

# 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, 5G NR, GPS, and WLAN. Keysight provides signal generators in multiple form factors, including benchtop and modular PXI.

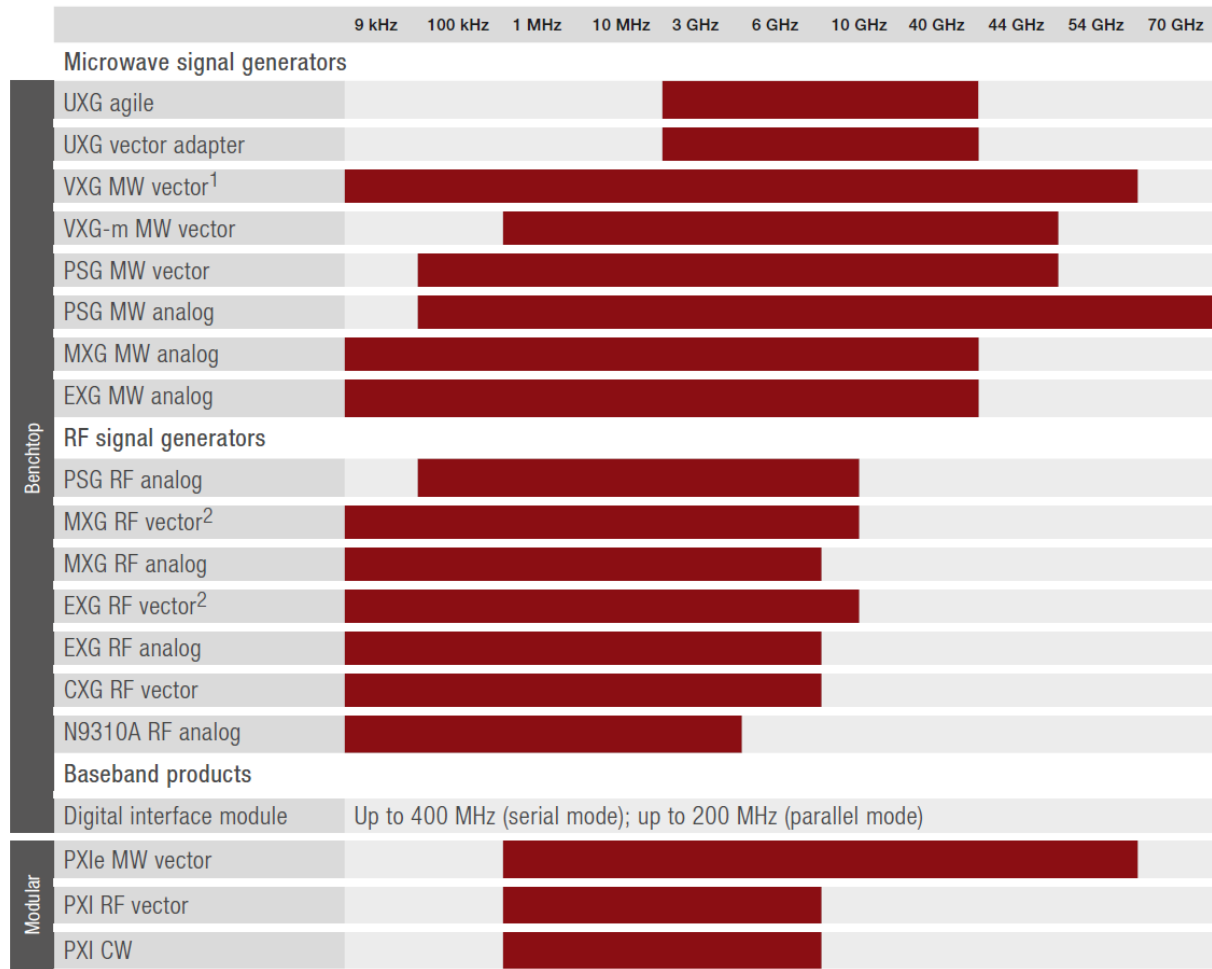
This guide provides an overview and side-by-side comparisons to help you determine which signal generator is right for you. It is intended to supplement online selection tools available at [www.keysight.com/find/sg](http://www.keysight.com/find/sg).



