

Agilent M9380A PXIe CW Source 1 MHz to 3 or 6 GHz



Specifications Guide



Agilent Technologies

Notices

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To contact Agilent for sales and technical support, refer to the “support” links on the following Agilent web resources:

- www.agilent.com/find/M9380A
(product-specific information and support, software and documentation updates)
- www.agilent.com/find/assist
(worldwide contact information for repair and service)

Information on preventing damage to your Agilent equipment can be found at www.agilent.com/find/tips.

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 regulations.corporate.agilent.com/DoC/search.htm.

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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.

Agilent 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 Agilent. 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 Agilent to maintain accuracy and functionality of the product). If you are unsure about the applicability of a replacement component, call an Agilent 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.



The C-Tick mark is a registered trademark of the Australian Spectrum Management Agency.

**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 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 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.



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.



KCC-REM-ATi-
BLMODSF01

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.

WARNING

CLEANING PRECAUTIONS:

To prevent electrical shock, disconnect the Agilent 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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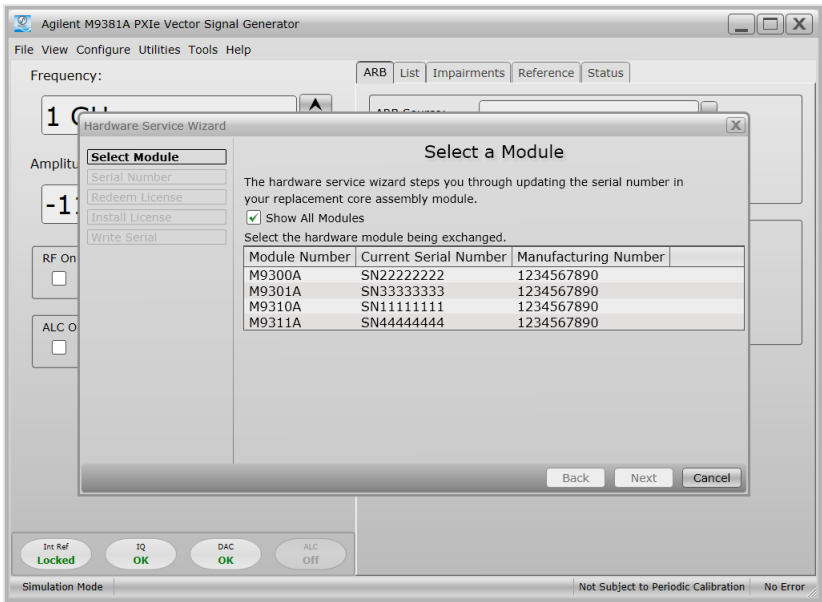
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HOW TO USE THIS DOCUMENT

This document contains technical specifications for all manufacturing versions of the M9380A PXI 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, as shown at left.

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

For the purposes of Revision 1.0 of this document, older equipment is defined as the M9310A with manufacturing numbers xx5236xxxx or lower.

TECHNICAL SPECIFICATIONS AND CHARACTERISTICS

Definitions for Specifications

Temperatures referred to in this document are defined as follows:

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

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 Agilent M9300A frequency reference

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. Agilent chassis and slot blockers optimize module temperature performance and reliability of test.
- At environment temperatures above $45\text{ }^{\circ}\text{C}$, chassis fan should be set to high.

Additional Information

- All graphs contain measured data from one unit and is representative of product performance within 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 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 controlled temperature range). Simultaneous carrier frequency and amplitude switching.

TECHNICAL SPECIFICATIONS AND CHARACTERISTICS

Frequency reference (M9300A PXIe frequency reference module)	
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	$< \pm 0.5 \text{ ppb/day, after 72 hour warm-up}$
Yearly	$< \pm 0.1 \text{ ppm/year, after 72 hours warm-up}$
Total 10 years	$< \pm 0.6 \text{ ppm/10yrs, after 72 hours warm-up}$
Achievable initial calibration accuracy (at time of shipment)	$\pm 5 \times 10^{-8}$
Temperature effects	
20 to 30 °C	$< \pm 10 \text{ ppb}$
Full temperature range	$< \pm 50 \text{ ppb}$
Warm up	
5 minutes over +20 to +30 °C, with respect to 1 hour	$< \pm 0.1 \text{ ppm}$
15 minutes over +20 to +30 °C, with respect to 1 hour	$< \pm 0.01 \text{ ppm}$
External reference input	
Frequency	$1 \text{ to } 110 \text{ MHz, sine wave}$
Lock range	$\pm 1 \text{ ppm, nominal}$
Amplitude	$0 \text{ to } 10 \text{ dBm, nominal}$
Connector	1 SMB snap-on
Impedance	$50 \Omega, \text{ nominal}$

