise measurements.

Characteristics

- Output impedance: 50 Ω nominal

ERR (STATUS)

The error message LED illuminates when an operational error occurs.

FROM DOWNCONVERTER

The signal at this connector is the input from the downconverter’s IF output connector. The From Downconverter connector, along with the To Downconverter connector, is used to insert a downconverter in the signal path.

LSN (GPIB)

The listen LED illuminates when the system addresses the instrument to listen.

MONITOR (PHASE DET OUTPUT)

A baseband signal from the detector and LNA in use is available at this port. It may be useful to observe this signal on an oscilloscope to help troubleshoot the phase noise measurement process, or to observe the noise characteristics of a device under test in the time domain.

Characteristics

- The source impedance is 50 Ω, but the port is intended to drive a load impedance much greater than 50 Ω.
- The voltage level may range from 1 mV to 2 V p-p.

NOISE (INPUT)

The noise input connector accepts the following inputs:

- Millimeter measurements using an external millimeter wave mixer
- AM noise measurements using an external AM detector
- Baseband noise measurements (using a DC block).

The input bypasses all of the internal phase detectors and routes the signal directly to the input filters and low noise amplifiers.

Limits

- Frequency: 0.01 Hz - 100 MHz

Characteristics

- Input impedance: 50 Ω, nominal

OUT OF LOCK

This LED illuminates if the internal comparators detect either an excessive peak voltage from the phase detector or an excessive change in the tune voltage.

POWER

This switch puts the instrument in active operation or standby mode. It is a standby switch and not a LINE switch. The detachable power cord is the test set’s disconnecting device. It disconnects the mains circuits from the mains supply before other parts of the instrument or system.

RF ANALYZER (PHASE DET OUTPUT)

The signal at the RF analyzer phase detector output connector is the output to the RF swept spectrum analyzer used for phase noise measurements.

Characteristics

- Output impedance: 50 Ω

RMT (GPIB)

The remote indicator LED illuminates when the instrument is enabled for GPIB control.

SIGNAL (INPUT)

This connector accepts the input (device under test) signal.

CAUTION To prevent damage to the N5500A test set’s hardware components, input signal must not be applied to the signal input connector until the input attenuator has been set correctly by the software for the desired destination, as shown below. Refer to the User’s Guide for your E5505A system for more information.

Limits

- Frequency: 50 kHz to 26.5 GHz
- Maximum signal input power: +30 dBm
- At attenuator output, operating level range:
- RF phase detector: 0 to +23 dBm
- Microwave phase detector: 0 to +5 dBm
- Internal AM detector: 0 to +20 dBm
- Downconverters:
  - N5507A/70427A: 0 to +30 dBm
  - N5502A/70422A: +5 to +15 dBm

Characteristics

- Input impedance: 50 Ω Nominal
- AM noise: dc coupled to 50 Ω load

SRQ (GPIB)

The service request LED illuminates when the instrument requests service.

TLK (GPIB)

The talk indicator LED illuminates when the system addresses the instrument to talk.

TO DOWNCONVERTER

The signal at this connector is the test set's output to the downconverter's Signal input connector. The To Downconverter connector, along with the From Downconverter connector, is used to insert a downconverter in the signal path.

TUNE VOLTAGE

The signal at this connector is the ouput to the VCO's (voltage controlled oscillator's) tune port connector.

Characteristics

- Input impedance: 50 Ω, 20 mA max

Option 201 Front-Panel Interfaces

This section describes the function of the front-panel interfaces on the N5500A test set with Option 201. The interfaces appear in alphabetical order.

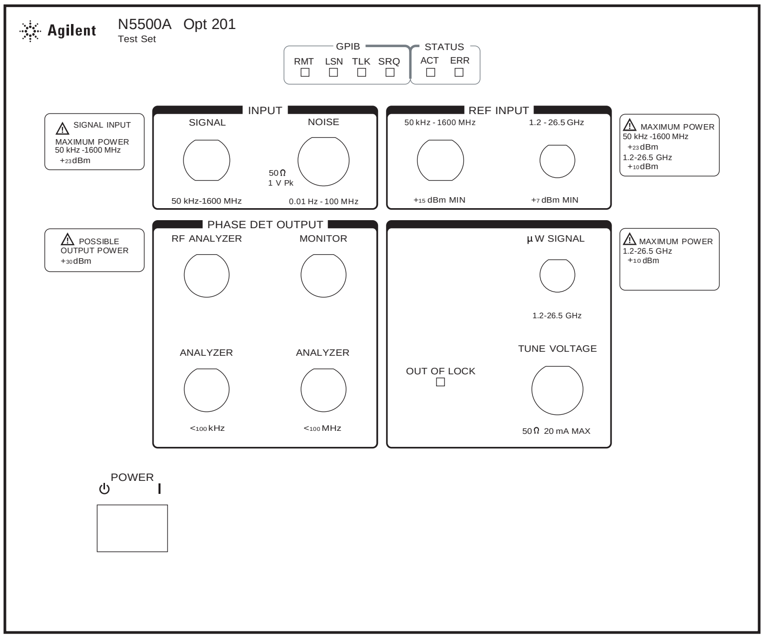

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Figure 4 N5500A option 201 front panel

50 kHz-1600 MHz (REF INPUT)

This connector is a reference signal input to the RF phase detectors.

