Keysight N9310A Signal Generator

Notice: This document contains references to Agilent. Please note that Agilent's Test and Measurement business has become Keysight Technologies. For more information, go to www.keysight.com.

KEYSIGHT TECHNOLOGIES

Quick Start Guide

Notices

Trademark Acknowledgments

Manual Part Number

N9310-90003

Edition

Edition 3, June 2014

Printed in China

Published by:
Keysight Technologies
No 116 Tianfu 4th street
Chengdu, 610041, China

Warranty

THE MATERIAL CONTAINED IN THIS DOCUMENT IS PROVIDED "AS IS," AND IS SUBJECT TO BEING CHANGED, WITHOUT NOTICE, IN FUTURE EDITIONS. FURTHER, TO THE MAXIMUM EXTENT PERMITTED BY APPLICABLE LAW, KEYSIGHT DISCLAIMS ALL WARRANTIES, EITHER EXPRESS OR IMPLIED WITH REGARD TO THIS MANUAL AND ANY INFORMATION CONTAINED HEREIN, INCLUDING BUT NOT LIMITED TO THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE. KEYSIGHT SHALL NOT BE LIABLE FOR ERRORS OR FOR INCIDENTAL OR CONSEQUENTIAL DAMAGES IN CONNECTION WITH THE FURNISHING, USE, OR PERFORMANCE OF THIS DOCUMENT OR ANY INFORMATION CONTAINED HEREIN. SHOULD KEYSIGHT AND THE USER HAVE A SEPARATE WRITTEN AGREEMENT WITH WARRANTY TERMS COVERING THE MATERIAL IN THIS DOCUMENT THAT CONFLICT WITH THESE TERMS, THE WARRANTY TERMS IN THE SEPARATE AGREEMENT WILL CONTROL.

Technology Licenses

The hardware and/or software described in this document are furnished under a license and may be used or copied only in accordance with the terms of such license.

U.S. Government Rights

The Software is "commercial computer software," as defined by Federal Acquisition Regulation ("FAR") 2.101. Pursuant to FAR 12.212 and 27.405-3 and Department of Defense FAR Supplement ("DFARS") 227.7202, the U.S. government acquires commercial computer software under the same terms by which the software is customarily provided to the public. Accordingly, Keysight provides the Software to U.S. government customers under its standard commercial license, which is embodied in its End User License Agreement (EULA), a copy of which can be found at http://www.keysight.com/find/sweula The license set forth in the EULA represents the exclusive authority by which the U.S. government may use, modify, distribute, or disclose the Software. The EULA and the license set forth therein, does not require or permit, among other things, that Keysight: (1) Furnish technical information related to commercial computer software or commercial computer software documentation that is not customarily provided to the public; or (2) Relinquish to, or otherwise provide, the government rights in excess of these rights customarily provided to the public to use, modify, reproduce, release, perform, display, or disclose commercial computer software or commercial computer software documentation. No additional government requirements beyond those set forth in the EULA shall apply, except to the extent that those terms, rights, or licenses are explicitly required from all providers of commercial computer software pursuant to the FAR and the DFARS and are set forth specifically in writing elsewhere in the EULA. Keysight shall be under no obligation to update, revise or otherwise modify the Software. With respect to any technical data as defined by FAR 2.101, pursuant to FAR 12.211 and 27.404.2 and DFARS 227.7102, the U.S. government acquires no greater than Limited Rights as defined in FAR 27.401 or DFAR 227.7103-5 (c), as applicable in any technical data.

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.

Quick Start Guide

This *Quick Start Guide* helps you in preparing the signal generator for use. With this guide, you will become familiar with its basic operation and programming information. For more information, please refer to *User's Guide* from:
www.keysight.com/find/n9310a

KEYSIGHT TECHNOLOGIES

Check the Shipment

After receiving the shipment, you should first check the shipment and your order list refer to the procedures below.

- Inspect the shipping container for damage.

