Agilent M9381A PXIe Vector Signal Generator

1 MHz to 3 or 6 GHz

Specifications Guide

Agilent Technologies

Notices

Manual Part Number

M9381-90015

Edition

Dec 2013. Build 2013.12.19.1500
Printed in USA
Agilent Technologies, Inc.

Sales and Technical Support

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

- www.agilent.com/find/M9381A (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.

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, Agilent 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. Agilent shall not be liable for errors or for incidental or consequential damages in connection with the furnishing, use, or performance of this document or of any information contained herein. Should Agilent 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 shall 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.

Restricted Rights Legend

If software is for use in the performance of a U.S. Government prime contract or subcontract, software is delivered and licensed as "commercial computer software" as defined in DFAR 252.227-7014 (June 1995), or as a "commercial item" as defined in FAR 2.101(a) or as "restricted computer software" as defined in FAR 52.227-19 (June 1987) or any equivalent agency regulation or contract clause. Use, duplication or disclosure of software is subject to Agilent Technologies' standard commercial license terms, and non-DOD Departments and Agencies of the U.S. Government will receive no greater than restricted rights as defined in FAR 52.227-19(c)(1-2) (June 1987). U.S. Government users will receive no greater than limited rights as defined in FAR 52.227-14 (June 1987) or DFAR 252.227-7015 (b)(2) (November 1995) 1995), as applicable in any technical data.

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.

N10149

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

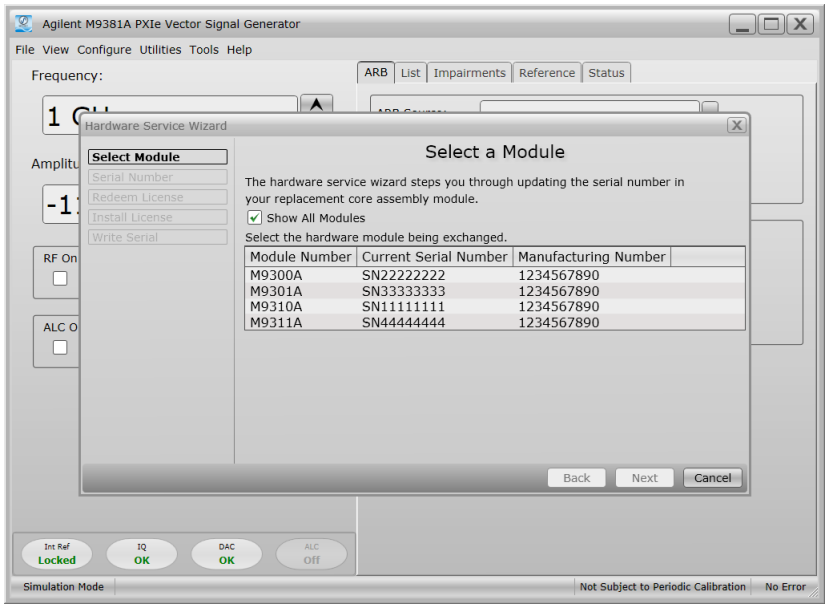
CLEANING PRECAUTIONS:

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.

TABLE OF CONTENTS

HOW TO USE THIS DOCUMENT

This document contains technical specifications for all manufacturing versions of the M9381A PXI Vector Signal Generator. 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 this document, older equipment is defined as the M9311A or 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 ≤ 75 °C, as reported by the module, and environment temperature of 0 to 55 °C.
- Controlled temperature range = Individual module temperature of ≤ 55 °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 Agilent M9300A frequency reference and Agilent interconnect 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. Agilent 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 within the controlled temperature range unless otherwise noted.
- The specifications contained in this document are subject to change.
- Specifications use the normal PLL mode setting, unless otherwise stated. Narrow loop bandwidth refers to specifications using the best wide offset PLL mode setting AGM938X_VAL_SYNTHESIZER_PLL_MODE_BEST_WIDE_OFFSET, available in the M938x Vector Signal Generator/CW Source Instrument Drivers versions 1.2.300 and later.

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	*Standard, nominal*	*Option UNZ, nominal*	
List mode switching speed [1]		Normal loop bandwidth	Narrow loop bandwidth [6]
Baseband frequency offset change [2]	*≤ 5 ms*	*≤ 10 µs*	*≤ 10 µs*
ALC off [3]			
Arbitrary frequency change	*≤ 5 ms*	*≤ 185 µs*	*≤ 240 µs*
Frequency change < 100 MHz within a band [4]	*≤ 5 ms*	*≤ 115 µs*	*≤ 120 µs*
ALC on [3]			
Arbitrary frequency change	*≤ 5 ms*	*≤ 365 µs*	*≤ 365 µs*
Frequency change < 100 MHz within a band [4]	*≤ 5 ms*	*≤ 265 µs*	*≤ 265 µs*
Non-list mode switching speed [5]			
Baseband frequency offset change [2]	*≤ 5 ms*	*≤ 250 µs*	*≤ 250 µs*
Arbitrary frequency change	*≤ 5 ms*	*≤ 2 ms*	*≤ 2.1 ms*

List mode	
List mode channel parameters	80 parameters including RF frequency, power, modulation arb and baseband, ALC, power search, triggers
Dwell time	0 seconds to 429 seconds
Number of points	1 to 3201
Triggering	Immediate, external, software, timer

1. Time from trigger input to frequency and amplitude settled within limits given below with digital modulation on and channel corrections enabled. Specifications are for amplitudes lower than +17 dBm and using an M9036A embedded controller in an M9018A chassis.

2. Baseband offset frequency settled within 100 Hz. Baseband offset can be adjusted ± from carrier frequency within limits determined by RF modulation bandwidth. Synthesizer frequency and amplitude are not changing and ALC off.

3. Carrier frequency settled within 1 ppm or 1 kHz, whichever is greater, and amplitude settled within 0.2 dB (within the controlled temperature range) or within 0.5 dB (at the full temperature range). For frequency changes ≥ 1.6 GHz at carriers ≥ 3.2 GHz nominal frequency settling time within ±0.05% of final frequency is 125 µs. Simultaneous carrier frequency and amplitude switching. For M9310A modules with manufacturing numbers xx5236xxxx and lower, if the ALC is off and if amplitudes in the list exceed +10 dBm, specification applies for amplitude settled within 0.4 dB above 3 GHz at controled temperature range.