TECHNICAL SPECIFICATIONS AND CHARACTERISTICS

AMPLITUDE

Output parameters		
Settable range	Standard	Option 1EA
	+10.7 to -130 dBm	+20 to -130 dBm
Resolution		
ALC on ²	0.02 dB, nominal	
ALC off	0.3 dB, nominal	

Maximum output power		
Frequency	Standard	Option 1EA
M9310A manufacturing numbers higher than xx5236xxxx		
1 MHz to 5 GHz	+10 dBm	+19 dBm
> 5 to 6 GHz	+10 dBm	+18 dBm
M9310A manufacturing numbers xx5236xxxx and lower		
1 MHz to 2.5 GHz	+10 dBm	+19 dBm
> 2.5 to 6 GHz	+10 dBm	+18 dBm

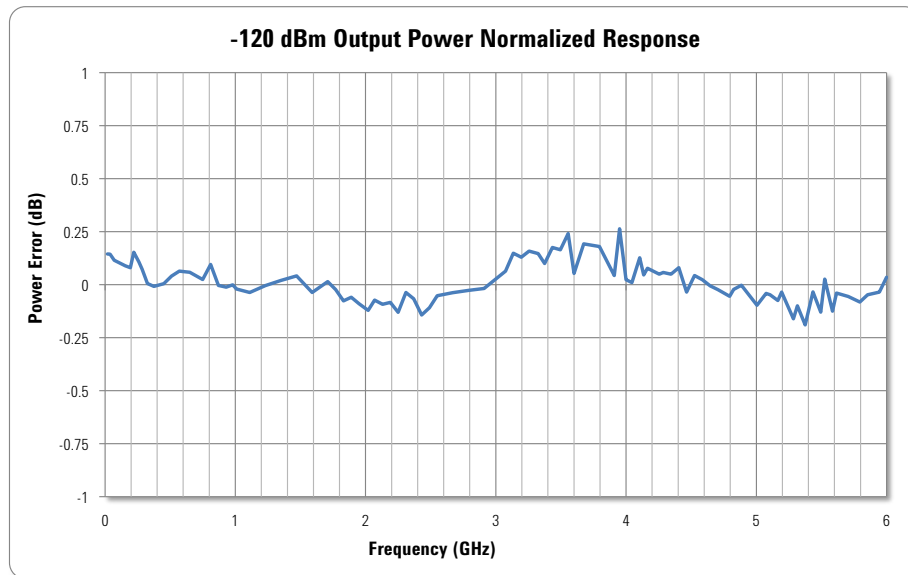


Figure 1. Output power normalized response at -120 dBm.

2. Settable to 0.01 dB.

TECHNICAL SPECIFICATIONS AND CHARACTERISTICS

Absolute level accuracy in CW mode [ALC on] ³ - 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) ³ - 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	±0.62dB ±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 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