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

- Carefully remove the contents from the shipping container and verify that your order is complete. Each signal generator includes the following items as standard:

Item	Quantity	Part Number
N9310A signal generator	1	N9310A
USB cable	1	8121-1482
Three-pin power cord	1	Specific to location
Quick Start Guide	1	N9310-90003
Help kit CD-ROM	1	N9310-84500
Calibration certificate	1	5962-0476

- Verify if the ordered options are included in the shipment by checking the serial number on the rear panel of the signal generator:

Option	Name	Part number
001	I/Q modulator	N9310A-001
1CM	Rackmount flange kit	N9310A-1CM
1TC	Hard transit case	N9310A-1TC

Any question about your shipment, please contact Keysight Technologies Customer Contact Center for consulting and service.

Safety Notice

Please read the following warnings and cautions carefully before you power on the signal generator to ensure your personal and instrumental safety.

WARNING **Always use a well-grounded, three-pin AC plug and power cord to connect to a power source. Personal injury may occur if there is any interruption of the AC power cord of the signal generator. Intentional interruption is prohibited.**

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.**

WARNING **Electrical shock may result if the signal generator is connected from the power supply while cleaning. Do not attempt to clean internally.**

CAUTION To install the signal generators in other racks, note that they may promote shock hazards, overheating, dusting contamination, and inferior system performance. Consult your Keysight customer engineer about installation, warranty, and support details.

CAUTION Damage to the signal generator may result when the total power dissipated in the cabinet is greater than 800 watts. When this condition exists, forced convection must be applied.

CAUTION The RF OUT connector is for signal output only. Avoid manually adding any external signal into the signal generator via this connector. This connector endures maximum +36 dBm RF power or 30 V DC input (1 minute lasting). Or it may result in instrument damages.

N9310A Overview

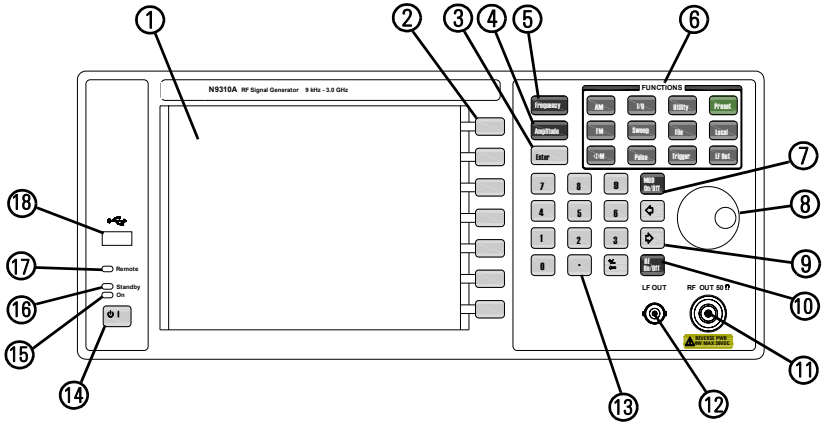
An Keysight N9310A RF Signal Generator finds general purpose test application between 9 kHz to 3 GHz. It is capable to generate variables of signals as shown below, which could be applied in the field of manufacture, service and repair, development and education:

- Continuous wave (CW) signal
- Low frequency (LF) signal
- RF/LF/Amplitude step sweep
- Amplitude modulation (AM) signal
- Frequency modulation (FM) signal
- Phase modulation (ΦM) signal
- Pulse modulation signal

The signal generator comprises an optional broadband I/Q modulator (option 001). With this option, N9310A is capable of generating complicated digital signal widely used in modern digital communication system in conjunction with an external I/Q signal generator.

