



Vector Signal Generators

From research to manufacturing testing

BUYING GUIDE

Keysight Signal Generators

One family. Three performance grades. 6 classes.

Vector Signal Generators



ESSENTIAL

XG1, XG2-class

- 6 GHz to 40 GHz
Maximum frequency
- 120 MHz to 160 MHz
Maximum modulation
bandwidth



EXPERT

XG4, XG5-class

- 8.5 GHz to 40 GHz
Maximum frequency
- 400 MHz to 1 GHz
Maximum modulation
bandwidth



PRO

XG7-class

- 54 GHz Maximum
frequency
- 2.5 GHz Maximum
modulation bandwidth

Analog Signal Generators



ESSENTIAL

XG1, XG2-class

- 6 GHz to 40 GHz
Maximum frequency
- 1 to 4 Number of outputs



EXPERT

XG5, XG6-class

- 8.5 GHz to 54 GHz
Maximum frequency
- 1 to 4 Number of outputs



PRO

XG7-class

- 67 GHz Maximum frequency
- 1 Number of output

Introduction

Selecting the right vector signal generator depends on a number of factors, including the purity, power, and throughput your application demands. Keysight offers three performance grades of vector signal generators, — Essential, Expert, and Pro. This buying guide compares these grades and their specifications. Whether you are working on general-purpose RF testing or enhanced multichannel, wideband signal emulation, each signal generator offers a unique combination of frequency range, bandwidth, output power, phase noise, harmonic performance, and switching speed. Use this guide to determine which signal generator grade aligns with your application requirements.

Essential

Keysight Essential vector signal generators offer two classes. The XG1-class includes the CXG and the XG2-class includes the EXG. They provide general-purpose features critical for RF testing needs and bandwidth of up to 160 MHz. These models include additive white Gaussian noise, multi-tone capabilities, and preconfigured waveforms to simulate real-world conditions.



Expert

Keysight Expert vector signal generators offer two classes. The XG4-class includes the AP5041A-AP5042A compact signal generators and the XG5-class includes the N5186A MXG. For labs requiring complex, wideband signals, these signal generators offer up to 1 GHz modulation bandwidth per channel on up to 4 channels, plus increased power output, and fast switching speeds down to 2 μ s.



Pro

The XG7-class Pro vector signal generators includes the VXG.. For labs pushing the edges of performance or exploring new industry standards, these offer test frequencies up to 54 GHz, 2.5 GHz modulation bandwidth, and complex signal emulation of up to 32 signals in a single unit



Step 1. Check the General Specifications

Keysight vector signal generators enable you to stimulate your device or system-under-test using complex, digitally modulated, realistic signals with high signal integrity. When paired with our signal generation software, you can perform rapid, accurate tests with predefined, standards-based waveforms for cellular communications like 5G New Radio (5G NR), 802.11 wireless LAN (WLAN), and global navigation satellite systems (GNSS).

The first part of your signal generation selection process will be based on maximum frequency, bandwidth, number of channels, and phase noise.

The table below summarizes the key specifications by product grade — Essential, Advanced, Expert, and Pro — to help you select the vector signal generator that is right for your application.

Vector signal generator comparison of specifications

Specifications	Essential	Expert	Pro
Class	XG1, XG2	XG4, XG5	XG7
Maximum frequency	6 GHz	8.5 GHz to 40 GHz	54 GHz
Maximum modulation bandwidth	120 MHz to 160 MHz	400 MHz to 1 GHz	2.5 GHz
Number of outputs	1	1 to 4	1 to 4
Phase noise @ 1 GHz (20 kHz offset)	-122 dBc/Hz to -119 dBc/Hz	-147 dBc/Hz to -145 dBc/Hz	-148 dBc/Hz
Output power @ 1 GHz	18 dBm to 21 dBm	18 dBm to 25 dBm	20 dBm
Harmonics @ 1 GHz	-35 dBc	-45 dBc to -35 dBc	-55 dBc
Frequency switching speed	800 µs to 5000 µs	2 µs to 800 µs	3 ms

EXPLORE
ESSENTIAL

EXPLORE
EXPERT

EXPLORE
PRO

Essential

Core Features

- bandwidth up to 160 MHz
- multitone signal generation
- additive white Gaussian noise (AWGN)
- self-maintenance capabilities

Key Capabilities

Use preconfigured waveforms and simulate noisy conditions with AWGN capabilities to characterize distortion.

