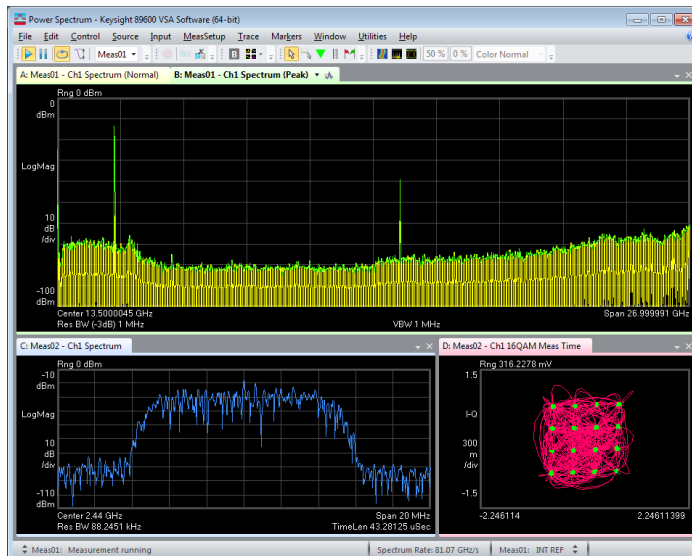


Keysight 89601B/BN-SSA

Spectrum Analysis

89600 VSA Software

Technical Overview



Key Features

- Benchtop-class spectrum analysis in PXI form factor
- Compatible with PXIe VSA hardware - M9391A up to 6 GHz and M9393A up to 27 GHz
- High-resolution spectrum sweeps at hundreds of GHz per second
- Digital RF corrections for improved noise and spurious performance
- Fully-integrated with 89600 VSA software platform



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Benchtop-Class Spectrum Analysis Plus All the Benefits of PXI

When test plans call for spectrum measurements, PXI system developers often find themselves with difficult choices. PXI-based analyzers may offer size, speed or cost advantages over traditional benchtop models, but they can also fall short on RF performance, or suffer from software packages that lack key features or are simply awkward to use.

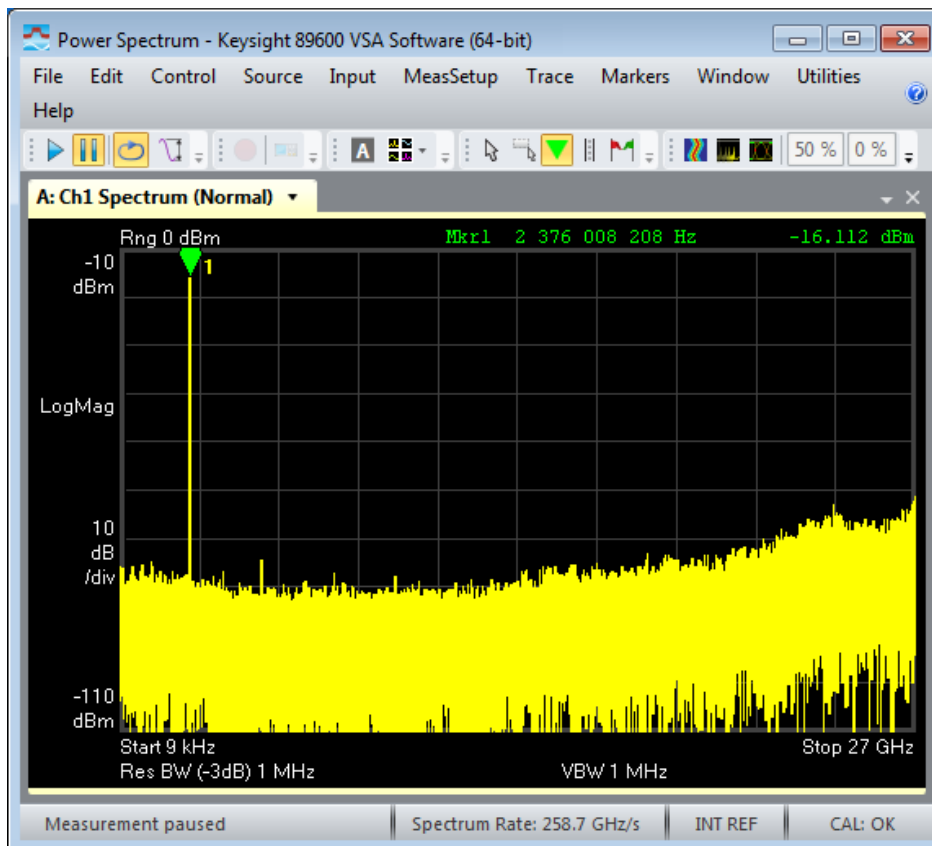
89600 VSA software with Option SSA eliminates the need to compromise. Based on Keysight's PXIe vector signal analyzer hardware, it delivers lab-quality spectrum analysis well-suited for PXI-based systems ranging from product development to design validation and high-speed manufacturing test.