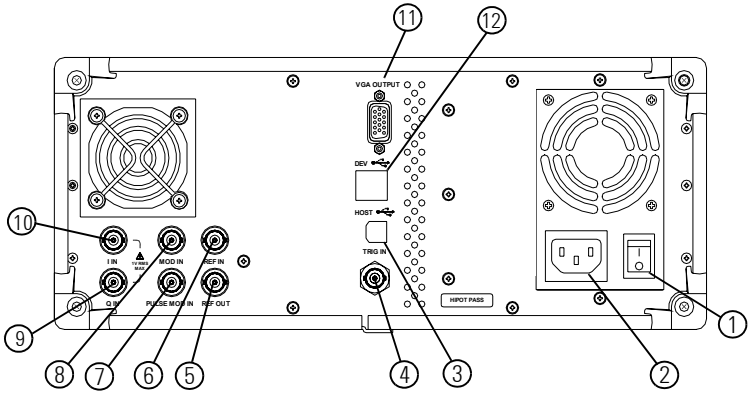
The N9310A RF Signal Generator has USB connectors for your remote control and fast file transferring.

Front Panel at a Glance



1	Screen	10	RF On/Off hardkey
2	Softkeys	11	RF OUT connector
3	Enter key	12	LF OUT connector
4	Amplitude hardkey	13	Numeric keypad
5	Frequency hardkey	14	Standby switch
6	Function hardkeys	15	Switch On LED
7	Mod On/Off hardkey	16	Standby LED
8	Knob	17	Remote LED
9	Arrow hardkeys	18	USB Device connector

Rear Panel at a Glance



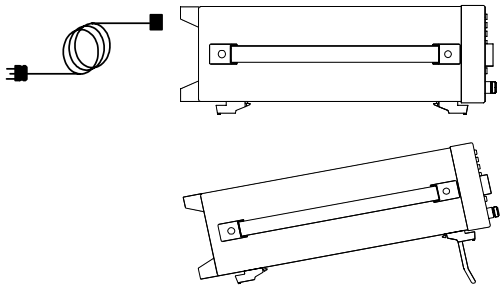
1	AC power switch	7	Pulse input connector
2	AC power connector	8	Modulation source input connector
3	USB host connector	9	Q input connector
4	Trigger input connector	10	I input connector
5	Reference output connector	11	VGA connector
6	Reference input connector	12	USB device connectors

The signal generator rear panel provides input, output, and remote interface connections. Refer to “Rear Panel Overview” on *User’s Guide* for more information.

Preparation for Use

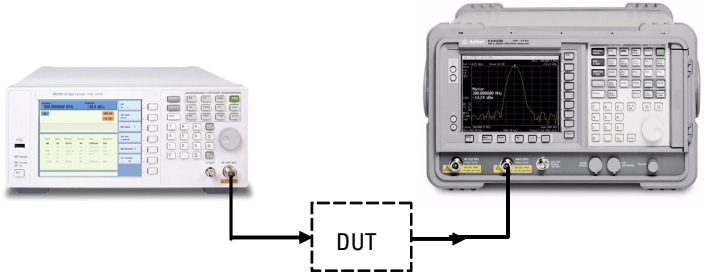
1 Connect the power cord. Insert the plug into a power socket provided with a protective earth. Set the tilt adjustor for your preference.

Figure 1 Plug in and angle adjustment



2 Connect an RF cable to the output connector of the signal generator and then connect the cable to your DUT (device under test) or other instrument.

Figure 2 Setup for DUT test with ESA



Turn On the Signal Generator

Follow this procedure to power on the signal generator:

1. Press the power switch on the rear panel. The orange LED will light and the signal generator is in standby mode.
2. Press the standby switch on the front panel. The green LED will light.

   Self-initialization takes about 30 seconds; the signal generator then defaults to the menu mode with the maximum frequency of 3 GHz and minimum amplitude of –127 dBm, then the signal generator is ready for your current use. After power on, let the signal generator warm up for 45 minutes for stabilization.

NOTE The front panel switch is a standby switch only; it is not a power switch. To disconnect the signal generator from the line power, shut off the power switch on the rear panel.

