

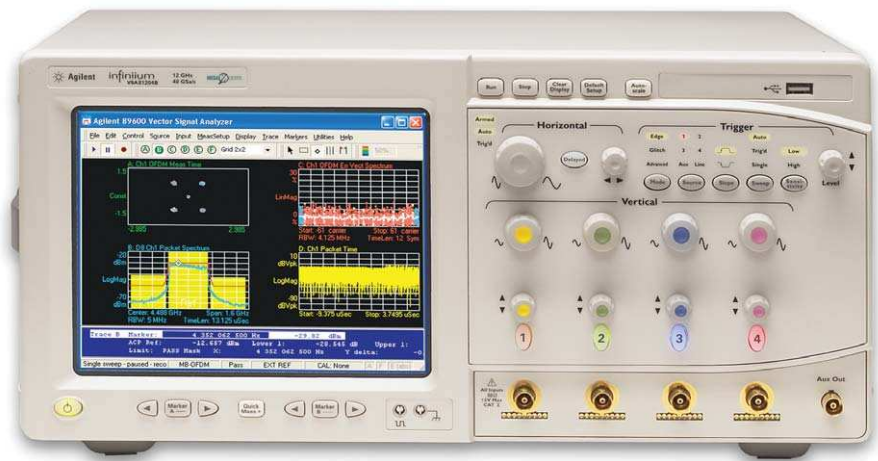
VSA80000A Ultra-Wideband Vector Signal Analyzer

Data Sheet

Wideband vector signal analysis and demodulation tools – for bandwidths up to 13 GHz

Applications:

- Certified Wireless USB
- Wireless LAN
- Radar
- Satellite communications
- Ultra-Wideband designs



Modulated wideband communications signals require wide-bandwidth signal analysis that goes beyond the capabilities of traditional spectrum analyzer-based signal acquisition. The VSA80000A ultra-wideband (UWB) vector signal analyzer (VSA) combines the performance of Agilent's Infiniium real-time oscilloscopes and 89601A vector signal analysis software to deliver

precise, accurate measurements and analysis for signal bandwidths up to 13 GHz. The software is installed and runs directly on the oscilloscope's internal PC, and analysis results are displayed on the oscilloscope display. The VSA80000A allows you to run key compliance-based tests, along with a host of troubleshooting and debugging measurements.



Agilent Technologies

VSA80000A overview

The VSA80000A gives you the ability to:

- Make measurements on WiMedia-based multi-band OFDM ultra-wideband PHY layer signals, such as those in Certified Wireless USB
- Characterize wideband radar and satellite communications signals
- Capture up to 13 GHz bandwidth in a single acquisition
- Measure constellation diagrams, carrier offset, and frequency error using flexible demodulation
- Make error vector magnitude (EVM) measurements
- Gain rapid insight into complex signal behavior using display formats including spectrogram, phase vs. time, and frequency vs. time
- Select specific portion of signals for signal analysis using time gating
- Protect your investment with the upgrade program for the 2-GHz and higher models to up to 13 GHz bandwidth

The Agilent 89600 vector signal analysis software is the industry's premier tool for developing and troubleshooting new and emerging technologies like ultra-wideband technology. Its rich tool set of flexible and powerful measurements and displays includes advanced demodulation measurements. Extensive vector features like time-gating, spectrogram displays, built-in ACPR and OBW capabilities, and more, make it well-equipped for the most demanding R&D tasks. Its PC-based architecture allows for quick and easy updates as standards change. And its ability to acquire and analyze signals with a narrowband spectrum analyzer or wideband oscilloscope makes it invaluable when you're dealing with modulated signals.

The Infiniium real-time oscilloscopes let you capture the complete UWB burst all at once –

up to 13 GHz. The VSA80000A 1-GHz-bandwidth model offers 4 gigasample/second (GSa/s) data rate, 128 Mpts memory length (32 ms), and four analog channels. The VSA80000A 2- to 13-GHz-bandwidth models offer 40 GSa/s data rate, 64 Mpts memory length (50 μ s), four analog channels, and the lowest noise floor of any high-frequency oscilloscope available. Both oscilloscope series offer spurious-free dynamic range greater than 40 dB. Use the oscilloscope to make coaxial measurements, or use the industry-leading InfiniiMax probing system for active differential measurements to 13 GHz in multiple formats.

You can now take advantage of Agilent's unparalleled experience and sustained leadership in signal analysis, combined with Agilent's industry-leading, high-performance, real-time digitizing oscilloscopes.

