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.

KEYSIGHT

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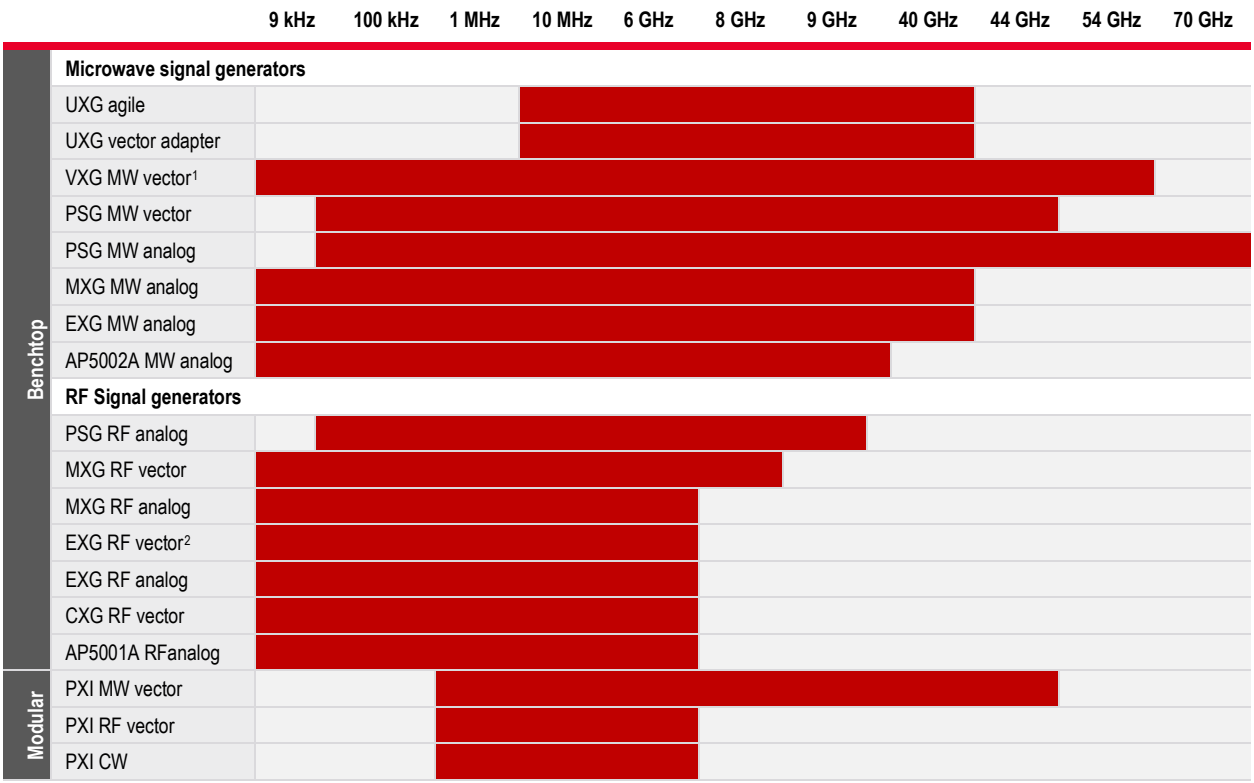
Frequency coverage for Keysight signal generators