Limits

- Level range: +15 to +23 dBm
- Frequency: 50 kHz to 1600 MHz

Characteristics

- Input impedance: 50 Ω nominal
- AC coupled: +15 VDC Max

1.2 - 26.5 GHz (REF INPUT)

This connector is a reference signal input to the microwave phase detector.

Limits

- Level range: +7 to +10 dBm
- Frequency: 1.2 to 26.5 GHz

ACT (STATUS)

This LED is not used for phase noise measurement.

ANALYZER: <100 kHz (PHASE DET OUTPUT)

The signal at the <100 kHz phase detector output connector is a high impedance output to the FFT analyzer used for phase noise measurements.

ANALYZER: <100 MHz (PHASE DET OUTPUT)

The signal at the <100 MHz phase detector output connector is the output to the baseband spectrum analyzer used for phase noise measurements.

Characteristics

- Output impedance: 50 Ω nominal

ERR (STATUS)

The error message LED illuminates when an operational error occurs.

LSN (GPIB)

The listen LED illuminates when the system addresses the instrument to listen.

MONITOR (PHASE DET OUTPUT)

A baseband signal from the detector and LNA in use is available at this port. It may be useful to observe this signal on an oscilloscope to help troubleshoot the phase noise measurement process, or to observe the noise characteristics of a device under test in the time domain.

Characteristics

- The source impedance is 50 Ω, but the port is intended to drive a load impedance much greater than 50 Ω.

- The voltage level may range from 1 mV to 2 V p-p.

NOISE (INPUT)

The noise input connector accepts the following inputs:

- Millimeter measurements using an external millimeter wave mixer
- AM noise measurements using an external AM detector
- Baseband noise measurements (using a DC block).

The input bypasses all of the internal phase detectors and routes the signal directly to the input filters and low noise amplifiers.

Limits

- Frequency: 0.01 Hz to100 MHz

Characteristics

- Input impedance: 50 W, nominal

OUT OF LOCK

This LED illuminates if the internal comparators detect either an excessive peak voltage from the phase detector or an excessive change in the tune voltage.

POWER

This switch puts the instrument in active operation or standby mode. It is a standby switch and not a LINE switch. The detachable power cord is the test set’s disconnecting device. It disconnects the mains circuits from the mains supply before other parts of the instrument or system.

RF ANALYZER (PHASE DET OUTPUT)

The signal at this connector is the output to the RF swept spectrum analyzer used for the noise measurements. The RF analyzer output can be internally switched between the baseband output and the IF output.

Characteristics

- Output impedance: 50 Ω

RMT (GPIB)

The remote indicator LED illuminates when the instrument is enabled for GPIB control.

SIGNAL (INPUT)

This connector accepts the input (device under test) signal.

Limits

- Frequency: 5 MHz to 1600 MHz

Characteristics

- Input impedance: 50 Ω, nominal

SRQ (GPIB)

The service request LED illuminates when the instrument requests service.

TLK (GPIB)

The talk indicator LED illuminates when the system addresses the instrument to talk.

TUNE VOLTAGE

The signal at this connector is the ouput to the VCO’s (voltage controlled oscillator’s) tune port connector.

Characteristics

- Input impedance: 50 Ω, 20 mA max

μW SIGNAL

This connector accepts the microwave input (device under test) signal.

Limits and characteristics

- Level range (microwave phase detector): 0 to +5 dBm
- Frequency: 1.2 to 26.5 GHz
- Input impedance: 50 Ω, nominal

Rear-Panel Connectors (All Options)

This section describes the function of the rear-panel interfaces on all options of the N5500A test set. The interfaces appear in alphabetical order.

