

# Spectrum Analyzer and Signal Analyzer



## Introduction

Keysight's extensive array of signal analyzer products address the applications you may be working on.

Proven measurement science and expertise are incorporated into all Keysight signal analyzers and measurement software, ensuring accurate frequency, amplitude, and modulation measurements, such as distortion, spurious, phase noise, and 2G to 6G wireless communications signals. Many of Keysight's benchtop and modular instruments share a common set of software applications providing efficiency with measurement integrity that ensures consistent results that correlate across platforms as your product moves through its product lifecycle.

Additionally, for applications that require greater mobility, handheld products offer the ability to take precision out into the field.

This technical overview and selection guide is designed to help you identify the right spectrum or signal analyzer and software to fit your budget, application, and specific measurement needs.

## Table of Contents

Introduction.....	2
Product Categories.....	4
Key Specifications Comparison - Benchtop .....	5
Key Specifications Comparison - Handheld .....	5
Key Specifications Comparison – Modular.....	6
Capability Comparison - Benchtop .....	7
Capability Comparison – Modular and Handheld.....	8
Benchtop – X-Series Signal Analysis .....	9
Basic Spectrum Analyzers (BSA).....	14
VXT PXIe Vector Transceiver .....	15
Modular PXI Vector Signal Analyzers .....	16
FieldFox Handheld Analyzers .....	17
Vector Network Analyzers .....	18
Specialized signal analysis.....	20
Applications and Measurement Software.....	21
PathWave X-Series Measurement Applications .....	22
Migration from Legacy Spectrum Analyzers.....	23

## Frequency coverage for Keysight spectrum and signal analyzers



1. Up to 2.2 T Hz with external mixing

## Product Categories

Traditionally, spectrum analyzers are referred to as swept-tuned, super-heterodyne receivers that provide a display of amplitude versus frequency. Today's analyzers offer both swept-tuned and Fast Fourier transform (FFT) architectures.

While the terms spectrum analyzer and signal analyzer are used interchangeably, signal analyzer is a more accurate term for today's analyzers that combine the superior dynamic range of a swept tuned spectrum analyzer with vector signal analyzer (VSA) capabilities and enable in-channel measurements such as error vector magnitude (EVM), requiring both magnitude and phase information. The signal analyzer's versatility comes from the implementation of a fully digital intermediate frequency (IF) replacing the analog IF used in traditional spectrum analyzers.

### Benchtop

Benchtop spectrum and signal analyzers are well-suited for R&D or design verification where analysis and troubleshooting benefit from interactive analysis. Keysight's benchtop analyzers range from low cost to industry-leading performance with the broadest range of measurement capabilities so you can choose the analyzer that best suits your needs.

### Modular PXI

Modular signal analyzers are ideal for applications that require fast, high quality measurements, such as high-volume manufacturing, where quality control, product conformance and test optimization are essential. Modular solutions offer speed, scalability and repeatability, along with the flexibility to configure a solution with a shared processor, frame/chassis, display, and interface. Benefit from Keysight's measurement expertise, software, and PXI integration to create an application-focused modular solution, including multi-channel or multi-measurement capability.

### Handheld

Whether you're looking for value or precision, RF or microwave, we offer rugged, accurate, fast, and easy-to-use handheld spectrum analyzers to address challenges faced by field technicians and engineers. Handheld analyzers are optimized for long battery life and minimal weight.

### Applications and measurement software

Available for a broad range of communication standards and modulation types, Keysight offers PC- and instrument-based applications and software that work with our benchtop and modular analyzers to address measurement needs from in-depth troubleshooting, to standard-compliant design validation, to high-speed pass/fail testing. Achieve greater efficiency, minimize development time and reduce risk through measurement integrity that ensures consistent, reliable results that correlate across your product lifecycle.

### Free trial license

Download the 89600 VSA software and use it for 30 days to make measurements with your analysis hardware or use our recorded demo signals. [www.keysight.com/find/vsa\\_trial](http://www.keysight.com/find/vsa_trial)

