



Signal Generation Solutions Catalog

TABLE OF CONTENTS

Innovating Technology Advances in Communications Networks

Innovation is happening everywhere, driven by our insatiable demand for data.

Big changes across multiple systems are coming to the wireless communication industry. The transition from 4G to 5G enables extreme data throughputs in cellular systems. Satellite networks launched in space enable high-speed communications from anywhere around the globe. The 6 GHz Wi-Fi band increases peak throughput via 1.2 GHz of accessible and unlicensed spectrum. Advanced radar technologies support high-resolution and high-frequency applications for safety and defense.

Achieving faster communications speeds requires more spectrum, higher frequencies, wider bandwidths, complex modulations, and multiple-input / multiple output. The use of highly directional signals helps overcome path loss associated with higher-frequency spectrum.

Keysight offers a wide range of instruments to help you generate a variety of stimuli to effectively test your device. Select the signal generator and measurement software that unleashes your insight, experience, and creativity while meeting your design objectives.

Generate True Performance for RF Receiver or Component Test

As you evaluate your device's behavior, you can take many paths. Whether you're evaluating a radio-frequency (RF) receiver's performance or characterizing RF components, Keysight signal generators produce the variety of signals you need — from simple to complex, clean to dirty — to test your design within and beyond its limits.

RF RECEIVER TEST

RF receiver tests quantify a receiver's performance in the presence of degradations on the path between transmitter and receiver. An RF receiver needs to handle various test scenarios:

- minimum or maximum input level
- interfering, blocking, intermodulation, and fading
- radiated or conducted tests

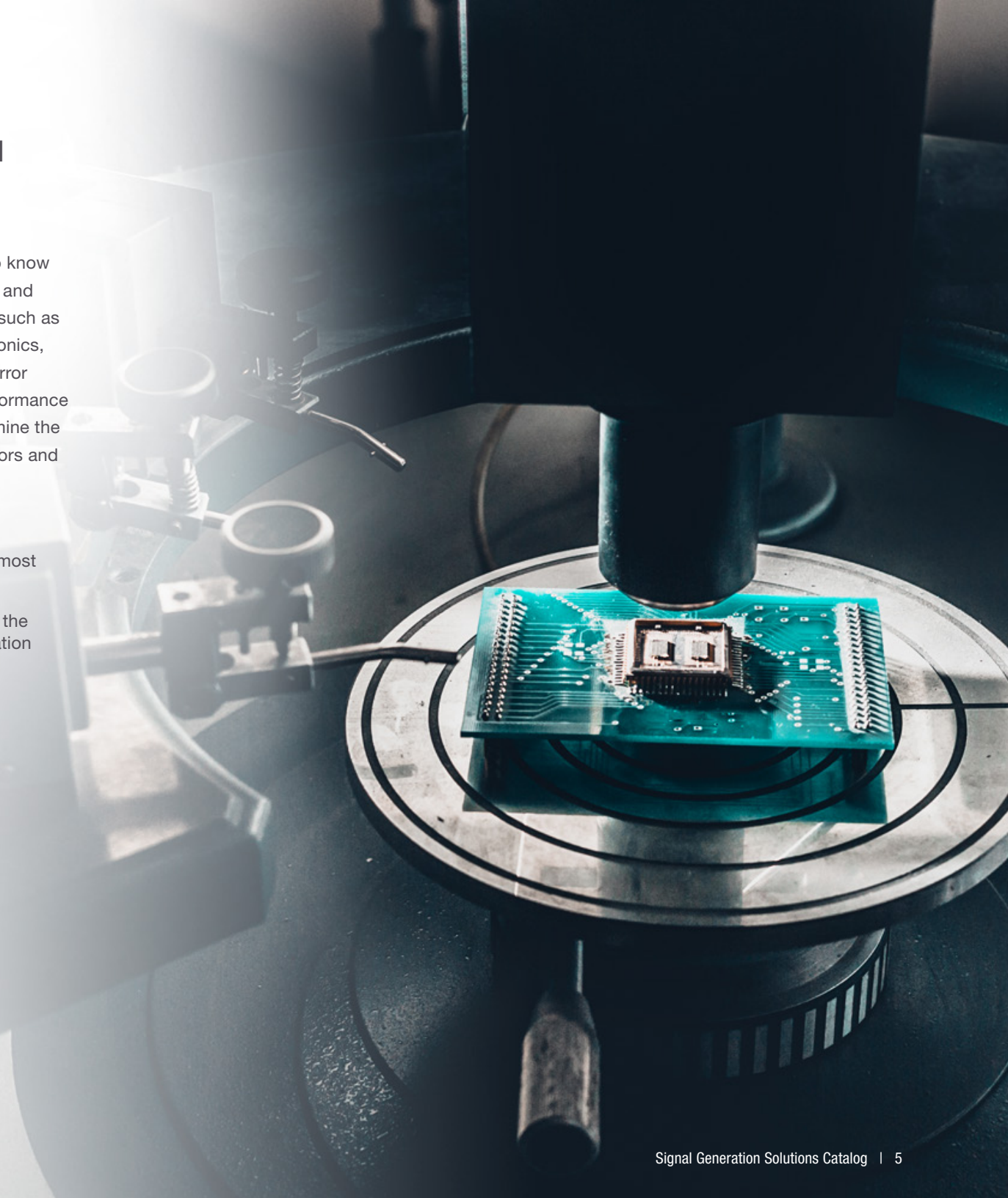
Whether you are working on a single radio format or integrating multiple formats into a wireless device, easy access to the right test signals streamlines validation and helps ensure interoperability. Accelerate your work with Keysight **PathWave Signal Generation software**, a flexible suite of signal-creation tools that reduces the time you spend on signal simulation.



