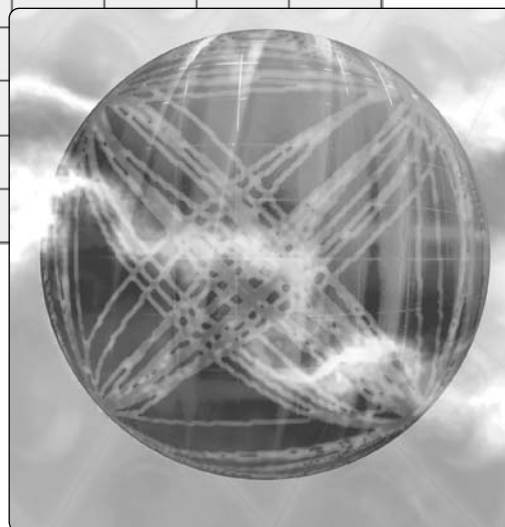
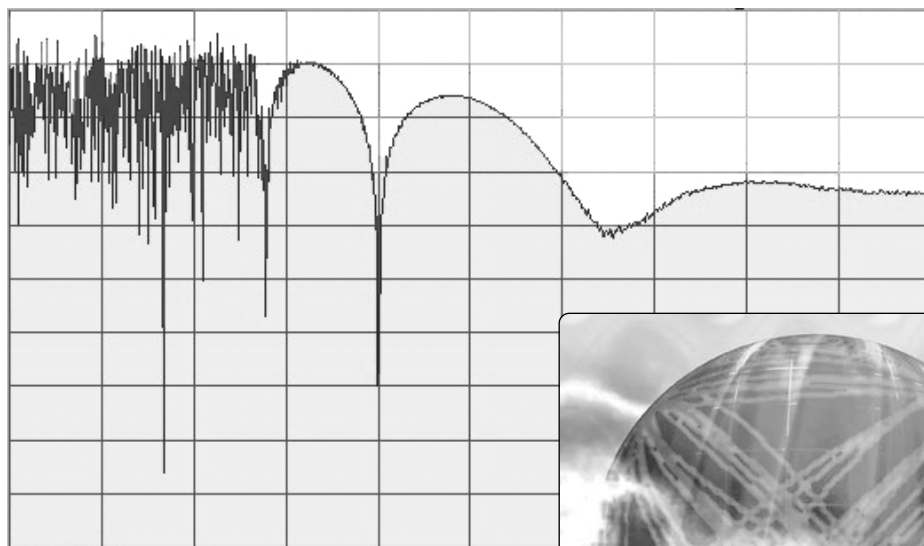


**Agilent**  
**89600 Series Vector Signal Analysis Software**  
**89601A/89601AN/89601N12**

Technical Overview



When you need to troubleshoot high performance systems with hard-to-measure signals – bursted, hopped, modulated – you need the Agilent 89600 vector signal analysis software.

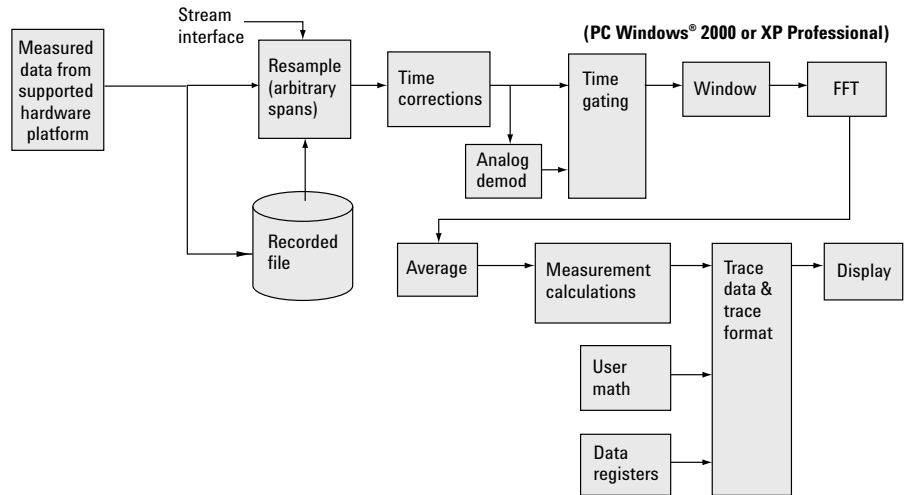
Time-, frequency-, and modulation-domain analysis provide measurements and displays to help you analyze your signal, and then quickly identify and track down problems.



## Introduction

This technical overview covers the features, capabilities, and benefits of the 89600 Series vector signal analysis software. For detailed specifications, please see the *89600 Series Vector Signal Analysis Software Data Sheet*, publication number 5989-1786EN.

## Advanced Digital Signal Processing to Uncover and Identify Problems



**Figure 1. The VSA software architecture provides DSP demodulation algorithms with user-controlled modulation parameters for flexible demodulation of a range of new and emerging formats, including 3G, WLAN, and 802.16. Data can come from several sources, including multiple supported hardware platforms, recorded files, and stream data from Agilent EEsolf's ADS simulation software.**

In RF/wireless communications applications, the Agilent 89600 vector signal analysis software lets you characterize complex, time-varying signals with detailed and simultaneous spectrum, modulation and time waveform analysis. Use these tools to uncover system problems—problems you really need to see and track down.

The 89600 VSA software connects your measurement hardware to your PC environment, using familiar, PC-based tools, providing a tightly linked software/hardware test and measurement environment. Use these tools to track down problems at any stage of your design process: from simulation to final prototype.

## **More than spectrum analysis**

The 89600 VSA software provides traditional spectrum displays and measurements, but today, spectrum analysis isn't enough. New digital formats require new measurements.

Familiar tools such as spectrum analyzers with demodulation may indicate that a problem exists, but they can't help you understand the cause of the problem. For instance, incorrect filtering, spurious interference, incorrect interpolation, DAC overflow, symbol mis-timing and other errors may all increase adjacent channel power and distort the constellation. So how do you determine what the real problem is?

The 89600 VSA software provides you the tools to identify the root cause of the problem and to analyze continually changing phase, magnitude, and frequency. Some tools, like the constellation and vector diagrams, are familiar to radio designers. Others, like the spectrogram display are tools for qualitatively understanding system behavior. And still others, like error vector time and spectrum, are entirely new measurements bringing new capabilities and requiring new displays.

## **PC-based for ease-of-use**

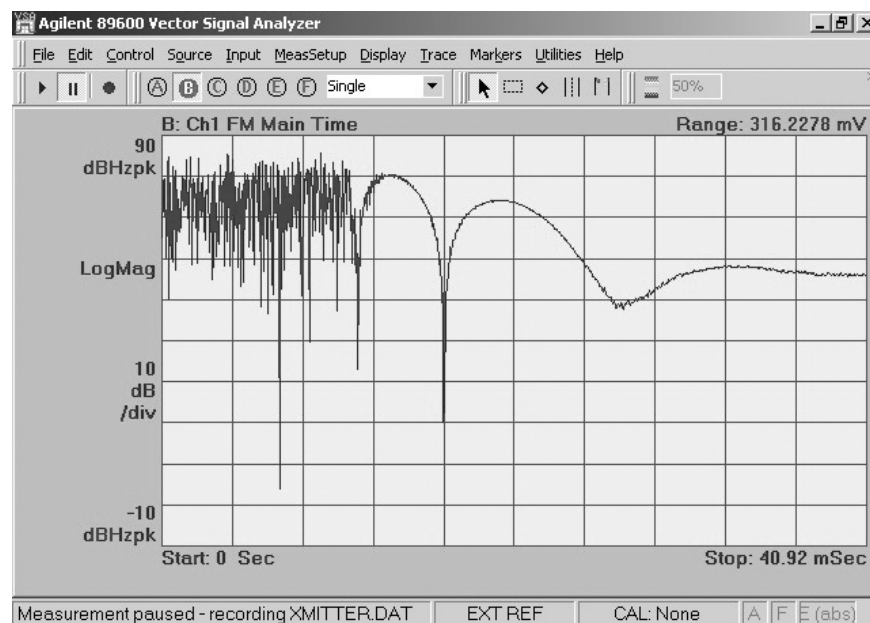
The 89600 software relies on a PC for its processing. Improvements in PC capabilities automatically improve the VSA software's performance. New capabilities for integrating test instrumentation and design automation software are also made possible because the VSA software can accept measurement data from a wide range of supported hardware platforms, or time series data from computational tools—and all with a familiar, easy-to-use Windows GUI.