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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 can upconvert complex modulation formats such as QPSK and 1024QAM. With an I/Q 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 millimeter wave. 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 PathWave Signal Generation software runs on a PC and embedded software runs directly on the signal generator.

# Key Specifications Comparison – Benchtop Vector Signal Generators

Benchtop Vector Signal Generators

Specifications <sup>1</sup>	UXG vector	VXG	VXG	PSG MW	MXG RF	EXG RF	CXG
<b>Model number</b>	<b>N5194A</b>	<b>M9484C</b>	<b>M9384B</b>	<b>E8267D</b>	<b>N5182B</b>	<b>N5172B</b>	<b>N5166B</b>
Performance	*****	*****	*****	*****	****	***	**
Frequency range (min. to max.)	10 MHz to 40 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 speed	170 ns	3 ms (meas)	28 ms (meas)	9 ms	800 $\mu$ s	800 $\mu$ s	5 ms
Sweep mode	Streaming, chirp	N/A	N/A	Step, list, ramp	Step, list	Step, list	Step, list
Minimum output power at 1 GHz	-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	$\pm$ 2.5 dB	$\pm$ 1.6 dB	$\pm$ 1.2 dB	$\pm$ 0.6 dB	$\pm$ 0.6 dB	$\pm$ 0.6 dB	$\pm$ 0.6 dB
SSB phase noise at 1 GHz	-144 dBc/Hz (10 kHz offset)	-148 dBc/Hz (10 kHz offset)	-137 dBc/Hz (10 kHz offset)	-143 dBc/Hz (10 kHz offset)	-146 dBc/Hz (10 kHz offset)	-122 dBc/Hz (20 kHz offset)	-119 dBc/Hz (20 kHz offset)
Harmonics at 1 GHz	-60 dBc	-55 dBc	-46 dBc	-55 dBc	-35 dBc	-35 dBc	-35 dBc
Non-harmonics at 1 GHz	-72 dBc	-60 dBc	-50 dBc	-80 dBc	-92 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
Maximum FM deviation	N/A	N/A	N/A	80 MHz	16 MHz	40 MHz	40 MHz
Maximum PM phase deviation (normal mode)	N/A	N/A	N/A	800 rad	8 rad	20 rad	20 rad
Narrow pulse width	1 ns	20 ns	30 ns	20 ns	20 ns	20 ns	20 ns
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 or pulse descriptor word capability	Standard	N/A	N/A	N/A	N/A	N/A	N/A

<sup>1</sup> Refer to individual product data sheets for details.

# Key Specifications Comparison - Benchtop Analog Signal Generators

Benchtop Analog Signal Generators

Specifications <sup>2</sup>	UXG	PSG MW	MXG MW	EXG MW	PSG RF	MXG RF	EXG RF	RF
<b>Model number</b>	<b>N5193A</b>	<b>E8257D</b>	<b>N5183B</b>	<b>N5173B</b>	<b>E8663D</b>	<b>N5181B</b>	<b>N5171B</b>	<b>N9310A</b>
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 speed	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
Minimum output power at 1 GHz	-80 dBm	-90 dBm	-90 dBm	-90 dBm	-90 dBm	-127 dBm	-110 dBm	-127 dBm
Maximum output power at 1 GHz	+10 dBm	+24 dBm	+23 dBm	+23 dBm	+21 dBm	+24 dBm	+21 dBm	+13 dBm
Level accuracy at 1 GHz	$\pm$ 1.5 dB	$\pm$ 0.6 dB	$\pm$ 0.6 dB	$\pm$ 0.6 dB	$\pm$ 0.6 dB	$\pm$ 0.6 dB	$\pm$ 0.6 dB	$\pm$ 1.0 dB
SSB phase noise at 1 GHz	-144 dBc/Hz (10 kHz offset)	-147 dBc/Hz (10 kHz offset)	-146 dBc/Hz (10 kHz offset)	-122 dBc/Hz (20 kHz offset)	-147 dBc/Hz (10 kHz offset)	-146 dBc/Hz (10 kHz offset)	-122 dBc/Hz (20 kHz offset)	-95 dBc/Hz (20 kHz offset)
Harmonics at 1 GHz	-40 dBc	-55 dBc	-33 dBc	-33 dBc	-55 dBc	-35 dBc	-35 dBc	-30 dBc
Non-harmonics at 1 GHz	-70 dBc	-80 dBc	-92 dBc	-72 dBc	-80 dBc	-92 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
Maximum FM deviation	600 MHz	128 MHz	128 MHz	320 MHz	16 MHz	16 MHz	40 MHz	100 kHz
Maximum PM phase deviation (normal mode)	12 $\pi$	1280 rad	64 rad	160 rad	160 rad	8 rad	20 rad	10 rad
Narrow pulse width	10 ns	20 ns	20 ns	20 ns	20 ns	20 ns	20 ns	100 $\mu$ s
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
Signal or pulse descriptor word capability	Standard	N/A	N/A	N/A	N/A	N/A	N/A	N/A

