Keysight
N5166B CXG
N5171B/72B/73B EXG
N5181B/82B/83B MXG
X-Series Signal Generators

Getting
Started Guide

KEYSIGHT
TECHNOLOGIES

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.

Where to Find the Latest Information

Documentation is updated periodically. For the latest information about these products, including instrument software upgrades, application information, and product information, browse to one of the following URLs, according to the name of your product:

http://www.keysight.com/find/mxg

To receive the latest updates by email, subscribe to Keysight Email Updates at the following URL:

http://www.keysight.com/find/MyKeysight

Information on preventing instrument damage can be found at:

www.keysight.com/find/PreventingInstrumentRepair

Is your product software up-to-date?

Periodically, Keysight releases software updates to fix known defects and incorporate product enhancements. To search for software updates for your product, go to the Keysight Technical Support website at:

http://www.keysight.com/find/techsupport

Table of Contents

1. Safety Information
- Warnings, Cautions, and Notes . . . 9
- General Safety Considerations . . . 10
- Instrument Markings . . . 11

2. Getting Started
- Checking the Shipment . . . 14
- Verifying Pre-Installed Software License . . . 15
- Signal Generator Physical Characteristics . . . 16
  - Dimensions . . . 16
  - Weight . . . 16
- Meeting Environmental and Electrical Requirements . . . 17
  - Environment . . . 17
  - Ventilation . . . 18
  - Line Setting Requirements . . . 18
  - Connecting the AC Power Cord . . . 19
- Configuring the Display . . . 20
- Configuring for Remote Control . . . 21
  - LAN Configuration . . . 21
  - GPIB Configuration . . . 22
- Ordering Accessories . . . 23
- Proper Use and Cleaning . . . 25
  - Cleaning Suggestions . . . 25
- Returning a Signal Generator to Keysight Technologies . . . 25
- Contacting Keysight . . . 26

3. Operation Verification
- Running Self Test . . . 28
  - Self Test Failure . . . 29
- Frequency Range and Accuracy Check . . . 30
  - Frequency Counter Procedure . . . 30
  - Troubleshooting Problems with the Frequency Accuracy Check . . . 32
- Checking the Output Power . . . 32
  - N5171B/81B Test Procedure . . . 33
  - N5171B/81B Alternative Test Procedure . . . 34
  - N5166B/72B/82B Test Procedure . . . 36
  - N5166B/72B/82B Alternative Test Procedure . . . 39
  - N5173B/83B Test Procedure . . . 40
  - N5173B/83B Alternative Test Procedure . . . 41
  - Troubleshooting Problems with the Output Power Check . . . 43

4. Regulatory Information
- General . . . 46

Certification . . . 46
Assistance . . . 46
Statement of Compliance . . . 46
Compliance with Canadian EMC Requirements . . . 46
South Korean Class A EMC Declaration . . . 47
Compliance with European Machinery Directive Acoustic Requirement . . . 47

5. Open Source Licenses
Apple mDNSresponder . . . 50
Sun ONC/RPC . . . 56
WCELIBCEX - Windows CE C Library Extensions . . . 57

Documentation Overview

Getting Started Guide

- Safety Information
- Receiving the Instrument
- Environmental & Electrical Requirements
- Basic Setup
- Accessories
- Operation Verification
- Regulatory Information

User's Guide

- Signal Generator Overview
- Preferences & Enabling Options
- Basic Operation
- Optimize Performance
- Avionics VOR/ILS (Option N5180302B)
- Analog Modulation (Option UNT)
- Pulse Modulation (Options UNW or N5180320B)
- Basic Digital Operation–No BBG Option
- Basic Digital Operation (Options 653/655/656/657)
- Digital Signal Interface Module (Option 003 /004)
- Baseband Operating Mode–Primary, BERT, or N5102A
- BERT (Option N5180UN7B)
- Real–Time Noise–AWGN (Option N5180403B)
- Real–Time Phase Noise Impairments (Option N5180432B)
- Real–Time Fading (Option 660)
- Custom Digital Modulation (Option N5180431B)
- Multitone and Two-Tone Waveforms (Option N5180430B)
- Troubleshooting
- Working in a Secure Environment

Programming Guide

- Getting Started with Remote Operation
- Using IO Interfaces
- Programming Examples
- Programming the Status Register System
- Creating and Downloading Files
- Creating and Downloading User–Data Files

SCPI Reference

- SCPI Basics
- Basic Function Commands
- System Commands
- Analog Modulation Commands
- Arb Commands
- Avionics VOR/ILS Commands
- Bit Error Rate Test (BERT) Commands
- Digital Signal Interface Module Commands
- Real-Time Commands

Programming Compatibility Guide	–	Provides a listing of SCPI commands and programming codes for signal generator models that are supported by the Keysight CXG, EXG, and MXG X- Series signal generators.
Service Guide	–	Troubleshooting
	–	Replaceable Parts
	–	Assembly Replacement
	–	Post–Repair Procedures
	–	Safety and Regulatory Information
	–	Instrument History
Error Messages Guide	–	Error Messages
	–	Error Message Format
	–	Error Message Type
	–	List of Error Messages
Key Help[a]	–	Key function description
	–	Related SCPI commands

a. Press the **Help** key, and then the key for which you wish help.

Keysight Technologies
X-Series Signal Generators

Getting Started Guide

1 Safety Information

- Warnings, Cautions, and Notes on page 9
- General Safety Considerations on page 10
- Instrument Markings on page 11

Warnings, Cautions, and Notes

The documentation for this product uses the following safety notations. Familiarize yourself with each notation and its meaning before operating the signal generator.

WARNING

Warning denotes a hazard. It calls attention to a condition or situation that could result in personal injury or loss of life. Do not proceed beyond a warning until you fully understand the indicated conditions or situations.

CAUTION

Caution calls attention to a condition or situation that could result in damage to or destruction of the signal generator, or in the loss of a user's settings or data. Do not proceed beyond a caution until you fully understand the indicated conditions.

NOTE

Note calls the user's attention to an important point or special information in the text.

General Safety Considerations

WARNING If the signal generator is not used as specified, the protection provided by the equipment could be impaired. The signal generator must be used in a normal condition only, in which all means for protection are intact.

WARNING Personal injury may result if the signal generator covers are removed. There are no operator serviceable parts inside. To avoid electrical shock, refer servicing to qualified personnel.

NOTE Safety of any system incorporating the equipment is the responsibility of the assembler of the system.

Instrument Markings

The signal generator may have the following markings. Familiarize yourself with each marking and its meaning before operating the signal generator.

	This symbol marks the standby position of the power line switch.
	This symbol indicates that the input power required is AC.
	This symbol indicates Frame or chassis Terminal.
	The instruction documentation symbol. The product is marked with this symbol when it is necessary for you to refer to instructions in the documentation.
	This symbol identifies the Protective Conductor Terminal.
	The CE mark is a registered trademark of the European Community. If this symbol is accompanied by a year, it is the year when the design was proven. It indicates that the product complies with all relevant directives.
ccr.keysight@keysight.com	The Keysight email address is required by EU directives applicable to our product.
	The CSA mark is a registered trademark of the CSA International.
	The RCM mark is a registered trademark of the Australian Communications and Media Authority.
	This is a combined marking to indicate product compliance with industry Canadian Interference-Causing Equipment Standard (ICES-001). This is also a symbol of an Industrial Scientific and Medical Group 1 Class A product (CISPR 11, Clause 5).
ICES/NMB-001	This is a marking to indicate product compliance with the Industry Canadian Interference-Causing Equipment Standard (ICES-001), Cet appareil ISM est conforme a la norme NMB du Canada.
ISM1-A	This is the symbol of an Industrial Scientific and Medical Group 1 Class A Product. (CISPER 11, Clause 5)
	This symbol indicates conformance to the standard specifications.

