

Keysight Technologies

M9380A PXIe CW Source

1 MHz to 3 or 6 GHz

Specifications Guide



Notices

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Manual Part Number

M9380-90015

Edition

May 2015
Printed in USA
Keysight Technologies, Inc.

Sales and Technical Support

For product specific information and support, and to obtain the latest software and documentation, refer to
www.keysight.com/find/m9380a.

Worldwide contact information for repair and service can be found at: www.keysight.com/find/assist.

Regulatory Compliance

This product has been designed and tested in accordance with accepted industry standards, and has been supplied in a safe condition. To review the Declaration of Conformity, go to: <http://regulations.about.keysight.com>.

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Safety Notices

The following safety precautions

should be observed before using this product and any associated instrumentation. This product is intended for use by qualified personnel who recognize shock hazards and are familiar with the safety precautions required to avoid possible injury. Read and follow all installation, operation, and maintenance information carefully before using the product.

WARNING

If this product is not used as specified, the protection provided by the equipment could be impaired. This product must be used in a normal condition (in which all means for protection are intact) only.

The types of product users are:

- Responsible body is the individual or group responsible for the use and maintenance of equipment, for ensuring that the equipment is operated within its specifications and operating limits, and for ensuring operators are adequately trained.
- Operators use the product for its intended function. They must be trained in electrical safety procedures and proper use of the instrument. They must be protected from electric shock and contact with hazardous live circuits.
- Maintenance personnel perform routine procedures on the product to keep it operating properly (for example, setting the line voltage or replacing consumable materials). Maintenance procedures are described in the user documentation. The procedures explicitly state if the operator may perform them. Otherwise, they should be performed only by service personnel.
- Service personnel are trained to work on live circuits, perform safe

installations, and repair products. Only properly trained service personnel may perform installation and service procedures.

WARNING

Operator is responsible to maintain safe operating conditions. To ensure safe operating conditions, modules should not be operated beyond the full temperature range specified in the Environmental and physical specification. Exceeding safe operating conditions can result in shorter lifespans, improper module performance and user safety issues. When the modules are in use and operation within the specified full temperature range is not maintained, module surface temperatures may exceed safe handling conditions which can cause discomfort or burns if touched. In the event of a module exceeding the full temperature range, always allow the module to cool before touching or removing modules from chassis.

Keysight products are designed for use with electrical signals that are rated Measurement Category I and Measurement Category II, as described in the International Electrotechnical Commission (IEC) Standard IEC 60664. Most measurement, control, and data I/O signals are Measurement Category I and must not be directly connected to mains voltage or to voltage sources with high transient over-voltages. Measurement Category II connections require protection for high transient over-voltages often associated with local AC mains connections. Assume all measurement, control, and data I/O connections are for connection to Category I sources unless otherwise marked or described in the user documentation.

Exercise extreme caution when a shock hazard is present. Lethal voltage may be present on cable connector jacks or test fixtures. The American National Standards Institute (ANSI) states that a shock hazard exists when voltage levels greater than 30V RMS, 42.4V peak, or 60VDC are present. A good safety practice is to expect that hazardous voltage is present in any unknown circuit before measuring.

Operators of this product must be protected from electric shock at all times. The responsible body must ensure that operators are prevented access and/or

insulated from every connection point. In some cases, connections must be exposed to potential human contact. Product operators in these circumstances must be trained to protect themselves from the risk of electric shock. If the circuit is capable of operating at or above 1000V, no conductive part of the circuit may be exposed.

Do not connect switching cards directly to unlimited power circuits. They are intended to be used with impedance-limited sources. NEVER connect switching cards directly to AC mains. When connecting sources to switching cards, install protective devices to limit fault current and voltage to the card.

Before operating an instrument, ensure that the line cord is connected to a properly-grounded power receptacle. Inspect the connecting cables, test leads, and jumpers for possible wear, cracks, or breaks before each use.