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

TECHNICAL SPECIFICATIONS AND CHARACTERISTICS

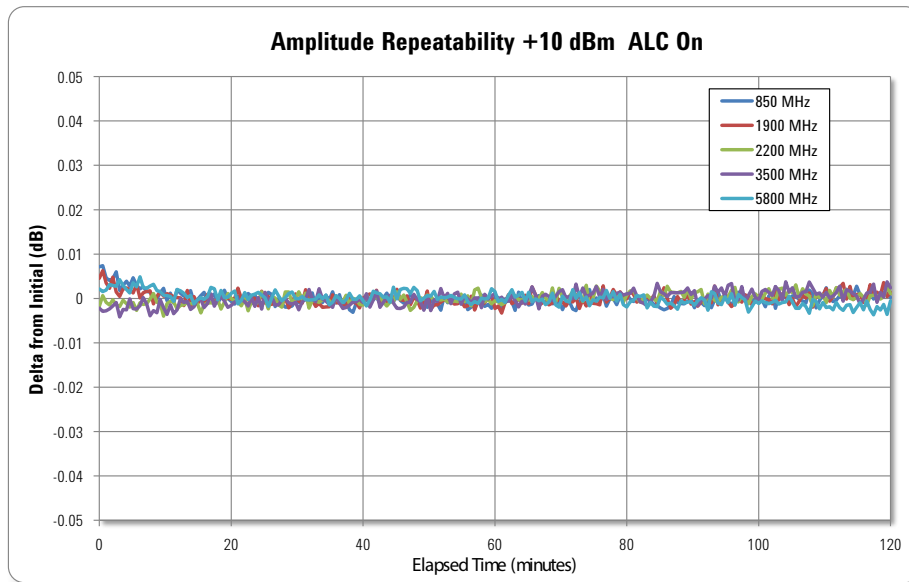


Figure 2. Amplitude repeatability at various carrier frequencies. Repeatability measures the ability of the instrument to return to a given power setting after a random excursion to any other frequency and power setting. It should not be confused with absolute level accuracy.

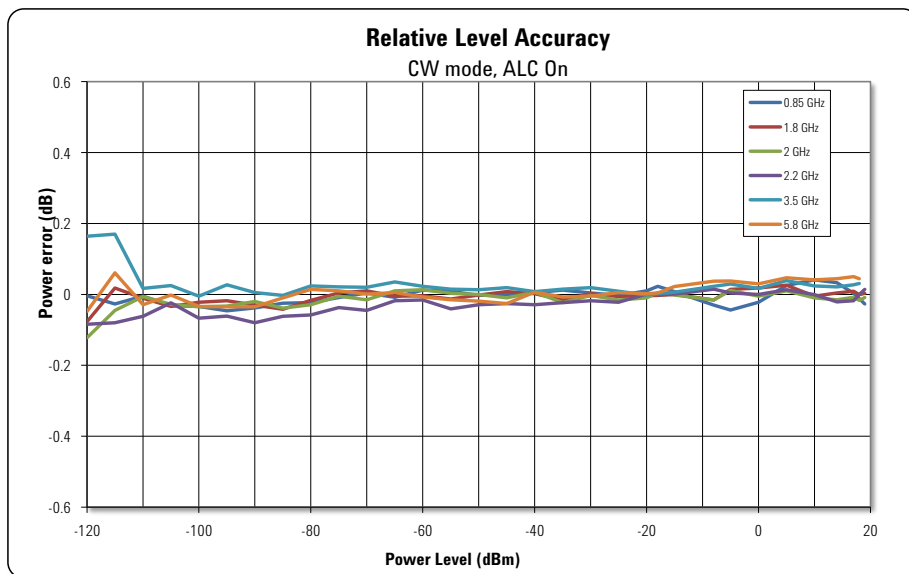


Figure 3. Relative level accuracy at various carrier frequencies.