4. Frequency bands: One (1 to 400 MHz); Two (> 400 to < 750 MHz); Three (≥ 750 to < 1500 MHz); Four (≥ 1500 to < 3000 MHz); Five (≥ 3000 to 6000 MHz).

5. 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. Simultaneous carrier frequency and amplitude switching.

6. Narrow loop bandwidth requires M938x vector signal generator/CW source instrument drivers versions 1.2.300 or later.

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*
Frequency accuracy	
Same as accuracy of internal time base or external reference input	
Internal timebase	
Accuracy	± [(time since last adjustment x aging rate) ± temperature effects ± calibration accuracy]
Frequency stability Aging rate	
Daily	< *±0.5 ppb/day, after 72 hour warm-up*
Yearly	< *±0.10 ppm/year, after 72 hours warm-up*
Total 10 years	< *±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	< *±10 ppb*
Full temperature range	< *±50 ppb*
Warm up	
5 minutes over +20 to +30 °C, with respect to 1 hour	< *±0.1 ppm*
15 minutes over +20 to +30 °C, with respect to 1 hour	< *±0.01 ppm*
External reference input	
Frequency	1 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*

AMPLITUDE

Output parameters		
Settable range	**Standard**	**Option 1EA**
	+10.7 to –130 dBm	+20 to –130 dBm
Resolution		
ALC on [6]	*0.02 dB, nominal*	
I/Q mode, ALC off [7]	*0.02 dB, nominal*	
I/Q mode, ALC off, baseband offset change	*0.001 dB, nominal*	
CW mode, 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 [8]
> 2.5 to 6 GHz	+10 dBm	+18 dBm [8]

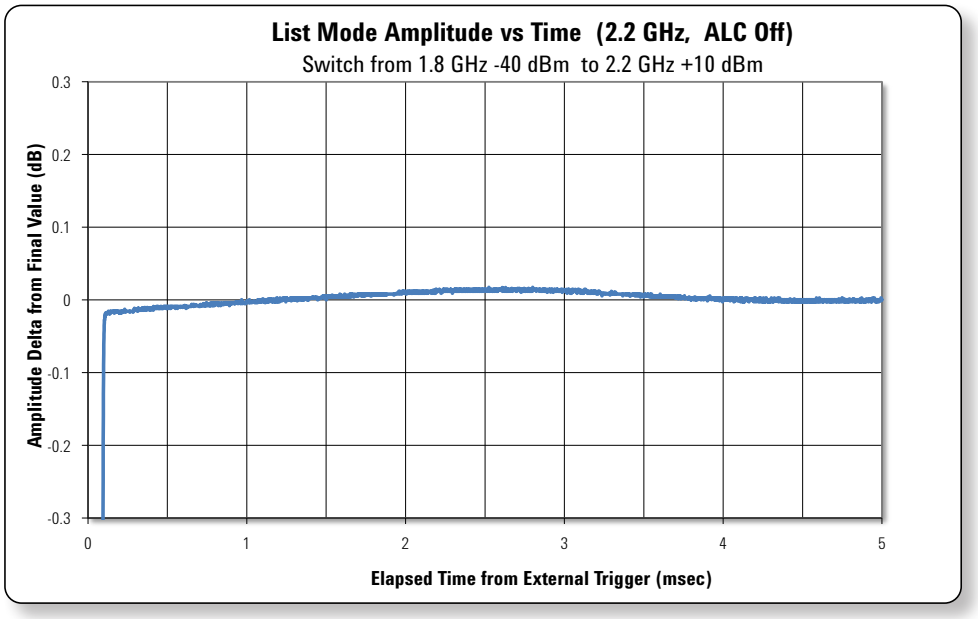


Figure 6. List mode amplitude vs time showing fast settling time to specified level accuracy.

6. Settable to 0.01 dB.
7. After a power search.
8. Specifications apply within controlled temperature range.

TECHNICAL SPECIFICATIONS AND CHARACTERISTICS

Amplitude switching speed	*Standard, nominal*	*Option UNZ, nominal*
List mode switching speed [9]		
Baseband power level change [10]	*≤ 5 ms*	*≤ 10 µs*
ALC off [11]	*≤ 5 ms*	*≤ 105 µs*
ALC on	*≤ 5 ms*	*≤ 105 µs*
Non-list mode switching speed [12]		
Baseband power level change [10]	*≤ 5 ms*	*≤ 250 µs*
Arbitrary power level change	*≤ 5 ms*	*≤ 1.5 ms*

List mode - see frequency specification section for more detail

Absolute level accuracy in CW mode [ALC on] [13] - 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 GHz 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) [13] - 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
1MHz 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 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*

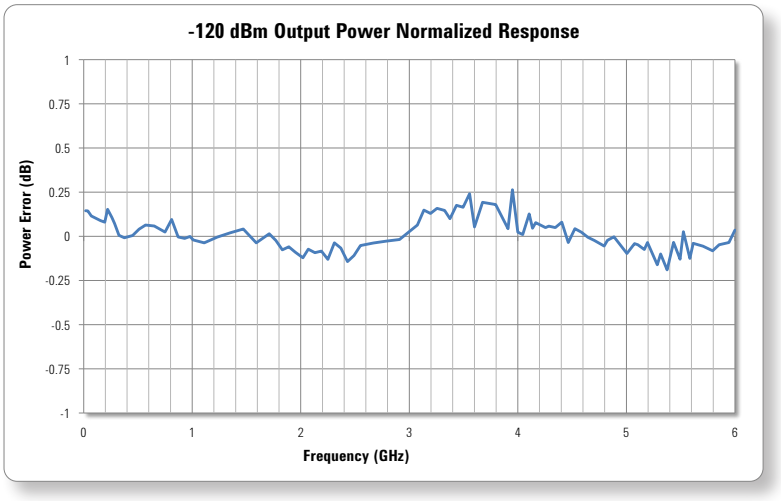


Figure 7. Output power normalized response at –120 dBm.