RF COMPONENT CHARACTERIZATION WITH A SIGNAL GENERATOR AND SIGNAL ANALYZER

To fully characterize your RF components, you need to know the power characteristics of the simulated input signal and the measured output signal. Stimulus-response tests, such as complementary cumulative distribution function, harmonics, third-order modulation, adjacent channel power, and error vector magnitude (EVM), help you understand the performance of RF components under different conditions to determine the best trade-offs in your design. Keysight signal generators and analyzers offer the following:

- performance for characterizing your designs
- wide bandwidths for stimulating and acquiring the most demanding applications
- a variety of measurement applications that simplify the creation and analysis of the signals for characterization testing of RF components



Produce the Signals You Need with Our Wide Selection of Signal Generators

You create test systems for a specific technology, application, or product development phase, such as research, validation, verification, or manufacturing. Some test systems, such as those for smartphones, tablets, and other consumer products, need to be fast, low cost, and easy to configure and update. Others, such as satellite payload test, cost several million dollars to manufacture, are complex, and must provide high-quality measurements to ensure functionality, accuracy, and repeatability of the payload while in orbit. We provide a wide range of instruments that generate the signals you need.

TYPES OF SIGNAL GENERATORS

Vector signal generators: Vector signal generators or digital signal generators have a built-in I/Q modulator to create complex modulation formats such as QPSK, 1024QAM, and complex orthogonal frequency division multiplexing.

Analog signal generators: Analog signal generators supply sinusoidal continuous wave signals with the option to add AM, FM, Φ M, and pulse modulation.

Agile signal generators: Agile signal generators are optimized for speed to quickly change the frequency, amplitude, and phase of the signal. They also have the unique ability to be phase coherent at all frequencies, all the time.

INSTRUMENT FORM FACTORS

Along the product life cycle, test needs evolve from unbounded to just enough. Benchtop signal generators are well-suited for research and development or design verification, because engineers need to interact with the instrument to analyze and troubleshoot their designs. Modular PXI signal generators are ideal for applications that require multichannel measurement capabilities, fast measurement speed, and a small footprint.

Keysight ensures consistent results across instrument form factors. The bedrock is our commitment to measurement integrity that lets you focus on what's needed and optimize how to get there.



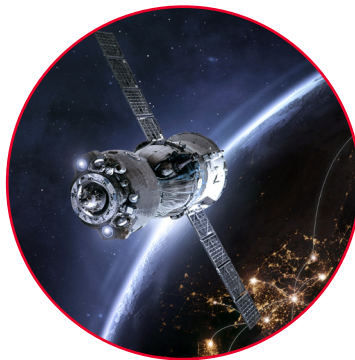
VXG Signal Generator in Benchtop (M9384B) and Modular (M9383B)

Master the Most Complex Signals with Vector Signal Generators

Meet your test requirements with the widest selection of signal generators with the best performance in every class, whether you need a traceable, metrology-grade solution or cost-effective basic signal generation. Below are applications that commonly use vector signal generators:



