Keysight Vector Signal Analysis (89600 VSA)

Vector signal analysis base platform and hardware connectivity

89601200C – Legacy Advanced Tier (VSA2019 U1 or Above)

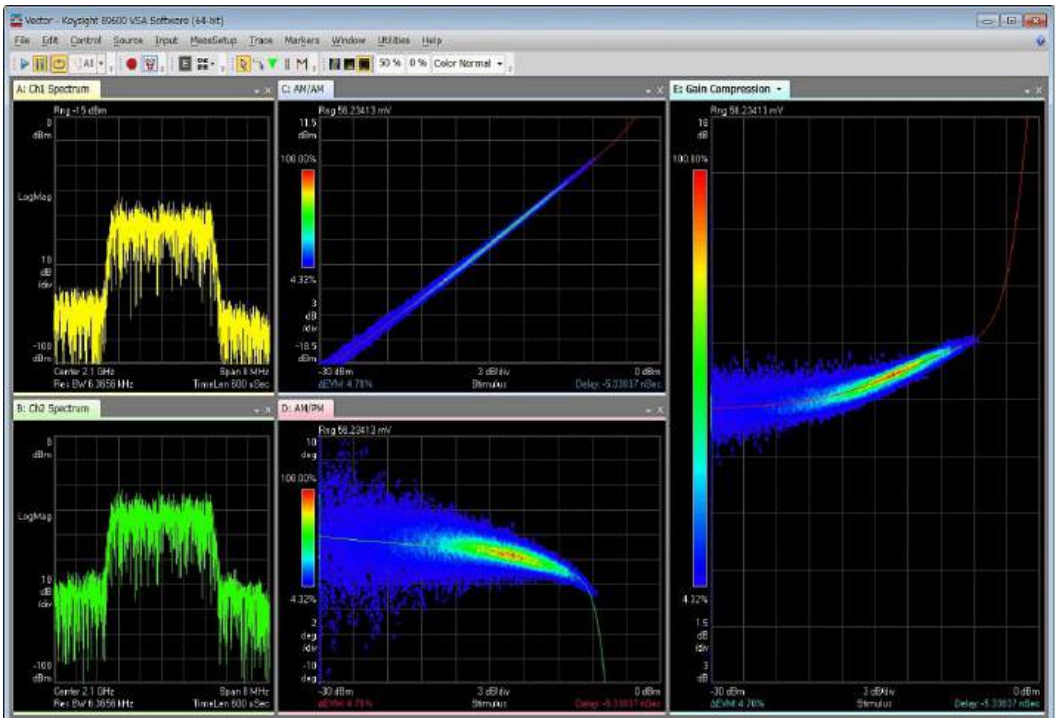
89601201C – Advanced Tier (VSA2025 U1 or Above)

89601202C – Standard Tier (VSA2025 U1 or Above)

89601203C – Essentials Tier (VSA2025 U1 or Above)

89601201U – Upgrade to Advanced (VSA2025 U2 or Above)

89601202U – Upgrade to Standard (VSA2025 U2 or Above)



Unleash the Power of Signal Analysis with Keysight Vector Signal Analysis (89600 VSA) Software

In today's rapidly evolving wireless landscape, engineers need powerful, flexible tools to tackle complex signal analysis challenges. Keysight's 89600 VSA software delivers unparalleled insight into virtually every facet of modern signals, empowering you to optimize your most advanced designs with confidence.

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Key Features

- Comprehensive signal analysis in time, frequency, and modulation domains
- Support for over 400+ hardware models, plus integration with leading simulation tools
- Flexible carrier aggregation and multi-measurement capabilities
- Advanced power amplifier characterization
- Intuitive multi-trace and multi-marker interface
- Channel quality measurements with wide-band multi-tone stimulus
- Signal recording and playback for in-depth analysis
- Streamlined instrument management within the VSA application
- Event-based actions for automated test sequences
- Extensive automation options: .NET, SCPI, MACRO, and more
- Rich programming examples in multiple languages and tools in C, C#, VB, Python, SCPI, LabView, MATLAB, VEE and Macros

Basic vector signal analysis options 8960120xC (including legacy option 89601200C, and new tiered options 89601201C, 89601202C, 89601203C) provides the foundation of the tools and user interface that make up Keysight Vector Signal Analysis (VSA) software. Explore virtually every facet of today's most complex signals with views of time, frequency and modulation domains. Benefit from the flexible GUI capabilities: arbitrary arrangement and sizing of unlimited display traces, each with unlimited markers. Powerful display formats, signal recording and playback, and detailed Help text provide the insight needed for analyzing signals.

Use Keysight Vector Signal Analysis (VSA) in simulation with sink and source components providing real-time, interactive analysis of results. Co-simulation is available with Keysight Technologies. Keysight EEsof EDA Advanced Design System (ADS) and SystemVue ESL as part of Option 8960120xC

Hardware connectivity, now part of Option 8960120xC, allows Keysight Vector Signal Analysis (VSA) to be linked to over 400 Keysight instrument model numbers. Choose the right instrument for your application and apply vector signal analysis across your mixed signal design. Use the 89600 VSA software for consistent, comparable results at simulation, prototype and design-validation stages of development.

Power spectrum measurements, now included in the Basic VSA Option 8960120xC (formerly Option 89601B-SSA), allow users to perform fast spectrum measurements when paired with PXIe VSA M9393A or M9391A. See document 5991-4582EN for the more information. These measurements offer capabilities such as FFT-based power spectral density, occupied bandwidth, and complementary cumulative distribution function (CCDF), giving users a solid foundation for analyzing signal power across frequency.

For more specialized power analysis, the PowerSuite Option 89601PSMC expands these capabilities to include advanced measurements like Spectrum Emission Mask (SEM) and Adjacent Channel Power (ACP). PowerSuite emulates the functionality of a dedicated spectrum analyzer, enabling the ability to check regulatory compliance in some standards. This emulation is achieved by processing time-domain IQ data to match frequency domain requirements, providing the flexibility to meet complex testing needs. Refer to document 3121-1438EN for more on PowerSuite capabilities.

These options work together to provide 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. As you assess the tradeoffs, Keysight Vector Signal Analysis (VSA) helps you see through the complexity.

Try before you buy!

Download Keysight Vector Signal Analysis (VSA) software and use it free for 30 days to make measurements with your analysis hardware, or use our recorded demo signals by selecting File > Recall > Recall Demo > Signals on the software toolbar. Request your free trial license today: www.keysight.com/ find/89600_trial

Vector signal analysis

Today's wide-bandwidth, vector-modulated (also called complex or digitally modulated), time-varying signals benefit greatly from the capabilities of FFT analysis and other DSP techniques. Vector signal analysis offers fast, high-resolution spectrum measurements, demodulation, and advanced time-domain analysis. It is especially useful for characterizing burst, transient, or modulated signals used in communications, video, broadcast, radar, and ultrasound imaging applications.

PathWave Vector Signal Analysis (VSA) is fundamentally a digital system that uses data and mathematical algorithms to perform analysis. All it requires is sampled data from an instrument, software, or digital bus. As a larger portion of wireless designs becomes digital, PathWave Vector Signal Analysis (VSA) software is uniquely suited to provide signal analysis for these complex systems.

PathWave Vector Signal Analysis (VSA) running on a PC uses a measurement "front- end" or data acquisition subsystem to provide formatted sampled data. The front-end performs the following functions: connection to the device under test, signal digitizing, signal capture capability, and data transfer to the PC in a sequential stream of data blocks. Once the data blocks are available, PathWave Vector Signal Analysis (VSA) software is able to perform all vector and modulation analysis functions.

Tiered Options for 89600 VSA Base Platform

Starting with VSA 2025 U1 release, the 89600 VSA software introduces three tiered options designed to balance cost and capability for a wide range of measurement needs. Whether you're managing a large lab, validating mobile devices, or developing advanced radar systems, these tier options provide scalable solutions for your specific requirements at least one of them is required to run 89600 VSA base platform.

Essentials Tier (89601203C):

- Optimized for mobile device testing, legacy WLAN, 5G NR FR1 compliance testing, and general RF design
- Covers frequencies up to 8 GHz with 160 MHz analysis bandwidth
- Supports single-carrier measurements, including I+Q using two physical inputs
- Ideal for individual test stations or dedicated application focus

Standard Tier (89601202C or 89601203C with 89601202U):

- Tailored for satellite communications, UWB, 5G NR FR2, WLAN, radar systems, and multi-channel applications
- Extends frequency range to 55 GHz with 2.16 GHz analysis bandwidth
- Supports up to 4 simultaneous measurements for efficient test sequencing
- Support up to 4 parallel VSA instances
- Includes source control and system calibration capabilities
- Enables phase-coherent measurements across channels, depending on hardware
- 89601203C essential tier can post upgrade to standard tier together with 89601202U, which will extend the capabilities from Essential to Standard.

Advanced Tier (89601201C or 89601202C with 89601201U):

- Designed for research labs, aerospace and advanced technology development
- No frequency or bandwidth limitations for cutting-edge applications
- Up to 64 measurement channels for complex MIMO and beamforming analysis
- Support up to 512 parallel VSA instances
- Full flexibility for large, shared lab environments
- 89601202C standard tier can post upgrade to advanced tier with 89601201U, which will extend the capabilities from Standard tier to Advanced tier.

For existing users, the legacy 89601200C license seamlessly transitions into the Advanced tier (89601201C), providing the same robust capabilities and measurement flexibility. It is fully compatible with VSA software version 2019 U1 or above, including those released prior to and following the VSA 2025 U1 update. This ensures continuity for existing users while offering access to the latest features.

Note that the newly introduced tiered options (89601201C, 89601202C, and 89601203C) require VSA 2025 U1 or later. 89601201U and 89601202U post upgrade requires VSA2025 U2 or later. For detailed guidance on compatibility and transition planning, contact your Keysight representative or visit www.keysight.com/find/89600.

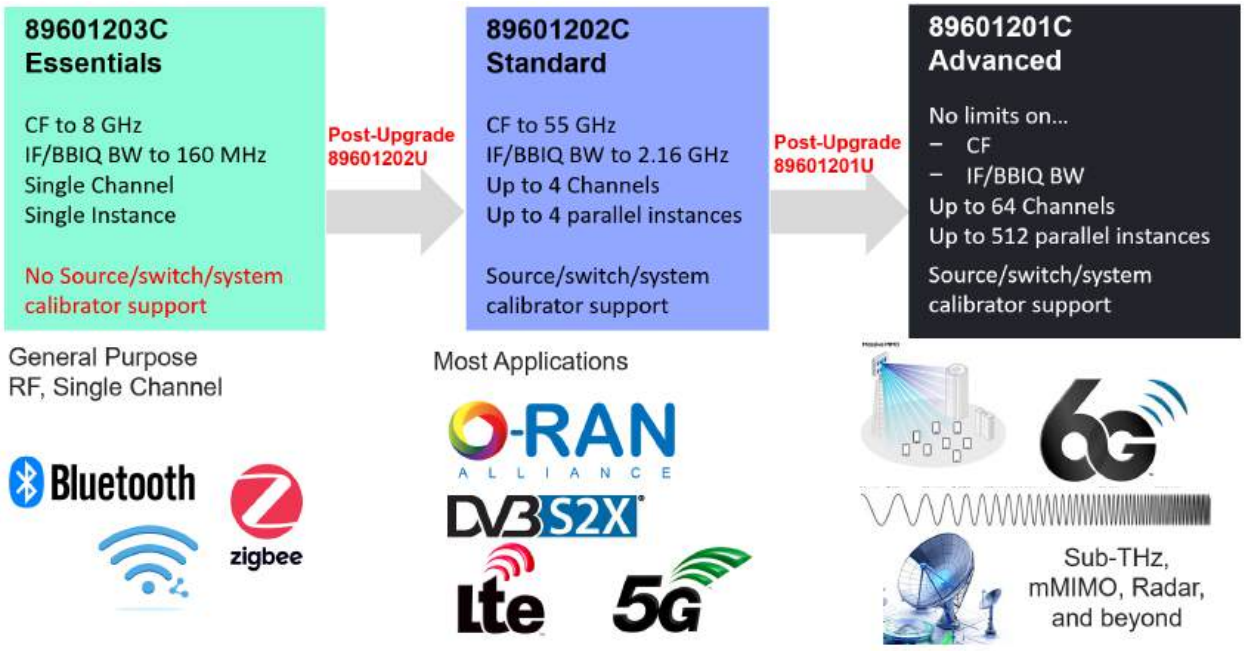


Figure: 89600 VSA tiered options definition and recommendation by applications

How to Choose the Right Hardware and VSA Tier

The figure above illustrates the 89600 VSA software's tiered options. When selecting your configuration, consider these factors:

1. **Center Frequency Requirements**
   - Applications below 8 GHz (e.g. 5G FR1, WLAN, general RF design): **Essentials Tier**
   - Applications between 8-55 GHz (e.g. satellite, radar, 5G FR2): **Standard Tier**
   - Applications above 55 GHz (e.g. sub-THz, optical modulation analysis, automotive radar): **Advanced Tier**
2. **Bandwidth Considerations**
   - Essentials tier's 160 MHz bandwidth supports most general RF and FR1 applications
   - Standard tier extends to 2.16 GHz for wider bandwidth applications
   - Advanced tier removes bandwidth restrictions for the most demanding applications
3. **Channel Count and MIMO**
   - Single-channel measurements are supported by any tier
   - Multi-channel applications up to 4 channels are supported by Standard tier
   - Applications requiring more than 4 channels need Advanced tier

5G NR FR1 Design

Key Requirements:

- Frequency: 450 MHz - 6 GHz
- Bandwidth: ≤ 100 MHz
- Single carrier analysis

Recommended:

Hardware: MXA N9020B

Tier: Essentials (89601203C)

Satellite Communications

Key Requirements:

- X/Ku/Ka-band (up to 40 GHz)
- Moderate bandwidth
- Multiple channels

Recommended:

Hardware: PXA N9030B

Tier: Standard (89601202C)

mmWave Research

Key Requirements:

- Frequencies > 55 GHz
- Wide bandwidth analysis
- Multiple channels/MIMO

Recommended:

Hardware: UXA N9042B+V3050A

Tier: Advanced (89601201C)

The examples above illustrate common hardware and tier combinations. Your specific requirements may vary - consult with your Keysight representative for detailed configuration guidance. The table below can be referred for basic vector signal analysis tiered option configuration recommended by Keysight hardware.