Expert

Core Features

- bandwidth up to 1 GHz
- spectrally efficient signals
- fast switching speeds
- ultra-low phase noise

Key Capabilities

Deliver ultra-low phase noise and generate complex wideband signals with excellent ACPR and fast switching speeds down to 2 μ s to accelerate testing.

Step 2. Look at Key Features



Pro

Core Features

- bandwidth up to 2.5 GHz
- emulate up to 32 signals
- real-time application support
- lowest phase noise

Key Capabilities

Perform cutting-edge research and development for next-generation wireless and aerospace applications with our highest bandwidth, highest frequency, and multichannel coherent source.

Step 3. Consider Your Use Cases

While specifications are important, considering the various ways your team will use an instrument will determine which level is best for your lab's needs. Here are a few typical use cases for each level.

Essential: General-purpose RF testing

Keysight Essential entry-level vector signal generators offer cutting-edge features such as additive white Gaussian noise (AWGN) to simulate real-world conditions and multitone generation capabilities to minimize distortion.

Our Essential models are optimized for applications with bandwidths of up to 120 MHz, including wireless communications for testing IoT and *Bluetooth*® systems. They are commonly used in RF testing when evaluating radar systems, antenna performance, and general electronics.

Common use cases for Essential signal generators include:

- How to Navigate the Complexity of IoT RF Receiver Testing
- How to Characterize RF Devices with Stimulus-Response Measurements



Expert: Sophisticated wideband signal testing

Keysight Expert vector signal generators add support for wider modulation bandwidth, up to 1 GHz, plus enhanced spectral purity. The XG5-class offers an embedded reflectometer, which improves measurement accuracy and reduces measurement uncertainty at the push of a button, generating a match-corrected signal at the reference plane. Expert signal generators offer fast frequency switching and reduced phase noise and distortion.

Expert signal generators are ideal for highly sensitive applications like 5G FR1, radar, and high-frequency oscillators. They can also generate complex wideband signals needed for carrier aggregation and digital pre-distortion (DPD) applications.

Common use cases for Expert signal generators include:

- How to Test RF Power Amplifiers with Digital Pre-Distortion
- How to De-embed Fixtures and Correct Mismatch Errors
- How to Conduct Blocking Tests, Coexistence Testing, and Carrier Aggregation
- How to Conduct Beamforming and Spatial Multiplexing MIMO Testing

Consider Your Use Cases (cont.)

Pro: Ultra-wide bandwidth, high-frequency signal testing

Keysight Pro vector signal generators deliver our highest frequency support, up to 54 GHz, or 110 GHz with a frequency extender, and bandwidth up to 2.5 GHz. Like our Expert generator, Pro models use a direct digital synthesis architecture to deliver exceptional signal purity. Additional capabilities include embedded signal generation software, channel bonding for up to 5 GHz aggregated bandwidth, real-time fading with custom fading models, and eight virtual signal generators per RF channel or 32 emulated transmitters in a single unit.

These generators cover all 5G NR frequency bands and are well-suited for EMSO and emerging 6G research.

Common use cases for Pro signal generators include:

- How to Test 5G NR Base Station Receivers
- How to Test CRPA-Enabled GNSS Receivers
- How to Test a Digital Wideband Transceiver
- How to Verify the Performance of a 6G Neural Receiver

Explore more **signal generator use cases** to help you innovate faster and with greater confidence.



Step 4. Final Key Considerations

As you look across your applications and your lab's typical use cases, it is good to revisit how use cases might drive each of your instrument's features. When evaluating each specification, be sure to account for future needs, including new standards, by adding a margin beyond your current requirements.

Factors to consider when choosing a vector signal generator:

Maximum frequency

Maximum frequency defines the highest signal your generator can produce, but must be evaluated together with required bandwidth and output power. Choose Essential (≤ 6 GHz), Expert (up to 40 GHz), or Pro (up to 54 GHz) based on application frequency requirements.

Bandwidth

Bandwidth affects your ability to generate wideband signals. Choose Essential (≤ 160 MHz), Expert (≤ 1 GHz), or Pro (≤ 2.5 GHz) for increasingly complex wideband standards. Reach up to 5 GHz bandwidth with channel bonding on our Pro models.

Number of channels

Multiple channels are required for multiport, phase-coherent testing. Choose Essential (≤ 1), Expert (≤ 4), or Pro (≤ 4) for coherent, multichannel signal generation, or to reduce lab footprint when test methodologies require multiple sources.