MB-OFDM ultra-wideband modulation analysis

Troubleshoot your WiMedia-based multi-band OFDM ultra-wideband PHY-layer signals, such as those in Certified Wireless USB, with the industry's most complete set of easy-to-use measurement tools. The VSA80000A ultra-wideband vector signal analyzer, when ordered with the 89601A Option BHB MB-OFDM ultra-wideband modulation analysis capability, provides an unparalleled view into your PHY-layer signals.

Key features:

- Analyze WiMedia-based multi-band OFDM ultra-wideband PHY-layer signals
- Supports all time frequency codes (TFC1 through TFC10), including FFI (non-hopped), TFI and TFI2 (hopped) modes
- Capture the complete UWB burst all at once – up to 13 GHz
- Measure EVM, CCDF, CPE, frequency error, I/O offset, PDF, and more

Support for all time frequency codes (TFC1 through TFC10), including FFI (non-hopped), TFI and TFI2 (hopped) modes, allows you to analyze a wide range of formats, including QPSK modulation (used for data rates from 53.3 Mb/s to 200 Mb/s), and DCM (at data rates from 200 Mb/s to 480 Mb/s), using burst or standard preamble types. In addition, you can manually turn off/on frequency hopping analysis. In the off mode, the synchronization pattern of the TFC selected will be used, but the software assumes that the signal occupies only one band. This mode of operation is especially

useful when you are bringing up and testing TFC 1-4.

You can see low-, mid-, and high-band error vector spectrum and IQ measurement time for hopped signals as well as composite traces for both of these types of results. These measurements can help you troubleshoot errors down to the individual band, carrier, or symbol, for in-depth error analysis. A band error summary provides EVM, CPE, frequency error and IQ offset for each band individually, while the composite error summary provides overall error measurements.

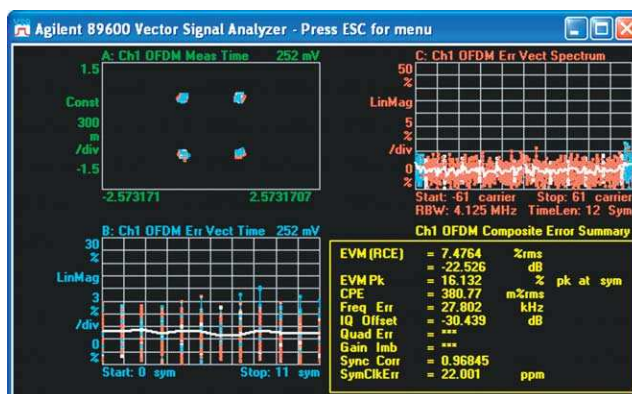


Figure 1. The MB-OFDM ultra-wideband modulation analysis option offers detailed error analysis down to the individual carrier (upper right), individual symbol (lower left), and an overall view of composite errors (lower right).

MB-OFDM ultra-wideband modulation analysis (continued)

Besides specialized UWB measurements, the standard vector measurements and displays can provide insight into the behavior of your signals. For instance, the spectrogram display provides a good visual tool for providing a wider perspective of your signal over time, particularly for hopping signals. You can use the time gating markers to easily focus in on a selected portion of your signal, such as the preamble, or any other area that might require closer inspection.

Instantaneous views of time and spectrum are enhanced with a spectrogram display. This provides a longer-term view of any desired data like the spectrum with CCDF, giving important statistical information about the behavior of your component or system over time. This capability is useful in determining or confirming system margins.

The VSA80000A allows you to capture the complete UWB burst all at once – up to 13 GHz. With the 2 GHz and higher models have a unique scalability – purchase the acquisition bandwidth you need today with the ability to upgrade to as much as 13 GHz in the future. So you can start with the lower UWB bands (up to band ID 5), using the 6-GHz model today. Later, you can easily upgrade the hardware to 12 GHz bandwidth, providing coverage of all band IDs (1 through 14.)

