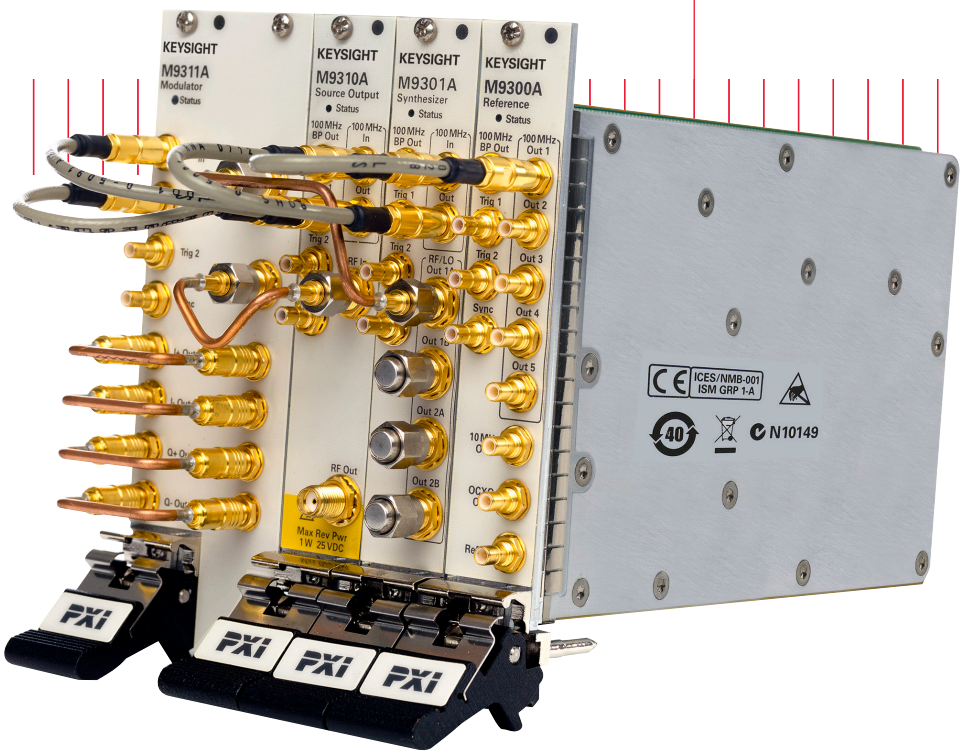
Keysight Technologies

M9381A PXIe Vector Signal Generator

1 MHz to 3 GHz or 6 GHz

Data Sheet



KEYSIGHT TECHNOLOGIES

Table of Contents

Overview

Be Ready for Tomorrow – Today

RF requirements keep growing while timelines keep shrinking. To help ease the technical and business pressures, the right test solution provides continuity in measurements and longevity in capability. The Keysight Technologies, Inc. M9381A PXIe vector signal generator (PXI VSG) is the next logical step in RF signal generation.

To get proven results even faster, use Keysight software with the PXI VSG to create the test stimulus you need to validate and test your RF communications designs. Signal Studio and Waveform Creator software simplify and streamline signal creation and generation from basic analog and digital modulation to the latest wireless standards like LTE-Advanced and 802.11ac WLAN.

Combine the M9381A PXI VSG with the M9391A PXIe vector signal analyzer for a complete solution for fast, high quality measurements optimized for RF manufacturing test environments. From fully modular hardware to software leverage to worldwide support, the PXI VSG is the low-risk way to manage change and be ready for tomorrow – today.

BEST IN TEST 2013 FINALIST

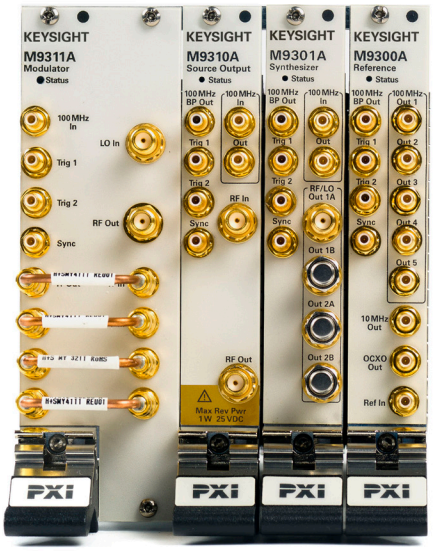


Figure 1. M9381A PXIe vector signal generator with four modules consisting of the M9311A digital vector modulator, M9310A source output, M9301A synthesizer, and M9300A frequency reference.

Product description

The M9381A PXIe vector signal generator (PXI VSG) is a compact modular instrument that provides frequency coverage from 1 MHz to 6 GHz and up to 160 MHz RF modulation bandwidth. The M9381A is comprised of four individual PXIe modules – M9311A modulator, M9310A source output, M9301A synthesizer, and M9300A frequency reference. A single M9300A frequency reference can be shared between multiple instruments to minimize footprint. A wide range of instrument drivers are available to support your development environment of choice.

The flexible, modular design of the M9381A enables you to efficiently scale to multi-channel signal generation to test multiple-input, multiple-output (MIMO) devices. Many capability options such as memory, frequency range and modulation bandwidth can also be easily upgraded in the field.

Applications

- Power amplifier and front-end-module design validation and manufacturing
- Radio transceiver design validation and production test
- MIMO and multi-channel device test

Reference solutions

Application-specific reference solutions, a combination of recommended hardware, software, and measurement expertise, provide the essential components of a test system. The following reference solutions include the M9381A PXI VSG as a hardware component:

- RF power amplifier/front end module characterization and test, Reference Solution for the industry's fastest power amplifier test solution including envelope tracking test, rapid waveform download, tight synchronization, automated calibration and digital pre-distortion. For more information, see **www.keysight.com/find/solution-padvt**
- LTE/LTE-Advanced multi-channel test, Reference Solution for faster insight into carrier aggregation, spatial multiplexing MIMO and beamforming designs. For more information, see **www.keysight.com/find/solution-LTE**

