

# Selecting a Signal Generator

## Introduction

Keysight Technologies, Inc. offers the widest selection of signal generators from baseband to 67 GHz, with frequency extensions to 1.1 THz. From basic to advanced functionality, each signal generator delivers benchmark performance in its class to address the requirements in design and manufacture of radio transceivers and their components; and applications ranging from low-frequency navigation signals, through cellular mobile radio, to millimeter wave radar, and satellite systems. Each offers synthesized frequency accuracy and stability, excellent calibrated level accuracy, and remote programmability.

Modulation capabilities vary from general-purpose AM, FM and digital I/Q to standard-specific formats such as GSM, W-CDMA, HSPA, LTE, LTE-Advanced, GPS, and WLAN. Keysight provides signal generators in multiple form factors, including benchtop and modular PXI.

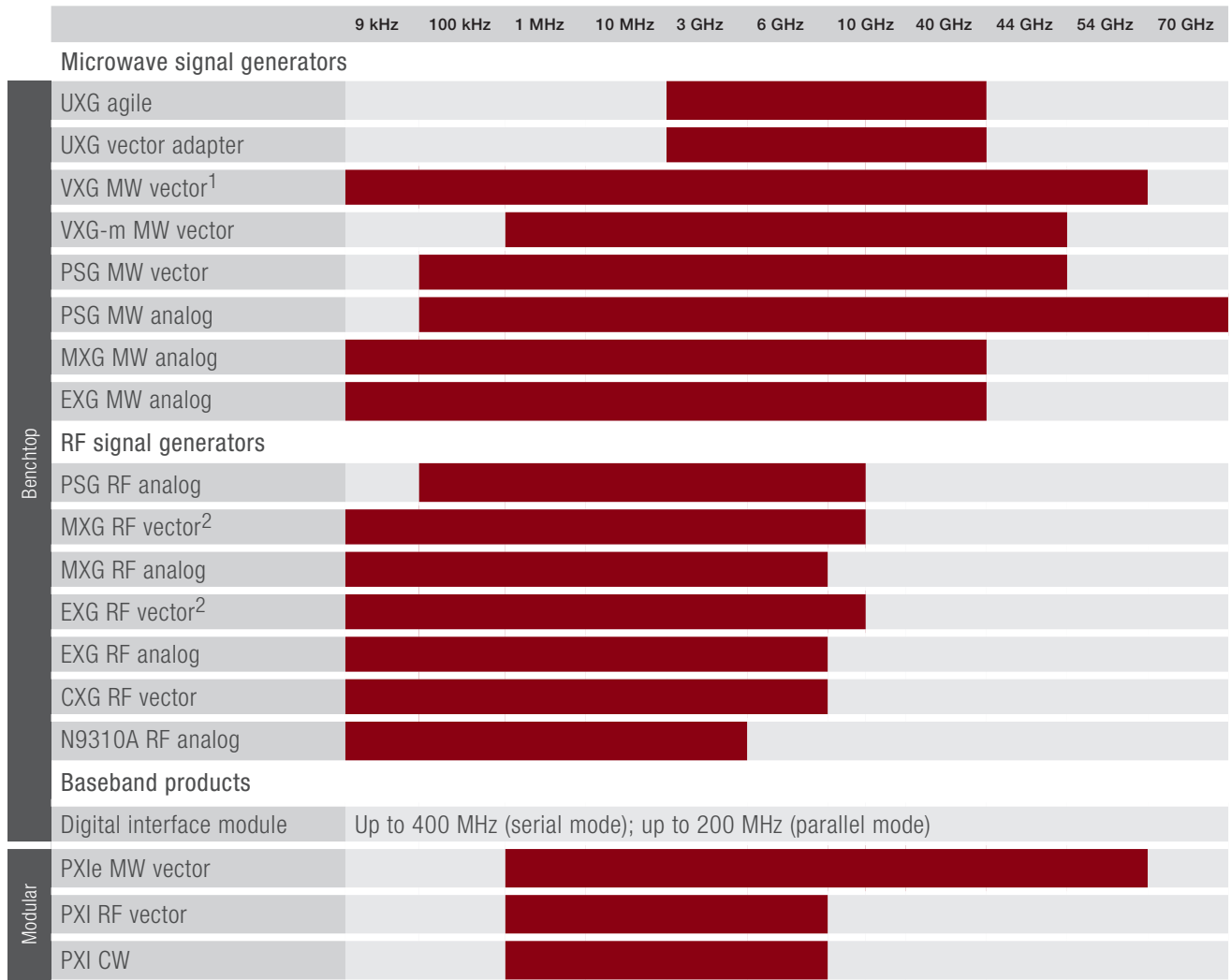
This guide provides an overview and side-by-side comparisons to help you determine which signal generator is right for you. It is intended to supplement online selection tools available at [www.keysight.com/find/sg](http://www.keysight.com/find/sg).



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## Frequency coverage for Keysight signal generators



1. Frequency for VXG MW vector can be extended up to 110 GHz with V3080A.
2. Frequency for MXG RF vector and EXG RF vector can be extended up to 7.2 GHz with N5182BX07

## Product Categories

### Benchtop and modular PXI signal generators

Benchtop signal generators are well-suited for R&D or design verification, where analysis and troubleshooting benefit from interactive analysis. Benchtop models range from RF to microwave with a broad range of capabilities so you can select which generator best suits your needs.

Modular PXI signal generators are ideal for applications that require multi-channel measurement capabilities, fast measurement speed, and a small footprint. They also offer scalability and flexibility to configure solutions with a shared processor, chassis and other modular instruments. The PXI vector signal generator can be used with the same software applications as bench top signal generators, providing measurement consistency and compatibility throughout the product development cycle.

### Vector signal generators

Vector signal generators or digital signal generators have a built-in I/Q modulator to upconvert complex modulation formats such as QPSK and 1024QAM. When combined with an IQ baseband generator, virtually any signal can be emulated and transmitted within the information bandwidth supported by the system.

### Analog signal generators

Analog signal generators supply sinusoidal continuous wave (CW) signals with optional capability to add AM, FM,  $\Phi$ M and pulse modulation. The maximum frequency range for analog signal generators spans from RF to microwave. Most generators feature step/list sweep modes for passive device characterization or calibration.