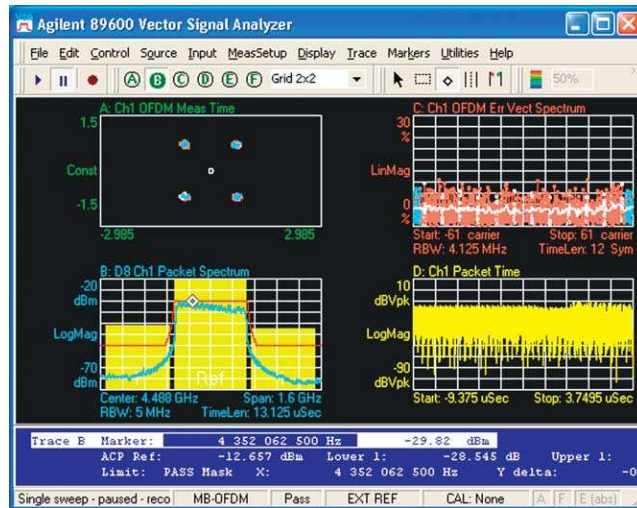


Figure 2. Use the powerful ACP calculation markers and limit lines on the packet spectrum displays to perform important spectral measurements.

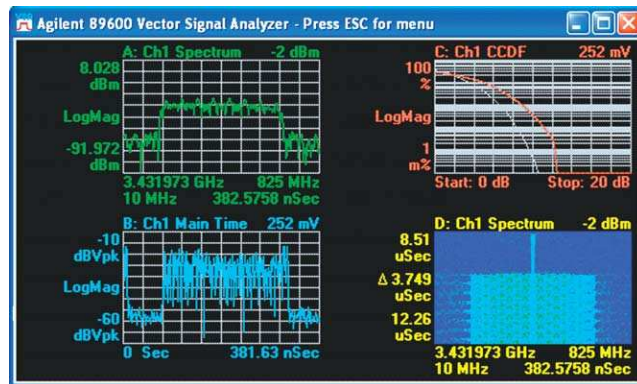


Figure 3. The 89601A VSA software makes many useful measurements, especially for characterizing components. Instantaneous views of time and spectrum (left-hand displays) are enhanced with a spectrogram display (lower right).

Flexible vector modulation analysis for radar and satellite communications

The VSA80000A UWB VSA provides flexible tools for analyzing and demodulating even the most advanced digital modulation formats for radar, satellite communications, and secure communications. Measurements are made on signals in the time and frequency domains using either the baseband or IF zoom mode. In baseband mode, the analysis frequency range is from 0 Hz to the stop frequency. In IF zoom mode, the analysis frequency range is defined by center frequency and span. There is also an I+jQ mode for analyzing two baseband quadrature channels. Results for any mode can be displayed as magnitude or phase, in I/Q and several other formats.

Key features:

- Characterize wideband radar and satellite communications signals
- Capture up to 13 GHz bandwidth in a single acquisition
- Measure pulsed, burst, or continuous signals
- Analyze modulation formats such as FSK, GFSK, MSK, BPSK, QA, APSK, VSB, and more
- Measure constellation diagrams, carrier offset, and frequency error using flexible demodulation

Modulation quality measurements in the form of error vector magnitude (EVM) can be made on digital wireless communications signals with bandwidths of hundreds of MHz. In addition, powerful diagnosis capabilities allow you to determine the exact

impairments that cause a digitally modulated signal to fail quality standards. A choice of 24 over 25 digital demodulators, more than 8 filters, and 25 instrument presets puts all this power at your fingertips.

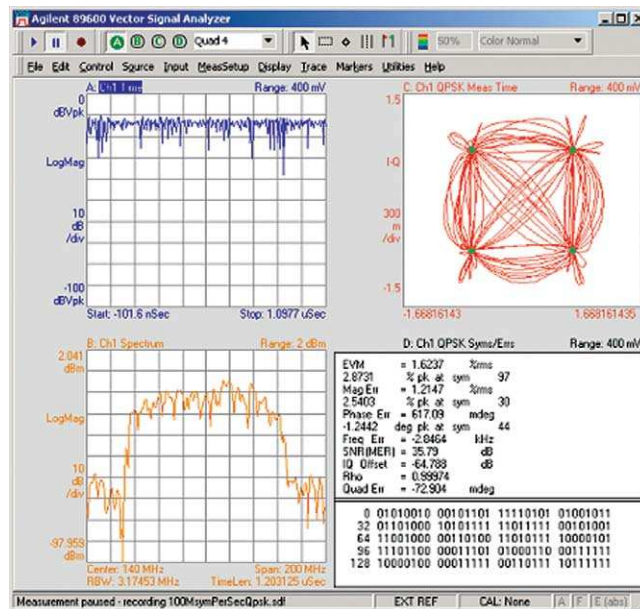


Figure 4. Modulation analysis of a QPSK signal in four different views – volts vs. time (upper left), I/Q trajectory (upper right), signal spectrum (lower left), and error analysis (lower right)