For a complete list of supported hardware configurations, visit www.keysight.com/find/89600_hardware

Table: 89600 VSA Recommended Basic Vector Analysis with Tiered Options By Hardware Models

Hardware model	Max frequency	Max bandwidth	Max channels	VSA tiered option
UXA N9042B	75 GHz	4 GHz	1	89601202C (Recommend) 89601201C (Freq>55 GHz or BW>2 GHz)
UXA N9042B+V3050A	110 GHz	4 GHz	1	89601201C (Recommend)
UXA N9041B	110 GHz	1 GHz	1	89601201C (Recommend)
UXA N9040B	50 GHz	1 GHz	1	89601202C (Recommend)
PXA N9032B	55 GHz	2 GHz	1	89601202C (Recommend)
PXA N9030A/B	50 GHz	2 GHz	1	89601202C (Recommend)
MXA N9021B	50 GHz	510 MHz	1	89601202C (Recommend)
MXA N9020A/B	50 GHz	160 MHz	1	89601202C (Recommend)
EXA N9010A/B	44 GHz	40 MHz	1	89601203C (Recommend) 89601202C (Freq>8 GHz)
CXA N9000A/B	26.5 GHz	25 MHz	1	89601203C (Recommend) 89601202C (Freq>8 GHz)
CXA-m M9290A	26.5 GHz	25 MHz	1	89601203C (Recommend) 89601202C (Freq>8 GHz)
PXE N9048B	44 GHz	40 MHz	1	89601202C (Recommend)
MXE N9038B	44 GHz	160 MHz	1	89601202C (Recommend)
PXI VXT M9421A/1xA PXI VXT M941xE	26.5GHz	1.2 GHz	8	89601202C (Recommend) 89601201C (MeasChannel >4)
PXI VSA M9391A/M9393A	27 GHz	160 MHz	4	89601202C (Recommend)
Radio Test Set M8920A/B	26.5 GHz	1.2 GHz	1	89601202C (Recommend)
OMA N4391B	110 GHz	110 GHz	4	89601201C (Recommend)

Hardware model	Max frequency	Max bandwidth	Max channels	VSA tiered option
UXR	110 GHz	110 GHz 2.16 GHz (DDC) 320MHz (RTSA)	4	89601202C (Recommend) 89601201C (Freq>55 GHz, BW >2.16 GHz or MeasChannel>4)
MXR	6 GHz	6 GHz 2 GHz (DDC) 320MHz (RTSA)	8	89601202C (Recommend) 89601201C (BW>2.16 GHz or MeasChannel>4)
EXR	6 GHz	6 GHz	8	89601202C (Recommend) 89601201C (MeasChannel >4)
InfiniiVision HD3	1 GHz	1 GHz	4	89601203C (Recommend)
FieldFox N99xxA	54 GHz	100 MHz	1	89601202C (Recommend)
PNA N52xxB	120 GHz	10 MHz	1	89601202C (Recommend) 89601201C (Freq>55 GHz)
ENA E508xA/B	53 GHz	10 MHz	1	89601202C (Recommend)
PXI NA M980xA	53 GHz	10 MHz	1	89601202C (Recommend)
Streamline USB VNA P50xxA	53 GHz	10 MHz	1	89601202C (Recommend)
UXM E7515A/B	49.2 GHz	800 MHz	8	89601202C (Recommend) 89601201C (MeasChannel >4)
EXM E6640A	6 GHz	160 MHz	8	89601202C (Recommend) 89601201C (MeasChannel >4)
Wireless Test Set E6680E	7.3 GHz	800 MHz	4	89601202C (Recommend)
5G Multi-band Vector Transceiver S9110A/E, S9115A	49 GHz	1.2 GHz	2	89601202C (Recommend)

Analysis and Troubleshooting

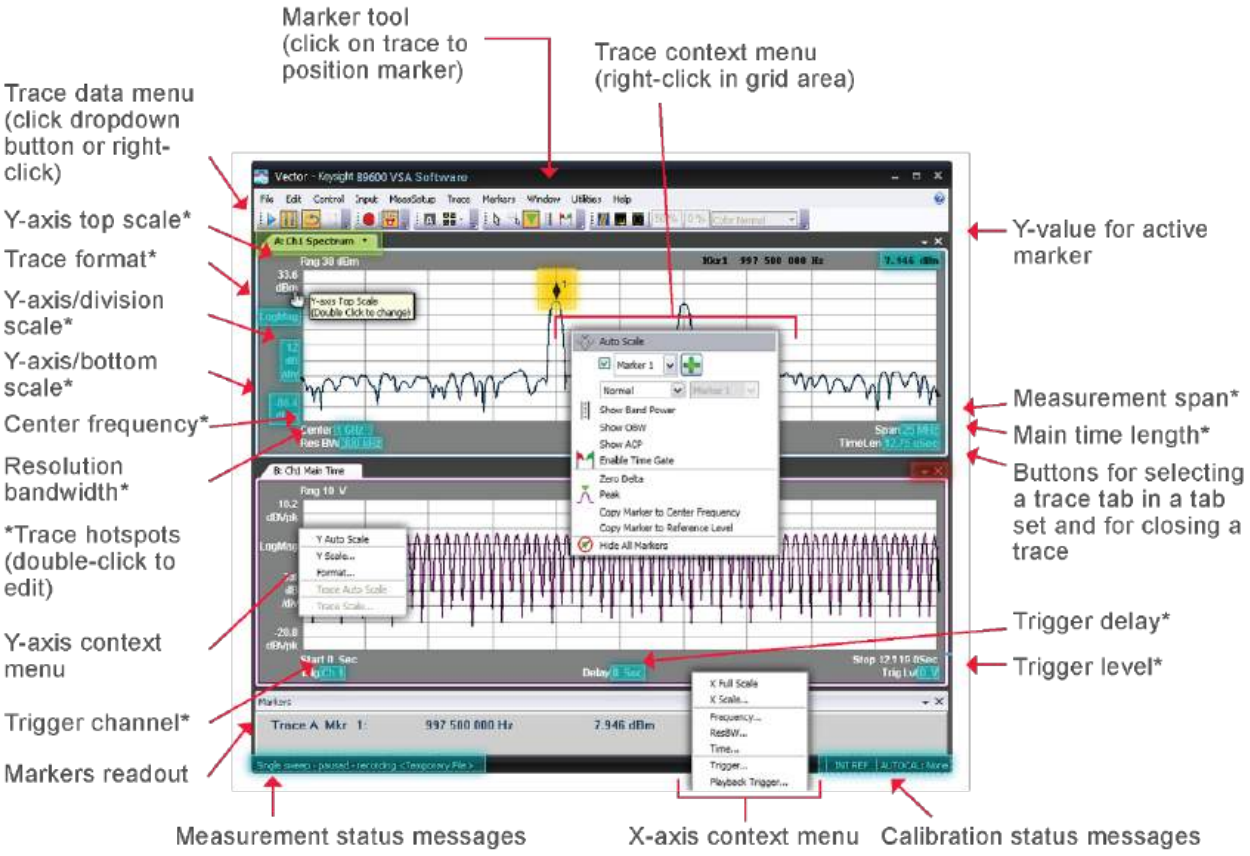
Streamline your workflow with VSA's Intuitive GUI

PathWave Vector Signal Analysis (VSA) software offers a sophisticated yet user-friendly interface designed to simplify complex measurement tasks. With a suite of interactive features, PathWave VSA enables you to quickly set up measurements, analyze data, and personalize your workspace for maximum efficiency.

Interactive trace hotspots

Easily adjust parameters on the go with PathWave VSA's interactive hotspots. Hover over any trace display "hotspot" to bring up a hand cursor and an instant message describing the parameter. You can modify values directly by:

- **Scrolling** with your mouse for incremental changes.
- **Typing** in a numeric value for precise adjustments.
- **Selecting** options from a drop-down menu tailored to the parameter.



Context-sensitive menus for quick access

Right-click within the trace display to access a menu of commonly used tools, such as Y-autoscale. This context-sensitive menu lets you perform frequent tasks with a single click, so you can focus on your analysis rather than navigating through multiple menus.

One-button toolbar for key functions

PathWave VSA's toolbar provides quick access to the most commonly used functions, including:

- Auto-range for automatic input range adjustment.
- Record to capture signals for later analysis and playback.
- Start/Stop measurement control to efficiently manage signal acquisition.
- Special Markers for pinpointing specific data points within the signal.
- Macros for executing predefined or custom sequences, saving you valuable time on repetitive tasks.

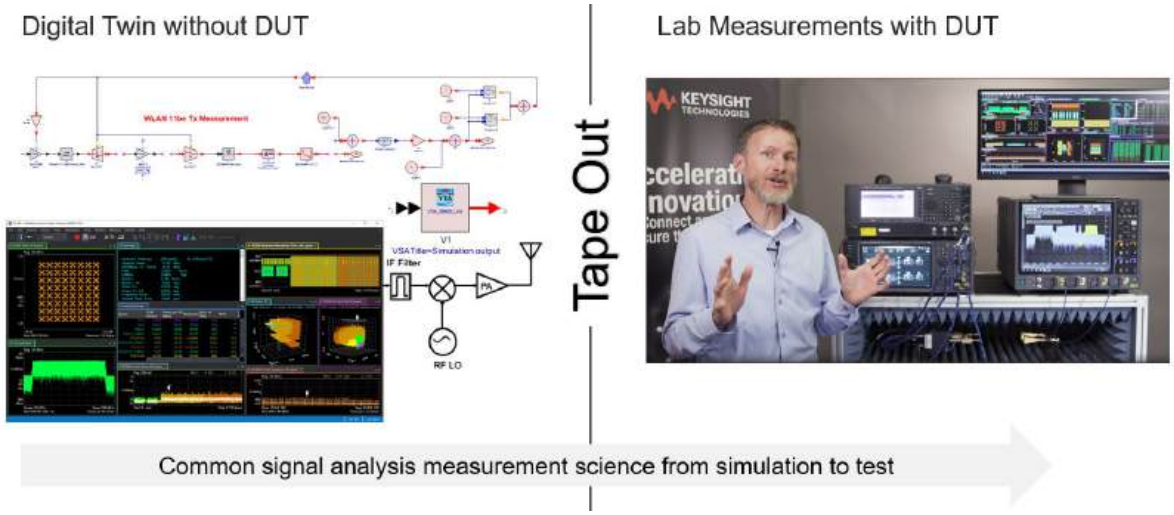
Customize your workspace

With PathWave VSA, you can tailor the GUI to fit your needs. Arrange traces in various layouts, apply color coding for easy identification, and take advantage of toolbar customization to create a workspace that matches your workflow:

- Drag-and-Drop functionality allows you to rearrange toolbar icons, add or remove buttons, and set up your own custom toolbar layout.
- Macro Icon Bar provides dedicated space for frequently used macros, making it easy to access automated routines at any time.

Consistent signal analysis, from simulation to production

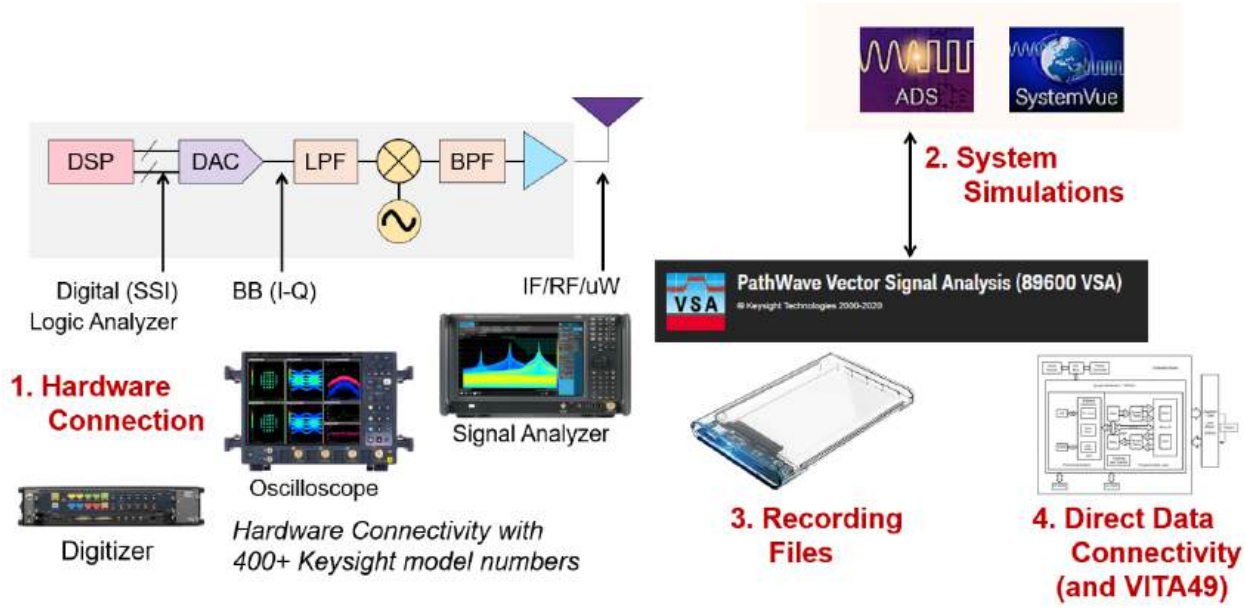
The VSA provides unmatched flexibility with a single floating license, enabling seamless integration across your entire design workflow—from simulation-based analysis to lab measurements. This approach allows you to apply consistent, reliable measurement science at every stage, reducing development time and improving accuracy as you move from digital twin simulations to hardware testing.



In the **digital twin** stage, use PathWave VSA to analyze and visualize simulated results, gaining early insight into your design's performance. When you're ready for hardware testing, select the measurement instruments best suited to your needs and apply the same trusted VSA algorithms to your physical device under test. Thus, you can move confidently through each stage of the development lifecycle, knowing that your measurement science remains consistent, whether you're working with simulated models or real-world hardware.