<sup>2</sup> Refer to individual product data sheets for details.

# Key Specifications Comparison - Modular Signal Generators

Specifications	Vector Modular Signal Generators			Analog Modular Signal Generators	
	VXG-m	PXI MW	PXI RF	PXI MW	PXI CW source
<b>Model number</b>	<b>M9383B</b>	<b>M9383A</b>	<b>M9381A</b>	<b>M9383A</b>	<b>M9380A</b>
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 speed	28 ms (meas)	250 $\mu$ s	10 $\mu$ s	250 $\mu$ s	5 ms
Sweep mode	N/A	Step	Step, list	Step	N/A
Minimum output power at 1 GHz	-90 dBm	-90 dBm	-120 dBm	-90 dBm	-120 dBm
Maximum output power at 1 GHz	+20 dBm	+19 dBm	+19 dBm	+19 dBm	+19 dBm
Level accuracy at 1 GHz	$\pm$ 1.2 dB	$\pm$ 1.0 dB	$\pm$ 0.4 dB	$\pm$ 1.0 dB	$\pm$ 0.4 dB
SSB phase noise at 1 GHz	-137 dBc/Hz (10 kHz offset)	-118 dBc/Hz (10 kHz offset)	-122 dBc/Hz (20 kHz offset)	-118 dBc/Hz (10 kHz offset)	-122 dBc/Hz (20 kHz offset)
Harmonics at 1 GHz	-46 dBc	-46 dBc	-34 dBc	-46 dBc	-29 dBc
Non-harmonics at 1 GHz	-61 dBc	-55 dBc	-66 dBc	-55 dBc	-66 dBc
AM rate	N/A	1 Hz to 640 MHz	6.25 MHz	DC to 70 kHz	N/A
Maximum FM deviation	N/A	320 MHz	1.25 MHz	40 MHz	N/A
Maximum PM phase deviation (normal mode)	N/A	10 rad	10 rads	8 rad	N/A
Narrow pulse width	30 ns	20 ns	200 ns	20 ns	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
Signal or pulse descriptor word capability	N/A	N/A	N/A	N/A	N/A

# Applications and Software Comparison

Applications and signal creation software	Benchtop					Modular				
	UXG Agile	UXG Vector	VXG Vector	PSG Vector	MXG and EXG 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			•	•	•	•	•	•		
Noise (Calibrated AWGN)			•	•	•	•	•	•		
Pulse Train	•	•	•		•	•		•		
BERT					•					
<b>PathWave signal generation software</b>										
<b>Cellular communications</b>										
5G NR			•		•	•	•	•	•	
LTE/LTE-Advanced FDD/TDD			•		•	•	•	•	•	
W-CDMA/HSPA+, cdma2000®			•	•	•	•	•	•	•	
GSM/EDGE/Evo			•	•	•	•	•	•	•	
V2X			•	•	•	•	•		•	
<b>Wireless connectivity</b>										
WLAN 802.11a/b/g/lj/p/n/ac/ah/ax			•	•	•	•	•	•	•	
Bluetooth®			•	•	•	•	•		•	
IoT (Internet of Things)			•	•	•	*3	•		•	
DFS Radar Profiles				•	•	•	•			
Mobile WiMAX			•		•		•		•	
<b>Audio/video broadcast</b>										
Digital video standards			•	•	•		•		•	
FM Stereo/RDS, DAB/DAB+/DMB			•		•		•		•	
Land Mobile Radio (LMR)			•		•		•			
<b>Detection, positioning, tracking, navigation</b>										
Global Navigation Satellite Systems (GNSS)			• 4	•	•	• 4	•		•	
<b>General RF &amp; Microwave</b>										
Real-time fading					•					
Custom Modulation			•	•	•	•	•	•	•	
Pulse building				•	•		•		•	
Power Amplifier Test				•	•		•	•	•	
Advanced Waveform Utility			•		•	•	•			
<b>Threat simulation</b>										
Multi-emitter scenario generation	•	•								
Simulation view	•	•								
Multi-source calibration	•	•								
<b>Other software tools</b>										
SystemVue	•	•	•	•	•	•	•	•	•	
MATLAB	•	•	•	•	•	•	•	•	•	