## Vector Signal Analysis (Option 200)

Option 200 is a required option that provides the baseline capability for the 89600 VSA software.

Powerful display formats, signal recording and playback, plus superlative help text provide you with the tools you need for analyzing signals.

### Precise analog demodulation



**Figure 2.** This FM demodulation of a transmitter at turn-on shows the frequency settling characteristics. Use AM or PM demodulation to show amplitude and phase settling performance as well.

Characterize amplitude-modulated, frequency-modulated, and phase-modulated signals in both the frequency and time domains with the built-in analog demodulation capabilities of the 89600 VSA software.

Use analog demodulation to analyze unintentionally modulated signals.

For example:

- Use FM and PM demodulation to examine phase and frequency trajectories during frequency hops or establish the phase-lock-loop lock-up time of oscillators and synthesizers.
- AM demodulate a burst signal to evaluate the time needed for the signal to stabilize.
- AM and PM demodulate sidebands to determine the type of modulation present in phase noise.
- Take the FFT of a demodulated AM/FM/PM noise signal for insight into spurious signals coupling through from other parts of the circuit. Often just the frequency alone of interfering AM/FM/PM modulation provides information about the root cause of the interference.

## Flexible vector analysis tools

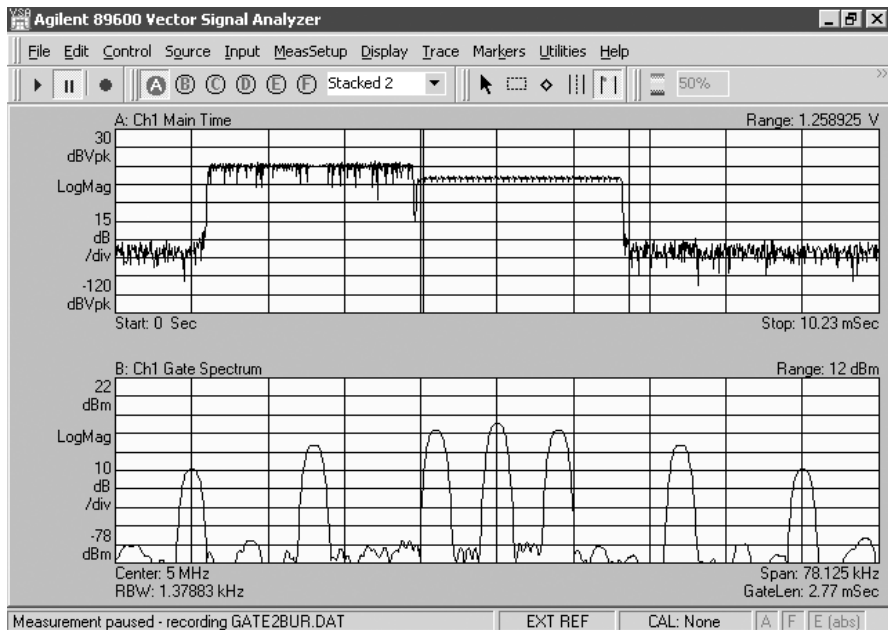
Analyze time, frequency, and amplitude domain behavior and more with one of the most complete set of vector and scalar analysis tools on the market today.

Measurements include:

- Time
- Gated time
- Spectrum
- Power spectral density
- CCDF and CDF
- Auto-correlation

Use the time tools to measure pulse width, rise and fall times, and observe the shape of your TDMA signals. These tools are particularly useful for setting the trigger level, hold-off and delay on your pulsed signals.

Use the spectrum tools to find the center frequency and bandwidth of your signal, find spurs, and more. A complete set of marker and time gating functions complement the spectrum display.



**Figure 3.** Look at time and frequency characteristics of your signal simultaneously. The top display shows the time trace of a bursted signal with gate markers on the second part of the burst. The bottom display shows the frequency spectrum of just the portion of the signal in-between the gate markers.

Statistically-based amplitude measurements provide a better description of system or component behavior on noise-like digital communications signals. Measure peak to average power ratio and more with the complementary cumulative distribution function (CCDF), probability distribution function (PDF) and cumulative distribution function (CDF) tools provided in Agilent's VSA software.

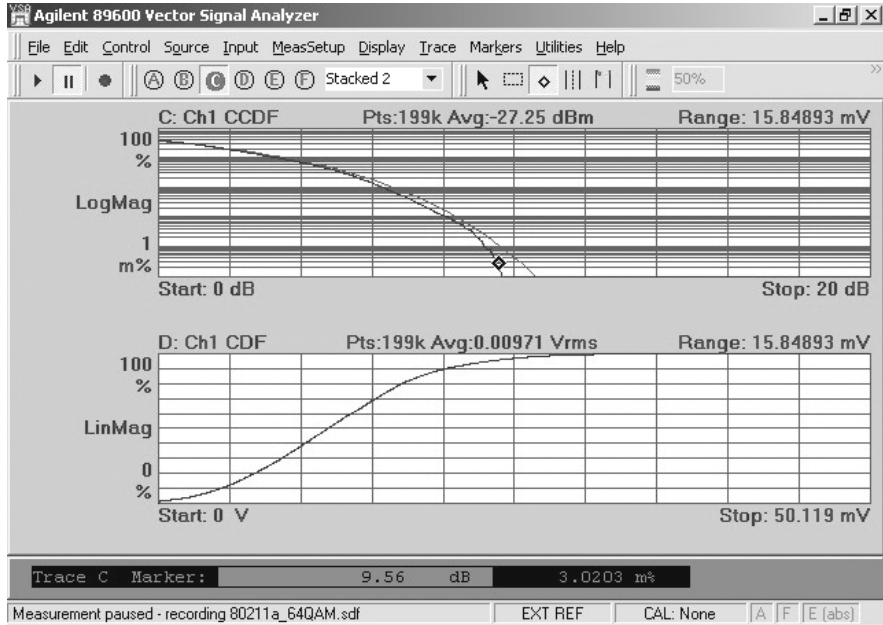


Figure 4. Both CCDF and CDF functions are available. The CCDF marker readout at the bottom of the display indicates that the signal exceeds 9.56 dB above the average signal level only .003% of the time, useful information when calculating design headroom.

## Display format and scaling

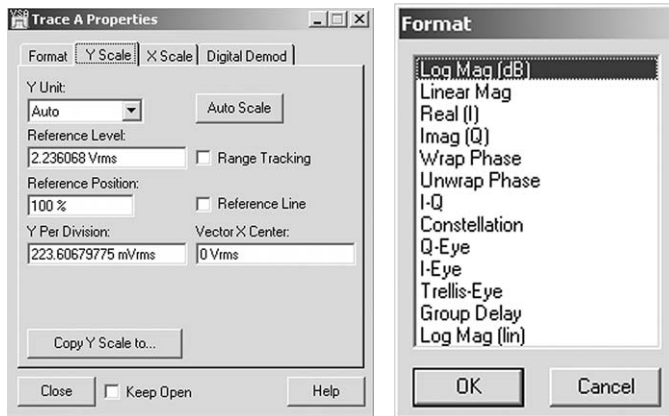


Figure 5. Example trace formats available.