1 Frequency for VXG MW vector can be extended up to 110 GHz with V3080A.
2 Frequency for MXG RF vector (N5182B) 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 benchtop 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, ΦM 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[3]	**UXG vector**	**VXG**	**VXG**	**PSG MW**	**MXG**	**MXG RF**	**EXG RF**	**CXG**
Model number	**N5194A**	**M9484C**	**M9384B**	**E8267D**	**N5186A**	**N5182B**	**N5172B**	**N5166B**
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 8.5 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	9 ms (meas)	800 µs	800 µs	5 ms
Sweep mode	Streaming, chirp	N/A	N/A	Step, list, ramp	N/A	Step, list	Step, list	Step, list
Minimum output power at 1 GHz	-90 dBm	-110 dBm	-90 dBm	-90 dBm	-127 dBm	-127 dBm	-110 dBm	-110 dBm
Maximum output power at 1 GHz	+6 dBm	+20 dBm	+20 dBm	+21 dBm	+25 dBm	+24 dBm	+21 dBm	+18 dBm
Level accuracy at 1 GHz	±2.5 dB	±1.6 dB	±1.2 dB	±0.6 dB	± 1.1 dB (typ)	± 0.6 dB	± 0.6 dB	±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)	-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	-35 dBc
Non-harmonics at 1 GHz	-72 dBc	-60 dBc	-50 dBc	-80 dBc	-80 dBc	-92 dBc	-72 dBc	-72 dBc
AM rate	N/A	N/A	N/A	DC to 100 kHz	N/A	DC to 50 kHz	DC to 50 kHz	DC to 50 kHz
Maximum FM deviation	N/A	N/A	N/A	80 MHz	N/A	16 MHz	40 MHz	40 MHz
Maximum PM phase deviation (normal mode)	N/A	N/A	N/A	800 rad	N/A	8 rad	20 rad	20 rad
Narrow pulse width	1 ns	20 ns	30 ns	20 ns	N/A	20 ns	20 ns	20 ns
Internal baseband generator RF BW	1.6 GHz	2.5 GHz	2 GHz	80 MHz	960 MHz	160 MHz	160 MHz	120 MHz
Waveform playback memory	6 GSa	4096 MSa	1024 MSa	64 MSa	2048 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	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	N/A
Wide chirp capability	1.6 GHz	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

3 Refer to individual product data sheets for details.

Key Specifications Comparison - Benchtop Analog Signal Generators

	Benchtop Analog Signal Generators								
Specifications[4]	**UXG**	**PSG MW**	**MXG MW**	**EXG MW**	**AP500xA MW**	**PSG RF**	**MXG RF**	**EXG RF**	**AP500xA RF**
Model number	**N5193A**	**E8257D**	**N5183B**	**N5173B**	**AP5002A**	**E8663D**	**N5181B**	**N5171B**	**AP5001A**
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	9 kHz to 26 GHz	100 kHz to 9 GHz	9 kHz to 6 GHz	9 kHz to 6 GHz	9 kHz to 6.1 GHz
Frequency switching speed	180 ns	9 ms	600 µs	600 µs	200 µs	9 ms	800 µs	800 µs	20 µs
Sweep mode	Normal, list, fast CW, streaming	list, step, ramp	list, step	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	-120 dBm	-90 dBm	-127 dBm	-110 dBm	-120 dBm
Maximum output power at 1 GHz	+10 dBm	+24 dBm	+23 dBm	+23 dBm	+23 dBm	+21 dBm	+24 dBm	+21 dBm	+17 dBm
Level accuracy at 1 GHz	±1.5 dB	± 0.6 dB	± 0.6 dB	± 0.6 dB	±1.0 dB	± 0.6 dB	± 0.6 dB	± 0.6 dB	± 0.8 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)	-130 dBc/Hz (20 kHz offset)	-147 dBc/Hz (10 kHz offset)	-146 dBc/Hz (10 kHz offset)	-122 dBc/Hz (20 kHz offset)	-130 dBc/Hz (20 kHz offset)
Harmonics at 1 GHz	-40 dBc	-55 dBc	-33 dBc	-33 dBc	-30 dBc	-55 dBc	-35 dBc	-35 dBc	-30 dBc
Non-harmonics at 1 GHz	-70 dBc	-80 dBc	-92 dBc	-72 dBc	-65 dBm	-80 dBc	-92 dBc	-72 dBc	-55 dBm
AM rate	DC to 10 MHz	DC to 100 kHz	DC to 100 kHz	DC to 100 kHz	0.1 Hz to 50 kHz	DC to 100 kHz	DC to 50 kHz	DC to 50 kHz	10 Hz to 50 kHz
Maximum FM deviation	600 MHz	128 MHz	128 MHz	320 MHz	200 MHz	16 MHz	16 MHz	40 MHz	200 MHz
Maximum PM phase deviation (normal mode)	12π	1280 rad	64 rad	160 rad	300 rad	160 rad	8 rad	20 rad	80 rad
Narrow pulse width	10 ns	20 ns	20 ns	20 ns	100 ns	20 ns	20 ns	20 ns	30 ns
Internal baseband generator RF BW	N/A	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	N/A
Baseband generator mode	N/A	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	N/A
Wide chirp capability	10% of carrier frequency	N/A	N/A	N/A	10% of carrier frequency	N/A	N/A	N/A	10% of carrier frequency
Signal or pulse descriptor word capability	Standard	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

