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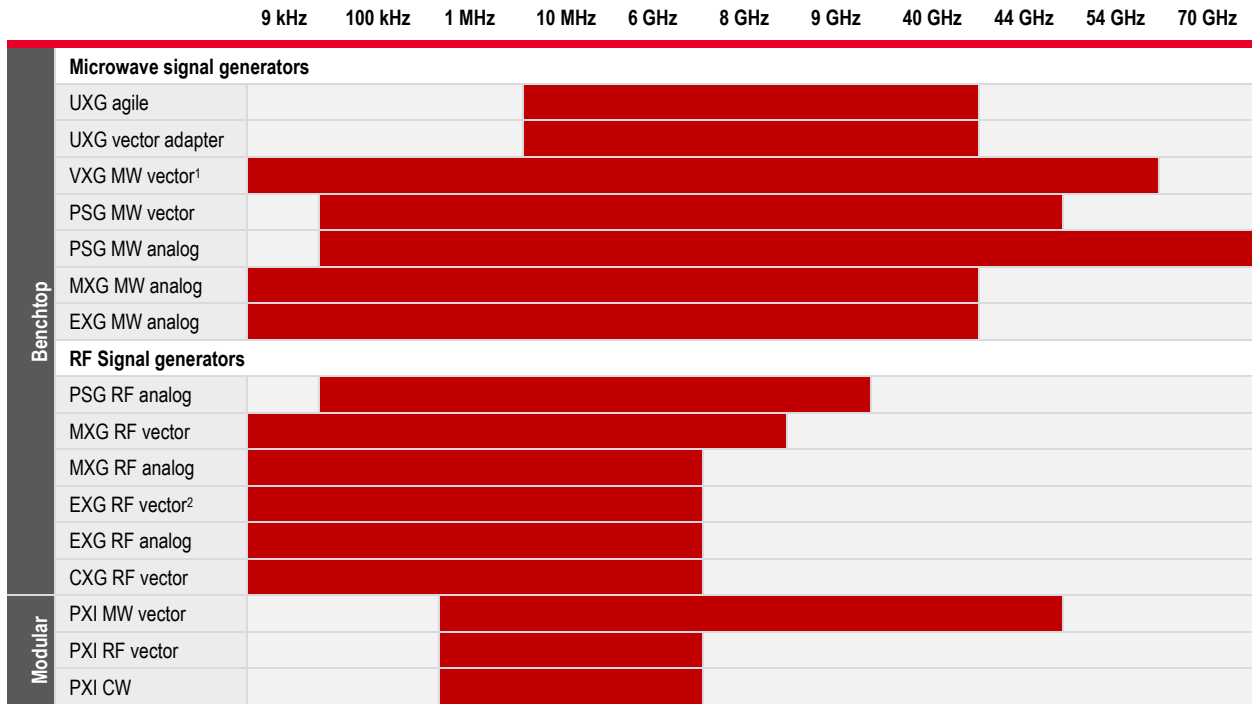
This guide provides an overview and side-by-side comparisons to help you determine which signal generator is right for you. It is intended to supplement online selection tools available at www.keysight.com/find/sg.



## KEYSIGHT

# Table of Contents

# Frequency coverage for Keysight signal generators

| | | 9 kHz | 100 kHz | 1 MHz | 10 MHz | 6 GHz | 8 GHz | 9 GHz | 40 GHz | 44 GHz | 54 GHz | 70 GHz |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Benchtop** | **Microwave signal generators** | | | | | | | | | | | |
| | UXG agile | | | | ● | ● | ● | ● | ● | ● | | |
| | UXG vector adapter | | | | ● | ● | ● | ● | ● | ● | | |
| | VXG MW vector[1] | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | |
| | PSG MW vector | | ● | ● | ● | ● | ● | ● | ● | ● | | |
| | PSG MW analog | | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● |
| | MXG MW analog | ● | ● | ● | ● | ● | ● | ● | ● | ● | | |
| | EXG MW analog | ● | ● | ● | ● | ● | ● | ● | ● | ● | | |
| | **RF Signal generators** | | | | | | | | | | | |
| | PSG RF analog | | ● | ● | ● | ● | ● | ● | | | | |
| | MXG RF vector | ● | ● | ● | ● | ● | ● | | | | | |
| | MXG RF analog | ● | ● | ● | ● | ● | | | | | | |
| | EXG RF vector[2] | ● | ● | ● | ● | ● | | | | | | |
| | EXG RF analog | ● | ● | ● | ● | ● | | | | | | |
| | CXG RF vector | ● | ● | ● | ● | ● | | | | | | |
| **Modular** | PXI MW vector | | | ● | ● | ● | ● | ● | ● | ● | | |
| | PXI RF vector | | | ● | ● | ● | | | | | | |
| | PXI CW | | | ● | ● | ● | | | | | | |

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 suites 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, ФM 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 |

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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 | 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 speed | 180 ns | 9 ms | 600 µs | 600 µs | 9 ms | 800 µs | 800 µs | 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 | ±1.5 dB | ± 0.6 dB | ± 0.6 dB | ± 0.6 dB | ± 0.6 dB | ± 0.6 dB | ± 0.6 dB | ± 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) | 12π | 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 µs |
| 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 |