Scale your display the way you want it, with the units you need using the flexible display formatting and scaling tools provided standard in the 89600 VSA software. Select from a complete list of formats including log and linear displays of the signal magnitude, displays of only the real (I) or imaginary (Q) part of the signal, vector and constellation displays, eye displays, trellis displays and group delay. Scaling is automatic with manual override provided for all parameters, including reference level and units per division for both the X and Y-axes.

## See six screen displays, simultaneously

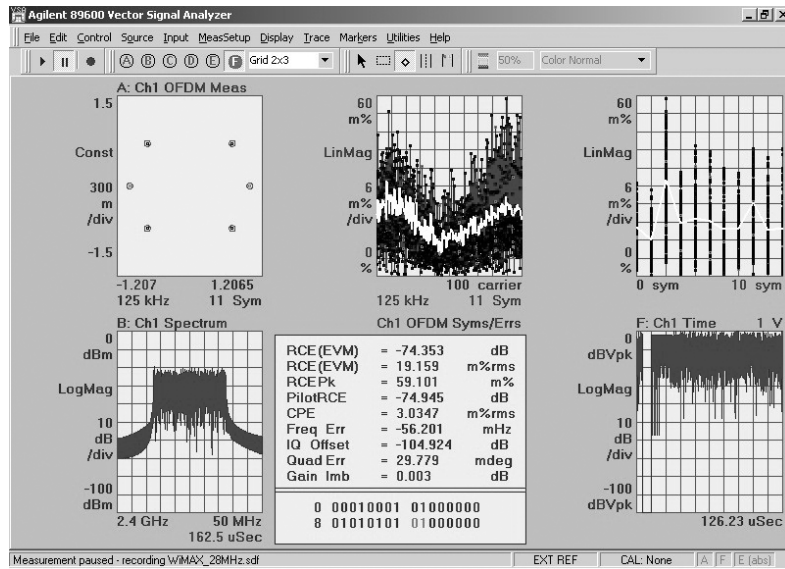


Figure 6. Display one, two, three, four, or six displays, simultaneously. You can choose to have them appear stacked, or in a symmetrical grid.

## Spectrogram display format

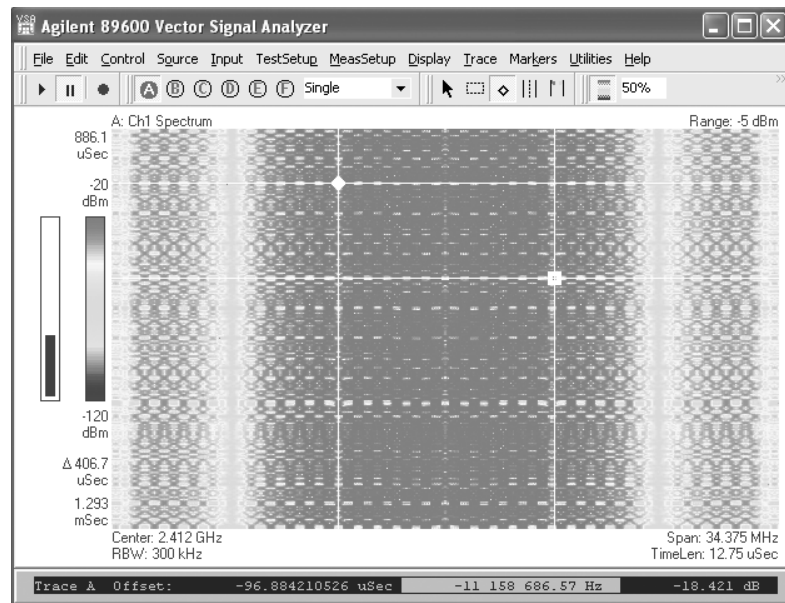


Figure 7. View the spectral behavior of wide bandwidth hopping signals over time using spectrogram displays. Grey-scale views provide even greater resolution.

Take advantage of the spectrogram display to view the behavior of your signal over time. This three-dimensional display is noted for its ability to track the frequency and amplitude behavior of signal, particularly frequency hopping signals and signals with poor signal-to-noise ratio. Use it to also survey signal environments for a quick pictorial view.

For a more in-depth view, use scale markers to expand a portion of the display. Offset and delta markers provide detailed timing information on signal events. Use them to determine time differences between events in both the time and frequency domains.

## Signal capture and playback

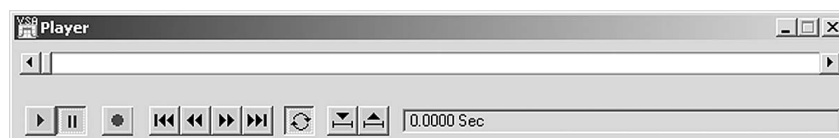


Figure 8. The signal recording user interface is familiar and simple to use.

The 89600 VSA software lets you capture your digitized signal in your measurement hardware and transfer it directly to your PC's disk drive. You can play the signal back at a later time, import it into other applications, and create and play your own recording through an Agilent signal generator.

### Why record signals?

- No gaps – offers continuous time record at full bandwidth of your hardware.
- Provides powerful post processing with more control over the analysis.
- Allows slow playbacks with overlap processing. Overlap processing allows you to vary the amount of new information included in each display update. The end result is to provide a “slow motion” view of your signal—extremely useful in understanding transients and transitions.
- Offers porting of simulations back to design software.
- Allows you to archive – saving signal records for future analysis.

### You have full control of the playback including:

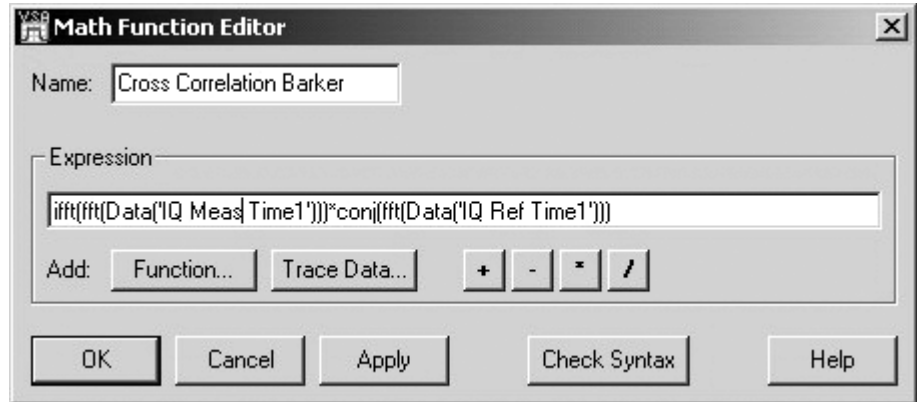
- Start and pause
- Drag the bar to any position in the record to begin playback
- Back up and rewind
- Loop the recording
- Set start and stop times
- Re-record
- Set span and center frequency (within the extent of the original capture)



## Signal generator download control

Record a time domain signal using the recording feature, and link it to a supported Agilent signal generator. You can record the signal at one frequency, and using the zoom mode feature, transfer the signal to the generator at a different frequency. For ease of use, you can control key features of the signal generator from the 89600 VSA software front panel.