China Restricted Substance Product Label. The EPUP (environmental protection use period) number in the center Indicates the time period during which no hazardous or toxic substance elements are expected to leak or deteriorate during normal use. Forty years is the expected useful life of the product.

This WEEE 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).

Universal recycling symbol. This symbol indicates compliance with the China standard GB 18455-2001 as required by the China RoHS regulations for paper/fiberboard packaging.

South Korean Certification (KC) mark. It includes the marking's identifier code which follows this format: R-R-Kst-ZZZZZZZZZ
To view the EMC Declaration, see "South Korean Class A EMC Declaration" on page 47.

2 Getting Started

CAUTION

To avoid damaging or degrading the performance of the signal generator, do not exceed 27 dBm (0.5W) for N5173B/83B models, or 33 dBm (2W) for N5166B/N5171B/72B/81B/82B models, or maximum of reverse power levels at the RF input. See also Tips for Preventing Signal Generator Damage on www.keysight.com.

NOTE

Software Updates

Is your product software up-to-date? Periodically, Keysight releases software updates to fix known defects and incorporate product enhancements. To search for software updates for your product, go to the Keysight Technical Support website at www.keysight.com/find/ss_firmware.

NOTE

Documentation Updates

Is your product documentation up-to-date? To search for documentation updates for your product, go to the Keysight X-Series Signal Generators website at www.keysight.com/find/X-Series_SG.

- Checking the Shipment on page 14
- Verifying Pre-Installed Software License on page 15
- Signal Generator Physical Characteristics on page 16
- Meeting Environmental and Electrical Requirements on page 17
- Configuring the Display on page 20
- Configuring for Remote Control on page 21
- Ordering Accessories on page 23
- Proper Use and Cleaning on page 25
- Returning a Signal Generator to Keysight Technologies on page 25
- Contacting Keysight on page 26

Checking the Shipment

1. Inspect the shipping container for damage.

   Signs of damage can include a dented or torn shipping container or cushioning material that indicates signs of unusual stress or compacting.

2. Carefully remove the contents from the shipping container and verify that your order is complete.

   The following items are included with each signal generator:

   - Getting Started Guide
   - three-prong AC power cord specific to geographic location

3. Verify that the options/accessories you ordered are included with the shipment by checking the serial number label on the rear of the signal generator and the packing literature included with the shipment.

   See also, "Ordering Accessories" on page 23.

4. If a pre-installed software license is part of the instrument order, verify its installation using the directions outlined in "Verifying Pre-Installed Software License" on page 15.

Verifying Pre-Installed Software License

If you purchased a signal generator where the order included the pre-installation of a fixed perpetual Signal Studio license (N76xx), or a Test Management Environment (TME) software license (N78xxA), or both, verify the license installation using the following key path:

Utility > Instrument Info > Options Info

This opens a menu with the choices: Instrument Options, Auxiliary Software Options, and Waveform Licenses. To view the license, press the appropriate menu key:

- For a Signal Studio license, press **Instrument Options**.
- For the TME license, press **Auxiliary Software Options**.

If a license is pre-installed, the software for that license still needs to be downloaded onto your PC. Use the following links to access the software for download and installation:

- Signal Studio software: www.keysight.com/find/signalstudio
- TME software: www.keysight.com/find/calibrationsoftware

If the software license(s) was ordered with the instrument for pre-installation and it does not show in the instrument, please contact Keysight Technologies:

www.keysight.com/find/contactus

Signal Generator Physical Characteristics

Dimensions

88 mm H x 426 mm W x 489 mm L (length includes rear panel feet)

(3.5 in H x 16.8 in W x 19.2 in L)

Max length (L) including RF connector tip to end of rear panel feet is 508 mm (20 in)

Weight

N5171B/81B: 13.6 kg (30 lb)

N5166B/72B/82B: 15.9 kg (35 lb)

N5173B/83B: 14.5–15 kg (32–33 lb)

Meeting Environmental and Electrical Requirements

CAUTION To avoid the loss of data, GPIB settings, or current user instrument states that have not been permanently saved to non-volatile memory, the signal generator should always be powered down either via the signal generator's front panel power button or the appropriate SCPI command. Signal generator's installed in rack systems and powered down with the system rack power switch rather than the signal generator's front panel switch display a Error -310 due to the signal generator not being powered down correctly.

NOTE The input terminals for this product are classified as Measurement Category None.

Environment

- For indoor use only.
- altitudes ≤ 15,092 feet (4,600 meters)
  Only with Option 660: ≤ 9,843 feet (3,000 meters)
- 0 to 55°C temperature, unless otherwise specified
- Maximum Relative Humidity (non-condensing): 95%RH up to 40°C, decreases linearly to 45%RH at 55°C[1]
- Storage: –40 to 70°C

CAUTION This product is designed for use in INSTALLATION CATEGORY II and POLLUTION DEGREE 2, per IEC 61010-1 Third Edition.

1. From 40°C to 55°C, the maximum % Relative Humidity follows the line of constant dew point.

NOTE The instruments can operate with mains supply voltage fluctuations up to ± 10% of the nominal voltage.

Ventilation

Ventilation holes are located on the rear panel and all four sides of the signal generator cover. To ensure proper air flow through the signal generator, do not allow these holes to be obstructed.

Rack-mounted units

When installing the instrument(s) into a cabinet, consideration shall be given to the convection flow into and out of the cabinet. Consideration shall also be given to the individual instruments to avoid having the heated discharge of one instrument, now becoming the cooling intake air for another instrument.

Another area of concern is verification that the maximum ambient operating temperature of the instrument(s) is not exceeded by cabinet installation. Keysight recommends forced air convection whenever an instrument(s) are installed in a cabinet and further recommends that the maximum operating temperature of the cabinet be reduced 10°C from the lowest, of the maximum operating temperature of a single instrument.

If there are any concerns or special requirements a Keysight Field Engineer should be consulted to assure instrument(s) temperature compliance and performance.

Line Setting Requirements

CAUTION The signal generator has autoranging line voltage input; ensure that the supply voltage is within the specified range.

Voltage:	100/120 volts nominal
	220/240 volts nominal
Frequency:	for 100/120 volts: 50/60/400 Hz nominal
	for 220/240 volts: 50/60 Hz nominal
Power:	160 W maximum (N5171B & N5181B)
	300 W maximum (N5166B, N5172B & N5182B)
	280 W maximum (N5173B & N5183B)

Connecting the AC Power Cord

This is a Safety Class 1 Product provided with a protective earth ground incorporated into the power cord. The front panel switch is only a standby switch; it is not a line switch. The AC power cord is the disconnecting device that disconnects the signal generator mains circuits from the mains supply. Alternatively, an external switch or circuit breaker, readily identifiable and easily reached by the operator, may be used as a disconnecting device.

WARNING The instrument shall be set flat in its normal use position so that the detachable power cord is readily identifiable and is easily reached by the operator. It shall not be placed on the four feet of the rear panel in normal use.

WARNING The mains plug shall be inserted only in a socket outlet provided with a protective earth contact. Always use the three-prong AC power cord supplied with the signal generator. Personal injury can occur if there is any interruption of the protective conductor inside or outside of the signal generator. Intentional interruption is prohibited.