### Agile signal generators

Agile signal generators are optimized for speed to quickly change frequency, amplitude, and phase of the signal. They also have the unique capability to be phase coherent at all frequencies, all of the time. This attribute, along with extensive pulse modulation and wideband chirp capabilities, is ideal for electronic warfare (EW) and radar applications.

### Signal creation software

Signal creation software products enable the generation of a wide range of application-specific test signals using vector signal generators. They can easily create signals to evaluate the performance of radio designs and the components that comprise them under various parametric and functional test conditions at baseband, RF and microwave frequencies. Keysight's Signal Studio software runs on a PC and embedded software runs directly on the signal generator.

## Key Specifications Comparison - Benchtop Vector Signal Generators

	Benchtop						
Specifications	UXG vector	VXG	VXG	PSG MW	MXG RF	EXG RF	CXG
Model number	N5194A	M9484C	M9384B	E8267D	N5182B	N5172B	N5166B
Performance	*****	*****	*****	*****	****	***	**
Frequency range (min. to max.)	10 MHz to 44 GHz	9 kHz to 54 GHz	1 MHz to 44 GHz	100 kHz to 44 GHz	9 kHz to 6 GHz	9 kHz to 6 GHz	9 kHz to 6 GHz
Frequency switching (list mode)	170 ns	N/A	N/A	9 ms	800 µs	800 µs	5 ms
Sweep mode	Streaming, chirp	N/A	N/A	Step, list, ramp	Step, list	Step, list	Step, list
Minimum output power	-90 dBm	-110 dBm	-90 dBm	-90 dBm	-127 dBm	-110 dBm	-110 dBm
Maximum output power (at 1 GHz)	+6 dBm	+20 dBm	+20 dBm	+21 dBm	+24 dBm	+21 dBm	+18 dBm
Level accuracy (at 1 GHz)	±2.5 dB	±0.6 dB	±1.5 dB	±0.6 dB	± 0.6 dB	± 0.6 dB	±0.6 dB
SSB phase noise (at 1 GHz; 20 kHz offset)	-144 dBm/Hz (at 10 kHz offset)	-148 dBm/Hz (at 10 kHz offset)	-137 dBc/Hz (at 10 kHz offset)	-143 dBc/Hz (at 10 kHz offset)	-146 dBc/Hz	-122 dBc/Hz	-119 dBc/Hz
Harmonics (at 1 GHz)	-65 dBc	-55 dBc	-46 dBc	-55 dBc	-35 dBc	-35 dBc	-35 dBc
Non-harmonics (at 1 GHz)	-72 dBc	-60 dBc	-61 dBc	-88 dBc	-96 dBc	-72 dBc	-72 dBc
AM rate	N/A	N/A	N/A	DC to 100 kHz	DC to 50 kHz	DC to 50 kHz	DC to 50 kHz
FM deviation (maximum)	N/A	N/A	N/A	1 to 128 MHz	1 to 16 MHz	2.5 to 40 MHz	2.5 to 40 MHz
PM phase deviation (maximum in normal mode)	N/A	N/A	N/A	1 to 800 rad	0.5 to 8 rad	1.25 to 20 rad	1.25 to 20 rad
Narrow pulse width	1 ns	20 ns	30 ns	20 ns	20 ns	20 ns	20 Msa
EVM (LTE)	N/A	N/A	0.28%	0.8%	0.2%	0.2%	0.2°
ACPR (3GPP LTE-FDD)	N/A	-68 dBc	N/A	N/A	-69 dBc	-69 dBc	-66 dBc
Internal baseband generator RF BW	1.6 GHz	2.5 GHz	2 GHz	80 MHz	160 MHz	160 MHz	120 MHz
Waveform playback memory	6 Gsa	4096 Msa	1024 Msa	64 Msa	1024 Msa	512 Msa	512 Msa
Baseband generator mode	Waveform playback and real-time	Waveform playback	Waveform playback	Waveform playback and real-time	Waveform playback and real-time	Waveform playback and real-time	Waveform playback
Phase coherent frequency switching	Standard	Standard	N/A	N/A	N/A	N/A	N/A
Wide chirp capability	1.6 GHz	N/A	N/A	N/A	N/A	N/A	N/A
Signal descriptor word capability	Standard	Optional	N/A	N/A	N/A	N/A	N/A

## Key Specifications Comparison - Benchtop Analog Signal Generators

	Benchtop							
Specifications	UXG	PSG MW	MXG MW	EXG MW	PSG RF	MXG RF	EXG RF	RF
Model number	N5193A	E8257D	N5183B	N5173B	E8663D	N5181B	N5171B	N9310A
Performance	*****	*****	****	***	****	****	***	**
Frequency range (min. to max.)	10 MHz to 40 GHz	100 kHz to 70 GHz	9 kHz to 40 GHz	9 kHz to 40 GHz	100 kHz to 9 GHz	9 kHz to 6 GHz	9 kHz to 6 GHz	9 kHz to 3 GHz
Frequency switching (list mode)	180 ns	9 ms	600 $\mu$ s	600 $\mu$ s	9 ms	800 $\mu$ s	800 $\mu$ s	10 ms
Sweep mode	Normal, list, fast, CW, streaming	list, step, ramp	list, step	list, step	list, step, ramp	list, step	list, step	list, step
Output power (minimum)	-130 dBm	-135 dBm	-130 dBm	-130 dBm	-135 dBm	-144 dBm	-144 dBm	-127 dBm
Output power (at 1 GHz)	+10 dBm	+26 dBm (at 20 GHz)	+20 dBm (at 20 GHz)	+20 dBm (at 20 GHz)	+23 dBm	+24 dBm	+21 dBm	+13 dBm
Level accuracy	$\pm$ 1.5 dB	$\pm$ 0.8 dB (at 20 GHz)	$\pm$ 0.7 dB (at 10 GHz)	$\pm$ 0.7 dB (at 10 GHz)	$\pm$ 0.6 dB	$\pm$ 0.6 dB	$\pm$ 0.6 dB	$\pm$ 1.0 dB
SSB phase noise (1 GHz, 20 kHz offset)	-144 dBm/Hz (at 10 kHz offset)	-126 dBc/Hz (at 10 GHz, 10 kHz offset)	-124 dBc/Hz (at 10 GHz)	-101 dBc/Hz (at 10 GHz)	-143 dBc/Hz (at 10 kHz offset)	-146 dBc/Hz	-122 dBc/Hz	-95 dBc/Hz
Harmonics (at 1 GHz)	-50 dBc	-55 dBc	-55 dBc (at 10 GHz)	-55 dBc (at 10 GHz)	-55 dBc	-35 dBc	-35 dBc	-30 dBc
Non-harmonics (at 1 GHz)	-70 dBc	-88 dBc	-100 dBc	-72 dBc	-88 dBc	-96 dBc	-72 dBc	-50 dBc
AM rate	DC to 10 MHz	DC to 100 kHz	DC to 100 kHz	DC to 100 kHz	DC to 100 kHz	DC to 50 kHz	DC to 50 kHz	20 Hz to 20 kHz
FM deviation (maximum)	5% of carrier frequency or 600 MHz, whichever is less	1 to 128 MHz	1 to 128 MHz	2.5 to 320 MHz	1 to 16 MHz	1 to 16 MHz	2.5 to 40 MHz	100 kHz
PM phase deviation (maximum in normal mode)	5% of (carrier frequency)/ (modulation frequency) or 600 MHz/ (modulation frequency) or $12\pi$ , whichever is less	1 to 1280 rad	0.5 to 64 rad	1.25 to 160 rad	1 to 160 rad	0.5 to 8 rad	1.25 to 20 rad	10 rad
Narrow pulse width	10 ns	20 ns	20 ns	20 ns	20 ns	20 ns	20 ns	100 $\mu$ s
EVM (LTE)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
ACPR (3GPP W-CDMA TM1 64 DPCH)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Internal baseband generator RF BW	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Waveform playback memory	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Baseband generator mode	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Phase coherent frequency switching	Standard	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Wide chirp capability	10% of carrier frequency	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Pulse descriptor word capability	Standard	N/A	N/A	N/A	N/A	N/A	N/A	N/A