## Trace math



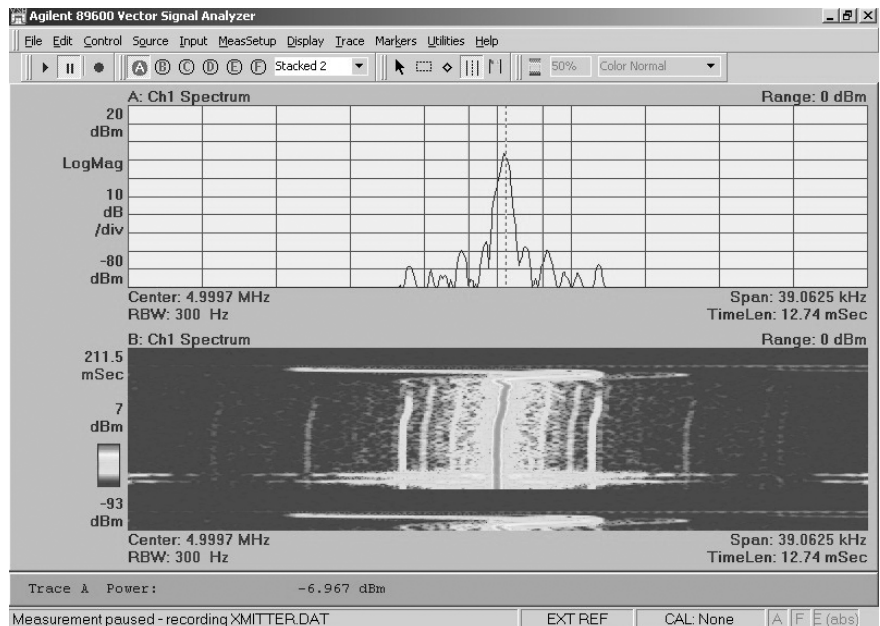
**Figure 9.** Create math functions for simple tasks like unit scaling, or for sophisticated new measurements like this Barker code cross correlation function.

Math functions let you create mathematical expressions that operate on trace data. Use math functions to:

- Perform mathematical operations on trace data.
- Create a mathematical expression that you can apply as a filter to a waveform.
- Manipulate data in the data registers.

Math functions can be simple or complex. For example, a simple math function may add two data registers. Another math function may compute the inverse FFT of channel 1 spectrum-data. Or a more complex math function may combine operations on trace data or data registers.

## Easy-to-Use Windows Graphical User Interface



**Figure 10. Marker-based measurements, such as band power (shown here) or time gating, or several others, are easy to set up. Just position the marker cursor by dragging and dropping, or type in numeric values manually.**

Changing parameters such as center frequency, span, or scale, is easy. Simply place the cursor on the display annotation, and a special cursor will appear. Double click and enter the parameter or use the up/down arrows. If you are familiar with Microsoft Windows applications, you can quickly master the 89600 VSA software.

### Versatile markers highlight signal behavior

The 89600 VSA offers markers which: display current location, calculate offset (delta) values, provide frequency counter capability, integrate between two lines to determine bandpower, calculate occupied bandwidth (OBW), let you set up zones to calculate adjacent channel power (ACPR), and conduct limit tests.

To display signal parameters using the marker function, simply place a marker on the highest signal using the marker search functions. The marker parameters are shown at the bottom of the display. Use the offset marker to measure parameters between two points on the display.

The ACPR marker allows you to easily perform generic adjacent channel power ratio measurements. You can configure the reference channel and up to five separate adjacent channels. Measurement results are displayed at the bottom of the display, or in the ACP Summary table.

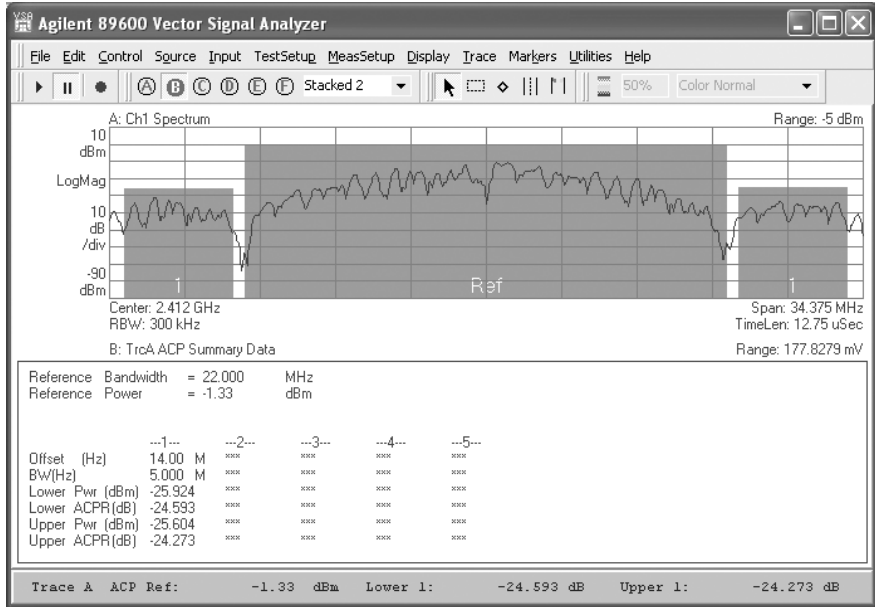


Figure 11. ACPR measurement with summary table enables you to specify up to five adjacent channels.

The OBW marker allows you to easily perform occupied bandwidth measurements. The OBW measurement determines the band of frequencies that contain a specified percentage of the total power within the measurement span.

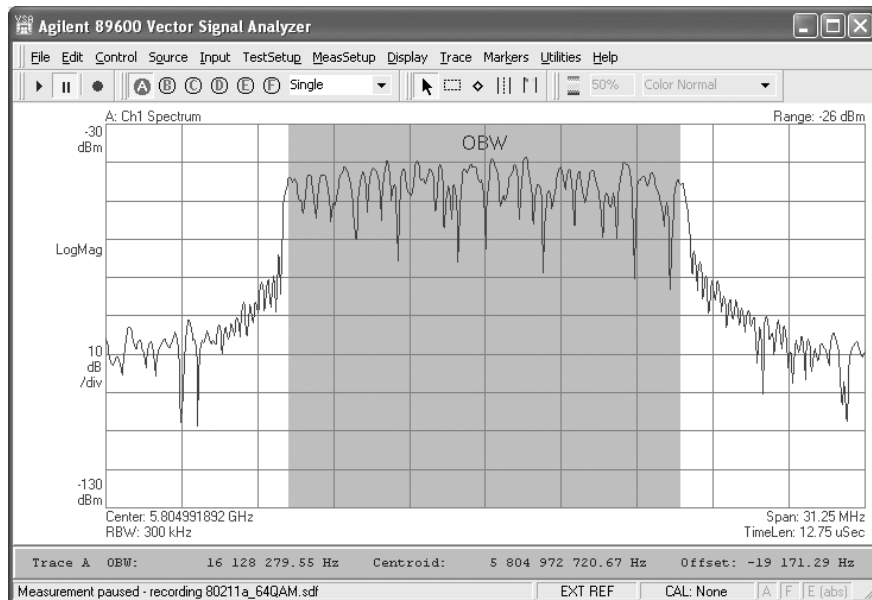
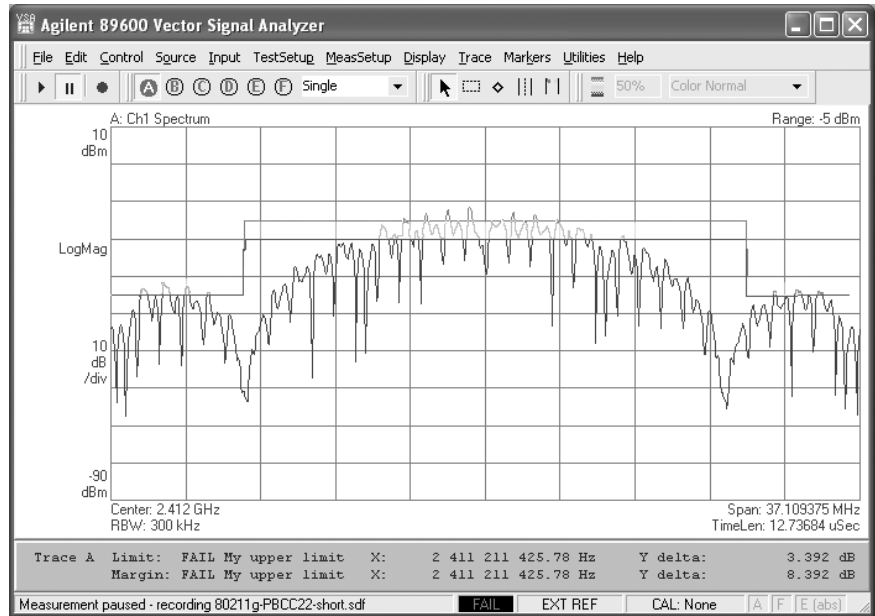


Figure 12. The OBW measurement with summary table can determine the centroid frequency, or you can manually set the centroid frequency to the center frequency.