When installing equipment where access to the main power cord is restricted, such as rack mounting, a separate main input power disconnect device must be provided in close proximity to the equipment and within easy reach of the operator.

For maximum safety, do not touch the product, test cables, or any other instruments while power is applied to the circuit under test. ALWAYS remove power from the entire test system and discharge any capacitors before: connecting or disconnecting cables or jumpers, installing or removing switching cards, or making internal changes, such as installing or removing jumpers.

Do not touch any object that could provide a current path to the common side of the circuit under test or power line (earth) ground. Always make measurements with dry hands while standing on a dry, insulated surface capable of withstanding the voltage being measured.

The instrument and accessories must be used in accordance with its specifications and operating instructions, or the safety of the equipment may be impaired.

Do not exceed the maximum signal levels of the instruments and accessories, as defined in the specifications and operating information, and as shown on the instrument or test

fixture panels, or switching card.

When fuses are used in a product, replace with the same type and rating for continued protection against fire hazard.

Chassis connections must only be used as shield connections for measuring circuits, NOT as safety earth ground connections.

If you are using a test fixture, keep the lid closed while power is applied to the device under test. Safe operation requires the use of a lid interlock.

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.

Instrumentation and accessories shall not be connected to humans.

Before performing any maintenance, disconnect the line cord and all test cables.

To maintain protection from electric shock and fire, replacement components in mains circuits – including the power transformer, test leads, and input jacks – must be purchased from Keysight. Standard fuses with applicable national safety approvals may be used if the rating and type are the same. Other components that are not safety-related may be purchased from other suppliers as long as they are equivalent to the original component (note that selected parts should be purchased only through Keysight to maintain accuracy and functionality of the product). If you are unsure about the applicability of a replacement component, call an Keysight office for information.

WARNING

No operator serviceable parts inside. Refer servicing to qualified personnel. To prevent electrical shock do not remove covers. For continued protection against fire hazard, replace fuse with same type and rating.

PRODUCT MARKINGS:



The CE mark is a registered trademark of the European Community.



Australian Communication and Media Authority mark to indicate regulatory compliance as a registered supplier.

**ICES/NMB-001
ISM GRP.1 CLASS A**

This symbol indicates product compliance with the Canadian Interference-Causing Equipment Standard (ICES-001). It also identifies the product is an Industrial Scientific and Medical Group 1 Class A product (CISPR 11, Clause 4).



This symbol represents the South Korean Class A EMC Declaration. This equipment is Class A suitable for professional use and is for use in electromagnetic environments outside of the home.

A 급 기기 (업무용 방송통신기자재)
이 기기는 업무용 (A 급) 전자파적합
기기로서 판매자 또는 사용자는 이 점
을 주 의하시기 바라 며 , 가정외의 지역
에서 사용하는 것을 목적으로 합니다.



This symbol indicates separate collection for electrical and electronic equipment, mandated under EU law as of August 13, 2005. All electric and electronic equipment are required to be separated from normal waste for disposal (Reference WEEE Directive, 2002/96/EC).



This symbol indicates the instrument is sensitive to electrostatic discharge (ESD). ESD can damage the highly sensitive components in your instrument. ESD damage is most likely to occur as the module is being installed or when cables are connected or disconnected. Protect the circuits from ESD damage by wearing a grounding strap that provides a high resistance path to ground. Alternatively, ground yourself to discharge any built-up static charge by touching the outer shell of any grounded instrument chassis before touching the port connectors.



This symbol on an instrument means caution risk of danger. You should refer to the operating instructions located in the user documentation in all cases where the symbol is marked on the instrument.



This symbol 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.

CLEANING PRECAUTIONS:

To prevent electrical shock, disconnect the Keysight Technologies 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. To clean the connectors, use alcohol in a well-ventilated area. Allow all residual alcohol moisture to evaporate, and the fumes to dissipate prior to energizing the instrument.