Unified hardware integration

PathWave 89600 VSA software provides the flexibility to connect with over 45 different instrument platforms, including signal analyzers, oscilloscopes, logic analyzers, and modular instruments—all within a single, unified GUI. This consistency across platforms reduces the learning curve, allowing you to focus on measurement tasks rather than adjusting to different interfaces. Whether connecting via GPIB, LAN, USB, PXI interface, or running VSA directly on PC-based instruments, you have a seamless experience regardless of the hardware. For a list of currently supported products, go to www.keysight.com/find/89600_hardware.

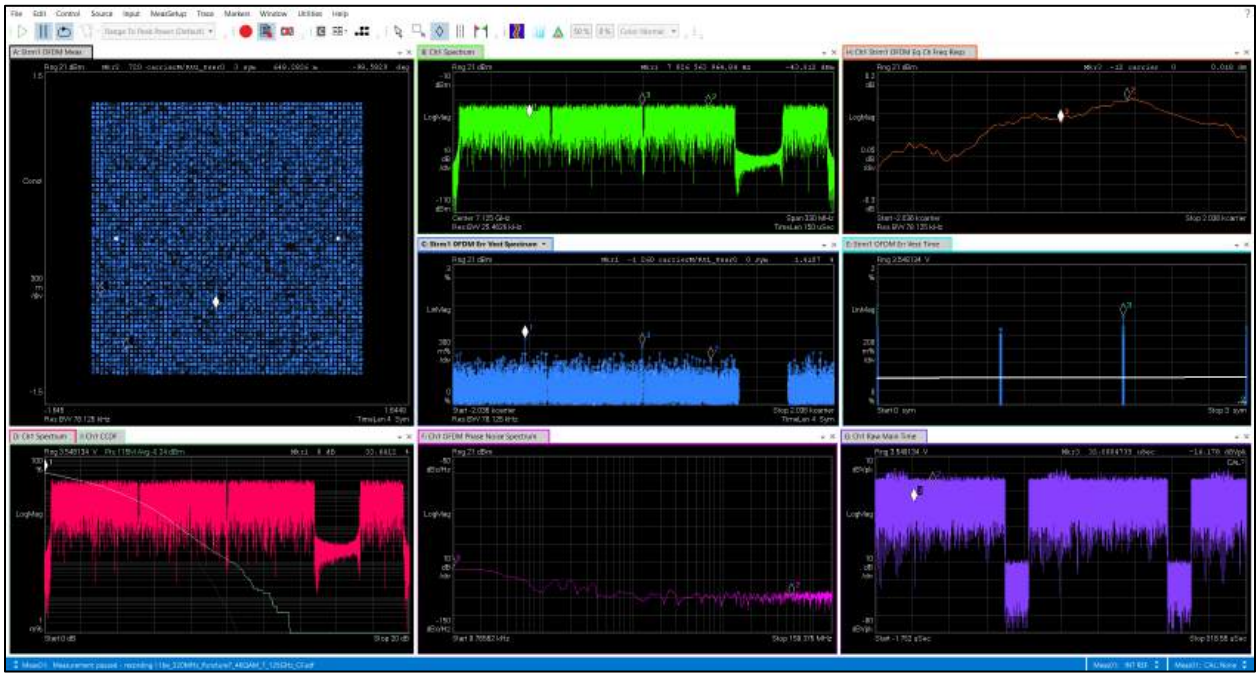


As shown in the above figure, the VSA furthermore supports IQ data from system simulations, recording files of many different types and direct data connectivity (with option 89601101C) from your own digitizers or custom hardware.

With the new **Instrument Manager Tab** under *Utilities* > *Hardware*, managing instrument connections has never been easier. The Instrument Manager replaces the previous VSA IO Connections utility and simplifies the process of adding, deleting, and ignoring instrument connections directly within the VSA software. Upon starting up or clicking the Rediscover Instruments button, the VSA software will automatically discover all configured instruments except those marked to be ignored, allowing you to keep connections for future use while focusing on your current measurement needs. You can also include instruments from VISA, managed through Keysight Connection Expert, in your discovery process, making it simple to integrate a wide range of setups into one workspace.

Display unlimited traces with flexible management

PathWave Vector Signal Analysis (VSA) software offers a powerful trace management system, allowing you to display an unlimited number of traces and arrange them with complete flexibility. Customize each trace window's shape and size to maximize data visibility, and assign any measurement to any trace, making it easy to compare and analyze different aspects of your signal side-by-side. The software supports unlimited markers per trace, enabling you to precisely highlight areas of interest and gain a deeper understanding of signal behavior.

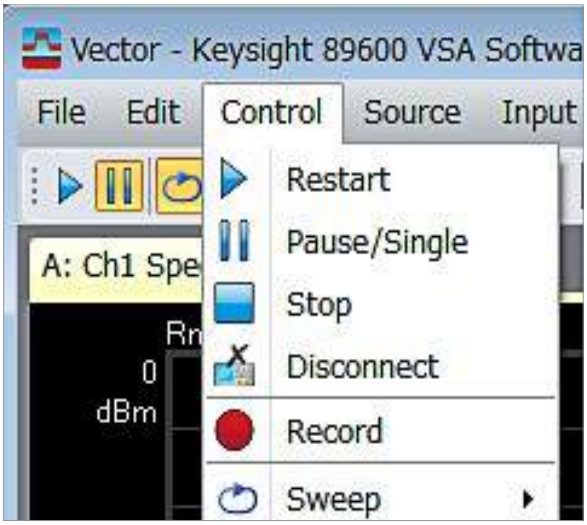


The **docking manager tool** provides drag-and-drop functionality, so you can position traces wherever they're needed within the display window. This includes the ability to create multiple display windows across one or more monitors, which is especially useful for managing large data sets or complex multi-channel measurements. PathWave VSA also allows you to overlay related traces, hide unnecessary ones, and undock windows for seamless desktop placement, enabling you to organize your workspace exactly how you want it.

Additionally, **coupled markers** offer synchronized analysis across multiple traces. When markers are coupled, moving a marker in one trace will automatically adjust the corresponding marker in other traces, making it easy to link observations across time, frequency, and modulation domains. This feature is invaluable for troubleshooting—such as correlating peaks in the frequency domain with specific symbols in the time domain—or for gaining a holistic view of your signal by exploring inter-domain relationships. PathWave VSA's trace management tools empower you to visualize and interpret complex signals with greater clarity, efficiency, and precision.

Record, replay, and analyze with precision

PathWave Vector Signal Analysis (VSA) software provides powerful signal recording capabilities, enabling you to capture and replay signals as if they were live measurements. This functionality is invaluable in early R&D, allowing you to record transient events, compare design iterations, and collaborate seamlessly with remote colleagues—all within a user-friendly interface.



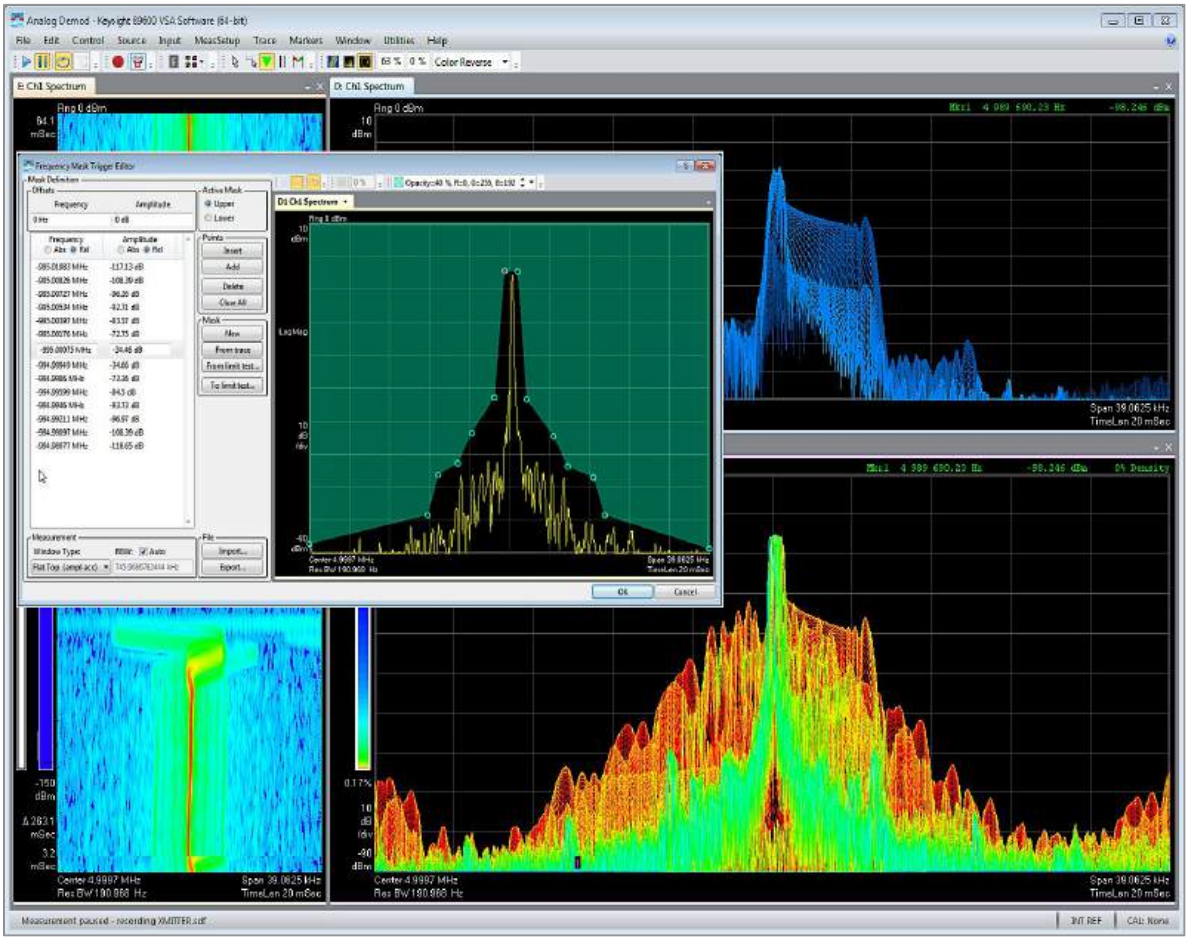
Key features

- Capture Transient Events: Record elusive signal glitches, interfering signals, and other transient events, replaying them as often as needed for detailed analysis. This enables you to troubleshoot issues that are difficult to catch in real-time.
- Design Iteration Comparisons: As your design evolves, PathWave VSA makes it easy to assess changes by loading and comparing signals recorded at different stages. You can quickly identify improvements or regressions.
- Remote Collaboration: Share recorded signals with your team, no matter where they are. Alongside the settings file, recorded signals facilitate collaborative analysis, accelerating problem resolution.

Leverage advanced tools like overlap processing to slow down your measurement playback; segmented capture to focus on active portions of signals and advanced triggering enabling you to capture signal epochs demarcated by external triggers. With VSA, you have the flexibility to analyze recorded signals as though they were live, applying all available measurement tools to characterize and troubleshoot with confidence. Whether you're working on early-stage designs or refining an established product, PathWave VSA's signal recording and analysis capabilities empower you to achieve reliable, accurate results.

Captured elusive signal events with advanced visualization and triggering

PathWave Vector Signal Analysis (VSA) software equips you with advanced tools to visualize and capture even the most fleeting signal events. Sophisticated displays like digital persistence, cumulative history, and spectrograms allow you to track signal amplitude and frequency behavior over time, revealing patterns that may go unnoticed in real-time monitoring. The **digital persistence** display mimics the fading effect of an analog oscilloscope, making it easy to spot amplitude and frequency changes. **Cumulative history** provides a color-coded view of signal activity, where denser colors represent more frequent occurrences, helping you quickly identify common states. The **spectrogram** offers a three-dimensional perspective, with time on the x-axis, frequency on the y-axis, and color intensity indicating signal amplitude, giving you a complete picture of your signal dynamics.

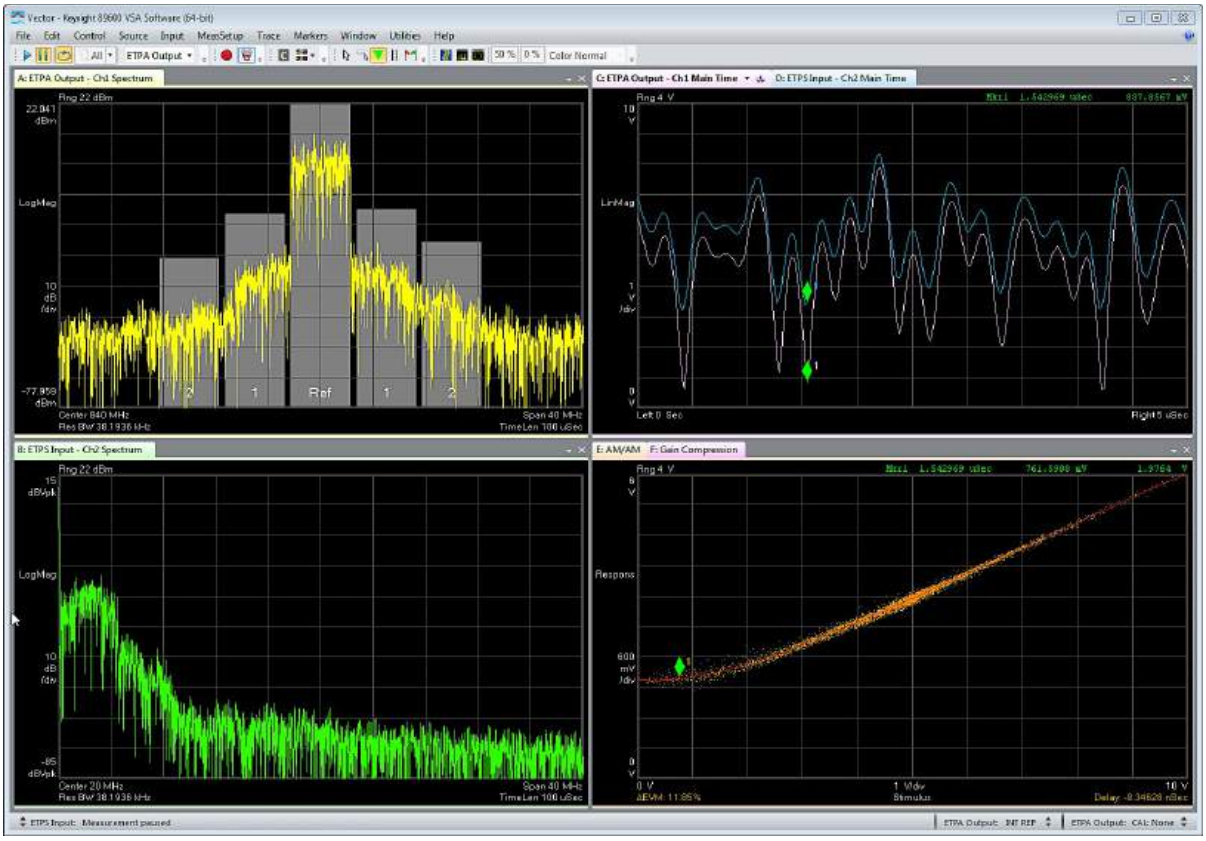


For capturing elusive or transient signals, PathWave VSA offers a range of flexible triggering options. Use a magnitude trigger to initiate measurements when signal amplitude crosses a threshold, or an external trigger to synchronize with external events or equipment. The frequency mask trigger (FMT), available with real-time-enabled UXA, PXA, and MXA analyzers, allows you to define a frequency range and trigger events based on whether the signal enters or leaves that range. To tackle complex scenarios, combine triggers—such as time-qualified and IF magnitude triggers with FMT — ensuring that only signals meeting all your specified criteria initiate measurements or recordings.