4 Refer to individual product data sheets for details.

Key Specifications Comparison - Modular Signal Generators

	Vector Modular Signal Generators			Analog Modular Signal Generators	
Specifications	**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 speed	28 ms (meas)	250 µs	10 µs	250 µs	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	± 1.2 dB	± 1.0 dB	± 0.4 dB	± 1.0 dB	± 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						
	UXG	UXG	VXG	PSG	MXG	MXG and EXG	CXG
	N5193A	N5194A	M9484C	E8267D	N5186A	N5182B and N5172B	N5166B
	Agile	Vector	Vector	Vector	Vector	Vector	Vector
Instrument embedded capabilities							
USB power meter	•					•	•
Step/list sweep	•	•		•		•	•
Ramp sweep		•		•			
AM, FM, PM, pulse	•	•	• [5]	•	• [5]	•	•
LF function generator	•			•		•	•
Real-time custom modulation (PSK, QAM, FSK)				•		•	•
Phase noise impairments						•	
Multitone			• [6]	•	• [6]	•	•
Noise (Calibrated AWGN)			•	•	•	•	•
Pulse Train	•	•	•			•	•
BERT						•	
PathWave signal generation embedded applications							
Channel Response Correction and S-parameter De-embedding			•		•		
5G NR			•				
Custom Modulation (Custom IQ)			•		•		
PathWave signal generation desktop application							
Advanced Waveform Utility (AWU)			•		•	•	•
5G NR			•		•	•	•
5G NR V2X			•		•	•	•
Custom Modulation (Beta)			•		•	•	•
PathWave signal generation waveform playback							
Cellular communications							
5G NR			•		•	•	•
NR V2X			•	•	•	•	•
LTE/LTE-Advanced FDD/TDD			•	•	•	•	•
W-CDMA/HSPA+, cdma2000®			•	•	•	•	•
GSM/EDGE/Evo			•	•	•	•	•
LTE V2X			•	•	•	•	•
Wireless connectivity							
WLAN 802.11a/b/g/j/p/n/ac/ah/ax/be			•	•	•	•	•
Bluetooth®			•	•	•	•	•
IoT (Internet of Things) (802.15.4 SUN, Z-Wave, ZigBee, LoRa, HRP UWB)			•	•	•	•	• [7]
DFS Radar Profiles				•		•	•
Mobile WiMAX			•		•	•	
Audio/video broadcast							
Digital video standards			•	•	•	•	
FM Stereo/RDS, DAB/DAB+/DMB			•		•	•	
Land Mobile Radio (LMR)			•		•	•	

5 I/Q based AM, FM, PM available as embedded application with N7642APPC for VXG and E7642APPC for N5186A MXG.
6 Multitone available as embedded application with N7621APPC for VXG and E7621APPC for N5186A MXG.
7 HRP UWB is not supported with N5166B CXG.

	Benchtop (continued)						
Applications and signal creation software	**UXG**	**UXG**	**VXG**	**PSG**	**MXG**	**MXG and EXG**	**CXG**
	N5193A	**N5194A**	**M9484C**	**E8267D**	**N5186A**	**N5182B and N5172B**	**N5166B**
	Agile	**Vector**	**Vector**	**Vector**	**Vector**	**Vector**	**Vector**
PathWave signal generation waveform playback (continued)							
Detection, positioning, tracking, navigation							
Global Navigation Satellite Systems (GNSS)			• [8]	• [9]		•	• [8]
General RF and Microwave							
Real-time fading						•	
Custom Modulation			•	•	•	•	•
Pulse building				•		•	
Power Amplifier Test				•		•	
Threat simulation							
Multi-emitter scenario generation	•	•					
Simulation view	•	•					
Multi-source calibration	•	•					
Other software tools							
SystemVue	•	•	•	•		•	•
MATLAB	•	•	•	•	•	•	•
Waveform pack license				•		•	•