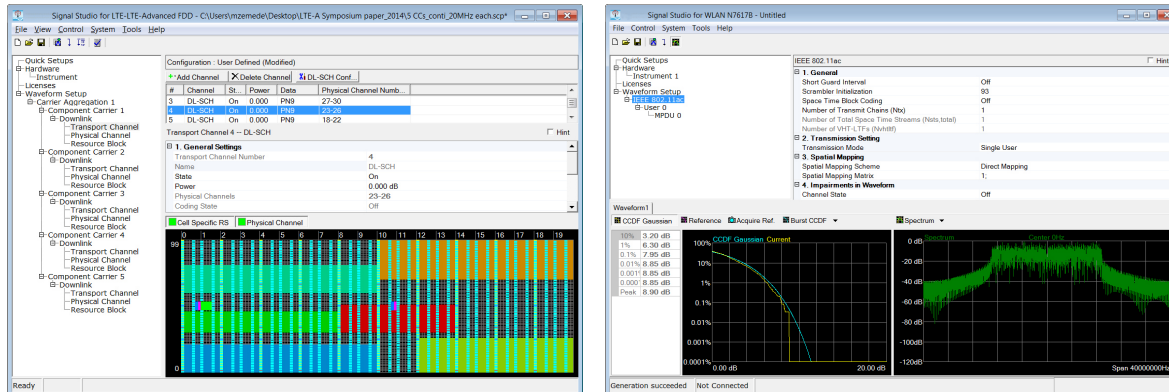
3 HRP UWB is not supported with N5166B CXG  
 4 No real-time support; ARB playback only



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

Benchtop					
Applications and signal creation software	PSG MW	MXG and EXG MW	MXG and EXG RF	PSG RF	N9310 RF
	Analog	Analog	Analog	Analog	Analog
<b>Instrument embedded capabilities</b>					
USB power meter		•	•		
Step/list sweep	•	•	•	•	•
Ramp sweep	•			•	
AM, FM, PM, pulse	•	•	•	•	•
LF function generator	•	•	•	•	•
Pulse Train		•	•		

# PathWave Signal Generation Software



## 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)

## 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)

# VXG Signal Generators

## M9484C VXG vector 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
- 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)

# M9384B VXG and M9383B VXG-m 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 VXG	M9384B VXG	M9383B VXG-m
Type	Benchtop	Benchtop	Modular
RF channels per box	1, 2, or 4 <sup>5</sup>	1 or 2	1 or 2
Frequency range	9 kHz to 54 GHz	1 MHz to 44 GHz	1 MHz to 44 GHz
Frequency switching speed	3 ms	28 ms	28 ms
Output power at 10 GHz	+23 dBm	+22 dBm	+22 dBm
Level accuracy at 10 GHz	± 1.2 dB	± 1.3 dB	± 1.3 dB
SSB phase noise at 10 GHz, 10 kHz offset	-132 dBc/Hz	-126 dBc/Hz	-126 dBc/Hz
Harmonics at 10 GHz	-55 dBc	-26 dBc	-26 dBc
Internal baseband generator RF bandwidth	2.5 GHz (5 GHz) <sup>6</sup>	2 GHz (4 GHz) <sup>6</sup>	2 GHz
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

<sup>5</sup> Four channels are available up to 20 GHz maximum frequency.

<sup>6</sup> 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.