Characterize AM, FM, and PM and amplifiers/mixers

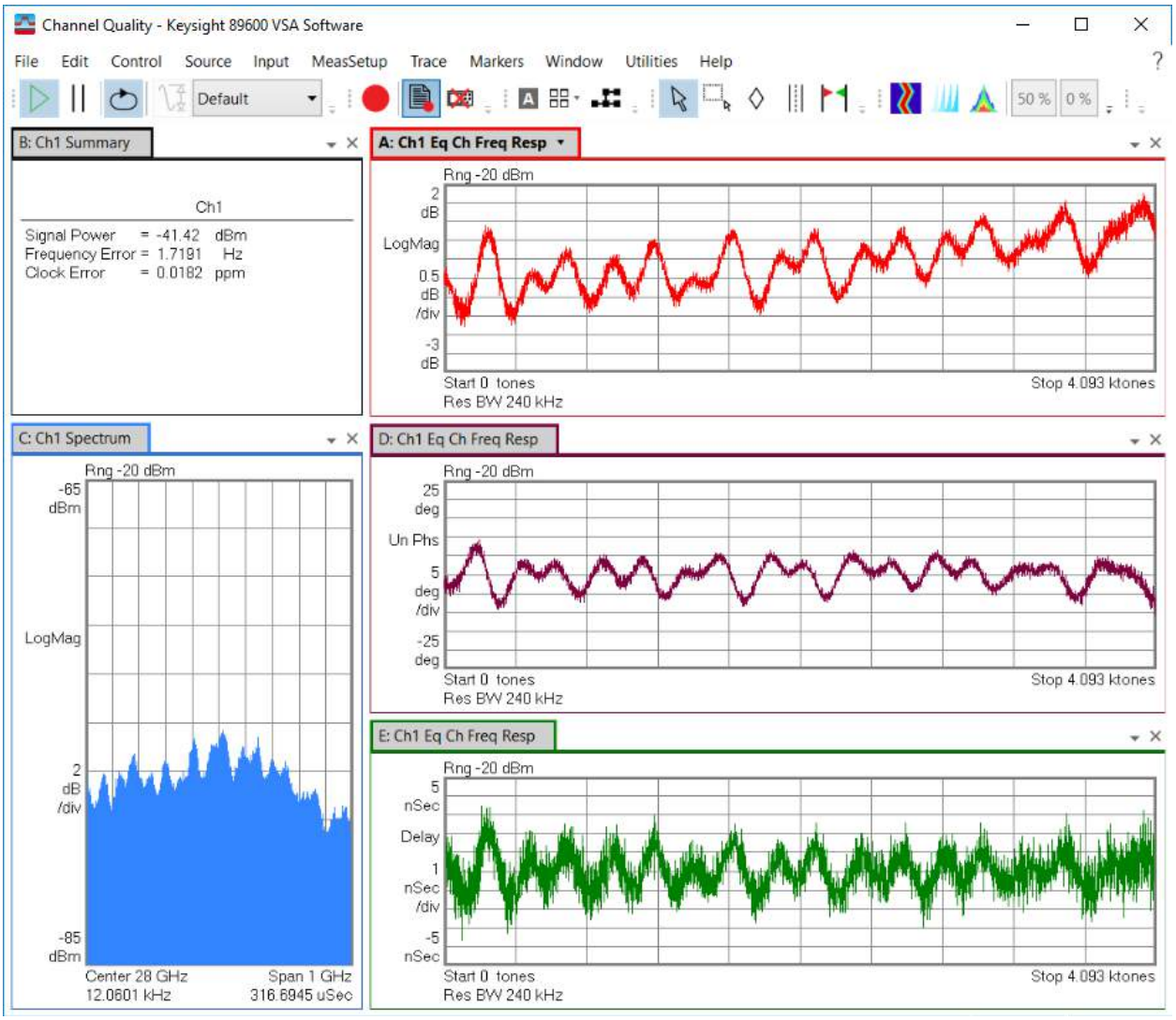
PathWave Vector Signal Analysis (VSA) software's Analog Demodulation Measurement Extension provides a toolset for analyzing amplitude modulation (AM), frequency modulation (FM), and phase modulation (PM) in signals. While it might sound basic, it has a range of applications, from studying oscillator frequency stability to examining phase and frequency transitions in complex systems. One valuable use case is in phase noise analysis. Phase noise, which appears as random fluctuations around the carrier frequency, can be measured using phase demodulation (PM), extracting the phase variations over time. Additionally, by demodulating the carrier's sidebands, engineers can identify modulation components within the phase noise, further characterizing its source.

For component test scenarios, complex stimulus-response measurements enable plotting one signal versus another for results like AM/AM, AM/PM and gain compression. The VSA features automatic time alignment, amplitude normalization and phase error compensation to greatly simplify measurement setup. This capability is especially useful for designs requiring power amplifier envelope tracking, as it offers a complete picture of how stimulus and response signals interact.



Channel quality measurements

Channel quality measurements in the 89600 VSA software provide a toolkit for characterizing key aspects of a communication channel, such as group delay, phase linearity, and magnitude response. These measurements deliver robust performance across a variety of applications, ranging from satellite payload testing to general channel characterization. This feature simplifies the testing process by configuring and leveraging a wideband multi-tone stimulus.



Simultaneous multi-measurements for cross-domain analysis

PathWave Vector Signal Analysis (VSA) offers cutting-edge multi-measurement functionality, enabling simultaneous or sequential measurements across multiple radio access formats. Designed to meet the needs of modern wireless communication systems, this feature allows users to analyze different signals in real-time or across different frequency bands, making it ideal for applications like carrier aggregation and Dynamic Spectrum Sharing (DSS) in 5G NR and LTE coexistence scenarios.

Acquisition modes for flexible measurement needs

The VSA provides multiple acquisition modes:

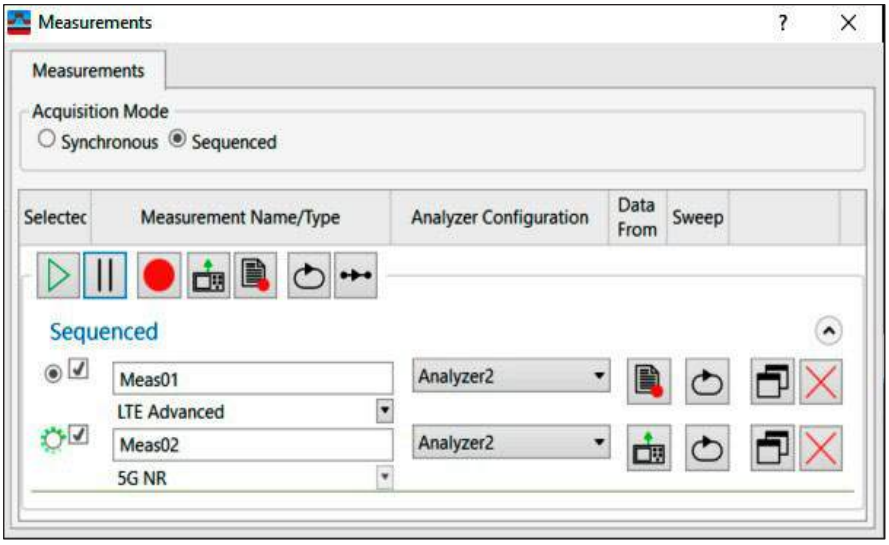
- Synchronous Mode: Capture data from multiple signals at the exact same moment, allowing phase and time synchronization essential for analyzing signals with interdependent timing, such as aggregated carriers in 5G.
- Sequenced Mode: Analyze signals at different trigger times or frequency ranges, capturing data sequentially. This mode is perfect for signals that do not require synchronized timing, such as measurements in different frequency bands or formats.

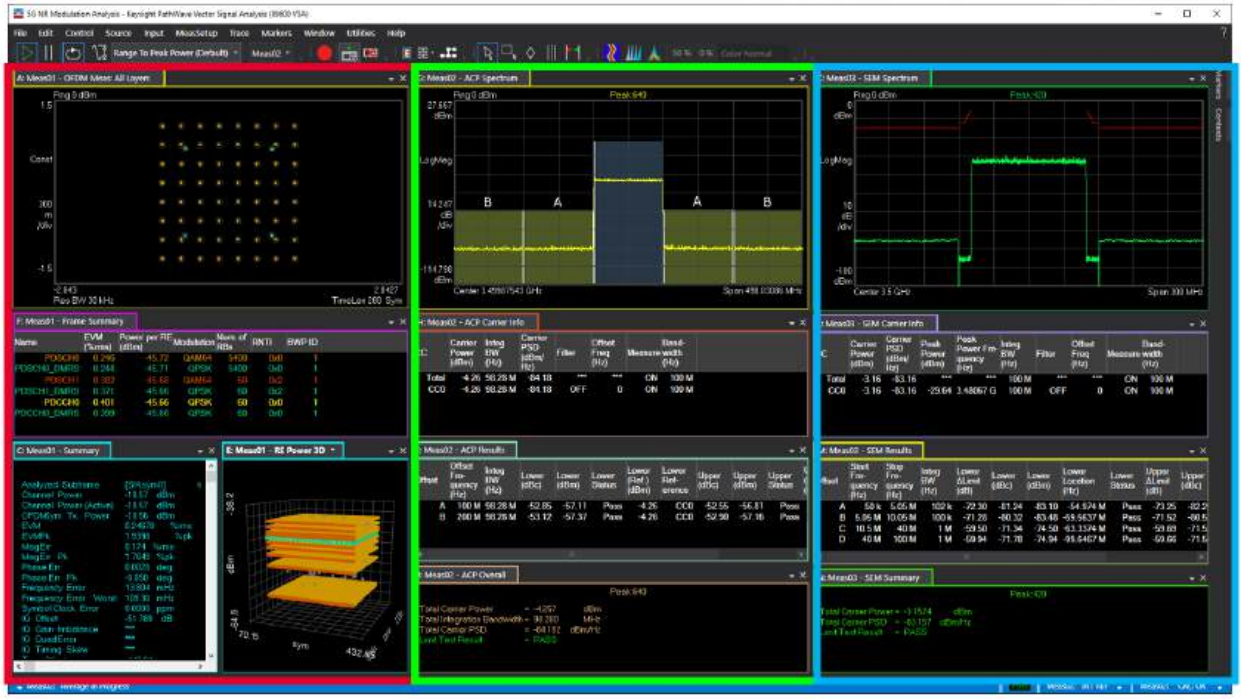
Unmatched analysis flexibility

The VSA's multi-measurement and acquisition modes offer:

- Versatile Measurement Configurations: Simultaneously analyze uplink and downlink signals, multi-format devices, or signals at various test points.
- Expanded Frequency Coverage: Coordinated acquisition across multiple instruments for broader frequency range analysis.

This multi-measurement capability, combined with advanced acquisition modes, delivers the flexibility and precision required to efficiently analyze complex, multi-standard devices, all within the powerful PathWave 89600 VSA platform.