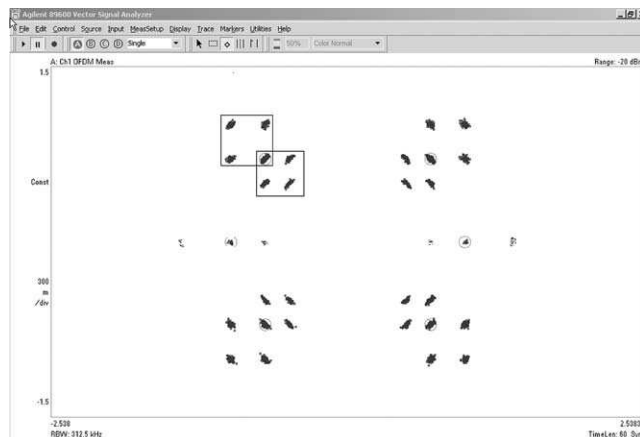


Figure 5. QPSK error vector magnitude (EVM) constellation diagram showing IQ gain imbalance

Flexible vector modulation analysis for radar and satellite communications

(continued)

With VSA80000A, you can measure phase linearity, frequency linearity, and other parameters of chirped radar signals easily (see Figure 6). Or measure the frequency behavior of the radar signal over time.

Understand the characteristics of your transmit channel, like the RF path delay between a pair of antennas (see Figure 7). Using a signal generator to provide the same stimulus to both input channels of the VSA80000A, the only difference observed at the receiver end would be the physical channels. With an RF power splitter, the signal generator output goes to the transmit antenna as well as the channel one input of the VSA80000A. The generator is set to produce a random noise signal, band limited to 15 MHz. A second receive antenna is connected to the channel two input of the VSA80000A. With two antennas separated by 2 meters and a large metal object positioned to partially block line-of-site transmission, we can analyze the signal spectrum.

The spectrum of the signal coming from the receive antenna clearly shows a spectral notch resulting from multipath in the RF channel. The frequency response result, computed using data from both measurement channels, can be interpreted in this measurement as the channel response. The frequency response is a complex function and is displayed in the upper right grid in Figure 6 in log-magnitude

coordinates. Other coordinates, such as phase or group delay, may also be selected. The cross correlation between the time waveforms on each measurement channel shows the impulse

response and delay spread of the channel. Time resolution in the cross-correlation result is a function of both the signal bandwidth, and the instrument span selected.

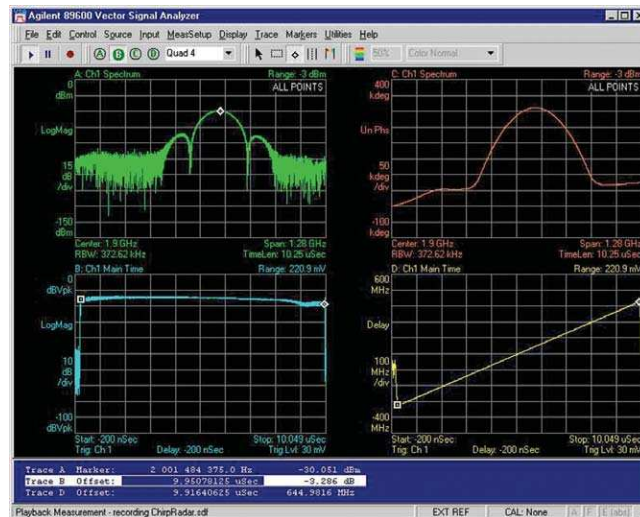


Figure 6. Measure phase linearity, frequency linearity, and other parameters of chirped radar signals easily.

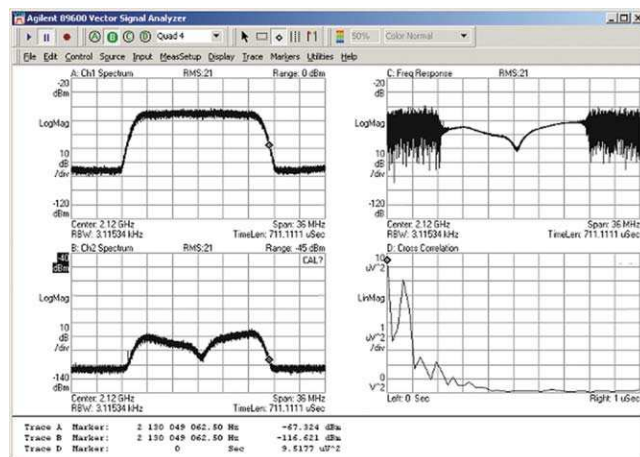


Figure 7. Measuring the difference in delay in RF multipath signals – TX reference spectrum (upper left), RX antenna spectrum (lower left), frequency response of antenna (upper right), and cross correlation (lower right)

Ordering information

The VSA80000A ultra-wideband VSA is based on an Infiniium 8000 Series or 80000B Series DSOs with the 89601A vector signal analyzer node-locked software installed and running on the oscilloscope's internal Windows® XP-based PC. The 89601A VSA software also includes 1 year of software update subscription service.