## Key Specifications Comparison - Benchtop

	Frequency range	Analysis bandwidth RF Standard (RF Optional)	Overall amplitude accuracy (95%)	Dynamic range, max third order at 1 GHz	Displayed avg noise level (DANL) @ 1 GHz	Third order intercept (TOI) @ 1 GHz	Phase noise @ 1 GHz 10 kHz offset
<b>UXA N9041B</b> *****	2 Hz to 110 GHz Mixers to 1.1 THz	25 MHz (40 MHz, 255 MHz, 1 GHz) 5 GHz <sup>1</sup>	± 0.25 dB		-174 dBm	22 dBm	-135 dBc/Hz <sup>2</sup>
<b>UXA N9040B</b> *****	2 Hz to 50 GHz Mixers to 1.1 THz	25 MHz (40, 255, 510 MHz, 1 GHz)	± 0.16 dB	119 dB	-174 dBm	22 dBm	-135 dBc/Hz
<b>PXA N9030B</b> *****	3 Hz to 50 GHz Mixers to 1.1 THz	25 MHz (40, 85, 160, 255, 510 MHz)	± 0.19 dB	119 dB	-174 dBm	22 dBm	-136 dBc/Hz
<b>MXA N9021B</b> ****	10 Hz to 50 GHz Mixers to 1.1 THz	25 MHz (255, 510 MHz)	0.41 dB	116 dB	-172 dBm/Hz	20 dBm	-129 dBc/Hz
<b>MXA N9020B</b> ****	10 Hz to 50 GHz Mixers to 1.1 THz	25 MHz (40, 85, 125, 160 MHz)	± 0.23 dB	116 dB	-114 dBm	20 dBm	-114 dBc/Hz
<b>EXA N9010B</b> ***	10 Hz to 44 GHz Mixers to 1.1 THz	25 MHz (40 MHz)	± 0.27 dB	112 dB 116 dB <sup>3</sup>	-172 dBm	18 dBm 19 dBm <sup>5</sup>	-109 dBc/Hz
<b>CXA N9000B</b> **	9 kHz to 26.5 GHz	10 MHz (25 MHz)	± 0.50 dB	111 dB	-163 dBm	17 dBm 15 dBm <sup>5</sup>	-110 dBc/Hz
<b>BSA N9320B</b> <b>N9322C</b> *	9 kHz to 7 GHz	1 MHz	± 0.50 dB, ± 0.60 dB	76 dB, 83 dB	-145 dBm -152 dBm	13 dBm, 15 dBm	-90 dBc/H

1. External analysis bandwidth
2. Phase noise @1 GHz (30 kHz offset)
3. Baseband options
4. For N9010A Option 532 or 544
5. For N9000A Option 513 or 526

## Key Specifications Comparison - Handheld

	Frequency range	Analysis bandwidth RF Standard (RF Optional)	Overall amplitude accuracy (95%)	Dynamic range, max third order at 1 GHz	Displayed avg noise level (DANL) @ 1 GHz	Third order intercept (TOI) @ 1 GHz	Phase noise @ 1 GHz 10 kHz offset
<b>FieldFox</b>	5 kHz to 26.5 GHz	25 MHz	± 0.5 dB	113 dB	-154 dBm	15 dBm	-111 dBc/Hz

## Key Specifications Comparison – Modular

	Frequency range	Analysis bandwidth RF Standard (RF Optional)	Overall amplitude accuracy (95%)	Displayed avg noise level (DANL) @ 1 GHz	Third order intercept (TOI) @ 1 GHz	Phase noise @ 1 GHz 10 kHz offset
<b>PXIe VXT M9415A</b>	380 MHz to 12 GHz	Will be available in October	+ 0.45 dB			
<b>PXIe VXT M9410A</b>	380 MHz to 6 GHz	300 MHz (600 MHz, 1200 MHz)	+ 0.60 dB	-167 dBm	+35 dBm	-130 dBc/Hz
<b>PXIe VXT M9411A</b>	380 MHz to 6 GHz	300 MHz (600 MHz, 1200 MHz)	+ 0.60 dB	-159 dBm	27 dBm	-130 dBc/Hz
<b>PXIe VXT M9421A</b>	60 MHz to 6 GHz	40 MHz (80 MHz, 160 MHz)	± 0.55 dB	-159 dBm	25 dBm	-111 dBc
<b>PXI RF VSA M9391A</b>	1 MHz to 6 GHz	40 MHz (100 MHz, 160 MHz)	± 0.45 dB	-161 dBm	18 dBm	-119 dBc/Hz
<b>PXI μW VSA M9393A</b>	9 kHz to 27 GHz	40 MHz (100 MHz, 160 MHz)	± 0.25 dB	-168 dBm	31 dBm	-110 dBc/Hz
<b>CXA-m M9290A</b>	10 Hz to 26.5 GHz	10 MHz (25 MHz)	± 0.6 dB	-163 dBm	16 dBm	-110 dBc/Hz