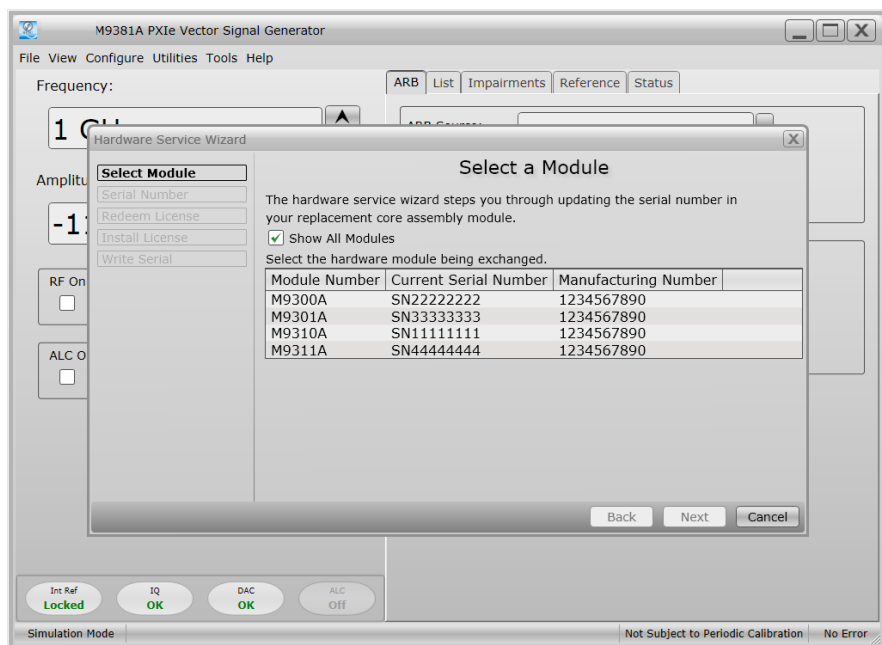
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How to use this document

This document contains technical specifications for all versions of the M9380A PXIe CW Source. Specifications published in the datasheet only apply to the current manufacturing version of the equipment. If a specification only applies to a certain manufacturing version of the equipment, it is indicated in this document. Manufacturing numbers can be found on the side of the module, or in the instrument's soft front panel, below.

This screen is accessed by selecting Utilities > Hardware Service Wizard > Show All Modules.



Technical Specifications and Characteristics

Definitions for specifications

Temperatures referred to in this document are defined as follows:

- Full temperature range = Individual module temperature of $\leq 75^{\circ}\text{C}$, as reported by the module, and environment temperature of 0 to 55°C .
- Controlled temperature range = Individual module temperature of $\leq 55^{\circ}\text{C}$, as reported by the module, and environment temperature of 20 to 30°C .

Specifications describe the warranted performance of calibrated instruments. Data represented in this document are specifications unless otherwise noted under the following conditions.

- Calibrated instruments have been stored for a minimum of 2 hours within the full temperature range
- 45 minute warm-up time
- Calibration cycle maintained
- When used with Keysight M9300A frequency reference
- When used with Keysight interconnection cables

Characteristics describe product performance that is useful in the application of the product, but that is not covered by the product warranty. Characteristics are often referred to as Typical or Nominal values and are italicized.

- Typical describes characteristic performance, which 80% of instruments will meet when operated within the controlled temperature range.
- Nominal describes representative performance that is useful in the application of the product when operated within the controlled temperature range.

Recommended best practices in use

- Use slot blockers and EMC filler panels in empty module slots to ensure proper operating temperatures.
- Keysight chassis and slot blockers optimize module temperature performance and reliability of test.
- At environment temperatures above 45°C , chassis fan should be set to high.

Additional information

- All graphs contain measured data from one unit and is representative of product performance at the controlled temperature range unless otherwise noted.
- The specifications contained in this document are subject to change.