Technical Specifications and Characteristics

Block diagram

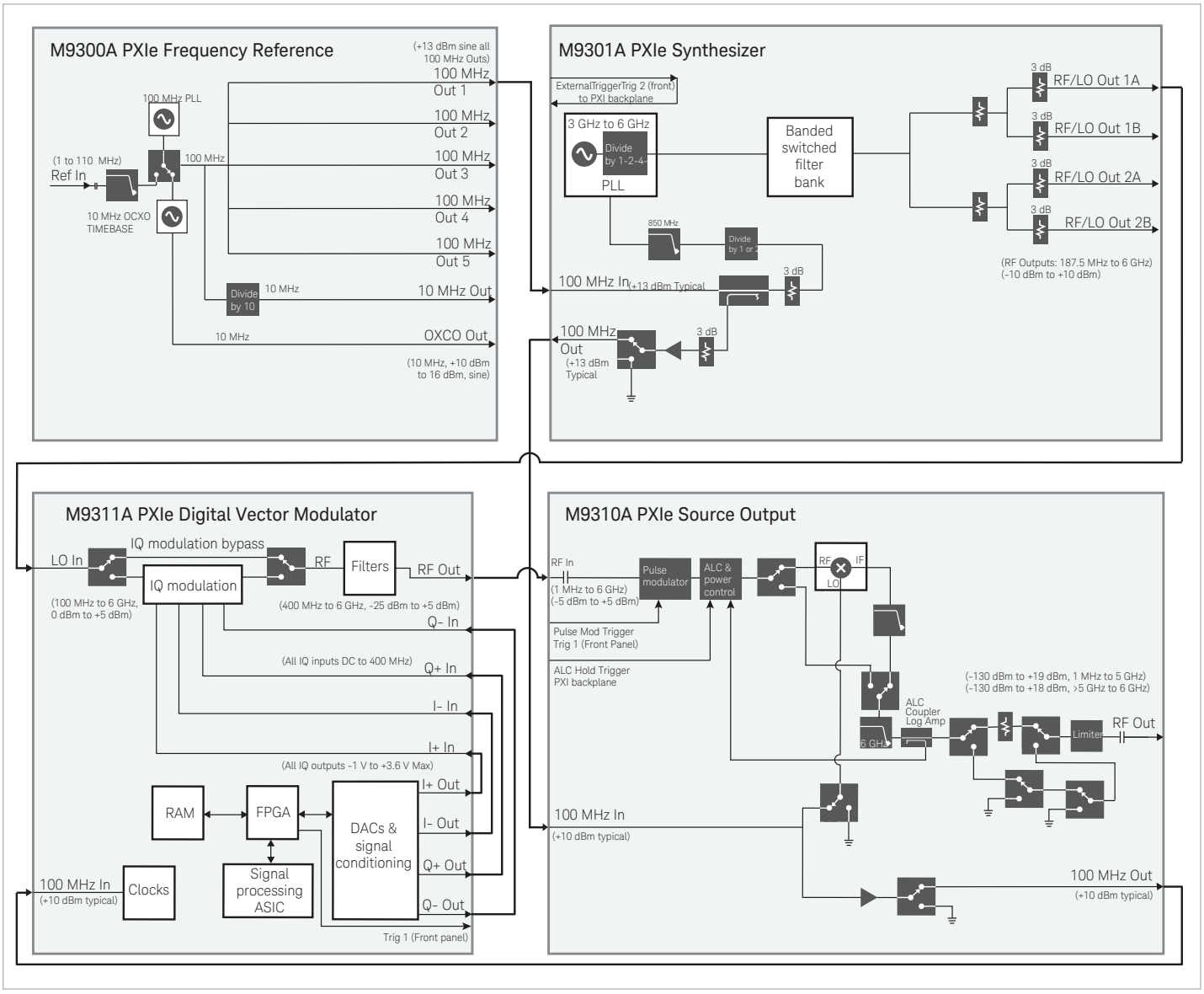


Figure 5. M9381A PXIe vector signal generator block diagram with four modules consisting of the M9301A synthesizer, M9310A source output, M9311A digital vector modulator, and optional M9300A frequency reference.

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 under the following conditions unless otherwise noted.

- 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 and Keysight interconnect cables

Characteristics *describe product performance that is useful in the application of the product. 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.
- Set chassis fan to high at environmental temperatures above 45 °C.
- Maintain temperature stability for best multi-channel phase coherence
  - Set chassis fans to maximum
  - Maintain stable ambient temperature
  - Perform warm-up with session open and representative waveform running

Additional information

- 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.
- Performance described in this document applies for module temperature within ± 5 degrees of IQ alignment, unless otherwise noted.
- When configured for multi-channel, phase-coherent operation (shared synthesizer configuration), instrument level warranted specifications only apply to the M9381A which was previously calibrated with the M9301A synthesizer, showing a valid calibration indicator. For all other M9381A channels, specifications revert to typical performance. If using an external LO distribution unit, such as the V2802A LO distribution network, specifications for all M9381A channels revert to typical performance.
- All graphs contain measured data from one unit and are 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	**Standard, nominal**	**Option UNZ, nominal**	
List mode switching speed [1]		**Normal loop bandwidth**	**Narrow loop bandwidth**
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 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.
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.

Technical Specifications and Characteristics

Frequency (continued)

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	< *± 0.1 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)	± 5 x 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*	

Technical Specifications and Characteristics

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**
1 MHz to 5 GHz	+10 dBm	+19 dBm
> 5 to 6 GHz	+10 dBm	+18 dBm

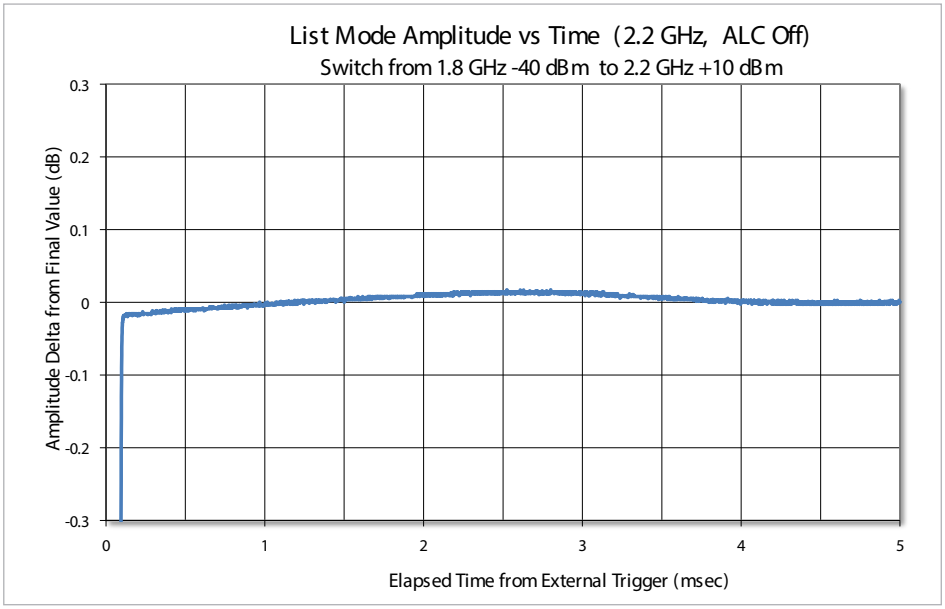


Figure 6. List mode amplitude vs time showing fast settling time to specified level accuracy.