**Commercial
Communications**



**Space and Satellite
Communications**



Military Communications



Electronic Warfare



Radar



Automotive

LEADING THE WAY IN MICROWAVE AND MILLIMETER-WAVE TESTING

Next-generation wireless systems such as 5G, emerging wireless communications, and military and automotive radar continue to push higher frequencies, wider bandwidths, and greater modulation complexity. Excessive path loss and noise in these wireless systems decrease signal quality and increase test complexity and measurement uncertainties. We offer signal generators to help you generate trusted performance — the signal purity, output power, and modulation you need to accelerate your innovation.

| Form factor | Product | Frequency range | RF bandwidth (internal / external) | SSB phase noise (at 10 GHz; 10 kHz offset) | Maximum output power (at 20 GHz) |
|-------------|------------|---|-------------------------------------|--|----------------------------------|
| Benchtop | E8267D PSG | 100 kHz to 44 GHz ¹ | 80 MHz / 4 GHz | -126 dBc/Hz | +22 dBm |
| | M9384B VXG | 1 MHz to 44 GHz ¹ | 2 GHz ² / 4 GHz | -126 dBc/Hz | +21 dBm |
| | M9484C VXG | 9 kHz to 54 GHz (110 GHz ³) | 2.5 GHz (5 GHz ⁴) / N/A | -148 dBc/Hz | +22 dBm |
| Modular | M9383B VXG | 1 MHz to 44 GHz ¹ | 2 GHz / 4 GHz | -126 dBc/Hz | +21 dBm |
| | M9383A | 1 MHz to 44 GHz ¹ | 1 GHz / 2 GHz | -118 dBc/Hz | +20 dBm |

¹ Extend the frequency range up to 1.1 THz with [millimeter-wave \(mmWave\) source modules](#).

² Get up to 4 GHz bandwidth with dual-channel bonding.

³ with V3080A frequency extender

⁴ with channel bonding

E8267D PSG Vector Signal Generator

High performance, fully-integrated microwave vector signal generator creates realistic wideband radar, electronic warfare (EW), and satellite communications (SATCOM) waveforms from 100 kHz to 44 GHz.



GAIN CONFIDENCE IN YOUR DEVICE'S PERFORMANCE WITH THE WORLD'S MOST ADVANCED SIGNAL GENERATOR

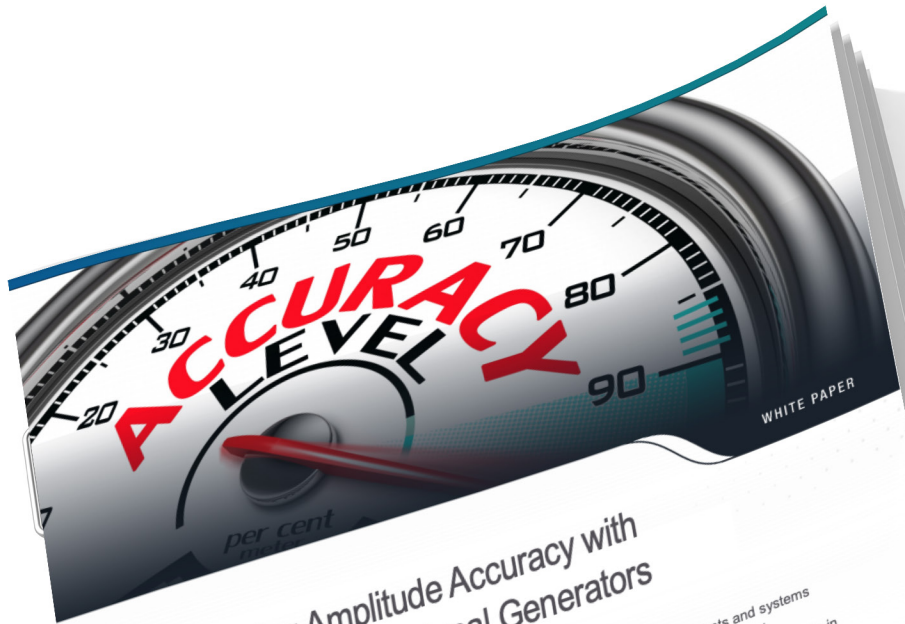
M9484C VXG MICROWAVE SIGNAL GENERATOR

Keysight's M9484C VXG provides the industry's first quad-channel vector signal generator with up to 110 GHz frequency range and 5 GHz of modulation bandwidth to enable your next breakthrough.

