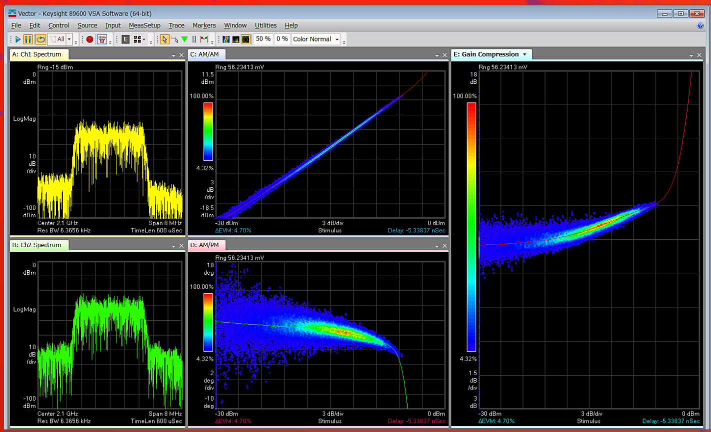



TECHNICAL OVERVIEW

# PathWave Vector Signal Analysis (89600 VSA) Basic Vector Signal Analysis and Hardware Connectivity

## Option 89601200C (Replaced the 89601B/BN/BK-200 and BHL)

## Key Features

- Measure and analyze signals in the time, frequency and modulation domains
- Support two different mode as synchronous or sequenced for carrier aggregation or multi-measurements
- Analyze data from over 45 supported hardware instruments, or use in simulation tools to verify design
- Characterize power amplifier behavior with complex stimulus-response measurements
- Configure, execute and display multiple measurements simultaneously or sequentially with unlimited number of traces and markers
- Record and playback signals for thorough analysis
- Automate tests using .NET language (full coverage) or SCPI (partial coverage)

Basic vector signal analysis (Option 89601200C) provides the foundation of the tools and user interface that make up PathWave 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.

KEYSIGHT TECHNOLOGIES

Use PathWave 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 89601200C.

Hardware connectivity, now part of Option 89601200C, allows PathWave Vector Signal Analysis (VSA) to be linked to over 45 Keysight instruments. 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 measurement, previously provided as Option 89601B-SSA, is also part of Basic VSA Option 89601200C. When used with PXIe VSA M9393A or M9391A, users can perform fast spectrum measurement. (Refer 5991-4582EN for more details.)

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, PathWave Vector Signal Analysis (VSA) helps you see through the complexity.

### Try Before You Buy!

Download PathWave 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.

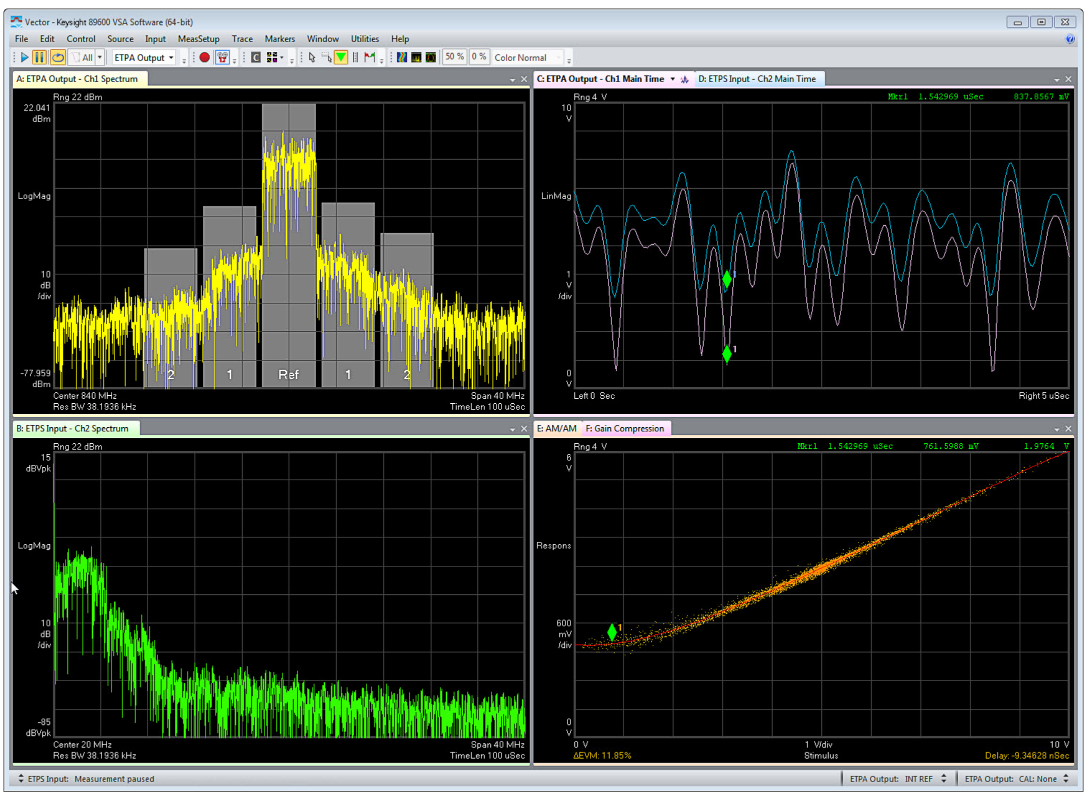
PathWave Vector Signal Analysis (VSA) running on a PC uses a measurement "front-end" or data acquisition subsystem to provide formatted sampled data. The front-end performs the following functions: connection to the device under test, signal digitizing, signal capture capability, and data transfer to 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.

# Analysis and Troubleshooting

## Find the root cause of signal problems with advanced troubleshooting tools

Quantify spectral performance with high-resolution FFT-based measurements and a rich set of markers. Analyze time domain signal quality using pulse-timing features, robust trigger controls, CCDF, and more. Use analog demodulation to characterize AM, FM and PM behavior.