Final Key Considerations (cont.)

Phase noise

Phase noise impacts signal purity and measurement accuracy. Select Essential (as low as -122 dBc/Hz), Expert (-147 dBc/Hz), or Pro (as low as -147 dBc/Hz) for increasingly stringent performance requirements.

Output power

Output power ensures sufficient signal strength to overcome losses and drive devices, and varies with the maximum frequency of the signal generator. Choose Essential (+21 dBm), Expert (up to +25 dBm), or Pro (+20 dBm) for the highest output power at high frequencies to meet the power demands of your applications.



Common mistakes to avoid when selecting a vector signal generator

- Choosing insufficient frequency coverage to meet current and future test requirements.
- Neglecting bandwidth or modulation support for MIMO or beamforming.
- Overlooking the need for phase-coherent, time-aligned signals in multiport tests.
- Not considering software to simplify the creation of complex modulated signals.
- Not ensuring adequate output power to overcome losses in cabling or switching.

Agile Signal Generators

Accurately simulate complex signal scenarios

Keysight agile signal generators simulate complex signal environments with an arbitrary waveform generator for testing specific protocols or unique communication formats for radar, electromagnetic spectrum operations (EMSO), and antenna testing. The base analog unit's rapid frequency, amplitude, and phase-switching capabilities allow for accurate emulation of multi-threat scenarios.

You can enhance with the optional 1.6 GHz bandwidth baseband vector generator to simulate complex electromagnetic environments across the full frequency range.



Maximum frequency	40 GHz
Maximum modulation bandwidth	1.6 GHz
Number of outputs	1
Phase noise @ 1 GHz (20 kHz offset)	-144 dBc/Hz
Output power @ 1 GHz	+3 dBm to +10 dBm
Harmonics @ 1 GHz	< -60 dBc to < -50 dBc
Frequency switching speed	0.22 μ s to 0.18 μ s

EXPLORE

Modular Signal Generators

Compact multichannel signal generation

Keysight modular analog and vector signal generators are built for applications that require multichannel measurement capabilities, measurement speed, and a small footprint. They provide you with the scalability and flexibility needed to create test systems with a shared processor, chassis, and other modular instruments.

With models ranging from 6 GHz to 44 GHz with varying performance grades, select the modular signal generator that is right for your application.