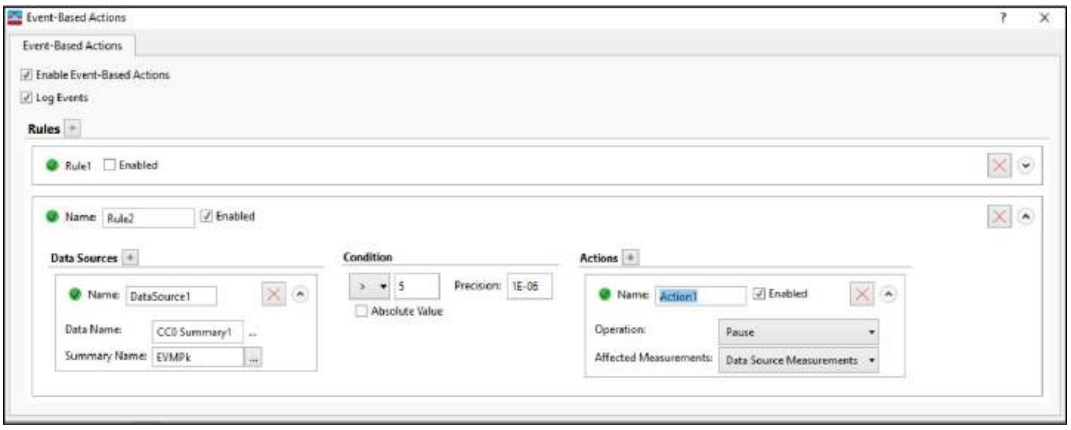




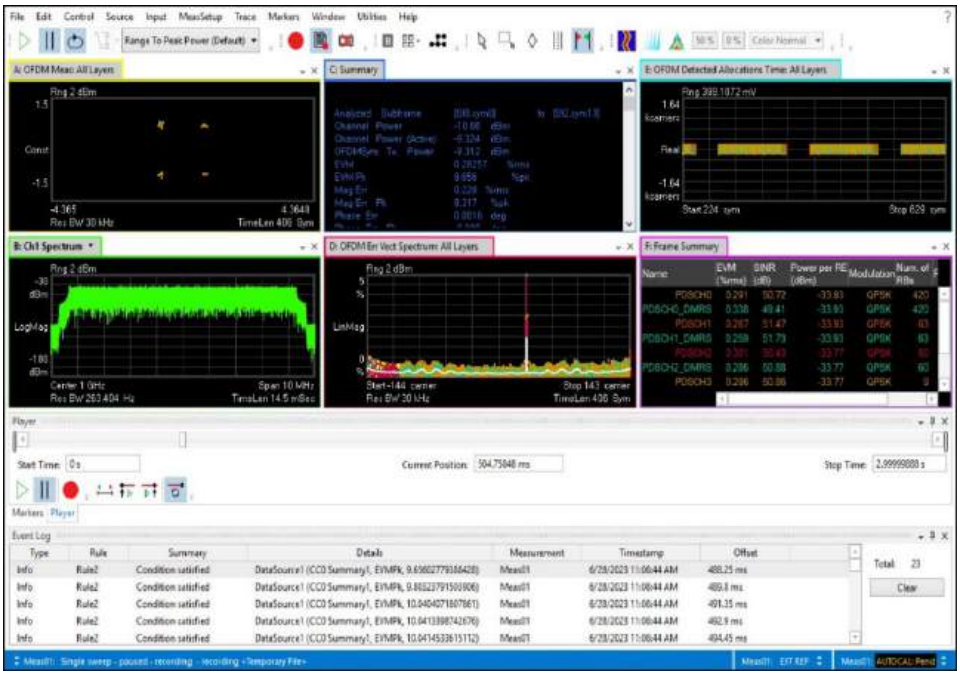
The above figure showcases simultaneous multi-measurements in action for 5G New Radio (NR) signals. Here, three critical measurements — Error Vector Magnitude (EVM), Adjacent Channel Power (ACP), and Spectral Emissions Mask (SEM) — are displayed side-by-side in a single, cohesive view. Context extensions streamline measurement configuration by automatically applying standardized settings across multiple measurements. The New Radio context, for instance, configures parameters for all three measurement types — EVM, ACP, and SEM — based on a single 5G NR standard setup. This unified approach ensures that key parameters like frequency offsets, carrier power references, and spectral mask limits remain consistent across measurements, eliminating setup redundancy and reducing the risk of configuration errors. Context extensions enable engineers to achieve accurate and repeatable results by applying a standard 3GPP configuration to multiple measurement types simultaneously.

Event based actions and statistical logging

The Event-Based Actions feature in the 89600 VSA software allows you to automate responses to specific measurement conditions, reducing the need for manual monitoring during long-duration tests. With Event-Based Actions, you can set up rules that define conditions for triggering actions. These conditions can be based on data sources such as specific measurement values or signal patterns. When a condition is met, the software can automatically pause the measurement, execute a specified macro, or perform other customized actions. This automation is particularly useful for capturing intermittent issues, flagging critical events, and running repetitive tasks, all while keeping the measurement process efficient and streamlined.



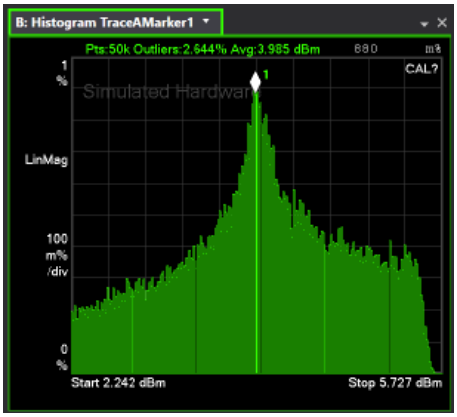
The Event Log window complements this feature by providing a record of all triggered events, complete with details such as the rule that was activated, the value that met the condition, the associated measurement name, and a timestamp. This log enables you to review event-based actions in real time or during playback, making it easy to pinpoint issues and troubleshoot specific signal behaviors. By leveraging Event-Based Actions and the Event Log, you can enhance your signal analysis and optimize your testing workflows for increased productivity and accuracy.



Trendlines and statistics: real-time monitoring and analysis

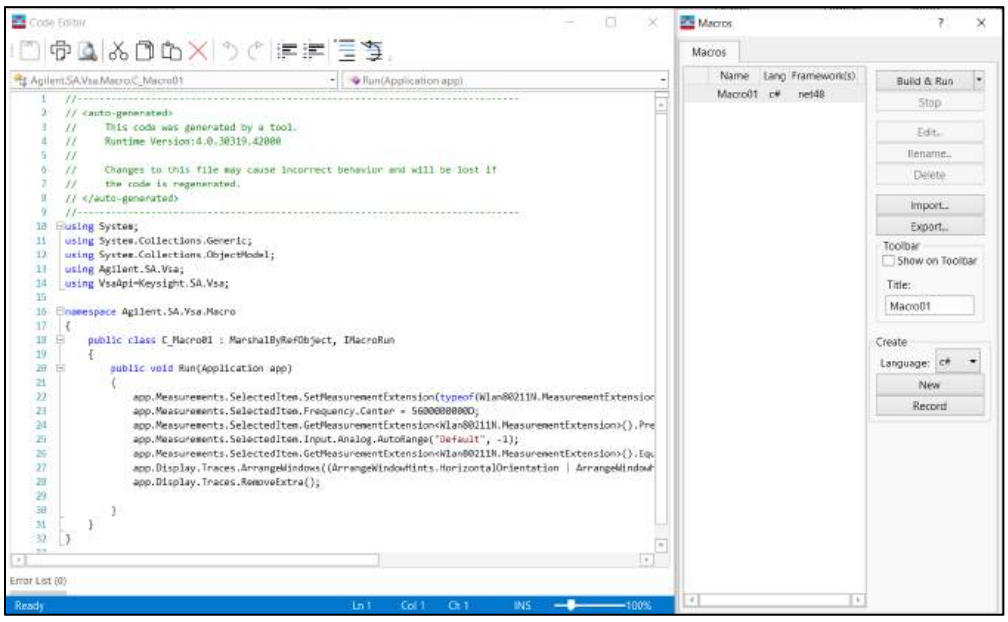
Located alongside Event-Based Actions, the Trendlines and Statistics feature allows you to visualize trends and statistical data across a wide range of metrics within any measurement type. This tool enables you to plot trendlines and create histograms for metrics such as peak power or error vector magnitude (EVM), tracking their behavior over time or across acquisitions. By defining one or more data sources—whether from a trace marker, table value, or metadata—you can continuously monitor key signal characteristics and gain insights into both their short-term variations and long-term trends.

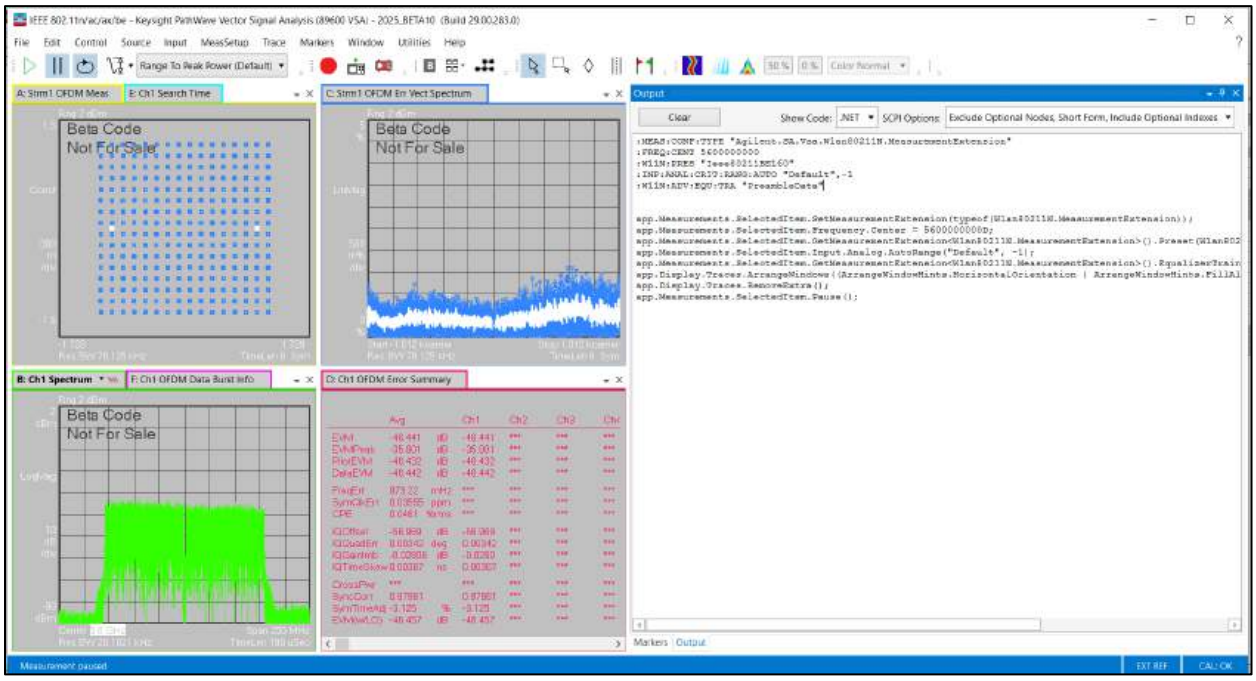
The Trend/Statistics dialog offers extensive customization options, such as removing mean values or linear slopes to isolate meaningful fluctuations. You can also configure display parameters, including the number of data points and the X-axis unit, to tailor the visualization to your analysis needs. For more advanced analysis, the X-Y Graph feature allows you to plot trended values against each other, providing an intuitive view of relationships between different metrics. With these capabilities, the Trendlines and Statistics feature supports detailed signal tracking and trend analysis, enhancing your ability to monitor, characterize, and optimize signal performance throughout your testing processes.



Easily automate your test workflows

The 89600 VSA software enables you to create design verification tests seamlessly with SCPI commands or any supported .NET language, including C#. Automate repetitive tasks using macro recording, which captures each keystroke and GUI action, simplifying the creation of custom scripts. Additionally, the VSA software now supports a “Show Code” feature, allowing users to view the generated C# code or SCPI commands for every interaction. This capability not only accelerates your testing process but also provides flexibility in selecting the language that best fits your needs. The convenient macros toolbar further enhances accessibility by offering quick selection and execution of saved macros.





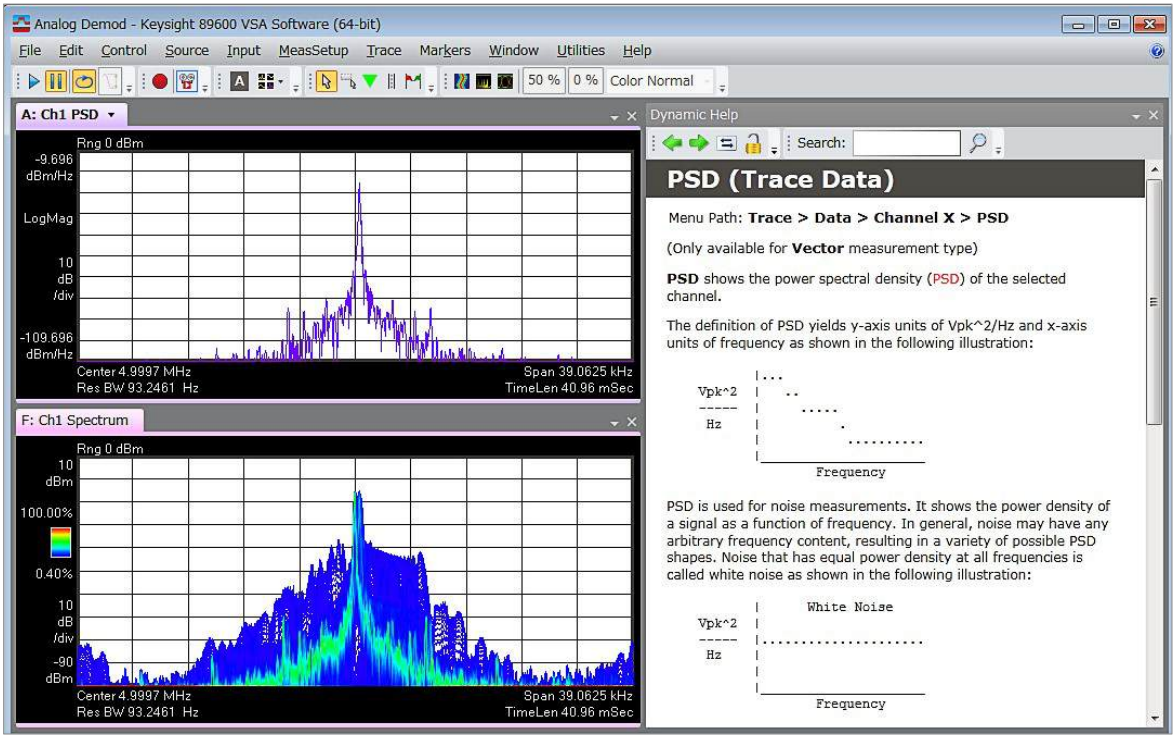
Get instant, context-sensitive help with Dynamic Help

The 89600 VSA software's Dynamic Help feature provides immediate, context-sensitive assistance, saving you time as you set up and analyze your signals. Simply hover over any trace, menu item, or setting, and the relevant help text will automatically appear, offering guidance precisely when you need it. This is especially valuable when configuring complex modulation schemes or exploring unfamiliar settings.