6. Settable to 0.01 dB.
7. After a power search.

Technical Specifications and Characteristics

Amplitude (continued)

Amplitude switching speed	Standard, nominal	Option UNZ, nominal
List mode switching speed [8]		
Baseband power level change [9]	*≤ 5 ms*	*≤ 10 µs*
ALC off	*≤ 5 ms*	*≤ 105 µs*
ALC on	*≤ 5 ms*	*≤ 105 µs*
Non-list mode switching speed [10]		
Baseband power level change [9]	*≤ 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] [11]				
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*

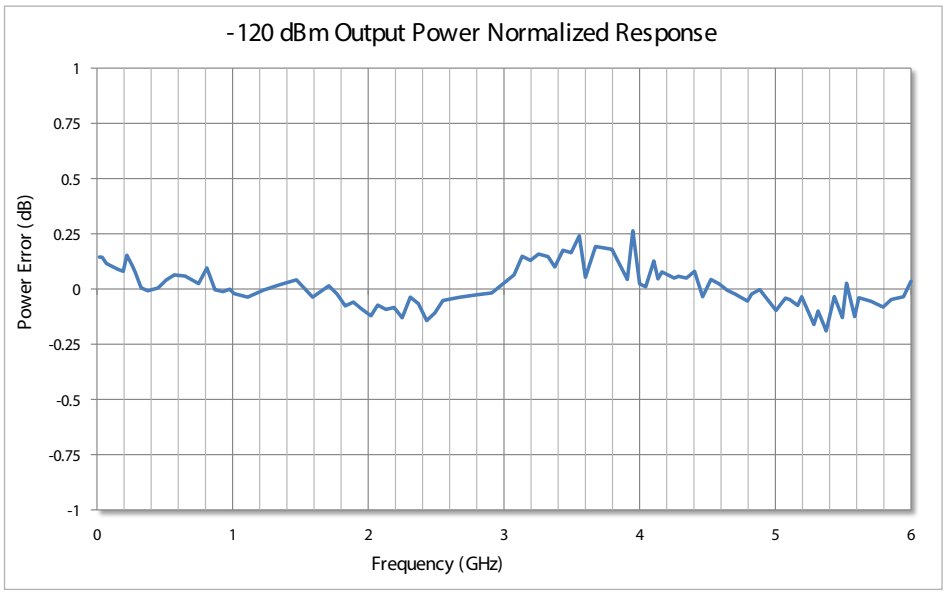


Figure 7. Output power normalized response at –120 dBm.

8. Time from trigger input to amplitude settled within 0.2 dB (within the 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.
9. Baseband offset amplitude settled within 0.2 dB. Baseband offset can be adjusted from 0 to –20 dB.
10. Mean time from IVI command to amplitude settled within 0.2 dB. Carrier frequency is not changing.
11. Specifications apply within the controlled temperature range. For temperatures outside this range, absolute level accuracy degrades by ± 0.02 dB/°C.

Technical Specifications and Characteristics

Amplitude (continued)

Absolute level accuracy (ALC off, relative to ALC on) [12]	
1 MHz to 5 GHz	*± 0.25 dB, typical*
> 5 to 6 GHz	*± 0.62 dB, typical*
Power search [13]	
Time	*< 20 ms, nominal*
Absolute level accuracy in digital I/Q mode (ALC on, relative to CW) [14]	
≤ 15 dBm	± 0.7 dB *(± 0.25 dB, nominal)*
≤ 10 dBm	± 0.2 dB
≤ 0 dBm	± 0.1 dB

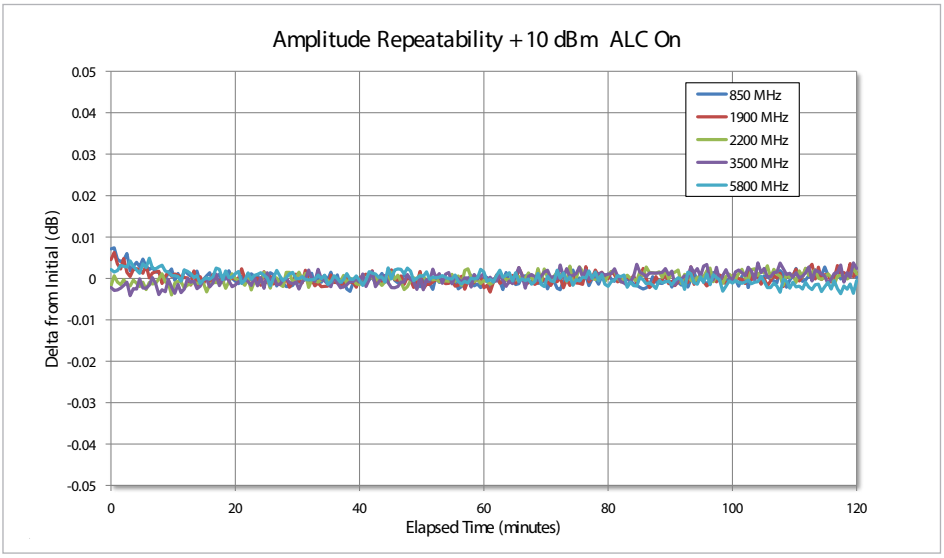


Figure 8. Amplitude repeatability at various carrier frequencies. Repeatability measures the ability of the instrument to return to a given power setting after a random excursion to any other frequency and power setting. It should not be confused with absolute level accuracy.

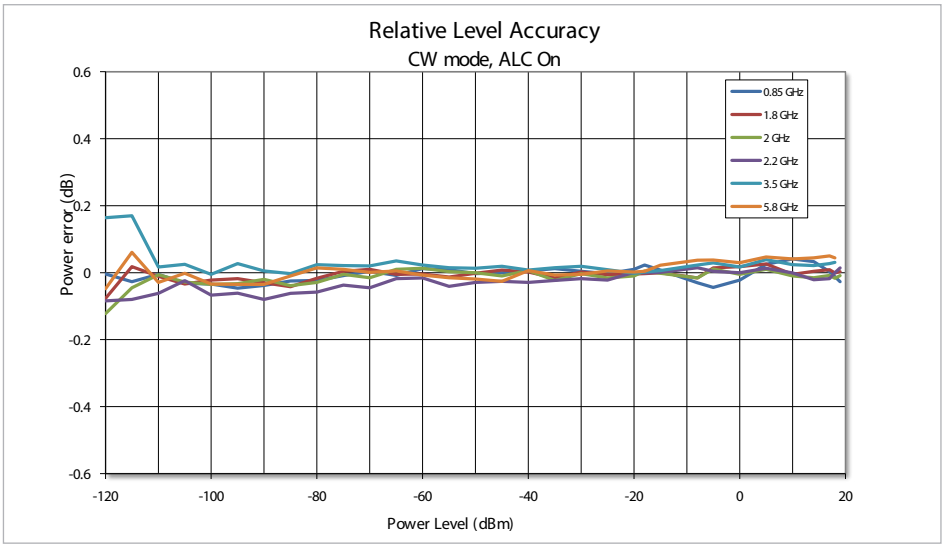


Figure 9. Relative level accuracy at various carrier frequencies.