## Key Specifications Comparison - Modular Signal Generators

Specifications	Vector			Analog	
	VXG-m	PXI MW	PXI RF	PXI MW	PXI CW source
Model number	M9383B	M9383A	M9381A	M9383A	M9380A
Performance	*****	*****	***	*****	**
Frequency range (min. to max.)	1 MHz to 44 GHz	1 MHz to 44 GHz	1 MHz to 6 GHz	1 MHz to 44 GHz	1 MHz to 6 GHz
Frequency switching (list mode)	N/A	250 $\mu$ s	185 $\mu$ s	250 $\mu$ s	5 ms
Sweep mode	N/A	Step	Step, list	Step	N/A
Output power (minimum)	-120 dBm	-120 dBm	-130 dBm	-120 dBm	-130 dBm
Output power (maximum; at 1 GHz)	+18 dBm	+19 dBm	+19 dBm	+19 dBm	+19 dBm
Level accuracy (at 1 GHz)	$\pm$ 1.5 dB	$\pm$ 1.1 dB	$\pm$ 0.4 dB	$\pm$ 1.1 dB	$\pm$ 0.4 dB
SSB phase noise (at 1 GHz; 20 kHz offset)	-137 dBc/Hz (at 10 kHz offset)	-118 dBc (at 10 kHz offset)	-122 dBc/Hz	-118 dBc (at 10 kHz offset)	-122 dBc/Hz
Harmonics (at 1 GHz)	-46 dBc	-48 dBc	-34 dBc	-48 dBc	-29 dBc
Non-harmonics (at 1 GHz)	-61 dBc	-55 dBc	-66 dBc nominal	-55 dBc	-66 dBc nominal
AM rate	N/A	640 MHz	6.2 MHz	70 kHz	N/A
FM deviation (maximum)	N/A	320 MHz	1.25 MHz	70 MHz	N/A
PM phase deviation (maximum in normal mode)	N/A	10 rad	10 rads	8 rad	N/A
Narrow pulse width	30 ns	20 ns	20 ns	20 ns	N/A
EVM (LTE)	0.28%	N/A	0.32%; 0.25% @ 900 MHz	N/A	N/A
ACPR (3GPP W-CDMA TM1 64 DPCH)	N/A	N/A	-70 dBc	N/A	N/A
Internal baseband generator RF BW	2 GHz	1 GHz	160 MHz	N/A	N/A
Waveform playback memory	1024 Msa	1024 Msa	1024 MSa	N/A	N/A
Baseband generator mode	Waveform playback	Waveform playback	Waveform playback	N/A	N/A
Phase coherent frequency switching	N/A	N/A	N/A	N/A	N/A
Wide chirp capability	N/A	N/A	N/A	N/A	N/A
Pulse descriptor word capability	N/A	N/A	N/A	N/A	N/A

# Applications, Core Capabilities, and Software Comparison

Applications and signal creation software	Benchtop						Modular		
	UXG Agile	UXG Vector	VXG Vector	PSG MW Vector	MXG and EXG RF Vector	CXG Vector	VXG-m Vector	PXI MW Vector	PXI RF Vector
<b>Instrument embedded capabilities</b>									
USB power meter	•				•	•	•		
Step/list sweep	•	•		•	•	•		•	•
Ramp sweep		•		•					
AM, FM, PM, pulse	•	•	•	•	•	•	•	•	•
LF function generator	•			•	•	•	•	•	
Real-time custom modulation (PSK, QAM, FSK)				•	•	•			
Phase noise impairments					•			•	
Multitone, NPR			•	•	•	•	•	•	
Noise (Calibrated AWGN)			•	•	•	•	•	•	
Pulse Train	•	•			•	•		•	
BERT					•				
SystemVue, MATLAB	•	•	•	•	•	•	•	•	•
Real-time fading					•				
<b>PathWave signal generation software</b>									
<b>Cellular communications</b>									
LTE/LTE-Advanced FDD			•	•	•	•	•	•	•
LTE/LTE-Advanced TDD			•	•	•	•	•	•	•
W-CDMA/HSPA+, cdma2000®			•	•	•	•	•	•	•
V2X			•	•	•	•	•		•
5G NR			•		•	•	•	•	•
<b>Wireless networking</b>									
WLAN 802.11, Bluetooth®			•	•	•	•	•		•
IoT (Internet of Things)			•	•	•	• <sup>1</sup>	•		•
DFS Radar Profiles				•	•	•			
Mobile WiMAX				•	•		•		•
<b>Audio/video broadcast</b>									
DVB-T/H/T2/S/S2, DVB-C (J.83 Annex A/C), J.83 Annex B (DOCSIS DS), ISDB-T/Tmm, ATSC, ATCS-M/H, DTMB (CTTB), CMMB			•	•	•		•		•
T-DMB, DAB/DAB+/DMB-audio, FM stereo with RDS/RBDS			•		•		•		•
Land Mobile Radio (LMR)			•		•		•		
<b>Detection, positioning, tracking, navigation</b>									
Global Navigation Satellite Systems (GNSS) GPS, GLONASS, Galileo, Beidou, SBAS, QZSS			• <sup>2</sup>	•	•	• <sup>2</sup>			•
<b>General RF</b>									
Custom Modulation			•	•	•	•	•	•	
Pulse building				•	•		•		
Multitone distortion, NPR				•	•		•		
Power Amplifier			•	•	•		•	•	
IQ Waveform Toolkit				•	•	•			
<b>Threat simulation</b>									
Multi-emitter scenario generation	•	•							
Simulation view	•	•							
Multi-source calibration	•	•							