TECHNICAL SPECIFICATIONS AND CHARACTERISTICS

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

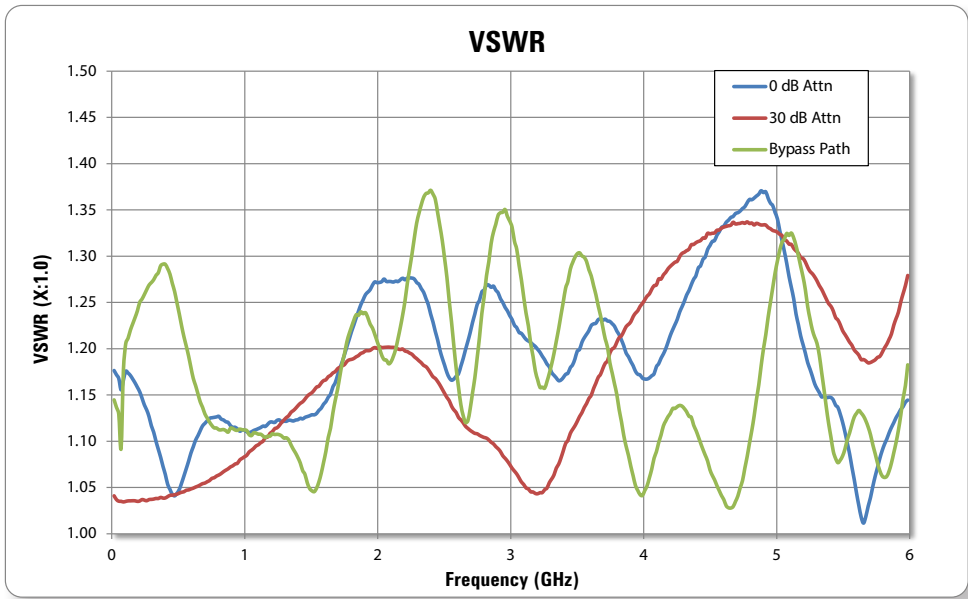


Figure 4. Measured VSWR from 1 MHz to 6 GHz.

TECHNICAL SPECIFICATIONS AND CHARACTERISTICS

SPECTRAL PURITY

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

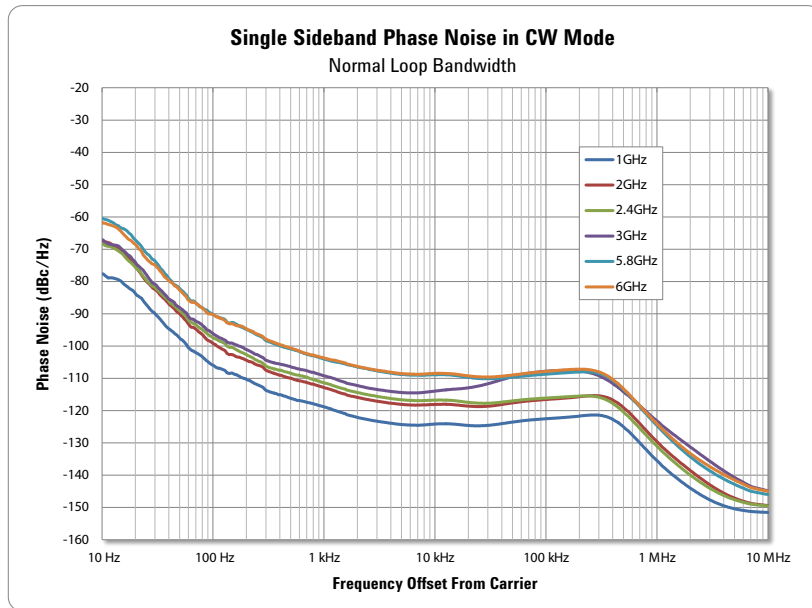


Figure 5. Single sideband phase noise in normal loop bandwidth, CW mode from 10 Hz to 10 MHz, offset at 1, 2, 2.4, 3, 5.8, and 6 GHz.