Technical Specifications and Characteristics

Frequency

Frequency range		
Option F03	1 MHz to 3 GHz	
Option F06	1 MHz to 6 GHz	
Resolution	0.01 Hz	
Frequency switching speed ¹		
	≤ 5 ms, nominal	
Frequency reference (M9300A PXIe frequency reference module)		
Reference outputs		
100 MHz Out (Out 1 through Out 5)		
Amplitude	≥ 10 dBm	13 dBm, typical
Connectors	5 SMB snap-on	
Impedance	50 Ω, nominal	
10 MHz Out		
Amplitude	9.5 dBm, nominal	
Connectors	1 SMB snap-on	
Impedance	50 Ω, nominal	
OCXO Out		
Amplitude	11.5 dBm, nominal	
Connectors	1 SMB snap-on	
Impedance	50 Ω, nominal	

1. Mean time from IVI command to carrier frequency settled within 1 ppm or 1 kHz whichever is greater and amplitude settled within 0.2 dB (at the controlled temperature range) or within 0.5 dB (at the full temperature range). If the ALC is off, the settle limit is 0.5 dB above +10 dBm, (at the controlled temperature range). Simultaneous carrier frequency and amplitude switching.

Technical Specifications and Characteristics

Frequency (continued)

Frequency accuracy	
Same as accuracy of internal time base or external reference input	
Internal timebase	
Accuracy	\pm (time since last adjustment x aging rate) \pm temperature effects \pm calibration accuracy
Frequency stability	
Aging rate	
Daily	$< \pm 0.5$ ppb/day, after 72 hour warm-up
Yearly	$< \pm 0.1$ ppm/year, after 72 hours warm-up
Total 10 years	$< \pm 0.6$ ppm/10yrs, after 72 hours warm-up
Achievable initial calibration accuracy (at time of shipment)	$\pm 5 \times 10^{-8}$
Temperature effects	
20 to 30 °C	$< \pm 10$ ppb
Full temperature range	$< \pm 50$ ppb
Warm up	
5 minutes over +20 to +30 °C, with respect to 1 hour	$< \pm 0.1$ ppm
15 minutes over +20 to +30 °C, with respect to 1 hour	$< \pm 0.01$ ppm
External reference input	
Frequency	1 MHz to 110 MHz, sine wave
Lock range	± 1 ppm, nominal
Amplitude	0 to 10 dBm, nominal
Connector	1 SMB snap-on
Impedance	50 Ω , nominal

Technical Specifications and Characteristics

Amplitude

Output parameters					
Settable range		Standard		Option 1EA	
		+10.7 to -130 dBm		+20 to -130 dBm	
Resolution					
ALC on ¹		0.02 dB, nominal			
ALC off		0.3 dB, nominal			
Maximum output power - M9310A manufacturing numbers higher than xx5236xxxx					
Frequency		Standard		Option 1EA	
1 MHz to 5 GHz		+10 dBm		+19 dBm	
> 5 to 6 GHz		+10 dBm		+18 dBm	
Maximum output power - M9310A manufacturing numbers xx5236xxxx and lower					
Frequency		Standard		Option 1EA	
1 MHz to 2.5 GHz		+10 dBm		+19 dBm	
> 2.5 to 6 GHz		+10 dBm		+18 dBm	
Absolute level accuracy in CW mode [ALC on] ² - M9310A manufacturing numbers higher than xx5236xxxx					
Frequency	< Max power to -20 dBm	< -20 to -110 dBm	< -110 to -120 dBm	<-120 to -130 dBm	
1 MHz to 3 GHz	±0.4 dB ±0.15 dB, typical	±0.5 dB ±0.15 dB, typical	±0.7 dB ±0.25 dB, typical	±0.8 dB, nominal	
> 3 to 6 GHz	±0.5 dB ±0.15 dB, typical	±0.6 dB ±0.25 dB, typical	±1.0 dB ±0.5 dB, typical	±0.8 dB, nominal	
Absolute level accuracy in CW mode [ALC on] ² - M9310A manufacturing numbers xx5236xxxx and lower					
Frequency	< Max power to -20 dBm	< -20 to -90 dBm	< -90 to -100 dBm	<-100 to -120 dBm	<-120 to -130 dBm
1 to 400 MHz	±0.5 dB ±0.2 dB, typical	±0.55 dB ±0.2 dB, typical	±0.62 dB ±0.2 dB, typical	±0.85 dB ±0.3 dB, typical	±0.8 dB, nominal
> 400 MHz to 3 GHz	±0.4 dB ±0.2 dB, typical	±0.55 dB ±0.2 dB, typical	±0.62 dB ±0.2 dB, typical	±0.85 dB ±0.25 dB, typical	±0.8 dB, nominal
> 3 GHz to 6 GHz	±0.5 dB ±0.2 dB, typical	±0.6 dB ±0.25 dB, typical	±0.65 dB ±0.25 dB, typical	±1.0 dB ±0.5 dB, typical	±0.8 dB, nominal