Dynamic Help offers a range of convenient features, reducing the need for extensive manual searches and helping you complete tasks faster:

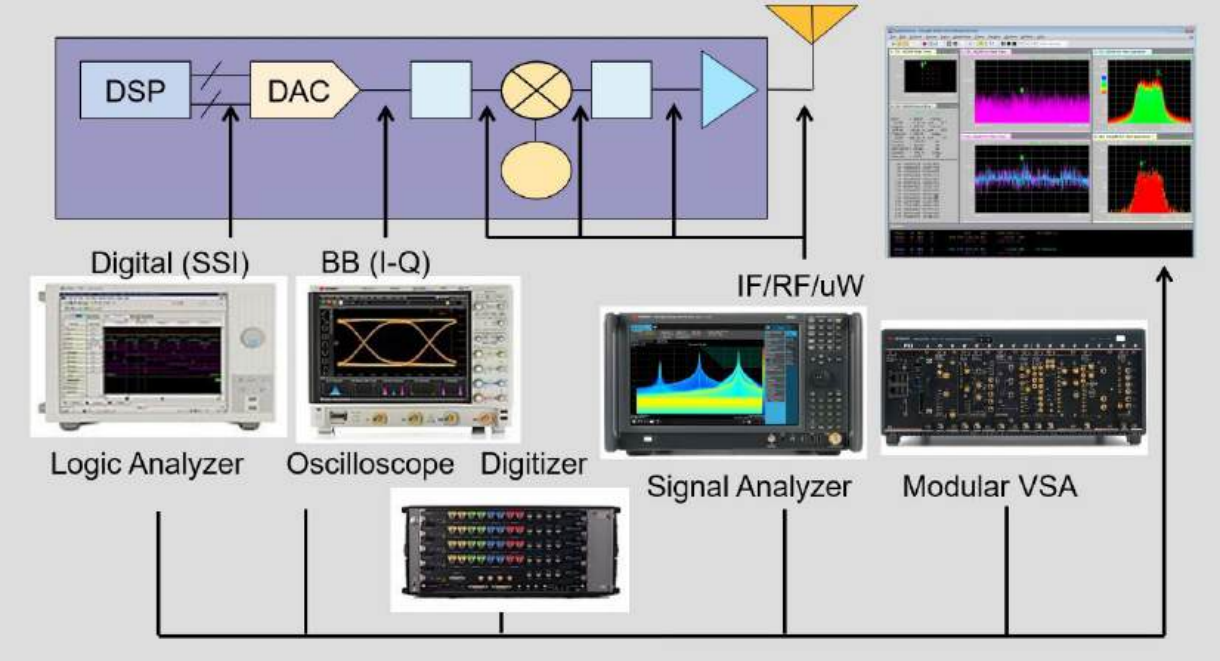
- Detachable and Lockable Help Window: Easily position the Help window anywhere on your workspace and lock it to keep specific information accessible as you work.
- Seamless Learning and Efficiency: Access over 4,000 pages of comprehensive information without leaving your workspace, empowering you to learn as you configure and analyze.

PathWave VSA: Making Complex Analysis Easier Dynamic Help transforms how you interact with the 89600 VSA software, bringing insights directly to your screen to simplify the learning curve and improve productivity.



Connect to over 45 instrument platforms

You can choose from signal analyzers, oscilloscopes, logic analyzers, modular instruments, and more. The same GUI is used to control measurements, no matter what hardware platform is used, minimizing the learning curve. Connect to the instruments via GPIB, LAN, USB, PXI interface, or embedded PXI controller. Or, run it inside the instrument itself if it is PC-based. For a list of currently supported products, go to www.keysight.com/find/89600_hardware. A configuration menu simplifies the instrument detection and validation process.



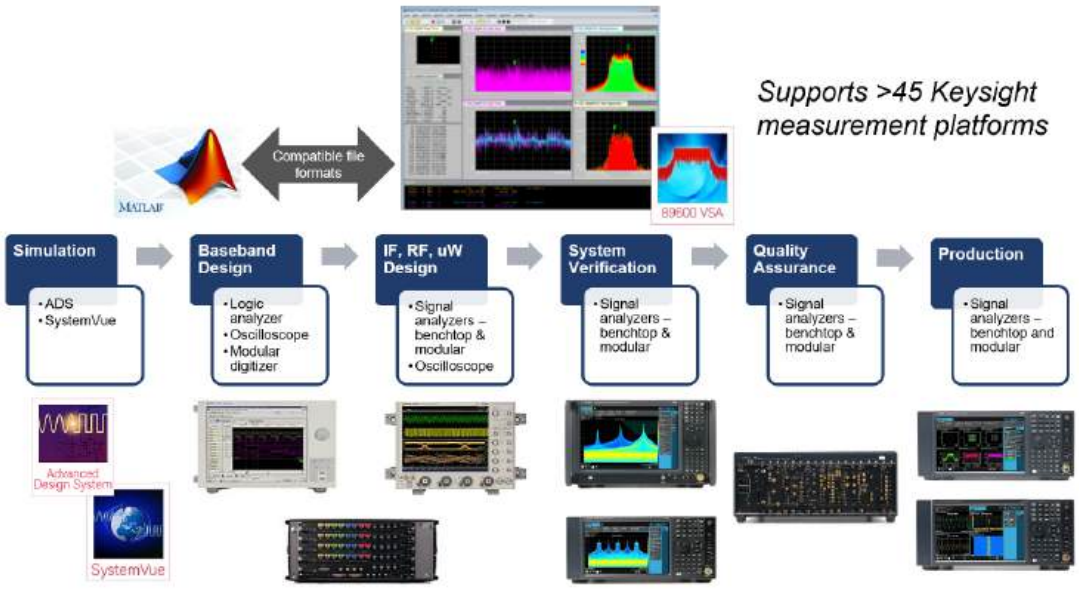
Whether you're making measurements using a logic analyzer, oscilloscope, or signal analyzer, the UI and measurement algorithms are the same. Safely compare results from baseband to RF and evaluate against your error budget.

Make measurements anywhere in your design process

Use PathWave Vector Signal Analysis (VSA) software in simulation environments to analyze and visualize simulated results. When device prototypes are ready, select the measurement hardware best suited to your task and apply the same PathWave Vector Signal Analysis (VSA) measurement science to your physical device under test. Access analog and digital baseband; IF and RF signals, comparing signal quality parameters, like EVM, from one signal block to the next, from simulation to implementation.

Apply vector signal analysis across the lifecycle

Produce consistent, comparable results from simulation to production



Reference Material and Tables

Base VSA platform software features

(Option 89601200C, 89601201C, 89601202C, 89601203C)

Note: The following features are independent of hardware platform used, unless otherwise noted.

Time and waveform

Time record characteristics	**In PathWave Vector Signal Analysis (VSA), measurements are based on time records. A time record is a block of samples of the signal waveform from which time, frequency, and modulation domain data is derived.**
Data mode	Two signal processing modes, baseband and zoom, affect the appearance and the duration of input waveforms displayed.
• Zoom	Measurements are made with non-zero start frequency. Time domain display shows a complex envelope representation of the input signal, i.e. the magnitude and phase of the signal relative to the analyzer's center frequency.
• Baseband	Measurements begin at 0 Hz. The input signal is directly digitized, and the waveform display shows the entire signal (carrier plus modulation), much as an oscilloscope would.
Time record length (main time)	$\frac{\text{(Number of frequency points – 1)}}{\text{Span with RBW mode set to arbitrary, auto-coupled}}$
Time sample resolution	1/(k x span)
	Where:
	k = 2.56 for time data mode set to baseband
	k = 1.28 for all other modes (default) including zoom
	Span = Currently selected frequency span
Time recording characteristics	In recording (time capture) mode the incoming waveform is captured gap-free into high-speed time capture memory. This data may then be replayed at full or reduced speed, saved to mass storage, or transferred to another software application.
	When time analyzing the captured waveform, users may adjust measurement span and center frequency in order to zoom in on a signal, as long as the new measurement span lies entirely within the originally captured span.
Time recording memory size	Memory size is dependent on the hardware used. See hardware specifications for more information.
Resolution Bandwidth (RBW)	
RBW values	The range of available RBW choices is a function of the selected frequency span and the number of calculated frequency points. Users may step through the available range in a 1-3-10 sequence or directly enter an arbitrarily chosen bandwidth.
Range	< 1 Hz to > 0.287 x Max span
RBW shape factor	The window choices below allow the user to optimize the RBW shape as needed for best amplitude accuracy, best dynamic range, or best response to transient signal characteristics.

	Selectivity	Passband flatness	Rejection
Flat top	0.41	0.01 dB	95 dBc
Gaussian top	0.25	0.68 dB	125 dBc
Hanning	0.11	1.5 dB	31 dBc
Uniform	0.0014	4.0 dB	13 dBc
Blackman-harris	0.26	0.83 dB	92 dBc
Kaiser-bessel	0.26	0.83 dB	89 dBc
Gaussian	0.22	0.83 dB	73 dBc

Measurement display and control

Input	
Channels	Up to 8 (hardware dependent)
Format	Individual; I+jQ (ch1 + jch2); dual I+jQ (ch1 + jch2, ch3 + jch4)
Range	Selectable, or one-shot auto-range which sets full scale input range of the hardware
	Applies to current active or all channels
Coupling	AC, DC
Connection	Single-ended; differential (balanced)
Triggering	
Trigger types	All trigger types are not available for all hardware
Free run	Measurements run continuously without waiting for any trigger condition
Channel	Level-based trigger used with baseband signals only
IF magnitude	Trigger on in-band energy, where trigger bandwidth is determined by the measurement span. For zoom data. Time criteria is available when wideband digital IF is installed on UXA, PXA or MXA signal analyzers.
External	Trigger signal provided to hardware through external trigger port
Periodic	Available only for PSA Option 122 measurement hardware
Frequency mask trigger	Frequency selective trigger, initiates measurement based on frequency mask and trigger criteria. Only available with real-time enabled UXA, PXA, or MXA signal analyzer. May be combined with time criteria.
Event trigger	Allow users to define VSA measurement actions based on event trigger like pause the measurement or run a Macro
Playback trigger	Trigger on recorded data during playback using free run, channel, magnitude or periodic style triggers
Trigger delay	Allows pre-trigger (negative) and post-trigger (positive) delay. Delay value range is hardware dependent.
Trigger hold-off	Prevents re-triggering until a full hold-off period has elapsed
Arming trigger	Trigger using External can be used as arming trigger
Gate trigger	Used for segmented capture

Trace data	For up to 8 channels, each channel displayed individually
Autocorrelation	Autocorrelation for the selected input channel, used to determine if the signal repeats within itself, as in multipath
CCDF	Complementary cumulative distribution function
CDF	Cumulative distribution function
Correction	Shows the correction data derived from calibration data
Gate time	Portion of the main time record marked by the gate when time gating is on
Instantaneous main time	Unaveraged time data
Instantaneous spectrum	Unaveraged spectrum data
Main time	Corrected, resampled time data
PDF	Probability density function
PSD	Power spectral data
Raw main time	Raw time series data
Spectrum	Frequency spectrum computed from time trace data
Graph	
• AM/AM	Response signal magnitude vs stimulus signal magnitude
• AM/PM	Response signal phase vs stimulus signal magnitude
• Gain compression	Gain vs stimulus signal magnitude
• Stimulus time	Stimulus signal after compensation and time alignment
• Response time	Response signal after compensation and time alignment
• Delta EVM time	Magnitude of the differential error vector between the stimulus and response signals vs time
Marker	Displays ACP or OBW tabular data
Math	Displays computed data in math register
Channel N x M (where M < N) cross channel data	
Coherence	Indicates similarity between two signals
Cross correlation	Determines time delays of a common signal between two different paths
Cross spectrum	Cross power spectrum of Ch N vs Ch M
Frequency response	Frequency response of Ch N vs Ch M
Impulse response	Inverse of frequency response for Ch N vs Ch M
Trace math	
Applications	Trace math can be used to manipulate data on each measurement. With multi-measurements, trace math can be done between results from different measurements. Applications include user- defined measurement units, data correction, and normalization.
Operands	Measurement data, data register, constants, jω
Operations	+, –, x, /, conjugate, magnitude, phase, real, imaginary, square, square root, FFT, inverse FFT, windowing, logarithm, exponential, peak value, reciprocal, phase unwrap, zero, cross correlation, differentiate, smoothing, sine, cosine, tangent, power operator, constants

Graphs	Perform complex stimulus-response measurements with modulated signals
Graph settings	Stimulus and response data selection (auto or manual)
	Compensation (amplitude normalization, time alignment, phase error compensation)
	Polynomial order of curve-fit line
Graph results	Differential error vector magnitude, averaged over all time points
	Average gain of response data over stimulus data
	Delay between stimulus and response data
	Average stimulus power
	Average response power
	Coefficients for curve-fit line
Trace appearance	
Trace formats	Log mag (dB or linear), linear mag, real (I), real (Q), wrap phase, unwrap phase, I-Q, constellation, I-eye, Q-eye, trellis-eye, group delay
Trace layouts	Unlimited traces, displayed on detachable grids with user-determined layout
Number of colors	User-definable color palette
Special visualization displays	Unique visual tools providing ways of looking at time-varying signals
Adjustable parameters	
Color mapping	Color normal, color reverse, grey normal, grey reverse, user-defined
Enhance	Determines how colors are distributed
Threshold	Sets threshold value for currently selected visualization display type
Display types	Cumulative history, digital persistence, spectrogram
Averaging	
Types	RMS (video), RMS (video) exponential, peak hold, time, time exponential
Number of averages, maximum	$> 10^8$
Overlap processing	0 to 99.99%
Time gaming	
Features	Time-selective frequency domain analysis on any input or analog demodulated time-domain data. Independent gate delays can be set for each input channel
Gate length, maximum	Main time length
Gate length, minimum	Window shape/(0.3 x frequency span) where window shape is:
	• Flat top 2.2
	• Hanning 1.5
	• Uniform 1
	• Blackman-Harris 2.0044
	• Kaiser-Bessel 2.0013
	• Gaussian 2.0212
	• Gaussian Top 2.215