- The scalable architecture of the VXG vector signal generator enables higher frequency coverage, wider bandwidths, and multichannel applications with ease and accuracy.
- The fully integrated, calibrated, and synchronized VXG signal generation solution helps you minimize measurement uncertainty and reduce test complexity.
- The **PathWave Signal Generation** software and VXG's streamlined graphic user interface (GUI) reduce the time you spend on signal simulation and accelerate your test and design workflows.



M9384B VXG Microwave Signal Generator



Improving Amplitude Accuracy with Next-Generation Signal Generators

Generate True Performance

Signal generators offer precise and highly stable test signals for a variety of components and systems test applications. In an RF test system, you extend the measurement accuracy from the signal generator's output to the device under test (DUT). The nature of the cables, components, and switches in the paths between the instruments and the DUT can degrade the measurement accuracy.

This whitepaper will help you improve the amplitude accuracy of your measurements that involve signal generators. Before learning why amplitude accuracy matters and how to optimize amplitude accuracy, let's start with the fundamentals of RF power measurements.



Page 1

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UNDERSTAND, CHARACTERIZE, AND CORRECT RF SIGNAL PATHS

RF signal generators test RF components, receivers, transmitters, and systems. Amplitude accuracy is a critical factor for RF test systems. In an RF test system, you extend the measurement accuracy from the signal generator's output to the device under test (DUT). The nature of the cables, components, and switches in the paths between the instruments and the DUT can degrade measurement accuracy.

TAKE YOUR DEVICES AND DESIGNS TO THE LIMIT

Crafted to create signals capable of testing your very best devices and designs, X-Series signal generators and VXT vector transceivers offer best-in-class 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.

| Form factor | Product | Frequency range | RF bandwidth (internal / external) | SSB phase noise (at 1 GHz; 20 kHz offset) | Maximum output power (at 1 GHz) |
|-------------|------------|--|------------------------------------|---|---------------------------------|
| Benchtop | N5182B MXG | 9 kHz to 6 GHz (7.2 GHz ¹) | 160 MHz / 200 MHz | -146 dBc/Hz | +26 dBm |
| | N5172B EXG | 9 kHz to 6 GHz (7.2 GHz ¹) | 160 MHz / 200 MHz | -122 dBc/Hz | +26 dBm |
| | N5166B CXG | 9 kHz to 6 GHz | 120 MHz / 200 MHz | -119 dBc/Hz | +18 dBm |
| Modular | M9381A | 1 MHz to 6 GHz | 160 MHz | -122 dBc/Hz | +19 dBm |
| | M9421A VXT | 60 MHz to 6 GHz | 160 MHz | -112 dBc/Hz | +20 dBm |
| | M9410A VXT | 380 MHz to 6 GHz | 1.2 GHz | -136 dBc/Hz | +20 dBm |
| | M9411A VXT | | | | |
| | M9415A VXT | 380 MHz to 12 GHz | 1.2 GHz | -136 dBc/Hz | +20 dBm |

¹Get up to 7.2 GHz with a N5182BX07 frequency extender.

N5166B CXG X-Series RF Signal Generator

Excellent RF performance and scalable capabilities at a low-cost for engineers designing general purpose devices, consumer electronics devices, or for educators in teaching labs.



M9415A VXT vector transceiver

A vector signal generator integrated with a vector signal analyzer in a three slot PXIe module with frequency range of 380 MHz to 12 GHz and bandwidth of up to 1.2 GHz. High performance mmWave heads enable you to extend the frequency range from sub-7 GHz to Frequency Range 2 (FR2) for 5G NR testing.



LEARN HOW TO MAKE BETTER MEASUREMENTS WITH YOUR SIGNAL GENERATOR

Signal generators provide precise, highly stable test signals for a variety of component and system test applications. Different applications have different performance requirements. Keysight's signal generators offer flexibility and diverse capabilities to optimize performance and measurement speed. The best solutions will come from your experience, insight, and creativity, combined with signal generators and measurement software that enable you to generate the signals required to effectively test your device.