Limit lines can be created to compare trace data to your defined limits and indicate a pass or fail condition.



**Figure 13.** Set the pass and fail color indication for either the limit, or the margin, or both. You define your own limits using the built-in limit line editor.

These more sophisticated marker measurements allow more sophisticated setup. For example, you define a table of values, as for ACPR or simple limit tests. For more complex limit tests, you can either define a set of limit points segment by segment, or import a measurement and add a margin limit around it. For all of these and other markers, the results are displayed at the bottom of the display.

Markers can be coupled across all six displays, allowing you to “walk” through your signal and see its behavior in multiple domains—a very powerful and useful feature.

## Highlight signals

For a closer look at a signal, use the highlight box to enhance signal viewing by scaling traces in. Place the box around the signal of interest and select the desired scaling. You can scale both the X- and Y-axis, or scale each separately.

## **Multi-channel ready**

The 89600 VSA software comes fully equipped to control and process two base band or two RF channels.

The built-in ch1 + jch2 mode combines two base band channels for automatic analysis of a single, composite signal. All measurements, including spectrum, time, and error analysis, are available on the combined signal.

Powerful and sophisticated trace data provide you with the basic capabilities to perform even MIMO-analysis:

- Auto-correlation and cross-correlation
- Coherence
- Frequency response
- Impulse response

Use these tools to develop and analyze complex multi-antenna, radar, or signal surveillance systems. If you're working on IEEE 802.11n MIMO systems, Option B7Z takes full advantage of the software's capability. For more information see the B7Z section.

Check hardware specifications to determine which hardware platform configurations support multiple channels.

## **Spectrum analyzer application**

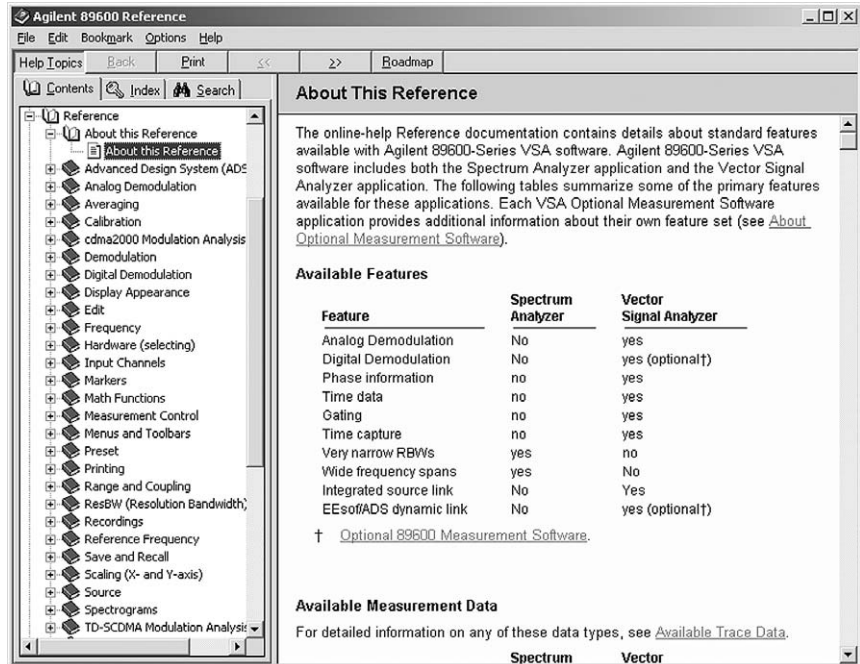
The 89600 VSA software includes a spectrum analyzer application. Use this application to identify signals present in a wide span and to evaluate small signals very close to the noise floor. This application makes scalar measurements, as opposed to vector measurements. Scalar measurements provide displays of amplitude versus frequency for both narrow and wide spans.

Scalar measurements step the application's local oscillator (LO) during the measurement. Each step of the LO produces a segment of the selected frequency span. In other words, the application sets its LO, performs an FFT, then steps its LO to a higher frequency, performs another FFT, and so forth. Because of this, not all hardware measurement platforms support the use of the spectrum analyzer application.

Use this application when you need:

- Very narrow resolution bandwidth with high speed
- Very low noise floor with wide spans
- High signal-to-noise dynamic range
- Maximum flexibility of frequency span, resolution bandwidth, and speed
- Wider frequency spans

## Help text



**Figure 14.** Everything, from reference information, to tutorials using recorded signals, to programming examples, is included in the incredibly comprehensive help text.

Over 2000 equivalent paper pages of help text, application information and tutorials are provided with the 89600 software. A complete set of search tools and hot links provide ready access to all of this information.

## Powerful Modulation Analysis Options

The real power of the VSA software is its ability to analyze complex, time-varying signals. The 89600 VSA software analyzes a wide variety of general communications formats, 2G, 3G, WLAN, WiMAX, UWB, broadband access, and many more.

You can quickly evaluate and troubleshoot digitally modulated signals with both qualitative displays and quantitative measurements. Then, visualize system performance rapidly and intuitively with familiar display formats.

Multiple modulation analysis options are available:

- Option AYA flexible modulation analysis
- Option B7T cdma2000/1xEV-DV modulation analysis
- Option B7U W-CDMA/HSDPA modulation analysis
- Option B7W 1xEV-DO modulation analysis
- Option B7X TD-SCDMA modulation analysis
- Option B7N 3G modulation analysis bundle (an ordering convenience equivalent to options B7T, B7U, B7W, B7X combined)
- Option B7R WLAN modulation analysis
- Option B7S IEEE 802.16-2004 OFDM modulation analysis
- Option B7Y IEEE 802.16 OFDMA modulation analysis
- Option B7Z IEEE 802.11n MIMO modulation analysis
- Option BHA TEDS modulation analysis and test
- Option BHB MB-OFDM ultra-wideband modulation analysis

The supported modulation formats are listed in the Table 1.

All the error analysis tools described in this section apply to all modulation analysis options. Specialized modulation formats may have additional tools besides.