1. Settable to 0.01 dB.

2. Specifications apply at the controlled temperature range. For temperatures outside this range, absolute level accuracy degrades by ± 0.02 dB/°C.

Technical Specifications and Characteristics

Amplitude (continued)

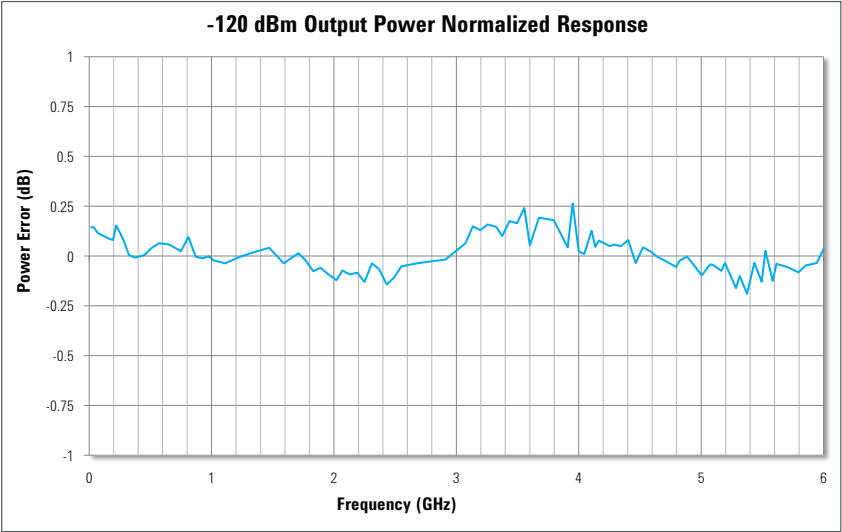


Figure 1. Output power normalized response at -120 dBm.