Generating a Continuous Wave Signal

To simplify the example, assume you wish to generate a continuous wave (CW) signal with a:

- Frequency of 1 GHz
- Power level of –20.0 dBm

Setting up Frequency

Operation	Notes
1. Press Preset hardkey	Sets the signal generator to its factory-defined instrument state.
2. Press Frequency hardkey	Frequency becomes the active function in the data entry area. This area displays the factory preset frequency.
3. Enter **1** using the numeric keypad and press **GHz** softkey	The `FREQUENCY` area and the active entry area both display the new carrier frequency (`1.0000000000 GHz`).

Setting up Amplitude

Operation	Notes
1. Press Amplitude hardkey	Frequency becomes the active function in the data entry area. This area displays the factory preset frequency.
2. Enter **–20** using the numeric keypad and press **dBm** softkey	The `AMPLITUDE` area and the active entry area display the new level (`–20.0 dBm`).

Enable RF Output

Operation	Notes
Press RF On/Off hardkey	Notice that the display annunciator changes from RF OFF to RF ON. The CW signal is now available at the RF OUT connector.

Figure 3 CW output Screenshot

Generating a Sweep Signal

To simplify the example, assume you wish to generate a RF sweep signal with the characteristics of:

- Frequency range from 1 to 2 GHz
- Step sweep of 10 points
- Dwell time of 500 ms for each step

Setting up a Step Sweep

Operation	Notes
1. Press Preset hardkey	Sets the signal generator to its factory-defined instrument state.
2. Press Sweep hardkey	Enables the submenu of sweep softkeys.
3. Press **Step Sweep** softkey	Enables the submenu of sweep settings.
4. Press **RF Start > 1 > GHz**	Sets the step sweep start frequency to 1 GHz.
5. Press **RF Stop > 2 > GHz**	Sets the step sweep stop frequency to 2 GHz.
6. Press **#Points > 10 > Enter**	Sets the step point to 10 in the step sweep.
7. Press **More>Step Dwell>500>ms**	Sets the dwell time to 500 ms for each point in the step sweep.

Enable RF Sweep

Operation	Notes
1. Press RF On/Off hardkey	Turn on the RF OUT connector. Notice that the display annunciator changes from RF OFF to RF ON.
2. Press **Return>Sweep Mode**	Displays another menu allowing you to choose the sweep mode
3. Press **RF** softkey	The SWEEP indicates sweep on, signifying that the sweep mode is enabled. The sweep signal is now available at the RF OUT connector.

Generating a Modulated Signal

To simplify the example, assume you wish to generate an amplitude modulated (AM) signal with a:

- Carrier frequency of 900 MHz
- Carrier power level of –20.0 dBm
- AM depth of 60%

Setting up carrier frequency and amplitude

Operation	Notes
1. Press Preset hardkey.	Sets the signal generator to its factory-defined instrument state.
2. Press Frequency > **900** > **MHz**	Sets the carrier frequency to **900 MHz** for amplitude modulation.
3. Press Amplitude **>–20** > **dBm**	Sets the carrier amplitude to **–20 dBm** for amplitude modulation.

Setting up Amplitude Modulation

Operation	Notes
1. Press AM hardkey.	Displays the **AM** first level menu.
2. Press **AM Depth > 60 > %**	Set the AM depth to 60%.
3. Press **AM On Off** softkey.	AM toggles from **Off** to **On**. The AM indicates "On" signifying that you have enabled amplitude modulation.

Enable Amplitude Modulation

Operation	Notes
Press RF On/Off hardkey.	The display annunciator changes from RF OFF to RF ON. The AM signal is now available at RF OUT connector.

NOTE After pressing Preset hardkey, MOD ON will display on the screen which indicates the modulation is active. If you ignore this procedure, you need to press Mod On/Off hardkey to enable the modulator.

Figure 4 Amplitude Modulation on

Refer to *User's Guide* for more information.