9. Time from trigger input to amplitude settled within 0.2 dB (within controlled temperature range) or within 0.5 dB (at the full temperature range). Carrier frequency is not changing. Measurements made with the M9036A embedded controller in an M9018A chassis.
10. Baseband offset amplitude settled within 0.2 dB. Baseband offset can be adjusted from 0 dB to –20 dB.
11. Above 3 GHz, if amplitudes in the list exceed +10 dBm, specification applies for amplitude settled within 0.4 dB (at controlled temperature range) or within 0.5 dB (at the full temperature range).
12. Mean time from IVI command to amplitude settled within 0.2 dB. Carrier frequency is not changing.
13. Specifications apply at controlled temperature range. For temperatures outside this range, absolute level accuracy degrades by ±0.02 dB/ °C.

Absolute level accuracy (ALC off, relative to ALC on) [14]	
Frequency	
1 MHz to 5 GHz	*±0.25 dB, typical*
> 5 to 6 GHz	*±0.62 dB, typical*
Power search [15]	
Time	*< 20 ms, nominal*
Absolute level accuracy in digital I/Q mode (ALC on, relative to CW) [16]	
≤ 15 dBm	±0.7 dB *(±0.25 dB, nominal)*
≤ 10 dBm	±0.2 dB
≤ 0 dBm	±0.1 dB

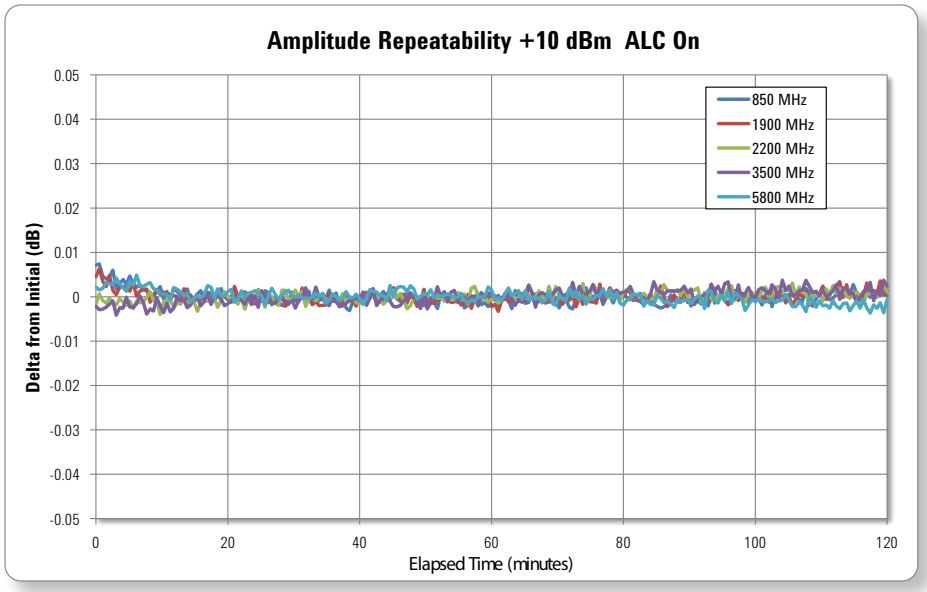


Figure 8. Amplitude repeatability at various carrier frequencies. Repeatability measures the ability of the instrument to return to a given power setting after a random excursion to any other frequency and power setting. It should not be confused with absolute level accuracy.

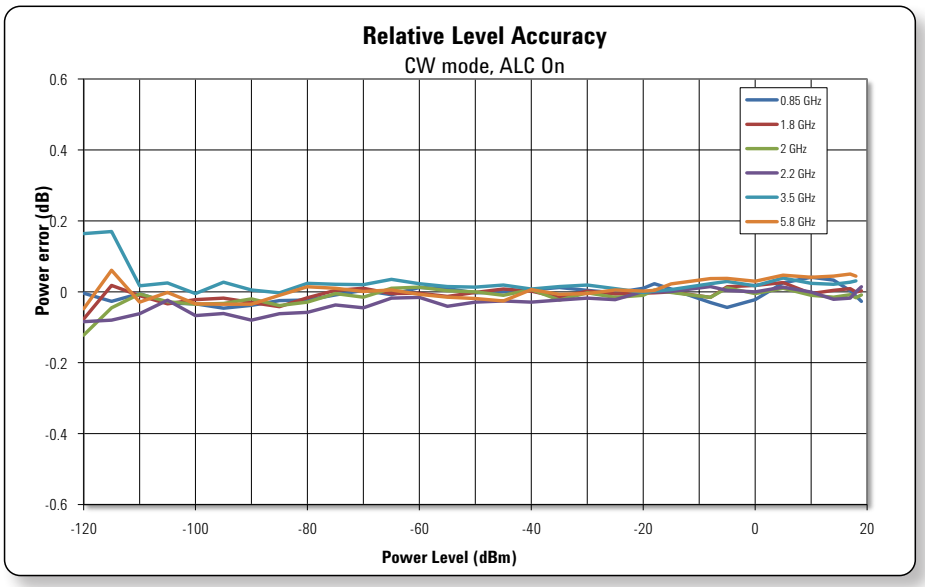


Figure 9. Relative level accuracy at various carrier frequencies.

14. After a power search, with a single side-band signal and with power search blanking on.
15. Power search is an internal alignment routine that improves level accuracy with ALC off.
16. QPSK waveform 4 MS/s symbol rate. Specifications apply within controlled temperature range.