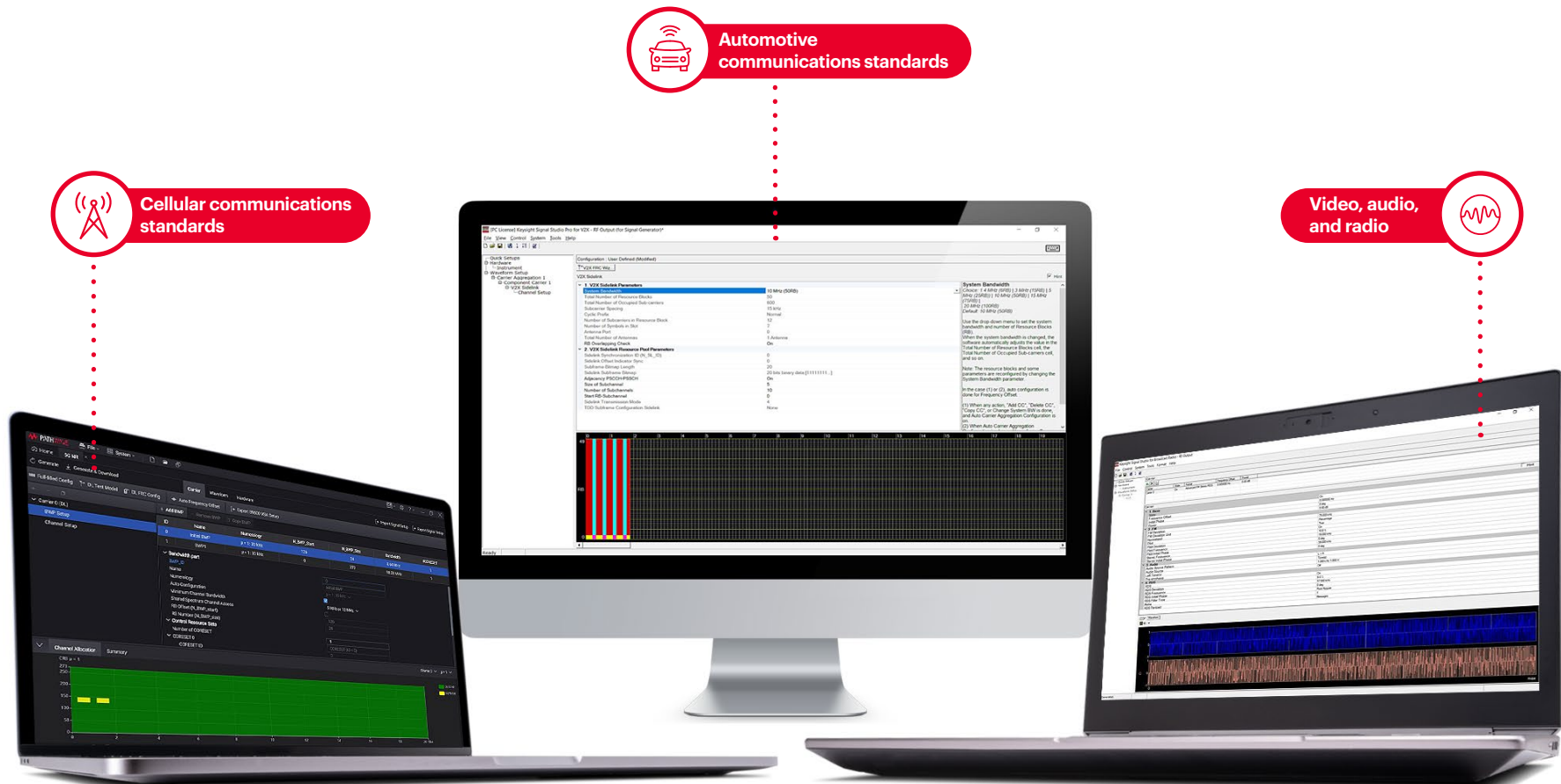


Maximum frequency	6 GHz to 44 GHz
Maximum modulation bandwidth	2 GHz
Phase noise @ 1 GHz (20 kHz offset)	-118 dBc/Hz to -137 dBc/Hz
Output power @ 1 GHz	+19 dBm to +20 dBm
Harmonics @ 1 GHz	-29 dBc to -46 dBc
Frequency switching speed	5 ms to 10 μ s

EXPLORE

Signal Generator Software Functionality

When looking for the right signal generator, often it is helpful to understand what kinds of measurements it can support. Keysight signal generation software streamlines the creation of complex test signals for various applications. Below are some examples. To explore the full range of signal generator software, visit our [instrument measurement software](#) page.





Why Choose Keysight?

Keysight vector signal generators deliver the performance, reliability, and flexibility engineers need to test today's most sophisticated designs. With exceptional specs and intuitive software, Keysight helps you generate accurate, high-quality signals — fast. Here's what makes Keysight vector signal generators stand out:

High signal quality

- Test your device with realistic, pure signals to see its true performance.
- Improved test repeatability with low phase noise and spurious levels minimizes result variability.

Broad frequency and modulation coverage

- Test higher-level wireless standards, including 5G NR and 6G.
- Future-proof test setups with high maximum frequencies and bandwidths.

Sophisticated and comprehensive signal creation

- Real-time signal creation enables testing complex scenarios such as MIMO real-time fading.
- Speed testing with comprehensive built-in waveform libraries and custom signal generation.

Fast, flexible integration

- Rapid switching speed reduces test time and increases throughput.
- Software APIs enable enhanced automation and control over RF signal generation.

Feature

Specification

Signal purity

Phase noise down to -148 dBc/Hz @ 1 GHz, 20 kHz offset

Frequency coverage

Up to 54 GHz (110 GHz with extender)

Modulation bandwidth

Up to 2.5 GHz

Phase noise

As low as -148 dBc/Hz

Channel count

Up to 4 phase-coherent channels

Switching speed

As fast as 180 ns



Calibration

Ensure your test system performs to specification and meets local and global standards.



Repair

Restore equipment to original functionality and specifications with trained technicians.



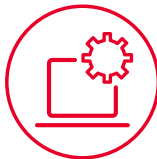
KeysightCare

Innovate at speed with curated support plans and prioritized response and turnaround times.



Education

Make measurements quickly with eLearning and in-house, instructor-led training.