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

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*

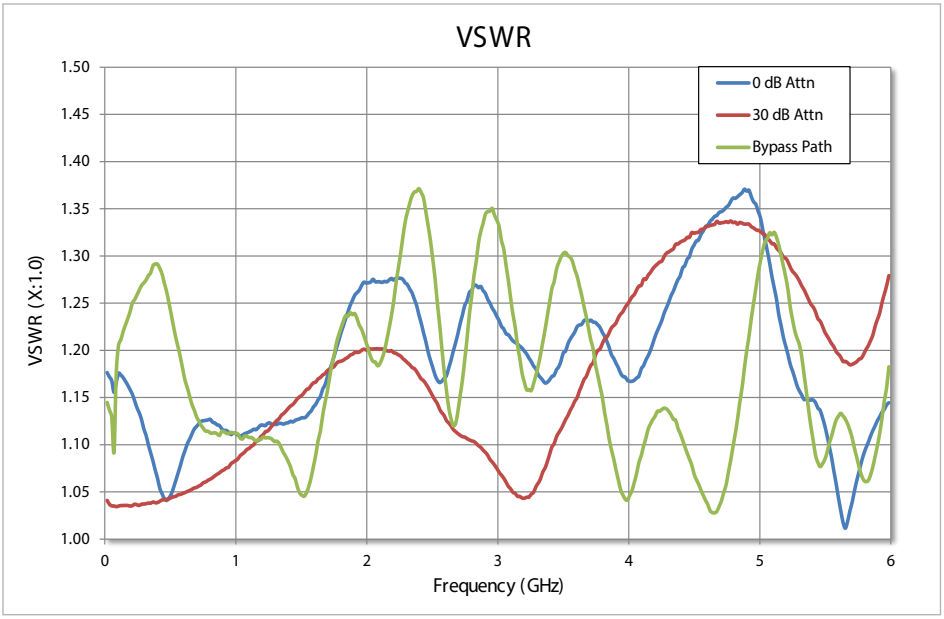


Figure 10. Measured VSWR from 1 MHz to 6 GHz.

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*

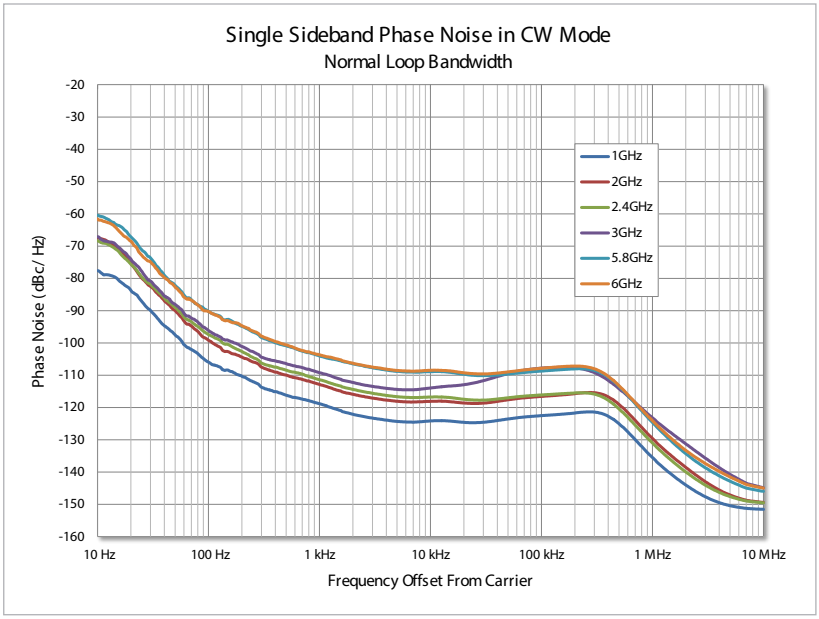


Figure 11. Single sideband phase noise in normal loop bandwidth, CW mode from 10 Hz to 10 MHz, offset at 1, 2, 2.4, 3, 5.8, and 6 GHz.

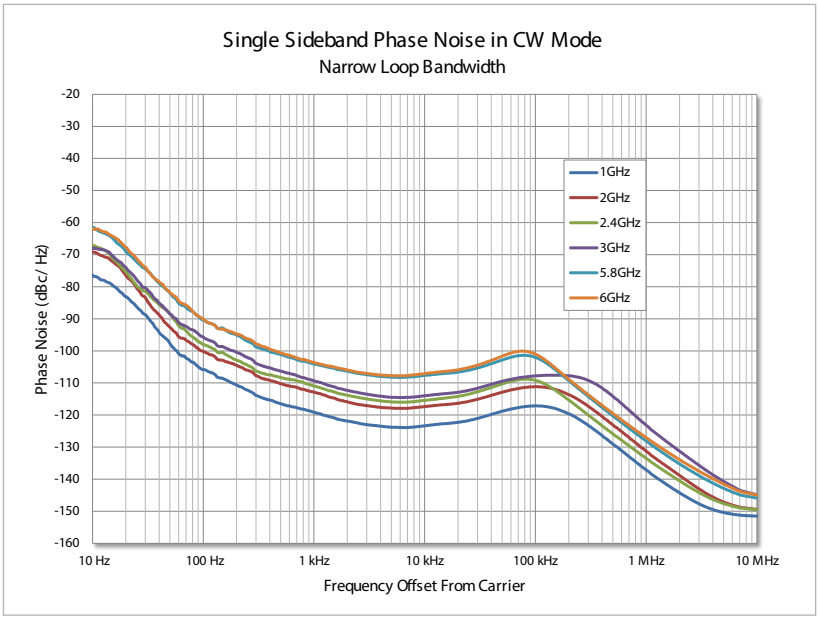


Figure 12. Single sideband phase noise in narrow loop bandwidth, CW mode from 10 Hz to 10 MHz, offset at 1, 2, 2.4, 3, 5.8, and 6 GHz.

Technical Specifications and Characteristics

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**	**≤ 0 dBm**	**≤ +10 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*	< –28 dBc	*–31 dBc, typical*
Nonharmonics [15]				
Nonharmonic miscellaneous spurious [16]	< *–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			

15. Non–harmonics include mixing spurs for frequencies below 400 MHz, synthesizer spurs, and other miscellaneous chassis and power supply products, for offsets > 10 kHz.
16. With Keysight M9036A embedded controller.