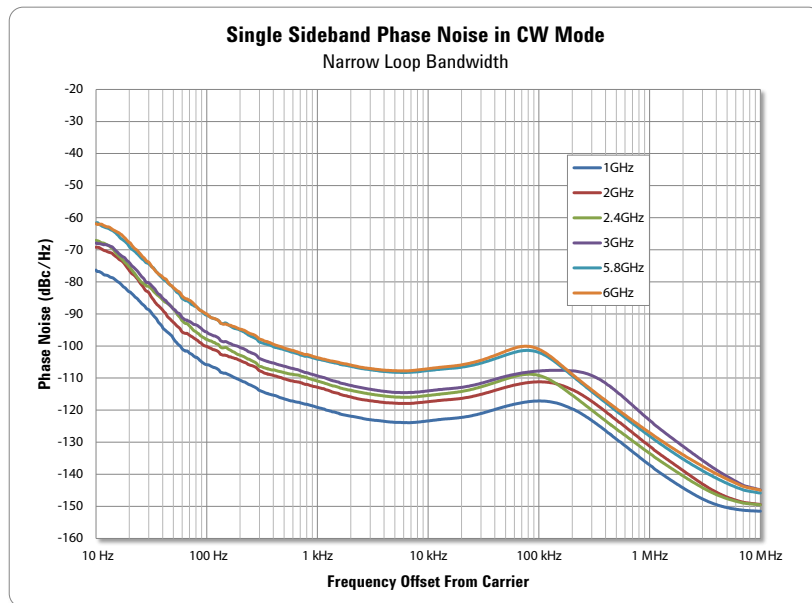


Figure 6. Single sideband phase noise in narrow loop bandwidth, CW mode from 10 Hz to 10 MHz, offset at 1, 2, 2.4, 3, 5.8, and 6 GHz.

TECHNICAL SPECIFICATIONS AND CHARACTERISTICS

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 < 1 GHz	< −39 dBc	−43 dBc, typical	< −35 dBc	−37 dBc, typical
1 to 2.5 GHz	< −34 dBc	−38 dBc, typical	< −32 dBc	−34 dBc, typical
> 2.5 GHz	< −35 dBc	−38 dBc, typical	< −30 dBc	−32 dBc, typical
Nonharmonics ⁴				
Nonharmonic miscellaneous spurious ⁵	< −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 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 and Vista requirements	Windows XP requirements
Operating systems	Windows 7 (32-bit and 64-bit) Windows Vista, SP1 and SP2 (32-bit and 64-bit)	Windows XP, SP 3
Processor speed	1 GHz 32-bit (x86), 1 GHz 64-bit (x64) (no support for Itanium 64)	600 MHz or higher required 800 MHz recommended
Available memory	4 GB minimum 8 GB or greater recommended	3 GB minimum
Available disk space ⁶	1.5 GB available hard disk space, includes: • 1 GB available for Microsoft .NET framework 3.5 SP1 ⁷ • 100 MB for Agilent IO libraries suite	
Video	Support for DirectX 9 graphics with 128 MB graphics memory recommended (Super VGA graphics is supported)	Super VGA (800 x 600) 256 colors or more
Browser	Microsoft Internet Explorer 7 or greater	Microsoft Internet Explorer 6 or greater
Agilent IO libraries	Version 16.3.16603.3 or later	

4. Non-harmonics include mixing spurs for frequencies below 400 MHz, synthesizer spurs, and other miscellaneous chassis and power supply products, for offsets >10 kHz.

5. With Agilent M9036A embedded controller.

6. Because of the installation procedure, less disk space may be required for operation than is required for installation.

7. .NET framework runtime components are installed by default with Windows Vista and Windows 7. Therefore, you may not need this amount of available disk space.

TECHNICAL SPECIFICATIONS AND CHARACTERISTICS

Environmental and physical specifications				
Temperature	Operating	0 to 55 °C		
	Non-operating (storage)	–40 to +70 °C		
Humidity ⁸		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 M9311A	1 PXle slot 1 PXle slot 1 PXle slot 2 PXle slots		
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
	M9311A	210 mm	42 mm	130 mm
Weight	M9300A M9301A M9310A M9311A	0.551 kg (1.215 lbs) 0.535 kg (1.179 lbs) 0.551 kg (1.215 lbs) 0.901 kg (1.986 lbs)		
Power drawn from chassis	M9300A M9301A M9310A M9311A	≤ 18 W ≤ 25 W ≤ 28 W ≤ 45 W		

SPECIFICATIONS FOR OLDER EQUIPMENT

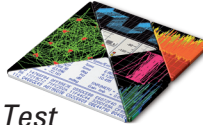
The following specifications relate only to older equipment, as defined below:	
For M9310A manufacturing numbers xx5236xxxx and lower, please find the following specifications at:	
Specification table	Page #
Maximum output power	9
Absolute level accuracy in CW mode [ALC on]	10

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



The Modular Tangram

The four-sided geometric symbol that appears in this document is called a tangram. The goal of this seven-piece puzzle is to create identifiable shapes—from simple to complex. As with a tangram, the possibilities may seem infinite as you begin to create a new test system. With a set of clearly defined elements—hardware, software—Agilent can help you create the system you need, from simple to complex.



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