Some Help Hints

Refer to the following hints to set the signal generator to your required setting:

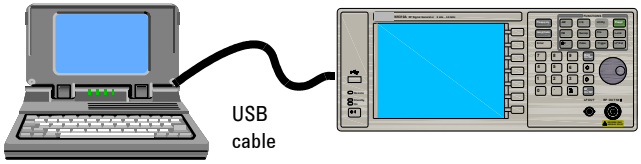
- Set the screen saver on by pressing Utility **> Screen Saver> On**
- Select a display style by pressing Utility **> Display Style**
- Toggle the phase noise mode by pressing Utility **> Opti. Φ Noise> Normal/ResFM Opt.**
- Save the current configures for your frequent use to either local memory or an external USB memory by pressing File **> Save**
- Connect and set an external reference by pressing Utility **> Ref Setups**
- Connect an external display monitor to the VGA connector for the education projects or other needs.

NOTE The calibration cycle of N9310A RF Signal Generator is one year.

NOTE A button cell provides power to the real time clock of the signal generator. It is not rechargeable. If you find your N9310A encounters a clock defect, please contact your nearest Keysight Customer Contact Center (CCC) for service.

Remote Control

The N9310A signal generator provides USB connection to your PC, allowing you run your N9310A in remote mode.



Before remotely control your N9310A, Make sure your PC meets the following minimum requirements:

- 450 MHz processor
- 128 MB RAM
- 175 MB available disk space
- Microsoft® Windows XP or Windows 7
- Display resolution: 800*600

NOTE Pressing Local hardkey returns the signal generator from remote mode to local mode.

Installing Keysight IO Libraries suite

Before trying to remotely control your N9310A, you need to install **Keysight IO Libraries suite** on your PC. The Keysight IO Libraries Suite is a general purpose instrument driver for all Keysight test and measurement instruments. This software is in the documentation CD with the shipment, or download a latest version from

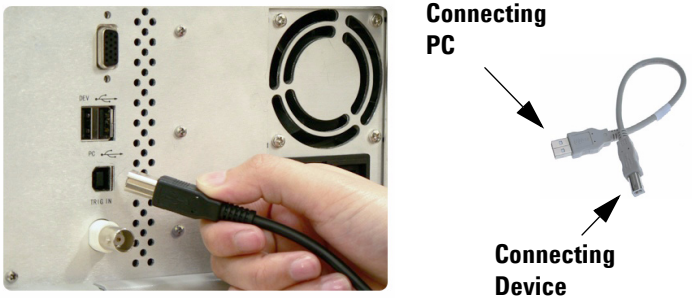
http://www.keysight.com/find/iolib

Follow the windows wizard to finish the installation. Then, you have successfully set up an environment for remotely control your N9310A.

Connecting your N9310A to a Controller

1. Switch on your N9310A. The orange standby LED on the front panel is turned off and the green LED is turned on.
2. Refer to the following Figure for your PC to instrument connection.

Figure 5 USB cable connection for remote control



Then the signal generator is available for your remotely control. Any further information on programming please refer to *User's Guide*.

SCPI Command List

	SCPI Command	Utility
Frequency SCPI command	:FREQuency:CW <val> <unit> :FREQuency:CW?	Set CW frequency
	:FREQuency:RF:STARt <val> <unit> :FREQuency:RF:STARt?	Set RF start frequency
	:FREQuency:LF:STARt <val> <unit> :FREQuency:LF:STARt?	Set LF start frequency
	:FREQuency:RF:STOP <val> <unit> :FREQuency:RF:STOP?	Set RF stop frequency
	:FREQuency:LF:STOP <val> <unit> :FREQuency:LF:STOP?	Set LF stop frequency
	:FREQuency:RF:SCALe LOG|LIN :FREQuency:RF:SCALe?	Set Sweep Scaling
Amplitude SCPI command	:AMPLitude:CW <val> <unit> :AMPLitude:CW?	Set CW frequency
	:AMPLitude:STARt <val> <unit> :AMPLitude:STARt?	Set Start Amplitude
	:AMPLitude:STOP <val> <unit> :AMPLitude:STOP?	Set Stop Amplitude
Trigger SCPI command	:TRIGger:IMMediate	Sweep immediately
	:TRIGger:SSWP	Trigger a single sweep
Sweep SCPI command	:SWEep:RF:STATe ON|OFF|1|0 :SWEep:RF:STATe?	Turn On/Off RF Sweep
	:SWEep:LF:STATe ON|OFF|1|0 :SWEep:LF:STATe?	Turn On/Off LF Sweep
	:SWEep:AMPLitude:STATe ON|OFF|1|0 :SWEep:AMPLitude:STATe?	Turn On/Off Ampl Sweep