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*

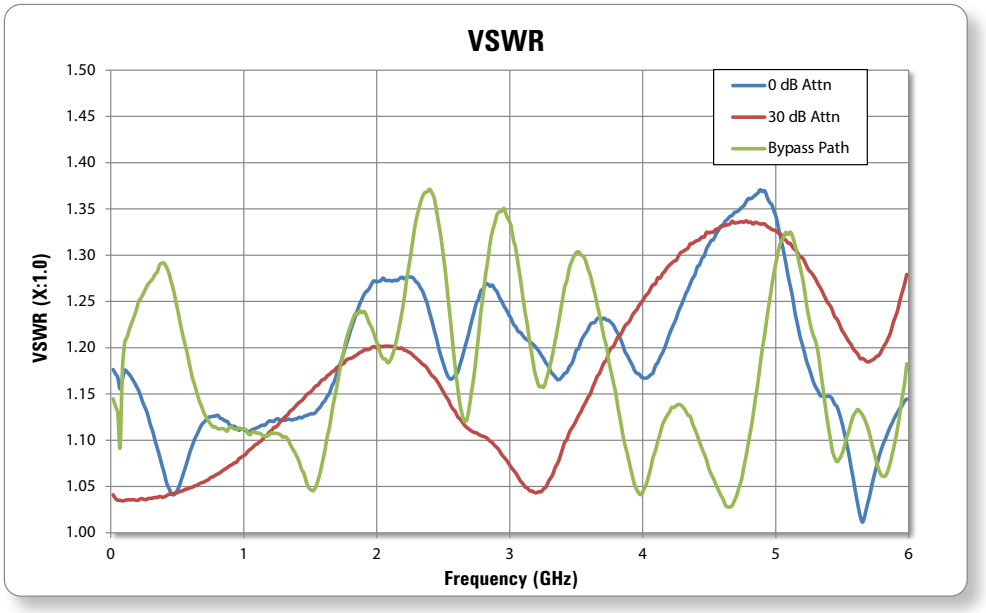


Figure 10. Measured VSWR from 1 MHz to 6 GHz.

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*

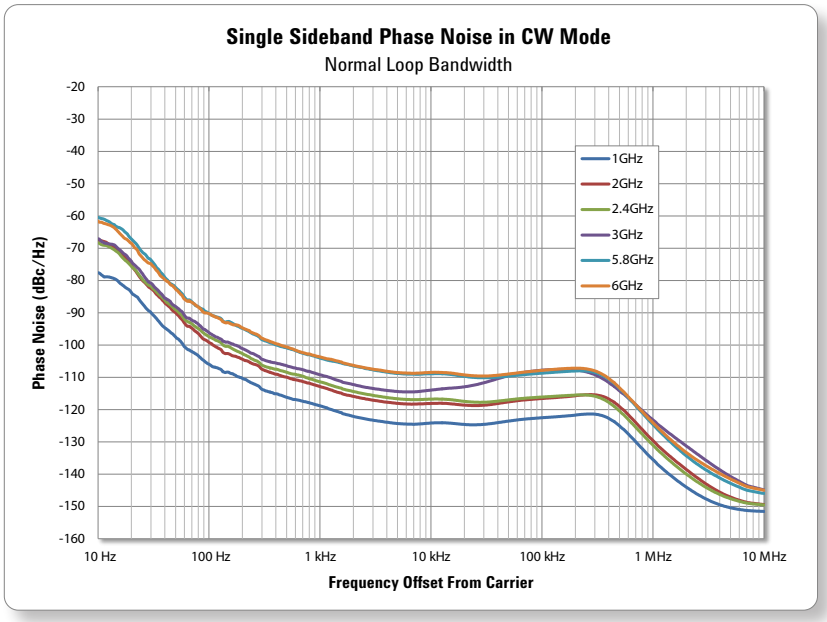


Figure 11. Single sideband phase noise in normal loop bandwidth, CW mode from 10 Hz to 10 MHz, offset at 1, 2, 2.4, 3, 5.8 and 6 GHz.

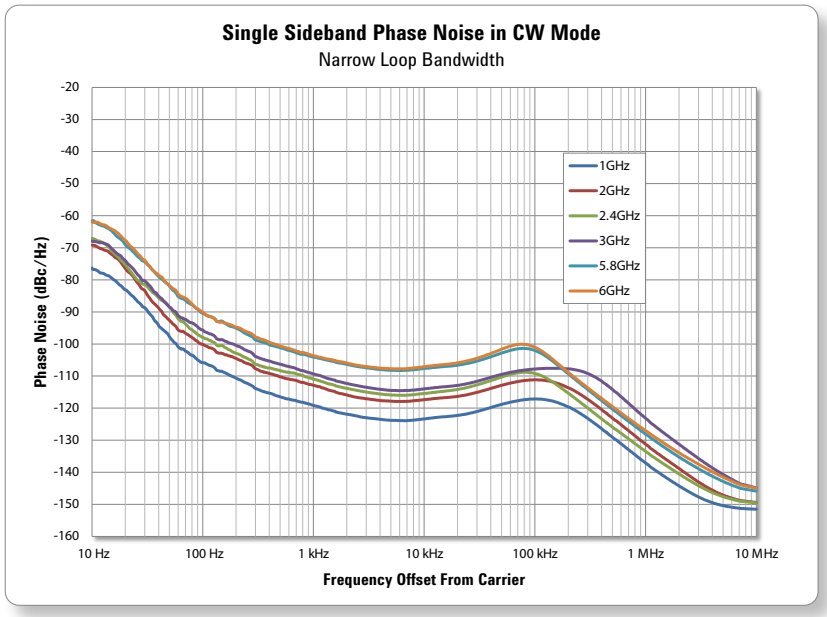


Figure 12. Single sideband phase noise in narrow loop bandwidth, CW mode from 10 Hz to 10 MHz, offset at 1, 2, 2.4, 3, 5.8 and 6 GHz.