CAUTION The mains wiring and connectors shall be compatible with the connector used in the premise electrical system. Inadequate earth grounding can damage the signal generator. Always use the three-prong AC power cord supplied with the signal generator.

CAUTION To avoid possible instrument damage, use the Keysight supplied power cord or one with same or better electrical rating.

Connect the AC power cord as follows:

1. Ensure that the power cord is not damaged.
2. Install the signal generator so that one of the following items is readily identifiable and easily reached by the operator: AC power cord, alternative switch, or circuit breaker.
3. Insert the mains plug into a socket outlet provided with a protective earth grounding.

Configuring the Display

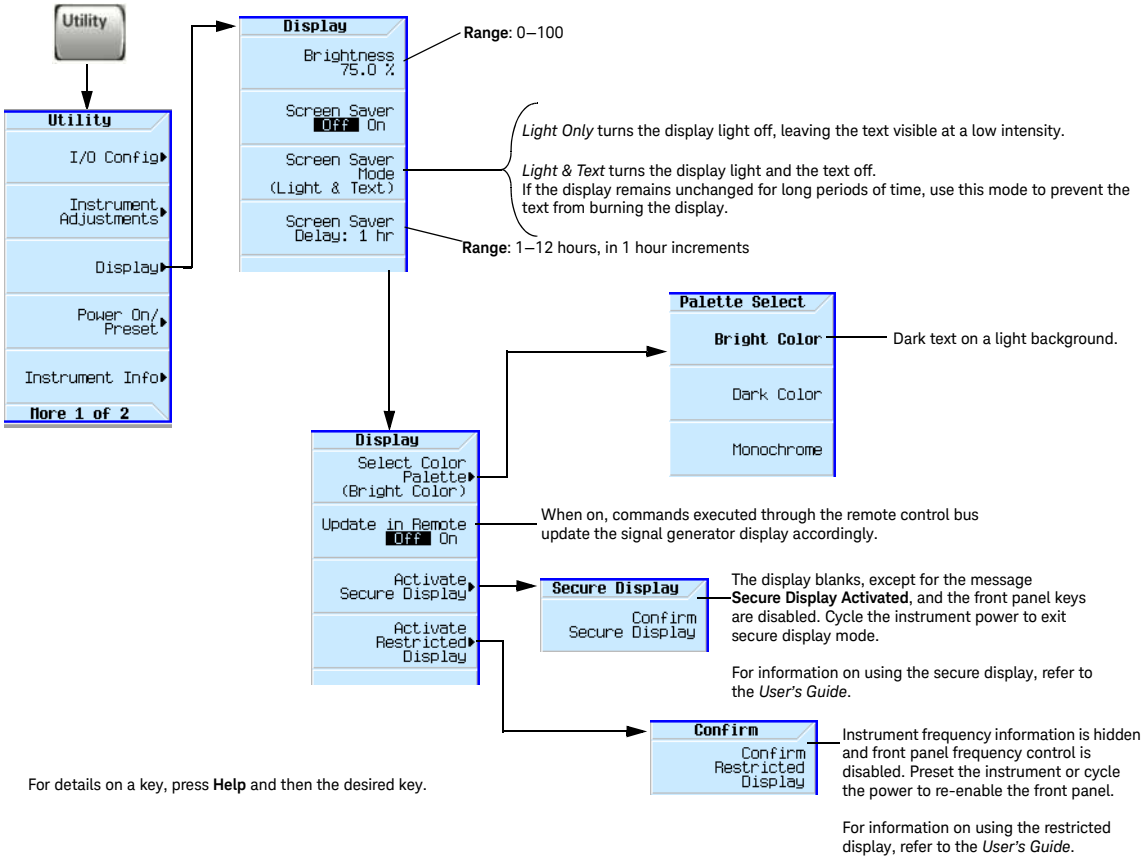
Screen saver settings are persistent states; they are unaffected by preset or a power cycle.

Use the arrow keys, numeric keypad, or front panel knob to adjust numeric values.

NOTE

X-Series signal generators are shipped from the factory with default display settings. When the signal generator display is not required to be active for long periods of time, consider using the Screen Saver Mode to extend the life of the display.

Figure 2-1 Display Softkeys



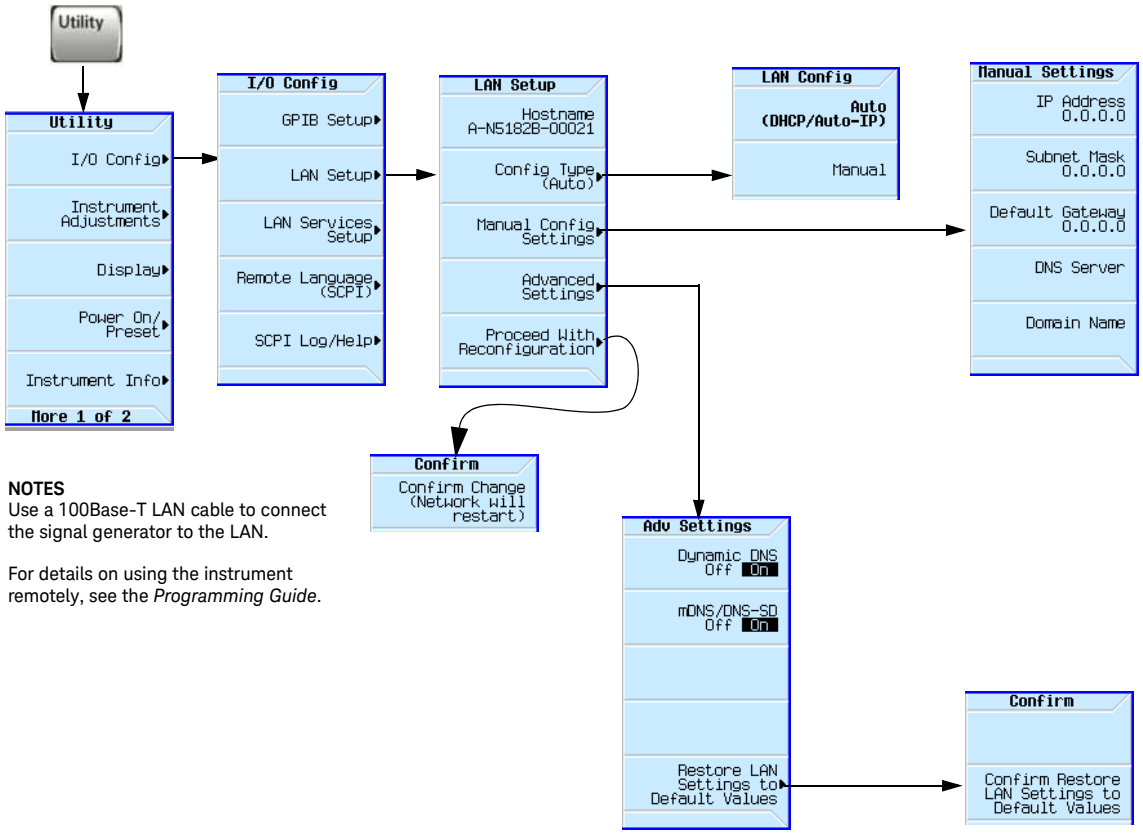
NOTE

With the brightness set to minimum, the display may be too dark to see the softkeys. If this happens, use Figure 2-1 to locate the brightness softkey and adjust the value so that you can see the display.

