M9383A PXIe Microwave Signal Generator

1 MHz to 14, 20, 31.8 or 44 GHz

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Overview

The M9383A PXIe microwave signal generator is a compact modular instrument that provides frequency coverage from 1 MHz to 44 GHz, up to 1 GHz RF modulation bandwidth with an internal baseband generator, and over 2 GHz RF modulation bandwidth with external I/Q inputs. Based on the PXIe industry standard, the M9383A is highly configurable and expandable. The smallest configuration, a 14 GHz analog signal generator, can be used in simple LO or blocking applications, and the largest configuration, a 44 GHz vector signal generator, can be used for 5G applications. Many other configurations are possible, allowing the M9383A PXIe microwave signal generator to be customized for specific application requirements.

The compact PXIe form factor allows a customized M9383A signal generator to be placed side-by-side other PXIe instruments to provide a complete stimulus and response solution. The M9019A PXIe chassis has 18 available slots with one slot dedicated to the M9037A high-performance embedded controller. With the M9383A PXIe microwave signal generator installed in the M9019A PXIe chassis, 5 to 13 empty slots remain available for installing other PXIe modules. Keysight Technologies, Inc. has an extensive PXIe portfolio including vector signal analyzers, vector network analyzers, oscilloscopes, digitizers, multimeters, digital-to-analog converters, data acquisition units, and more. As technology moves forward, new PXIe modules can be installed to provide new capability in the M9019A chassis.

The PXIe platform provides a high-performance foundation for developing advanced measurement solutions. The high-speed, Gen3 backplane in the M9019A chassis moves data quickly between the controller and the M9383A modules, resulting in fast waveform loading and tuning speed. The M9037A high-performance embedded controller has the power to run the newest instrument control software. The configurability of PXIe modules provides customizable measurement solutions for market-specific needs. Use the power of PXIe to build up the system you need today with the confidence that it can be expanded with additional capability when your requirements change tomorrow.

Reference solutions

Application-specific reference solutions, a combination of recommended hardware, software, and measurement expertise, provide the essential components of a test system.

For pre-5G applications, the recommended configuration includes the following options:

- Option F44 provides frequency coverage to 44 GHz, which includes the pre-5G 28 and 39 GHz bands.
- Option ST4 provides reduced phase noise to achieve the stringent EVM requirements for pre-5G waveforms with narrow subcarrier spacing.
- Option C11 provides 1 GHz of RF bandwidth for creating the 800 MHz pre-5G bands.
- Options 1EA and 1EB provide additional dynamic range
- Option 016 provides external I/Q inputs for wider pre-5G bands of up to 2 GHz.
- Keysight Signal Studio for pre-5G simplifies creation of pre-5G waveforms which are easily loaded into the M9318A PXIe vector modulator.
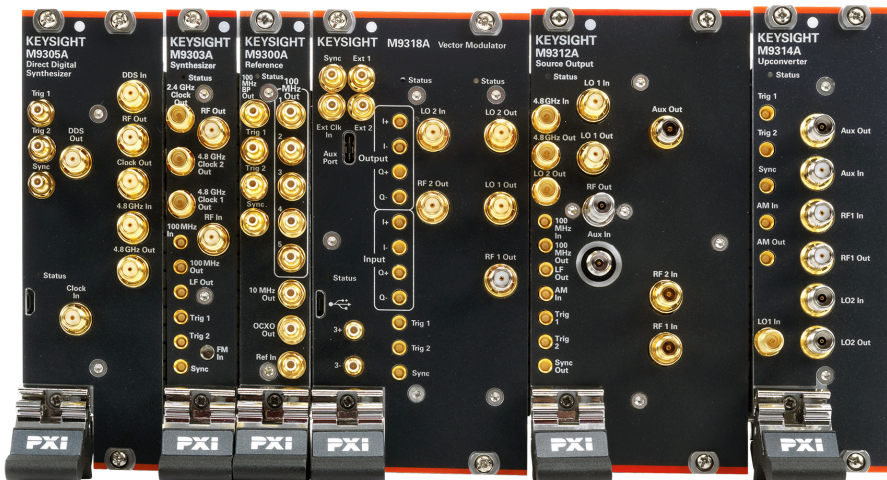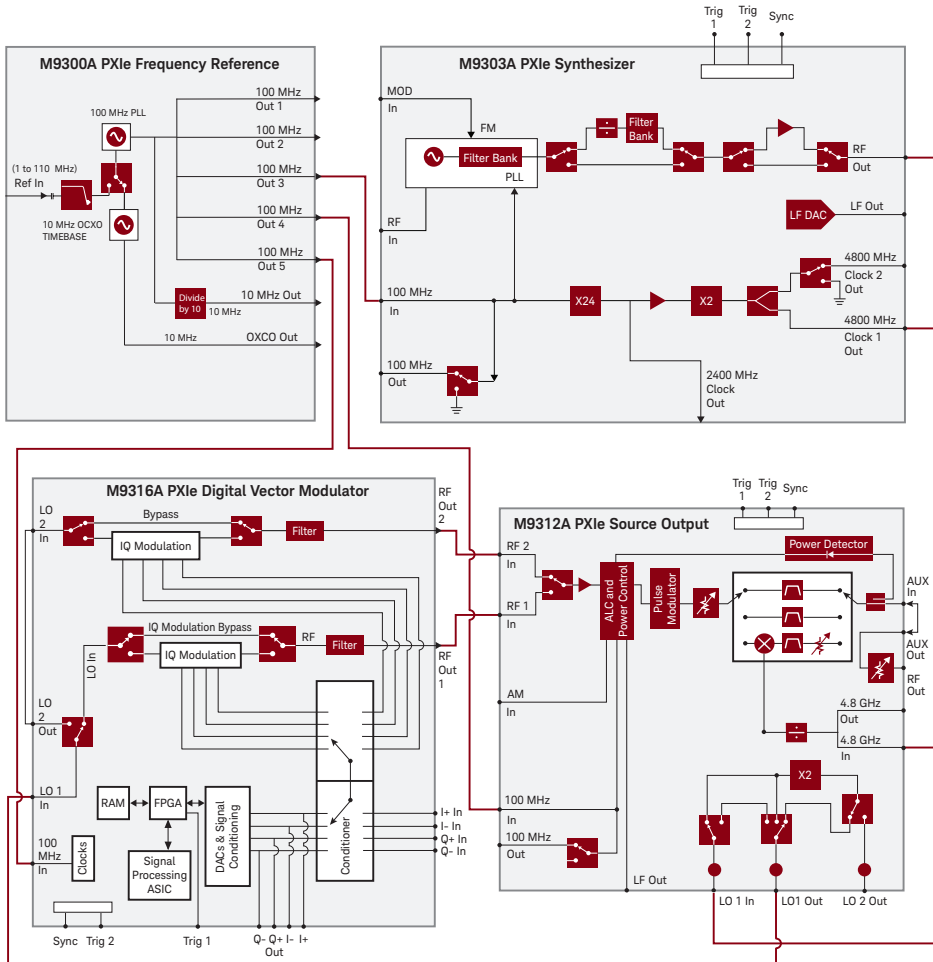
Block Diagram

M9383A-F20

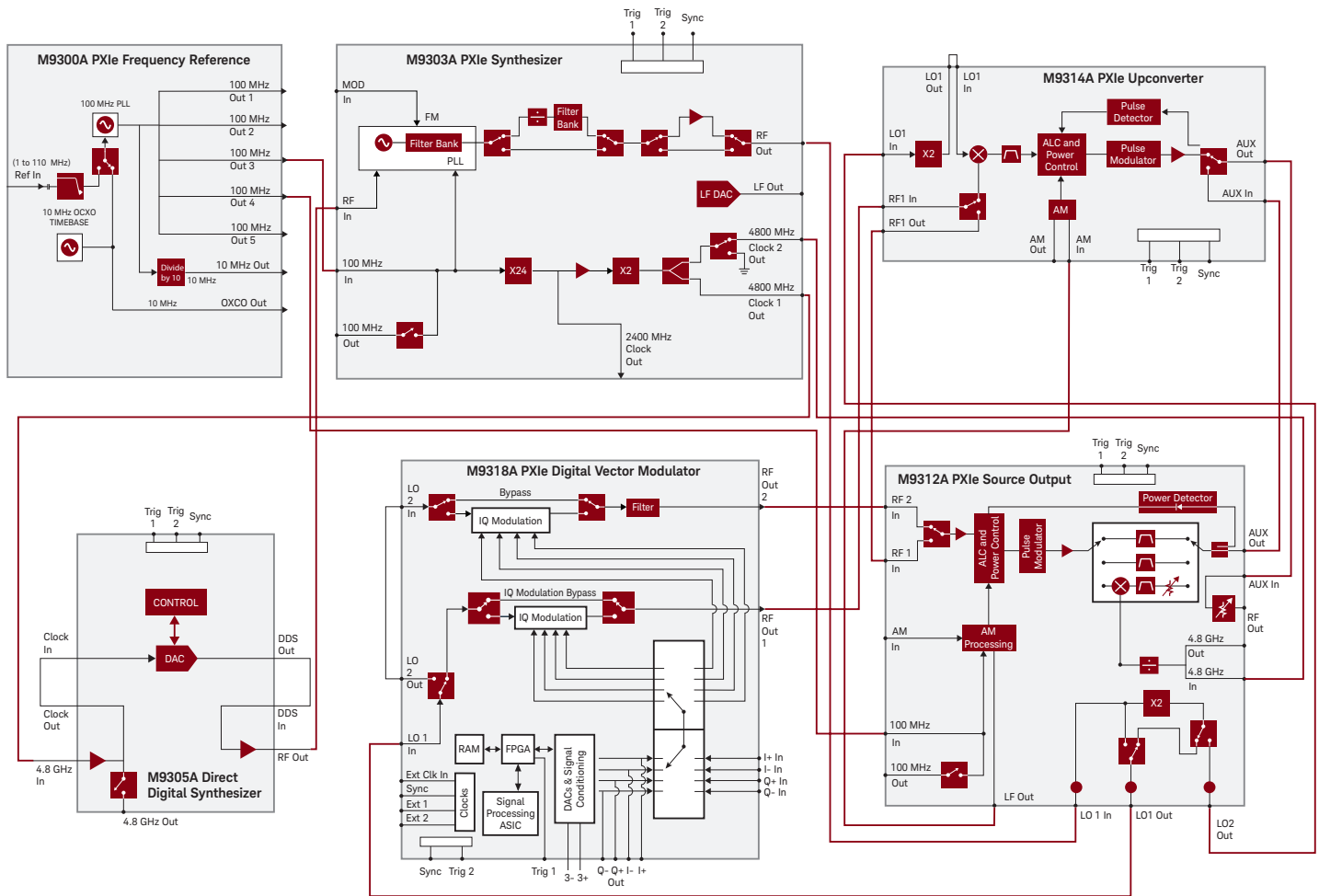Figure 1. Block diagram for a 20 GHz signal generator with 160 MHz bandwidth.