## E8267D PSG microwave vector signal generator



- 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)

# E8257D PSG microwave analog signal generator



- 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	100 kHz to 44 GHz	100 kHz to 70 GHz
Frequency switching speed	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	-128 dBc/Hz
Harmonics at 10 GHz	-55 dBc	-55 dBc
Internal baseband generator RF BW	80 MHz	N/A
EVM (16 QAM)	0.8%	N/A

## 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, PM, 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 RF analog
Frequency range	100 kHz to 9 GHz
Frequency switching speed	9 ms
Output power at 1 GHz	+23 dBm
Level accuracy at 1 GHz	± 0.6 dB
SSB phase noise (1 GHz; 10 kHz offset)	-147 dBc/Hz
Harmonics at 1 GHz	-55 dBc

## Millimeter Wave Accessories for the PSG

Signal generator frequency extension modules from VDI, Inc.



The N5179V 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.

# 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.

## N5193A, N5191A UXG agile signal generator

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)



# N5194A, N5192A<sup>7</sup>

## UXG agile vector adapter

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)

Key Specification	N5193A UXG agile signal generator	N5194A UXG agile vector adapter
Frequency switching speed	180 ns	220 ns
Output power at 10 GHz	+10 dBm	+7 dBm
SSB phase noise at 10 GHz, 10 kHz offset	-126 dBc/Hz	-127 dBc/Hz
Harmonics at 10 GHz	-55 dBc	-61 dBc
Minimum pulse width	10 ns	1 ns
Baseband generator sample rate	N/A	2 GSa/s
Baseband generator memory	N/A	6 GSa

<sup>7</sup> 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.

## N5183B MXG microwave analog signal generator

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  $< 124$  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  $600 \mu\text{s}$

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

## N5173B EXG microwave analog signal generator

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 (< 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	9 kHz to 40 GHz	9 kHz to 40 GHz
Frequency switching speed	600 $\mu$ s	600 $\mu$ s
Output power at 10 GHz	+20 dBm	+20 dBm
Level accuracy at 10 GHz	$\pm 0.7$ dB	$\pm 0.7$ dB
SSB phase noise at 10 GHz	-129 dBc/Hz (10 kHz offset)	-101 dBc/Hz (20 kHz offset)
Harmonics at 10 GHz	-55 dBc	-55 dBc

## N5182B vector and N5181B analog MXG RF signal generators

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 <  $\pm 0.2$  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)

## N5172B vector and N5171B analog EXG RF signal generators

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	N5182B MXG RF vector	N5181B MXG RF analog	N5172B EXG RF vector	N5171B EXG RF analog
Frequency range	9 kHz to 6 GHz <sup>8</sup>	9 kHz to 6 GHz	9 kHz to 6 GHz <sup>8</sup>	9 kHz to 6 GHz
Frequency switching speed	800 $\mu$ s	800 $\mu$ s	800 $\mu$ s	800 $\mu$ s
Output power at 1 GHz	+26 dBm	+26 dBm	+26 dBm	+26 dBm
Level accuracy at 1 GHz	$\pm$ 0.6 dB	$\pm$ 0.6 dB	$\pm$ 0.6 dB	$\pm$ 0.6 dB
SSB phase noise at 1 GHz, 20 kHz offset	-146 dBc/Hz	-146 dBc/Hz	-122 dBc/Hz	-122 dBc/Hz
Harmonics at 1 GHz	-35 dBc	-35 dBc	-35 dBc	-35 dBc
Internal baseband generator RF bandwidth	160 MHz	N/A	160 MHz	N/A
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
Baseband generator memory	Up to 1024 MSa	N/A	Up to 512 MSa	

<sup>8</sup> 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 or 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 speed	5 ms
Output power at 1 GHz	+18 dBm
Level accuracy at 1 GHz	± 0.6 dB
SSB phase noise at 1 GHz, 20 kHz offset	-119 dBc/Hz
Harmonics at 1 GHz	< -35 dBc
Internal baseband generator RF bandwidth	120 MHz
EVM (LTE)	0.2%
ACPR (3GPP W-CDMA TM1 64 DPCH)	-70 dBc
Baseband generator memory	Up to 512 MSa

# Frequency Extender for EXG or MXG

## N5182BX07 Frequency Extender for EXG or MXG

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

## N9310A analog RF signal generator

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	N9310A
Frequency range	9 kHz to 3 GHz
Frequency switching speed	10 ms
Output power at 1 GHz	+13 dBm
Level accuracy at 1 GHz	± 1.0 dB
SSB phase noise at 1 GHz, 20 kHz offset	-95 dBc/Hz
Harmonics at 1 GHz	-30 dBc