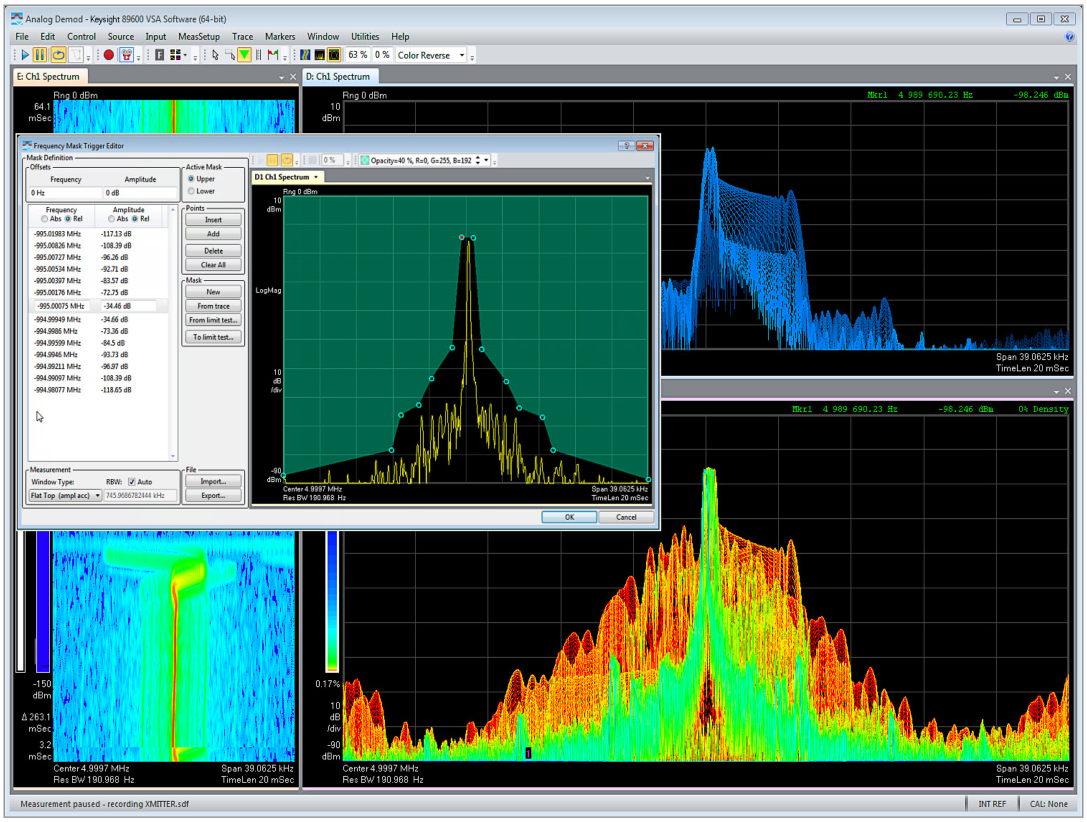
Complex stimulus-response measurements enable plotting of one signal versus another for results like AM/AM, AM/PM and gain compression. Automatic time alignment, amplitude normalization and phase error compensation greatly simplify measurement setup. As the industry's only solution to correlate baseband and RF signals, the 89600 VSA software is ideal for characterizing envelope tracking power amplifier and power supply designs.




**Complex stimulus-response measurements analyze envelope tracking power amplifier and power supply signals together, providing envelope/RF time alignment and shaping information.**

## Catch short-lived signal events using sophisticated displays and triggering

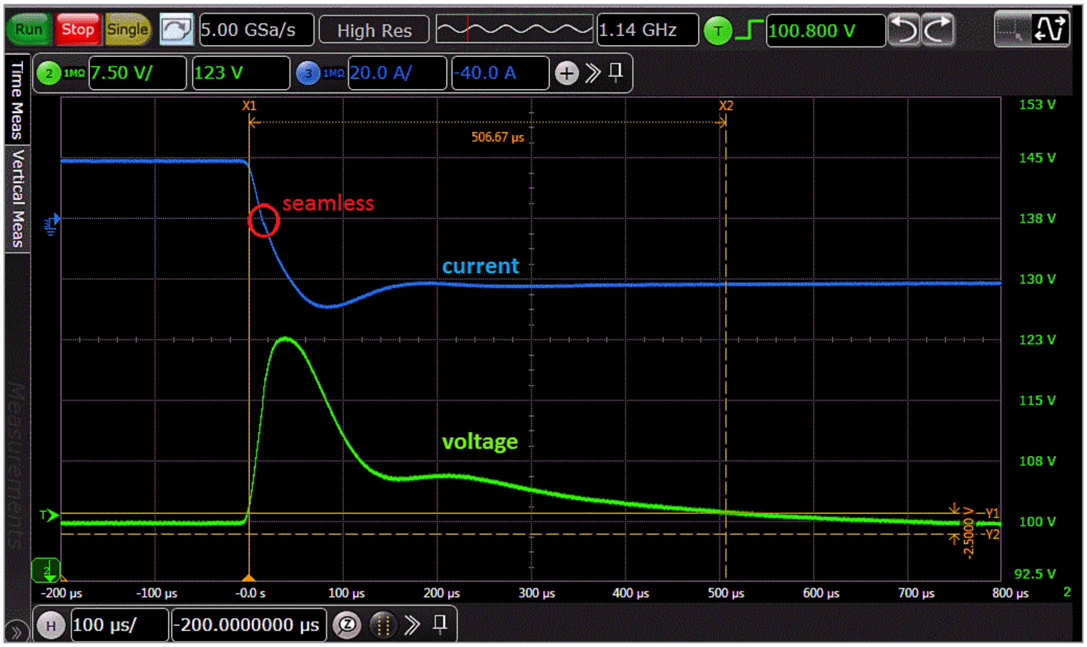
The digital persistence, cumulative history and spectrogram displays are useful for viewing signal amplitude and frequency behavior over time and identifying infrequently occurring events. Capture elusive signals with flexible magnitude and external triggers, as well as frequency mask trigger (FMT) with real-time enabled UXA, PXA and MXA signal analyzers. Initiate measurements or recordings based on trigger conditions to analyze and thoroughly characterize dynamic signals. Time qualified trigger may be combined with FMT and IF magnitude triggers.




**Powerful visualization and triggering tools highlight subtle and transient events like this radio turn-on event.**

## Display unlimited traces simultaneously to gain greater clarity

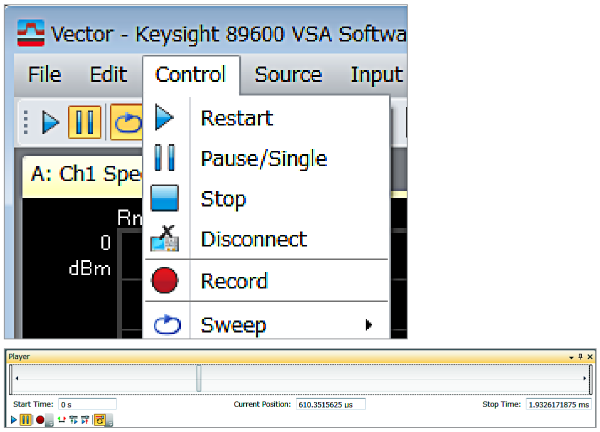
Pinpoint problems with arbitrary arrangement and sizing of trace windows. You can assign any measurement to any trace, as well as unlimited markers per trace. Optimize the trace window shape to see the most data in each trace. A docking manager tool lets you position traces anywhere within PathWave Vector Signal Analysis (VSA) display window. Multiple display windows can be created to manage a large number of results or take advantage of multiple monitors.