M9383A-F44

Figure 2. Block diagram for a 44 GHz signal generator with 1 GHz bandwidth and enhanced phase noise.

Definitions and Conditions

Specification (spec)

Represents warranted performance of a calibrated instrument that has been stored for a minimum of 2 hours within the operating temperature range of 0 to 50 °C, unless otherwise stated, and after a 1 hour warm-up period. Specifications apply when used with the Keysight M9300A frequency reference and Keysight interconnect cables. The specifications include measurement uncertainty. Data represented in this document are specifications unless otherwise noted.

Typical (typ)

Describes additional product performance information that is not covered by the product warranty. It is performance beyond specifications that 80% of the units exhibit with a 95% confidence level at room temperature (approximately 25 °C). Typical performance does not include measurement uncertainty. Typical performance is not warranted.

Nominal (nom)

Describes the expected mean or average performance, or an attribute whose performance is by design, such as the 50 Ω connector. This data is measured at room temperature (approximately 25 °C). Nominal performance is not warranted.

Measured (meas)

Describes an attribute measured during the design phase for purposes of communicating expected performance, such as amplitude drift vs. time. This data is measured at room temperature (approximately 25 °C). Measured performance is not warranted.

Additional Information

All data are measured from multiple units at room temperature and are representative of product performance within the operating temperature range unless otherwise noted. All of the above apply when using the instrument in its default settings unless otherwise stated.
The specifications contained in this document are subject to change.

Technical Specifications

Frequency

Range		
Option F14	1 MHz to 14 GHz	
Option F20	1 MHz to 20 GHz	
Option F32	1 MHz to 31.8 GHz	
Option F44 with 1EB	1 MHz to 40 GHz	
Option F44 without 1EB	1 MHz to 44 GHz	
Resolution		
0.01 Hz		
Frequency Bands		
Band	**Frequency**	**N[1]**
1	1 MHz to < 400 MHz	1/4
2	400 MHz to < 706.25 MHz	1/8
3	706.25 MHz to < 1.4125 GHz	1/4
4	1.4125 GHz to < 2.825 GHz	1/2
5	2.825 GHz to < 5.65 GHz	1
6	5.65 GHz to < 11.3 GHz	2
7	11.3 GHz to 44 GHz	4

1. N is a multiplicative factor used throughout this document

Frequency Reference

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 Yearly Total 10 years	< ± 0.5 ppb/day, after 72 hour warm-up < ± 0.1 ppm/year, after 72 hours warm-up < ± 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

Power

Step Attenuator (Option 1E1)

Range	0 dB to 70 dB in 10 dB steps
Attenuator hold	On = manual, off = automatic
Power range with attenuator hold on	-40 dBm to maximum output power with step attenuator set to 0 dB. Offset by attenuation for other steps of the attenuator.

Maximum Output Power (Option F14 or F20)

Specifications apply from 20 to 30 °C.

Frequency	Standard	Option 1EA
10 MHz to < 200 MHz	10 dBm	17 dBm
200 MHz to 400 MHz (1EH Filters on)	10 dBm	13 dBm
> 400 MHz to 1.5 GHz (1EH Filters on)	10 dBm	12 dBm
> 1500 MHz to 2 GHz (1EH Filters on)	10 dBm	21 dBm
200 MHz to 400 MHz (1EH Filters off)	10 dBm	18 dBm
> 400 MHz to 1.5 GHz (1EH Filters off)	10 dBm	19 dBm
> 1.5 GHz to 2 GHz (1EH Filters off)	10 dBm	22 dBm
> 2 GHz to 3.6 GHz	10 dBm	22 dBm
> 3.6 GHz to 10 GHz	10 dBm	22 dBm
> 10 GHz to 16 GHz	10 dBm	21 dBm
> 16 GHz to 20 GHz	10 dBm	20 dBm

Maximum Output Power (Option F32 or F44)

Specifications apply from 20 to 30 °C.

Frequency	Standard	Option 1EA
10 MHz to < 200 MHz	10 dBm	16 dBm
200 MHz to 400 MHz (1EH Filters on)	10 dBm	12 dBm
> 400 MHz to 1.5 GHz (1EH Filters on)	10 dBm	10 dBm
> 1500 MHz to 2 GHz (1EH Filters on)	10 dBm	18 dBm
200 MHz to 400 MHz (1EH Filters off)	10 dBm	16 dBm
> 400 MHz to 1.5 GHz (1EH Filters off)	10 dBm	16 dBm
> 1.5 GHz to 2 GHz (1EH Filters off)	10 dBm	20 dBm
> 2 GHz to 3.6 GHz	10 dBm	20 dBm
> 3.6 GHz to 10 GHz	10 dBm	17 dBm
> 10 GHz to 16 GHz	10 dBm	15 dBm
> 16 GHz to 20 GHz	10 dBm	13 dBm
> 20 GHz to 34 GHz	10 dBm	11 dBm
> 34 GHz to 40 GHz	10 dBm	10 dBm
> 40 GHz to 44 GHz	8 dBm	8 dBm

Measured maximum output power (Option F20)

Measured maximum output power (Option F44)
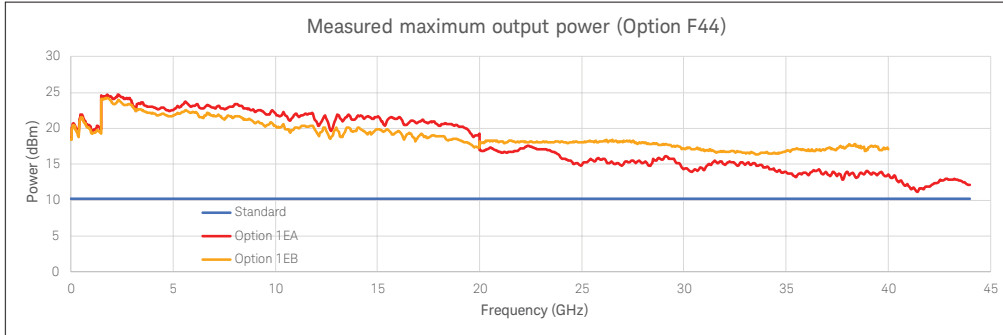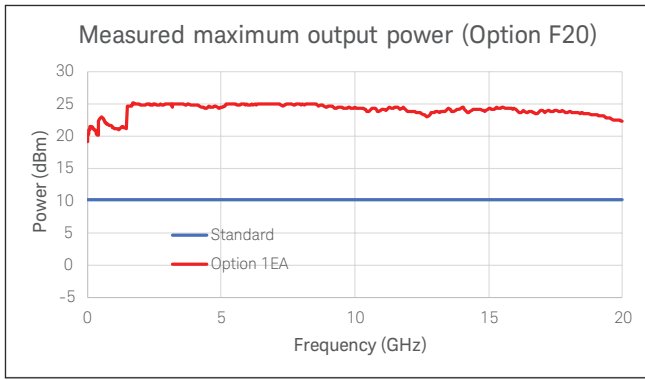
Settable Output Power Range (nom)

	Standard	Option 1E1	Option 1EA or Option 1EB	Option 1E1/1EA or Option 1E1/1EB
Maximum settable	+10.7 dBm	+10.7 dBm	+25 dBm	+25 dBm
Minimum settable				
≤ 20 GHz	-40 dBm	-110 dBm	-40 dBm	-110 dBm
> 20 GHz	-40 dBm	-120 dBm	-40 dBm	-120 dBm

ALC

Modes	On, Off, Off with Power Search
Bandwidths	Very slow, Slow, Medium, Fast
ALC hold modes	Off, Track on trigger, Hold on trigger, Use pulse generator
ALC usage	
≤20 GHz	CW
>20 GHz	CW and many modulated signals

Level Accuracy (ALC On or ALC Off with Power Search)

Specifications apply from 20 to 30 °C with attenuator hold off. Specifications do not apply above the maximum specified output power. Specifications apply at the carrier frequency. With ALC Off, specifications apply after a power search.[1]

Frequency	> 5 dBm	5 to -40 dBm	< -40 to -80 dBm	< -80 to -90 dBm
10 MHz to < 200 MHz	± 1.0 dB	± 1.0 dB	± 1.7 dB	± 1.7 dB
200 MHz to < 400 MHz	± 0.8 dB	± 1.0 dB	± 1.1 dB	± 1.6 dB
400 MHz to < 3.6 GHz	± 1.1 dB	± 1.0 dB	± 1.2 dB	± 2.1 dB
3.6 GHz to < 16 GHz	± 2.0 dB	± 1.3 dB	± 1.3 dB	± 1.5 dB
16 GHz to 20 GHz	± 2.6 dB	± 1.7 dB	± 1.7 dB	± 1.9 dB
> 20 GHz to < 34 GHz	± 1.9 dB	± 1.4 dB	± 1.5 dB	± 1.9 dB
34 GHz to 44 GHz	± 2.3 dB	± 2.1 dB	± 2.2 dB	± 3.0 dB

1. Power search is an internal alignment routine that improves level accuracy with ALC off

SWR (meas) with Option F20			
Frequency	**SWR**		
10 MHz to 400 MHz	1.2 : 1		
> 400 MHz to 3.2 GHz	1.2 : 1		
> 3.2 GHz to 10 GHz	1.3 : 1		
> 10 GHz to 20 GHz	1.4 : 1		