Configuring for Remote Control

LAN Configuration

Configuring the LAN Interface

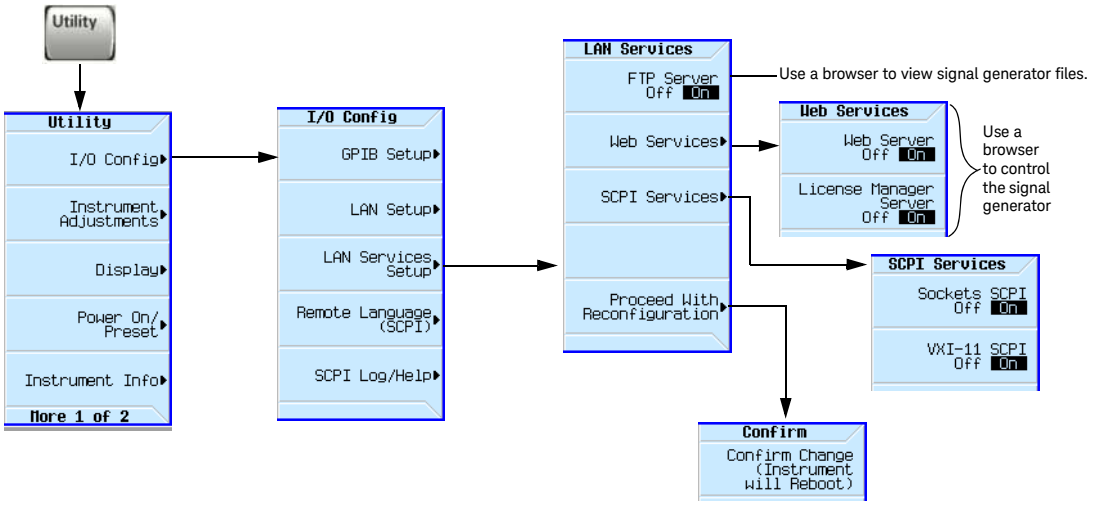


NOTES
Use a 100Base-T LAN cable to connect the signal generator to the LAN.

For details on using the instrument remotely, see the *Programming Guide*.

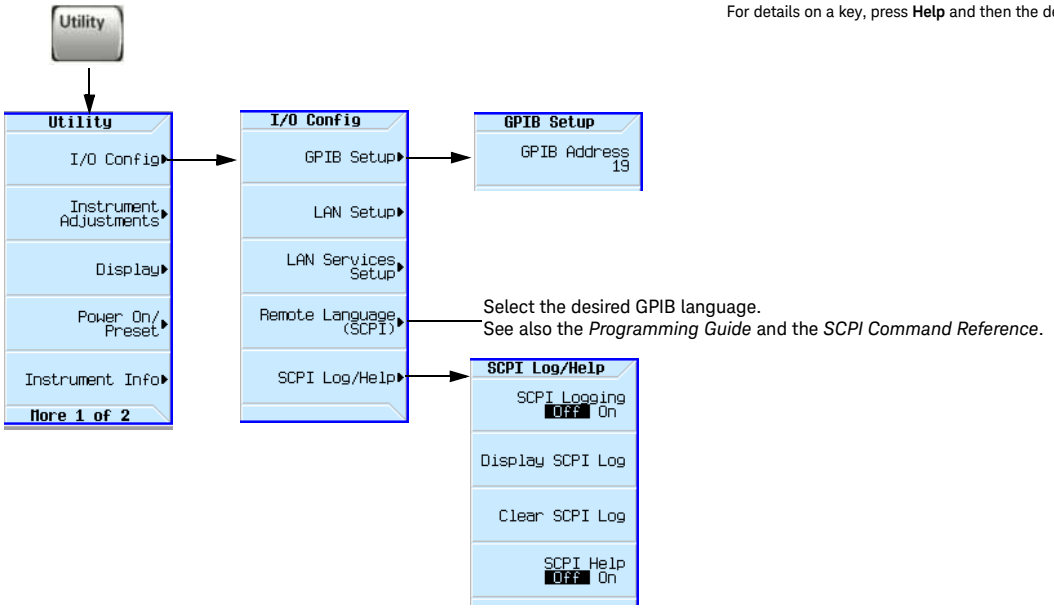
For details on a key, press **Help** and then the desired key.

Enabling LAN Services: Browser, Sockets, and VXI-11



GPIB Configuration

For details on a key, press **Help** and then the desired key.



NOTES
USB is also available. It is not shown in the menu because it requires no configuration.
For details on using the instrument remotely, see the *Programming Guide*.

Ordering Accessories

NOTE Only Keysight approved accessories should be used.

You can purchase accessories and find the latest documentation at: **http://www.keysight.com/find/mxg**

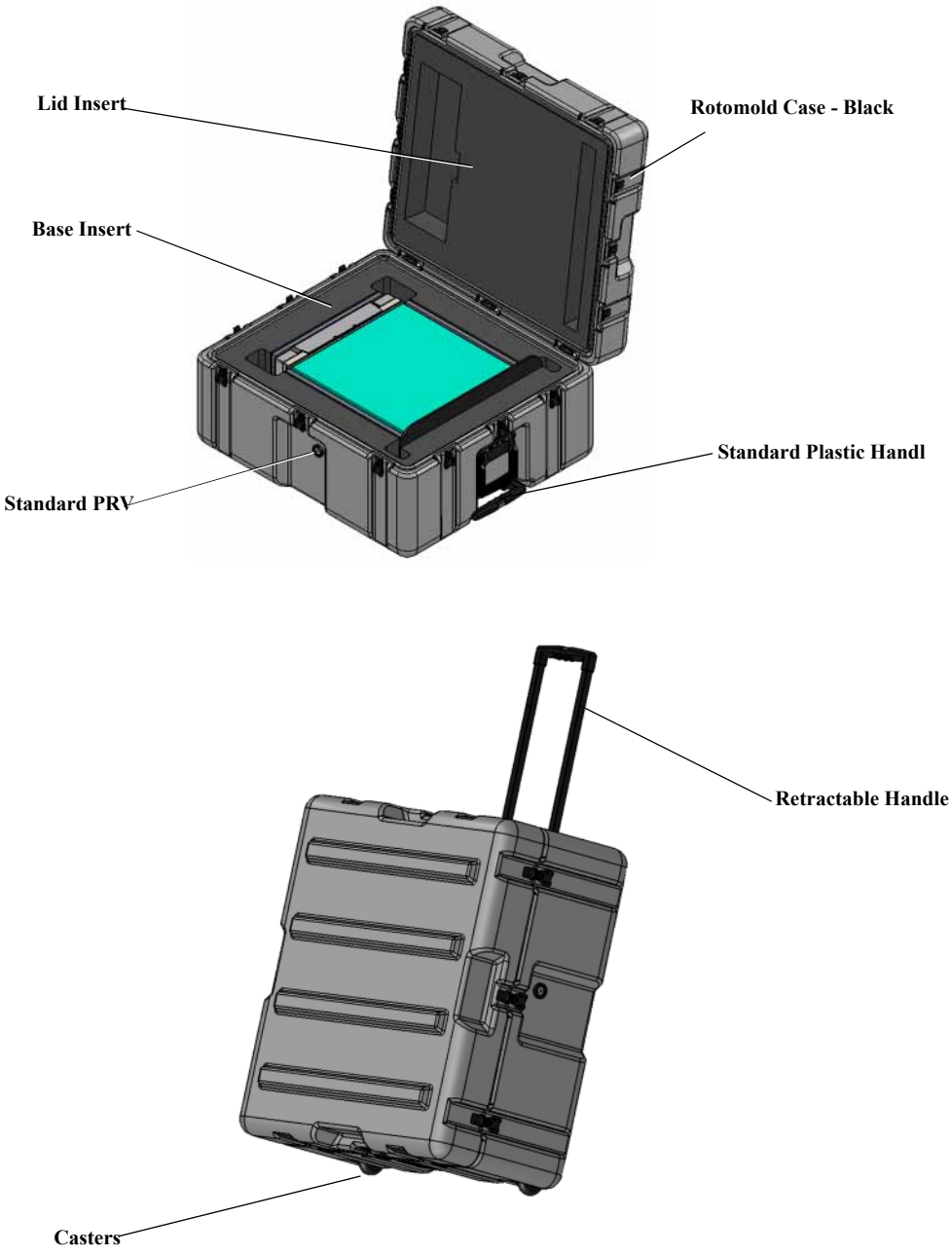
If you do not have access to the Internet, please contact your Keysight field engineer.