**Show unlimited traces, each with unlimited markers, wherever and however you need them. Overlay related traces or hide them. Undock a window and place it anywhere on your desktop using the docking manager tool.**

## Record and analyze your signals in detail

Especially useful in early R&D, you can capture transient events, compare signal outputs after design iterations, or share the signal for collaborative analysis with remote colleagues. Additional tools, like overlap processing, let you effectively “slow down” the apparent measurement for more in-depth analysis.

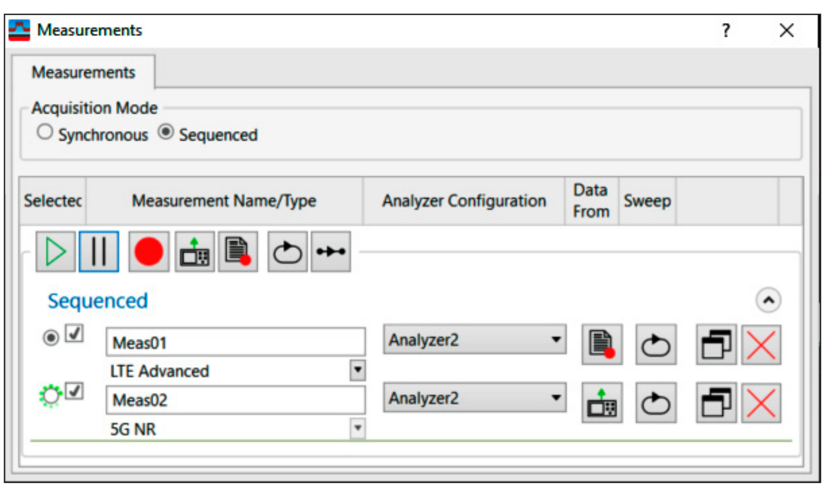



**PathWave Vector Signal Analysis (VSA) lets you record signals. Using familiar recording controls, you can replay and analyze the signal as though it were a live measurement.**

# Multi-measurement and Acquisition Mode

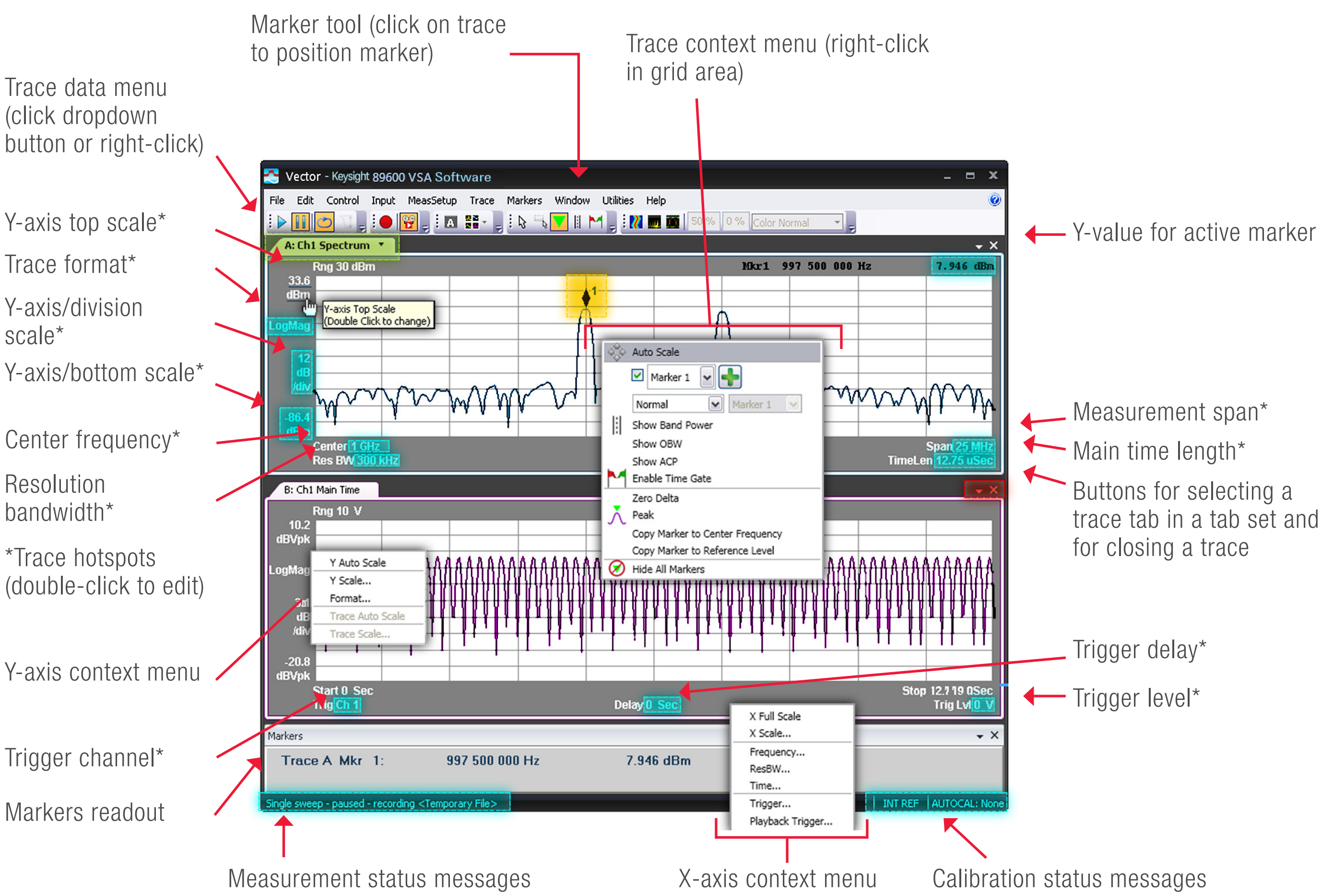
PathWave Vector Signal Analysis (VSA) provides the multiple measurement which can enable you to measure carrier aggregation or DSS (Dynamic Spectrum Sharing) for 5G NR coexistence with LTE. With PathWave Vector Signal Analysis (VSA), you can achieve three different levels of acquisition concurrency with two acquisition modes.

- Phase-synchronous or time-synchronous is supported with synchronous mode
- Non-synchronous is supported with sequenced mode in PathWave Vector Signal Analysis (VSA) 2020 release or above.