You can depend on this PXI spectrum analyzer because it incorporates the RF measurement expertise that Keysight has been refining and perfecting in real-world test systems for over 70 years.

Try before you buy!

Download the 89600 software and use it for 30 days to make measurements with your analysis hardware, or use our recorded demo signals which are available by selecting File > Recall > Recall Demo > QPSK (or QAM, DTV, APSK, Zigbee) on the software toolbar. Request your free trial license today:

www.keysight.com/find/89600_trial

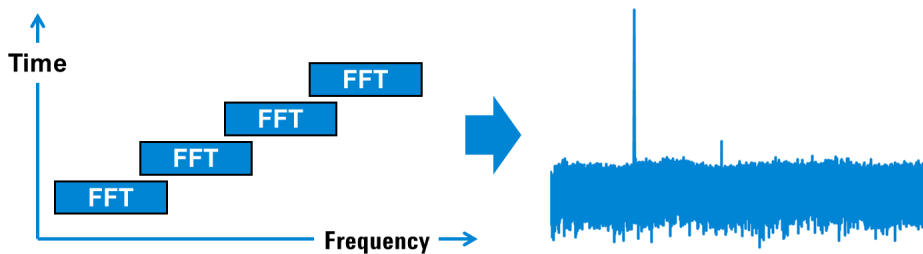


89600 Option SSA makes it easy to include Keysight-quality spectrum analysis in your PXI-based test system.

Technology Overview

The 89600 VSA Spectrum Analysis software, option SSA, performs traditional spectrum measurements across any portion of the PXI hardware's frequency range, from 1 MHz to 6 GHz (M9391A) or 9 kHz to 27 GHz (M9393A). You choose your measurement settings – such as center frequency, span, input range, RBW – just as you would with any benchtop spectrum analyzer. Based on these settings, the analyzer performs a rapid sequence of FFT-based spectrum measurements at frequency steps across the span. These results are then merged into a single, continuous spectrum.

But this is only the beginning. Depending on your settings, this spectrum is further processed to precisely replicate the results produced by a traditional swept analyzer – for example, through accurate implementations of various detector types, averaging modes or video filters. Other processing compensates front-end hardware characteristics, using sophisticated algorithms to drive down internally generated noise by 10 dB or more, or to detect and suppress internally generated images and spurs.