SWR (meas) with Option F44 but without Option 1EB			
Frequency	**SWR**		
10 MHz to 400 MHz	1.2 : 1		
> 400 MHz to 3.2 GHz	1.2 : 1		
> 3.2 GHz to 10 GHz	1.3 : 1		
> 10 GHz to 20 GHz	1.5 : 1		
> 20 GHz to 44 GHz	1.5 : 1		

SWR (meas) with Option F44 and Option 1EB			
Frequency	**> -6 dBm**	**-6 to -8 dBm**	**< -8 dBm**
10 MHz to 400 MHz	1.6 : 1	1.6 : 1	1.1 : 1
> 400 MHz to 3.2 GHz	1.6 : 1	1.6 : 1	1.2 : 1
> 3.2 GHz to 10 GHz	1.6 : 1	1.6 : 1	1.4 : 1
> 10 GHz to 20 GHz	1.6 : 1	1.6 : 1	1.6 : 1
> 20 GHz to 37 GHz	1.7 : 1	1.9 : 1	1.9 : 1
> 37 GHz to 40 GHz	1.7 : 1	2.3 : 1	2.3 : 1

Other Power Characteristics	
Power search time	< 20 ms, nominal
Resolution	0.01 dB
Output impedance	50 Ω, nominal
Maximum reverse power	1/2 Watt, 0 VDC, nominal
Units	dBm, dBmV, dBµV

Step Mode

Operating Modes	
Step	Frequency start and stop (linear or logarithmic steps) Frequency center and span (linear or logarithmic steps) Power start and stop

Step Time	
Entry time	100 µs to 1 s
Dwell time	100 µs to 1 s

Number of Points	
Step	1 to 3200

Input Triggering	
Start Step	Immediate, external trigger, software trigger or software trigger button
End Step	Dwell time, entry time, external trigger, last segment, software trigger or software trigger button

Output Triggering	
Step Out	Trigger when stepping
Settled Out	Trigger when settled

Timeout	
	1 ms to 2000000 s

Spectral Purity

Harmonics

Measured at 5 dBm or maximum specified power, whichever is lower. Performance is unspecified for harmonics beyond the specified frequency range.

Fundamental Frequency	Harmonic Level
< 50 MHz	-30 dBc (typ)
50 MHz to < 220 MHz	-40 dBc (typ)
220 MHz to < 2 GHz (Option 1EH filters off)	-30 dBc (typ)
220 MHz to < 2 GHz (Option 1EH filters on)	-48 dBc (typ)
2 GHz to < 3.2 GHz	-60 dBc (typ)
3.2 GHz to < 3.4 GHz	-45 dBc (typ)
3.4 GHz to < 16 GHz	-55 dBc (typ)
16 GHz to 22 GHz	-52 dBc (typ)

Sub-harmonics

Measured at 9 dBm or maximum specified power, whichever is lower. Sub-harmonics are defined as Carrier Freq * (k/m), where k and m are integers, but excluding harmonics. Does not apply to non-harmonic spurs which may overlap sub-harmonic spurs. Performance is unspecified for sub-harmonics beyond the specified frequency range.

Fundamental Frequency	Sub-Harmonic Level
1 MHz to 20 GHz	-55 dBc (typ)
> 20 GHz to 44 GHz	-50 dBc (meas)

Non-harmonics

Measured at 10 dBm or maximum specified power, whichever is lower. Non-harmonic spurs include mixing products for frequencies below 400 MHz, synthesizer spurs, and other miscellaneous chassis and power supply products. Performance is unspecified for non-harmonics beyond the specified frequency range. With option ST4, excludes 9.6 GHz and harmonics of 9.6 GHz with software earlier than 2.1.243.0.

Fundamental Frequency	Non-Harmonic Level
1 MHz to 20 GHz (Option ST2)	-50 dBc (typ)
1 MHz to 20 GHz (Option ST4)	-55 dBc (typ)
> 20 GHz to 44 GHz	-45 dBc (meas)

Phase noise

Phase noise is measured with ALC off using a CW signal at +10 dBm or maximum specified power, whichever is less. Phase noise specifications exclude external mechanical vibration.

Option ST2: Absolute SSB phase noise (dBc/Hz) for offsets ≤ 100 kHz

	Offset from carrier				
Frequency	**10 Hz** **(typ)**	**100 Hz** **(typ)**	**1 kHz** **(typ)**	**10 kHz** **(typ)**	**100 kHz** **(typ)**
10 to 400 MHz	(-70)	(-93)	(-105)	(-114)	(-114)
> 400 MHz to 10 GHz	(-42)	(-71)	(-93)	(-98)	(-99)
> 10 GHz to 20 GHz	(-38)	(-66)	(-87)	(-91)	(-92)
> 20 GHz to 26.5 GHz	(-26)	(-53)	(-80)	(-88)	(-89)
> 26.5 GHz to 44 GHz	(-31)	(-59)	(-80)	(-84)	(-85)

Option ST2: Absolute SSB phase noise (dBc/Hz) for offsets ≥ 1 MHz

	Offset from carrier		
Frequency	**1 MHz (typ)**	**10 MHz (typ)**	**100 MHz (typ)**
10 to 400 MHz	(-126)	(-126)	
> 400 MHz to 10 GHz	(-125)	(-130)	(-130)
> 10 GHz to 20 GHz	(-121)	(-131)	(-132)
> 20 GHz to 26.5 GHz	(-118)	(-130)	(-129)
> 26.5 GHz to 44 GHz	(-114)	(-124)	(-125)

Option ST4: Absolute SSB phase noise (dBc/Hz) for offsets ≤ 100 kHz

	Offset from carrier				
Frequency	**10 Hz** **(typ)**	**100 Hz** **(typ)**	**1 kHz** **(typ)**	**10 kHz** **(typ)**	**100 kHz** **(typ)**
10 to 400 MHz	(-65)	(-100)	(-116)	(-128)	(-134)
> 400 MHz to 10 GHz	(-35)	(-68)	(-95)	(-112)	(-124)
> 10 GHz to 20 GHz	(-30)	(-60)	(-91)	(-109)	(-117)
> 20 GHz to 26.5 GHz	(-29)	(-55)	(-85)	(-106)	(-114)
> 26.5 GHz to 44 GHz	(-23)	(-53)	(-84)	(-102)	(-110)

Option ST4: Absolute SSB phase noise (dBc/Hz) for offsets ≥ 1 MHz

	Offset from carrier		
Frequency	**1 MHz (typ)**	**10 MHz (typ)**	**100 MHz (typ)**
10 to 400 MHz	(-133)	(-135)	
> 400 MHz to 10 GHz	(-124)	(-136)	(-137)
> 10 GHz to 20 GHz	(-117)	(-132)	(-132)
> 20 GHz to 26.5 GHz	(-114)	(-129)	(-129)
> 26.5 GHz to 44 GHz	(-110)	(-125)	(-125)

Option ST2 measured absolute SSB phase noise, CW

Option ST4 measured absolute SSB phase noise, CW
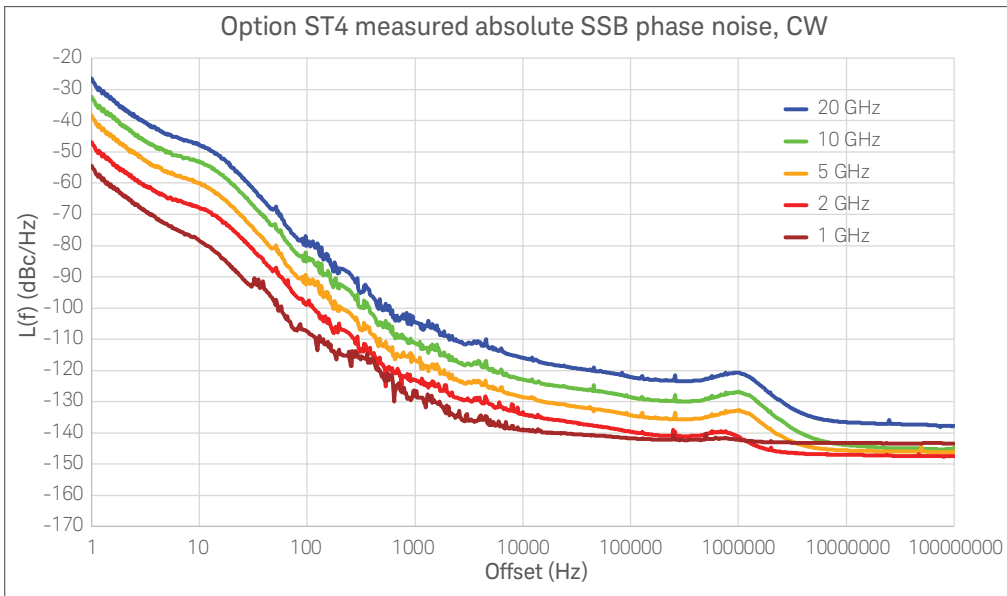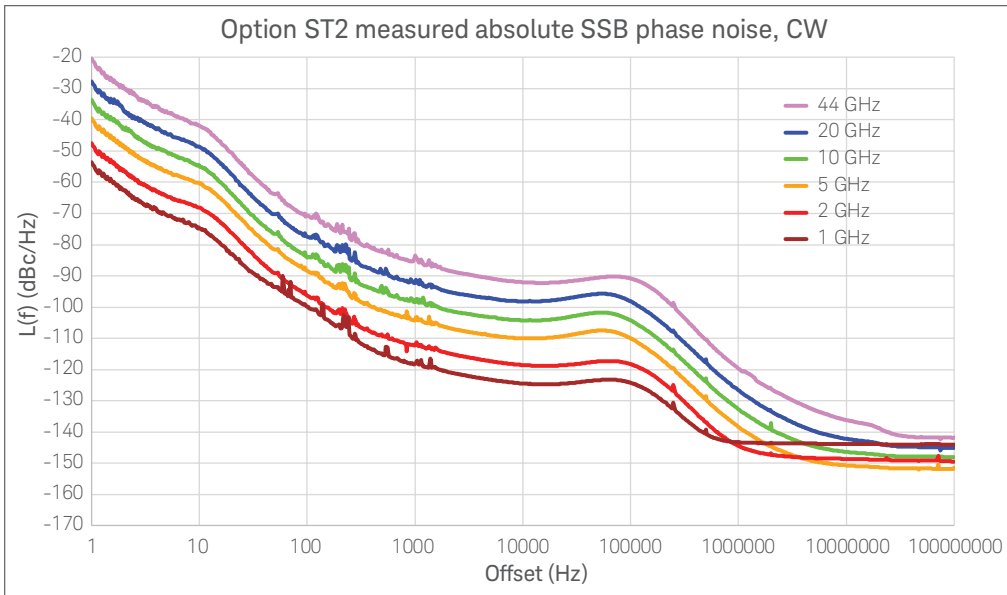
Pulse Modulation (Option PM1 or PM2)

Specifications apply with attenuator hold off (default mode) and output level ≤ 10 dBm from 20 to 30 °C.