Read the 2-part application note:

9 Best Practices for Optimizing Your Signal Generator



Performance
%

Keep Pushing the Envelope with Trusted Analog Signal Generators

Keysight's analog signal generators are an essential part of today's most advanced measurement systems. They reliably provide the signal purity, output power, and modulation you need to push the envelope and address the demanding needs of the test applications below:

- RF component parametric testing
- LO substitution
- receiver blocking
- ADC characterization
- transmitter / receiver intermodulation
- system calibration
- radar pulse



E8257D PSG Analog Signal Generator

MEET YOUR TOUGHEST REQUIREMENTS IN MICROWAVE AND MMWAVE TESTING

To test your most advanced devices, you need signals that combine frequency and level accuracy with excellent distortion and spurious characteristics. The PSG microwave analog signal generators offer high output power, outstanding level accuracy, low harmonics, and spurious distortion. With increased vigilance on program efficiencies placing constraints on budget and space, the MXG and EXG microwave analog signal generators offer alternatives in size, speed, and cost.

| Form factor | Product | Frequency range | Frequency switching (list mode) | SSB phase noise (at 10 GHz; 10 kHz offset) | Maximum output power (at 20 GHz) |
|-------------|------------|--------------------------------|---------------------------------|--|----------------------------------|
| Benchtop | E8257D PSG | 100 kHz to 70 GHz ¹ | 9 ms | -126 dBc/Hz | +27 dBm |
| | N5183B MXG | 9 kHz to 40 GHz ¹ | 600 μ s | -129 dBc/Hz | +19 dBm |
| | N5173B EXG | 9 kHz to 40 GHz ¹ | 600 μ s | -101 dBc/Hz | +19 dBm |

¹Extend the frequency range up to 1.1 THz with [mmWave source modules](#).

N5173B EXG X-Series Microwave Analog Signal Generator



REVEAL THE TRUE RF PERFORMANCE OF YOUR DEVICE

Test radar receiver sensitivity, characterize analog-to-digital converter or mixer signal-to-noise ratio, and find receiver out-of-band rejection capability with industry-leading phase noise and spurious performance.

| Form factor | Product | Frequency range | Frequency switching (list mode) | SSB phase noise (at 1 GHz; 10 kHz offset) | Maximum output power (at 1 GHz) |
|-------------|------------|------------------|---------------------------------|---|---------------------------------|
| Benchtop | E8663D PSG | 100 kHz to 9 GHz | 9 ms | -143 dBc/Hz | +23 dBm |
| | N5181B MXG | 9 kHz to 6 GHz | 800 μ s | -146 dBc/Hz | +26 dBm |
| | N5171B EXG | 9 kHz to 6 GHz | 800 μ s | -122 dBc/Hz | +26 dBm |
| | N9310A | 9 kHz to 3 GHz | 10 ms | -95 dBc/Hz | +13 dBm |
| Modular | M9380A | 1 MHz to 6 GHz | 5 ms | -122 dBc/Hz | +19 dBm |

N5181B MXG X-Series RF Analog Signal Generator



N5181B MXG X-Series Analog Signal Generator

Fine-tuned to be your “golden transmitter” in R&D - whether you're pushing for a linear RF chain or an optimized link budget. Reveal the true performance of your devices and test your designs within and beyond their limits with the MXG.



Simulate Complex Radar Threat Environments with Agile Signal Generators

Creating realistic multi-emitter electronic warfare (EW) scenarios involves correctly interleaving multiple pulse trains as well as identifying, counting, and prioritizing pulse collisions. For increased realism, you need to add antenna radiation and scan patterns, as well as Pulse Repetition Interval (PRI) patterns, to the pulse train. Manually managing all these parameters can be a daunting task.

- Multiple pulse-Doppler radars efficiently maintain pulse phase coherently as the signal generator hops from one emitter frequency to another.
- EW scenarios simulate thousands of radar threat emitters and millions of pulses per second with unique antenna scans.
- I/Q custom complex modulation creates custom linear and nonlinear frequency modulated chirps over a 1.6 GHz bandwidth.
- High-pulse-density environments let you quickly perform pulse-on-pulse simulations or multiport angle-of-arrival (AoA) simulations.
- AoA simulations easily simulate staggering identical pulses out of different ports in time, phase, amplitude, or all three.