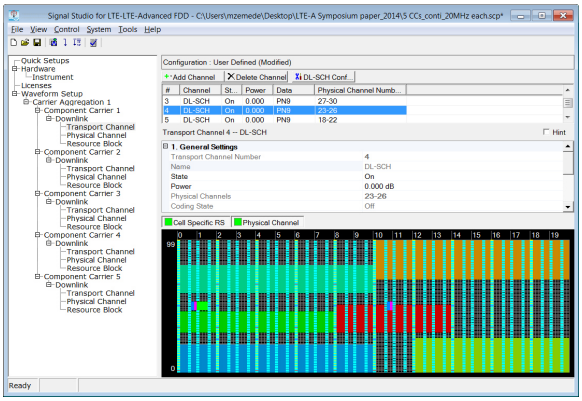
8 No real-time support; ARB playback only.
9 Real-time support with E8267D-409 and E8267D-423, not N7609C.

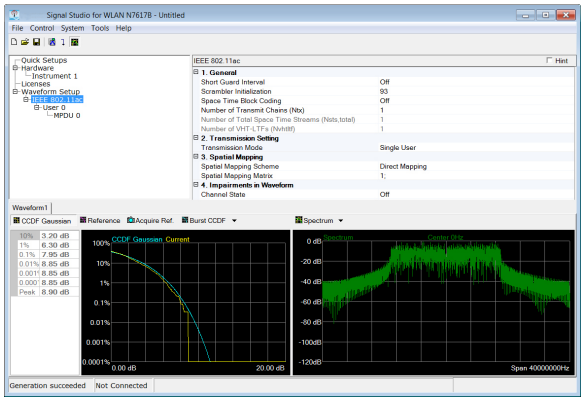
Applications and Software Comparison (continued)

Applications and signal creation software	Modular			Benchtop				
	VXG-m	PXI MW	PXI RF	PSG MW	MXG and EXG MW	MXG and EXG RF	AP500x RF/ MW	PSG RF
	M9383B	M9383 A	M9381 A	E8257D	N5183B and N5173B	N5181B and N5171B	AP5001A and AP5002A	E8663D
	Vector	Vector	Vector	Analog	Analog	Analog	Analog	Analog
Instrument embedded capabilities								
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								
PathWave signal generation software								
Cellular communications								
5G NR	•	•	•					
LTE/LTE-Advanced FDD/TDD	•	•	•					
W-CDMA/HSPA+, cdma2000®	•	•	•					
GSM/EDGE/Evo	•	•	•					
V2X	•		•					
Wireless connectivity								
WLAN 802.11a/b/g/j/p/n/ac/ah/ax	•	•	•					
Bluetooth®	•		•					
IoT (Internet of Things)	•		•					
DFS Radar Profiles	•							
Mobile WiMAX	•		•					
Audio/video broadcast								
Digital video standards	•		•					
FM Stereo/RDS, DAB/DAB+/DMB	•		•					
Land Mobile Radio (LMR)	•							
Detection, positioning, tracking, navigation								
Global Navigation Satellite Systems (GNSS)	•[10]		•[10]					
General RF & Microwave								
Real-time fading								
Custom Modulation	•	•	•					
Pulse building	•		•					
Power Amplifier Test	•	•	•					
Advanced Waveform Utility	•							
Threat simulation								
Multi-emitter scenario generation								
Simulation view								
Multi-source calibration								
Other software tools								
SystemVue	•	•	•					
MATLAB	•	•	•					

10 No real-time support; ARB playback only.

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

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

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

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

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[11]	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)[12]	2 GHz (4 GHz)[12]	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

11 Four channels are available up to 20 GHz maximum frequency.
12 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

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

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

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

N5194A, N5192A[13]

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

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

[13] 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 µs

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 ± 5 x 10^{-10} parts per day
- Shrink your test stand with optional integrated multifunction generator and USB power sensor interface

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 µs	600 µs
Output power at 10 GHz	+20 dBm	+20 dBm
Level accuracy at 10 GHz	± 0.7 dB	± 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

N5186A MXG vector signal generator

Compact, integrated performance. With reduced external connections and up to four channels in a 2U box, the Keysight N5186A MXG signal generator simplifies your complex test setups while still delivering powerful, precise signals. The MXG is optimized to be your ideal signal generator with the outstanding performance you desire, all in one easy-to-use box.