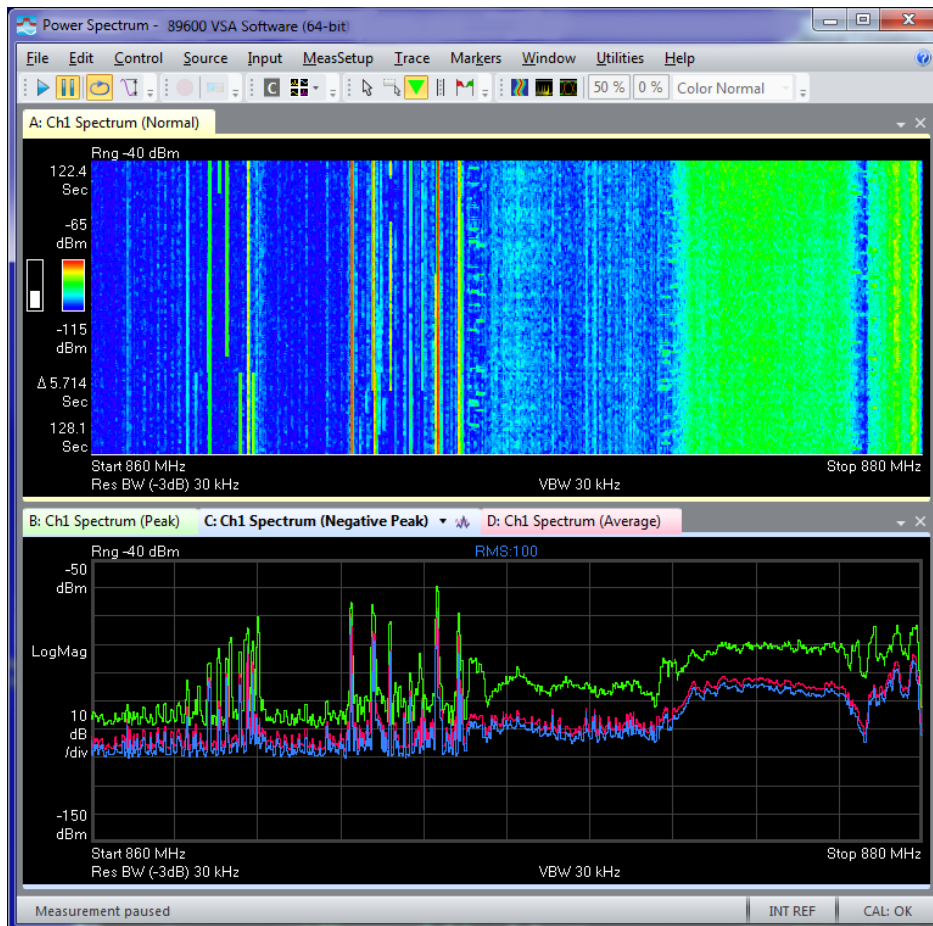
With careful attention to detail, stepped-FFT spectrum analysis produces results that are indistinguishable from those of a benchtop instrument. At narrower resolution bandwidths, the speed advantage can be significant.

Unlike other stepped-FFT spectrum analyzers, 89600 option SSA insulates the user from the inherent complexity of the measurement. Critical, but low-level details such as digitizer settings, frequency step sizes, overlap amounts are automatically optimized by the software but still accessible to the advanced user. The innovative software architecture assigns hardware acquisition and measurement processing to separate execution threads in order to maximize measurement speed.