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 [17]				
Nonharmonic miscellaneous spurious [18]	*< –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 on/off ratio with I/Q modulation	*> 140 dB, nominal*
Pulse rise/fall time	*< 10 ns, nominal*
Frequency modulation (Option UNT) [19]	
Maximum deviation	1.25 MHz
Resolution of deviation	0.1 Hz
Maximum rate	5 MHz
Phase modulation (Option UNT) [19]	
Maximum deviation	10 radians
Resolution of deviation	0.001 radians
Maximum rate	5 MHz
Amplitude modulation (Option UNT) [19]	
Maximum depth	100%
Resolution of depth	0.001%
Maximum rate	6.25 MHz
Pulse (Option UNT) [19]	
Rate	1 Hz to 1 MHz
Pulse on time	200 ns to 2 ms
Multitone (Option UNT) [19]	
Rate (tone separation)	100 Hz to 1 MHz
Number of tones	2 to 16

17. Non-harmonics include mixing spurs for frequencies below 400 MHz, synthesizer spurs, and other miscellaneous chassis and power supply products, for offsets > 10 kHz.
18. With Agilent M9036A embedded controller.
19. With arbitrary waveforms. Sine, dual-sine, triangle, ramp and square waveforms supported.

VECTOR MODULATION

Residual carrier leakage		
Frequency	**Specifications**	***Typical***
M9311A manufacturing numbers higher than xx5236xxxx [20]		
1 MHz to 5 GHz	< –55 dBc	*< –62 dBc*
> 5 to 6 GHz	< –51 dBc	*< –58 dBc*
M9311A manufacturing numbers xx5236xxxx and lower [21]		
1 to 700 MHz	< -53 dBc	*< -59 dBc*
> 700 MHz to 4 GHz	< -55 dBc	*< -62 dBc*
> 4 to 6 GHz	< -49 dBc	*< -53 dBc*

I/Q image suppression		
Frequency	**Specifications**	***Typical***
M9311A manufacturing numbers higher than xx5236xxxx [20]		
1 to 850 MHz	< –43 dBc	*< –54 dBc*
> 850 MHz to 5 GHz	< –52 dBc	*< –61 dBc*
> 5 to 6 GHz	< –45 dBc	*< –54 dBc*
M9311A manufacturing numbers xx5236xxxx and lower [21]		
1 to 700 MHz	< -46 dBc	*< -55 dBc*
> 700 to 850 MHz	< -46 dBc	*< -57 dBc*
> 850 MHz to 4 GHz	< -54 dBc	*< -62 dBc*
> 4 to 5 GHz	< -49 dBc	*< -54 dBc*
> 5 to 6 GHz	< -48 dBc	*< -54 dBc*

I/Q baseband feed-through [20]	
Frequency	**Specifications**
1 to 400 MHz	*< –65 dBc, typical*
> 400 MHz to 3 GHz	*< –80 dBc, typical*
> 3 GHz	*< –90 dBc, typical*

RF modulation bandwidth with internal ARB	
Option B04 (standard)	40 MHz
Option B10	100 MHz
Option B16	160 MHz

RF I/Q channel flatness		
Bandwidth	**1 MHz to 5.5 GHz**	**> 5.5 GHz to 6 GHz**
40 MHz BW (Option B04 standard)	*< ±0.1 dB, typical*	*< ±0.2 dB, typical*
100 MHz BW (Option B10)	*< ±0.2 dB, typical*	*< ±0.3 dB, typical*
160 MHz BW (Option B16)	*< ±0.3 dB, typical*	*< ±0.5 dB, typical*

Multi-channel [22]	
Maximum channel-to-channel deviation	*20 ns, nominal*

20. Measured with an SSB waveform with an I/Q scale factor of 0.25 for offsets ≤ 50 MHz, after executing IQ DC alignment. Specifications apply at 625 kHz and 50 MHz offsets.

21. Measured with an SSB waveform with an I/Q scale factor of 0.5 for offsets ≤ 50 MHz. Specifications apply at 625 kHz and 50 MHz offsets.

22. MIMO capability only supported when configured with an Agilent M9018A PXIe chassis.

Corrected phase error		
Bandwidth	**1 GHz**	**3 GHz**
40 MHz BW (Option B04 standard)	*±0.25 °, nominal*	*±1.25 °, nominal*
100 MHz BW (Option B10)	*±0.65 °, nominal*	*±2.5 °, nominal*
160 MHz BW (Option B16)	*±0.9 °, nominal*	*±3.0 °, nominal*
Arbitrary waveform memory maximum playback capacity		
Option M01 (standard)	32 MSa	
Option M05	512 MSa	
Option M10	1024 MSa	

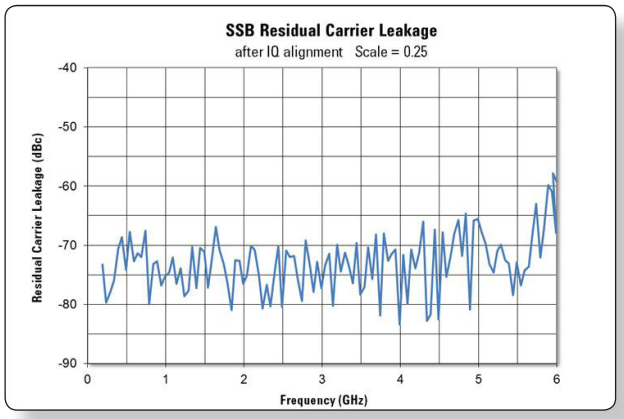


Figure 13. SSB residual carrier leakage.

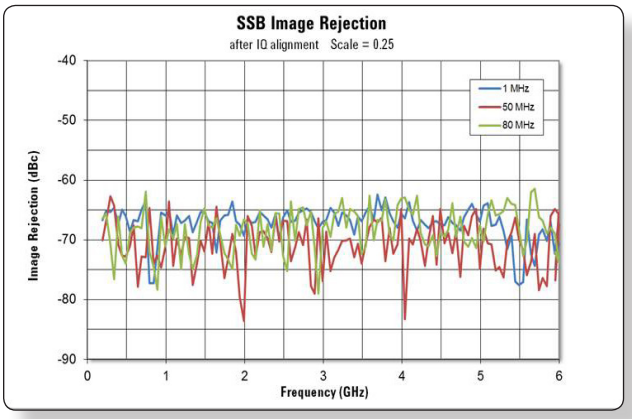


Figure 14. SSB image rejection at 1, 50, and 80 MHz offsets.