Pulse Paths		
	Internal pulse generator, external input	
Minimum Pulse Width (T_w) with duty cycle ≤ 50%		
Mode	Option PM1	Option PM2
ALC on	1 µs	1 µs
ALC off, 10 MHz to 20 GHz	100 ns	100 ns
ALC off, > 20 GHz	30 ns	20 ns
On/Off Ratio without I/Q Modulation		
Frequency	Option F14 or F20	Option F32 or F44
10 MHz to 10 GHz	70 dB	70 dB
> 10 GHz to 20 GHz	60 dB (typ)	60 dB (typ)
> 20 GHz to 44 GHz	n/a	80 dB
On/Off Ratio with I/Q Burst Aligned to Pulse (Option B04, B05, B16, B17, C05, C06, C10 or C11)		
Frequency	Option F14 or F20	Option F32 or F44
10 MHz to 10 GHz	80 dB (typ)	80 dB (typ)
> 10 GHz to 20 GHz	80 dB (typ)	80 dB (typ)
> 20 GHz to 44 GHz	n/a	80 dB (typ)
Rise/fall Times (T_r and T_f)		
ALC off	10 ns (typ)	
Level Accuracy (relative to CW)[1]		
10 MHz to 30 GHz	± 1 dB (typ)	
> 30 GHz	± 1.5 dB (typ)	
Width Compression (T_{rf}-T_w)		
RF width relative to video out	± 16 ns	
Video Feed-Through (V_f)[2]		
0.4 GHz to 3.2 GHz	< 200 mV pk-pk (typ)	
> 3.2 GHz to 5.2 GHz	< 100 mV pk-pk (typ)	
> 5.2 GHz to 44 GHz	< 30 mV pk-pk (typ)	
Pulse Overshoot		
≤ 3.2 GHz	< 15% (typ)	
> 3.2 GHz	< 5% (typ)	
External Input Level		
	+1 V = RF on 0 V = RF off	
	+1 V = RF on 0 V = RF off	
External Input Impedance		
	50 Ω (nom)	

1. For pulse width ≥ 1 us with ALC on and for pulse width ≥ 50 ns with ALC off after power search
2. With step attenuator in 0 dB position. Video feed-through decreases directly with step attenuator setting

Measured Pulse Shape

Frequency = 9 GHz, power = 5 dBm, amplitude = 5 dBm, ALC off, pulse width = 50 ns, pulse period = 200 ns. The oscilloscope is protected by a 10 dB pad and the timescale is set to 10 ns/div.
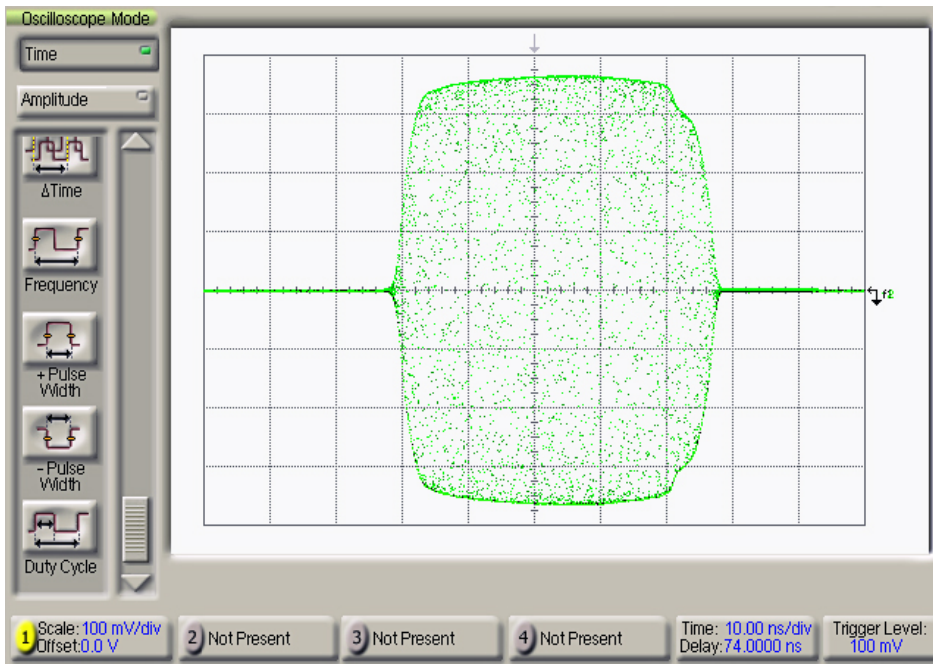
Internal Pulse Generator (Option PM1 or PM2)

Internal Pulse Generator	
Modes	Square, adjustable doublet, pulse train
Triggering	Free run, triggered, gated, and external pulse
Triggers	Trig 1, Trig 2, Backplane 0-7
Signal Routing	Sync to Sync, Trig/Pulse in to TRIG1, Video out to TRIG2
Square wave rate	(50 MHz)/k from 0.1 Hz to 50 MHz where k is an integer (nom)

Timing		
	Option PM1	Option PM2
Pulse period (PRI) (Tp)	30 ns to 41.99 s	20 ns to 41.99 s
Pulse width (Tw)	30 ns to 41.99 s	20 ns to 41.99 s
Video delay (Td)		
Free run	± 4 µs	± 4 µs
Triggered modes	0 to 42 s	0 to 42 s
RF delay (Tm)	0 to 42 s	0 to 42 s
Sync Trigger	30 ns to 3.99 µs	20 ns to 3.99 µs
Pulse doublets		
Delay 1	0 to 42 s	0 to 42 s
Pulse Width 1	30 ns to 60 ns	20 ns to 60 ns
Delay 2	60 ns to 42 s	60 ns to 42 s
Pulse Width 2	30 ns to 42 s	20 ns to 42 s
Pulse train		
Repetitions	1 to 2046	1 to 2046
On time	30 ns to 42 s	20 ns to 42 s
Off time	30 ns to 42 s	20 ns to 42 s

- Td video delay (variable)
- Tw video pulse width (variable)
- Tp Pulse period (variable)
- Tm RF delay
- Trf RF pulse width
- Tf RF pulse fall time
- Tr RF pulse rise time
- Vor pulse overshoot
- Vf video feedthrough
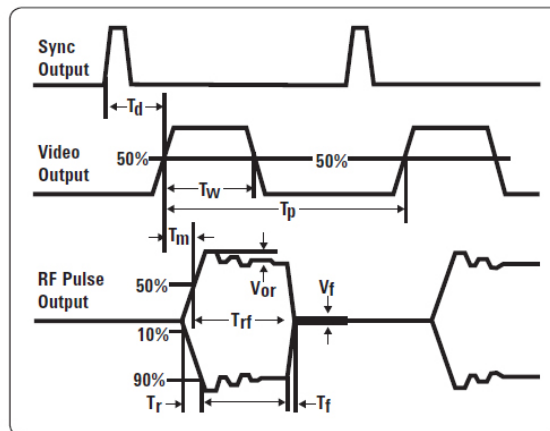
Frequency Modulation (Option UNT)

Refer to the N value in the table of frequency bands. With Option ST4 and FM on, the effective phase noise and spectral purity are equivalent to Option ST2. Using FM through the "ARB Modulation" subsystem does not have this limitation.

Maximum peak deviation	± N × 10 MHz, nominal	
Deviation resolution	0.1% of deviation or 1 Hz, whichever is greater (nom)	
Deviation Accuracy		
Measured at a 1 kHz rate with deviation ≤ 100 kHz, freq ≤ 20 GHz, 20 to 30 °C	±(3.5% of deviation + 20 Hz)	
Distortion		
Measured at a 1 kHz rate with deviation ≤ N × 0.8 MHz	< 3.5% (typ)	
Modulation Frequency Response[1]		
Mode	**1 dB bandwidth**	**3 dB bandwidth**
DC coupling	DC to 100 kHz (nom)	DC to 10 MHz (nom)
AC coupling	5 Hz to 100 kHz (nom)	5 Hz to 10 MHz (nom)
External DC FM Carrier Offset[2]		
± (0.2% of set deviation + N x 8 Hz) (typ)		
External Input Sensitivity		
± 1 V_{peak} for indicated deviation		
± 1.2 V max		
External input impedance		
50 Ω, 600 Ω or 1 MΩ, selectable (nom)		
Paths		
Internal FM generator, external input.		
Waveforms		
See "Internal modulation sources (Option UNT)"		

Frequency Modulation (Option B04, B05, B16, B17, C05, C06, C10 or C11)

This section describes frequency modulation through the "ARB Modulation" subsystem. For frequency modulation through the synthesizer subsystem, see "Frequency modulation (Option UNT)". The ARB Modulation subsystem provides wider bandwidths but does not provide external inputs.

Peak Deviation		
Option	**Frequency < 3.2 GHz**	**Frequency ≥ 3.2 GHz**
B04 or B05	0 Hz to 12.5 MHz	0 Hz to 12.5 MHz
B16 or B17	0 Hz to 50 MHz	0 Hz to 50 MHz
C05 or C06	0 Hz to 50 MHz	0 Hz to 160 MHz
C10 or C11	0 Hz to 50 MHz	0 Hz to 320 MHz
Rate		
Option	**Frequency < 3.2 GHz**	**Frequency ≥ 3.2 GHz**
B04 or B05	1 Hz to 12.5 MHz	1 Hz to 12.5 MHz
B16 or B17	1 Hz to 50 MHz	1 Hz to 50 MHz
C05 or C06	1 Hz to 50 MHz	1 Hz to 160 MHz
C10 or C11	1 Hz to 50 MHz	1 Hz to 320 MHz
Paths		
Internal FM generator		
Waveforms		
Sine, Dual-sine, Triangle, Ramp Up, Ramp Down, Square		

1. Measured at N × 1 MHz deviation
2. At the calibrated deviation and carrier frequency, within 5° C of ambient temperature at time of user calibration.