Full-Featured Spectrum Analysis

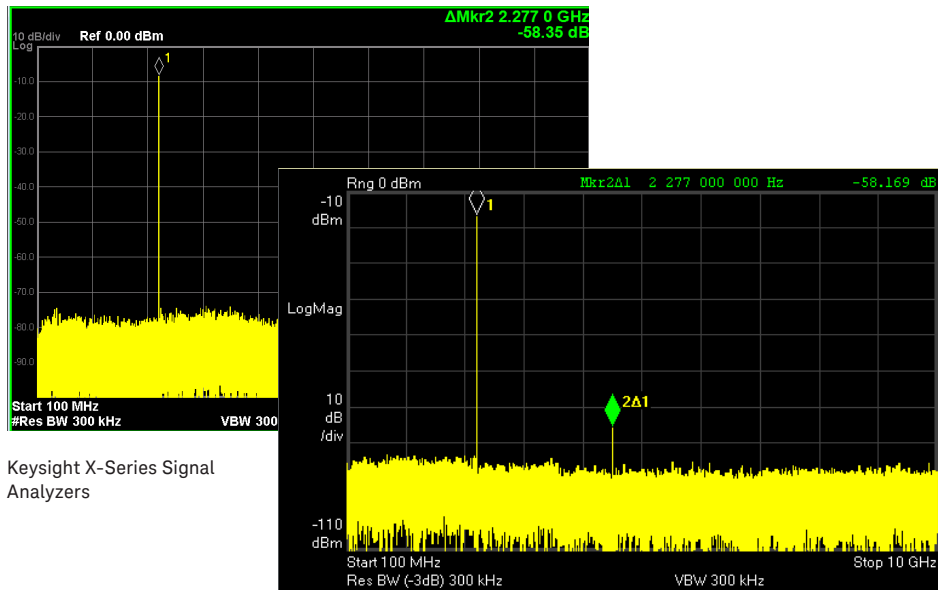
Option SSA provides all the features you would expect in a high-end spectrum analyzer, including:

- **Continuous frequency coverage** from 1 MHz to 6 GHz (M9391A) or 9 kHz to 27 GHz (M9393A), with no hardware imposed gaps.
- **Selectable measurement spans** from <1 kHz to the full hardware frequency range.
- **Precision RBW and VBW filters**, selected automatically or user-configured, for consistency with legacy analyzers and test procedures.
- **Selectable detector types**, including industry standards such as Normal, Peak, Sample and Averaging, which can be used individually or viewed simultaneously on separate or overlapping traces.
- **Sweep gating** to facilitate analysis of repetitive or bursted signals.
- **Live spectrum displays** are an integral part of the application, rather than a separate utility, to portray the actual measurement in progress. Results are updated continuously for visual observation and troubleshooting, or can be turned off to maximize speed.
- **Powerful markers** compute key results such as occupied bandwidth (OBW), adjacent channel power (ACP), integrated band power and/or power density. Spectral emission mask (SEM) testing is enabled by automatic go/no-go testing to user-defined limit lines.
- **Advanced display modes** such as spectrogram, cumulative history and digital persistence to help you better visualize spectrum results, and quickly gain key insights into device behavior.



Spectrum traces can be viewed in a wide variety of specialized formats. Results are updated continuously on the analyzer's built-in display window, with no need to launch a separate 'soft front panel' utility.

Measurement Consistency with Benchtop Analyzers



Keysight X-Series Signal Analyzers

Keysight 89600 Option SSA Spectrum Analysis with PXI VSA

Option SSA incorporates the same advanced measurement science used across Keysight's entire family of industry-leading spectrum analyzers. This means that you can depend on it to provide results that are highly consistent with your other Keysight analyzers.

While running as a PC-hosted application, Option SSA still offers much the same look and feel as its benchtop counterparts, using similar display layouts, annotation and terminology wherever possible. This means less time needed for training, along with fast, seamless operator transitions between PXI and benchtop analyzers.