Technical Specifications and Characteristics

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) [17]	
Maximum deviation	1.25 MHz
Resolution of deviation	0.1 Hz
Maximum rate	5 MHz
Phase modulation (Option UNT) [17]	
Maximum deviation	10 radians
Resolution of deviation	0.001 radians
Maximum rate	5 MHz
Pulse (Option UNT) [17]	
Rate	1 Hz to 1 MHz
Pulse on time	200 ns to 2 ms
Multitone (Option UNT) [17]	
Rate (tone separation)	100 Hz to 1 MHz
Number of tones	2 to 16
Frequency modulation (Option UNT) [17]	
Maximum deviation	1.25 MHz
Resolution of deviation	0.1 Hz
Maximum rate	5 MHz

17. With arbitrary waveforms. Sine, dual–sine, triangle, ramp, and square waveforms supported.

Technical Specifications and Characteristics

Vector modulation

Residual carrier leakage [18]		
Frequency	**Specifications**	**Typical**
1 MHz to 5 GHz	< –55 dBc	*< –62 dBc*
> 5 to 6 GHz	< –51 dBc	*< –58 dBc*
I/Q image suppression [18]		
Frequency	**Specifications**	**Typical**
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*
I/Q baseband feed-through [18]		
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 to 6 GHz**
40 MHz BW	*< ± 0.1 dB, typical*	*< ± 0.2 dB, typical*
100 MHz BW	*< ± 0.2 dB, typical*	*< ± 0.3 dB, typical*
160 MHz BW	*< ± 0.3 dB, typical*	*< ± 0.5 dB, typical*

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

Technical Specifications and Characteristics

Vector modulation (continued)

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

Channel-to-channel synchronization [19]		
	Timing	**Phase**
Skew	*≤ 500 ps, nominal*	–
Jitter [20]	*≤ 45 ps, nominal*	*≤ 1 °, nominal*
Repeatability [21]	*≤ 70 ps, nominal*	*≤ 1.5 °, nominal*
Adjustment resolution	50 ps	0.05 °
Drift over 12 hours	*20 ps, nominal*	*0.5 °, nominal*

19. Multi-channel capability only supported with up to 8-channels when configured with a Keysight M9018A PXIe chassis, with FPGA version 1.05 or greater. Characteristics measured at 400, 900, 2400, 5800 MHz. V2802A LO distribution network used for phase synchronization for more than 4 channels
20. Jitter indicates measurement-to-measurement variation and applies over short time interval at room temperature without resetting or reinitializing a driver session.
21. Repeatability indicates stability of alignment between channels across power cycles and IVI sessions, with identical cabling and hardware settings frequency, span, sample rate, etc.)

Technical Specifications and Characteristics

Vector modulation (continued)

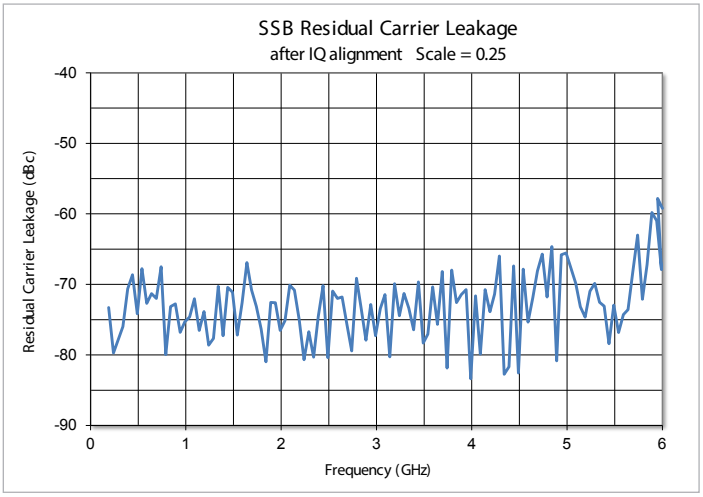


Figure 13. SSB residual carrier leakage.

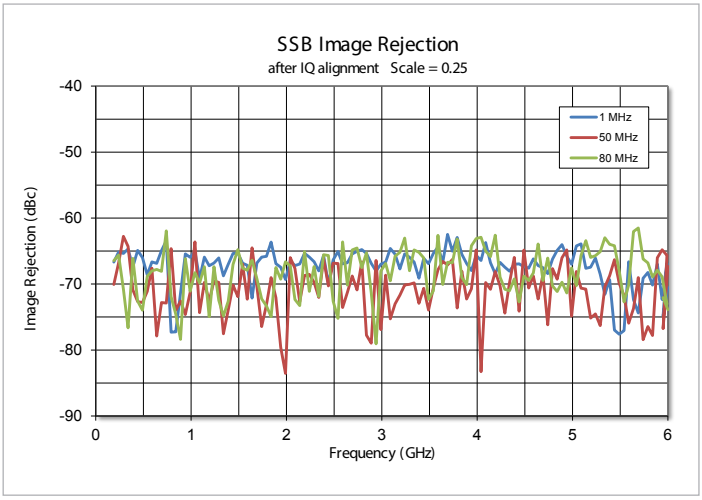


Figure 14. SSB image rejection at 1, 50, and 80 MHz offsets.

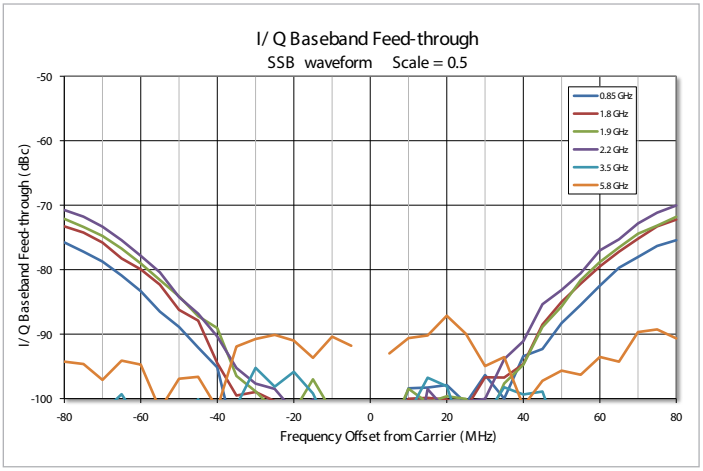


Figure 15. I/Q baseband feed-through at various carrier frequencies.

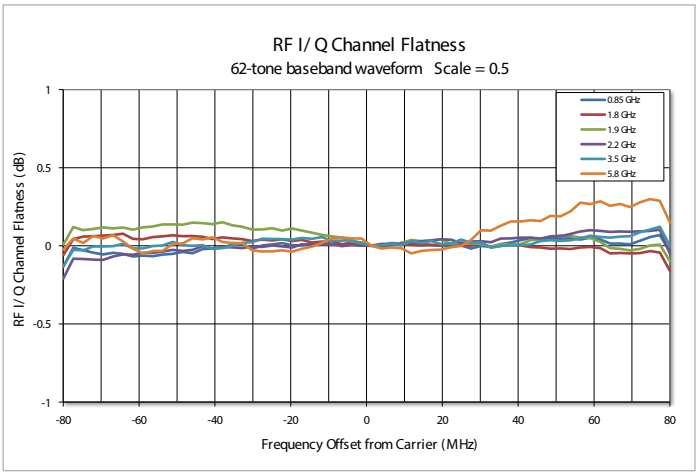


Figure 16. RF I/Q channel flatness at various carrier frequencies.