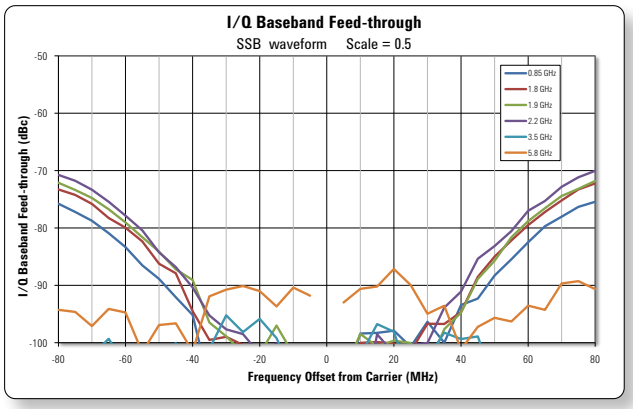


Figure 15. I/Q baseband feed-through at various carrier frequencies.

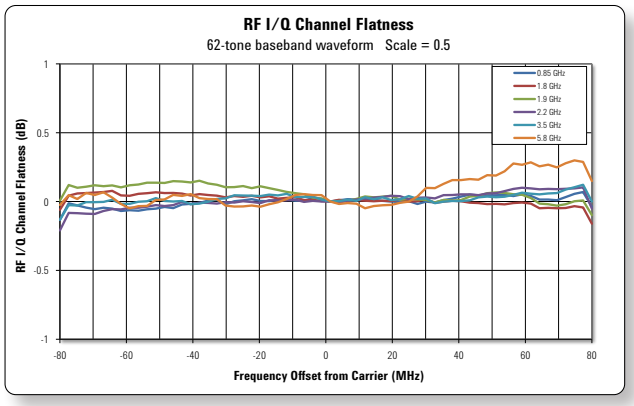


Figure 16. RF I/Q channel flatness at various carrier frequencies.

3GPP W–CDMA performance data [23]						
Modulation type	QPSK					
EVM (2 GHz, 1 DPCH, ≤ 5 dBm)	*0.57% rms, typical*					
Channel distortion [24]						
M9311A manufacturing numbers higher than xx5236xxxx						
	Power level		**0 dBm**		**5 dBm**	
Offset	**Configuration**	**Frequency**	**Spec (dBc)**	***Typical (dBc)***	**Spec (dBc)**	***Typical (dBc)***
Adjacent 5 MHz	1 DPCH 1 carrier	900 MHz	–70	*–72*	–71	*–72*
Alternate 10 MHz			–71	*–73*	–72	*–74*
Adjacent 5 MHz		1800 to 2200 MHz	–70	*–72*	–70	*–71*
Alternate 10 MHz			–71	*–73*	–72	*–73*
Adjacent 5 MHz	64 DPCH 1 carrier	900 MHz	–69	*–71*	–69	*–72*
Alternate 10 MHz			–71	*–72*	–71	*–73*
Adjacent 5 MHz		1800 to 2200 MHz	–68	*–70*	–68	*–70*
Alternate 10 MHz			–70	*–72*	–71	*–73*
M9311A manufacturing numbers xx5236xxxx and lower						
Adjacent 5 MHz	1 DPCH 1 carrier	900 MHz	–70	*– 71*	–71	*–72*
Adjacent 10 MHz			–71	*– 73*	–72	*–74*
Adjacent 5 MHz		1800 to 2200 MHz	–70	*– 71*	–70	*– 71*
Adjacent 10 MHz			–71	*– 73*	–72	*– 73*
Adjacent 5 MHz	64 DPCH 1 carrier	900 MHz	–69	*– 70*	–67	*– 69*
Adjacent 10 MHz			–71	*– 72*	–71	*– 73*
Adjacent 5 MHz		1800 to 2200 MHz	–68	*– 70*	–67	*– 70*
Adjacent 10 MHz			–70	*– 72*	–71	*– 73*

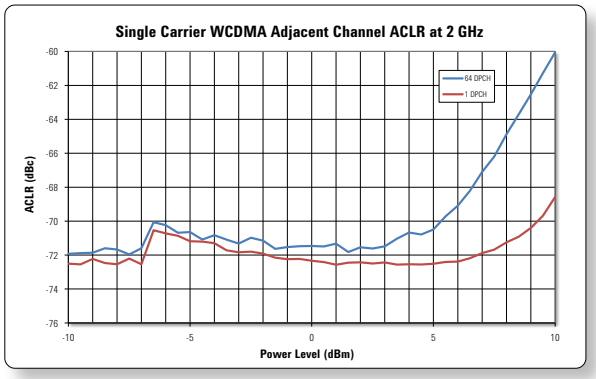


Figure 17. Single carrier W-CDMA adjacent channel ACLR versus power level at 2 GHz.

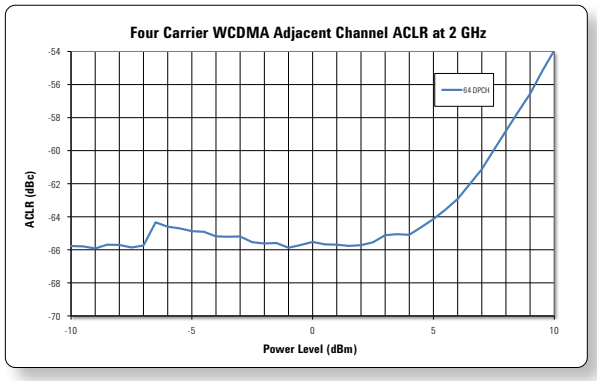


Figure 18. Four carrier W-CDMA adjacent channel ACLR versus power level at 2 GHz.

23. W-CDMA characteristics apply at 900 MHz and between 1.8 to 2.2 GHz, 3.84 Mcps rate, within 5 °C of internal alignment.