To configure your VSA80000A, order the following:

- Select the VSA80000A ultra-wideband vector signal analyzer
- Select one of the oscilloscopes in Table 1
- Select any of the oscilloscope options for additional capability. For 8000 Series oscilloscopes (see Table 2), Option 640 memory is required and is not modifiable. For 80000B Series DSOs (see Table 3), Option 001 memory is required and is not modifiable.
- Select any of the 89601A VSA software options for additional capability (see Table 4). Option 200 basic VSA software, Option 300 hardware connectivity, Option AYA flexible modulation analysis, and Option 012 free 12-month software update subscription service are required and are not modifiable. Note that some 89601A VSA options may add measurement and/or analysis capabilities that are best performed by a spectrum analyzer.

For example, to configure a 1-GHz system for radar oriented measurements, a minimal configuration would be:

- VSA80000A ultra-wideband vector signal analyzer
- DSO8104A Option 640 1-GHz oscilloscope
- 89601A VSA software with Options 200, 300, AYA and 012

To configure a 6-GHz system for Certified Wireless USB-oriented measurements, a minimal configuration would be:

- VSA80000A ultra-wideband vector signal analyzer
- DSO80604B Option 001 6-GHz oscilloscope
- 89601A VSA software with Options 200, 300, AYA, BHB and 012

Refer to the Infiniium 8000 Series Oscilloscopes Data Sheet or the Infiniium DSO80000B Series Oscilloscopes Data Sheet for complete specifications and information on probes and options. Refer to the 89601A VSA software data sheet for more information on the VSA software and its options.

Ordering information (continued)

Oscilloscope model	Options included	Analysis bandwidth	Maximum sampling rate	Channels	Memory depth (samples)	Maximum recording length
DSO8104A	Option 640 64M memory	0 to 1.0 GHz	4 GSa/s	4	128 M at 4 GSa/s, 64 M at 2 GSa/s	32 ms at 128M, 16 ms at 64M
MSO8104A	Option 640 64M memory	0 to 1.0 GHz	4 GSa/s	4 analog + 16 digital	128 M at 4 GSa/s, 64 M at 2 GSa/s	32 ms at 128M, 16 ms at 64M
DSO80204B	Option 001 64M memory	0 to 2.0 GHz	40 GSa/s	4	2 M at 40 GSa/s, 1 M at 20 GSa/s	48 μ s at 512K, 200 μ s at 64M
DSO80304B	Option 001 64M memory	0 to 3.0 GHz	40 GSa/s	4	2 M at 40 GSa/s, 1 M at 20 GSa/s	48 μ s at 512K, 200 μ s at 64M
DSO80404B	Option 001 64M memory	0 to 4.0 GHz	40 GSa/s	4	2 M at 40 GSa/s, 1 M at 20 GSa/s	24 μ s at 512K, 100 μ s at 64M
DSO80604B	Option 001 64M memory	0 to 6.0 GHz	40 GSa/s	4	2 M at 40 GSa/s, 1 M at 20 GSa/s	24 μ s at 512K, 100 μ s at 64M
DSO80804B	Option 001 64M memory	0 to 8.0 GHz	40 GSa/s	4	2 M at 40 GSa/s, 1 M at 20 GSa/s	12 μ s at 512K, 50 μ s at 64M
DSO81004B	Option 001 64M memory	0 to 10.0 GHz	40 GSa/s	4	2 M at 40 GSa/s, 1 M at 20 GSa/s	12 μ s at 512K, 50 μ s at 64M
DSO81204B	Option 001 64M memory	0 to 12.0 GHz	40 GSa/s	4	2 M at 40 GSa/s, 1 M at 20 GSa/s	12 μ s at 512K, 50 μ s at 64M
DSO81304B	Option 001 64M memory	0 to 13.0 GHz	40 GSa/s	4	2 M at 40 GSa/s, 1 M at 20 GSa/s	12 μ s at 512K, 50 μ s at 64M