See also, "Contacting Keysight" on page 26.

Description[a]	Part Number
Rack Mount Kit	1CM110A
Rack Mount Kit with Handles	1CP104A
Rack Slide Kit	1CR112A
Front Handle Kit	1CN106A
Transit Case (See Figure 2-2 on page 24)	N5180-80053
CXG Data Sheet (N5166B)[b]	5992-3959EN
EXG Data Sheet (N5171B/72B/73B)[b]	5991-0039EN
MXG Data Sheet (N5181B/82B/83B)[b]	5991-0038EN
Getting Started Guide[b]	N5180-90054
User's Guide[b]	N5180-90056
SCPI Reference[b]	N5180-90057
Programming Guide[b]	N5180-90074
Programming Compatibility Guide[b]	N5180-90069
Service Guide[b]	N5180-90059
Error Messages Guide[b]	N5180-90075

a. For a description of the contents of each guide and reference, see page 7.
b. Always refer to **www.keysight.com** for the most up-to-date documentation.

Figure 2-2 Transit Case



Proper Use and Cleaning

The signal generator cover protects against physical contact with internal assemblies that contain hazardous voltages, but does not protect internal assemblies against contact with liquids. To avoid damage and personal injury, ensure that liquids are positioned away from the signal generator.

WARNING

Personal injury may result if the signal generator is not used as specified. Unspecified use impairs the protection provided by the equipment. The signal generator must be used with all means for protection intact.

Cleaning Suggestions

WARNING

To prevent electrical shock, disconnect the instrument 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.

Cleaning connectors with alcohol shall only be done with the instruments power cord removed, and in a well-ventilated room. Allow all residual alcohol moisture to evaporate, and the fumes to dissipate prior to energizing the instrument.

To ensure good connections, regularly clean the instrument's front and rear panel connectors with alcohol.

To prevent dust build-up that could potentially obstruct ventilation, periodically clean the instrument's cover. Use a dry cloth or a cloth slightly dampened with water to clean the external case parts.

Returning a Signal Generator to Keysight Technologies

1. Gather as much information as possible about the signal generator's problem.
2. Contact Keysight using the phone number that is specific to your geographic location. These phone numbers are listed on the Internet at **http://www.keysight.com/find/assist**. If you do not have access to the Internet, contact your Keysight field engineer.

   After you provide information about the signal generator and its condition, you will receive information about where to ship your signal generator for repair.
3. Ship the signal generator in the original factory packaging materials, if available, or use similar packaging to properly protect the signal generator.

Contacting Keysight

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

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

NOTE

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

3 Operation Verification

CAUTION

To avoid damaging or degrading the performance of the signal generator, do not exceed 27 dBm (0.5W) for N5173B/83B models, or 33 dBm (2W) for N5166B/71B/72B/81B/82B models, or maximum of reverse power levels at the RF input. See also Tips for Preventing Signal Generator Damage on www.keysight.com.

NOTE

For the instrument to meet performance specifications allow a warm up period of 45 minutes within an operational temperature range of 0 to 55 °C. For more information, refer to the CXG, EXG, and MXG signal generator Data Sheets.

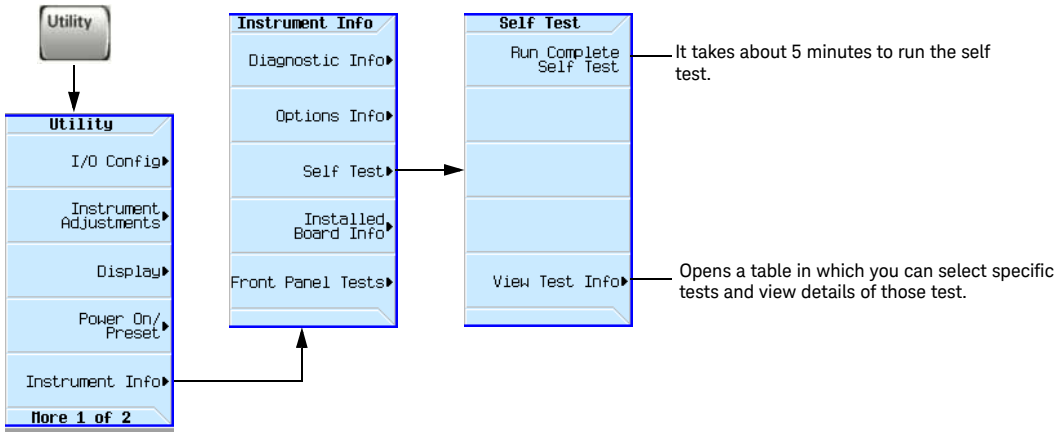
Operation verification is a series of tests used to confirm that the signal generator is operating properly, or to diagnose problems. Operation verification does not verify performance to instrument specifications.

Perform operation verification when you initially set up the signal generator, after a minor repair (refer to the **Service Guide** for details), or when the integrity of the signal generator is in question.

– Running Self Test on page 28
– Frequency Range and Accuracy Check on page 30
– Checking the Output Power on page 32

Running Self Test

Self Test is a series of internal tests of signal generator functions. If this test fails, refer to "Self Test Failure" on page 29 for further instructions.



Use the following procedure to run self test:

1. Disconnect all external cables, including GPIB, LAN, and USB cables.
2. Preset the signal generator: Press **Preset** > **Utility** > **Instrument Info** > **Self Test**.

   The following message appears:

   – `The current status of the self-test is: Incomplete. Not all tests have been run.`
3. Press **Run Complete Self Test**.

   An activity bar displays on the screen indicating the test progress.

   If you press **Abort** while self-test is running, the following message displays:

   – `The current status of the self-test is: Incomplete. Not all tests have been run.`

   When self-test completes, one of the following messages displays:

   – `The current status of the self-test is: Passed`

   – `The current status of the self-test is: Failure. One or more tests have failed. System diagnostics indicate this test as the root failure: xxx`

   If the signal generator fails only one test, the title of the failed test displays. If the signal generator fails more than one test, the test number of the most significant failure `(root failure)` displays.