Phase Modulation (Option UNT)

Refer to the N value in the table of frequency bands. With Option ST4 and phase modulation on, the effective phase noise and spectral purity are equivalent to Option ST2. Using phase modulation through the "ARB Modulation" subsystem does not have this limitation.

Maximum Peak Deviation		
± N × 2 rad (nom)		
Deviation Resolution		
0.1% of set deviation (nom)		
Deviation Accuracy		
Measured at a 1 kHz rate, freq ≤ 20 GHz, 20 to 30 °C, deviation >= 0.2 rad	±(5% of deviation + 0.01 rad)	
Modulation Frequency Response[1]		
Mode	Normal bandwidth mode	High bandwidth mode
DC coupling	DC to 100 kHz (nom)	DC to 1 MHz (nom)
AC coupling	5 Hz to 100 kHz (nom)	5 Hz to 1 MHz (nom)
Distortion[2]		
Total harmonic distortion	≤ 1% (typ)	
External Input Sensitivity		
± 1 V_{peak} for indicated deviation		
± 1.2 V max		
External Input Impedance		
50 Ω, 600 Ω or 1 MΩ, selectable (nom)		
Paths		
Internal ΦM generator, external input		
Waveforms		
See "Internal modulation sources (Option UNT)"		

1. 3 dB bandwidth measured at N × 1 rad deviation
2. Measured in normal bandwidth mode at a 1 kHz rate with deviation ≤ N × 1 rad

Phase Modulation (Option B04, B05, B16, B17, C05, C06, C10 or C11)

This section describes phase modulation through the "ARB Modulation" subsystem. For phase modulation through the synthesizer subsystem, see "Phase modulation (Option UNT)". The ARB Modulation subsystem provides wider bandwidths but does not provide external inputs.

Rate		
Option	Frequency < 3.2 GHz	Frequency ≥ 3.2 GHz
B04 or B05	1 Hz to 12.5 MHz	1 Hz to 12.5 MHz
B16 or B17	1 Hz to 50 MHz	1 Hz to 50 MHz
C05 or C06	1 Hz to 50 MHz	1 Hz to 160 MHz
C10 or C11	1 Hz to 50 MHz	1 Hz to 320 MHz
Peak Deviation		
0 to 10 rad (nom)		
Paths		
Internal ΦM generator		
Waveforms		
Sine, Dual-sine, Triangle, Ramp Up, Ramp Down, Square		

Amplitude Modulation (Option UNT)

AM performance is not specified with attenuator hold on, above 20 GHz or when AM peaks exceed maximum specified power. With ALC Off, specifications apply after power search is executed.

Depth		
	Linear mode	**Exponential (log) mode**
Maximum (ALC off)	99%	40 dB
Settable range	0 to 100%	0 to 40 dB
Resolution	0.1%	0.01 dB
Depth Accuracy		
ALC on, 1 kHz rate, depth ≤ 80%, 20 to 30 °C	±(6% of setting + 2%)	n/a
External Input		
	Linear mode	**Exponential (log) mode**
Polarity	Selectable	Downward modulation only
Sensitivity for indicated depth	± 1 V (nom)	-1 V (nom)
Maximum voltage range	± 1.2 V (nom)	-1.2 V to 0 V (nom)
Modulation Frequency Response[1]		
DC coupling	DC to 70 kHz (nom)	
AC coupling	5 Hz to 70 kHz (nom)	
Distortion		
30% AM, 1 kHz rate	< 2.0% total harmonic distortion (typ)	
60% AM, 1 kHz rate	< 2.5% total harmonic distortion (typ)	
External Input Impedance		
50 Ω, 600 Ω or 1 MΩ, selectable (nom)		
Paths		
Internal AM generator, external input.		
Waveforms		
See "Internal modulation sources (Option UNT)"		

1. 3 dB bandwidth measured with depth ≤ 30%

Amplitude Modulation (Option B04, B05, B16, B17, C05, C06, C10 or C11)

This section describes amplitude modulation through the "ARB Modulation" subsystem. For amplitude modulation through the output subsystem, see "Amplitude modulation (Option UNT)". The ARB Modulation subsystem provides better amplitude accuracy but does not provide external inputs. AM performance is not specified with attenuator hold on, above 20 GHz or when AM peaks exceed maximum specified power. With ALC Off, specifications apply after power search is executed.

Rate		
Option	Frequency < 3.2 GHz	Frequency ≥ 3.2 GHz
B04 or B05	1 Hz to 25 MHz	1 Hz to 25 MHz
B16 or B17	1 Hz to 100 MHz	1 Hz to 100 MHz
C05 or C06	1 Hz to 100 MHz	1 Hz to 320 MHz
C10 or C11	1 Hz to 100 MHz	1 Hz to 640 MHz
Depth		
0 to 100%		
Paths		
Internal AM generator		
Waveforms		
Sine, Dual-sine, Triangle, Ramp Up, Ramp Down, Square		

Internal Modulation Sources (Option UNT)

Dual Function Generators	
AM function generator	Provides one signal for use with AM or M9312A LF Output.
FM function generator	Provides one signal for use with FM, ΦM or M9303A LF Output.
Output	Internal 1, internal 2, noise generator 1, noise generator 2
Monitoring	Provides monitoring of function generators when used for AM, FM, or ΦM
Output impedance	50 Ω (nom)
Waveforms	
Types	Sine, pulse, positive ramp, negative ramp, triangle, noise, dual sine, dual ramp, dual triangle
Rate range	
Sine	0.1 Hz to 10 MHz
Other waveforms	0.1 Hz to 1 MHz
Rate resolution	0.1 Hz
Rate accuracy	Same as PXIe backplane reference
Phase Offset	-6.29 rad to +6.29 rad
Pulse duty cycle	0% to 100%
Noise type	Uniform, Gaussian

Vector Modulation (Option B04, B05, B16, B17, C05, C06, C10 or C11)

External I/Q Inputs (Option 016)	
Type	Differential: I, $\bar{\text{I}}$, Q, $\bar{\text{Q}}$
Input impedance	50 Ω (nom)
Recommended input level	-1 dBm or $\sqrt{I^2 + Q^2}$ = 0.2 V_{rms} (nominal)
Input level range	Different RMS levels are accommodated by adjusting the internal I/Q modulator attenuator which may be either manually or automatically set. The minimum input level required to maintain RF level accuracy is $\sqrt{I^2 + Q^2}$ = 0.1 V_{rms}. Minimum 0.1 V_{rms}, maximum 1 V_{peak}

External I/Q Bandwidth (Option 016)		
Frequency	**Baseband frequency range**	**RF modulation bandwidth**
< 3.2 GHz	DC to 80 MHz (nom)	160 MHz (nom)
≥ 3.2 GHz	DC to 1 GHz (nom)	2 GHz (nom)

I/Q Adjustments	
I and Q offset adjustment	± 50% (nom)
I/Q quadrature skew adjustment	
< 3.2 GHz	none
≥ 3.2 GHz	± 20° (nom)
I/Q gain balance adjustment	± 10 dB (nom)
Delay adjustment	
Option B04 or B05	± 125 ns (nom)
Option B16 or B17	± 250 ns (nom)
Option C05 or C06	± 19 ns (nom)
Option C10 or C11	± 39.1 ns (nom)

I/Q input adjustments (Option 016 with Option C05, C06, C10 or C11)	
I Offset	± 50 mV (nom)
Q Offset	± 50 mV (nom)

I/Q Baseband Output[1]	
Type	Differential: I, $\bar{\text{I}}$, Q, $\bar{\text{Q}}$
Frequency range	DC to 80 MHz (nom) for 1 dB bandwidth
DC offset adjustments	± 3 V
DC offset resolution	1 mV
Common-mode I/Q offset	± 200 mV (nom)
Differential mode I or Q offset	± 50 mV (nom)

I/Q Baseband Output Amplitude[2]	
Output voltage	
Internal I/Q modulation	0.8 V_{rms} (typ)
External I/Q modulation	Variable from 0.8 to 1.8 V_{rms} (typ)

1. All output voltages measured with a 50 Ω load.
2. Measured with a 50 Ω load with scale = 1. Amplitude of each output in Vpk-pk, or total output in Vrms amplitude is directly proportional to scale.

Internal Baseband Generator (Option B04, B05, B16, B17, C05, C06, C10 or C11)

Channels		
Option B04, B05, B16 or B17	In-phase and Quadrature (I and Q)	
Option C05, C06, C10 or C11	In-phase and Quadrature (I and Q) and a third channel (3)	
Resolution		
16 bits [1/65536]		
RF Bandwidth		
Option	**Frequency < 3.2 GHz**	**Frequency ≥ 3.2 GHz**
B04 or B05	40 MHz	40 MHz
B16 or B17	160 MHz	160 MHz
C05 or C06	160 MHz	500 MHz
C10 or C11	160 MHz	1 GHz
Sample Rate		
Option	**Frequency < 3.2 GHz**	**Frequency ≥ 3.2 GHz**
B04 or B05	50 MSa/s	50 MSa/s
B16 or B17	200 MSa/s	200 MSa/s
C05 or C06	200 MSa/s	625 MSa/s
C10 or C11	200 MSa/s	1.28 GSa/s
Waveform Memory		
Option M01	32 MSa	
Option M05	512 MSa	
Option M10	1024 MSa	
Spectral Inversion		
Invert I, Swap I and Q		
Frequency Offset Range (Option B04, B05, B16 or B17)		
B04 or B05	-20 MHz to +20 MHz	
B16 or B17	-80 MHz to +80 MHz	
Real-time Additive Noise Impairment (AWGN) (Option B04, B05, B16 or B17)		
Type	Real-time, continuously calculated, and played using DSP	
Carrier-to-noise ratio	0 dBc to 70 dBc	
Bandwidth		
Option B04 or B05	1 Hz to 40 MHz	
Option B16 or B17	1 Hz to 160 MHz	
Real-time Phase Noise Impairment (Option B04, B05, B16 or B17)		
Close-in phase noise characteristics	-20 dB per decade	
Far-out phase noise characteristics	-20 dB per decade	
Mid-frequency characteristics		
Start frequency (f1)	Offset settable from 0 to 20 MHz	
Stop frequency (f2)	Offset settable from 0 to 20 MHz	
Phase noise amplitude level (L(f))	User selected; max degradation dependent on f2	