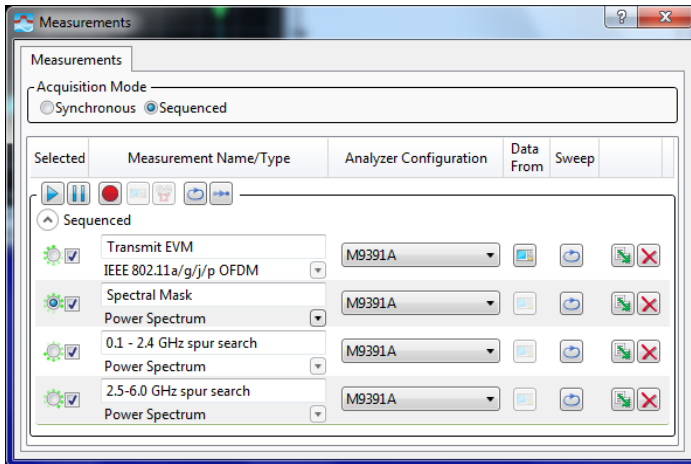
Built on the 89600 VSA Software

Option SSA is an add-on to the 89600 VSA software, the industry's most comprehensive solution for modulation and vector signal analysis. With the 89600 VSA software, you can measure more than 75 signal standards and modulation types for cellular communications, wireless connectivity, MILCOM, satellite communications and more. The 89600 VSA software also helps you leverage Keysight's consistent track record of being first to market with support for emerging standards, even before they are fully ratified.

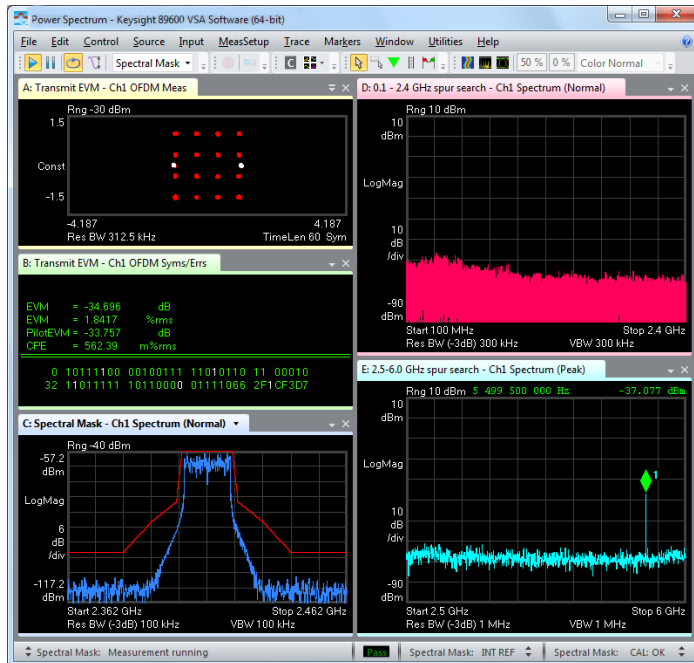
With Option SSA, you can use one analyzer platform for everything from in-channel modulation measurements to wideband sweeps. Because the swept measurements are fully integrated into the VSA software feature set, they share the same core capabilities – display features, marker functions, import/export capabilities and much more.

In addition, Option SSA works with advanced VSA software features such as Multi-Measurement mode, which can greatly enhance test throughput. In the example shown, a test sequence has been created consisting of an in-channel modulation quality test (“Transmit EVM”), a spectral mask test covering 100 MHz span width, and spur searches over two separate spectrum segments, 0.1-2.4 GHz and 2.5-6.0 GHz.

As these tests are configured, they are held in memory in pre-built, ready-to-execute form. A single command initiates the sequence, causing the VSA to step rapidly through the measurements with no further operator intervention.



Use the VSA software’s Multi-Measurement mode to sequence quickly and automatically through a list of pre-built measurements.



89600 VSA software integrates both narrowband analysis and wideband sweeps into a single GUI.

Designed to Integrate With Your Test Environment

Option SSA is programmable from today's most popular ATE test environments, including Keysight VEE, LabVIEW, MATLAB, user-developed executables, etc. Choose from either of two interfaces: a standard .NET API, which supports the complete set of 89600 VSA software features and options, or a SCPI interface, which supports all spectrum analyzer features plus the majority of 89600 VSA software features.

Compatible SCPI Commands

A special compatibility mode for Option SSA enables it to recognize many of the same SCPI commands used in Keysight's X-Series signal analyzers, so your existing code can be migrated quickly – often without modification – from older test systems. New test routines can even be developed and verified using available benchtop analyzers, with good confidence that they will perform the same way when connected to your PXI hardware.