NOTE

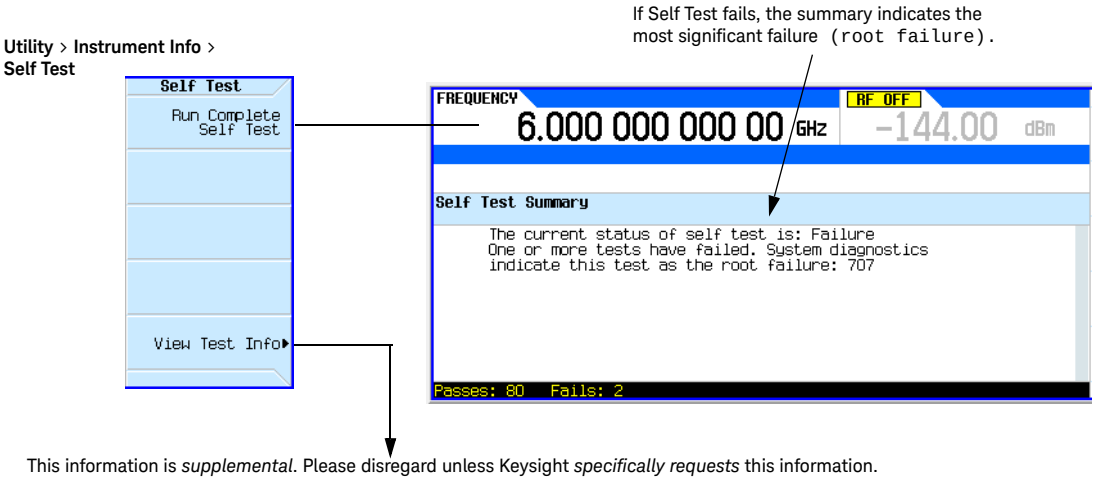
NOTE The `root failure` is the error to report to Keysight Support. Refer to "Contacting Keysight" on page 26.

Self Test Failure

1. Confirm that all external cables, including GPIB, LAN, and USB cables, are disconnected from the signal generator and repeat the self-test.
2. If the self-test continues to fail, the signal generator requires service. If you are unable to service the signal generator, send it to an Keysight service center for repair. Include a detailed description of the most significant failure (`root failure`) and any displayed error messages. Also include the model, serial number, installed options, and firmware version.

   See "Returning a Signal Generator to Keysight Technologies" on page 25 for return instructions.

Viewing Test Results



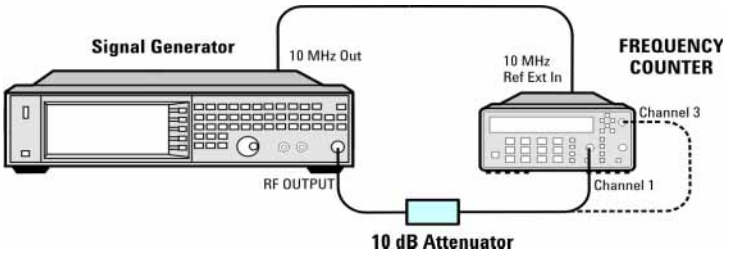
Frequency Range and Accuracy Check

The frequency range is tested by determining the frequency accuracy relative to the timebase at the frequency limits of the signal generator. This test can be performed with a frequency counter that meets the frequency accuracy limits in Table 3-1.

Frequency Counter Procedure

Test Setup

1. Connect the equipment as shown.



2. Preset the signal generator: Press **Preset**.
3. Turn modulation off: Press the **Mod On/Off** so that the MOD On/Off LED turns off.
4. Set the amplitude:
   Press **Amplitude** and enter 0 dBm.
5. Turn RF on: Press **RF On/Off** so that the RF On/Off LED lights.
6. Verify that the frequency counter is locked to the 10 MHz external reference frequency (±1 Hz).
7. For maximum accuracy, set the gate time on the frequency counter to >5 seconds.
   (For example, press **Gate & ExtArm** twice and use the arrow keys to set the value.)
8. Set the frequency: Press **Frequency** and set the signal generator to the first frequency listed in Table 3-1.
9. Confirm that the measured frequency is within the limits listed.
10. Repeat step 8 and step 9 for all of the frequencies in the table that are within the frequency range of your signal generator.

NOTE

For frequencies <200 MHz, use Channel 3 on the frequency counter (press **Freq Ratio** until `CH3:` displays).

Table 3-1 Frequency Accuracy Limits

Frequency (MHz)	Limit (Hz)
0.01 MHz	±2
0.1 MHz	±2
200 MHz	±2
300 MHz	±2
500 MHz	±2
1000 MHz	±2
2000 MHz	±2
3100 MHz	±2
6000 MHz	±2

Troubleshooting Problems with the Frequency Accuracy Check

- Verify the cables are connected correctly.
- If you are using a frequency counter, verify that you are using the correct channel for the frequencies you are measuring.

Checking the Output Power

This test verifies that the CW output power from the signal generator is within defined limits. The following table lists the preferred equipment for this test.

Test Equipment	Recommended Model
Power Meter	Keysight E4418B or E4419A/B E-Series or equivalent
Power Sensor, Input: Type-N (m)	Keysight E9304A

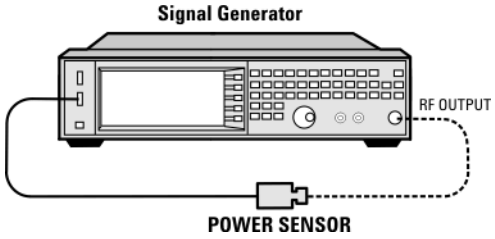
- N5171B/81B Test Procedure on page 33
- N5171B/81B Alternative Test Procedure on page 34
- N5166B/72B/82B Test Procedure on page 36
- N5166B/72B/82B Alternative Test Procedure on page 39
- N5173B/83B Test Procedure on page 40
- N5173B/83B Alternative Test Procedure on page 41

If this test fails, refer to “Troubleshooting Problems with the Output Power Check” on page 43 for further instructions.

N5171B/81B Test Procedure

Test Setup

1. Connect the equipment as shown:



2. Zero and calibrate the power sensor.

NOTE USB U2000A Series Power Sensors do not require the sensor to be zeroed or calibrated.

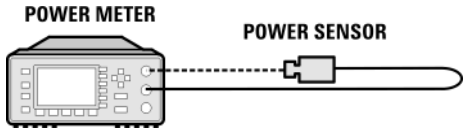
3. Connect the power sensor to the RF output of the signal generator. Once the LED on the power sensor turns off, the sensor is ready to measure.
4. Preset the signal generator: Press **Preset**
5. Turn the internal power meter channel on: Press **Aux Fctn** > **Power Meter Measurements** > **Channel A On** (or **Channel B On**).
6. Turn RF on: Press **RF On/Off** so that the RF On/Off LED lights.
7. Turn modulation off: Press **Mod On/Off** so that the **Mod On/Off** LED turns off.
8. Set the frequency: Press **Frequency** and enter the first frequency value listed in Table 3-2.
9. Set the amplitude: Press **Amplitude** and enter the amplitude value for that frequency.
10. Measure the output power level.
11. Repeat steps 8 through 10 to measure power at each of the frequencies listed in Table 3-2.
12. Confirm that the measured power levels are within the limits listed in the table.

N5171B/81B Alternative Test Procedure

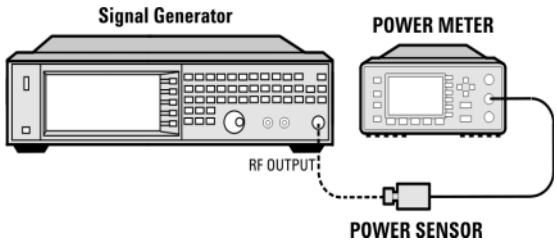
If a USB power sensor is not available, use a power meter to measure the output power of the signal generator.