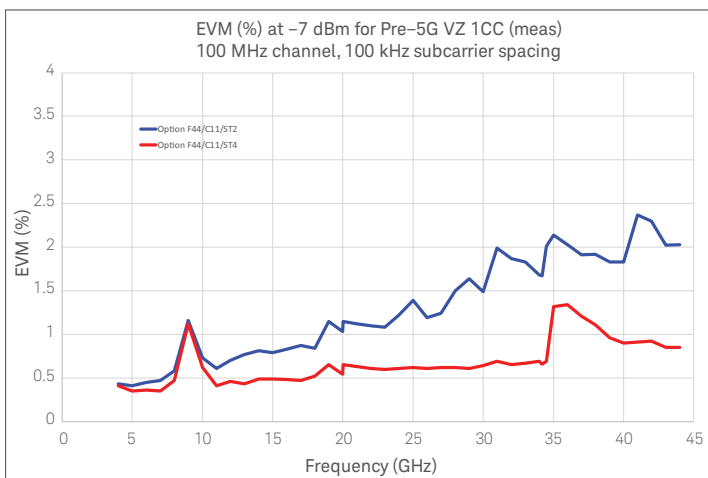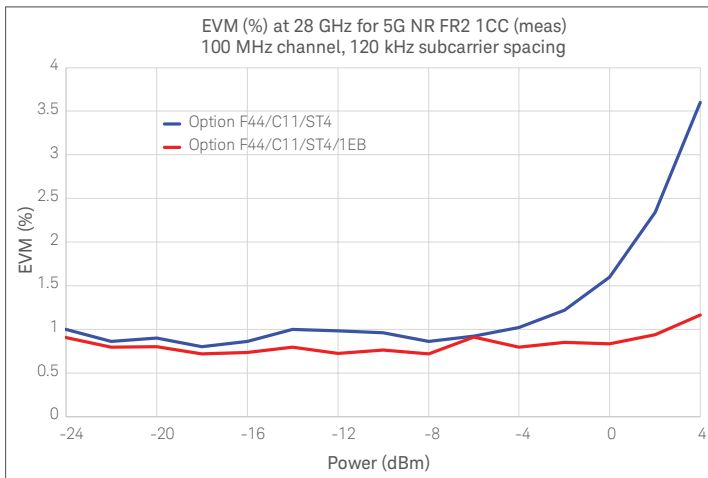| **Triggers**	
Play start trigger	Immediate, external, software trigger, software trigger button
ALC hold trigger	None, Marker 1, Marker 2, Marker 3, Marker 4
Pulse trigger	None, Marker 1, Marker 2, Marker 3, Marker 4
Sync Output trigger	
Option B04, B05, B16 or B17	None, Per waveform, Marker 1, Marker 2, Marker 3, Marker 4
Option C05, C06, C10 or C11	None, Marker 1, Marker 2, Marker 3, Marker 4
Markers	
Markers can be routed to the ALC hold function and the pulse modulator	
Marker polarity	Negative, positive
Number of markers	4
Multitone	
Number of tones	2 to 1000
Frequency spacing	Number of tones at selected spacing cannot exceed RF bandwidth
Option B04 or B05	100 Hz to 50 MHz
Option B16 or B17	100 Hz to 100 MHz
Option C05 or C06	100 Hz to 320 MHz
Option C10 or C11	100 Hz to 640 MHz
Vector Accuracy	

EVM (%) at 28 GHz for 5G NR FR2 1CC (meas)
100 MHz channel, 120 kHz subcarrier spacing

EVM (%) at –7 dBm for Pre–5G VZ 1CC (meas)
100 MHz channel, 100 kHz subcarrier spacing

Auxiliary Waveform Generator (Option C05, C06, C10 or C11)

Channel Name		
3+ and 3- (Aux Awg)		
Sample Rate		
Option	**Frequency < 3.2 GHz**	**Frequency ≥ 3.2 GHz**
B04 or B05	50 MSa/s	50 MSa/s
B16 or B17	200 MSa/s	200 MSa/s
C05 or C06	200 MSa/s	625 MSa/s
C10 or C11	200 MSa/s	1.28 GSa/s
Settings		
Modes	Free Run, Synchronous with I/Q channels	
Delay	0 s to 1 s	
Level	0 V to 600 mV	
Offset	-100 mV to 100 mV	
Common offset	0 V	
Load impedance	48.5 to 51.5 Ω	
Output types	Single-ended Positive, Differential	

Simultaneous Modulation

All modulation types can be operated independently and simultaneously, except:
1. Frequency and phase modulation (FM and ΦM)
2. Linear and exponential amplitude modulation (AM)
3. Internal and external I/Q modulation

Remote Programming

Software drivers	IVI.NET, IVI-COM, IVI-C
Interfaces	GPIB (IEEE-488.2,1987) with listen and talk, and 1000BaseT LAN interface.
Control languages	SCPI version 1997.0.
IEEE-488 functions	SH1, AH1, T6, TE0, L4, LE0, SR1, RL1, PP0, DC1, DT0, C0, E2
Keysight IO libraries	Keysight's IO Library Suite helps you quickly establish an error-free connection between your PC and instruments - regardless of the vendor. It provides robust instrument control and works with the software development environment you choose.

Environmental and Physical Specifications

Environmental Specifications and Regulatory Compliance		
Temperature	Operating Non-operating (storage)	0 to 50 °C −40 to +70 °C
Humidity[10]	Type tested at 95%, +40 °C (non-condensing)	
Shock/vibration[10]	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

10. 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.

Altitude	Up to 15,000 feet (4,572 meters)[1]

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
Environmental testing	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. Phase noise specifications are not warranted in a vibrating environment.
ISO compliant	This family of signal generators is manufactured in an ISO-9001 registered facility in concurrence with Keysight's commitment to quality.
Self-test	Internal diagnostic routine tests most modules in a preset condition. If a module's node voltages are within acceptable limits, then the module passes the test.

Physical Specifications

Module	Size	Length	Width	Height	Weight	Weight
M9300A	1 PXIe slot	210 mm	22 mm	130 mm	0.55 kg	1.22 lbs
M9303A	1 PXIe slot	210 mm	22 mm	130 mm	0.57 kg	1.25 lbs
M9305A	2 PXIe slots	210 mm	42 mm	130 mm	0.91 kg	2.00 lbs
M9312A	3 PXIe slots	210 mm	62 mm	130 mm	1.86 kg	4.10 lbs
M9314A	2 PXIe slots	210 mm	42 mm	130 mm	1.21 kg	2.67 lbs
M9316A	3 PXIe slots	210 mm	62 mm	130 mm	1.70 kg	3.75 lbs
M9318A	3 PXIe slots	210 mm	62 mm	130 mm	1.70 kg	3.75 lbs
M9405A	1 PXIe slot	210 mm	22 mm	130 mm	0.57 kg	1.25 lbs
M9155CH40	1 PXIe slot	210 mm	22 mm	130 mm	0.40 kg	0.88 lbs

DC Power Requirements

Module	5 V	5 V VIO	12 V	3.3 V	-12 V	5 V Aux	Total
M9300A	0 W	0 W	17 W	2 W	0 W	0 W	19 W
M9303A	0 W	0 W	38 W	10 W	0 W	0 W	48 W
M9305A	0 W	0 W	21 W	5 W	0 W	0 W	26 W
M9312A	0 W	0 W	82 W	2 W	0 W	0 W	84 W
M9314A	0 W	0 W	44 W	2 W	0 W	0 W	46 W
M9316A	0 W	0 W	64 W	15 W	0 W	0 W	79 W
M9318A	0 W	0 W	95 W	15 W	0 W	0 W	110 W
M9405A	0 W	0 W	3 W	0 W	0 W	0 W	3 W
M9155CH40	0.1 W	0 W	5 W	2 W	0 W	0 W	7.1 W

1. At 15,000 feet, the maximum environmental temperature is de-rated to 40 °C.

System Requirements

Operating systems	Windows 7 (32-bit and 64-bit), Windows 10 (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	1.5 GB available hard disk space
Video	Support for DirectX 9 graphics with 128 MB graphics memory recommended (Super VGA graphics is supported)
Browser	Microsoft Internet Explorer 7 or greater
Keysight IO libraries	Version 16.3.17914 or later

Input and Output Connections

The connection diagram is found in the M9383A Startup Guide, M9383-90001

M9300A PXIe frequency reference – 1 slot

See the M9300A datasheet (5991-0898EN) for the table of input and output connectors