1. HRP UWB is not supported with N5166B CXG

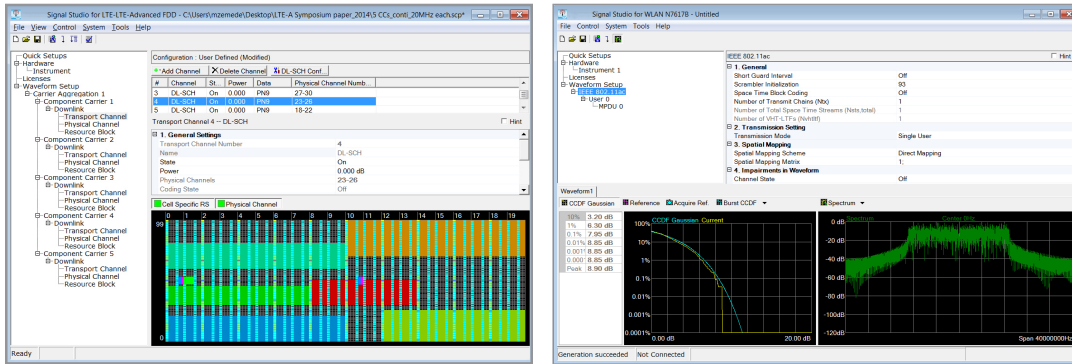
2. No real-time support; ARB playback only



## Applications, Core Capabilities, and Software Comparison (continued)

Applications and signal creation software	Benchtop				
	PSG MW	MXG and EXG MW	MXG and EXG RF	PSG RF	N9310 RF
Instrument embedded capabilities	Analog	Analog	Analog	Analog	Analog
USB power meter		•	•		
Step/list sweep	•	•	•	•	•
Ramp sweep	•			•	
AM, FM, PM, pulse	•	•	•	•	•
LF function generator	•	•	•	•	•
ARB custom modulation					
Real-time custom modulation (PSK, QAM, FSK)					
Phase noise impairments					
Multitone, NPR					
Noise (Calibrated AWGN)					
Pulse Train		•	•		
BERT					
<b>SystemVue, MATLAB</b>					
Real-time fading					
<b>Signal Studio software</b>					
<b>Cellular communications</b>					
LTE/LTE-Advanced FDD					
LTE/LTE-Advanced TDD					
W-CDMA/HSPA+, cdma2000®					
V2X					
5G NR					
<b>Wireless networking</b>					
WLAN 802.11a/b/g/j/p/n/ac/ah, Mobile WiMAX™, Bluetooth®					
IoT (Internet of Things)					
DFS Radar Profiles					
Mobile WiMAX					
<b>Audio/video broadcast</b>					
DVB-T/H/T2/S/S2, DVB-C (J.83 Annex A/C), J.83 Annex B (DOCSIS DS), ISDB-T/Tmm, ATSC, ATCS-M/H, DTMB (CTTB), CMMB					
T-DMB, DAB/DAB+/DMB-audio, FM stereo with RDS/RBDS					
Land Mobile Radio (LMR)					
<b>Detection, positioning, tracking, navigation</b>					
Global Navigation Satellite Systems (GNSS) GPS, GLONASS, Galileo, Beidou, SBAS, QZSS					
<b>General RF</b>					
Custom Modulation					
Pulse building					
Multitone distortion, NPR					
Power Amplifier					
IQ Waveform Toolkit					
<b>Threat simulation</b>					
Multi-emitter scenario generation					

# PathWave Signal Generation Software



## Simplify signal creation

Whether you are working on a single radio format or integrating multiple formats into a single device, easy access to the right test signals streamlines validation and helps ensure interoperability. Accelerate your work with Keysight PathWave signal generation software, a flexible suite of signal-creation tools that reduces the time you spend on signal simulation. Its performance-optimized reference signals, validated by Keysight, enhance the characterization and verification of your devices.


Configure PathWave signal generation to match your requirements:

- Select the license type that fits your specific use case and budget, including fixed, transportable, and 5- or 50-pack waveforms
- Connect to a wide range of Keysight instruments

Leverage and customize built-in signals with flexible signal generation, additive impairments, graphs, convenient connectivity and automation, and embedded and online documentation. Control your vector signal generator directly from the software GUI and/or instrument front panel.

Connect your vector source to PathWave signal generation—and simplify signal creation.

[www.keysight.com/find/SignalStudio](http://www.keysight.com/find/SignalStudio)



### Free Trial License

Free 30-day trials of PathWave signal generation software are available to evaluate the user interface and generate signals. Redeem a trial license online at

[www.keysight.com/find/SignalStudio\\_trial](http://www.keysight.com/find/SignalStudio_trial)

## VXG Signal Generators

### VXG M9484C microwave signal generator

Keysight has created the ultimate VXG signal generator to take your designs to the widest bandwidths, highest frequencies, and multichannel applications. With this fully integrated, calibrated, and synchronized solution, you don't need to worry about the errors caused by additional connections and instruments.

- Up to 4 synchronized and phase coherent channels in a single instrument, and more than 32 channels across multiple instruments
- Support MIMO real-time fading for all 3GPP 5G NR required base station conformance tests with PathWave Signal Generation software
- Generate the most demanding test signals with up to 2.5 GHz of modulation bandwidth, or 5 GHz with channel bonding
- Streamline complex receiver test scenarios with up to 8-virtual-signal generators per RF channel, up to 32 signals in one instrument



[www.keysight.com/find/m9484c](http://www.keysight.com/find/m9484c)

### VXG M9384B and VXG-m M9383B microwave signal generators

Reduce your test system setup complexity with the world's first dual-channel 44 GHz vector signal generator with 2 GHz modulation bandwidth in a single test instrument. A simple setup also enables quicker OTA conformance test by switching from blocker and interferer tests with two independent channels to dual channel MIMO and beamforming tests, without ever having to touch any hardware. The VXG has been designed for precise and repeatable time and phase alignment for coherent operation.