	SCPI Command	Utility
	:SWEep:RF:STARt <val> <unit> :SWEep:RF:STARt?	Set RF start frequency
	:SWEep:LF:STARt <val> <unit> :SWEep:LF:STARt?	Set LF start frequency
	:SWEep:RF:STOP <val> <unit> :SWEep:RF:STOP?	Set RF stop frequency
	:SWEep:LF:STOP <val> <unit> :SWEep:LF:STOP?	Set LF stop frequency
	:SWEep:AMPLitude:STARt <val> <unit> :SWEep:AMPLitude:STARt?	Set start amplitude
	:SWEep:AMPLitude:STOP <val> <unit> :SWEep:AMPLitude:STOP?	Set stop amplitude
	:SWEep:STEP:POINts <val> :SWEep:STEP:POINts?	Set sweep point
	:SWEep:STEP:DWELl <val> <unit> :SWEep:STEP:DWELl?	Set step dwell time
	:SWEep:REPeat SINGle|CONTinuous :SWEep:REPeat?	Set sweep repeat
	:SWEep:STRG IMMediate|EXT|KEY :SWEep:STRG?	Set sweep trigger
	:SWEep:STRG:SLOPe EXTN|EXTP :SWEep:STRG:SLOPe?	Set sweep trigger slope
	:SWEep:PTRG IMMediate|EXT|KEY :SWEep:PTRG?	Set point trigger
	:SWEep:PTRG:SLOPe EXTN|EXTP :SWEep:PTRG:SLOPe?	Set point trigger slope
	:SWEep:DIRection UP|DOWN :SWEep:DIRection?	Set sweep direction
AM **SCPI command**	:AM:STATe ON|OFF|1|0 :AM:STATe?	Turn on/off AM

	SCPI Command	Utility
	:AM:DEPTh <val> :AM:DEPTh?	Set AM depth
	:AM:SOURce INT|EXT|INT+EXT :AM:SOURce?	Set AM source
	:AM:RATE <val> <unit> :AM:RATE?	Set AM rate
	:AM:EXTCoupling AC|DC :AM:EXTCoupling?	Set external coupling
FM SCPI command	:FM:STATe ON|OFF|1|0 :FM:STATe?	Turn on/off FM
	:FM:DEViation <val> <unit> :FM:DEViation?	Set FM deviation
	:FM:SOURce INT|EXT|INT+EXT :FM:SOURce?	Set FM source
	:FM:RATE <val> <unit> :FM:RATE?	Set FM rate
	:FM:EXTCoupling AC|DC :FM:EXTCoupling?	Set external coupling
ΦM SCPI command	:PM:STATe ON|OFF|1|0 :PM:STATe?	Turn on/off ΦM
	:PM:DEViation <val> <unit> :PM:DEViation?	Set ΦM deviation
	:PM:RATE <val> <unit> :PM:RATE?	Set ΦM rate
Pulse SCPI command	:PULM:STATe ON|OFF|1|0 :PULM:STATe?	Turn on/off pulse
	:PULM:SOURce INT|EXT :PULM:SOURce?	Set pulse source
	:PULM:PERiod <val> <unit> :PULM:PERiod?	Set pulse period