## Capability Comparison - Benchtop

Measurements/applications	UXA	PXA	MXA	EXA	CXA	BSA
<b>General purpose</b>						
AM/FM tune and listen	●	●	●	●	●	●
Analog demodulation	●	●	●	●	●	●
EMI precompliance	●	●	●	●	●	●
Enhanced display package (spectrogram plus)	●	●	●	●	●	●
Stimulus/response measurement	●	●	●	●	●	●
Flexible digital modulation analysis	●	●	●	●	●	●
MATLAB	●	●	●	●	●	●
Noise figure	●	●	●	●	●	●
Phase noise	●	●	●	●	●	●
Pulse	●	●	●	●	●	●
Real-time spectrum analysis	●	●	●			
Remote language compatibility for 856xE/EC and 8566/68	●	●	●	●		
SCPI language compatibility	●	●	●	●	●	●
<b>Cellular communications</b>						
1xEV-DO	●	●	●	●	●	●
cdma2000®/cdmaOne	●	●	●	●	●	●
GSM/EDGE/EVO	●	●	●	●	●	●
iDEN/WiDEN/MotoTalk	●	●	●	●		
LTE FDD and TDD	●	●	●	●	●	●
LTE-Advanced FDD and TDD	●	●	●	●		
Multi-standard radio (MSR)	●	●	●	●		
TD-SCDMA/HSPA	●	●	●	●		
W-CDMA/HSPA+	●	●	●	●		
<b>Wireless connectivity</b>						
Bluetooth®	●	● <sup>1</sup>	● <sup>1</sup>	● <sup>1</sup>	● <sup>1</sup>	
Fixed WiMAX™	●		●	●		
Mobile WiMAX™	●	●	●	●		
WLAN 802.11a/b/g/n/ac	●	●	●	●		
ZigBee	●	● <sup>1</sup>	● <sup>1</sup>	● <sup>1</sup>	● <sup>1</sup>	
<b>Digital video</b>						
CMMB	●	●	●	●	●	●
Digital cable TV	●	●	●	●	●	●
DTMB (CTTB)	●	●	●	●	●	●
DVB-T/H/T2	●	●	●	●	●	●
ISDB-T/T <sub>SB</sub> / T <sub>mm</sub>	●	●	●	●	●	●
<b>PowerSuite one-button measurements</b>						
Channel power	●	●	●	●	●	●
Occupied bandwidth	●	●	●	●	●	●
Multicarrier, multi-offset ACP	●	●	●	●	●	●
Multicarrier power	●	●	●	●	●	●
CCDF	●	●	●	●	●	●
Harmonic distortion	●	●	●	●	●	●
Burst power	●	●	●	●	●	●
Intermodulation (TOI)	●	●	●	●	●	●
Spurious emissions	●	●	●	●	●	●
Spectrum emission mask	●	●	●	●	●	●

1. VXA vector signal analysis measurement application provides digital demodulation with standard presets

## Capability Comparison – Modular and Handheld

Measurements/ applications	PXI RF VSA	PXI μW VSA	PXIe VXT M9410/11A	PXIe VXT M9421A	CXA-m	FieldFox
AM/FM tune and listen					●	●
Analog demodulation	●	●	●	●	●	●
EMI precompliance					●	
Enhanced display package (spectrogram plus)					●	●
Stimulus/response measurement	●	●				●
Flexible digital modulation analysis	●	●	●	●	●	
MATLAB	●	●	●	●	●	
Noise figure			●	●	●	
Phase noise	●				●	
Pulse	●					●
Real-time spectrum analysis						
<b>Remote language compatibility for:</b>						
856xE/EC and 8566/68						
SCPI language compatibility	●	●			●	●
<b>Cellular Communications</b>						
1xEV-DO	●	●			●	
cdma2000/cdmaOne	●	●	●	●		
GSM/EDGE/EVO	●	●	●	●		
iDEN/WiDEN/MotoTalk						
LTE FDD and TDD	●	●	●	●	●	●
LTE-Advanced FDD and TDD	●	●	●	●	●	
Multi-standard radio (MSR)						
TD-SCDMA/HSPA	●	●			●	
W-CDMA/HSPA+	●	●	●	●	●	
<b>Wireless connectivity</b>						
Bluetooth	● <sup>1</sup>	● <sup>1</sup>	●	●	●	
Fixed WiMAX	●	●				
Mobile WiMAX	●			●		
WLAN 802.11a/b/g/n/ac	●	●	●	●		
ZigBee	● <sup>1</sup>	● <sup>1</sup>				
<b>Digital video</b>						
CMMB						
Digital cable TV						
DTMB (CTTB)						
DVB-T/H/T2						
ISDB-T/T <sub>SB</sub> /T <sub>mm</sub>						
<b>PowerSuite one-button measurements</b>						
Channel power					●	●
Occupied bandwidth					●	●
Multicarrier, multi-offset ACP					●	●
Multicarrier power					●	
CCDF					●	
Harmonic distortion					●	
Burst power					●	
Intermodulation (TOI)					●	
Spurious emissions					●	
Spectrum emission mask					●	●
89600 VSA Software compatible	●	●	●	●	●	●

1. VXA vector signal analysis measurement application provides digital demodulation with standard presets

## Benchtop – X-Series Signal Analysis

It's hard to predict the future, but Keysight can help you shape it with our future-ready test assets. The X-Series is a flexible approach to signal analysis that spans instrumentation, measurements, and software. The X-Series signal analyzers provide a measurement solution for your business and technical requirements across multiple products and programs. The X-Series creates a consistent framework to help progress your projects at a faster pace. Stay ready, stay in sync, and arrive ahead with the Keysight X-Series.

### Future-ready instruments

X-Series signal analyzers can evolve as technology changes. With X-Series instruments, you can expect high performance today and tomorrow without rewriting your test code and optimize between performance and cost for the technologies you're working with. Upgradeable hardware and license-keys allow you to add functionality or measurement applications. Keep your test assets current and extend instrument longevity by taking advantage of the signal analyzer's:

- Upgradeable CPU, memory, solid state drives, I/O ports
- Performance enhancements with Windows 10
- Optional real-time spectrum analysis and bandwidth
- New standard features, including fast sweep (depending on hardware configuration) and enhanced phase noise and third-order intercept (TOI)

### Consistent measurement framework

Proven algorithms, 100% code-compatibility, and a common UI across the X-Series create a consistent measurement framework for signal analysis that ensures repeatable results and measurement integrity through all phases of product development. A common, familiar user-interface means increased efficiency and productivity. When you learn how to use one X-Series analyzer, you know how to use them all.