- Dual-channel millimeter wave vector signal generator with 2 GHz RF bandwidth in a single instrument
- High output power to compensate for system loss and enable 5G power amplifier and over-the-air (OTA) testing
- Phase coherent LO and baseband synchronization for multi-user or beamforming MIMO OTA testing
- PathWave Signal Generation software to accelerate your design and test workflow
- 3GPP 5G NR standard-compliant signals with channel coding and multi-antenna port support



[www.keysight.com/find/m9384b](http://www.keysight.com/find/m9384b)

[www.keysight.com/find/m9383b](http://www.keysight.com/find/m9383b)

Key specifications	M9484C	M9384B	M9383B
Type	Benchtop	Benchtop	Modular
RF channels per box	1, 2, or 4 <sup>1</sup>	1 or 2	1 or 2
Frequency range	9 kHz to 54 GHz (110 GHz) <sup>2</sup>	1 MHz to 44 GHz	1 MHz to 44 GHz
Modulation bandwidth	2.5 GHz (5 GHz) <sup>3</sup>	2 GHz (4 GHz)	2 GHz
Output power at 10 GHz	+23 dBm	+22 dBm	+22 dBm
Phase noise at 10 GHz, 10 kHz offset	-132 dBc/Hz	-126 dBc/Hz	-126 dBc/Hz
EVM (5G, 100 MHz, 28 GHz)	0.35% (meas.)	0.96% (nom.)	0.96% (nom.)
ACPR (5G, 100 MHz, 3.4 GHz)	-56 dBc (meas.)	-53 dBc (nom.)	-53 dBc (nom.)
Baseband generator memory	Up to 4 GSa	Up to 2 GSa	Up to 2 GSa

1. Four channels are available up to 20 GHz maximum frequency.
2. With the V3080A vector signal generator frequency extender.
3. With channel bonding.

## PSG Signal Generators

The PSG is the industry's most trusted microwave signal generator, with thousands of units deployed in hundreds of programs around the world. With metrology-grade performance and evolving capabilities across RF and microwave frequencies, it continues to enable new designs that stay ahead of emerging threats.

### PSG microwave signal generator E8267D vector

- Test advanced receivers with realistic wideband radar, EW, and SATCOM waveforms up to 44 GHz
- Flexible, integrated 80 MHz AWG, real-time and baseband generator to simulate cellular, wireless, GPS and custom communications
- Exercise advanced EW, radar, and satellite systems with Signal Studio, a vector PSG, and a wideband AWG such as the Keysight M8190A for up to 2 GHz bandwidth
- Test phased-array systems and direction-finding receivers with multiple phase-coherent signals generated by linking up to 16 vector PSGs

[www.keysight.com/find/E8267D](http://www.keysight.com/find/E8267D)



### PSG microwave signal generator E8257D analog

- Meet test system needs across a wide range: 13, 20, 31.8, 40, 50, and 67 GHz models available (add frequency extender modules to cover up to 1.1 THz)
- Test high-power devices and overcome test system losses with options capable of generating up to 1 W (+30 dBm) of output power
- Address the demanding needs of Doppler radar, ADC, and receiver-blocking tests with extremely low phase noise:  $-91$  dBc/Hz at 100 Hz offset and  $-126$  dBc/Hz at 10 kHz offset (10 GHz)
- Test your DUT with the highest quality signals—the PSG combines metrology-grade frequency and level accuracy with excellent distortion and spurious characteristics

[www.keysight.com/find/E8257D](http://www.keysight.com/find/E8257D)



Key specifications	E8267D MW vector	E8257D MW analog
Frequency range (min. to max.)	100 kHz to 44 GHz	100 kHz to 70 GHz
Frequency switching	9 ms	9 ms
Output power (at 10 GHz)	+23 dBm	+30 dBm
Level accuracy (at 10 GHz)	± 0.8 dB	± 0.8 dB
SSB phase noise (10 GHz; 10 kHz offset)	-126 dBc/Hz	-126 dBc/Hz
Harmonics (10 GHz)	-55 dBc	-55 dBc
Internal baseband generator RF BW	80 MHz	N/A
EVM (16 QAM)	0.8%	N/A

## Millimeter Wave Accessories for the PSG Signal Generator

Millimeter wave sources are essential instruments for developing almost all millimeter-wave systems. Easily extend the frequency range of your E8257D or E8267D PSG signal generators with these multiplier modules from select partners.

Millimeter-wave source modules from OML, Inc.

The E8257DSxx-Series of external, frequency banded millimeter-wave source modules provide synthesized frequency performance, millimeter-wave test signals for waveguide bands from 50 to 500 GHz.



Signal generator frequency extension modules from VDI, Inc.

The E8257DVxx-Series of signal generator frequency extension modules provide high power, synthesized frequency performance millimeter-wave test signals for waveguide bands from 50 GHz to 1.1 THz.



## PSG RF signal generator E8663D analog

The E8663D PSG RF analog signal generator provides excellent phase noise in a commercially-available signal generator. With optional analog modulation (AM, FM, ØM, and pulse) capability, superior level accuracy, and high output power, the E8663D is the right choice for demanding applications such as radar system development, satellite communications evaluation, or when a very low noise local oscillator or reference signal is needed. Built on the outstanding legacy of the 8663A, the E8663D delivers improved performance and is fully code-compatible with its predecessor for seamless upgrades to existing test systems. Enhanced narrow pulse modulation and high output power are optionally available.



[www.keysight.com/find/E8663D](http://www.keysight.com/find/E8663D)

Key specifications	E8663D MW vector
Frequency range (min. to max.)	100 kHz to 9 GHz
Frequency switching	9 ms
Output power	+23 dBm
Level accuracy	± 0.6 dB
SSB phase noise (1 GHz; 10 kHz offset)	-143 dBc/Hz
Harmonics	-55 dBc



## X-Series Signal Generators

Crafted to create signals capable of testing your very best devices and designs, the X-Series signal generators offer outstanding performance and low cost of ownership. A proven, scalable platform combined with cost-effective calibration and internal diagnostics allows you to buy the capabilities you need today and easily upgrade to meet future requirements.