# Make use of sophisticated tools with an easy-to-use GUI

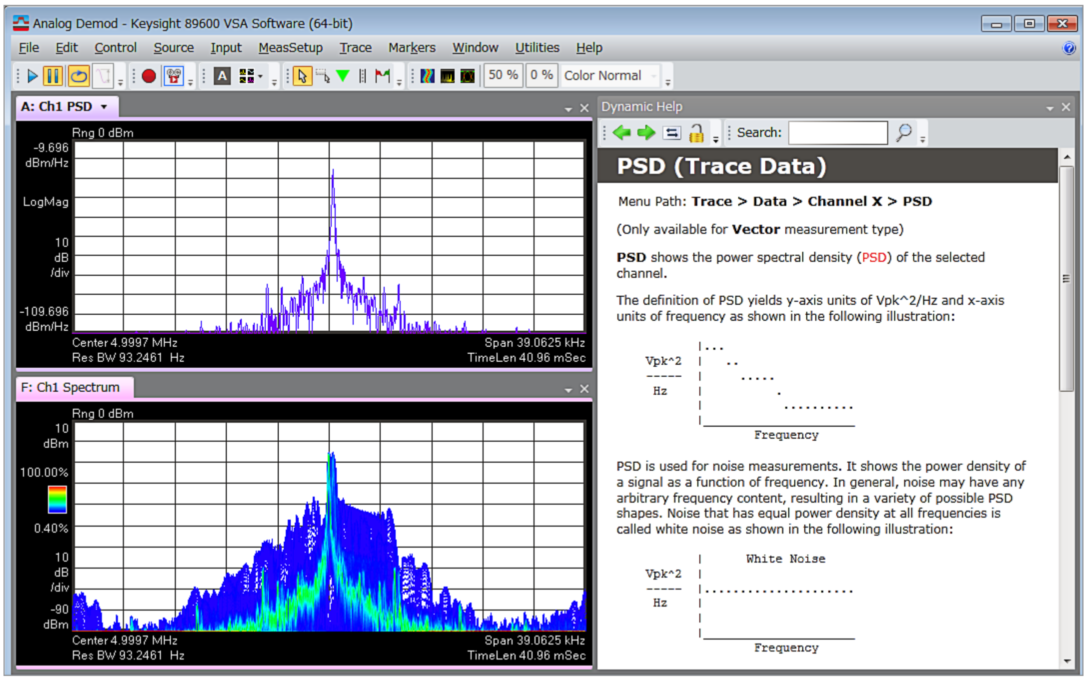
PathWave Vector Signal Analysis (VSA) software features many time-saving GUI features. Hover your mouse over a display “hot spot” to bring up a special cursor and a helpful message. To change a value, you can choose from a drop-down menu, scroll using the mouse, or type in a numeric value, depending on the parameter. Right-clicking in the trace display brings up a menu of often-used tools, such as Y-autoscale. PathWave Vector Signal Analysis (VSA) toolbar includes one-button selection of other common tasks, such as auto-range, record, start/stop, special markers selection, macros, and more.




**GUI tools let you easily set up your measurements and customize your work area. Hover your mouse over the many “hot spots” on the display, shown highlighted here. Use them to easily change any parameter value without accessing the menus. In addition, you can right-click in the display to bring up a menu of frequently-performed tasks, like auto-scaling the trace.**

# Learn about PathWave Vector Signal Analysis (VSA)—the fast way

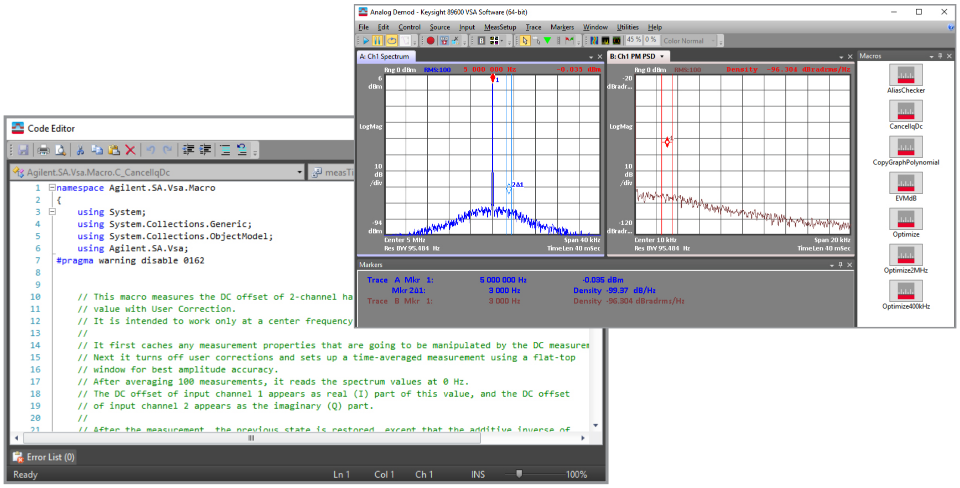
Dynamic Help lets you access detailed information on the product and its applications. Place your mouse over any trace or menu and the pertinent Help text automatically appears - this is particularly useful when setting up complex new modulation schemes. Help text includes information on using PathWave Vector Signal Analysis (VSA) software, setting up measurements, and application information for the specific modulation schemes.




**Click in a trace (to make it active) or hover your mouse over a menu and Dynamic Help will provide you with an instant display of user documentation. The content can be locked to show your desired information, and the Help window detached and placed anywhere on your workspace.**

# Develop automated tests easily

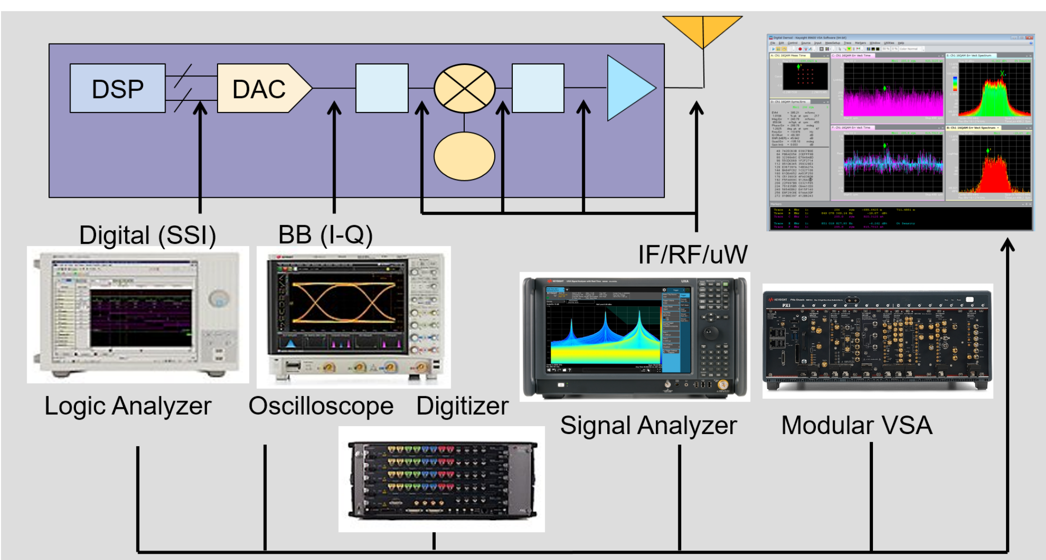
Create design verification tests using familiar SCPI or any supported .NET language. Use macro recording to capture key-strokes and automate repetitive tasks. The macros toolbar can be displayed for easy macro selection.