24. Specifications apply within the controlled temperature range.

GSM/EDGE performance data [25]		
	GSM	**EDGE**
Modulation type	GMSK bursted	3pi/8-8PSK bursted
Modulation rate	270.833 ksps	70.833 ksps
EVM [ALC off]	*± 0.15 ° rms global phase error, typical*	*0.3%, typical*
EVM [ALC on]	*± 0.15 ° rms, global phase error, typical*	*0.6%, typical*
Output RF spectrum (ORFS) Offset	**GSM, *typical***	**EDGE, *typical***
Narrow loop bandwidth - M9311A manufacturing numbers higher than xx5236xxxx [26]		
200 kHz	*-37 dBc*	*-39 dBc*
400 kHz	*-66 dBc*	*-66 dBc*
600 kHz	*-71 dBc*	*-71 dBc*
800 kHz	*-76 dBc*	*-76 dBc*
1200 kHz	*-81 dBc*	*-81 dBc*
1800 kHz	*-80 dBc*	*-79 dBc*
Normal loop bandwidth - M9311A manufacturing numbers xx5236xxxx and lower		
200 kHz	*-36 dBc*	*-39 dBc*
400 kHz	*-64 dBc*	*-64 dBc*
600 kHz	*-68 dBc*	*-68 dBc*
800 kHz	*-75 dBc*	*-75 dBc*
1200 kHz	*-80 dBc*	*-80 dBc*
1800 kHz	*-80 dBc*	*-79 dBc*

25. GSM/EDGE characteristics apply 800 to 900 MHz, and 1800 to 1900 MHz, with 1 timeslot channel configuration, within ± 5 °C of internal alignment.

26. Narrow loop bandwidth is not available in M938x vector signal generator/CW source instrument drivers version 1.1.199.3 and earlier.

WLAN 802.11 performance data	EVM					
Narrow loop bandwidth – M9311A manufacturing numbers higher than xx5236xxxx [27]						
	Preamble Only					
Power level	**–7 dBm**		**0 dBm**		**+5 dBm**	
	Typical	*Nominal*	*Typical*	*Nominal*	*Typical*	*Nominal*
802.11n, 20 MHz, 64 QAM						
2.4 GHz	*–52.5 dB*	*–53.2 dB*	*–52.7 dB*	*–53.4 dB*	*–51.3 dB*	*–52.1 dB*
5.8 GHz	*–44.6 dB*	*–45.8 dB*	*–45.2 dB*	*–45.8 dB*	*–41.3 dB*	*–42.8 dB*
802.11n, 40 MHz, 64 QAM						
2.4 GHz	*–48.5 dB*	*–49.5 dB*	*–48.6 dB*	*–49.7 dB*	*–47.8 dB*	*–49.2 dB*
5.8 GHz	*–44.1 dB*	*–44.5 dB*	*–44.1 dB*	*–44.7 dB*	*–40.1 dB*	*–41.7 dB*
802.11ac, 80 MHz, 256 QAM						
5.8 GHz	*–42.2 dB*	*–45.6 dB*	*–42.8 dB*	*–46.1 dB*	*–40.6 dB*	*–42.8 dB*
802.11ac, 160 MHz, 256 QAM						
5.8 GHz	*–42.5 dB*	*–43.7 dB*	*–42.7 dB*	*–44.1 dB*	*–39.8 dB*	*–40.6 dB*
	Preamble, pilots & data					
Power level	**–7 dBm**		**0 dBm**		**+5 dBm**	
	Nominal		*Nominal*		*Nominal*	
802.11n, 20 MHz, 64 QAM						
2.4 GHz	*–54.4 dB*		*–54.7 dB*		*–54.5 dB*	
5.8 GHz	*–46.5 dB*		*–46.9 dB*		*–43.7 dB*	
802.11n, 40 MHz, 64 QAM						
2.4 GHz	*–52.8 dB*		*–53.3 dB*		*–52.9 dB*	
5.8 GHz	*–47.2 dB*		*–47.6 dB*		*–44.0 dB*	
802.11ac, 80 MHz, 256 QAM						
5.8 GHz	*–48.7 dB*		*–48.9 dB*		*–45.2 dB*	
802.11ac, 160 MHz, 256 QAM						
5.8 GHz	*–47.2 dB*		*–47.8 dB*		*–43.9 dB*	

EVM, nominal				
Normal loop bandwidth – M9311A manufacturing numbers xx5236xxxx and lower				
	Preamble only			
Frequency	**2.4 GHz**		**5.8 GHz**	
Power level	**5 dBm**	**15 dBm**	**1 dBm**	**11 dBm**
802.11a/g, 20 MHz, 64 QAM	*–49.6 dB*	*–39.4 dB*	*–44.0 dB*	*–34.2 dB*
802.11n, 40 MHz, 64 QAM	*–47.8 dB*	*–40.4 dB*	*–43.0 dB*	*–33.3 dB*
802.11ac, 80 MHz, 64 QAM	*–46.8 dB*	*–38.0 dB*	*–42.1 dB*	*–31.7 dB*
802.11ac, 80 MHz, 256 QAM	*–46.1 dB*	*–38.6 dB*	*–42.1 dB*	*–32.3 dB*
802.11ac, 160 MHz, 64 QAM	*–46.0 dB*	*–38.2 dB*	*–40.6 dB*	*–32.1 dB*

27. Narrow loop bandwidth is not available in M938x vector signal generator/CW source instrument drivers version 1.1.199.3 and earlier.