	SCPI Command	Utility
	:PULM:WIDTh <val> <unit> :PULM:WIDTh?	Set pulse width
I/Q modulation SCPIcommand	:IQ:STATe ON|OFF|1|0 :IQ:STATe?	Turn On/Off I/Q modulation
LF Out SCPI command	:LFOutput:STATe ON|OFF|1|0 :LFOutput:STATe?	Turn on/off LF output
	:LFOutput:FREQuency <val> <unit> :LFOutput:FREQuency?	Set LF frequency
	:LFOutput:AMPLitude <val> <unit> :LFOutput:AMPLitude?	Set LF amplitude
System SCPI command	:SYSTem:DISPlay WHITE|BLUE|GREEN :SYSTem:DISPlay?	Set display style
	:SYSTem:SSAVer ON|OFF|1|0 :SYSTem:SSAVer?	Set screen saver
	:SYSTem:ERRor?	View error messages
	:SYSTem:DATE <year><month><day> :SYSTem:DATE?	Set system date
	:SYSTem:TIME <hour><minute> :SYSTem:TIME?	Set system time
	:SYSTem:REFerence:FREQuency INT10MHz|EXT2MHz|EXT5MHz|EXT10MHz :SYSTem:REFerence:FREQuency?	Set external reference source
	:SYSTem:PNMD NORMal|RESFM :SYSTem:PNMD?	Set phase noise mode
Modulation SCPI command	:MOD:STATe ON|OFF|1|0 :MOD:STATe?	Turn on/off modulation
RF OUT SCPI command	:RFOutput:STATe ON|OFF|1|0 :RFOutput:STATe?	Turn on/off RF output

Contact Keysight Technologies

Keysight Technologies has offices around the world to provide you with complete support for your signal generator. To obtain servicing information or to order replacement parts, contact the Keysight Technologies customer contact center listed below. In any correspondence or telephone conversations, refer to your signal generator by its product number and full serial number.

Press Utility **> Information** to find those information.

Online assistance: http://www.keysight.com/find/assist

United States

(tel) 800 829 4444
(fax) 800 829 4433

Canada

(tel) 877 894 4414
(fax) 800 746 4866

China

(tel) 800 810 0189
(fax) 800 820 2816

Europe

(tel) +31 20 547 2111

Japan

(tel) +81 426 56 7832
(fax) +81 426 56 7840

Korea

(tel) 080 769 0800
(fax) 080 769 0900

Latin America

(tel) +1 (305) 269 7500

Taiwan

(tel) 0800 047 866
(fax) 0800 286 331

Australia

(tel) 1 800 629 485
(fax) +61 (3) 9210 5947

Other Asia Pacific Countries

(tel) +65 6375 8100

(fax) +65 6755 0042
Email: tm_ap@keysight.com

Factory Default Settings

Item	Default	Item	Default
Frequency	3.000 000 0000 GHz	Sweep Type	Step
Amplitude	–127.0 dBm	Sweep/Point Trigger	Immediate
LF Out	Off	Sweep Direction	Up
LF Out Freq	1.0000 kHz	Trig In Polarity	Negative
LF Out Ampl	500 mV	Modulation	
Mod On/Off	On	Modulation State	Off
RF On/Off	Off	AM Depth	0.0 %
Sweep		ΦM Deviation	0.000 rad
Sweep Mode	Off	FM Deviation	20 Hz
RF Start	9.0000 kHz	Pulse Period	200 μs
RF Stop	3.000 000 0000 GHz	Pulse Width	100 μs
Ampl Start	–127.0 dBm	Modulation Source	INT
Ampl Stop	–126.0 dBm	Modulation Rate	1.0000 kHz
LF Start	20.0 Hz	Ext Coupling	AC
LF Stop	80.0000 kHz	System	
#Point	10	Catalog	Local
Step Dwell	10.0 ms	Φ Noise Mode	Normal
Sweep Repeat	Cont	Reference Source	Int_10MHz

Edition 3 June 2014

N9310-90003

www.keysight.com