Markers	
Number available	Unlimited markers per trace
Types	Normal, delta, fixed, OBW, ACP, spectrogram
Search	Peak, next peak left, next peak right, peak lower, peak higher, minimum
Copy marker to >	Start freq, stop freq, center freq, ref level, despread chan, analysis TS/FS, delta to span, counter to center frequency, centroid to center
Marker functions	Peak signal track, frequency counter, band power, couple
Band power	Can be placed on any time, frequency, or demodulated trace for direct computation of band power, rms square root (of power), C/N, or C/No, computed within the selected portion of the data.
Occupied bandwidth (OBW)	Placed on spectrum traces only to dynamically compute the bandwidth required to provide x% of power in the band. User selectable from 0 to 100%
OBW results	Total power in span
	Power in OBW
	Power ratio (OBW/Span)
	OBW lower frequency
	OBW higher frequency
	OBW
	Centroid frequency
	Offset frequency (measurement center freq – centroid freq)
Adjacent channel power	Placed on spectrum traces only
User-settable parameters	Center frequency and bandwidth of the carrier channel
	Offset frequency and bandwidth of each offset channel
	Reference offset allows offset channel to be centered anywhere on screen
ACP results	Pass/fail limits for each offset (applied to both lower and upper result)
	Carrier band power
	Power in both lower and upper offset bands for each frequency offset
	Power in both lower and upper offset bands for each frequency offset, relative to the carrier (ACPR)
	Worst case (of the upper and lower offsets) ACPR for each frequency offset
	Pass/fail condition relative to user supplied thresholds
Limit lines	
Limit tests	Collection of limit lines applied to trace data. Defined by user or from save trace.
Marker results	Pass/fail status for limit and margin; worst-case failed point, or smallest margin point if no failure; limit test status for all traces, limit line table with tabular results
Settable line parameters	Upper, lower limit; limit margin
	Export/import from frequency mask
Limit programming	All features controllable via .NET
Limit test failure	Generates measurement status event

Software interface

Programming and macros	**Fully encapsulates all access to the front-end measurement hardware. Direct programmatic access to the measurement hardware is not required and not supported by any of these interfaces.**
Remote programming .NET	.NET is the primary remote interface. Software development environments capable of interacting with .NET remoting includes Microsoft Visual Studio and others. Support clients using .NET 6.0 or greater to access 89600 VSA, enabling users to remotely connect to VSA installed on Windows 10 or 11 from Linux-based platforms (VSA2024 Update 2)
SCPI	The SCPI remote interface allows SCPI-based instrument controllers full access to a subset of 89600 VSA software features. Compatible SCPI software development environments include Keysight VEE and Keysight Command Expert. MATLAB users should consider using SCPI for their remote programming needs. Echo SCPI command while interacting with user interface (VSA2025)
Macro language	Supports macro-recording with a built-in editor using C# and VB.NET. Also, macros can be developed using any supported .NET language. Full-featured code editor complete with syntax coloring allows copy and paste into Microsoft Visual Studio for editing and debugging. Macros developed for the 89601A using VBA can only access features that are part of the COM compatibility interface.
Remote displays	To operate the 89600 VSA software or view its display from a remote location, the use of commercially available remote PC software is recommended.
File formats [1]	**For storage and recall of measured or captured waveforms, spectra and other measurement results.**
ASCII	Tab delimited (.txt), comma delimited (.csv)
Binary	Keysight standard data format (.sdf, .cap, .dat), Keysight E3238 search system time snapshot (.cap), time recording (.cap) files under 2 GB in size. Keysight N5110 or N5106 signal generator files (.bin) can be over 2 GB with the 89600 VSA 2020 release or above
MATLAB 4 and later	MAT-file (.mat)
MATLAB 2006 and later	MAT-file (.mat) and HDF5 file format (.hdf, .h5)
Vita49	File as *.vita49 base on DIFI v1.0/v1.1; Also support the Vita49 stream with VSA2024 or above release; support for bit depth of 4 through 15 bits compliant with DIFI with VSA2025 release
ORB	File as *.orb (support recall multiple single channel *.orb recording files into a multi-channel measurement)
Timestamp	Support hardware-provided or user-provided timestamps for data captures
Simulation environments	
Supported software	Keysight EDA SystemVue and ADS, MathWorks Simulink (only available with VSA version 7.00 to 17.20)

1. With VSA 2018 and later, accessible file size is increased up to 2^63 samples per channel to recall recording in SDF and HDF5 formats. File size is not increased with other file formats such as MAT-file (.mat), ASCII (.txt, .csv) or Binary (.bin).

Key Specifications

This technical overview provides nominal performance specifications for the software when making measurements with the specified platform [1]. Nominal values indicate expected performance or describe product performance that is useful in the application of the product but is not covered by the product warranty. For a complete list of specifications refer to the measurement platform literature.

Integration with X-Series signal analyzers

The specifications in this table represent a summary of the performance of the instruments indicated and apply for cases where the 89600 VSA software is installed inside the instrument as well as when it is used with an external PC controller connected via LAN.

General performance	UXA	PXA	MXA	EXA	CXA
See the I/Q analyzer section of the respective X-Series signal analyzer data sheets for more information					
Literature number	5992-0090EN	5990-3952EN	5989-4942EN	5989-6529EN	5990-4327EN
	5992-1822EN	5992-1317EN	5992-1255EN	5992-1256EN	5992-1274EN
Frequency span Baseband IQ (Option BBA)					

	I+jQ BW	1 Ch BW	2 Ch BW	I+jQ BW	1 Ch BW	2 Ch BW
Standard	20 MHz	10 MHz	10 MHz	20 MHz	10 MHz	10 MHz
Option B25	50 MHz	25 MHz	20 MHz [2]	50 MHz	25 MHz	20 MHz [2]
Option B40	80 MHz	40 MHz	20 MHz [2]	80 MHz	40 MHz	20 MHz [2]

Frequency points per span	
Calibrated points	51 to 409,601
Displayed points	51 to 524,288

1. Data subject to change.
2. Values are for baseband measurements; values increase to match 1 Ch BW for zoom measurements. Select baseband/zoom in the 89600 VSA software by clicking on MeasSetup > Frequency (tab) > Time Data > then either baseband or zoom.

General performance	UXA	PXA	MXA	EXA	CXA
Input	**Full scale, combines attenuator setting and ADC gain**				
Range					
Without preamp	–22 dBm to +30 dBm (2 dB steps)		–20 dBm to 30 dBm (2 dB steps)	–20 dBm to 20 dBm (10 dB steps)	
With Option FSA or EA3				–20 dBm to 22 dBm (2 dB steps)	
With preamp, f < 3.6 GHz	–42 dBm to +30 dBm (2 dB steps)		–40 dBm to 30 dBm (2 dB steps)	–40 to 20 dBm (10 dB steps)	
With Option FSA or EA3				–40 to 22 dBm (2 dB steps)	
With preamp, f > 3.6 GHz	–56 dBm to +30 dBm (2 dB steps)			–50 to 20 dBm (10 dB steps)	
With Option FSA or EA3				–54 to 22 dBm (2 dB steps)	
Option BBA (50 ohm input)		–8 dBm to 10 dBm			
Option BBA (1 Mohm input)		–14 dBm to 4 dBm			
ADC overload	+2 dBfs				

Time and waveform capture	UXA	PXA	MXA	EXA	CXA
Max capture size					
Complex samples			4 Msa (standard)	4 Msa (standard)	4 Msa (standard)
(B40 with DP2)	512 MSa (32-bit)	512 MSa (32 bits)	512 MSa (32 bits) [1]	512 MSa (32 bits) [2]	
	256 MSa (64-bit)	256 MSa (64 bits)	256 MSa (64 bits) [1]	256 MSa (64 bits) [2]	
(B85/B1X/B2X/B5X with DP4)	1073 MSa (32-bit)	1073 MSa (32-bit)	2147 Msa (32-bit)		
	536 MSa (64-bit)	536 MSa (64-bit)	1073 MSa (64-bit)		
(H1G)	838 MSa (32 bit)				
R10/R15/R20	4 GSa (32-bit)	4 GSa (32-bit)			
R40	4 GSa (32-bit)				
Analog baseband samples		500 MSa (Opt BBA)	500 MSa (Opt BBA)		
Maximum capture time (at max. span with RF)	(Complex samples, 32 bit)				
10 MHz	40 sec	40 sec	266.6 msec	266.6 msec	266.6 msec
25 MHz	16 sec	16 sec	88.8 msec	88.8 msec	88.8 msec
40 MHz (B40)	10 sec	10 sec	10 sec	10 sec	
85 MHz (B85)	4.9 sec (DP2)	4.9 sec (DP2)	4.9 sec		
	9.8 sec (DP4)	9.8 sec (DP4)			
125 MHz (B1A)	3.3 sec (DP2)	N/A	3.3 sec		
	6.6 sec (DP4)				
160 MHz (B1X)	2.6 sec (DP2)	2.6 sec (DP2)	2.6 sec		
	5.2 sec (DP4)	5.2 sec (DP4)			
255 MHz (B2X)	7.1 sec (DP4)	7.1 sec (DP4)	3.57 sec (DP4)		
510 MHz (B5X)	3.55 sec (DP4)	3.55 sec (DP4)	3.56 sec (DP4)		
1 GHz (H1G)	665 msec				
1 GHz (R10)	1660 msec	1660 msec			
1.5 GHz (R15)	830 msec	830 msec			
2 GHz (R20)	830 msec				
4 GHz (R40)	429 msec				
System requirements with PathWave Vector Signal Analysis (VSA) and X-Series signal analyzer					
PC to analyzer interface	PathWave Vector Signal Analysis (VSA) software can run both inside and X-Series signal analyzer or on an external PC connected to the analyzer via LAN. Installing the 89600 VSA software into the analyzer enables its use with a connected mouse and keyboard via USB. When the software is running in a remote PC, use of a LAN crossover cable, LAN hub, or LAN switch is required and allows to transfer the data from the signal analyzer.				
PC requirements	www.keysight.com/find/89600-pc				

Note: When running the 89600 VSA software inside most of the X-Series signal analyzers, you can gain immediate, direct access to all of the signal analyzer's features by pressing [Mode] on the analyze, using Control > Disconnect on the 89600 VSA software's command toolbar, or closing the 89600 VSA software. When running the 89600 VSA software on a remote PC connected to the analyzer, you can use the same disconnect command or close the 89600 VSA software to release the data acquisition.

1. With Option MPB, DP2, B40, B85, B1A or B1X.
2. With Option MPB, DP2 or B40.

Hardware connectivity

For a complete list of specifications refer to the measurement platform literature.

Each tiered option (Advanced tier 89601200C and 89601201C, Standard tier 89601202C, and Essentials tier 89601203c) only limits the 89600 vector signal analysis capabilities as defined, while any tier option can be used with any hardware or data input method including IQ recording files.

For a complete list of currently supported hardware with the latest version of PathWave Vector Signal Analysis (VSA), go to www.keysight.com/find/89600_hardware

Description	Models supported	Input channels	Baseband (I/Q)	MIMO	Analysis bandwidth [1]	Frequency range [1]	EVM performance [1, 2]	Applications
X-Series signal analyzers	N9000A/B, N9010A/B, N9020A/B, N9021B N9030A/B	1, 2 if N9010A or N9020A controlled together [4]	Yes, optional	2x2 MIMO with dual N9010A/B or N9020A/B analyzers, time synchronous only [4]	Up to 510 MHz; 25 MHz max for controlled units	Up to 50 GHz	0.50% rms to 1.5% rms [3]	Low cost to high performance baseband, RF, 2-ch MIMO
	N9032B	1 or 2 RF	No	No	Up to 2 GHz	Up to 55 GHz	TBD	mmWave, 5G, 2-ch ccEVM
	N9040B	1 RF	No	No	Up to 1 GHz	Up to 50 GHz	0.16~0.89% (nom)	mmWave, 5G
	N9041B	1 RF	No	No	Up to 1 GHz (int.) Up to 4 GHz (ext.)	Up to 110 GHz	0.29~0.89% (nom)	mmWave, 5G
	N9042B	1 or 2 RF	No	No	Up to 4 GHz (int.) Up to 11 GHz (ext.)	Up to 50 GHz Up to 110 GHz with V3050A VDI mixer with N9042B-EXW	TBD	5G, Satellite Comm, 2-ch ccEVM
UXM Wireless Test Set	E7515A	2 RF, 2 digital	No	No	100 MHz	300 MHz to 6 GHz	Not available	Signaling test, 2G/3G/4G
PXE EMI receiver	N9048B	1 RF	No	No	40 MHz	1 Hz to 44 GHz	Not available	CISPR compliance testing
MXE EMI receiver	N9038A	1 RF	No	No	Up to 85 MHz	Up to 44 GHz	Not available	CISPR compliance testing
CXA-m PXIe signal analyzer	M9290A	1 RF	No	No	Up to 25 MHz	Up to 26.5 GHz	Not available	Modular, low cost
PSA spectrum analyzer [7]	E4440A, E4443A, E4445A, E4446A, E4447A, E4448A	1, 2 if 2 units controlled together	No	2x2 MIMO, time synchronous only	Up to 80 MHz; 8 MHz max for controlled units	Up to 50 GHz	0.50% rms to 1.5% rms5	High performance RF
Wideband transceiver	E7760A, E7760B	1 RF	No	No	2 GHz	2 to 18 GHz, 55 to 68 GHz	Not available	WLAN 802.11ad, compact mmWave 5G non-signalling
Wireless Device Set	E6680A, E6680E	1 to 4 RF	No	4x4 MIMO	Up to 800 MHz	Up to 7.3 GHz	Not available	WLAN 802.11ax/11be

FieldFox handheld analyzers	N99xxA/B/C (spectrum, combination analyzer)	1 RF	No	No	Up to 120 MHz	Up to 50 GHz	Not available	Handheld, field use, I&M
Infiniium oscilloscopes	S-Series V-Series Z-Series 9000 Series 90000A Series 90000 X-Series [7] 90000 Q-Series [7] 9000 H-Series [7] UXR Series	1, 2, 3, 4	Yes, including dual I+jQ, and quad I+jQ	Up to 4x4, including baseband	61 GHz (62.5 GHz with reduced alias protection)	61 GHz (62.5 GHz with reduced alias protection)	Not available	Wide bandwidth; baseband; economic MIMO analysis
	UXR Series MXR Series EXR Series	Up to 4 ch Up to 8 ch Up to 8 ch		Up to 4x4 Up to 8x8 Up to 8x8	Up to 110 GHz Up to 6 GHz Up to 2.5 GHz	Up to 110 GHz Up to 6 GHz Up to 2.5 GHz		
InfiniiVision	2000 Series	Up to 2 ch		Up to 2 ch	Up to 200 MHz	Up to 200 MHz		Narrowband demod analysis
	4000G Series	Up to 4 ch		Up to 4x4	Up to 1.5 GHz	Up to 1.5 GHz		
	HD3	Up to 4 ch		Up to 4x4	Up to 1 GHz	Up to 1 GHz		

1. Depending on model/option.
2. On QPSK signal; full scale signal, fully contained in the measurement span; random data sequence; start frequency ≥ 15 % of span; alpha/BT ≥ 0.3; symbol rate ≥ 1 kHz; averaging = 10; Requires Option AYA. Data provided for comparison purposes only.
3. Frequency < 3.6 GHz; range ≥ —30 dBm.
4. Option B40 is not supported (i.e. if any analyzer has Option B40, it cannot be used together with another analyzer).
5. Frequency < 3 GHz; range ≥ —24 dBm.
6. Frequency between 30 MHz and 3 GHz; range ≥ —20 dBm.
7. Discontinued but currently supported.