## Supported modulation formats

### Available with Option AYA

APCO 25	DECT	DVB64	HIPERLAN/1 (HBR)	TETRA
Bluetooth™	DTV8	DVB128	HIPERLAN/1 (LBR)	VDL mode 3
CDMA base	DTV16	DVB256	NADC	WLAN (802.11b)
CDMA mobile	DVB16	EDGE	PDC	ZigBee (IEEE 802.15.4-2003)
CDPD	DVB32	GSM	PHP (PHS)	

### General modulation formats, available with Option AYA

(With variable center frequency, symbol rate, filtering type and alpha/BT)

BPSK, 8PSK		VSB 8-, 16-	Offset QPSK
QPSK		FSK 2-, 4-, 8-, 16-level	EDGE
Pi/4 DQPSK		DQPSK	DVBQAM 16, 32, 64, 128, 256
MSK type 1, type 2		D8PSK	APSK 16/32 (12/4QAM)
QAM 16-, 32-, 64-, 128-, 256-, 512-, 1024-			

### 3G Wireless communications formats

cdma2000/1xEV-DV	Opt B7T
W-CDMA/HSDPA	Opt B7U
1xEV-DO	Opt B7W
TD-SCDMA	Opt B7X
All of the above	Opt B7N

### Broadband Wireless Access formats

IEEE 802.16-2004 OFDM	Opt B7S
IEEE 802.16 OFDMA	Opt B7Y

### Wireless Networking formats

WLAN (IEEE 802.11a,b,g); WLAN (HiperLAN/2)	Opt B7R
IEEE 802.11n MIMO (WLAN-HT)	Opt B7Z

### Public Safety Radio formats

TETRA Enhanced Data Service	Opt BHA
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### Ultra-wideband formats

MB-OFDM	Opt BHB
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**Table 1. Choose from the many available modulation analysis options to meet your measurement needs. The modulation formats supported by each option are listed above.**

## Advanced digital demodulators

The 89600 VSA software offers a wide range of digital demodulators. These advanced technology demodulators do not require external filtering, coherent carrier signals, or symbol-clock timing signals to successfully demodulate a signal, just the carrier frequency and symbol rate.

In addition to demodulating your signal, the 89600 digital demodulators use your signal to generate an ideal reference signal called I/Q reference or FSK reference. It then compares your measured signal to this ideal reference to quantify and locate errors in your signal. Built-in filters can be applied to both the measured and reference signals for maximum flexibility comparing the signals or probing points in your communication system.



## Unique error analysis tools highlight problems

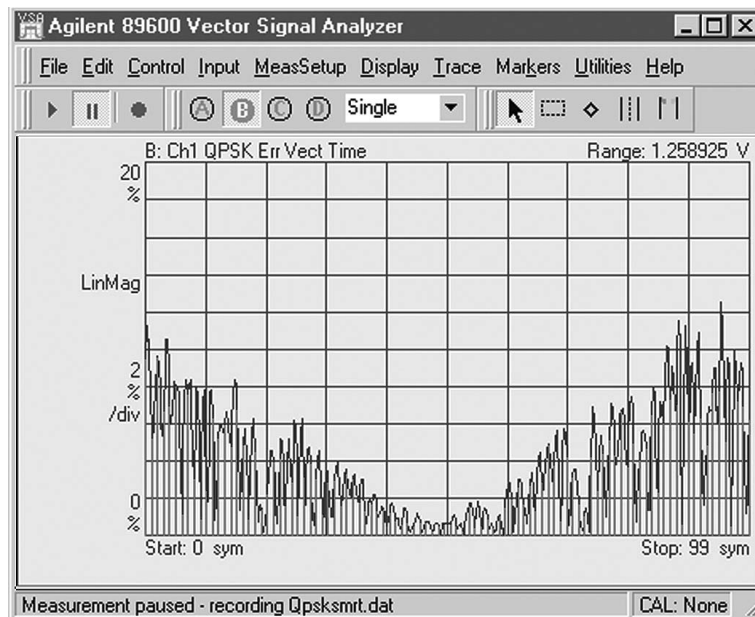


Figure 15. The “v” shape in the EVM versus time display indicates a symbol clock timing error. Trace math can help determine the approximate clock rate.

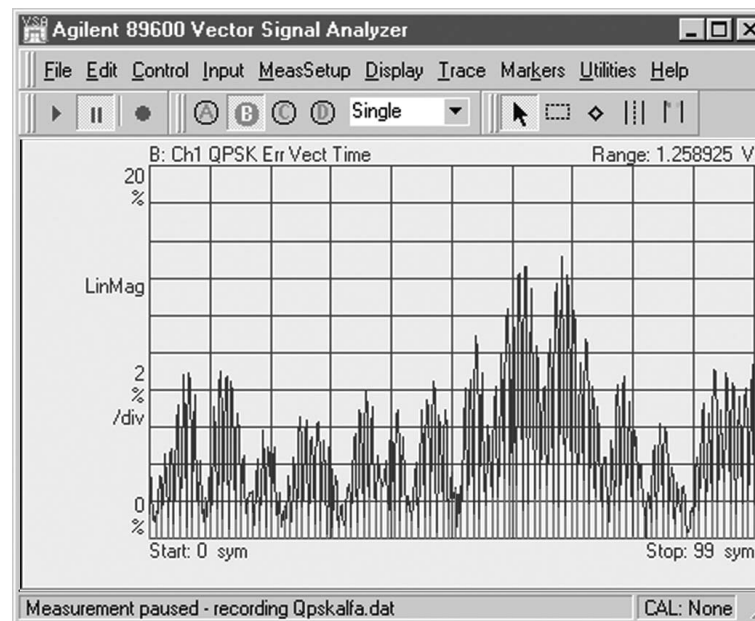
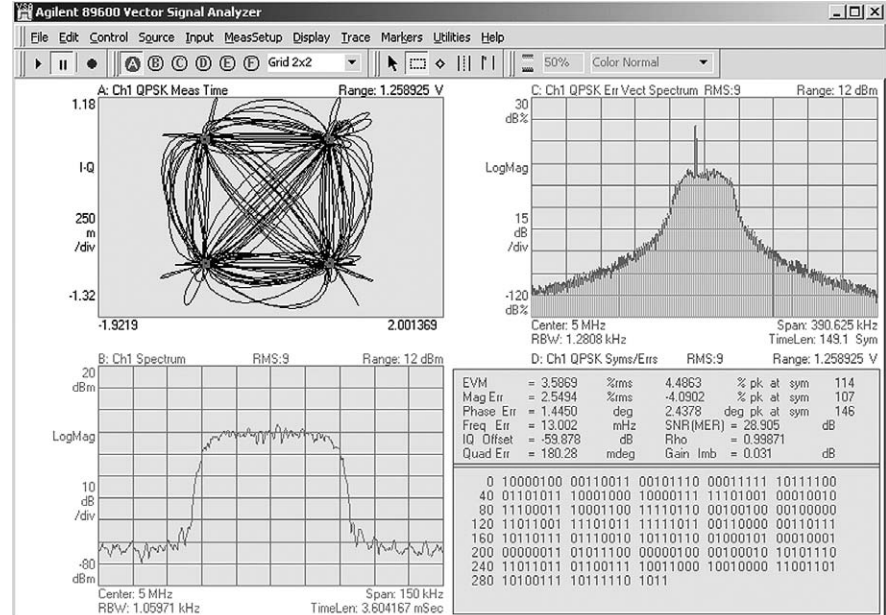


Figure 16. This signal shows higher EVM in between the symbols (shown in green) than at the symbol clock times (shown in red), a clear indication of filtering errors. You can try and determine the correction needed by using the adaptive equalization filter.

Agilent 89600 VSAs offer sophisticated error analysis that lets you see both RF and DSP problems. The key is the EVM measurement. The error vector time plots an error signal versus time diagram. With it, you can identify problems such as clock timing errors, DAC overflow, compensation errors and more –all with one screen. Other tools include error vector spectrum and adaptive equalization.

## Error vector magnitude (EVM)



**Figure 17.** This signal's spectrum, constellation, and EVM error look reasonable. But the error vector spectrum display (top right) clearly shows the presence of an interferer. Further investigation shows that this frequency is related to a subsystem in another part of the DUT. It is obviously leaking through to the point where this measurement was made.

EVM is a powerful analysis tool that helps you pinpoint marginal conditions before they become system performance problems. EVM compares the phase and magnitude of the input signal with an ideal reference signal stream. The average error over time is displayed as a single percent, or the error can be viewed on a symbol-by-symbol basis.