**Automate tests using programs written in SCPI or any supported .NET language. The 89600 VSA software also supports macros developed with C# and other languages.**

## Connect to over 45 instrument platforms

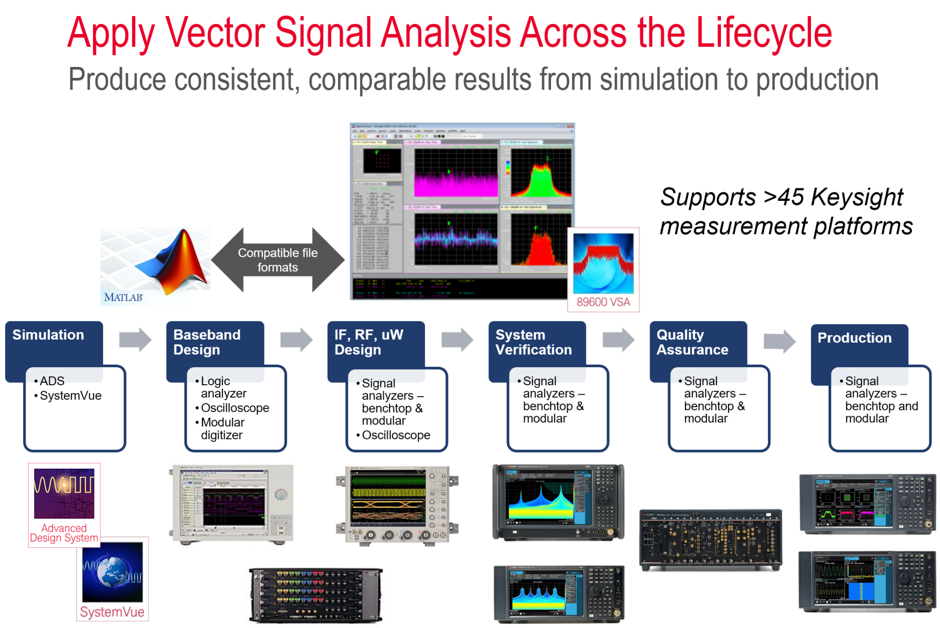
You can choose from signal analyzers, oscilloscopes, logic analyzers, modular instruments, and more. The same GUI is used to control measurements, no matter what hardware platform is used, minimizing the learning curve. Connect to the instruments via GPIB, LAN, USB, PXI interface, or embedded PXI controller. 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.**

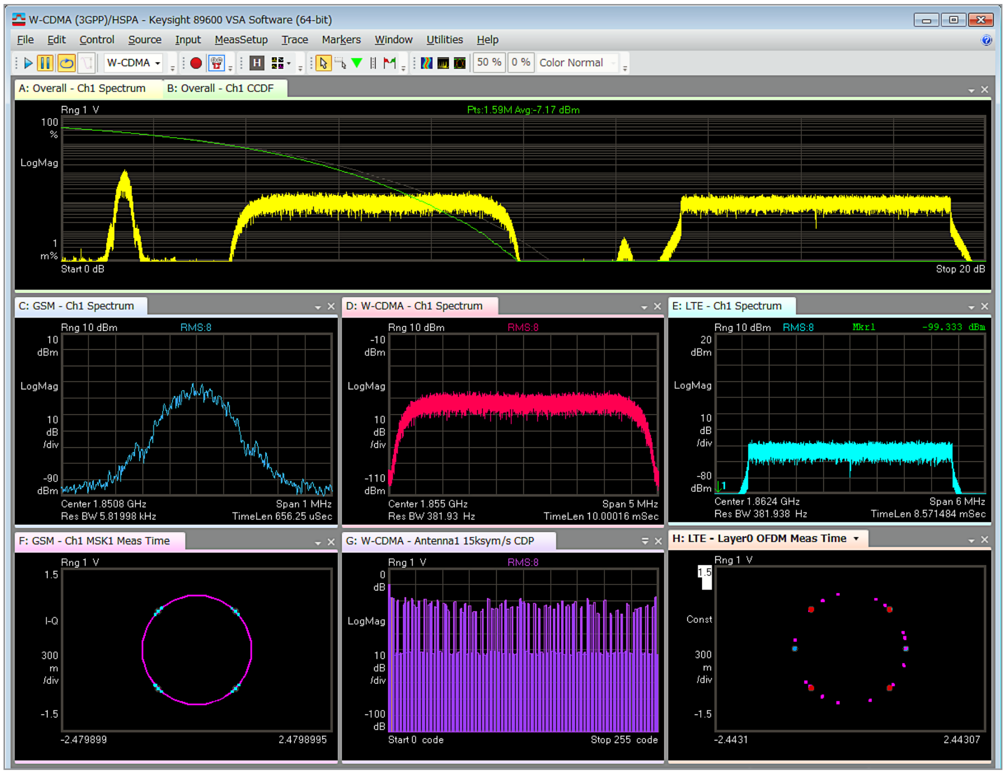
## Make measurements anywhere in your design process

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.