Technical Specifications and Characteristics

Format specific modulation data

3GPP W-CDMA performance data [22]						
Modulation type	QPSK					
EVM (2 GHz, 1 DPCH, ≤ 5 dBm)	*0.57% rms, typical*					
Channel distortion [23]	**ACLR**					
	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*

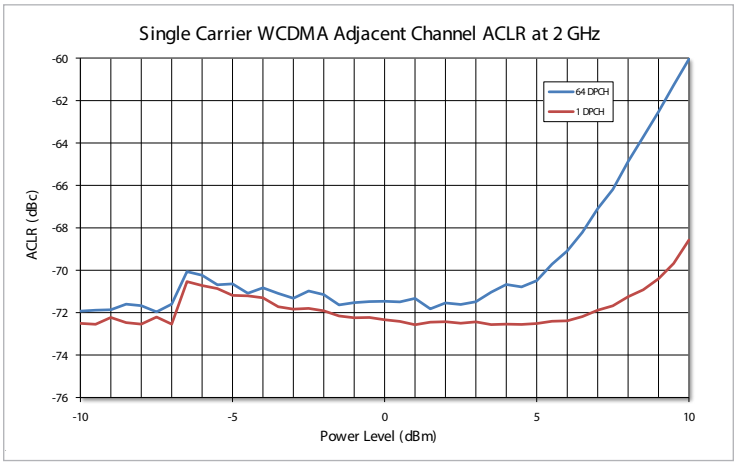


Figure 17. Single carrier W-CDMA adjacent channel ACLR versus power level at 2 GHz.

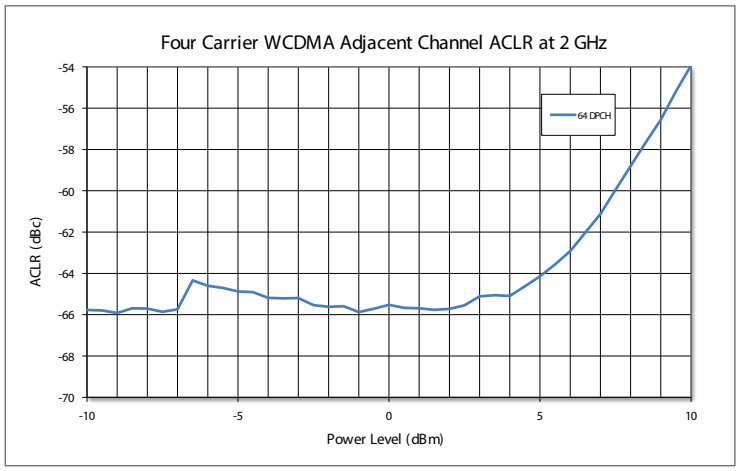


Figure 18. Four carrier W-CDMA adjacent channel ACLR versus power level at 2 GHz.

22. W-CDMA characteristics apply at 900 MHz and between 1.8 to 2.2 GHz, 3.84 Mcps rate.
23. Specifications apply within the controlled temperature range.

Technical Specifications and Characteristics

Format specific modulation data (continued)

GSM/EDGE performance data [24]		
	GSM	**EDGE**
Modulation type	GMSK bursted	3pi/8-8PSK bursted
Modulation rate	270.833 ksps	70.833 ksps
EVM [ALC off]	*±0.15 °C rms global phase error, typical*	*0.3%, typical*
EVM [ALC on]	*±0.15 °C rms, global phase error, typical*	*0.6%, typical*
Output RF spectrum (ORFS)	**Narrow loop bandwidth**	**Narrow loop bandwidth**
Offset	**GSM, *typical***	**EDGE, *typical***
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

WLAN 802.11 performance data – single channel	**EVM**					
	Preamble only – narrow loop bandwidth					
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 - narrow loop bandwidth		
Power level	**–7 dBm, *nominal***	**0 dBm, *nominal***	**+5 dBm, *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*

24. GSM/EDGE characteristics apply 800 to 900 MHz, and 1800 to 1900 MHz, with 1 timeslot channel configuration.

Technical Specifications and Characteristics

Format specific modulation data (continued)

WLAN 802.11 performance data – multi-channel[25]	EVM			
	Preamble only – narrow loop bandwidth, 0 dBm			
	2-channel, nominal	*3-channel, nominal*	*4-channel, nominal*	*8-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*	*-43.0 dB*
802.11ac, 160 MHz, 256 QAM				
5.8 GHz	*–42.1 dB*	*–40.3 dB*	*–41.7 dB*	*-41.4 dB*
	Preamble, pilots & data – narrow loop bandwidth, 0 dBm			
	2-channel, nominal	*3-channel, nominal*	*4-channel, nominal*	*8-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*	*-44.0 dB*
802.11ac, 160 MHz, 256 QAM				
5.8 GHz	*–45.4 dB*	*–43.0 dB*	*–43.3 dB*	*-41.5 dB*

25. Multi-channel performance data applies when each channel is configured with its own independent synthesizer. Sharing a single synthesizer will degrade EVM performance approximately 1 dB.

Technical Specifications and Characteristics

Format specific modulation data (continued)

LTE FDD performance data – single channel [26] nominal			
EVM			
900 MHz	*–52.0 dB (0.25%)*		
2 GHz	*–50.0 dB (0.32%)*		
ACPR [23]	**Adjacent (< 5 dBm)**	**Alternate (< 5 dBm)**	
900 MHz	*–68 dBc*	*–70 dBc*	
2 GHz	*–67 dBc*	*–70 dBc*	
LTE FDD & LTE TDD performance data – multi-channel [27] nominal			
LTE FDD – EVM	**2x2 MIMO [28]**	**4x4 MIMO [28]**	**8x8 MIMO [29]**
900 MHz	*–50.5 dB (0.30%)*	*–51.5 dB (0.27%)*	*-53.9 dB (0.20%)*
2 GHz	*–50.0 dB (0.32%)*	*–50.5 dB (0.30%)*	*-51.1 dB (0.28%)*
LTE TDD – EVM	**2x2 MIMO [28]**	**4x4 MIMO [28]**	**8x8 MIMO [29]**
900 MHz	*–51.0 dB (0.28%)*	*–50.7 dB (0.29%)*	*-56.7 dB (0.15%)*
2 GHz	*–49.8 dB (0.32%)*	*–49.7 dB (0.33%)*	*-55.7 dB (0.16%)*

26. LTE FDD E-TM 1.1 and E-TM 3.1, 10 MHz, 64 QAM PDSCH, full resource block, ≤ +6 dBm.
27. MIMO performance data applies when each channel is configured with its own independent synthesizer. Sharing a single synthesizer will degrade EVM performance approximately 1 dB.
28. LTE FDD/TDD MIMO R9 downlink, full filled 64 QAM 10 MHz (50 RB), at 0 dBm, open-loop spatial multiplexing transmission mode.
29. LTE FDD/TDD 10 MHz BW, DL, TM9 multi-layer, TM4 closed-loop spatial multiplexing transmission mode.