Use the FFT of the error vector time signal to identify systematic impairments you couldn't otherwise see. Identify spurs coupling from other parts of the system by looking at the error vector spectrum for peaks.

## Adaptive equalization

Adaptive equalization identifies and removes linear errors from I-Q modulated signals by dynamically creating and applying a compensating filter. These errors include group delay distortion, frequency response errors, and reflections or multi-path distortion. You can also uncover DSP errors such as miscoded bits, or incorrect filter coefficients.

Equalization is a tool designers can use to identify and correct linear errors. Pre-distorting a signal to correct for linear errors can be simpler, faster, and cheaper than modifying hardware to make the corrections. Further, some wideband signals are almost impossible to measure without adaptive equalization.

## Flexible Modulation Analysis (Option AYA)

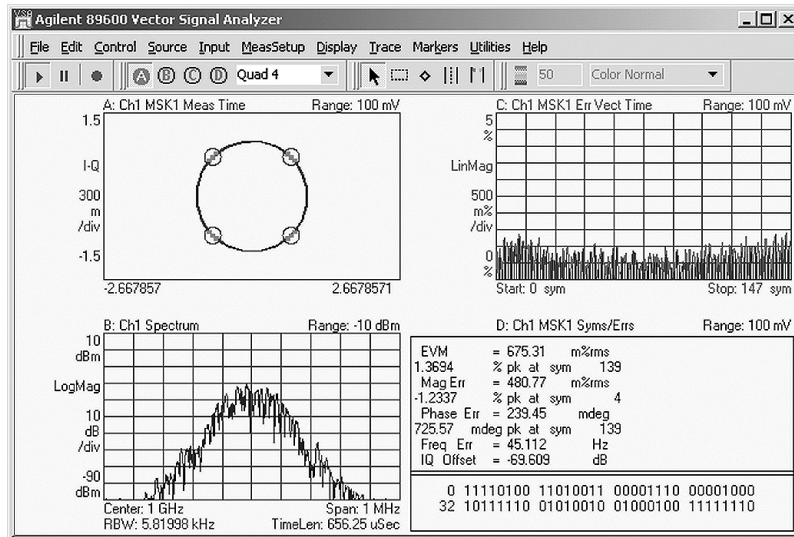


Figure 18. GSM signal MSK format with spectrum and EVM versus time.

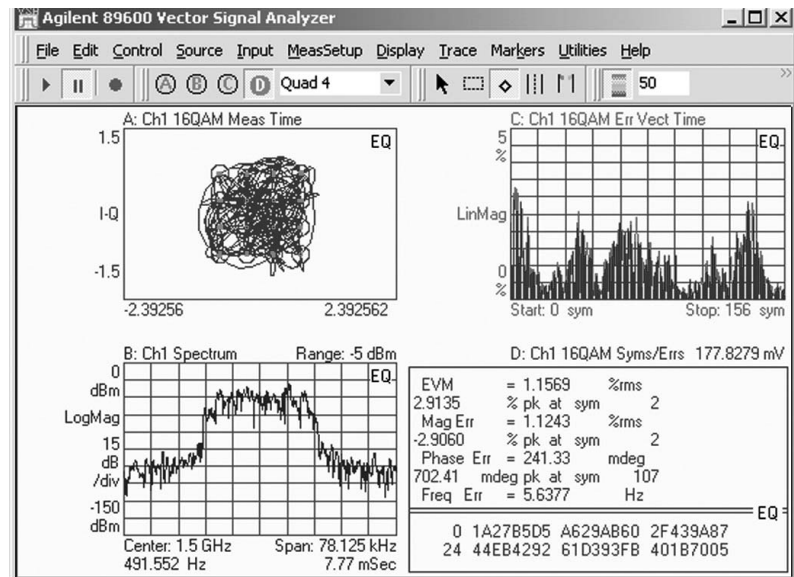
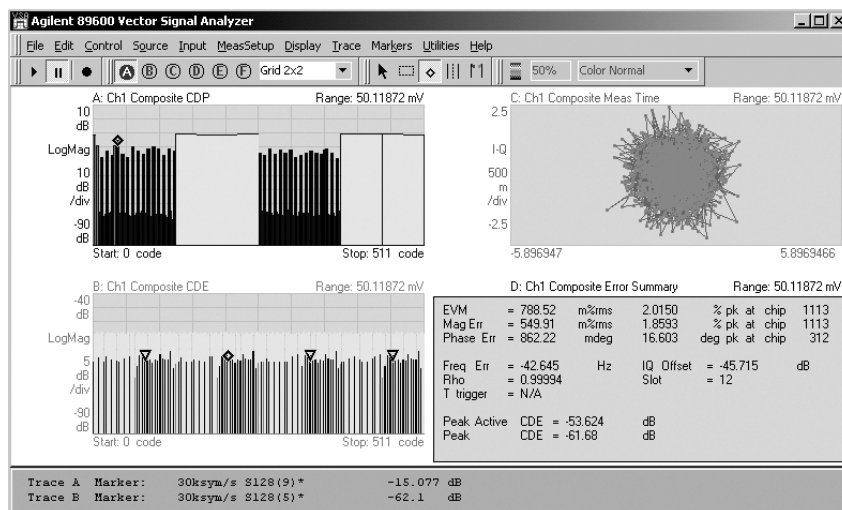


Figure 19. 16QAM signal with spectrum and error vector magnitude versus time display.

Option AYA demodulates a wide range of standard communication formats, such as EDGE and GSM. But it also offers a wide range of demodulators for FSK, BPSK, QPSK, offset QPSK, QAM, APSK, and VSB, all with variable filter type and alpha, symbol clock rate, and bandwidth. You can even apply your own proprietary filtering by providing the filter's impulse or frequency response.

Whether you are designing to a mainstream standard, secondary standard, an emerging standard or a proprietary specification, the 89600 VSA flexible modulation analysis capability has the tools you need to evaluate and characterize signal performance and dig down to the root of your modulation problems.

## 3G-Modulation Analysis Bundle (Option B7N)



**Figure 20.** Analyze W-CDMA and HSDPA signals using the 89600. Here the 89600 displays show the code domain power and error of the composite signal in bit reverse (trace A) and Hadamard (trace B) channel order. The markers in trace B point to all parts of a single channel. Notice also, the composite vector constellation display and the composite error summary table. Similar tools are provided for layer and channel analysis.

Evaluate and troubleshoot your 3G modulation signals with Option B7N 3G modulation analysis. Whether your signal is cdma2000, or W-CDMA, TD-SCDMA, or 1xEV-DO, HSDPA or 1xEV-DV, the tools and analysis flexibility in Option B7N help you test your signal to its standard and troubleshoot the problem if the signal fails to meet its standard.

Option B7N is a cost-effective ordering bundle of all the supported 3G modulation analysis options (B7T, B7U, B7X, B7W). However, you can also purchase the modulation analysis options separately.

### W-CDMA/HSDPA (Option B7U)

Measure, evaluate and troubleshoot your W-CDMA and HSDPA signals with the tools in Option B7U. Use these tools to descramble, despread, and demodulate W-CDMA uplink and downlink signals. The analyzer automatically identifies all active channels regardless of the symbol rate or spread code-length.