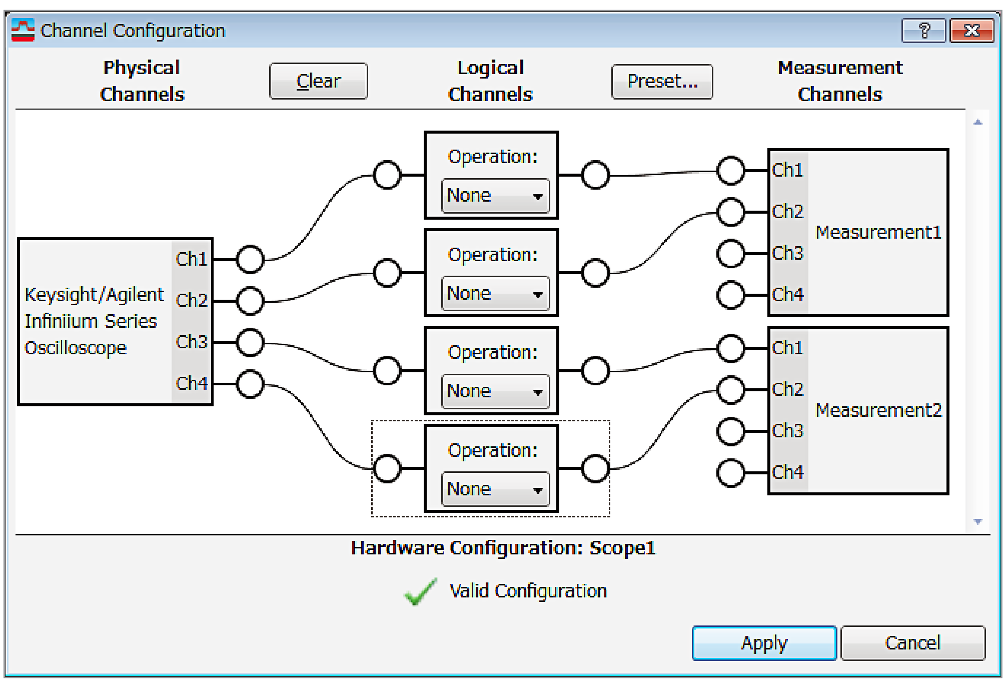



## Simultaneously create, configure, and execute multiple measurements

The new, innovative multi-measurement capability is now standard PathWave Vector Signal Analysis (VSA) software. The multi-measurement capability allows you to configure, execute and display several measurements at once, simplifying and speeding analysis of multi-carrier or multi-format devices, simultaneous uplink and downlink signals, or single signals compared at multiple test points (baseband, IF, RF). When all signals are spaced to fit within an instrument's analysis bandwidth, measurements are perfectly simultaneous. For wider frequency coverage, the VSA software can coordinate two or more independent instruments to acquire all desired signals. You can also configure the data acquisition mode from synchronous (default) or sequenced to speed up measurement switching time from one to another.




Multi-measurements in action: Traces A and B provide a composite spectrum overlaid with the CCDF statistics for the combined waveform. Traces C and F show a GSM signal. Traces D and G outline a W-CDMA downlink signal and Traces E and H analyze an LTE downlink signal.




Channel configuration wizard lets you view and map hardware channels to multiple measurements.

# Software Features

## Basic VSA (Option 89601200C)

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) | (Number of frequency points – 1) / 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. |
| Playback trigger | Trigger on recorded data during playback using free run, channel or magnitude 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 |
| **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 differental error vector between the stimulus and response signals vs time |

| Measurement display and control (continued) | |
|---|---|
| Trace data (continued) | For up to 8 channels, each channel displayed individually |
| 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 | |
| Uses | 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% |

| | |
|---|---|
| **Measurement display and control (continued)** | |
| Time gating | |
| 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 include Microsoft Visual Studio and others. |
| 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. |
| 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) |
| 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.

## Basic VSA (Option 89601200C)

### X-Series signal analyzers

| General performance | UXA | PXA | | | MXA | | | EXA | CXA |
|---|---|---|---|---|---|---|---|---|---|
| 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. | | | | | | | | | |
| 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** | | | | | | | | | |
| Minimum frequency | | | | | | | | | |
| AC coupled | 10 MHz | 10 MHz | | | 10 MHz | | | 10 MHz | 9 kHz (Option 503/507) |
| | | | | | | | | | 10 MHz (Option 513/526) |
| DC coupled | 2 Hz | 2 Hz | | | 10 Hz | | | 10 Hz | 9 kHz (Option 513/526) |
| Maximum frequency | | | | | | | | | |
| Option dependent | Up to 50 GHz (N9040B)<br>Up to 110 GHz (N9041B or N9042B+ V3050A) | Up to 50 GHz (N9030B or N9032B) | | | Up to 26.5 GHz (N9020B)<br>Up to 50 GHz (N9021B) | | | Up to 44 GHz | Up to 26.5 GHz |
| Center frequency tuning | | | | | | | | | |
| Resolution | 10 µHz | 10 µHz | | | 1 mHz | | | | |
| Frequency span | | | | | | | | | |
| Option dependent | Up to 1 GHz (N9040B, N9041B)<br>Up to 4 GHz (N9042B) | Up to 510 MHz (N9030B)<br>Up to 2 GHz (N9032B) | | | Up to 160 MHz (N9020B)<br>Up to 510 MHz (N9021B) | | | Up to 40 MHz | Up to 25 MHz |
| 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 | | | | | | | |

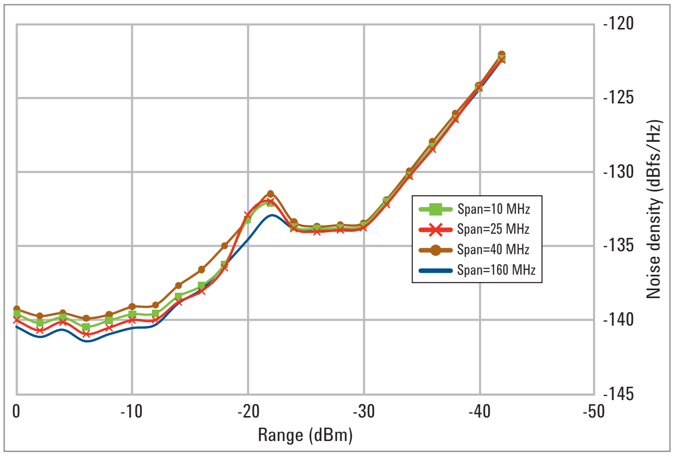
1. Data subject to change.

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.

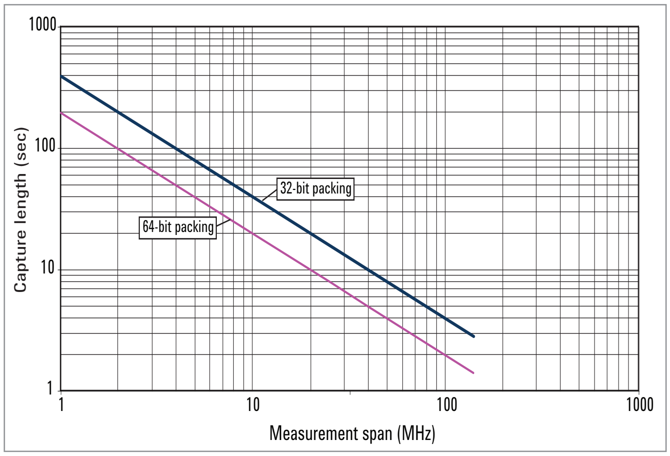
| General performance | UXA | PXA | MXA | EXA | CXA |
|---|---|---|---|---|---|
| **Input** | | | | | |
| **Range** | Full scale, combines attenuator setting and ADC gain | | | | |
| Without preamp | –22 dBm to +30 dBm (2 dB steps) | | –20 dBm to 30 dBm (2 dB steps) | –20 dBm to 20 dBm (10 dB steps) | |
| 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 | | | | |