M9000 Resource Manager Support

In even well-designed test systems, sharing a single hardware device among several applications can dramatically lengthen test times. This is because of the overhead involved in having each application's driver layer connect and then disconnect from the hardware with every measurement.

To remedy this issue, Keysight provides a powerful capability called Resource Manager. This utility maintains a single connection to the hardware (i.e. a single driver session), which it shares at the software API level, thus allowing near-instantaneous switching between applications. Supported products include:

Supported Hardware	Supported Applications
– M9391A PXIe VSA, 6 GHz	– 89600 VSA (including option SSA)
– M9393A PXIe VSA, 27 GHz	– M90XA X-Series measurement applications for modular
	– User applications utilizing M939x IVI-driver functions

For example, a test system might employ a user-written executable for fast power level setting (e.g. power servo), the M9080B X-Series measurement application for LTE modulation analysis, and the 89600 VSA Option SSA for spurious and/or harmonic search. With Resource Manager, these three applications can efficiently share a single set of VSA hardware, as control is switched from one to another with little or no speed penalty.

```
:INST:SEL SA
*RST
:FREQ:CENT 1e9
:FREQ:SPAN 500e6
:INIT
*OPC?
:CALC:MARK1:MAX
:CALC:MARK:Y?
:CALC:MARK:X?
```


89601B/BN Option SSA Signal Analyzer Characteristics

Measurement Features	M9391A	M9393A
Frequency Range	1 MHz to 3 or 6 GHz	9 kHz to 8, 14, 18 or 27 GHz
Frequency Span	800 Hz to full frequency range.	
RF Performance <i>(summary of nominal or typical hardware characteristics at 1 GHz input; see data sheets for full specifications)</i>		
Amplitude accuracy	±0.29 dB	±0.26 dB
DANL (preamp OFF)	-148 dBm/Hz	-158 dBm/Hz (noise corr ON)
DANL (preamp ON)	-161 dBm/Hz	-168 dBm/Hz (noise corr ON)
Third-order intercept (TOI)	+23 dBm	+33 dBm
Phase noise, 10 kHz offset	-120 dBc/Hz	-110 dBc/Hz
Sweep modes	Continuous, Single, Time-Gated	
Input characteristics		
Channels	1	
Range	-50 to +30 dBm in 1 dB steps	
Impedance	50 ohms	
Coupling	AC	
Time Gating		
Trigger modes	Synchronizes each sweep segment to a user-supplied input	
Free run	Measurements run continuously	
External	Triggers on signal provided to external hardware port	
RF burst (M9393A only)	Triggers on input signal within ±150 MHz of sweep center frequency	
PXI backplane	Triggers on one of 8 PXI backplane trigger lines	
Resolution Bandwidth (RBW)		
Range	1 Hz to >30 MHz (hardware and span-dependent).	
Shapes	Gaussian (dynamic range) or Flat Top (amplitude accuracy)	
Video Bandwidth (VBW)		
Range	<1 Hz to current RBW	
Detector types		
Normal, Peak, Negative Peak, Average, Sample Detectors are selectable per trace		
Performance Enhancements		
IF dithering	Enhances rejection of images and internally-generated spurious	
Noise correction (M9393A only)	Reduces displayed noise level (DANL) by 10 dB or more	
Digital image protection (M9393A only)	Detects and suppresses images and spurs that may be present in non-preselected hardware.	

89601B/BN Option SSA Signal Analyzer Characteristics (continued)