### UXG agile signal generator N5193A, N5191A<sup>1</sup>

The N5193A UXG agile signal generator creates realistic multi-emitter threat simulations for EW test. Off the shelf, the UXG is a powerful building block as a dependable LO or a scalable threat simulator that lowers the barriers between new intelligence and up-to-date signal scenarios.

- Using direct digital synthesis (DDS), the UXG can update frequency, amplitude, and phase settings in as little as 180 ns, with built-in phase repeatability.
- The UXG directly accepts pulse descriptor words (PDWs) to quickly and efficiently generate long pulse trains while allowing individual phase control.
- The UXG can simulate advanced radar signals, generating narrow pulses with 90 dB on/off ratio and chirps as wide as 10 to 25 percent of the carrier frequency.



[www.keysight.com/find/N5193A](http://www.keysight.com/find/N5193A)

### UXG agile vector adapter N5194A, N5192A<sup>1</sup>

To take your lab to the next level, the N5194A UXG agile vector adapter works together with the N5193A to simulate increasingly complex signal environments with enhanced realism and greater confidence.

- Ideal for generating shaped pulses and wideband linear or non-linear chirps
- 2 Gsa/s baseband generator provides 1.6 GHz instantaneous bandwidth
- Built-in solid-state attenuator provides 120 dB agile amplitude range



[www.keysight.com/find/N5194A](http://www.keysight.com/find/N5194A)

1. Because of the high-performance characteristics of the N5193A and N5194A UXG models, a US export license is required. The N5191A and N5192A are modified versions of the UXG agile signal generator and vector adapter that provide high performance without requiring an export license. Notable differences include switching speed, minimum pulse width, and chirp bandwidth.



Key Specification	N5193A UXG agile signal generator	N5194A UXG agile vector adapter
Frequency switching speed	370 ns	220 ns
Frequency/amplitude/phase update speed	180 ns	170 ns
Output power	-130 to +10 dBm	-120 to +7 dBm
Harmonics	-50 dBc	-60 dBc
Non-harmonics	-70 dBc	-72 dBc
Phase noise	-126 dBc/Hz at 10 GHz carrier, 10 kHz offset	-127 dBc/Hz at 10 GHz carrier, 10 kHz offset
Minimum pulse width	10 ns	1 ns
Baseband generator sample rate	N/A	2 Gsa/s
Baseband generator memory	N/A	6 Gsa

## MXG microwave signal generator N5183B analog

The MXG is the pure and precise alternative to the analog PSG, with advantages in size and speed. It delivers the performance you need to perform module- and system-level testing—fast—in only two rack units.

- Meet test system needs up to 13, 20, 31.8, or 40 GHz
- Address demanding tests of radar modules and systems with excellent phase noise of  $\leq 124$  dBc/Hz (10 kHz offset) with -75 dBc spurious (at 10 GHz)
- Save space and maintain test rigor with near-PSG performance levels in just two rack units
- Accelerate your calibration process with excellent switching speed of less than 600  $\mu$ s



[www.keysight.com/find/N5183B](http://www.keysight.com/find/N5183B)

## EXG microwave signal generator N5173B analog

The EXG is the cost-effective choice when you need to balance budget and performance. In just two rack units, it provides the essential signals that address parametric testing of broadband filters, amplifiers, receivers, and more.

- Perform basic LO upconversion or CW blocking with low cost coverage to 13, 20, 31.8, or 40 GHz
- Characterize broadband microwave components such as filters and amplifiers with the best combination of output power (+20 dBm at 20 GHz), low harmonics ( $\leq 55$  dBc), and full step attenuation)
- Use as a high-stability system reference with standard high-performance OCXO at an aging rate of less than  $\pm 5 \times 10^{-10}$  parts per day
- Shrink your test stand with optional integrated multifunction generator and USB power sensor interface



[www.keysight.com/find/N5173B](http://www.keysight.com/find/N5173B)

Key specifications	N5183B MXG microwave analog	N5173B EXG microwave analog
Frequency range (min. to max.)	9 kHz to 40 GHz	9 kHz to 40 GHz
Frequency switching	600 us	600 us
Output power (10 GHz)	+20 dBm	+ 20 dBm
Level accuracy (10 GHz)	$\pm 0.7$ dB	$\pm 0.7$ dB
SSB phase noise (10 GHz)	-129 dBc/Hz	-101 dBc/Hz
Harmonics (10 GHz)	-55 dBc	-55 dBc

## MXG RF signal generators N5182B vector and N5181B analog

To help you reach better performance, the MXG X-Series vector and analog signal generators are fine-tuned to be your “golden transmitter” in R&D. Whether you’re pushing for a linear RF chain or an optimized link budget, the MXG delivers what you need: phase noise, ACPR, channel coding, and much more. Reveal the true performance of your devices and test your designs within and beyond their limits with the MXG.

- Test radar receiver sensitivity or characterize ADC with excellent phase noise
- Characterize nonlinear PA behavior with excellent ACPR and output power
- Test 802.11ac with < 0.4% EVM, or characterize multi-carrier PAs with < ± 0.2 dB flatness across 160 MHz bandwidth
- Go beyond standard application requirements with sophisticated real-time and waveform-based PathWave signal generation software



[www.keysight.com/find/N5182B](http://www.keysight.com/find/N5182B)

[www.keysight.com/find/N5181B](http://www.keysight.com/find/N5181B)

## EXG RF signal generators N5172B vector and N5171B analog

To help you achieve faster throughput and greater uptime, the cost-effective EXG X-Series signal generators are optimized for manufacturing test. With analog and vector models, the EXG provides the signals you’ll need for basic parameter testing of components and functional verification of receivers. Get “just enough” test at the right price with the EXG.