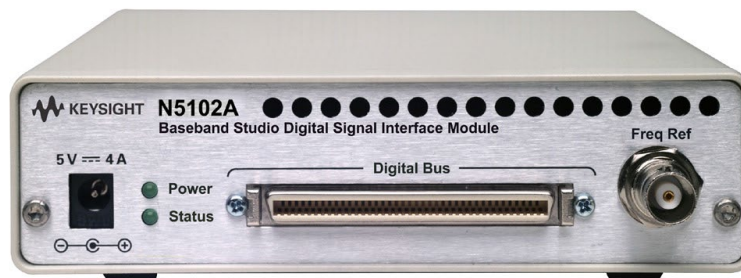


# Digital Signal Interface Module

## 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 pW 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 multichannel 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.



### 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)

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

Key specifications	M9381A PXIe vector	M9380A PXIe CW
Frequency range	1 MHz to 6 GHz	1 MHz to 6 GHz
Frequency switching speed	10 $\mu$ s	5 ms
Output power at 1 GHz	+19 dBm	+19 dBm
Level accuracy at 1 GHz	$\pm 0.4$ dB	$\pm 0.4$ dB
SSB phase noise at 1 GHz, 20 kHz offset)	-122 dBc/Hz	-122 dBc/Hz
Harmonics at 1 GHz	-34 dBc	-29 dBc
Internal baseband generator RF bandwidth	160 MHz	N/A
EVM (LTE)	0.32%	N/A
ACPR (3GPP W-CDMA TM1 64 DPCH)	-70 dBc	N/A
Baseband generator memory	Up to 1024 MSa	N/A

## 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.



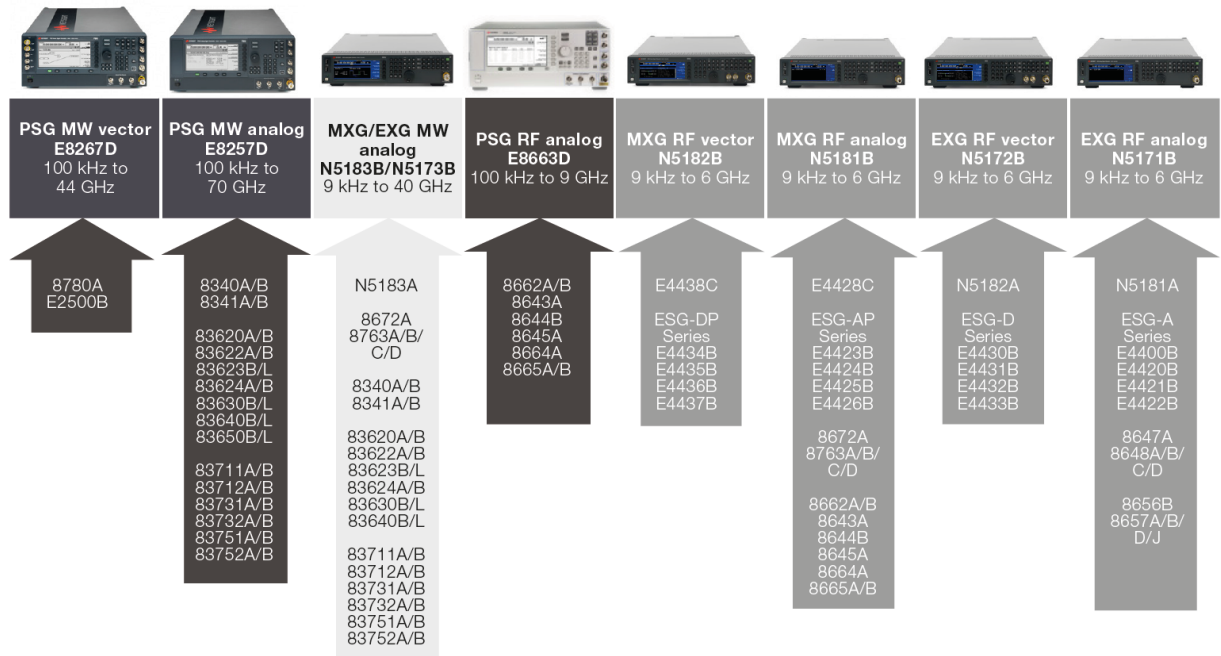
- Modular test solution for design validation that can be efficiently leveraged into manufacturing
- Flexibility to solve your immediate test needs, but upgradable for what comes next - whether that's upgrading for frequency coverage, or a rapid shift to high volume production.
- Easily configurable 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 speed	250 us
Output power at 10 GHz	+22 dBm
Level accuracy at 10 GHz	± 1.3 dB
SSB phase noise at 10 GHz, 10 kHz offset	-118 dBc/Hz
Harmonics at 10 GHz	-55 dBc
Internal baseband generator RF BW	1 GHz
Baseband generator memory	Up to 1024 MSa