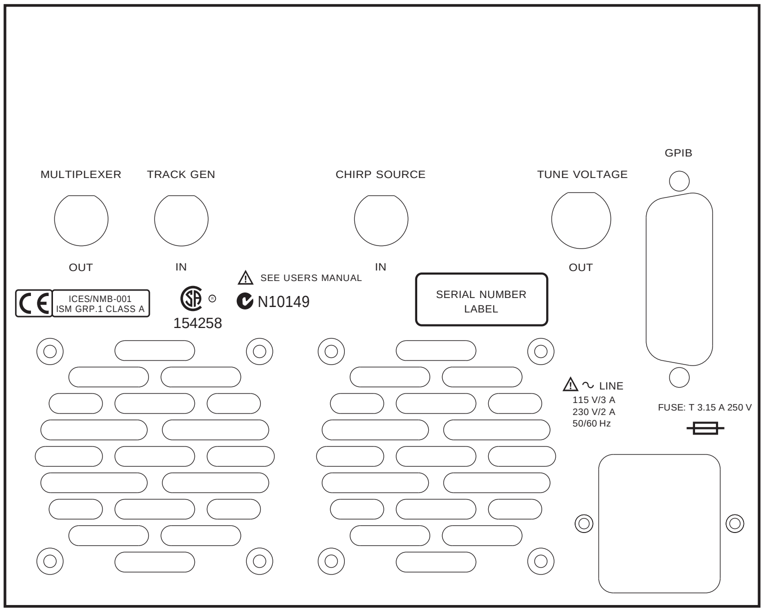

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Figure 5 N5500A Rear Panel

CHIRP SOURCE IN

This connector accepts a pseudo-random noise source from the PC digitizer or FFT analyzer.

GPIB

GPIB communication between the test set and the system occurs through this connector.

MULTIPLEXER OUT

The signal at this connector is the voltage measured by the internal voltmeter and is used for factory troubleshooting purposes.

Characteristics

- Output level range: +/–10 V
- Output impedance: 1 k Ω

- Bandwidth: 100 kHz

Power Connector (~ LINE)

This is the connection for the AC power cord. The detachable power cord is the test set’s disconnecting device. It disconnects the mains circuits from the mains supply before other parts of the instrument or system. For information on power requirements, see the specifications chapter.

TRACK GEN IN

This connector accepts the signal from the tracking generator of a baseband analyzer.

TUNE VOLTAGE OUT

The signal at this connector is the ouput to the VCO’s tune port connector. This Tune Voltage Output port is the default at power-up.

3
Technical Data

Specifications

This section contains general specifications for the N5500A test set. It also includes data on system phase noise and spurious response levels, and the frequency and amplitude ranges for the phase detector input ports.

Table 1 Environmental and mechanical specifications

Altitude	Up to 2,000 meters (6,500 ft)
Operating temperature range	+0 °C to +45 °C (41 °F to 110 °F)
Warm-up time	20 minutes
Max relative humidity	80% for temperatures up to 31 °C, decreasing linearly to 50% relative humidity at 40 °C.
Height	177.2 mm (7 in)
Width	212.5 mm (8.4 in)
Depth	574.3 mm (22.6 in)
Weight	~ 30 lbs (13.6 kg)

Table 2 Tuning voltage output

Voltage range	±10 V, open circuit
Current	20 mA, max
Output impedance	50 Ω, typical

Table 3 Noise input port

Frequency	0.01 Hz to 100 MHz
Amplitude	1 V peak, max
Input impedance	50 Ω, typical (DC coupled, RL < 9.5 dB)

Table 4 Noise floor degradation

Degrade system noise floor 1 dB for every dB reduction in R input levels less than:	+15 dBm (low frequency input)

NOTE

The N5500A has low susceptibility to RFI and mechanical vibration. Care must be exercised, however, in making measurements in high RFI or mechanical vibration environments as spurious signals may be induced in the instrument.

Power Requirements

This section contains the power requirements and characteristics for the N5500A test set.

Table 5 N5500A power supply requirements

Nominal Voltage	115	230
Nominal Frequency	60 Hz	50 Hz
Power	3 A, max	2 A max

Power line module

The power module in the N5500A has the following characteristics:

- 200 W
- 85 to 264 VAC continuous-range operation
- 47 to 63 Hz
- Internal fuse: 5 A, 250 V

Fuse

The instrument's AC line cable has a replaceable fuse with the following characteristics:

- 3.15 A, 250 V, time delayed
- Agilent part number: 2110-1124

System Phase Noise and Spurious Responses

The internal noise design of the N5500A is capable of measuring a range of reference sources, including very low noise reference sources. The graph in Figure 6 shows the phase noise and spurious response levels specified for the system.

The specified response does not include the phase noise or spurious signal contributions of a reference source.