- Generate precise, low-distortion signals with a custom digital-to-analog converter (DAC) ASIC that uses direct digital synthesis.
- Maximize performance with the embedded reflectometer to correct the match of your device under test (DUT) to improve the response of the output signal's power and channel flatness.
- Generate wireless communication standards-based signals, extend your reference plane, and correct the power incident to the DUT using Keysight PathWave signal generation software.

www.keysight.com/find/N5186A

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
- Go beyond standard application requirements with sophisticated real-time and waveform-based PathWave signal generation software

www.keysight.com/find/N5182B

www.keysight.com/find/N5181B

Key specifications	N5186A MXG vector	N5182B MXG RF vector	N5181B MXG RF analog
Frequency range	9 kHz to 8.5 GHz	9 kHz to 6 GHz[14]	9 kHz to 6 GHz
Frequency switching speed	9 ms (meas)	800 µs	800 µs
Output power at 1 GHz	+26 dBm	+26 dBm	+26 dBm
Level accuracy at 1 GHz	± 1.1 dB (typ)	± 0.6 dB	± 0.6 dB
SSB phase noise at 1 GHz, 10 kHz offset	-146 dBc/Hz	-146 dBc/Hz	-146 dBc/Hz
Harmonics at 1 GHz	-35 dBc	-35 dBc	-35 dBc
Internal baseband generator RF bandwidth	960 MHz	160 MHz	N/A
EVM (LTE)	0.2% (typ)	0.2% (meas)	N/A
ACPR (LTE)	-71 dBc	-71 dBc	N/A
Baseband generator memory	Up to 2048 MSa	Up to 1024 MSa	N/A

14 Frequency extension up to 7.2 GHz for N5182B with frequency extender N5182BX07.

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 µs 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

www.keysight.com/find/N5171B

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

Key specifications	N5172B EXG RF vector	N5171B EXG RF analog	N5166B CXG RF
Frequency range	9 kHz to 6 GHz[15]	9 kHz to 6 GHz	9 kHz to 6 GHz
Frequency switching speed	800 µs	800 µs	5 ms
Output power at 1 GHz	+26 dBm	+26 dBm	+18 dBm
Level accuracy at 1 GHz	± 0.6 dB	± 0.6 dB	± 0.6 dB
SSB phase noise at 1 GHz, 20 kHz offset	-122 dBc/Hz	-122 dBc/Hz	-119 dBc/Hz
Harmonics at 1 GHz	-35 dBc	-35 dBc	< -35 dBc
Internal baseband generator RF bandwidth	160 MHz	N/A	120 MHz
EVM (LTE)	0.2%	N/A	0.2%
ACPR (3GPP W-CDMA TM1 64 DPCH)	-73 dBc	N/A	-70 dBc
Baseband generator memory	Up to 512 MSa	N/A	Up to 512 MSa

15 Frequency extension up to 7.2 GHz for N5172B with frequency extender N5182BX07

AP500xA Analog Signal Generators

Portable, general-purpose, analog signal generators enable wireless device characterization and full stress-testing. Test devices up to 26 GHz quickly and confidently with outstanding output power range (up to +23 dBm), phase noise (-130 dBc/Hz), and switching speed (down to 200 µs).

Additional capabilities include AM, FM, PM, and pulse modulation. A high-performance oven-controlled crystal oscillator (OCXO), and excellent harmonic/non-harmonic performance.

AP5001A, AP5002A analog signal generator

The AP5001A and AP5002A's comprehensive, precise testing capabilities allow you to characterize subsystem receiver sensitivity and throughput better to understand link budgets and design margins. These capabilities include up to 26 GHz coverage with best-in-class phase noise and output power range.