Test Setup

1. Zero and calibrate the power sensor to the power meter:



2. Connect the equipment as shown:



3. Preset the signal generator: Press **Preset**.
4. Turn RF on: Press **RF On/Off** so that the RF On/Off LED lights.
5. Turn modulation off: Press **Mod On/Off** so that the Mod On/Off LED turns off.
6. Set the frequency: Press **Frequency** and enter the first frequency value listed in Table 3-2.
7. Set the amplitude: Press **Amplitude** and enter the amplitude value for that frequency.
8. Configure the power meter for the measurement.
   a. Press the **Frequency Cal Fac** button on the power meter.
   b. Select a power meter channel (if applicable).
   c. Use the arrow keys to enter the frequency at which to measure the power.
9. Measure the output power level.
10. Repeat steps 6 through 9 to measure power at each of the 15 frequencies listed in Table 3-2.
11. Confirm that the measured power levels are within the limits listed in the table.

NOTE

Limit values are due to power meter uncertainty.

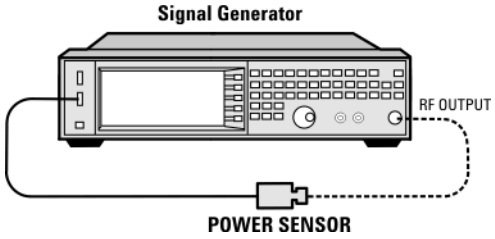
Table 3-2 Leveled Output Power Limits

N5171B/81B Output Power		
Frequency	**Amplitude (dBm)**	**Limits (dB)**
125 MHz	7	±2
275 MHz	7	±2
338 MHz	7	±2
425 MHz	7	±2
538 MHz	7	±2
675 MHz	7	±2
850 MHz	7	±2
1075 MHz	7	±2
1350 MHz	7	±2
1700 MHz	7	±2
2150 MHz	7	±2
2700 MHz	7	±2
3400 MHz	7	±2
4300 MHz	7	±2
5400 MHz	7	±2

N5166B/72B/82B Test Procedure

Test Setup

1. Connect the equipment as shown:



2. Zero and calibrate the power sensor.

NOTE

USB U2000A Series Power Sensors do not require the sensor to be zeroed or calibrated.

3. Connect the power sensor to the RF output of the signal generator. Once the LED on the power sensor turns off, the sensor is ready to measure.
4. Preset the signal generator: Press **Preset**
5. Turn the internal power meter channel on: Press **Aux Fctn** > **Power Meter Measurements** > **Channel A On** (or **Channel B On**).
6. Turn RF on: Press **RF On/Off** so that the RF On/Off LED lights.
7. Turn modulation off: Press **Mod On/Off** so that the **Mod On/Off** LED turns off.
8. Set the frequency: Press **Frequency** and enter the first frequency value listed in Table 3-3.
9. Set the amplitude: Press **Amplitude** and enter the amplitude value for that frequency.
10. Measure the output power level.
11. Repeat steps 8 through 10 to measure power at each of the frequencies listed in Table 3-3.
12. Confirm that the measured power levels are within the limits listed in the table.

Without Modulation

a. Set the signal generator frequency to the first value listed in Table 3-3:

   Press **Frequency** > **250** > **MHz**.

b. Set the amplitude to 7 dBm:

   Press **Amplitude** > **7** > **dBm**.

c. If using a power meter, configure the power meter as follows:

1. On the power meter, press the **Frequency Cal Fac** button.
2. If applicable, select a power meter channel.
3. Use the arrow keys to enter the frequency at which to measure the power.

d. Measure the output power level.

e. Repeat steps a through d for the remaining frequencies in the table, and confirm that the power level at each point is within limits.

Table 3-3 Output Power without Modulation

N5166B/72B/82B Output Power without Modulation		
Frequency (MHz)	**Amplitude (dBm)**	**Limits (dB)**
250	7	±2
338	7	±2
425	7	±2
538	7	±2
675	7	±2
850	7	±2
1075	7	±2
1350	7	±2
1700	7	±2
2150	7	±2
2700	7	±2
3400	7	±2
4300	7	±2
5400	7	±2

With Modulation

13. Preset the signal generator: Press **Preset**.

14. Select the factory-supplied waveform `SINE_TEST_WFM`:

a. Press **Mode** > **Dual ARB** > **Select Waveform**.

b. Highlight the `SINE_TEST_WFM` waveform.

c. Press **Select Waveform**.

15. Turn the arbitrary waveform player on: Press the **ARB** softkey to highlight **On**.

16. Set the frequency to the first value listed in Table 3-4:

Press **Frequency** > **250** > **MHz**.

17. Set the amplitude to 7 dBm:

Press **Amplitude** > **7** > **dBm**.

18. If using a power meter, configure the power meter as follows:

- **a.** On the power meter, press the **Frequency Cal Fac** button.
- **b.** Select a power meter channel (if applicable).
- **c.** Use the arrow keys to enter the frequency at which to measure the power.

19. Measure the output power.

20. Repeat steps 16 through 19 for the remaining frequencies listed in Table 3-4, and confirm that the power level at each point is within limits.

Table 3-4 Output Power with Modulation

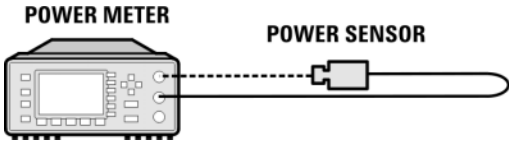
N5166B/72B/82B Output Power with Modulation		
Frequency (MHz)	**Amplitude (dBm)**	**Limits (dB)**
250	7	±2
323	7	±2
512	7	±2
814	7	±2
1275	7	±2
2025	7	±2
2750	7	±2
3750	7	±2
5250	7	±2

N5166B/72B/82B Alternative Test Procedure

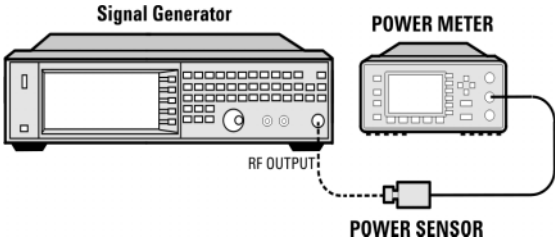
If a USB power sensor is not available, use a power meter to measure the output power of the signal generator.

Test Setup

1. Zero and calibrate the power sensor to the power meter:



2. Connect the equipment as shown below:



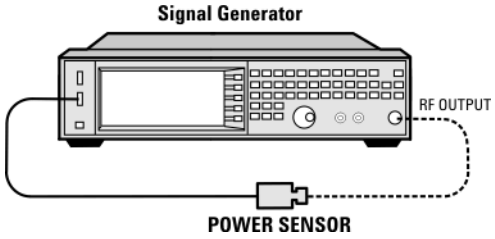
3. Preset the signal generator: Press **Preset**.
4. Turn RF on: Press **RF On/Off** so that the RF On/Off LED lights.
5. Turn modulation off:

   Press **Mod On/Off** so that the Mod On/Off LED turns off.
6. Continue the procedure from "Without Modulation" on page 36.
7. Continue the procedure from "With Modulation" on page 37 to complete the output power measurements of the N5166B/72B/82B.

N5173B/83B Test Procedure

Test Setup

1. Connect the equipment as shown:



2. Zero and calibrate the power sensor.

NOTE

USB U2000A Series Power Sensors do not require the sensor to be zeroed or calibrated.

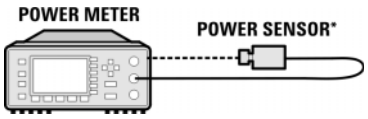
3. Connect the power sensor to the RF output of the signal generator. Once the LED on the power sensor turns off, the sensor is ready to measure.
4. Preset the signal generator: Press **Preset**
5. Turn the internal power meter channel on: Press **Aux Fctn** > **Power Meter Measurements** > **Channel A On** (or **Channel B On**).
6. Turn RF on: Press **RF On/Off** so that the **RF On/Off** LED lights.
7. Turn modulation off: Press **Mod On/Off** so that the **Mod On/Off** LED turns off.
8. Set the frequency: Press **Frequency** and enter the first frequency value listed in Table 3-6.
9. Set the amplitude: Press **Amplitude** and enter the amplitude value for that frequency.
10. Measure the output power level.
11. Repeat steps 8 through 10 to measure power at each of the frequencies listed in Table 3-6.
12. Confirm that the measured power levels are within the limits listed in the table.