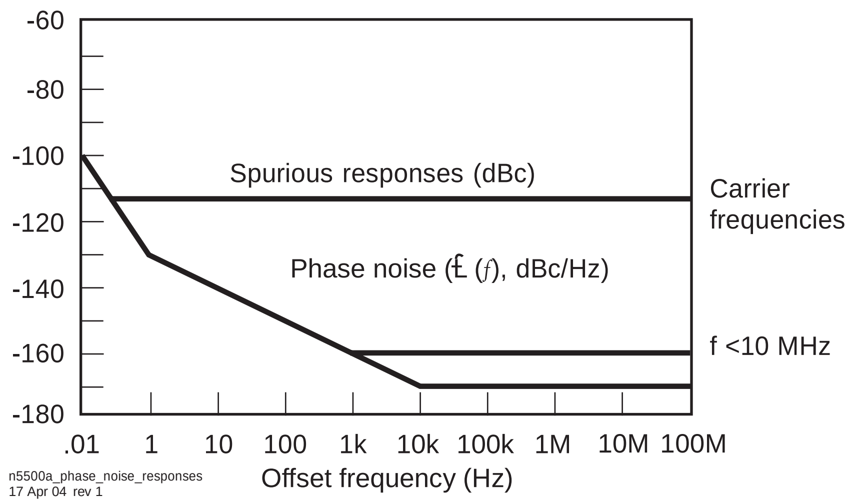

Figure 6 Graph of system phase noise and spurious responses

Figure 7 on page 31 shows the increase in system noise and spurious response levels as the signal level at the Signal Input (R input) port of the N5500A Phase Detector is decreased below +15 dBm.

To determine the system noise and spurious response level for a given Signal Input port (R port) level, determine the resulting dB degradation using Figure 7, and then adjust the phase noise and spurious response levels shown in Figure 6 by the degradation value.

For example, if the signal input (R port) signal level is +5 dBm, the resulting degradation is +10 dB. Applying the +10 dB degradation to Figure 6 increases the system's maximum noise level at 10 kHz offset frequencies from -170 to -160 dBc/Hz. The specified maximum spurious signal level also increases from -112 to -102 dBc at all offset frequencies.

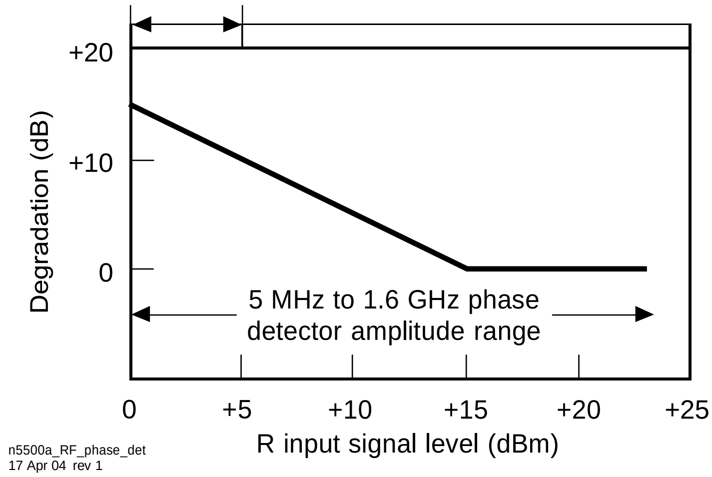

Figure 7 Results of decreased input on the RF phase detector R-Ports

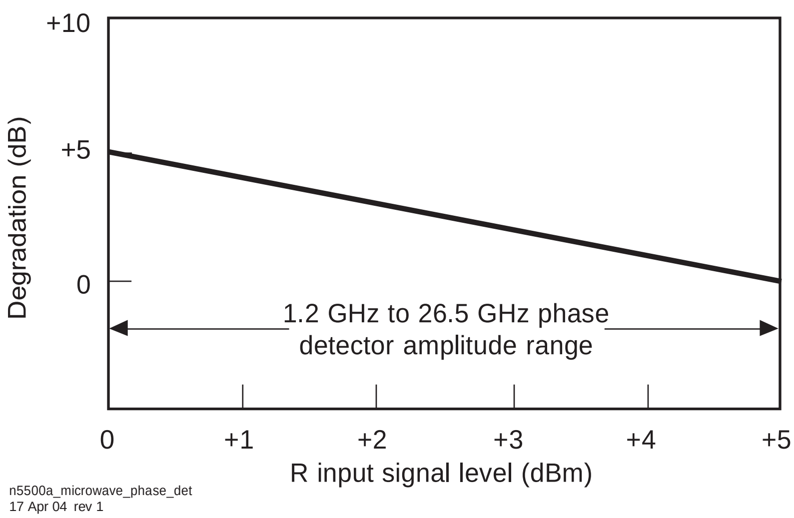

Figure 8 Results of decreased input on the microwave phase detector R-ports

Phase Detector Input Ports

The wide frequency and amplitude ranges enable you to make noise measurements for a wide variety of application requirements. Table 6 indicates the frequency ranges, and Table 7 the amplitude ranges, for the phase detector input ports on the N5500A.