# 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.




# Confidently Covered by Keysight Services

Prevent delays caused by technical questions, or system downtime due to instrument maintenance and repairs with Keysight Services. Keysight Services are here to support your test needs with expert technical support, instrument repair and calibration, software support, training, alternative acquisition program options, and more.

A KeysightCare agreement provides dedicated, proactive support through a single point of contact for instruments, software, and solutions. KeysightCare covers an extensive group of instruments, application software, and solutions and ensures optimal uptime, faster response, faster access to experts, and faster resolution.

## Keysight Services

Offering	Benefits
<p><b>KeysightCare</b></p> 	<p>KeysightCare provides elevated support for Keysight instruments and software, with access to technical support experts that respond within a specified time and ensure committed repair and calibration turnaround times (TAT). KeysightCare offers multiple service agreement tiers, including KeysightCare Assured, Enhanced, and Application Software Support. See the <a href="#">KeysightCare data sheet</a> for details.</p>
<p>KeysightCare Assured</p>	<p>KeysightCare Assured goes beyond basic warranty with repair services that include committed TAT and unlimited access to technical experts.</p>
<p>KeysightCare Enhanced</p>	<p>KeysightCare Enhanced includes all the benefits of KeysightCare Assured plus Keysight’s accurate and reliable calibration services, accelerated, and committed TAT, and technical response.</p>
<p><b>Keysight Support Portal &amp; Knowledge Center</b></p>	<p>All KeysightCare tiers include access to the Keysight Support Portal where you can manage support and service resources related to your assets such as service requests, and status, or browse the Knowledge Center.</p>
<p><b>Education Services</b></p>	<p>Build confidence and gain new skills to make accurate measurements, with flexible Education Services developed by Keysight experts. Including Start-up Assistance.</p>
<p><b>Alternative product acquisition</b></p>	
<p><b>KeysightAccess</b></p>	<p>Reduce budget challenges with a subscription service enabling you to get the instruments, software, and technical support you want for your test needs.</p>

## Recommended services

Maximize your test system up-time by securing technical support, repair, and calibration services with committed response and turnaround times. 1-year KeysightCare Assured is included in every new instrument purchase. Obtain multi-year KeysightCare upfront to eliminate the need for lengthy and tedious paperwork and yearly requests for maintenance budget. Plus, you benefit from secured service for 2, 3, or 5 years.

Service	Function
<b>KeysightCare Enhanced*</b>	<b>Includes tech support, warranty and calibration</b>
R-55B-001-1	KeysightCare Enhanced – Upgrade 1 year
R-55B-001-2	KeysightCare Enhanced – Extend to 2 years
R-55B-001-3	KeysightCare Enhanced – Extend to 3 years (recommended)
R-55B-001-5	KeysightCare Enhanced – Extend to 5 years (recommended)
<b>KeysightCare Assured</b>	<b>Includes tech support and warranty</b>
R-55A-001-2	KeysightCare Assured – Extend to 2 years
R-55A-001-3	KeysightCare Assured – Extend to 3 years
R-55A-001-5	KeysightCare Assured – Extend to 5 years
<b>Start-Up Assistance</b>	
PS-S10	Included – instrument fundamentals and operations starter
PS-S20	Optional, technology & measurement science standard learning

\* Available in select countries. For details, please view the [datasheet](#). R-55B-001-2/3/5 must be ordered with R-55B-001-1.

Keysight enables innovators to push the boundaries of engineering by quickly solving design, emulation, and test challenges to create the best product experiences. Start your innovation journey at [www.keysight.com](http://www.keysight.com).



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