Table 1. Required minimum oscilloscope configuration

Ordering information (continued)

Option	Description
002	EZJIT jitter analysis software
003	High-speed serial data analysis software with clock recovery
006	My Infiniium integration package
007	Low-speed serial data analysis software for I ² C and SPI
008	CAN serial data analysis software
009	InfiniiScan event identification software
010	Infiniium User Defined Function application software
017	Removable hard disk drive
A6J	ANSI Z540-compliant calibration

Table 2. Additional options for 8000 Series oscilloscopes

Option	Description
002	EZJIT jitter analysis software
003	High-speed serial data analysis software with clock recovery
004	EZJIT Plus jitter analysis software
005	Noise reduction software (included standard for DS081304B)
006	My Infiniium integration package
007	Low-speed serial data analysis software for I ² C and SPI
008	CAN serial data analysis software
009	InfiniiScan event identification software
010	Infiniium User Defined Function application software
017	Removable hard disk drive
A6J	ANSI Z540-compliant calibration

Table 3. Additional options for DS080000B Series oscilloscopes

Ordering information (continued)

VSA model	Option	Description	Comments
89601A		Vector signal analysis software	Required
89601A	200	Basic VSA software	Required
89601A	300	Hardware connectivity	Required
89601A	AYA	Flexible modulation analysis	Required
89601A	012	12-month software update subscription service	Required. Can be extended to up to 24-month coverage
89601A	105	Dynamic link to EEsof ADS simulation software	Recommended for circuit or system simulation
89601A	BHB	MB-OFDM ultra-wideband modulation analysis	Recommended for WiMedia-based multi-band OFDM ultra-wideband PHY-layer signals
89601A	B7N	3G modulation analysis bundle (includes Options B7T, B7U, B7W, and B7X)	See note 1
89601A	B7T	cdma2000/1xEV-DV modulation analysis	See note 1
89601A	B7U	W-CDMA/HSDPA modulation analysis	See note 1
89601A	B7W	1xEV-DO modulation analysis	See note 1
89601A	B7X	TD-SCDMA modulation analysis	See note 1
89601A	B7R	WLAN modulation analysis	See note 1
89601A	B7Z	IEEE 802.11n MIMO modulation analysis	See note 1
89601A	B7Y	IEEE 802.16 OFDMA modulation analysis	See note 1
89601A	B7S	IEEE 802.16-2004 OFDM modulation analysis	See note 1
89601A	BHA	TEDS modulation and test	See note 1

Table 4. 89601A VSA software options

Note 1: These 89601A VSA options add measurement and/or analysis capabilities that may be best performed by a spectrum analyzer.

Product upgrades

Additional information on the VSA80000A can found at:
www.agilent.com/find/vsa80000a

If you wish to upgrade your Infiniium 8000 Series oscilloscope in the future by adding options, please consult your local Agilent sales representative for ordering information. Learn more at:
www.agilent.com/find/mso8000

If you wish to upgrade your Infiniium DSO80000B Series oscilloscope in the future by adding options, please consult your local Agilent sales representative for ordering information. The After-Burner II Upgrade Program is available that allows you to upgrade your Infiniium DSO80000B Series oscilloscope to a higher bandwidth model, protecting your valuable Infiniium oscilloscope and probing system investment over the long term. Learn more at:
www.agilent.com/find/dso80000b

To upgrade the 89601A vector signal analyzer node-locked software in the future by adding options, consult your local Agilent sale representative for ordering information and the benefits of the 89601AS software update subscription service. Learn more at:
www.agilent.com/find/89600

Related literature

Publication title	Publication type	Publication number
<i>Infiniium 8000 Series Oscilloscopes</i>	Data sheet	5989-4271EN
<i>Infiniium DSO80000B Series Oscilloscopes and InfiniiMax Probes</i>	Data sheet	5989-4604EN
<i>Agilent 89600 Series Vector Signal Analyzer Software</i>	Data sheet	5989-1786EN
<i>Agilent 89600 Series Vector Signal Analysis Software 89601A/89601AN/ 89601N12</i>	Technical overview	5989-1679EN
<i>Agilent Infiniium Oscilloscopes Performance Guide Using 89601A Vector Signal Analyzer Software</i>	Application note	5988-4096EN
<i>Agilent Technologies Solutions for MB-OFDM Ultra-Wideband</i>	Application note	5989-5280EN
<i>Agilent WLAN and Baseband Transmitter Analysis Using Agilent Infiniium Oscilloscopes and 89600 Software</i>	Data sheet	5989-0327EN



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