M9303A PXIe synthesizer – 1 slot

Connectors	
RF Out	SMA (f) connector. Outputs the primary RF signal of the synthesizer. Nominal frequency range is 187.5 MHz to 13.7 GHz. Nominal power range is 0 to 15 dBm from 187.5 MHz to 10 GHz and 0 to 10 dBm from 10 GHz to 13.7 GHz. 50 Ω nominal impedance. Damage level is 30 dBm.
RF In	SMA (f) connector. Accepts an RF signal which can be routed to RF Out. Nominal frequency range is 10 MHz to 6 GHz. Nominal power is 5 dBm. 50 Ω nominal impedance. Damage level is 30 dBm.
FM In	SMP (m) connector. Drives either FM or ΦM , selectable. Nominal frequency range is DC to 10 MHz for FM and DC to 1 MHz for ΦM . Nominal impedance is 50 Ω, 600 Ω, and 1MΩ, selectable. Damage level is ±5 V.
2.4 GHz Clock Out	APC 3.5 mm (f) connector. Outputs the internal 2.4 GHz clock derived from the 100 MHz clock input. Nominal power is 10 dBm. 50 Ω nominal impedance. Damage level is 20 dBm.
4.8 GHz Clock 2 Out	APC 3.5 mm (f) connector. Outputs the internal 4.8 GHz clock derived from the 100 MHz clock input. Output can be switched on or off. Nominal power is 10 dBm. 50 Ω nominal impedance. Damage level is 20 dBm.
4.8 GHz Clock 1 Out	APC 3.5 mm (f) connector. Outputs the internal 4.8 GHz clock derived from the 100 MHz clock input. Nominal power is 10 dBm. 50 Ω nominal impedance. Damage level is 20 dBm.
100 MHz In	SMP (m) connector. Accepts a 100 MHz clock input as a timebase for the synthesizer. Nominal power is 13 dBm. 50 Ω nominal impedance.
100 MHz Out	SMP (m) connector. Outputs a copy of the 100 MHz clock input for use in a daisy chain of multiple modules. Nominal power is 12 dBm. 50 Ω nominal impedance.
LF Out	SMP (m) connector. Outputs the waveform from the internal function generator or a copy of the FM modulation. Nominal frequency range is DC to 10 MHz. Nominal voltage is 0 to 5 V peak into 50 Ω with a -5 V to 5 V offset. 50 Ω nominal impedance.
Trig 1	SMP (m) connector. Bidirectional signal for trigger and events. When configured as an output, VOL < 0.4 V, VOH is 2.8 V to 3.3 V into high impedance. When configured as an input, trigger level is adjustable from -2.1 V to +4.1 V. 50 Ω nominal impedance. Damage level is ± 5 V.
Trig 2	SMP (m) connector. Bidirectional signal for trigger and events. When configured as an output, VOL < 0.4 V, VOH is 2.8 V to 3.3 V into high impedance. When configured as an input, trigger level is adjustable from -2.1 V to +4.1 V. 50 Ω nominal impedance. Damage level is ±5 V.
Sync	SMP (m) connector. Bidirectional signal for synchronization with other modules. 50 Ω nominal impedance. Damage level is ± 5 V.
Status	LED indicator. Green = functioning properly. Red = fault condition.

M9305A PXIe digital direct synthesizer – 2 slots

Connectors	
RF Out	SMA (f) connector. Provides the RF Output. Nominal frequency range is 150 MHz to 1.2 GHz. Nominal power is 5 dBm. 50 Ω nominal impedance. Damage level is 17 dBm.
DDS In	SMA (f) connector. Accepts the DDS signal for use by the module. Nominal frequency range is 150 MHz to 1.2 GHz. Nominal power is -5 dBm. 50 Ω nominal impedance. Damage level is 17 dBm.
DDS Out	SMA (f) connector. Outputs a copy of the signal from DDS In. Nominal frequency range is 150 MHz to 1.2 GHz. Nominal power is 5 dBm. 50 Ω nominal impedance. Damage level is 17 dBm.
4.8 GHz In	SMA (f) connector. Accepts a 4.8 GHz reference clock. Nominal power is 10 dBm. 50 Ω nominal impedance. Damage level is 25 dBm.
4.8 GHz Out	SMA (f) connector. Outputs a copy of the signal from 4.8 GHz In. Output can be switched on or off. Nominal power is 10 dBm. 50 Ω nominal impedance. Damage level is 14 dBm.
Clock In	SMA (f) connector. Accepts a clock for use by the DDS system. Nominal frequency is 4.8 GHz. Nominal power is 10 dBm. 50 Ω nominal impedance. Damage level is 17 dBm.
Clock Out	SMA (f) connector. Provides a copy of the signal from Clock In. Nominal frequency is 4.8 GHz. Nominal power is 10 dBm. 50 Ω nominal impedance. Damage level is 14 dBm.
Trig 1	SMP (m) connector. Bidirectional signal for trigger and events. 1 MΩ nominal impedance. Damage level is 10 V peak, 5 V rms.
Trig 2	SMP (m) connector. Bidirectional signal for trigger and events. 1 MΩ nominal impedance. Damage level is 10 V peak, 5 V rms.
Sync	SMP (m) connector. Bidirectional signal for synchronization with other modules. 1 MΩ nominal impedance. Damage level is 10 V peak, 5 V rms.
Status	LED indicator. Green = functioning properly. Blue = software not connected. Red = fault condition.
USB connector	Unlabeled. Reserved for future use. Not for use with USB devices.

M9312A PXIe source output – 3 slots

Connectors	
RF 1 In	SMA (f) connector. Accepts a 3.2 to 20 GHz IF signal. 50 Ω nominal impedance.
RF 2 In	SMA (f) connector. Accepts a 400 MHz to 3.2 GHz IF signal. 50 Ω nominal impedance.
Aux In	SMA (f) connector. Accepts an output signal from 1 MHz to 44 GHz. Normally Aux Out and Aux In are connected by a jumper. 50 Ω nominal impedance.
Aux Out	SMA (f) connector. Provides the output signal before the output attenuator. 50 Ω nominal impedance.
LO 1 In	SMA (f) connector. Accepts an LO signal between 400 MHz and 10 GHz. 50 Ω nominal impedance.
LO 1 Out	SMA (f) connector. Outputs either a copy of LO 1 In or a doubled copy of LO 1 In (selectable). 50 Ω nominal impedance.
RF Out	2.4 mm (f) connector. Provides an RF output signal between 1 MHz and 20 GHz when Aux Out is connected to Aux In. Otherwise, outputs the signal on Aux Out attenuated by the selected attenuation value. Nominal frequency range is 1 MHz to 44 GHz. 50 Ω nominal impedance.
4.8 GHz In	APC 3.5 mm (f) connector. Accepts a 4.8 GHz reference clock. Nominal power is 10 dBm. 50 Ω nominal impedance. Damage level is 25 dBm.
4.8 GHz Out	APC 3.5 mm (f) connector. Outputs a copy of the signal from 4.8 GHz In. Nominal power is 10 dBm. 50 Ω nominal impedance. Damage level is 14 dBm.
LO 2 Out	APC 3.5 mm (f) connector. Outputs either a copy of LO 1 In or a doubled copy of LO 1 In (selectable). 50 Ω nominal impedance.
100 MHz In	SMP (m) connector. Accepts a 100 MHz clock input as a timebase for the module. Nominal power is 10 dBm. 50 Ω nominal impedance. Damage level is 20 dBm.
100 MHz Out	SMP (m) connector. Provides a copy of the 100 MHz clock input. Nominal power is 10 dBm. 50 Ω nominal impedance. Damage level is 20 dBm.
LF Out	SMP (m) connector. Outputs the waveform from the internal function generator or a copy of the AM modulation. Nominal frequency range is DC to 10 MHz. Nominal voltage is 0 to 5 V peak into 50 Ω with a -5 V to 5 V offset. 50 Ω nominal impedance.

AM In	SMP (m) connector. Accepts an external amplitude modulation signal. Nominal frequency range is DC to 1 MHz. 1 MΩ nominal impedance.
Trig 1	SMP (m) connector. Bidirectional signal for trigger and events. When configured as an output, VOL < 0.4 V, VOH is 2.8 V to 3.3 V into high impedance. When configured as an input, trigger level is adjustable from -2.1 V to +4.1 V. 50 Ω nominal impedance. Damage level is ±5 V.
Trig 2	SMP (m) connector. Bidirectional signal for trigger and events. When configured as an output, VOL < 0.4 V, VOH is 2.8 V to 3.3 V into high impedance. When configured as an input, trigger level is adjustable from -2.1 V to +4.1 V. 50 Ω nominal impedance. Damage level is ±5 V.
Sync Out	SMP (m) connector. Bidirectional signal for synchronization with other modules. 50 Ω nominal impedance. Damage level is ±5 V.
Status	LED indicator. Green = functioning properly. Red = unleveled power or fault condition.

M9314A PXIe upconverter – 2 slots

Connectors	
Aux Out	2.4 mm (f) connector. Provides the RF output as either the upconverted signal from RF1 In or the Aux In signal. Nominal frequency range is 1 MHz to 44 GHz. Nominal power range is -50 to +20 dBm. 50 Ω nominal impedance. Damage level is 27 dBm.
Aux In	SMA (f) connector. Accepts a 1 MHz to 20 GHz signal from M9312A. This signal is not upconverted. Nominal frequency range is 1 MHz to 20 GHz. Nominal power range is -50 to +20 dBm. 50 Ω nominal impedance. Damage level is 26 dBm.
RF1 In	SMA (f) connector. Accepts the IF signal between 400 MHz and 20 GHz. Nominal power range is -5 to +15 dBm. 50 Ω nominal impedance. Damage level is 25 dBm.
RF1 Out	SMA (f) connector. Provides a copy of the signal at RF 1 In below 20 GHz. Nominal frequency range is 400 MHz to 20 GHz. Nominal power range is -5 to +15 dBm. 50 Ω nominal impedance. Damage level is 25 dBm.
LO 1 In	2.4 mm (f) connector. Accepts a 22 to 38 GHz LO signal for the upconverter. Normally LO 1 Out is connected to LO 1 In by a jumper. Nominal power is 20 dBm. 50 Ω nominal impedance. Damage level is 23 dBm.
LO 1 Out	2.4 mm (f) connector. Outputs a doubled version of LO 2 In. Nominal frequency range is 22 to 38 MHz. Nominal power is 20 dBm. 50 Ω nominal impedance. Damage level is 25 dBm.
LO 2 In	SMA (f) connector. Accepts a 11 to 19 GHz signal which is doubled and then used as the LO for the upconversion. Nominal power is 0 dBm. 50 Ω nominal impedance. Damage level is 20 dBm.
Trig 1	SMP (m) connector. Bidirectional signal for trigger and events. 1 MΩ nominal impedance. Damage level is 10 V peak, 5 V rms.
Trig 2	SMP (m) connector. Bidirectional signal for trigger and events. 1 MΩ nominal impedance. Damage level is 10 V peak, 5 V rms.
Sync	SMP (m) connector. Bidirectional signal for synchronization with other modules. 1 MΩ nominal impedance. Damage level is 10 V peak, 5 V rms.
AM In	SMP (m) connector. Accepts an external amplitude modulation signal with 50%/Volt or 20 dB/Volt, selectable. Nominal frequency range is DC to 1 MHz. 1 MΩ nominal impedance. Damage level is 10 V peak, 5 V rms.
AM Out	SMP (m) connector. Provides a copy of the signal at AM In. Nominal frequency range is DC to 1 MHz. 50 Ω nominal impedance. Damage level is 10 V peak, 5 V rms.
Status	LED indicator. Green = functioning properly. Red = fault condition.