Table 6 Frequency ranges

Carrier Frequency	Offset Frequency
50 kHz to 500 kHz	0.01 Hz to 20 kHz
500 kHz to 5 MHz	0.01 Hz to 200 kHz
5 MHz to 50 MHz	0.01 Hz to 2 MHz
50 MHz to 250 MHz	0.01 Hz to 20 MHz
250 MHz to 1.6 GHz	0.01 to 100 MHz

Table 7 Amplitude ranges

	Low Frequency Inputs	Options 001 & 201 High Frequency Inputs	Options 001 AM Noise
Carrier Frequency Range	50 kHz to 1.6 GHz	1.2 GHz to 26 GHz	50 kHz to 26.5 GHz
RF Input (R port)	0 dBm to +23 dBm	0 dBm to +5 dBm	N/A
RF Input with Option 001	0 dBm to +30 dBm	0 dBm to +30 dBm	0 dBm to +30 dBm
Signal Input (L port)	+15 dBm to +23 dBm	+7 dBm to +10 dBm	

Noise Floor Specifications

Table 8 through Table 12 contain various noise floor and accuracy specifications.

Table 8 RF phase detector noise floor specifications

Input Frequency		Offset from Carrier (Hz)										Spurious (dBc)		
		.01	1	10	100	1k	10k	100k	1M	10M	100M	.01	0.1	>10
50 kHz to 1.6 GHz	Special	–70	–130	–140	–150	–160	–170	–170	–170	–170	–170	–70	–100	–112
	Typical	–77	–137	–147	–157	–167	–177	–177	–177	–177	–177	–77	–107	–119

1. Input ports: L port (Reference Input) = +15 dBm to 23 dBm; R port (Signal Input) = +15 dBm

Table 9 RF phase detector accuracy

Frequency Range	Offset from Carrier
.01 Hz to 1 MHz	±2 dB
1 MHz to 100 MHz	±4 dB

Table 10 µ Detector noise floor specifications (Option 001/201)

Input Frequency		Offset from Carrier (Hz)											Spurious (dBc)		
		.01	1	10	100	1k	10k	32k	100k	1M	10M	100M	1	10	100M
1.2 to 26.5 GHz	Spec.	–55	–115	–125	–135	–145	–155	–160	–160	–160	–160	–160	–97	–97	–97
	Typical	–62	–122	–132	–142	–152	–162	–167	–167	–167	–167	–165	–104	–104	–104

1. Input ports: L port (Reference Input) = +7 dBm to 10 dBm; R port (Signal Input) = +5 dBm

Table 11 AM detector noise floor specifications (option 001)

Input Frequency		Offset from Carrier (Hz)										Spurious (dBc)		
		10	100	1k	10k	100k	10k	1M	10M	100M	100M	≥10	1k	100M
+10 to +20 dBm	Spec.	–105	–115	–125	–140	–149	–150	–150	–150	–170	–170	–70	–100	–112
	Typical	–77	–137	–147	–157	–167	–177	–177	–177	–177	–177	–77	–107	–119

Table 12 AM detector accuracy

Frequency Range	Offset from Carrier
.01 Hz to 1 MHz	±3 dB
1 MHz to 100 MHz	±5 dB

4
Preventive Maintenance

Using, Inspecting, and Cleaning RF Connectors

Taking proper care of cables and connectors protects your system's ability to make accurate measurements. One of the main sources of measurement inaccuracy can be caused by improperly made connections or by dirty or damaged connectors.

The condition of system connectors affects measurement accuracy and repeatability. Worn, out-of-tolerance, or dirty connectors degrade these measurement performance characteristics.

Repeatability

If you make two identical measurements with your system, the differences should be so small that they will not affect the value of the measurement. Repeatability (the amount of similarity from one measurement to another of the same type) can be affected by:

- Dirty or damaged connectors
- Connections that have been made without using proper torque techniques (this applies primarily when connectors in the system have been disconnected, then reconnected).

CAUTION

Static-Sensitive Devices
This system contains instruments and devices that are static-sensitive. Always take proper electrostatic precautions before touching the center conductor of any connector, or the center conductor of any cable that is connected to any system instrument. Handle instruments and devices only when wearing a grounded wrist or foot strap. When handling devices on a work bench, make sure you are working on an anti-static worksurface.

RF cable and connector care

Connectors are the most critical link in a precision measurement system. These devices are manufactured to extremely precise tolerances and must be used and maintained with care to protect the measurement accuracy and repeatability of your system.

To extend the life of your cables or connectors:

- Avoid repeated bending of cables—a single sharp bend can ruin a cable instantly.
- Avoid repeated connection and disconnection of cable connectors.