### Software and applications

Save time and money with a shared library of applications to measure your signals, whether you're engaged in cellular, wireless connectivity, MILCOM, SATCOM, or general-purpose testing. Each application can be easily upgraded as new features and technologies are introduced. With the open Windows OS you can run software such as MATLAB or 89600 VSA.

## UXA N9040B and N9041B

The UXA is the flagship product of the X-Series signal analyzers. By providing a wider, deeper view of wideband and elusive signals, it allows you to take your design farther by measuring small signals in the presence of large signals. It is also ideal for both spurs and interferers. The large streamlined touch-driven screen with flexible measurement displays simplifies measurement setup and analysis. The high-performance wide analysis bandwidth can be combined with real time spectrum analysis (RTSA) and industry-leading phase noise to see the real DUT performance.



- Wide analysis bandwidth spurious free dynamic range allows analysis of radar and wide bandwidth comms signals
- Industry-leading frequency coverage for emerging applications
- Trigger, capture and analyze elusive signals with RTSA and 89600 VSA software
- Standards-compliant SEM or ACLR measurements

	N9040B	N9041B
Maximum frequency	50 GHz	110 GHz
Maximum analysis bandwidth	1 GHz	1 GHz
DANL @ 1 GHz	-174 dBm	-174 dBm
TOI	+22 dBm @ 1 GHz	+22 dBm @ 1 GHz

[www.keysight.com/find/N9040B](http://www.keysight.com/find/N9040B)

[www.keysight.com/find/N9041B](http://www.keysight.com/find/N9041B)

## PXA N9030B

The high-performance PXA signal analyzer is the evolutionary replacement for other performance signal analyzers. Advanced performance, flexibility and expandability enable users to meet demanding applications in aerospace, defense, commercial communications, and more. Remote language compatibility features make it easy to replace existing spectrum analyzers. Adding real-time spectrum analysis (RTSA) capability to new or existing PXAs lets you see, capture and understand the most elusive signals.



- Keysight's exclusive noise floor extension (NFE) technology delivers  $-172$  dBm effective noise floor
- Excellent phase noise performance ( $-132$  dBc/Hz at  $10$  kHz offset) and third-order intercept (up to  $+23$  dBm)
- Analyze the most complex signals with  $510$  MHz analysis bandwidth and upgradable RTSA capability
- Max IQ Baseband input  $40$  MHz

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

## MXA N9020B and N9021B

The midrange MXA is the optimum choice as you develop new wireless devices and deliver them to manufacturing and the marketplace. It has the flexibility to quickly adapt to your evolving test requirements, today and tomorrow. Address multiple formats, generations and devices with the MXA N9020/21B and accelerate in wireless. The MXA's enhanced phase noise, optional wide bandwidth, real-time, and fast sweep capability make the MXA highly versatile.



- Best-in-class phase noise performance ( $-129$  dBc/Hz at  $10$  kHz offset)
- Optional up to  $510$  MHz analysis bandwidth to analyze complex signals within your budget
- Upgradable RTSA capability to capture elusive signals
- Max IQ Baseband input  $40$  MHz

	N9020B	N9021B
Maximum frequency	50 GHz	50 GHz
Maximum analysis bandwidth	160 MHz	510 MHz
DANL @ 1 GHz	$-172$ dBm	$-172$ dBm/Hz
TOI @ 1 GHz	+20 dBm	+21 dBm

[www.keysight.com/find/N9020B](http://www.keysight.com/find/N9020B)

[www.keysight.com/find/N9021B](http://www.keysight.com/find/N9021B)

## EXA N9010B

From RF to millimeter wave, whether you're pushing to enhance a product or improve test throughput, your general-purpose signal analyzer should be ready for a wide range of challenges. That's what drives the Keysight EXA signal analyzer—the fast, flexible way to cover diverse needs with a single tool. With the most recent enhancements in phase noise, dynamic range, and sweep speed, the EXA provides a solid mix of speed and performance and offers the versatility of X-Series measurement applications.



- Widest frequency coverage in its class from 10 Hz to 44 GHz and beyond
- Fast sweep and fast power measurement maximize and enhance yield
- Up to 40 MHz analysis bandwidth

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

## CXA N9000B

A great low-cost signal analyzer surpasses the basics and delivers crucial functionality. That's the strength of the CXA signal analyzer, the leading low-cost tool for essential signal characterization up to 26.5 GHz. Its capabilities provide a foundation for cost-effective testing and seamless integration with the other X-Series models. The CXA is also an excellent teaching tool for RF and microwave technologies and signal analysis.