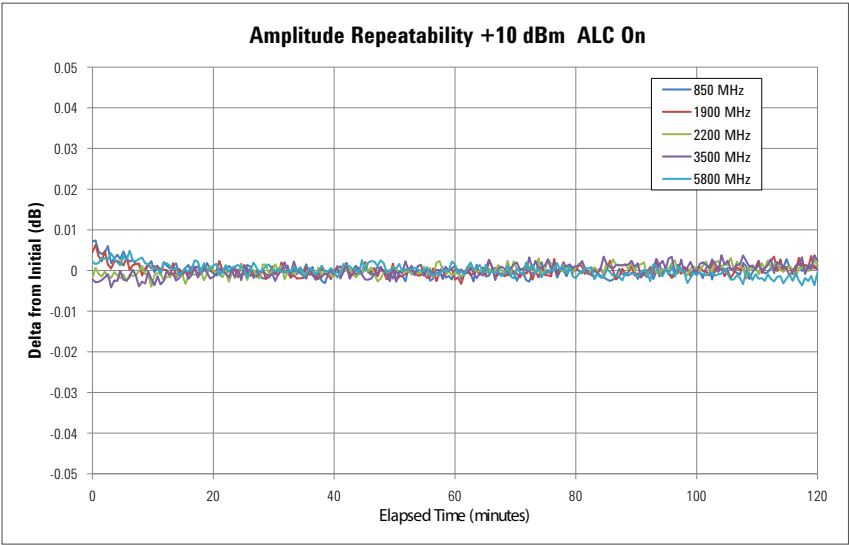


Figure 2. Amplitude repeatability at various carrier frequencies. Repeatability measures the ability of the instrument to return to a given power setting after a random excursion to any other frequency and power setting. It should not be confused with absolute level accuracy.

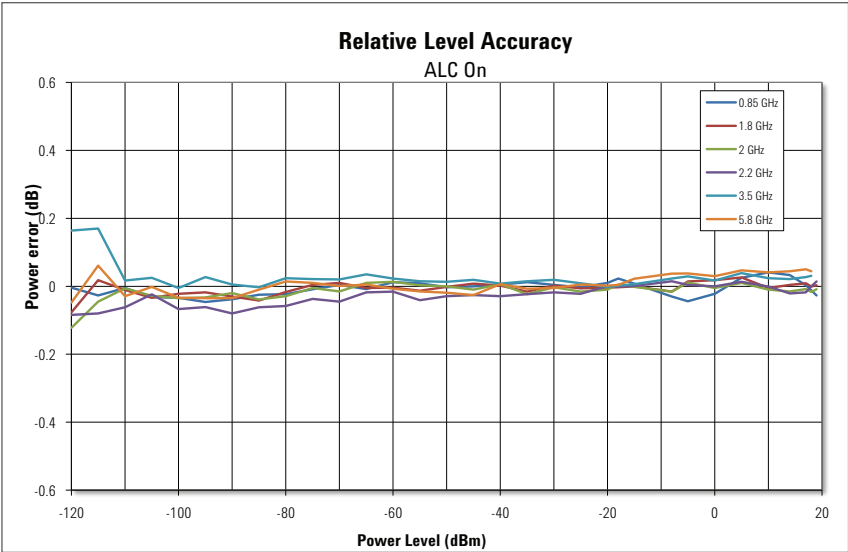


Figure 3. Relative power level accuracy at various carrier frequencies.

Technical Specifications and Characteristics

Amplitude (continued)

VSWR	
1 MHz to 6 GHz	< 1.5:1, nominal
Maximum reverse power	
1 MHz to 6 GHz	1 W, nominal
Max DC voltage	25 VDC, nominal