| General performance | UXA | | PXA | | MXA | |
|---|---|---|---|---|---|---|
| **Amplitude accuracy** | | | | | | |
| Absolute amplitude accuracy | ± 0.19 dB | | < 3.6 GHz | | | |
| | | | ± 0.19 dB | | ± 0.23 dB | |
| Display scale fidelity | 0.12 dB | | | | | |
| Linearity (input mixer level, ML) | N/A | | ± 0.10 dB (—18 dBm ≤ ML ≤ —10 dBm) | ± 0.04 dB (typical) | ± 0.10 dB (—80 dBm ≤ ML ≤ —10 dBm) | |
| | | | ± 0.07 dB (ML < —18 dBm) | ± 0.02 dB (typical) | ± 0.15 dB (ML < —80 dBm) | |
| **Dynamic range** | | | | | | |
| DANL (Displayed Average Noise Level)<br>Preamp off | —153 dBm typical | (10 MHz to 1.2 GHz, 0 dB input attenuation) | —155 dBm typical | (10 MHz to 1.2 GHz, 0 dB input attenuation) | —154 dBm typical | (10 MHz to 2.1 GHz, 0 dB input attenuation) |
| Preamp on | —164 dBm typical (10 MHz to 2.1 GHz) | | —166 dBm typical | (10 MHz to 2.1 GHz, 0 dB input attenuation, requires option P0x) | —166 dBm typical | (10 MHz to 2.1 GHz, 0 dB input attenuation, requires option P0x) |
| Third-order intermodulation distortion (TOI)<br>Preamp off | | | Two —16 dBm tones at input mixer with tone separation > 5 times IF prefilter bandwidth | TOI for all frequency options | Two —30 dBm tones at input mixer with tone separation > 5 times IF prefilter bandwidth | TOI for all frequency options |
| | | | 10 to 150 MHz | +16 dBm typical | 10 to 100 MHz | +17 dBm typical |
| | | | 150 to 600 MHz | +21 dBm typical | 100 to 400 MHz | +20 dBm typical |
| | | | 0.6 to 1.1 GHz | +22 dBm typical | 400 MHz to 1.7 GHz | +20 dBm typical |
| | | | 1.1 to 3.6 GHz | +23 dBm typical | 1.7 to 3.6 GHz | +19 dBm typical |
| | | | | | 3.6 GHz to 26.5 GHz | +18 dBm typical |
| Preamp on | | | 10 to 500 MHz | +4 dBm nominal (Two —45 dBm tones) | 10 to 500 MHz | +4 dBm nominal |
| | | | 500 MHz to 3.6 GHz | +4.5 dBm nominal (Two —45 dBm tones) | 500 MHz to 3.6 GHz | +5 dBm nominal |
| | | | 3.6 GHz to 26.5 GHz | -15 dBm nominal (Two —50 dBm tones) | 3.6 to 26.5 GHz | —15 dBm nominal (Two —45 dBm tones) |

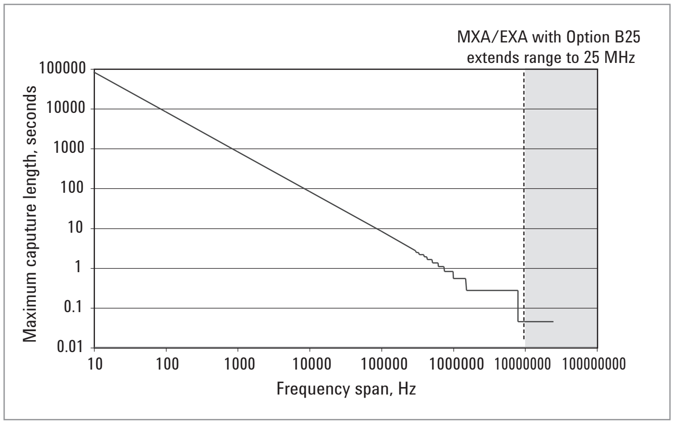
| General performance | EXA | | CXA | |
|---|---|---|---|---|
| **Amplitude accuracy** | | | | |
| Absolute amplitude accuracy | | | 2.0 to 3.0 GHz | |
| | ± 0.27 dB | | ± 0.60 dB | |
| Display scale fidelity | | | | |
| Linearity<br>(input mixer level, ML) | ± 0.15 dB<br>(—80 dBm ≤ ML ≤<br>—10 dBm) | | ± 0.15 dB<br>(—80 dBm ≤ ML ≤<br>—15 dBm) | |
| | ± 0.25 dB<br>(ML < -80 dBm) | | ± 0.30 dB<br>(—15 dBm ≤ ML ≤<br>—10 dBm) | ± 0.30 dB (typical) |
| **Dynamic range** | | | | |
| DANL (Displayed Average Noise Level)<br>Preamp off | —150 dBm typical | (10 MHz to 2.1 GHz,<br>0 dB input attenuation) | —150 dBm typical | (10 MHz to 1.5 GHz,<br>0 dB input attenuation) |
| Preamp on | —163 dBm typical | (10 MHz to 2.1 GHz,<br>0 dB input attenuation,<br>requires option P0x) | —163 dBm typical | (10 MHz to 1.5 GHz,<br>0 dB input attenuation,<br>requires option P0x) |
| Third-order intermodulation distortion (TOI)<br>Preamp off | Two —30 dBm tones at input mixer with tone separation > 5 times IF prefilter bandwidth | TOI with RF/MW (option 503/507/513/526) | Two -20 dBm tones at input mixer with tone separation 10 kHz, 0 dB attenuation | TOI with RF<br>(option 503/507) |
| | 100 to 400 MHz | +17 dBm typical | 10 to 400 MHz | +14 dBm typical |
| | 400 MHz to 3.6 GHz | +18 dBm typical | 400 MHz to 3 GHz | +17 dBm typical |
| | 3.6 GHz to 13.6 GHz | +18 dBm typical | 3.0 to 7.5 GHz | +15 dBm typical |
| | 13.6 GHz to 26.5 GHz | +16 dBm typical | | |
| Preamp on | 30 MHz to 3.6 GHz | 0 dBm nominal<br>(Two —45 dBm tones) | 10 MHz to 26.5 GHz | —8 dBm nominal<br>(Two —45 dBm tones spaced by 100 kHz,<br>0 dB attenuation) |
| | 3.6 GHz to 26.5 GHz | —18 dBm nominal<br>(Two —50 dBm tones ) | | |



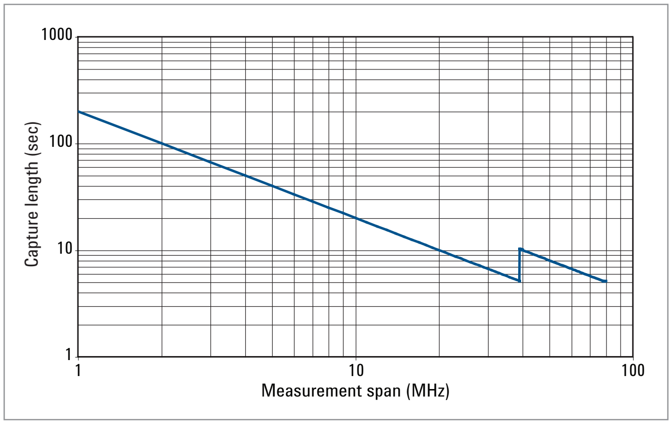

PXA noise density (nominal, 1.8 GHz).