- Reduce costs and improve throughput in manufacturing test
- Built-in tracking generator for component characterization
- Up to 25 MHz analysis bandwidth

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

## Basic Spectrum Analyzers (BSA)

### BSA N9320B

For the consumer or general-purpose RF electronic devices or components you are manufacturing, spectrum analysis provides essential device performance, characteristics, and interaction information. In today's competitive world, you need dependable and affordable analysis. The N9320B spectrum analyzer is perfect for consumer electronics manufacturing, and bench repair, and provides:

- Fast sweep speed in narrow resolution bandwidths
- AM/FM, ASK/FSK demodulation analysis
- Tracking generator: 100 kHz to 3 GHz

[www.keysight.com/find/N9320B](http://www.keysight.com/find/N9320B)



### BSA N9322C

Given the dynamic nature of RF devices, using the evolutionary N9322C spectrum analyzer is ideal to meet your changing needs. Beyond its feature rich base model, the N9322C supports an array of beneficial capabilities you can add when needed.

- Tracking generator with built-in VSWR bridge
- AM/FM, and ASK/FSK signal analysis
- Signal monitoring with spectrogram recording and playback
- Channel scanner for simultaneous channel power measurement of up to 20 channels

[www.keysight.com/find/N9322C](http://www.keysight.com/find/N9322C)



	N9320B	N9322C
Maximum frequency	3 GHz	7 GHz
DANL @ 1 GHz	-158 dBm/Hz	-162 dBm/Hz
TOI @ 1 GHz	+13 dBm	+15 dBm

## VXT PXIe Vector Transceiver

The modular and scalable VXT vector transceivers have built-in 1.2 GHz signal generation and analysis bandwidth. The VXT is optimized for your manufacturing and DVT applications with an integrated RF source and up to 8x8 MIMO. Other key features include:

- High output power up to >+20 dBm
- Amplitude accuracy  $< \pm 0.5$  dB for both generator and analyzer
- Excellent SSB phase noise –130 dBc/Hz at 1 GHz (10 kHz offset)
- $< 0.3$  % EVM of 100 MHz bandwidth OFDM signal for 5G test
- Frequency extension to cover mmW (FR2) with M1740A mmW Transceiver
- Support multi-channel timing synchronization.



	M9421B	M9410/11A	M9415A
Maximum frequency	6 GHz	6 GHz	12 GHz
Signal generation and analysis bandwidth	1.2 GHz	1.2 GHz	1.2 GHz
DANL @ 1 GHz	–167 dBm	–159 dBm	–159 dBm
TOI @ 1 GHz	+35 dBm	+27 dBm	+25 dBm

## Modular PXI Vector Signal Analyzers

### PXIe RF vector signal analyzer M9391A

The M9391A PXI VSA is optimized for RF device design validation and manufacturing test environments and quickly delivers proven results with fast hardware speed and Pathwave X-Series measurement applications.



- 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
- Easily integrate into test environments with IVI-COM, IVI-C, LabVIEW and MATLAB drivers

[www.keysight.com/find/M9391A](http://www.keysight.com/find/M9391A)

### PXIe performance μW vector signal analyzer M9393A

The M9393A provides Keysight's microwave measurement expertise in modular form. It integrates hardware speed and accuracy with stepped FFT based spectrum analysis to measure harmonics and spurs up to 50 GHz.



- Characterize spurs and harmonics with 27 GHz sweep in 1 second at 10 kHz resolution bandwidth
- Quickly test multiple frequencies with tuning as fast as 135 μs
- Compact multi-channel analysis with up to 4 time-synchronous channels in one 18-slot PXI chassis

[www.keysight.com/find/M9393A](http://www.keysight.com/find/M9393A)

### CXA-m PXIe signal analyzer M9290A

The Keysight CXA-m, a PXIe signal analyzer, offers fully specified performance up to 26.5 GHz in a small, modular format. Manage RF and microwave signals in four slots and leverage your existing code.



- Optimize speed, sensitivity and accuracy with swept and FFT modes
- Reduce system deployment time with drivers and SCPI commands
- Code compatibility simplifies the transition from box instruments to PXI

[www.keysight.com/find/M9290A](http://www.keysight.com/find/M9290A)

	M9391A	M9393A	M9290A
Maximum frequency	6 GHz	50 GHz	26.5 GHz
Maximum analysis bandwidth	160 MHz	160 MHz	25 MHz
DANL @ 1 GHz	-157 dBm	-168 dBm	-163 dBm
TOI @ 1 GHz	+23 dBm	+31 dBm	+16 dBm

## FieldFox Handheld Analyzers

### FieldFox spectrum and combination analyzers

Measuring up and earning a spot in your test kit is the Keysight's FieldFox portable analyzers goal. The analyzers are available in frequencies up to 50 GHz for precision RF and microwave measurements. Every FieldFox operating mode is flexible enough for use by novices and experts alike. You can count on the durability of these handheld analyzers because they are designed to withstand your toughest working conditions.

- Get precision measurements that agree with benchtop results
- Meets MIL-PRF-28800F Class 2 and MIL-STD-810G, Method 511.5, Procedure 1, operation in explosive environments (type tested)
- Meets IP53 dust and water ingress tests (type tested)
- Compact and lightweight (3.0 kg/6.6 lbs.)