M9316A PXIe vector modulator – 3 slots

Connectors	
RF 1 Out	APC 3.5 mm (f) connector. Outputs the modulated RF signal from the 3.2 to 20 GHz modulator. Output can be switched on or off. Nominal power is -5 dBm modulated or -6 dBm CW. 50 Ω nominal impedance. Damage level is 20 dBm.
RF 2 Out	SMA (f) connector. Outputs the modulated RF signal from the 0.4 to 3.2 GHz modulator. Nominal power is -5 dBm modulated or -6 dBm CW. 50 Ω nominal impedance. Damage level is 20 dBm.
LO 2 In	SMA (f) connector. Accepts an LO signal from 400 MHz to 3.2 GHz for use by the 400 MHz to 3.2 GHz modulator. Nominal power is 8 dBm. 50 Ω nominal impedance. Damage level is 30 dBm.
LO 2 Out	APC 3.5 mm (f) connector. Outputs a copy of the LO 1 In signal from 400 MHz to 3.2 GHz. This output is normally connected to LO 2 In by a jumper. Nominal power is 8 dBm. 50 Ω nominal impedance. Damage level is 30 dBm.
LO 1 In	APC 3.5 mm (f) connector. Accepts an LO signal from 0.4 to 20 GHz for use by the 3.2 to 20 GHz modulator. The range from 0.4 to 3.2 GHz is only usable by the LO 2 Out. Nominal power is 13 dBm. 50 Ω nominal impedance. Damage level is 20 dBm.
I+ Output	SMP (m) connector. Outputs the I+ signal, one of four signals provided by the internal baseband generator. Nominal frequency range is DC to 540 MHz. 50 Ω nominal impedance. Damage level is ± 2 V.
I- Output	SMP (m) connector. Outputs the I- signal, one of four signals provided by the internal baseband generator. Nominal frequency range is DC to 540 MHz. 50 Ω nominal impedance. Damage level is ± 2 V.
Q+ Output	SMP (m) connector. Outputs the Q+ signal, one of four signals provided by the internal baseband generator. Nominal frequency range is DC to 540 MHz. 50 Ω nominal impedance. Damage level is ± 2 V.
Q- Output	SMP (m) connector. Outputs the Q- signal, one of four signals provided by the internal baseband generator. Nominal frequency range is DC to 540 MHz. 50 Ω nominal impedance. Damage level is ± 2 V.
I+ Input	SMP (m) connector. Accepts the I+ signal, one of four signals required for external differential I/Q. Nominal frequency range is DC to 540 MHz. 50 Ω nominal impedance. Damage level is 5 V peak, 1 V rms.
I- Input	SMP (m) connector. Accepts the I- signal, one of four signals required for external differential I/Q. Nominal frequency range is DC to 540 MHz. 50 Ω nominal impedance. Damage level is 5 V peak, 1 V rms.
Q+ Input	SMP (m) connector. Accepts the Q+ signal, one of four signals required for external differential I/Q. Nominal frequency range is DC to 540 MHz. 50 Ω nominal impedance. Damage level is 5 V peak, 1 V rms.
Q- Input	SMP (m) connector. Accepts the Q- signal, one of four signals required for external differential I/Q. Nominal frequency range is DC to 540 MHz. 50 Ω nominal impedance. Damage level is 5 V peak, 1 V rms.
Trig 1	SMP (m) connector. Bidirectional signal for trigger and events. When configured as an output, VOL < 0.4 V, VOH is 2.8 V to 3.3 V into high impedance. When configured as an input, trigger level is adjustable from -2.1 V to +4.1 V. 50 Ω nominal impedance. Damage level is ±5 V.
Trig 2	SMP (m) connector. Bidirectional signal for trigger and events. When configured as an output, VOL < 0.4 V, VOH is 2.8 V to 3.3 V into high impedance. When configured as an input, trigger level is adjustable from -2.1 V to +4.1 V. 50 Ω nominal impedance. Damage level is ± 5 V.
Sync	SMP (m) connector. Bidirectional signal for synchronization with other modules. 50 Ω nominal impedance. Damage level is ± 5 V.
100 MHz In	SMP (m) connector. Accepts a 100 MHz clock input as a timebase for the modulator. Nominal power is 10 dBm. 50 Ω nominal impedance. Damage level is 20 dBm.
Status	Two LED indicators. Green = functioning properly. Red = fault condition.

M9318A PXIe Vector Modulator – 3 slots

Connectors	
RF 1 Out	APC 3.5 mm (f) connector. Outputs the modulated RF signal from the 3.2 to 20 GHz modulator. Output can be switched on or off. Nominal power is -5 dBm modulated or -6 dBm CW. 50 Ω nominal impedance. Damage level is 20 dBm.
RF 2 Out	SMA (f) connector. Outputs the modulated RF signal from the 0.4 to 3.2 GHz modulator. Nominal power is -5 dBm modulated or -6 dBm CW. 50 Ω nominal impedance. Damage level is 20 dBm.
LO 2 In	SMA (f) connector. Accepts an LO signal from 400 MHz to 3.2 GHz for use by the 400 MHz to 3.2 GHz modulator. Nominal power is 8 dBm. 50 Ω nominal impedance. Damage level is 30 dBm.
LO 2 Out	APC 3.5 mm (f) connector. Outputs a copy of the LO 1 In signal from 400 MHz to 3.2 GHz. This output is normally connected to LO 2 In by a jumper. Nominal power is 8 dBm. 50 Ω nominal impedance. Damage level is 30 dBm.
LO 1 In	APC 3.5 mm (f) connector. Accepts an LO signal from 0.4 to 20 GHz for use by the 3.2 to 20 GHz modulator. The range from 0.4 to 3.2 GHz is only usable by the LO 2 Out. Nominal power is 13 dBm. 50 Ω nominal impedance. Damage level is 20 dBm.
I+ Output	SMP (m) connector. Outputs the I+ signal, one of four signals provided by the internal baseband generator. Nominal frequency range is DC to 540 MHz. 50 Ω nominal impedance. Damage level is ± 2 V.
I- Output	SMP (m) connector. Outputs the I- signal, one of four signals provided by the internal baseband generator. Nominal frequency range is DC to 540 MHz. 50 Ω nominal impedance. Damage level is ± 2 V.
Q+ Output	SMP (m) connector. Outputs the Q+ signal, one of four signals provided by the internal baseband generator. Nominal frequency range is DC to 540 MHz. 50 Ω nominal impedance. Damage level is ± 2 V.
Q- Output	SMP (m) connector. Outputs the Q- signal, one of four signals provided by the internal baseband generator. Nominal frequency range is DC to 540 MHz. 50 Ω nominal impedance. Damage level is ± 2 V.
I+ Input	SMP (m) connector. Accepts the I+ signal, one of four signals required for external differential I/Q. Nominal frequency range is DC to 540 MHz. 50 Ω nominal impedance. Damage level is 5 V peak, 1 V rms.
I- Input	SMP (m) connector. Accepts the I- signal, one of four signals required for external differential I/Q. Nominal frequency range is DC to 540 MHz. 50 Ω nominal impedance. Damage level is 5 V peak, 1 V rms.
Q+ Input	SMP (m) connector. Accepts the Q+ signal, one of four signals required for external differential I/Q. Nominal frequency range is DC to 540 MHz. 50 Ω nominal impedance. Damage level is 5 V peak, 1 V rms.
Q- Input	SMP (m) connector. Accepts the Q- signal, one of four signals required for external differential I/Q. Nominal frequency range is DC to 540 MHz. 50 Ω nominal impedance. Damage level is 5 V peak, 1 V rms.
Trig 1	SMP (m) connector. Bidirectional signal for trigger and events. When configured as an output, VOL < 0.4 V, VOH is 2.8 V to 3.3 V into high impedance. When configured as an input, trigger level is adjustable from -2.1 V to +4.1 V. 50 Ω nominal impedance. Damage level is ±5 V.
Trig 2	SMP (m) connector. Bidirectional signal for trigger and events. When configured as an output, VOL < 0.4 V, VOH is 2.8 V to 3.3 V into high impedance. When configured as an input, trigger level is adjustable from -2.1 V to +4.1 V. 50 Ω nominal impedance. Damage level is ±5 V.
Sync (lower center)	SMP (m) connector. Bidirectional signal for synchronization with other modules. 50 Ω nominal impedance. Damage level is ±5 V.
Sync (upper left)	Reserved for future use.
Ext 1	SMB (m) connector. Bidirectional signal for trigger and events. 50 Ω nominal output impedance, 10 kΩ nominal input impedance. ± 5 V maximum input level.
Ext 2	SMB (m) connector. Bidirectional signal for trigger and events. 50 Ω nominal output impedance, 10 kΩ nominal input impedance. ± 5 V maximum input level.
3+	SMB (m) connector. Provides a third output channel synchronized with the I and Q outputs. Nominal frequency range is DC to 540 MHz. Nominal voltage is 0 Vpp to 1.65 Vpp without corrections and 0 Vpp to 1.26 Vpp with corrections. 100 Ω nominal impedance.
3-	SMB (m) connector. Provides a third output channel synchronized with the I and Q outputs. Nominal frequency range is DC to 540 MHz. Nominal voltage is 0 Vpp to 1.65 Vpp without corrections and 0 Vpp to 1.26 Vpp with corrections. 100 Ω nominal impedance.
Ext Clk In	Reserved for future use.
Aux Port	Reserved for future use.
USB	Reserved for future use. Not for use with USB devices.
Status	Three LED indicators. Blue or Green = functioning properly. Red = fault condition.

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 assistance

	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 instrument 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
	SystemVue	System–level EDA software platform for designing communications and defense systems. Used with the M9383A, 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 M9383A Microwave Signal Generator 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		
Calibration cycle	A one year calibration cycle is recommended.	
Keysight calibration status utility	The Keysight calibration status utility helps ensure your M9383A is calibrated by managing the calibration interval and providing messages regarding instrument and module calibration status.	Included in base configuration

Support and Warranty

Warranty		

Global warranty	Keysight's warranty service provides standard coverage for the country where product is used.
	  – All parts and labor necessary to return to full specified performance
	  – Recalibration for products supplied originally with a calibration certificate
	  – Return shipment
		Included

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

Learn more at: www.keysight.com

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

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