- Inspect the connectors before connection; look for dirt, nicks, and other signs of damage or wear. A bad connector can ruin the good connector instantly.
- Clean dirty connectors. Dirt and foreign matter can cause poor electrical connections and may damage the connector.
- Minimize the number of times you bend cables.
- Never bend a cable at a sharp angle.
- Do not bend cables near the connectors.
- If any of the cables will be flexed repeatedly, buy a back-up cable. This will allow immediate replacement and will minimize system down time.

Before connecting the cables to any device:

- Check all connectors for wear or dirt.
- When making the connection, torque the connector to the proper value.

Proper connector torque

- Provides more accurate measurements
- Keeps moisture out of the connectors
- Eliminates radio frequency interference (RFI) from affecting your measurements

The torque required depends on the type of connector. Refer to Table 13. Do not overtighten the connector.

Never exceed the recommended torque when attaching cables.

Table 13 Proper Connector Torque

Connector	Torque cm-kg	Torque N-cm	Torque in-lbs	Wrench P/N
Type-N	52	508	45	hand tighten
3.5 mm	9.2	90	8	8720-1765
SMA	5.7	56	5	8710-1582

Connector wear and damage

Look for metal particles from the connector threads and other signs of wear (such as discoloration or roughness). Visible wear can affect measurement accuracy and repeatability. Discard or repair any device with a damaged connector. A bad connector can ruin a good connector on the first mating. A magnifying glass or jeweler’s loupe is useful during inspection.

SMA connector precautions

Use caution when mating SMA connectors to any precision 3.5 mm RF connector. SMA connectors are not precision devices and are often out of mechanical tolerances, even when new. *An out-of-tolerance SMA connector can ruin a 3.5 mm connector on the first mating*. If in doubt, gauge the SMA connector before connecting it. The SMA center conductor must *never* extend beyond the mating plane.

Cleaning procedure

1 Blow particulate matter from connectors using an environmentally-safe aerosol such as Aero-Duster. (This product is recommended by the United States Environmental Protection Agency and contains tetrafluoroethane. You can order this aerosol from Agilent (see Table 14).)
2 Use alcohol and a lint-free cloth to wipe connector surfaces. Wet a small swab with a small quantity of alcohol and clean the connector with the swab.
3 Allow the alcohol to evaporate off of the connector before making connections.

CAUTION

Do not allow excessive alcohol to run into the connector. Excessive alcohol entering the connector collects in pockets in the connector's internal parts. The liquid will cause random changes in the connector's electrical performance. If excessive alcohol gets into a connector, lay it aside to allow the alcohol to evaporate. This may take up to three days. If you attach that connector to another device it can take much longer for trapped alcohol to evaporate.

Table 14 Cleaning Supplies Available from Agilent

Product	Part Number
Aero-Duster	8500-6460
Isopropyl alcohol	8500-5344
Lint-Free cloths	9310-0039
Small polyurethane swabs	9301-1243

WARNING **Cleaning connectors with alcohol should only be performed with the instruments' mains power cord disconnected, in a well ventilated area. Connector cleaning should be accomplished with the minimum amount of alcohol. Prior to connector reuse, be sure that all alcohol used has dried, and that the area is free of fumes.**

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

General Procedures and Techniques

This section introduces you to the various cable and connector types used in the system. Read this section before attempting to remove or install an instrument! Each connector type may have unique considerations.

Always use care when working with system cables and instruments.