LOWER THE BARRIERS BETWEEN NEW INTELLIGENCE AND UP-TO-DATE SIGNAL SCENARIOS

Better testing done sooner equals deeper confidence in EW system performance. The Keysight N5193A / N5191A UXG agile signal generator allows you to accurately simulate multi-emitter scenarios for radar, antenna, and EW tests with the fastest switching, phase coherency, and extensive pulse modulation. The Keysight N5194A / N5192A UXG vector adapter extends the UXG's ability to simulate complex pulses with variable rise / fall times and arbitrary modulation within the pulse, including nonlinear chirps and comms signals.

| Product | Form factor | Frequency range | Frequency switching (list mode) | Narrow pulse width | SSB phase noise (at 1 GHz; 10 kHz offset) | Maximum output power (at 1 GHz) |
|-------------------------|-------------|------------------|---------------------------------|--------------------|---|---------------------------------|
| N5193A UXG | Benchtop | 10 MHz to 40 GHz | 180 ns | 10 ns | -144 dBc/Hz | +10 dBm |
| N5191A UXG | Benchtop | 10 MHz to 40 GHz | 180 ns | 10 ns | -135 dBc/Hz | +10 dBm |
| N5194A ¹ UXG | Benchtop | 50 MHz to 40 GHz | 170 ns | 1 ns | -144 dBc/Hz | +7 dBm |
| N5192A ² UXG | Benchtop | 50 MHz to 20 GHz | 101 μ s | 1 ns | -144 dBc/Hz | +7 dBm |

¹Extend the N5193A UXG's capability.

²Extend the N5191A UXG's capability.

N5193A UXG X-Series Agile Signal Generator





N5193A UXG X-Series Agile Signal Generator and N5194A Vector Adapter

Create realistic multi-emitter threat simulations for EW test with the N5193A UXG, 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. To take your lab to the next level, the N5194A UXG agile vector adapter works with the N5193A to simulate increasingly complex signal environments with enhanced realism and greater confidence.

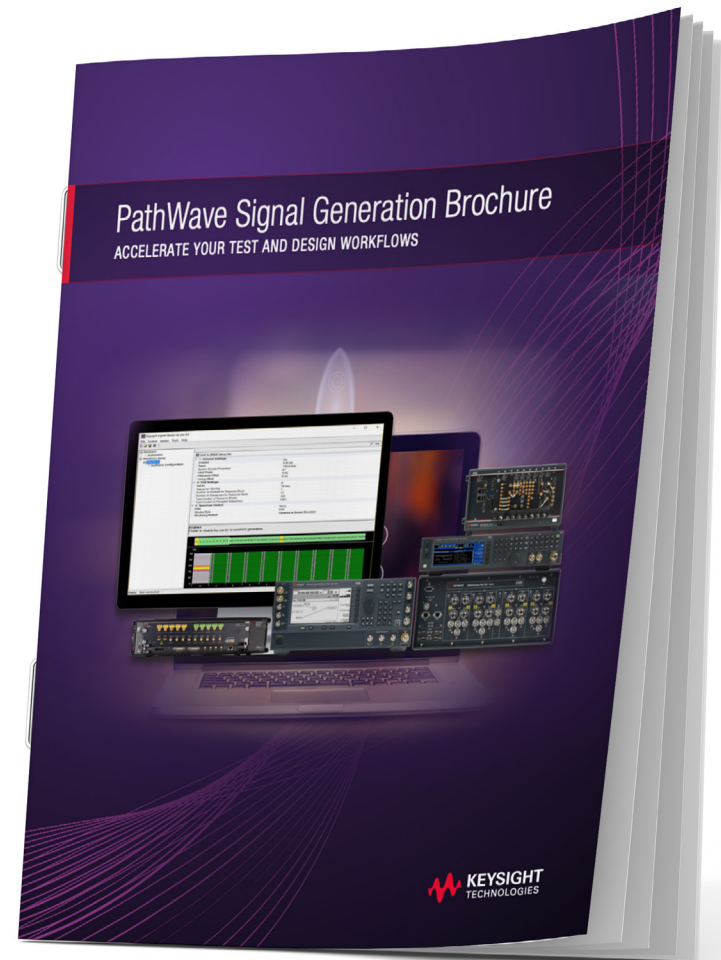
Accelerate Your Test and Design Workflows — PathWave Signal Generation Software

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.

PathWave Signal Generation supports a wide variety of wireless industry applications:

- cellular communications
- wireless connectivity
- video, audio, and radio test
- detection, position, tracking, and navigation
- general purpose

Explore bundles and get a [free trial](#).





This information is subject to change without notice.
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