Nominal Spectrum Rates (GHz/second)										
<i>Use the data in these tables to compare performance of various hardware and software configurations¹</i>										
M9393A - B16²	Full Span				High Band				Low Band	
IF BW = 160 MHz	(9 kHz - 27.0 GHz)				(3.6 - 27.0 GHz)				(9 kHz - 3.6 GHz)	
Conversion Type	Auto		Single High		Auto		Single High		Auto	
IF Dither + Noise Correction	OFF	ON	OFF	ON	OFF	ON	OFF	ON	OFF	ON
RBW: 10 MHz	315	28	540	48	310	25	600	50	660	31
1 MHz	435	35	745	64	440	33	805	72	620	49
100 kHz	295	20	575	34	280	19	535	35	520	31
10 kHz	25	2.2	43	4.0	22	2.1	44	4.0	41	3.8
M9393A - B04²	Full Span				High Band				Low Band	
IF BW = 40 MHz	(9 kHz - 27.0 GHz)				(3.6 - 27.0 GHz)				(9 kHz - 3.6 GHz)	
Conversion Type	Auto		Single High		Auto		Single High		Auto	
IF Dither + Noise Correction	OFF	ON	OFF	ON	OFF	ON	OFF	ON	OFF	ON
RBW: 7.7 MHz	62	6.2	111	11	60	6.1	120	13	85	7.6
1 MHz	104	10	180	19	97	9.8	190	20	120	15
100 kHz	92	8.1	165	16	90	7.6	170	16	115	12
10 kHz	28	1.9	55	3.5	26	1.8	52	3.5	51	3.5
M9391A - B16³	Full Span				High Band					
IF BW = 160 MHz	(1 MHz - 6.0 GHz)				(400 MHz - 6.0 GHz)					
Conversion Type	Auto		Single High		Auto		Single High			
IF Dither + Noise Correction	OFF	ON	OFF	ON	OFF	ON	OFF	ON	OFF	ON
RBW: 7.7 MHz	109	50	52	50	395	72	74	72		
1 MHz	115	63	68	62	585	111	127	111		
100 kHz	105	61	66	60	440	101	112	101		
10 kHz	33	27	31	27	42	33	38	33		
M9391A - B04³	Full Span				High Band					
IF BW = 40 MHz	(1 MHz - 6.0 GHz)				(400 MHz - 6.0 GHz)					
Conversion Type	Auto		Single High		Auto		Single High			
IF Dither + Noise Correction	OFF	ON	OFF	ON	OFF	ON	OFF	ON	OFF	ON
RBW: 7.7 MHz	69	17	17	17	108	17	17	18		
1 MHz	77	24	24	25	177	29	29	30		
100 kHz	76	26	26	28	125	33	33	34		
10 kHz	36	17	17	17	48	18	18	19		

1. Configurations include M9018A PXIe chassis with M9037A embedded controller. All modules installed per startup guide recommendations. Software includes 64-bit versions of Microsoft Windows 7 and Keysight 89600 Vector Signal Analyzer Software with option SSA. Non-warranted data.
2. M9393A performance data is measured on systems with option UNZ (Fast Switching). Without option UNZ, performance is nominally 1.9-26 GHz/s with option B16 and 0.8-6.2 GHz/s with option B04.
3. M9391A performance data is measured on systems with option UNZ (Fast Switching). Without option UNZ, performance is nominally 11-21 GHz/s with option B16 and 2.9-6.3 GHz/s with option B04.

89601B/BN Option SSA Signal Analyzer Characteristics (continued)

Display Features	
Display characteristics	
Number of windows	>20
Traces per window	>20 (overlaid or in separate grids)
Trace data	
	Spectrum, saved data registers, trace math results
Trace formats	
Y-axis	Log magnitude, linear magnitude
X-axis	Log frequency, linear frequency
Number of X-axis points	11 - 50001
Trace Averaging	
Types	Clear Write, Trace Average, Max Hold, Min Hold
Maximum number of averages	>108
Trace math	
Operands	All spectrum traces
Operators	Add, subtract, multiply, divide plus 23 additional math functions
Markers	
Quantity per trace	>20
Types	normal, delta, fixed
Calculations	band power, adjacent channel power, occupied BW
Advanced displays	
Spectrogram	Successive traces shown as single lines on a spectrum vs. time raster; color denotes signal amplitude
Digital persistence	Successive traces overlay on display, with older results fading gradually at a user-defined rate
Cumulative history	Successive traces overlay indefinitely; color denotes relative frequency of occurrence.