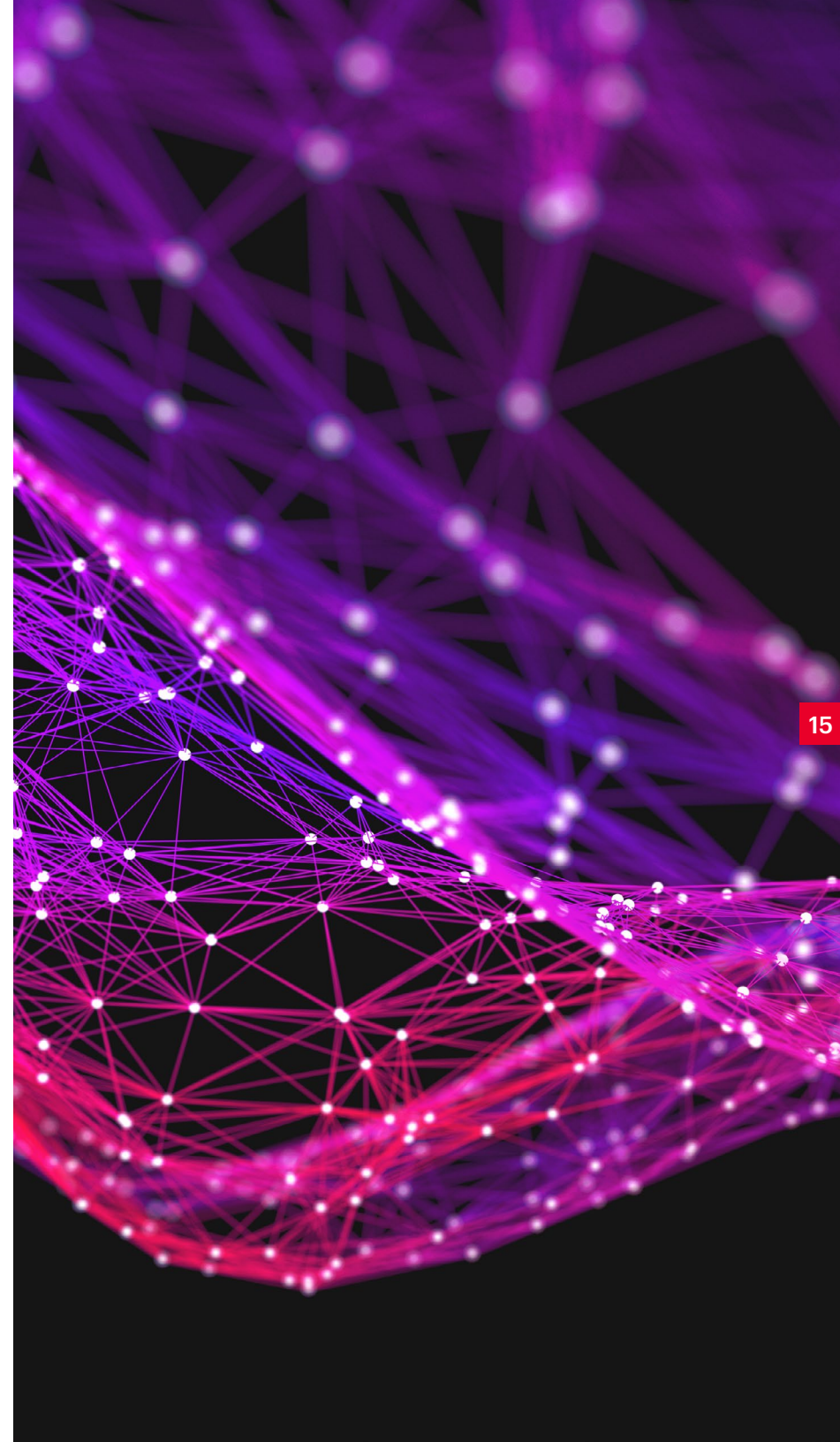
Keysight Support

Get 24x7 access to service requests, case management help, and technical articles.

Select the Signal Generator That Is Right for You

Should you need more information on Keysight signal generator offerings, visit our extensive **library of resources** to help you select the right signal generator for your application. Here are some of the resources that can guide you in determining the best signal generator for your needs:

- > The Essential Signal Generator Guide
- > PathWave Signal Generation Software Brochure
- > Basics of Vector Signal Generators
- > Understanding Phase Noise Needs and Choices in Signal Generation



Once you are ready, visit **Keysight signal generators** to select one of our popular configurations or build one to meet your specific application.



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

This information is subject to change without notice. © Keysight Technologies, 2026, Published in USA, February 28, 2026, 7125-1029.EN