- Maximize test margins on the production line with great ACPR
- Maximize throughput with < 800  $\mu$ s simultaneous switching of frequency, power and waveform type
- Enable rapid, accurate tests using Signal Studio’s predefined, standards-based waveforms
- Shrink your test stand with two rack-unit height and integrated multi-function generator and USB power sensor interface



[www.keysight.com/find/N5172B](http://www.keysight.com/find/N5172B)

[www.keysight.com/find/N5171B](http://www.keysight.com/find/N5171B)

Key specifications	MXG RF vector N5182B	MXG RF analog N5181B	EXG RF vector N5172B	EXG RF analog N5171B
Frequency range (min. to max.)	9 kHz to 6 GHz <sup>1</sup>	9 kHz to 6 GHz	9 kHz to 6 GHz <sup>1</sup>	9 kHz to 6 GHz
Frequency switching	800 μs	800 μs	800 μs	800 μs
Output power	+24 dBm	+24 dBm	+21 dBm	+21 dBm
Level accuracy	± 0.6 dB	± 0.6 dB	± 0.6 dB	± 0.6 dB
SSB phase noise (1 GHz; 20 kHz offset)	-146 dBc/Hz	-146 dBc/Hz	-122 dBc/Hz	-122 dBc/Hz
Harmonics	-35 dBc	-35 dBc	-35 dBc	-35 dBc
EVM (LTE)	0.2%	N/A	0.2%	N/A
ACPR (3GPP W-CDMA TM1 64 DPCH)	-73 dBc	N/A	-73 dBc	N/A
Internal baseband generator RF BW	160 MHz	N/A	160 MHz	N/A

1. Frequency extension up to 7.2 GHz for N5172B and N5182B with frequency extender N5182BX07.

## CXG RF vector signal generator N5166B

The N5166B CXG X-Series RF Vector Signal Generator, that is a low-cost, multi-functional signal generation tool, used in general-purpose and educational applications. CXG provides excellent RF performance, and scalable capabilities in a low-cost of ownership for engineers, designing general purpose devices, consumer electronics devices, or for educators in teaching labs.

- Frequency range of 9 kHz – 3/6 GHz and up to 120 MHz RF modulation bandwidth
- Perform basic parametric testing of components and functional verification of receivers
- Test your device with multiple verified, standards-compliant vector signals
- Easily troubleshoot your component within a wireless communication system using a reliable vector signal generator
- Minimize downtime and expenses with self-maintenance solutions and low-cost repairs



[www.keysight.com/find/n5166b](http://www.keysight.com/find/n5166b)

Key specifications	N5166B CXG RF
Frequency range	9 kHz to 6 GHz
Frequency switching	5 ms
Internal baseband generator RF bandwidth	120 MHz
Output power	+18 dBm
Level accuracy	±0.6 dB
Phase noise	-119 dBc/Hz
Harmonics	< -35 dBc
EVM (LTE)	0.2%
ACPR (3GPP W-CDMA TM1 64 DPCH)	-70 dBc

## Frequency Extender for EXG or MXG

### Frequency Extender for EXG or MXG N5182BX07

The N5182BX07 Frequency Extender extends any N5182B MXG or N5172B EXG with Option 506 to cover the 802.11ax bands and 5G unlicensed bands up to 7.2 GHz with exceptional error vector magnitude (EVM). Take your devices and designs to the limit with the N5182BX07 Frequency Extender.

- Provide a single RF output for full frequency coverage from 9 kHz to 7.2 GHz and 160 MHz modulation bandwidth.
- Control from an MXG/EXG front panel as usual and automate the test systems using the same SCPI commands via LAN, GPIB, or USB.
- Generate an 802.11ax 160 MHz bandwidth signal at 7.2 GHz and achieve excellent EVM performance  $< -47$  dB (0.45%) for output power up to +5 dBm.

[www.keysight.com/find/n5182bx07](http://www.keysight.com/find/n5182bx07)



# RF Analog Signal Generator

## RF signal generator N9310A analog

The N9310A is a general-purpose RF signal generator covering a frequency range from 9 kHz to 3 GHz. Ideal for manufacturing, education, and service maintenance, it delivers affordable, reliable performance. If your application only requires a simple continuous wave (CW) source, the N9310A RF signal generator provides just enough functionality at the lowest price.

- Optimized for low-cost consumer electronics manufacturing test, education, and service and repair
- Optional I/Q modulator 40 MHz bandwidth (ext. I/Q inputs only)
- USB interface, with flash memory support

[www.keysight.com/find/N9310A](http://www.keysight.com/find/N9310A)



Key specifications	
Frequency range (min. to max.)	9 kHz to 3 GHz
Frequency switching	10 ms
Output power	+13 dBm
Level accuracy	± 1.0 dB
SSB phase noise (1 GHz; 20 kHz offset)	-95 dBc/Hz
Harmonics	-30 dBc

# Digital Signal Interface Module

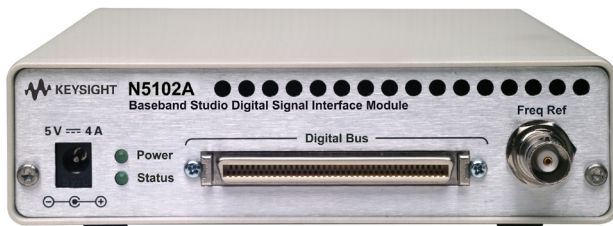
## Digital signal interface module N5102A

The N5102A digital signal interface module provides fast and flexible digital inputs and outputs for the MXG and EXG X-Series vector signal generators, E8267D PSG vector signal generator and N5106A PXB baseband generator and channel emulator. In output mode, you can deliver realistic, complex-modulated signals such as LTE, HSPA, W-CDMA, GPS, WLAN, digital video, custom pulses, and many others directly to your digital devices and subsystems. In the input mode, the interface module ports your digital input to the signal generator's baseband system, providing a quick and easy way of upconverting to calibrated analog IF, RF, or  $\mu$ W frequencies.

In both operating modes, the interface module adapts to your device with the logic type, data format, clock features, and signaling you require. With its 3-meter extension cable and a selection of connector types, the interface module connects easily to your device, in most cases eliminating the need for custom fixtures.

- Up to 400 MHz in serial mode, 200 MHz in parallel mode
- Provision for internal, external, or device clocking
- Independent data input and output rates; adjustable clock phase and skew

[www.keysight.com/find/N5102A](http://www.keysight.com/find/N5102A)





# PXI Signal Generators

## PXIe vector signal generator M9381A

Optimized for RF device design validation and manufacturing test environments, the M9381A PXI VSG delivers a combination of speed, performance, and multi-channel capability. Built on a flexible, scalable modular platform, the M9381A PXI VSG is the low-risk way to manage change and be ready for tomorrow—today.