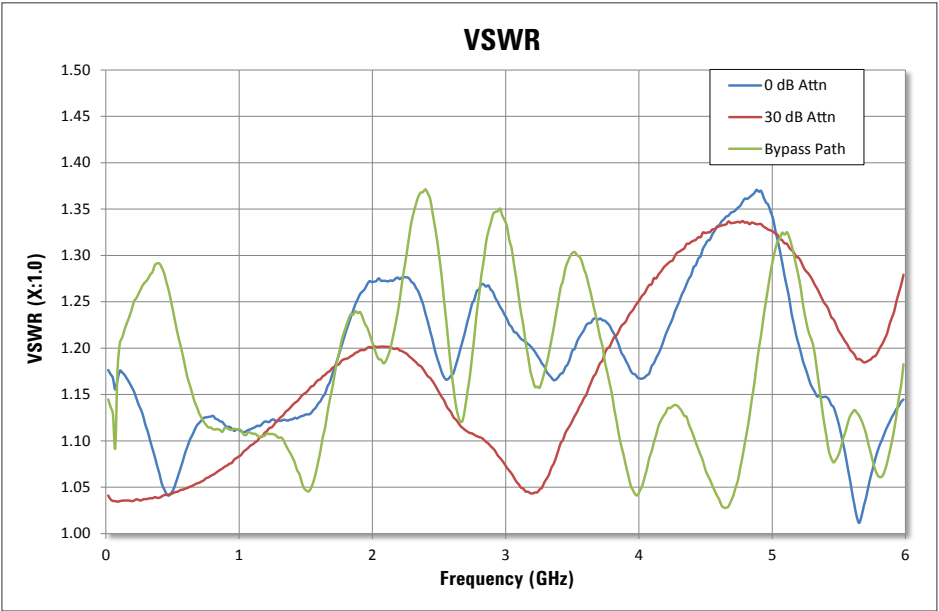


Figure 4. Measured VSWR from 1 MHz to 6 GHz.

Technical Specifications and Characteristics

Spectral purity

Phase noise at 20 kHz offset	
1 GHz	-122 dBc/Hz, typical
2 GHz	-117 dBc/Hz, typical
3 GHz	-112 dBc/Hz, typical
6 GHz	-108 dBc/Hz, typical

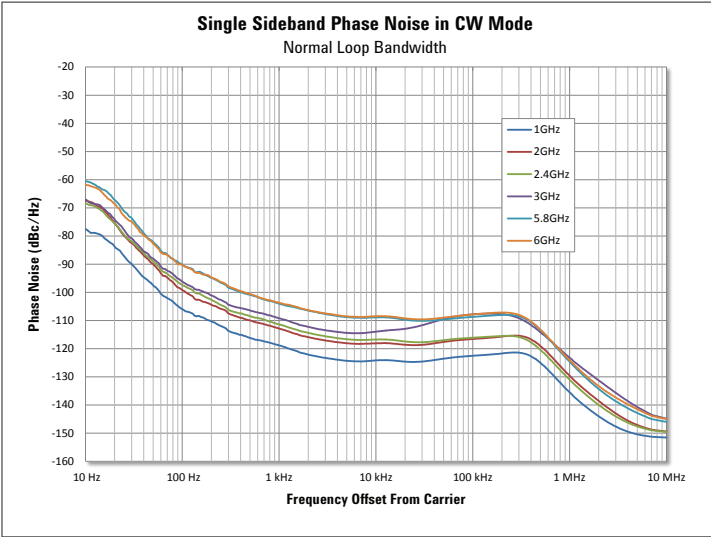


Figure 5. Single sideband phase noise in normal loop bandwidth from 10 Hz to 10 MHz, offset at 1, 2, 2.4, 3, 5.8, and 6 GHz.

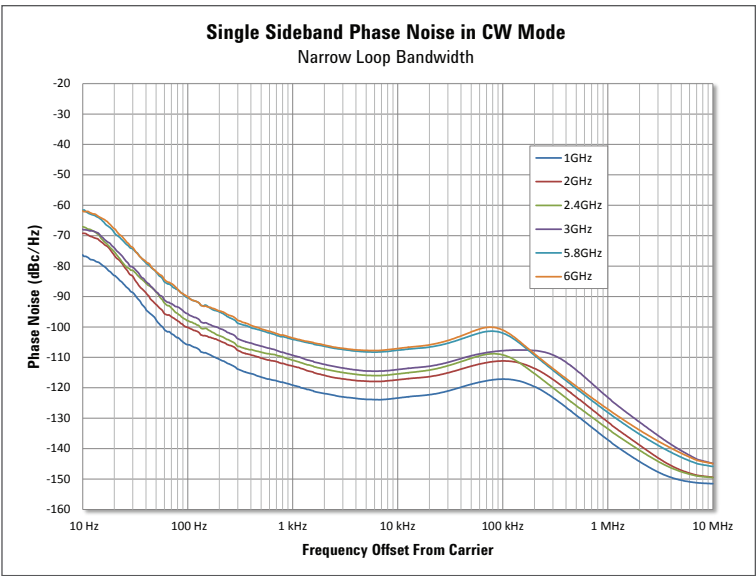


Figure 6. Single sideband phase noise in narrow loop bandwidth from 10 Hz to 10 MHz, offset at 1, 2, 2.4, 3, 5.8, and 6 GHz.