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



### FieldFox spectrum analyzers

FieldFox spectrum analyzers are optimized to excel in the dynamic spectral environment seen commonly in the field.

- Frequency coverage up to 50 GHz. With external mixer up to 110 GHz
- Unprecedented amplitude accuracy of  $\pm 0.5$  dB with InstAlign - no warmup required
- 1100 MHz RTSA and 4G/5G demodulation
- Full-band tracking generator and preamplifier



### FieldFox combination analyzers

For maximum functionality, FieldFox combination analyzers integrate the measurement capabilities needed in a single, compact instrument.

- Make measurements quickly with CalReady and QuickCal; no need for a cal kit
- Base is a cable and antenna analyzer; Option 233 adds spectrum analyzer capability
- Optional vector network analyzer capability for full two-port S-parameters

	FieldFox spectrum analyzers	FieldFox combination analyzers
Maximum frequency	50 GHz	50 GHz
Maximum analysis bandwidth	10 MHz	100 MHz
DANL @ 1 GHz	-163 dBm/Hz	-163 dBm/Hz
TOI @ 1 GHz	+10 dBm	+11 dBm

## Vector Network Analyzers

Vector network analyzers measure not only S-parameters but also other parameters. Most modernized network analyzers can now do spectrum analysis to measure spurious and harmonics of active devices: frequency converters, mixers and amplifiers.

- Frequency up to 67 GHz, and up to 1.5 THz with test set controller and frequency extenders
- Spectrum analysis function for spurious and harmonics measurements for active devices: mixers, frequency converters, and amplifiers
- Benchtop, USB, PXI form factors
- Multiport spectrum analysis
- Modulation distortion, EVM, ACPR, and NPR measurements

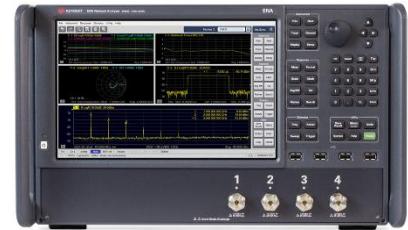
### PNA family microwave network analyzers

PNA family microwave network analyzers (PNA-X, PNA, and PNA-L) are high performance benchtop network analyzers. PNA-X achieves comprehensive active device characterization with the best accuracy leveraging vector correction with a simplified setup with its single-connection-multiple-measurement feature.



### ENA vector network analyzers

ENA Series vector network analyzers provide the right mix of speed and performance for both R&D and production engineers. The E5080B ENA supports spectrum analysis capabilities with the same calibration and measurement science as the PNA family.



### USB vector network analyzers

Keysight Streamline Series USB vector network analyzers such as P500xA Series drastically reduce the size of your test. The instrument in a compact form factor can be easily shared between your test locations.



### PXI vector network analyzers

Keysight PXI vector network analyzers meet the most demanding multiport measurement challenges with a true multiport architecture eliminating the need for external switch matrices. By using the M980xA series PXI VNA, a 53 GHz multiport VNA with up to 50-ports can be configured in a single PXI chassis.



## Modulation Distortion Application

PNA-X Microwave Network Analyzer and M981xAS Series PXI Vector Component Analyzer (VCA) with S9x070B Modulation distortion analysis software perform frequency domain analysis with wideband modulated signal using a vector signal generator and provide EVM, ACPR, and NPR of active devices: amplifiers (PNA-X and M981xAS) and frequency converters (PNA-X),

## Key Specifications Comparison – Vector Network Analyzer

	PNA family	ENA / USB VNA / PXI VNA / PXI VCA
Maximum frequency	PNA/PNA-X 67 GHz (1.5 THz with frequency extenders) PNA-L 50 GHz	53 GHz
Maximum analysis bandwidth	38 MHz	29 MHz
DANL @ 1 GHz	-128 to -135 dBm/Hz (depending on models)	-144 dBm/Hz
TOI @ 1 GHz	+20 to +22 dBm (depending on models)	+22 dBm

## Capability Comparison – Vector Network Analyzer

Measurements/ applications	PNA-X	PNA	PNA-L	ENA	USB VNA	PXI VNA /PXI VCA
Stimulus/response measurement (vector network analysis)	•	•	•	•	•	•
Noise figure	•	•		•	•	•
Modulation distortion analysis in various communication formats	•					•
Pulse	•	•		•	•	•

Refer to the vector network analyzer selection guide for more detailed information about network analyzer capabilities. [Vector Network Analyzer - Selection Guide](#)

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

## Specialized signal analysis

### UXR Oscilloscope

The UXR oscilloscope is a great option for signal analysis offering a very wide bandwidth up to 110 GHz. Up to 4 channels can be used for multi-channel MIMO, delta EVM, angle of arrival, and cross correlation. The UXR also provides BBI/time domain measurements.