Technical Specifications and Characteristics

Environmental and physical specifications				
Temperature	Operating Non-operating (storage)		0 to 55 °C –40 to +70 °C	
Humidity [30]			Type tested at 95%, +40 °C (non-condensing)	
Shock/vibration [30]	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) [31]	
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	

30. 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.

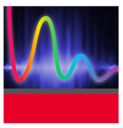
31. At 15,000 feet, the maximum environmental temperature is de-rated to 52 °C.

Technical Specifications and Characteristics

System requirements	
Topic	
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 [32]	1.5 GB available hard disk space, includes: 1 GB available for Microsoft .NET framework 3.5 SP1 [33] 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 or greater
M938x vector signal generator/CW source instrument drivers	
Keysight IO libraries	Version 16.3.17914 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

32. Because of the installation procedure, less disk space may be required for operation than is required for installation.
33. 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.

Software

Instrument connection software			
	Keysight IO library	The IO library suite offers a single entry point for connection to the most common instruments including AXIe, PXI, GPIB, USB, Ethernet/ LAN, RS-232, and VXI test instruments from Keysight and other vendors. It automatically discovers interfaces, chassis, and instruments. The graphical user interface allows you to search for, verify, and update IVI instrument and soft front panel drivers for modular and traditional instruments. The IO suite safely installs in side-by-side mode with NI I/O software.	Free software download at **www.keysight.com/find/iosuite**
Module setup and usage			
	Keysight soft front panel	The PXI module includes a soft front panel (SFP), a software based graphical user interface (GUI) which enables the instrument's capabilities from your PC.	Included on CD-ROM shipped with module or **online**
Programming			
Driver		**Development environments**	
IVI-COM IVI-C LabVIEW MATLAB		Visual Studio (VB.NET, C#, C/C++) VEE LabVIEW, LabWindows/CVI, MATLAB	Included on CD-ROM shipped with module or **online**
Programming assitance			
	Command Expert	Assists in finding the right instrument commands and setting correct parameters. A simple interface includes documentation, examples, syntax checking, command execution, and debug tools to build sequences for integration in Excel, MATLAB, Visual Studio, LabVIEW, VEE, and SystemVue.	Free software download at **www.keysight.com/find/commandexpert**
Programming examples		Each module includes programming examples for Visual Studio.net, LabVIEW, MATLAB, LabWindows, and Keysight VEE Pro.	Included on CD-ROM shipped with module or **online**
Signal generation software			
	Signal Studio	Suite of flexible, easy-to-use, signal creation tools that provides validated and performance optimized reference signals for commonly used communications standards. It configures signals in an easy-to-use, application specific graphical interface and enables you to scale the capability and performance to meet your specific test needs.	Licensed software. For more information, **visit www.keysight.com/find/signalstudio**
	Waveform Creator	Built around a drag-and-drop graphical user interface, Waveform Creator enables quick development of multi-format, multi-track custom waveforms to be used in the validation and test of digital communications products	Licensed software. For more information, **visit www.keysight.com/find/m9099**
	SystemVue	System–level EDA software platform for designing communications and defense systems. Used with the M9381A, SystemVue bridges the gap between simulation and prototyping to reduce design iterations and accelerate deployment of emerging wireless technologies.	Licensed software. For more information, visit **www.keysight.com/find/systemvue**
	MATLAB	Interactive tools and command-line functions for instrument control and data analysis tasks such as signal processing, signal modulation, and digital filtering.	Licensed software. For more information, visit **www.keysight.com/find/matlab**

Setup and Calibration Services

Assistance		
One day startup assistance	Gain access to a technical expert who will help you get started quickly with the M9381A VSG and its powerful software tools. The flexible instruction format is designed to get you to your first measurements and familiarize you with ways to adapt the equipment to a specific application.	Included in base configuration
Calibration and traceability		
Factory calibration	The M9381A VSG ships factory calibrated with an ISO-9002, NIST-traceable calibration certificate.	Included in base configuration
Calibration cycle	A one year calibration cycle is recommended.	
Calibration sites	– At Keysight Worldwide Service Centers – On-site by Keysight – By self-maintainers	For more information visit **www.keysight.com/find/infoline**
N7800A calibration and adjustment software	The M9381A VSG is supported by Keysight's calibration and adjustment software. This is the same software used at Keysight service centers to automate calibration. The software offers compliance tests for ISO 17025:2005, ANSI/NCSL Z540.3-2006, and measurement uncertainty per ISO Guide to Expression of Measurement Uncertainty.	Licensed software. For more information, visit **www.keysight.com/find/calibrationsoftware**
Keysight calibration status utility	The Keysight calibration status utility helps ensure your M9381A is calibrated by managing the calibration interval and providing messages regarding instrument and module calibration status.	Included in base configuration

Support

Support		
Core exchange program	Keysight's replacement core exchange program allows fast and easy module repairs. A replacement core assembly is a fully functioning pre-calibrated module replacement that is updated with the defective module serial number, allowing the replacement module to retain the original serial number.	For qualified self maintainers in US only
Self-test utility	A self-test utility runs a set of internal tests which verifies the health of the modules and reports their status.	Included in base configuration

Configuration and Ordering Information

Ordering information

Model	Description
M9381A	PXIe vector signal generator: 1 MHz to 3 or 6 GHz Includes: M9301A PXIe synthesizer M9310A PXIe source output M9311A PXIe digital vector modulator One day startup assistance Module interconnect cables Software, example programs, and product information on CD
Base configuration	
M9381A-F03	Frequency range: 1 MHz to 3 GHz
M9381A-B04	RF modulation bandwidth, 40 MHz
M9381A-M01	Memory, 32 MSa
M9381A-300 Required for warranted specifications	PXIe frequency reference: 10 and 100 MHz Adds M9300A PXIe frequency Reference: 10 and 100 MHz (M9300A module can support multiple M9381A modular instruments)