Technical Specifications and Characteristics

Spectral purity (continued)

Broadband noise floor				
Range				
1 MHz to 6 GHz		< -140 dBc/Hz, nominal, at +10 dBm output power level		
Harmonics				
Range	≤ 0 dBm		≤ +10 dBm	
1 MHz to < 400 MHz	< -43 dBc	-46 dBc, typical	< -35 dBc	-37 dBc, typical
400 MHz to 1.5 GHz	< -29 dBc	-31 dBc, typical	< -27 dBc	-29 dBc, typical
> 1.5 GHz to 3 GHz	< -35 dBc	-39 dBc, typical	< -30 dBc	-33 dBc, typical
Nonharmonics ¹				
Nonharmonic miscellaneous spurious ²		< -70 dBc, nominal		
Nonharmonic HET band mixing spurs (0 dBm)		< -67 dBc, nominal		
Nonharmonic Frac-N		< -66 dBc, nominal		
Subharmonics				
1 MHz to 6 GHz		none		

Analog modulation

Pulse parameters	
Pulse on/off ratio 1 MHz to 400 MHz	> 85 dB, typical
Pulse on/off ratio > 400 MHz to 6 GHz	> 95 dB, typical
Pulse rise/fall time	< 10 ns, nominal

System requirements

Topic	Windows 7 requirements
Operating systems	Windows 7 (32-bit and 64-bit)
Processor speed	1 GHz 32-bit (x86), 1 GHz 64-bit (x64) (no support for Itanium 64)
Available memory	4 GB minimum 8 GB or greater recommended
Available disk space ³	1.5 GB available hard disk space, includes: – 1 GB available for Microsoft .NET framework 3.5 SP1 ⁴ – 100 MB for Keysight IO libraries suite
Video	Support for DirectX 9 graphics with 128 MB graphics memory recommended (Super VGA graphics is supported)
Browser	Microsoft Internet Explorer 7.0 or greater
Keysight IO libraries	Version 16.3.16603.3 or later

1. Non-harmonics include mixing spurs for frequencies below 400 MHz, synthesizer spurs, and other miscellaneous chassis and power supply products, for offsets >10 kHz.
2. With a Keysight M9036A embedded controller.
3. Because of the installation procedure, less memory may be required for operation than is required for installation.
4. .NET framework runtime components are installed by default with Windows 7. Therefore, you may not need this amount of available disk space.

Technical Specifications and Characteristics

Environmental and physical specifications

Temperature	Operating Non-operating (storage)	0 to 55 °C -40 to +70 °C		
Humidity ¹		Type tested at 95%, +40 °C (non-condensing)		
Altitude		Up to 15,000 feet (4,572 meters)		
Connectors	RF OUT	SMA female		
EMC		Complies with European EMC Directive 2004/108/EC – IEC/EN 61326-2-1 – CISPR Pub 11 Group 1, class A – AS/NZS CISPR 11 – ICES/NMB-001 This ISM device complies with Canadian ICES-001. Cet appareil ISM est conforme a la norme NMB-001 du Canada.		
Warm-up time		45 minutes		
Size	M9300A M9301A M9310A	1 PXIe slot 1 PXIe slot 1 PXIe slot		
Dimensions	Module	Length	Width	Height
	M9300A	210 mm	22 mm	130 mm
	M9301A	210 mm	22 mm	130 mm
	M9310A	210 mm	22 mm	130 mm
Weight	M9300A M9301A M9310A		0.551 kg (1.215 lbs) 0.535 kg (1.179 lbs) 0.551 kg (1.215 lbs)	
Power drawn from chassis	M9300A M9301A M9310A		≤ 18 W ≤ 25 W ≤ 28 W	

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

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