Capture length vs. span for MXA/EXA (with DP2, MPB, B40 or wider bandwidth) and PXA.




Capture length vs. span for MXA/EXA (without DP2, MPB, B40 or wider bandwidth).




PXA and MXA (BBIQ mode) capture length vs. span.

| 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.

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 RF | No | No | Up to 2 GHz | Up to 50 GHz | TBD | mmWave, 5G |
| | 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 | Up to 110 GHz | 0.29~0.89% (nom) | mmWave, 5G |
| | N9042B + V3050A | 1 RF | No | No | Up to 4 GHz | Up to 110 GHz | TBD | 5G, Satellite Comm |
| 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 |
| 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% rms[5] | High performance RF |
| Wideband transceiver | E7760A | 1 RF | No | No | 2 GHz | 2 to 18 GHz, 55 to 68 GHz | Not available | WLAN 802.11ad, compact |
| Wireless Device Set | S8780A (E6680A) | 1 RF | No | 4x4 MIMO | Up to 800 MHz | Up to 7.3 GHz | Not available | WLAN 802.11ax/11be |
| FieldFox handheld analyzers | N99xxA/B (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<br>V-Series<br>Z-Series<br>9000 Series<br>90000A Series<br>90000 X-Series[7]<br>90000 Q-Series[7]<br>9000 H-Series[7]<br>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 | Up to 4 ch | | Up to 4x4 | up to 110 GHz | up to 110 GHz | | |
| | MXR Series | Up to 8 ch | | Up to 8x8 | up to 6 GHz | up to 6 GHz | | |
| | EXR Series | Up to 8 ch | | Up to 8x8 | up to 2.5 GHz | up to 2.5 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 |
|---|---|---|---|---|---|---|---|---|
| InfiniiVision oscilloscopes | 1000 X-Series<br>3000T X-Series<br>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 | 16800/16900; RDX[3] | 1-4 channel analysis | No | No | Up to 1.5 GHz | Up to 1.5 GHz | Not applicable | Digital bus and FPGA analysis, all apps |
| PXIe vector tranceiver | M9421A, M9420A | 8 | No | Up to 8x8 (WLAN)<br>Up to 4x4 (5G NR) | Up to 160 MHz | 60 MHz to 6 GHz | Not available | Modular, cost effective, WLAN, MIMO |
| | M9410A, M9411A | 4[6] | No | Up to 4x4 | Up to 1.2 GHz | 380 MHz to 6 GHz | Not available | Modular, wide bandwidth, 5G, WLAN, MIMO |
| | M9415A | 1 | No | No | 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 |
| | 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 vector network analyzer | M980xA | Up to 50 ports | No | Yes | Up to 40 MHz | 9 kHz to 20 GHz | Not available | Modular, cost effective |
| S9100A | M1740A + E7770A + M9410A | 1 | No | No | Up to 1.2 GHz | FR1: 380 MHz to 6 GHz<br>FR2: 24.25 to 43.5 GHz | < 0.3% (Sub-6 GHz)<br>< 1.0% (28 GHz)<br><1.2% (39 GHz) | 5G Base Station Manufacturing |
| PXIe digitizer | M9203A | 2 | Yes | Up to 8x8 | 1 GHz | DC to 2 GHz | Not available | Multi-channal, wide bandwidth, baseband |
| | M8131A | 4 | Yes | Up to 4x4 | Up to 12.5 GHz | DC to 12.5 GHz | Not available | Multi-channal, MIMO wide bandwidth, multi-antenna, RF & baseband |
| 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 |

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).
5. 89600 VSA also supports the source control with the M9383B/M9384B VXG, M9381A PXIe VSG, N5171B/N5172B/N5181B/N5182B X-Series signal generator, E8257D/E8267D PSG.

# 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

## Basic vector signal analysis and hardware connectivity (89601200C)

| Software License Type | Software License | Support Subscription |
|---|---|---|
| Node-locked perpetual | R-Y5A-001-A | R-Y6A-001-z[2] |
| Node-locked time-based | R-Y4A-001-z[1] | Included |
| Transportable perpetual | R-Y5A-004-D | R-Y6A-004- z[2] |
| Transportable time-based | R-Y4A-004-z[1] | Included |
| Floating perpetual (single site) | R-Y5A-002-B | R-Y6A-002-z[2] |
| Floating time-based (single site) | R-Y4A-002-z[1] | Included |
| Floating perpetual (regional) | R-Y5A-006-F | R-Y6A-006-z[2] |
| Floating time-based (regional) | R-Y4A-006-z[1] | Included |
| Floating perpetual (worldwide) | R-Y5A-010-J | R-Y6A-010-z[2] |
| Floating time-based (worldwide) | R-Y4A-010-z[1] | Included |
| USB portable perpetual | R-Y5A-005-E | R-Y6A-005-z[2] |
| USB portable time-based | R-Y4A-005-z[1] | Included |

1. z means different time-based license duration. F for six months, L for 12 months, X for 24 months, and Y for 36 months. All time-based licenses have included the support subscription same as the time-base duration.
2. z means different support subscription duration. L for 12 months (as default), X for 24 months, Y for 36 months, and Z for 60-months. Support subscription must be purchased for all perpetual licenses with 12-months as the default. All software upgrades and KeysightCare support are provided for software licenses with valid support subscription.

# 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
- Exploring Signal Interactions with Multi-Measurements in the 86900 VSA Software, Application Note, literature number 5991-1620EN

## Web

- www.keysight.com/find/89600vsa
- www.keysight.com/find/eesof-systemvue
- www.keysight.com/find/eesof-ads

## You can upgrade!

UP GRADE

All PathWave Vector Signal Analysis (VSA) options can be added after your initial purchase and are license-key enabled. For more information please refer to www.keysight.com/find/89600_upgrades

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

With rapidly evolving standards and continuous advancements in signal analysis, PathWave Vector Signal Analysis (VSA) software with valid 89601200C 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.

## Upgrade your PathWave Vector Signal Analysis (VSA) software up to date (89601B to 89601C)

Keysight now launches the totally new PathWave Vector Signal Analysis (VSA) as 89601C after September 2019 as version 2019 update 1.0, the existing 89601B customers can continue to use new 89601C software with valid 89601B licenses and subscription or can visit the Keysight software upgrade webpage to fill in their current 89601B software license information and get a quote for upgrading from 89601B licenses to 89601C licenses before July 31, 2021.

https://upgrade.software.keysight.com/software_upgrade_form.html

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