	Configurable options	
Frequency		
	M9381A-F03	1 MHz to 3 GHz
✓	M9381A-F06	1 MHz to 6 GHz
Power		
✓	M9381A-1EA	High output power
Switching Speed		
✓	M9381A-UNZ	Fast switching
RF modulation bandwidth		
	M9381A-B04	40 MHz
	M9381A-B10	100 MHz
✓	M9381A-B16	160 MHz
Memory		
	M9381A-M01	32 MSa
	M9381A-M05	512 MSa
✓	M9381A-M10	1024 MSa
Other		
✓	M9381A-UNT	Analog modulation
	M9381A-012	Phase coherency
	M9381A-UK6	Commercial calibration certificate with test data for M9381A (M9301A, M9310A, M9311A)
	M9300A-UK6	Commercial calibration certificate with test data for M9300A (module only)
Related products in recommended configuration		
✓	M9037A	PXIe embedded controller
✓	M9018A	18-slot PXIe chassis

1. ✓ Recommended configuration

Configuration and Ordering Information

Software information

Supported operating systems	Microsoft Windows XP (32-bit) Microsoft Windows 7 (32/64-bit)
Standard compliant drivers	IVI-COM, IVI-C, LabVIEW, MATLAB
Supported application development environments (ADE)	VisualStudio (VB.NET, C#, C/C++), VEE, LabVIEW, LabWindows/CVI, MATLAB
Keysight IO libraries (version 16.3 or newer)	Includes: VISA libraries, Keysight connection expert, IO monitor
Keysight command expert	Instrument control for SCPI or IVI-COM drivers
Signal Studio software (Playback on up to four channels per license): – N76xxB-9TP, transportable perpetual license – N76xxB-9FP, fixed perpetual license. – N7650B-2xx provides 5/50 waveform pack licenses – M9950A Signal Studio software extension from 4 to 8 channels	N7600B W-CDMA/HSPA+ N7601B cdma2000®/1xEV-DO N7602B GSM/EDGE/Evo N7606B *Bluetooth*® N7609B Global navigation satellite system N7611B Broadcast radio N7612B TD-SCDMA/HSDPA N7615B Mobile WiMAX™ N7617B WLAN 802.11a/b/g/n/ac N7623B Digital video N7624B LTE/LTE-Advanced FDD N7625B LTE/LTE-Advanced TDD
Waveform Creator:	
M9099T	Waveform Creator
M9099T-LIC	Core w/utility & multi-tone plug-ins (required)
M9099T-AYA	Digital modulation plug-in
M9099T-SVM	SystemVue plug-in (requires SystemVue v2013.08 or later)
M9099T-DFW	File based write unencrypted waveform license
M9099T-XXX-12M	Adds premium support for 1 year
SystemVue software:	
W1461	SystemVue Architect
SystemVue libraries:	
W1918	LTE-Advanced
W1910	LTE
W1916	3G (GSM/EDGE/CDMA/cdma2000®/W-CDMA/HSPA+)
W1911	WiMAX™ 802.16e
W1917	WLAN 802.11a/b/g/n/ac
W1915	mmWave WPAN
W1919	Global navigation satellite system
W1914	DVB-x2
W1905	Radar
W1716	Digital predistortion builder

Accessories

Model	Description
Y1212A	Slot blocker kit: 5 modules
Y1213A	PXI EMC filler panel kit: 5 slots
Y1243A	Cable kit for M9301A LO distribution
Y1299A	PXI solutions startup kits – MIMO solution

Related products

Model	Description
M9380A	PXIe CW source
M9300A	PXIe frequency reference
M9391A	PXIe vector signal analyzer

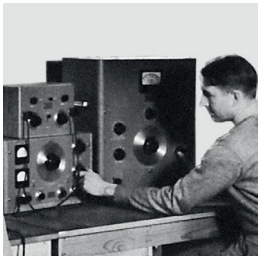
Accesories

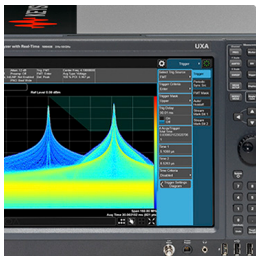
M9021A	PCIe® cable interface
M9045B	PCIe express card adaptor for laptop connectivity
Y1200B	PCIe cable for laptop connectivity
M9048A	PCIe desktop adaptor for desktop connectivity
Y1202A	PCIe cable for desktop connectivity

Advantage services: Calibration	
Keysight Advantage Services is committed to your success throughout your equipment's lifetime	
N7800A	Calibration & adjustment software

Evolving Since 1939

Our unique combination of hardware, software, services, and people can help you reach your next breakthrough. We are unlocking the future of technology.
From Hewlett-Packard to Agilent to Keysight.





myKeysight

myKeysight

www.keysight.com/find/mykeysight
A personalized view into the information most relevant to you.

www.keysight.com/find/emt_product_registration
Register your products to get up-to-date product information and find warranty information.

KEYSIGHT SERVICES
Accelerate Technology Adoption.
Lower costs.

Keysight Services

www.keysight.com/find/service
Keysight Services can help from acquisition to renewal across your instrument's lifecycle. Our comprehensive service offerings—one-stop calibration, repair, asset management, technology refresh, consulting, training and more—helps you improve product quality and lower costs.

CALIBRATION UP TO 10 YEARS WARRANTY
ASSURANCE PLANS

Keysight Assurance Plans

www.keysight.com/find/AssurancePlans
Up to ten years of protection and no budgetary surprises to ensure your instruments are operating to specification, so you can rely on accurate measurements.

Keysight Channel Partners

www.keysight.com/find/channelpartners
Get the best of both worlds: Keysight's measurement expertise and product breadth, combined with channel partner convenience.

www.keysight.com/find/m9381a
www.keysight.com/find/modular

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

Americas

Canada	(877) 894 4414
Brazil	55 11 3351 7010
Mexico	001 800 254 2440
United States	(800) 829 4444

Asia Pacific

Australia	1 800 629 485
China	800 810 0189
Hong Kong	800 938 693
India	1 800 11 2626
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) 6375 8100

Europe & Middle East

Austria	0800 001122
Belgium	0800 58580
Finland	0800 523252
France	0805 980333
Germany	0800 6270999
Ireland	1800 832700
Israel	1 809 343051
Italy	800 599100
Luxembourg	+32 800 58580
Netherlands	0800 0233200
Russia	8800 5009286
Spain	800 000154
Sweden	0200 882255
Switzerland	0800 805353 Opt. 1 (DE) Opt. 2 (FR) Opt. 3 (IT)
United Kingdom	0800 0260637

For other unlisted countries:
www.keysight.com/find/contactus
(BP-9-7-17)

DEKRA Certified
ISO9001 Quality Management System

www.keysight.com/go/quality
Keysight Technologies, Inc.
DEKRA Certified ISO 9001:2015
Quality Management System

KEYSIGHT TECHNOLOGIES

Published in USA, December 1, 2017
5991-0279EN
www.keysight.com