TECHNICAL SPECIFICATIONS AND CHARACTERISTICS

WLAN 802.11 performance data	EVM, nominal		
	Preamble only - narrow loop bandwidth		
Power level	**0 dBm**		
	2-channel, nominal	*3-channel, nominal*	*4-channel, nominal*
802.11n, 20 MHz, 64 QAM			
2.4 GHz	*–52.4 dB*	*–50.8 dB*	*–50.9 dB*
5.8 GHz	*–45.6 dB*	*–44.3 dB*	*–45.1 dB*
802.11n, 40 MHz, 64 QAM			
2.4 GHz	*–49.2 dB*	*–48.3 dB*	*–48.8 dB*
5.8 GHz	*–44.2 dB*	*–42.7 dB*	*–43.3 dB*
802.11ac, 80 MHz, 256 QAM			
5.8 GHz	*–43.3 dB*	*–42.0 dB*	*–42.9 dB*
802.11ac, 160 MHz, 256 QAM			
5.8 GHz	*–42.1 dB*	*–40.3 dB*	*–41.7 dB*
	Preamble, pilots & data - narrow loop bandwidth		
Power level	**0 dBm**		
	2-channel, nominal	*3-channel, nominal*	*4-channel, nominal*
802.11n, 20 MHz, 64 QAM			
2.4 GHz	*–54.2 dB*	*–54.2 dB*	*–52.9 dB*
5.8 GHz	*–46.4 dB*	*–45.6 dB*	*–45.7 dB*
802.11n, 40 MHz, 64 QAM			
2.4 GHz	*–52.8 dB*	*–52.7 dB*	*–51.7 dB*
5.8 GHz	*–47.1 dB*	*–46.1 dB*	*–45.3 dB*
802.11ac, 80 MHz, 256 QAM			
5.8 GHz	*–46.8 dB*	*–45.4 dB*	*–44.7 dB*
802.11ac, 160 MHz, 256 QAM			
5.8 GHz	*–45.4 dB*	*–43.0 dB*	*–43.3 dB*

TECHNICAL SPECIFICATIONS AND CHARACTERISTICS

LTE FDD performance data			
Modulation type	64 QAM		
EVM	**1-channel [28]**	**2-channel - MIMO [29]**	**4-channel - MIMO [29]**
900 MHz	*–52.0 dB (0.25%), nominal*	*–50.5 dB (0.30%), nominal*	*–51.5 dB (0.27%), nominal*
2 GHz	*–50.0 dB (0.32%), nominal*	*–50.0 dB (0.32%), nominal*	*–50.5 dB (0.30%), nominal*
ACPR			
Frequency	**Adjacent (< 5 dBm)**	**Alternate (< 5 dBm)**	
900 MHz	*–68 dBc, nominal*	*–70 dBc, nominal*	
2 GHz	*–67 dBc, nominal*	*–70 dBc, 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 [30]	1.5 GB available hard disk space, includes: • 1 GB available for Microsoft .NET framework 3.5 SP1 [31] • 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
M938x vector signal generator/CW source instrument drivers		
Agilent IO libraries	Version 16.3.16603.3 or later	
Narrow loop bandwidth	Narrow loop bandwidth using the best wide offset PLL mode setting AGM938X_VAL_SYNTHESIZER_PLL_MODE_BEST_WIDE_OFFSET requires instrument drivers version 1.2.300.0 or later	

28. LTE FDD E-TM 1.1 and E-TM 3.1, 10 MHz, 64 QAM PDSCH, full resource block, ≤+6 dBm. Characteristics apply with ± 5 °C of internal alignment.

29. LTE FDD MIMO R9 downlink, full filled 64 QAM 10 MHz (50 RB) at 0 dBm, open loop spacial multiplexing transmission mode.

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

31. 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 Non-operating (storage)		0 to 55 °C –40 to +70 °C	
Humidity [32]			Type tested at 95%, +40 °C (non-condensing)	
Shock/vibration [32]	Operating random vibration Survival random vibration Functional shock Bench handling		Type tested at 5 to 500 Hz, 0.21 g rms Type tested at 5 to 500 Hz, 2.09 g rms Type tested at half-sine, 30 g, 11 ms Type tested per MIL-PRF-28800F	
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 PXIe slot 1 PXIe slot 1 PXIe slot 2 PXIe 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	

32. 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.

SPECIFICATIONS FOR OLDER EQUIPMENT

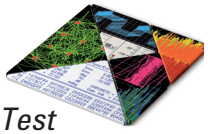
The following specifications relate only to older equipment, as defined below:	
For M9310A manufacturing numbers xx5236xxxx and lower, please find the following specifications at:	
Specification table	**Page #**
Maximum output power	9
Absolute level accuracy in CW mode [ALC on]	10

For M9311A manufacturing ID xx5236xxxx and lower, please find the following specifications at:	
Residual carrier leakage	15
I/Q image suppression	15
WLAN 802.11 performance data	19

Narrow loop bandwidth is not available in M938x vector signal generator/CW source instrument drivers version 1.1.199.3 and earlier. For normal loop bandwidth specifications, please refer to:	
3GPP W-CDMA performance data	17
GSM/EDGE performance data	18
WLAN 802.11 performance data	19

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.



Challenge the Boundaries of Test

Agilent Modular Products

3-Year Warranty
www.agilent.com/find/threeyearwarranty

myAgilent
www.agilent.com/find/myagilent

www.pxisa.org

Agilent Solutions Partners

www.agilent.com/find/solutionspartners

Agilent Advantage Services

Agilent Advantage Services is committed to your success throughout your equipment's lifetime.

www.agilent.com/find/advantageservices

www.agilent.com
www.agilent.com/find/modular
www.agilent.com/find/m9381a

For more information on Agilent Technologies' products, applications or services, please contact your local Agilent office. The complete list is available at: **www.agilent.com/find/contactus**

Americas	
Canada	(877) 894 4414
Brazil	(11) 4197 3500
Mexico	01800 5064 800
United States	(800) 829 4444

Asia Pacific	
Australia	1 800 629 485
China	800 810 0189
Hong Kong	800 938 693
India	1 800 112 929
Japan	0120 (421) 345
Korea	080 769 0800
Malaysia	1 800 888 848
Singapore	1 800 375 8100
Taiwan	0800 047 866
Other AP Countries	(65) 375 8100

Europe & Middle East	
Belgium	32 (0) 2 404 93 40
Denmark	45 70 13 15 15
Finland	358 (0) 10 855 2100
France	0825 010 700* *0.125 €/minute
Germany	49 (0) 7031 464 6333
Ireland	1890 924 204
Israel	972-3-9288-504/544
Italy	39 02 92 60 8484
Netherlands	31 (0) 20 547 2111
Spain	34 (91) 631 3300
Sweden	0200-88 22 55
United Kingdom	44 (0) 118 9276201

For other unlisted Countries: **www.agilent.com/find/contactus**
(BP-3-1-13)

Product specifications and descriptions in this document subject to change without notice.

Printed in USA, December 19, 2013

Agilent Technologies