Supported Hardware and Recommended Configurations

M9393A PXIe Performance Vector Signal Analyzer

Model-Option	Description	Notes
M9393A-F08, -F14, -F18, or -F27	8 GHz, 14 GHz, 18 GHz, or 27 GHz frequency range	One required.
M9393A-B04, -B10, or -B16	40 MHz, 100 MHz or 160 MHz analysis bandwidth	One required. <i>-B16 recommended for fastest spectrum measurements with 89601B-SSA.</i>
M9393A-300	PXIe frequency reference	Recommended.
M9393A-UNZ	Fast tuning	Recommended. <i>Highly recommended for fastest spectrum measurements with 89601B-SSA.</i>
M9393A-P08, P14, P18 or P27	Pre-amplifier	Recommended to improve low level signal detection.
M9393A-M01, -M05, or -M10	Memory options (512 MB, 2 GB, or 4 GB)	Recommend 4 GB (1 Gsample) memory.

M9391A PXIe Vector Signal Analyzer

Model-Option	Description	Notes
M9391A-F03, -F06	3 GHz or 6 GHz frequency range	One required.
M9391A-B04, -B10, or -B16	40 MHz, 100 MHz or 160 MHz analysis bandwidth	One required. <i>-B16 recommended for fastest spectrum measurements with 89601B-SSA.</i>
M9391A-300	PXIe frequency reference	Recommended.
M9391A-UNZ	Fast tuning	Recommended. <i>Highly recommended for fastest spectrum measurements with 89601B-SSA.</i>
M9391A-M01, -M05, or -M10	Memory options (512 MB, 2 GB, or 4 GB)	Recommend 4 GB (1 Gsample) memory.

Software Information

89601B/BN-SSA Spectrum Analysis	Requires 89601B/BN version 18.5 or later, including options: 200, Basic Vector Signal Analysis 300, Hardware Connectivity SSA, Spectrum Analysis
PC Requirements	See: http://www.keysight.com/find/89600-pc
License types	
Transportable (89601B)	Allows the entire VSA software package or any of its individual options to be moved manually from one computer to another
Floating (89601BN)	Standard floating license; requires license server
Additional 89600 options	
AYA, Vector modulation analysis	B7W, 1xEV-DO modulation analysis
BHF, Custom OFDM modulation analysis	B7X, TD-SCDMA/HSPA modulation analysis
BHK, Custom IQ modulation analysis	B7N, 3G modulation analysis bundle
BHG, LTE-Advanced FDD modulation analysis	BHJ, WLAN 802.11ac modulation analysis
BHH, LTE-Advanced TDD modulation analysis	B7Z, WLAN 802.11n modulation analysis
BHD, LTE FDD modulation analysis	B7R, WLAN 802.11a/b/g modulation analysis
BHE, LTE TDD modulation analysis	BHC, RFID modulation analysis
B7T, cdma2000®/1xEV-DV modulation analysis	BHA, TEDS modulation analysis
B7U, W-CDMA/HSPA+ modulation analysis	

For further information

- 89600 VSA Home Page: <http://www.keysight.com/find/89600vsa>
- 89600 Vector Signal Analysis Software - Brochure, 5990-6553EN
- 89600 Vector Signal Analysis Software - Configuration Guide, 5990-6386EN
- M9391A PXIe VSA - Data Sheet, 5991-2603EN
- M9393A PXIe Performance VSA Data Sheet - Data Sheet, 5991-4538EN
- Achieving Excellent Spectrum Analysis Results Using Innovative Noise, Image and Spur-Suppression Techniques - Application Note, 5991-4039EN

Keep your 89600 VSA up-to-date

With rapidly evolving standards and continuous advancements in signal analysis, the 89601BU/BN software update and subscription service offers you the advantage of immediate access to the latest features and enhancements available for the 89600 VSA software.

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