Description	Models supported	Input channels	Baseband (I/Q)	MIMO	Analysis bandwidth [1]	Frequency range [1]	EVM performance [1, 2]	Applications
PXIe digitizer	M9203A	2	Yes	Up to 8x8	1 GHz	DC to 2 GHz	Not available	Multi-channel, wide bandwidth, baseband
	M8131A	4	Yes	Up to 4x4	Up to 12.5 GHz	DC to 12.5 GHz	Not available	Multi-channel, MIMO wide bandwidth, multi-antenna, RF & baseband
	M3102A	4	Yes	Up to 4x4	Up to 200 MHz	DC to 200 MHz	Not available	Multi-channel, baseband, Baseband I/Q
	M5200A	4	Yes	Up to 4x4	Up to 2 GHz	DC to 2 GHz	Not available	Multi-channel, baseband, Baseband I/Q
AXIe high speed digitizer	M9703A 3, M9703B	8	Yes	Up to 8x8	1 GHz	DC to 1.6 GHz	–44 dB and –47 dB (nominal) [4]	Multi-channel, wide bandwidth, baseband, multi-antenna, MIMO
	M9710A	4	Yes	Up to 4x4	2.5 GHz	DC to 2.5 GHz	Not available	
PCIe high speed digitizer	U5303A	8	Yes	Up to 8x8	1 GHz	DC to 1.6 GHz	Not available	Multi-channel, wide bandwidth, baseband, multi-antenna, MIMO
RF sensor	N6841A	1	No	No	Up to 20 MHz	20 MHz to 6 GHz	Not available	Outdoor weatherproof, cost effective
RF Transceiver	E6416A	16	No	Up to 16	Up to 200 MHz	30-7250 MHz	Not available	Massive MIMO
	E6464A	64	No	Up to 64	Up to 200 MHz	30-7250 MHz	Not available	Massive MIMO

1. Depending on model/option.
2. On QPSK signal; full scale signal, fully contained in the measurement span; random data sequence; start frequency ≥ 15 % of span; alpha/BT ≥ 0.3; symbol rate ≥ 1 kHz; averaging = 10; Requires Option AYA. Data provided for comparison purposes only.
3. Discontinued but currently supported.
4. Measurement made with a 256QAM signal and a 160 MHz analysis bandwidth (802.11ac).

Description	Models supported	Input channels	Baseband (I/Q)	MIMO	Analysis bandwidth [1]	Frequency range [1]	EVM performance [1, 2]	Applications
Streamline vector network analyzer	P50xxA, P50xxB	Up to 50 ports	No	Yes	Up to 29 MHz	Up to 53 GHz	Not available	Modular, cost effective
PNA vector network analyzer	E5221B, E5222B, E5224B, E5225B, E5227B, E5241B, E5242B, E5244B, E5245B, E5247B, E5249B	Up to 4 ports	No	Yes	Up to 33 MHz	Up to 67 GHz	Not available	DPD of amplifiers, EVM on frequency converters, OTA measurements of phased-array antennas
ENA vector network analyzer	E5080B	Up to 4 ports	No	Yes	Up to 33 MHz	Up to 53 GHz	Not available	DPD of amplifiers, EVM on frequency converters, OTA measurements of phased-array antennas
InfiniiVision oscilloscopes	1000 X-Series, 2000 Series, 3000T X-Series, 4000 X-Series	1, 2, 3, 4 depending on model and options	Yes, for all 2-channel scopes; dual, I+jQ with 4-channel models	Up to 4×4	Up to 1 GHz	Up to 1.5 GHz	Not available	Wide bandwidth; baseband; economic baseband MIMO analysis
Logic analyzer	Any Logic and Protocol Analyzer supported with its software	Depends on hardware	No	No	Depends on hardware	Depends on hardware	Not applicable	Digital bus and FPGA analysis, all apps
PXIe vector transceiver	M9421A, M9420A	8	No	Up to 8x8 (WLAN) Up to 4x4 (5G NR)	Up to 160 MHz	60 MHz to 6 GHz	Not available	Modular, cost effective, WLAN, MIMO
	M9410A/E, M9411A/E	4	No	Up to 4x4	Up to 1.2 GHz	380 MHz to 6 GHz	Not available	Modular, wide bandwidth, 5G, WLAN, MIMO
	M9415A/E, M9416A/E	4	No	Up to 4x4	Up to 1.2 GHz	380 MHz to 12 GHz	Not available	Modular, wide bandwidth, 5G, WLAN
PXIe vector signal analyzers	M9393A	Up to 4 per chassis	No	Up to 4x4	Up to 160 MHz	9 kHz to 50 GHz	Not available	Modular, high performance, fast, MIMO, Power Spectrum
	M9391A	Up to 4 per chassis	No	Up to 4x4	Up to 160 MHz	1 MHz to 6 GHz	–42 dB to –47.5 dB (nominal) [4]	Modular, wide bandwidth, fast, MIMO
	M9393A + M9203A	Up to 4 per chassis	No	Up to 4x4	Up to 1 GHz	9 kHz to 50 GHz	Not available	Modular, wide bandwidth, fast

PXIe VNA	M980xA	Up to 50 ports	No	Yes	Up to 29 MHz	100 kHz to 53 GHz	Not available	Modular, cost effective
PXIe VNA	M983xA	'a' receiver channel	No	Yes	Up to 29 MHz	10 MHz to 44 GHz	Not available	Modular, cost effective
S9100A	M1740A +, E7770A +, M9410A	1	No	No	Up to 1.2 GHz	• FR1: 380 MHz to 6 GHz • FR2: 24.25 to 43.5 GHz	• < 0.3% (Sub-6 GHz) • < 1.0% (28 GHz) • < 1.2% (39 GHz)	5G Base Station Manufacturing
S9110A S9110E (Beta)		1 or 2	No	Yes	Up to 1.2 GHz	• FR1: 380 MHz to 6 GHz • FR2: 22.7 to 49.2 GHz	Not available	5G Base Station
S9115A		1 or 2	No	Yes	Up to 1.2 GHz	• FR1: 380 MHz to 6 GHz • FR2: 22.7 to 49.2 GHz	Not available	Wideband Transceiver Test Solution

1. Depending on model/option.
2. On QPSK signal; full scale signal, fully contained in the measurement span; random data sequence; start frequency ≥ 15 % of span; alpha/BT ≥ 0.3; symbol rate ≥ 1 kHz; averaging = 10; Requires Option AYA. Data provided for comparison purposes only.
3. Discontinued but currently supported.
4. Measurement made with a 256QAM signal and a 160 MHz analysis bandwidth (802.11ac).

Signal generator control

Description	Models supported	Frequency	Source Channel	Modulation	Download Waveform	Requirement
VXG-C	M9484C	9 kHz to 54 GHz	1/2/4	Vector	Yes	89601200C (Version ≥ 2019 Upd 1, 1-ch) 89601200C (Version ≥ 2024 Upd 2, 2-ch) 89601200C (Version ≥ 2025 multiple virtual signals per channel support)
VXG-B	M9384B	1 MHz to 44 GHz	1/2	Vector	Yes	89601200C (Version≥2020)
VXG-m	M9383B	1 MHz to 44 GHz	1	Vector	Yes	89601200C (Version≥2020)
PXI VSG	M9381A	1 MHz to 6 GHz	1	Vector	Yes	89601200C (Version ≥ 2019 Update 1.3)
EXG	N5172B	9 kHz to 6 GHz	1	Vector	Yes	89601200C (Version ≥ 2019 Update 1.3)
MXG-B	N5182B	9 kHz to 6 GHz	1	Vector	Yes	89601200C (Version ≥ 2019 Update 1.3)
MXG	N5186A	9 kHz to 8.5 GHz	1/4	Vector	Yes	89601200C (Version ≥ 2024 Update 1.0)
PXI VXT	M9410/11/15/16A M9410/11/15/16E	380 MHz to 6/8/12 GHz Extend up to 26.5 GHz	1	Vector	Yes	89601200C (Version ≥ 2024 Upd 1, 1-ch) 89601200C (Version ≥ 2025, >1 channel)
PSG	E8267D	1 MHz to 44 GHz	1	Vector	Yes	89601200C (Version ≥ 2019 Update 1.3)
EXG	N5171B	9 kHz to 6 GHz	1	Analog	No	89601200C (Version ≥ 2019 Update 1.3)
MXG	N5181B	9 kHz to 6 GHz	1	Analog	No	89601200C (Version ≥ 2019 Update 1.3)
PSG	E8257D	100 kHz to 67 GHz	1	Analog	No	89601200C (Version ≥ 2019 Update 1.0)
5G Multi-band Vector Transceiver	S9110A	380 MHz to 6 GHz 22.7 GHz to 49.2 GHz	1/2	Vector	Yes	89601200C (Version ≥ 2024 Update 2.0)

Ordering Information

Software licensing and configuration

Flexible licensing and configuration

- **Perpetual:** License can be used in perpetuity.
- **Time-based:** License is time limited to a defined period, such as 12-months.
- **Node-locked:** Allows you to use the license on one specified instrument/computer.
- **Transportable:** Allows you to use the license on one instrument/computer at a time.
- This license may be transferred to another instrument/computer using Keysight's online tool.
- **Floating:** Allows you to access the license on networked instruments/computers from a server, one at a time. For concurrent access, multiple licenses may be purchased.
- **USB portable:** Allows you to move the license from one instrument/computer to another by end-user only with certified USB dongle, purchased separately.
- **Software support subscription:** Allows the license holder access to Keysight technical support and all software upgrades

89600 VSA base platform and hardware Cconnectivity (at least one of 89601200C/201C/202C/203C is required)

- **89601200C –** Advanced tier with no center frequency, bandwidth, up to 64 measurement channels and 512 parallel VSA instances; Run with VSA versions above VSA2019 U1
- **89601201C –** Advanced tier with no center frequency, bandwidth up to 64 measurement channels and 512 parallel VSA instances; Run with VSA versions above VSA2025 U1
- **89601202C –** Standard tier up to 55 GHz CF, 2.16 GHz bandwidth, up to four measurement channels and four parallel VSA instances; Run with VSA versions above VSA2025 U1
- **89601203C –** Essentials tier up to 8 GHz center frequency, 160 MHz bandwidth, single measurement channel and VSA instance; Run with VSA versions above VSA2025 U1
- **89601201U –** Post upgrade from standard tier to advanced tier together with 86901202C which extends the capabilities to no frequency and bandwidth limits, up to 64 measurement channels, and 512 parallel VSA instances; Run with VSA versions above VSA2025 U2
- **89601202U –** Post upgrade essential tier to standard tier together with 89601203C: which extends the capabilities to 55 GHz center frequency, 2.16 GHz bandwidth, up to 4 measurement channels and 4 parallel VSA instances; Run with VSA versions above VSA2025 U2

Software license type	Software license	Support subscription
Node-locked perpetual	SW1000-LIC-01	SW1000-SUP-01
Node-locked time-based	SW1000-SUB-01	Included
Transportable perpetual	SW1000-LIC-01	SW1000-SUP-01
Transportable time-based	SW1000-SUB-01	Included
Floating perpetual (single site)	SW1000-LIC-01	SW1000-SUP-01
Floating time-based (single site)	SW1000-SUB-01	Included
Floating perpetual (regional)	SW1000-LIC-01	SW1000-SUP-01
Floating time-based (regional)	SW1000-SUB-01	Included

Floating perpetual (worldwide)	SW1000-LIC-01	SW1000-SUP-01
Floating time-based (worldwide)	SW1000-SUB-01	Included
USB portable perpetual	SW1000-LIC-01	SW1000-SUP-01
USB portable time-based	SW1000-SUB-01	Included

One month software support subscription extensions[1]

Support subscription	Description
SW1000-SUP-01	Perpetual KeysightCare support (1 month to 60 months)
SW1000-B2S	Back to KeysightCare support fee (Perpetual support only, one time fee) Minimum of 12 months required for a renewal

Additional Information

Literature

- PathWave Vector Signal Analysis (VSA) Software, Brochure, literature number 5990-6553EN
- PathWave Vector Signal Analysis (VSA) Software, Configuration Guide, literature number 5990-6386EN
- Keysight Vector Signal Analysis Basics, Application Note, literature number 5990-7451EN
- Channel Quality Modulation Analysis 89600 VSA Software, Technical Overview, literature number 5992-4237EN
- Exploring Signal Interactions with Multi-Measurements in the 86900 VSA Software, Application Note, literature number 5991-1620EN

Keep your Keysight Vector Signal Analysis (VSA) software up-to-date

With rapidly evolving standards and continuous advancements in signal analysis, Keysight Vector Signal Analysis (VSA) software with valid 8960120xC KeysightCare support subscription can offers you the advantage of immediate access to the latest features and enhancements available for PathWave Vector Signal Analysis (VSA) software. Refer the 89600 VSA Configuration Guide (5990-6386EN) for more details.