N5173B/83B Alternative Test Procedure

If a USB power sensor is not available, use a power meter to measure the output power of the signal generator.

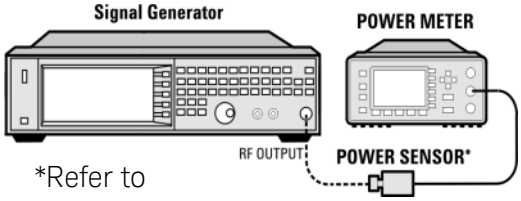
Test Setup

1. Zero and calibrate the power sensor to the power meter:



*Refer to

2. Connect the equipment as shown:



*Refer to

3. Preset the signal generator: Press **Preset**.
4. Turn RF on: Press **RF On/Off** so that the **RF On/Off** LED lights.
5. Turn modulation off: Press **Mod On/Off** so that the **Mod On/Off** LED turns off.
6. Set the frequency: Press **Frequency** and enter the first frequency value listed in Table 3-6.
7. Set the amplitude: Press **Amplitude** and enter the amplitude value for that frequency.
8. Configure the power meter for the measurement.
   a. Press the **Frequency Cal Fac** button on the power meter.
   b. Select a power meter channel (if applicable).
   c. Use the arrow keys to enter the frequency at which to measure the power.
9. Measure the output power level.
10. Repeat steps 6 through 9 to measure power at each of the 15 frequencies listed in Table 3-6.
11. Confirm that the measured power levels are within the limits listed in the table.

Table 3-5 Power Sensors by Frequency and Options

N5173B/83B	Frequency	Power Sensor
Option 513/520/540	< 5GHz	E9304A
Option 520	> 5GHz	8485A
Option 532/540	> 5GHz	8487A

Table 3-6 Leveled Output Power Limits

N5173B/83B Output Power					
Frequency	**Amplitude (dBm) Standard Power**		**Amplitude (dBm) Option 1EA**		**Limits[ab] (dB)**
	513/520	**532/540**	**513/520**	**532/540**	
200 MHz	11	7	15	14	±2
300 MHz	11	7	15	14	±2
500 MHz	11	7	15	14	±2
800 MHz	11	7	15	14	±2
1.0 GHz	11	7	15	14	±2
2.0 GHz	11	7	15	14	±2
3.1 GHz	11	7	15	14	±2
5.0 GHz	11	7	18	14	±2
10 GHz	11	7	18	14	±2
20 GHz (Option 520)	--	7	--	13	±2
31.8 GHz (Option 532)	--	7	--	13	±2
40 GHz (Option 540)	--	7	--	12	±2

a. Limit values are due to power meter uncertainty.
b. For questions around measurement uncertainty, refer to the **Data Sheet**.

Troubleshooting Problems with the Output Power Check

- Verify that you are using the appropriate power sensor.
- Normally, power sensor calibration factors are automatically downloaded to the power meter when the power meter turns on. If this does not occur, manually enter the correct calibration factors for the power sensor you are using.
- Verify that the power sensor is properly calibrated to the power meter.

4 Regulatory Information

– General on page 46
– Certification on page 46
– Assistance on page 46
– Statement of Compliance on page 46
– Compliance with Canadian EMC Requirements on page 46
– South Korean Class A EMC Declaration on page 47
– Compliance with European Machinery Directive Acoustic Requirement on page 47

General

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.

Certification

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

Assistance

Product maintenance agreements and other customer assistance agreements are available for Keysight Technologies products. For assistance, contact Keysight Technologies (see page 26).

Statement of Compliance

This product(s) complies with applicable Safety and EMC regulations and directives. A copy of the manufacturer's Declaration of Conformity for this product(s) can be obtained by contacting your local Keysight Technologies sales representative.

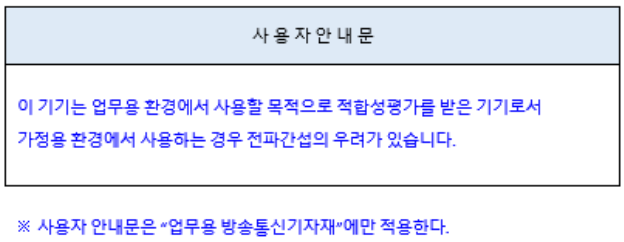
Compliance with Canadian EMC Requirements

This ISM device complies with Canadian ICES-001.

Cet appareil ISM est conforme a la norme NMB du Canada.

South Korean Class A EMC Declaration

This equipment has been conformity assessed for use in business environments. In a residential environment this equipment may cause radio interference.



Compliance with European Machinery Directive Acoustic Requirement

Table 4-1

Acoustic statement (European Machinery Directive 2002/42/EC, 1.7.4.2u)

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

5 Open Source Licenses

This chapter contains the licenses for open source software used in the Keysight CXG, MXG and EXG X-Series signal generators.

Apple mDNSresponder

Apache License

Version 2.0, January 2004

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WCELIBCEX - Windows CE C Library Extensions

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Index

A
AC
  power cord, connecting 19
  symbol 11
accessories 23
address, GPIB 22
alcohol, cleaning with 25
altitude requirements 17
Australian Communications Authority (C-tick) mark 11
auto-IP 21

B
brightness adjustment 20

C
Canadian
  EMC requirements 46
  Standards Association (CSA) mark 11
cautions 9
certification 46, 50
checking the shipment 14
cleaning suggestions 25
contrast adjustment 20

D
DHCP 21
dimensions, signal generator 16
display adjustment 20
documentation 7
documentation, ordering 23

E
European Community (CE) trademark 11

F
frequency accuracy check 30
frequency range and accuracy check 30
FTP server 22

G
German noise requirements 47
GPIB address, setting 22
guides, content of 7

H
hostname, setting 21
humidity requirements 17

I
ICES symbol 11
ICES-001 46
IEC Publication 61010 46, 57
inspection, shipping container 14
installation guide content 7
instrument warm up 27
interface, GPIB 22
interface, LAN 21
IP address, setting 21
ISM1-A symbol 11

K
Keysight, contacting 26

L
LAN configuration 21
line setting requirements 18
LXI standard specifications symbol 11

M
manuals, content of 7
manuals, ordering 23

N
noise requirements 47

O
operation verification 27
operation, remote 21
output power, checking 32

P
power
  checking 32
  connecting 19
  disconnecting 19
  line cord 19
  requirements 18
  symbol 11
programming 21
programming guide content 7

R
references, content of 7
regulatory information 45, 49
remote operation 21
requirements 17, 18, 47

returning a signal generator 25

S
safety information 9
SCPI
  reference content 7
SCPI, enabling 22
self test 28
server, enabling 22
service
  guide content 7
service, Keysight sales and service offices 26
shipping container, inspection 14
shipping requirements 25
sockets, enabling 22
South Korean Emc Requirements 47
standby symbol 11

T
temperature requirements 17
troubleshooting output power 32

U
user
  documentation content 7

V
ventilation requirements 18
verification, operation 27
voltage requirements 18
VXI-11, enabling 22

W
warnings 9
web server 22
weight, signal generator 16

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