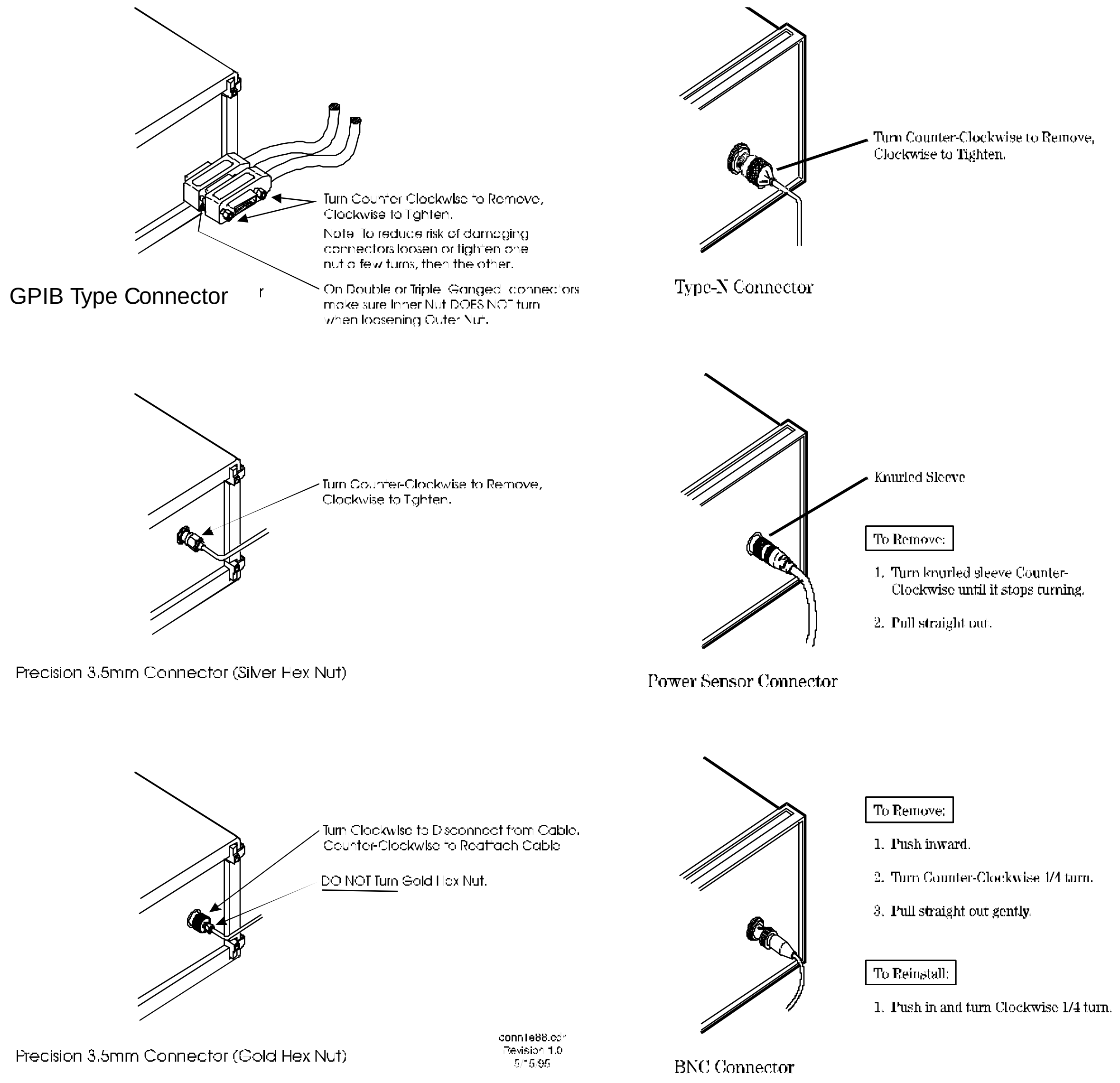

Figure 9 GPIB, 3.5 mm, Type-N, power sensor, and BNC connectors

Connector removal

GPIB connectors

These are removed by two captured screw, one on each end of the connector; these usually can be turned by hand. Use a flathead screwdriver if necessary.

GPIB connectors often are stacked two or three deep. When you are removing multiple GPIB connectors, disconnect each connector one at a time. It is a good practice to connect them back together even if you have not yet replaced the instrument; this avoids confusion, especially if more than one instrument has been removed.

When putting GPIB connectors back on, you must again detach them from one another and put them on one at a time.

Precision 3.5 mm connectors

These are precision connectors. Always use care when connecting or disconnecting this type of connector. When reconnecting, make sure you align the male connector properly. Carefully join the connectors, being careful not to cross-thread them.

Loosen precision 3.5 mm connectors on flexible cables by turning the connector nut counter-clockwise with a 5/16 inch wrench. Always reconnect using an 8 inch-lb torque wrench (Agilent part number 8720-1765). Semirigid cables are metal tubes, custom-formed for this system from semirigid coax cable stock.

3.5 mm connectors with a gold hex nut

The semirigid cables that go to the RF outputs of some devices have a gold connector nut. These do not turn. Instead, the RF connector on the instrument has a cylindrical connector body that turns. To disconnect this type of connector, turn the connector body on the instrument clockwise. This action pushes the cable’s connector out of the instrument connector.

To reconnect, align the cable with the connector on the instrument. Turn the connector body counterclockwise. You may have to move the cable slightly until alignment is correct for the connectors to mate. When the two connectors are properly aligned, turning the instrument’s connector body will pull in the semirigid cable’s connector. Tighten firmly by hand.

3.5 mm connectors with a silver hex nut

All other semirigid cable connectors use a silver-colored nut that *can* be turned. To remove this type of connector, turn the silver nut counter-clockwise with a 5/16 inch wrench.

When reconnecting this type of cable:

- Carefully insert the male connector center pin into the female connector. (Make sure the cable is aligned with the instrument connector properly before joining them.)
- Turn the silver nut clockwise by hand until it is snug, then tighten with an 8 inch-lb torque wrench (part number 8720-1765).