### Add – more functionality – signal analysis

The Infiniium UXR is the first real-time oscilloscope to provide flexible bandwidth options, hardware accelerated acquisition and the signal integrity necessary to enable affordable wideband multi-channel mmWave signal analysis. Available mmWave Wideband Analysis Acceleration and Frequency Extension options, coupled with 1 mm input UXR-Series models, enable users to dynamically allocate 5 GHz or 10 GHz wide bandwidth windows for analysis of frequency ranges up to 110 GHz, regardless of the oscilloscopes maximum licensed native bandwidth. Additionally, all Infiniium UXR models come standard with 40 MHz of hardware accelerated real-time Digital Down Conversion1 (DDC) – with the option to expand to 160 MHz and >2 GHz of analysis bandwidth. With Infiniium UXR, you get world-leading digital and mmWave performance in a single instrument with up to four phase coherent channels – enabling you to more quickly deliver next generation mmWave technologies, pulsed radar, integrated mixed signal designs, spread spectrum clocking (SSC), and advanced wideband research and development.



## Applications and Measurement Software

## Choosing Measurement Software and Applications

Pathwave Vector Signal Analysis (89600 VSA) software is a comprehensive set of tools for demodulation and vector signal analysis. These tools enable you to explore virtually every facet of a signal and optimize your most advanced designs. Use the 89600 VSA software with a variety of Keysight hardware platforms to pinpoint the answers to signal problems in R&D.

X-Series measurement applications provide embedded format-specific, one button measurements for X-Series and modular analyzers. With fast measurement speed, SCPI command programmability, pass/fail testing and simplicity of operation, these applications are ideally suited for design verification and manufacturing.

## PathWave Vector Signal Analysis (89600 VSA)

The PathWave vector signal analysis (VSA) software provides a high-resolution FFT-based spectrum, time and modulation domain analysis. More than 75 signal standards and modulation types, found in cellular, wireless-connectivity, aerospace defense and general-purpose applications, are supported by the VSA software. The 89600 VSA software is an essential tool in every stage of your design, from simulation to production, baseband and RF.



## General purpose

Digital demodulation, Custom IQ, Custom OFDM, channel quality analysis

## *Cellular communication*

5G NR, LTE/LTE-Advanced FDD/TDD, NB-IoT, 1xEV-DO, cdma2000, TD-SCDMA/HSPA, W-CDMA/HSPA+

## Wireless connectivity

WLAN 802.11, WiMAX, HRP UWB (802.15.4/4z), RFID

## *Aerospace and defense*

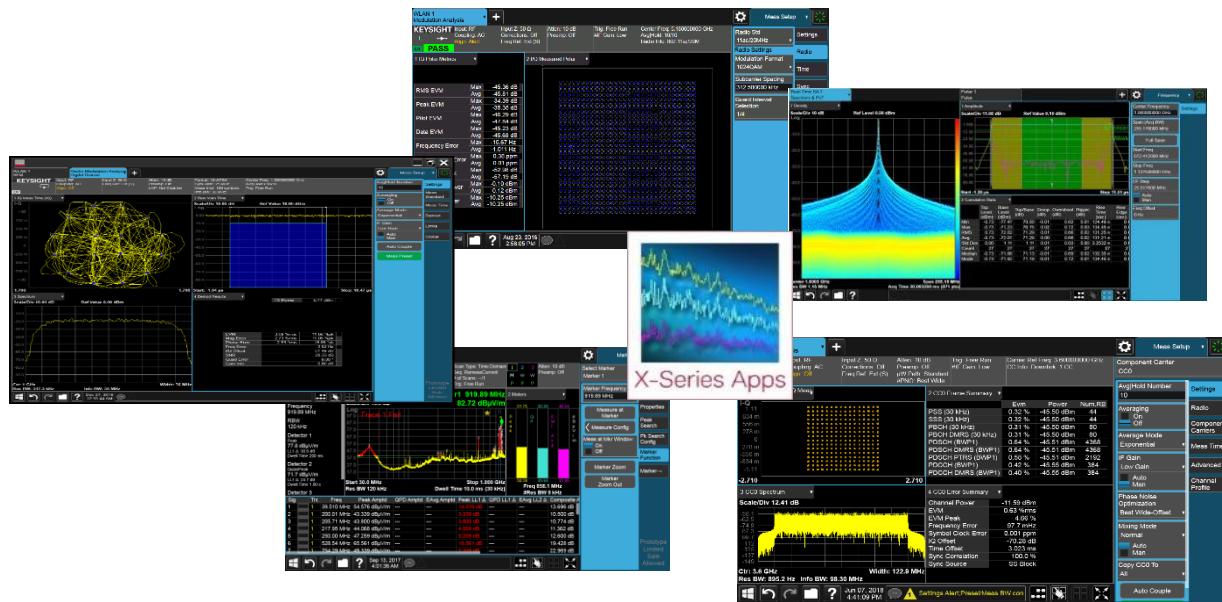
## Pulse analysis, FMCW

## *Automotive and broadcasting*

## DOCSIS 3.1, 802.11p, FMCW

89600 VSA: [www.keysight.com](http://www.keysight.com)

## PathWave X-Series Measurement Applications



PathWave X-Series measurement applications increase the capability and functionality of your Keysight signal analyzer to speed your time to insight. They provide essential measurements for more than 40 standards or modulation types. The applications are identical across all of the analyzers, including benchtop and modular. The only difference is the level of performance achieved by the hardware you select. Choose the level of performance necessary for your application and have full assurance that the calculations and algorithms are the same across your signal analyzers, from development into manufacturing.