- Fast amplitude and frequency switching to reduce test time
- Scalable platform fits up to 4 channels in one chassis, and 8 channels in multi-chassis configuration
- Channels time synchronized to within 1 ns and phase coherent to within 1 degree
- Up to 160 MHz RF bandwidth
- Easily integrate into test environments with IVI-COM, IVI-C, LabVIEW, and MATLAB drivers

[www.keysight.com/find/M9381A](http://www.keysight.com/find/M9381A)



## PXIe CW source M9380A

With high output power and accurate amplitude control, the M9380A PXIe CW source is a compact, cost-effective analog source, ideal for LO substitution, interference injection, and wireless component test. With fast PXI architecture and multiple drivers and programmatic interfaces, the M9380A is designed for high-speed automated test.

[www.keysight.com/find/M9380A](http://www.keysight.com/find/M9380A)



Key specifications	M9381A PXIe vector	M9380A PXIe CW source
Frequency range (min. to max.)	1 MHz to 6 GHz	1 MHz to 6 GHz
Frequency switching	185 $\mu$ s	5 ms
Output power (at 1 GHz)	+19 dBm	+19 dBm
Level accuracy	$\pm$ 0.4 dB	$\pm$ 0.4 dB
SSB phase noise (1 GHz; 20 kHz offset)	-122 dBc/Hz	-122 dBc/Hz
Harmonics	-34 dBc	-29 dBc
EVM (LTE)	0.32%	N/A
ACPR (3GPP W-CDMA TM1 64 DPCH)	-70 dBc	N/A
Internal baseband generator RF BW	160 MHz	N/A



### KeySight Quality and Support in PXI

Keep measurement quality while reducing your cost of ownership with Keysight's unique RF modular calibration and fast core exchange strategy. Keysight PXI signal generators are factory calibrated, shipped with ISO-9002, NIST traceable Cal certificate, and include a 1-year warranty.

[www.keysight.com/find/pxi-vsg](http://www.keysight.com/find/pxi-vsg)

## PXIe MW signal generator M9383A

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.

- Modular test solution for design validation that can be efficiently leveraged into manufacturing
- Flexibility to solve your immediate test needs, but upgradable for what comes next – whether that's upgrading for frequency coverage, or a rapid shift to high volume production.
- Easily configurable to support a variety of uses, from LO and blocking applications to 5G test

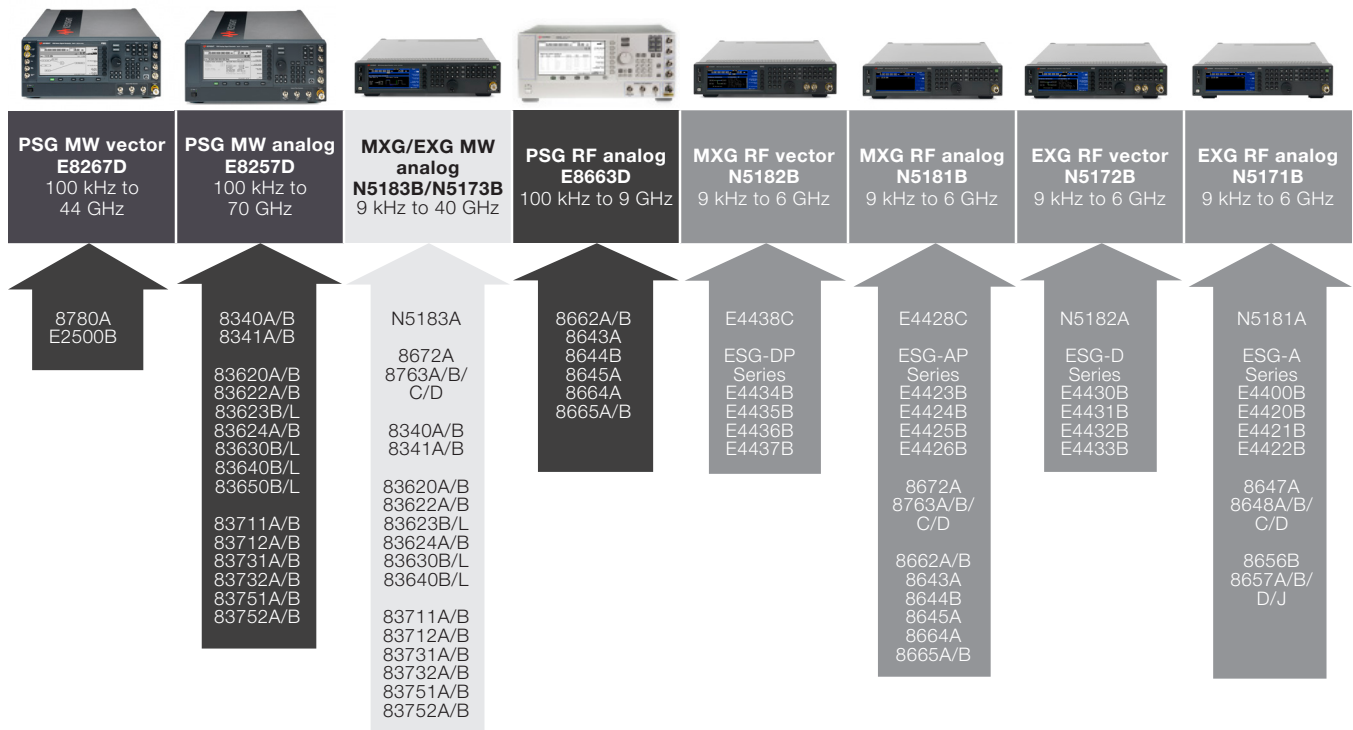


[www.keysight.com/find/m9383a](http://www.keysight.com/find/m9383a)

Key specifications	M9383A PXI MW
Frequency range	1 MHz to 44 GHz
Frequency Switching	250 us
Output power (at 10 GHz)	+22 dBm
Level accuracy	±2 dB
SSB phase noise (10 GHz; 10 kHz offset)	-118 dBc/Hz
Harmonics	-55 dBc
Internal baseband generator RF BW	1 GHz

## Migrating from Legacy Signal Generators

- Carefully planned instrument migration and modernization can maximize your test-system efficiency, performance, and readiness, while minimizing risk and potential disruptions, keeping you at the leading edge in the competitive marketplace. The Keysight VXG, PSG and X-Series signal generators are designed as evolutionary replacements to their in-class predecessors. Take advantage of their performance, flexibility, speed, and modern connectivity in replacing legacy Keysight signal generators.



Learn more at: [www.keysight.com](http://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](http://www.keysight.com/find/contactus)