Bent semirigid cables

Semirigid cables are not intended to be bent outside of the factory. An accidental bend that is slight or gradual may be straightened carefully by hand. Semirigid cables that are crimped will affect system performance and must be replaced. Do not attempt to straighten a crimped semirigid cable.

Instrument Removal

To remove an instrument from the system, use one of the following procedures.

Required tools

- #2 Phillips screwdriver
- #2 POZIDRIV screwdriver

Half-Rack-Width instrument

To remove a half-width instrument from a system rack

1 Power off the system.	• For details, see the system installation guide.
2 Remove the selected instrument's power cord from the power strip in the rack.	
3 The instrument is attached to the half-rack width instrument beside it; remove that instrument's power cord from the power strip also.	• The instruments are secured together by lock links at the front and rear. The lock links at the rear attach with screws. The lock links at the front hook together.
4 Remove the power cord and other cables from the front and rear of both instruments.	• Note the location of cables for re-installation.
5 Remove the four corner screws on the front of the rack panel that secures the instruments in place.	• The screws are located near the corners of the face of the instrument. • Use a #2 Phillips screwdriver.
6 Slide both instruments, as a single unit, out from the front of the rack and set them on a secure, flat surface.	
7 Detach the lock links that secure the rear of the instruments together by removing their screws.	• Use a #2 POZIDRIV screwdriver. • See Figure 10 on page 44.
8 Carefully and at the same time, push one instrument forward and pull the other back to unhook the lock links that secure the front of the instruments to each other.	
9 Store the "partner" instrument and lock links while the selected instrument is out of the rack.	• Only install the instruments as a pair; individual installation is not secure.

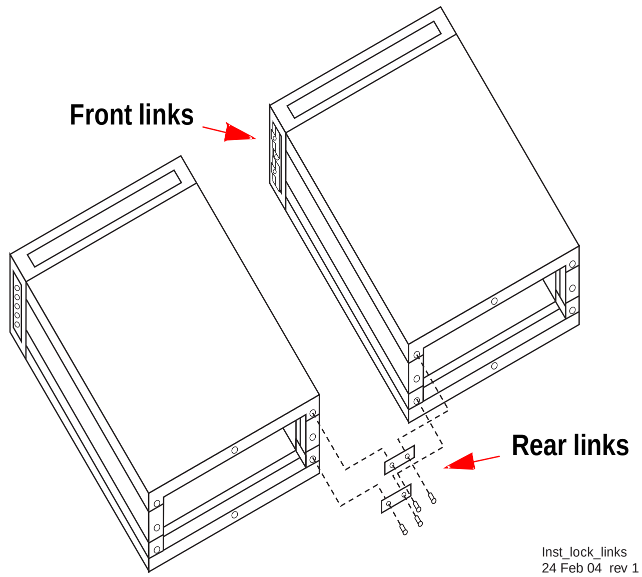

Figure 10 Instrument lock links, front and rear

Benchtop instrument

To remove an instrument from a benchtop system

1 Power off each instrument in the system.	• For details, see the system installation guide or system user's guide.
2 Unplug the selected instrument's power cord from the AC power supply.	
3 Remove the power cord and other cables from the front and rear of the instrument.	• Note the location of cables for re-installation.

Instrument installation

To install or re-install an instrument in a system, use one of the following procedures.

Required tools

- #2 Phillips screwdriver
- #2 POZIDRIV screwdriver

Half-Rack-Width instrument

To install the instrument in a rack

Step	Note
1 Make sure the system is powered off.	• For details, see the system installation guide or system user's guide.
2 Re-attach the lock link that secures the front of the returned instrument to it's partner half-rack-width instrument.	• Use a #2 POZIDRIV screwdriver. • See Figure 10 on page 44.
3 Re-attach the lock link that secures the rear of the instruments together.	• Use a #2 POZIDRIV screwdriver.
4 Insert the attached instruments in the same slot from which you removed them, sliding them along the support rails until they meet the rack-mount ears.	• The rack-mount ears stop the instruments at the correct depth.
5 Replace the rack panel in front of the instruments and secure the four corner screws.	• The screws are located near the corners of the face of the instrument. • Use a #2 Phillips screwdriver.
6 Confirm that the instrument is turned off.	
7 Connect the appropriate cables to the instruments (front and rear), including the power cords.	
8 Power on the system.	• For details, see the system installation guide or system user's guide.

Benchtop instrument

To install an instrument in a benchtop system

1 Make sure the system is powered off.	• For details, see For details, see the system installation guide or system user's guide.
2 Connect all cables to the instrument (front and rear), including the power cord.	
3 Connect the power cord to the AC power source.	
4 Power on the system.	• For details, see the system installation guide or system user's guide.
5 Set the instrument GPIB address, if necessary.	• For procedures, see the system installation guide or system user's guide.

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