### General purpose

Analog demodulation, EMI, FM stereo/RDS, MATLAB, noise figure, phase noise, pulse, remote language compatibility, SCPI language compatibility, VMA vector signal analysis (digital demodulation and Custom OFDM)

### Cellular communication

5G NR, LTE/LTE-A FDD/TDD, NB-IoT/eMTC, 1xEV-DO, cdma2000, TD-SCDMA/HSPA, W-CDMA/HSPA+, GSM/EDGE/EVO, MSR

### Wireless connectivity

Bluetooth, WLAN 802.11, WiMAX, 802.15.4 (BPSK and O-QPSK), Z-Wave (ITU G.9959), LoRa™ CSS

### Aerospace and Defense

Pulse analysis, measuring receiver, avionics, radio test

### Digital video

CMMB, digital cable TV, DTMB (CTTB), DVBT/H/T2-lite, ISDB-T/Tb/T<sub>SB</sub>/T<sub>mm</sub>

[www.keysight.com/find/X-Series\\_apps](http://www.keysight.com/find/X-Series_apps)

## Migration from Legacy Spectrum Analyzers

Whether you are working in the aerospace and defense or communications industries, technologies change but one thing stays the same: the need to ensure readiness of your test system.

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 X-Series signal analyzers were designed as evolutionary replacements to their in-class benchtop predecessors. Take advantage of the X-Series' performance, flexibility, speed, modern connectivity, and backward compatibility in replacing the legacy HP/Keysight spectrum analyzers to achieve seamless migration and avoid the need to rewrite test software.

Which migration path is right for you?

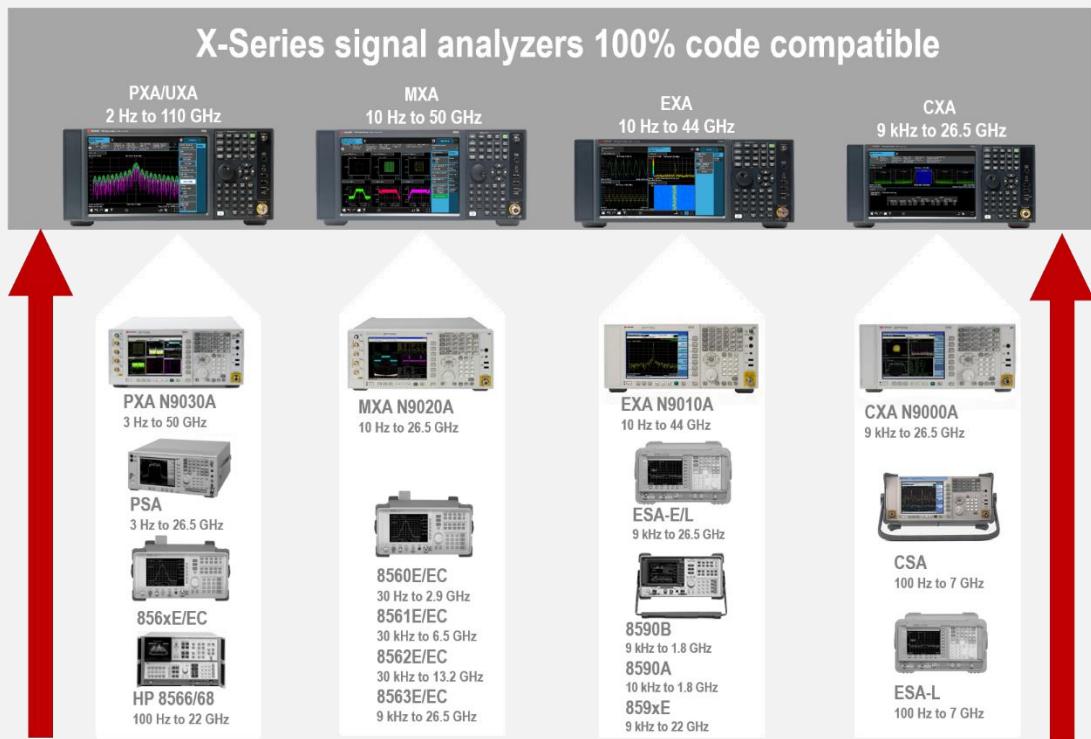
Visit our signal analyzer migration page to learn more about migrating from legacy spectrum analyzers to the X-Series signal analyzer that's right for you.

[www.keysight.com/find/SA\\_migration](http://www.keysight.com/find/SA_migration)

If you are interested in moving to a handheld spectrum analyzer, please visit

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

If you are considering converting your test systems to modular, please visit [www.keysight.com/find/pxi](http://www.keysight.com/find/pxi)



Learn more at: [www.keysight.com](http://www.keysight.com)

For more information on Keysight Technologies' products, applications or services, please contact your local Keysight office. The complete list is available at: [www.keysight.com/find/contactus](http://www.keysight.com/find/contactus)