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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 N5193A Agile | UXG N5194A Vector | VXG M9484C Vector | PSG E8267D Vector | MXG N5186A Vector | MXG and EXG N5182B and N5172B Vector | CXG N5166B 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 & 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.

| Applications and signal creation software | UXG N5193A Agile | UXG N5194A Vector | VXG M9484C Vector | PSG E8267D Vector | MXG N5186A Vector | MXG and EXG N5182B and N5172B Vector | CXG N5166B Vector |
|---|---|---|---|---|---|---|---|
| **PathWave signal generation waveform playback (continued)** | | | | | | | |
| **Detection, positioning, tracking, navigation** | | | | | | | |
| Global Navigation Satellite Systems (GNSS) | | | • [8] | • [9] | | • | • [8] |
| **General RF & 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 | | | | • | | • | • |

Benchtop (continued)

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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 M9383B Vector | PXI MW M9383A Vector | PXI RF M9381A Vector | PSG MW E8257D Analog | MXG and EXG MW N5183B and N5173B Analog | MXG and EXG RF N5181B and N5171B Analog | PSG RF E8663D 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 | • | • | • | | | | |

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10 No real-time support; ARB playback only.

# PathWave Signal Generation Software
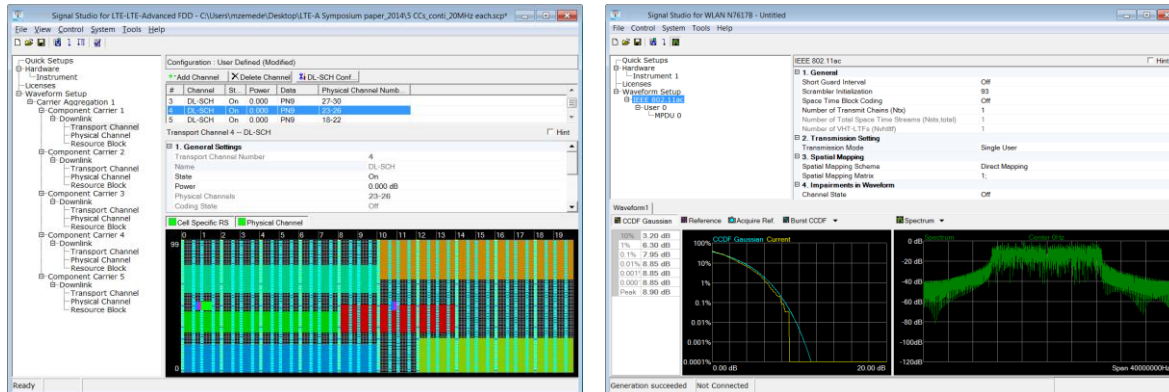


## Free Trial License

- 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.

**KEYSIGHT**

13

# 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.

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# 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 |

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[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 |

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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 |

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

# 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 | PSG MW analog E8257D | MXG/EXG MW analog N5183B/N5173B | PSG RF analog E8663D | MXG RF vector N5186A | MXG RF analog N5181B | EXG RF vector N5172B | EXG RF analog N5171B |
|---|---|---|---|---|---|---|---|
| E8267D | 8340A/B | N5183A | 8662A/B | N5182B | E4428C | N5182A | N5181A |
|  | 8341A/B |  | 8643A |  |  |  |  |
| 8780A |  | 8672A | 8644B | E4438C | ESG-AP Series | ESG-D Series | ESG-A Series |
| E2500B |  | 8763A/B/C/D | 8645A |  | E4423B | E4430B | E4400B |
|  | 83620A/B |  | 8664A |  | E4424B | E4431B | E4420B |
|  | 83622A/B |  | 8665A/B | ESG-DP Series | E4425B | E4432B | E4421B |
|  | 83623B/L | 8340A/B |  | E4434B | E4426B | E4433B | E4422B |
|  | 83624A/B | 8341A/B |  | E4435B |  |  |  |
|  | 83630B/L |  |  | E4436B | 8672A |  |  |
|  | 83640B/L | 83620A/B |  | E4437B | 8763A/B/C/D |  | 8647A |
|  | 83650B/L | 83622A/B |  |  |  |  | 8648A/B/C/D |
|  |  | 83623B/L |  |  | 8662A/B |  |  |
|  | 83711A/B | 83624A/B |  |  | 8643A |  | 8656B |
|  | 83712A/B | 83630B/L |  |  | 8644B |  | 8657A/B/D/J |
|  | 83731A/B | 83640B/L |  |  | 8645A |  |  |
|  | 83732A/B |  |  |  | 8664A |  |  |
|  | 83751A/B | 83711A/B |  |  | 8665A/B |  |  |
|  | 83752A/B | 83712A/B |  |  |  |  |  |
|  |  | 83731A/B |  |  |  |  |  |
|  |  | 83732A/B |  |  |  |  |  |
|  |  | 83751A/B |  |  |  |  |  |
|  |  | 83752A/B |  |  |  |  |  |

# 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 & 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.

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