- Characterize devices thoroughly with up to +23 dBm output power
- Accelerate testing with down to 200 µs switching speed
- Offers an OCXO stabilized low-phase noise signal (-130 dBc/Hz at 1 GHz, 20 kHz offset) with micro-Hz resolution
- Offers sweep, trigger functions, and user-programmable external reference frequency

Key specifications	AP5001A	AP5002A
Frequency range	9 kHz to 2, 4, or 6.1 GHz	9 kHz to 12, 20, or 26 GHz
Output power range	-30 to +17 dBm; -120 to +17 dBm (Opt. 1E1)	-20 to +15 dBm; -120 to +23 dBm (Opt. 1E1/1EA)
Phase noise at 1 GHz, 20 kHz offset	-128 dBc/Hz, -130 dBc/Hz typical	-128 dBc/Hz, -130 dBc/Hz typical
Harmonics at 1 GHz	-30 dBc, -40 dBc typical	-30 dBc, -40 dBc typical
Non-harmonics at 1 GHz	-55 dBc, -65 dBc typical	-65 dBc, -75 dBc typical
Frequency switching speed	200 µs	300 µs
Modulation capabilities	AM, FM, PM, pulse, frequency chirps	AM, FM, PM, pulse, frequency chirps
Weight	⩽ 2.5 kg/6 lbs	⩽ 2.5 kg/6 lbs

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

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

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 IS0-9002, NIST traceable Cal certificate, and include a 1-year warranty.

www.keysight.com/find/pxi-vsg

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 µs	5 ms
Output power at 1 GHz	+19 dBm	+19 dBm
Level accuracy at 1 GHz	± 0.4 dB	± 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

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.

VXG MW vector
M9484C

E8267D

8780A
E2500B

PSG MW analog
E8257D

8340A/B
8341A/B

83620A/B
83622A/B
83623B/L
83624A/B
83630B/L
83640B/L
83650B/L

83711A/B
83712A/B
83731A/B
83732A/B
83751A/B
83752A/B

MXG/EXG MW analog
N5183B/N5173B

N5183A

8672A
8763A/B/C/D

8340A/B
8341A/B

83620A/B
83622A/B
83623B/L
83624A/B
83630B/L
83640B/L

83711A/B
83712A/B
83731A/B
83732A/B
83751A/B
83752A/B

PSG RF analog
E8663D

8662A/B
8643A
8644B
8645A
8664A
8665A/B

MXG RF vector
N5186A

N5182B

E4438C

ESG-DP Series
E4434B
E4435B
E4436B
E4437B

MXG RF analog
N5181B

E4428C

ESG-AP Series
E4423B
E4424B
E4425B
E4426B

8672A
8763A/B/C/D

8662A/B
8643A
8644B
8645A
8664A
8665A/B

EXG RF vector
N5172B

N5182A

ESG-D Series
E4430B
E4431B
E4432B
E4433B

EXG RF analog
N5171B

N5181A

ESG-A Series
E4400B
E4420B
E4421B
E4422B

8647A
8648A/B/C/D

8656B
8657A/B/D/J

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
KeysightCare KEYSIGHTCARE	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 KeysightCare data sheet for details.
KeysightCare Assured	KeysightCare Assured goes beyond basic warranty with repair services that include committed TAT and unlimited access to technical experts.
KeysightCare Enhanced	KeysightCare Enhanced includes all the benefits of KeysightCare Assured plus Keysight's accurate and reliable calibration services, accelerated, and committed TAT, and technical response.
Keysight Support Portal & Knowledge Center	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.
Education Services	Build confidence and gain new skills to make accurate measurements, with flexible Education Services developed by Keysight experts. Including Start-up Assistance.
Alternative product acquisition	
KeysightAccess	Reduce budget challenges with a subscription service enabling you to get the instruments, software, and technical support you want for your test needs.

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
KeysightCare Enhanced*	**Includes tech support, warranty and calibration**
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)
KeysightCare Assured	**Includes tech support and warranty**
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
Start-Up Assistance	
PS-S10	Included – instrument fundamentals and operations starter
PS-S20	Optional, technology and 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.