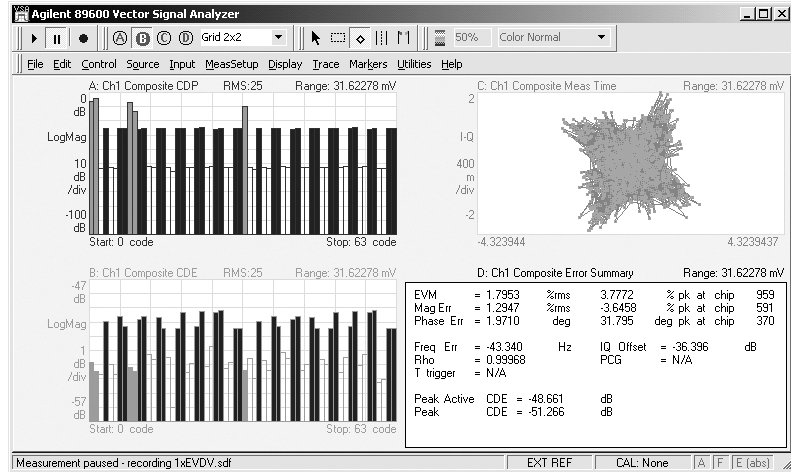
Speed measurement set-up with standard pre-sets for uplink (mobile station or user equipment) and downlink (base station). Use the single layer and composite code-domain power and code-domain error displays (the composite display shows all code layers simultaneously) to determine the overall performance of your signal and the behavior of specific layers and channels.

Take advantage of the composite and single channel constellation, trellis and eye diagrams, IQ magnitude/ phase error displays, and error vector traces to search out specific errors.

Use the measurement offset and interval controls to select specific data slots for analysis.

For the HSDPA portion of your W-CDMA signal, automatically detect the modulation scheme for HS-PDSCH. Also, despread the HS-PDSCH channels manually or automatically.

## cdma2000/1xEV-DV (Option B7T)



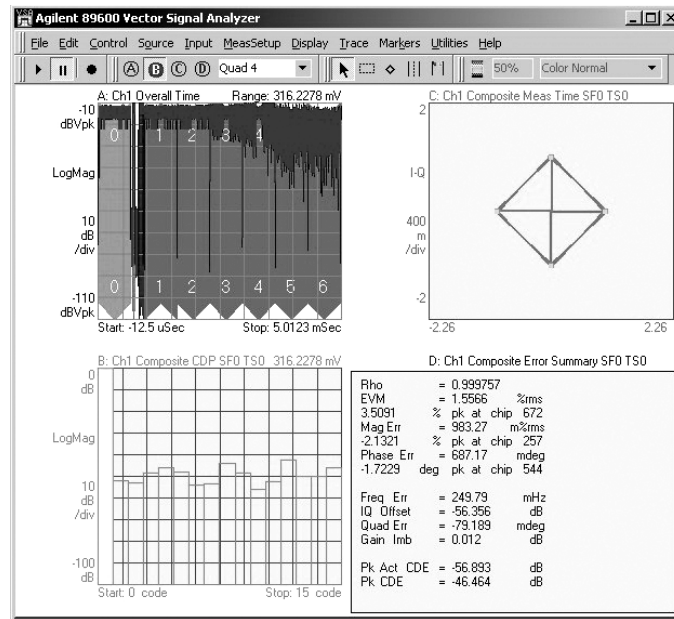
**Figure 21.** Use the extensive 89600 Option B7T toolset to evaluate the performance of your cdma2000/1xEV-DV signals. Notice the code domain power and error displays, vector constellation display and error summary table. These traces are for the composite (entire) signal. Similar tools are available for layer and channel analysis.

The robust and flexible features provided in Option B7T give you the tools you need to test your cdma2000 / 1xEV-DV signals to their standards and identify the cause if the signal fails to meet its standard. Descramble, despread, and demodulate both the forward and reverse link signals. The software automatically identifies all active channels regardless of symbol rate or Walsh code.

Signal analysis capabilities are identical to the advanced tools provided for W-CDMA analysis. These include single layer and composite code-domain power and code domain error traces, composite and single channel constellation, trellis and eye diagrams, EVM, IQ magnitude and phase error traces and much more.

1xEV-DV features include automatic detection of the modulation on the F-PDCH channels, automatic active channel identification and optional predefined F-PDCH active channel configuration for adaptive modulated signals.

## TD-SCDMA (Option B7X)



**Figure 22 Composite TD-SCDMA modulation analysis.**

Troubleshoot and analyze your time division synchronous code domain multiple access (TD-SCDMA) modulation and RF performance with Option B7X for Agilent's 89600 VSA software.

This analysis package handles the 3GPP N-TDD 1.28 Mcps version of TD-SCDMA, including HSDPA (16QAM) and 8PSK. Demodulate HSDPA 16QAM and 8PSK modulated code channels, with automatic detection of code channel modulation type with manual override. Single code domain layer or composite power and code domain displays are provided. Normalize code-domain power to display code domain power relative to total signal power. Automatic measurements include rho, EVM, frequency error, I/Q offset and I/Q skew.

## 1xEV-DO (Option B7W)

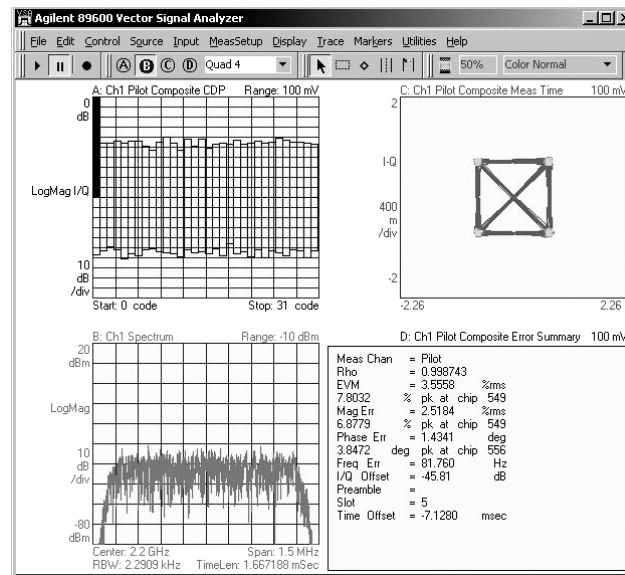


Figure 23. Multiple views of a composite 1xEV-DO signal.

Measure and analyze 1xEV-DO modulated signals with the capabilities offered as part of Option B7W. Descramble, despread, and demodulate 1xEV-DO modulated signals. You can also analyze the reverse link (mobile station or access terminal) and forward link (base station or access network) channels. The analyzer automatically identifies all active channels regardless of the symbol rate or Walsh code length.

The advanced technology demodulator used in this option does not require coherent carrier signals, or symbol-clock timing signals, and comes with an internal IS-2000 filter. All you have to do is enter carrier frequency, chip rate, reverse/forward link direction, and set the long code mask. The analyzer will do the rest.

Measurement results include CDP (composite or layer specific), code domain error (composite or layer specific), EVM, IQ offset, rho, overall 1 rho, and overall 2 rho.

## Market Leading WLAN Analysis (Option B7R)

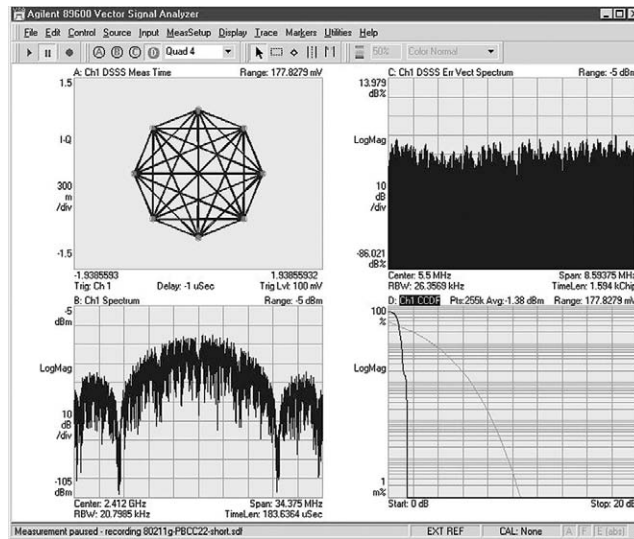


Figure 24. Demodulate the optional PBCC modes of IEEE 802.11g.

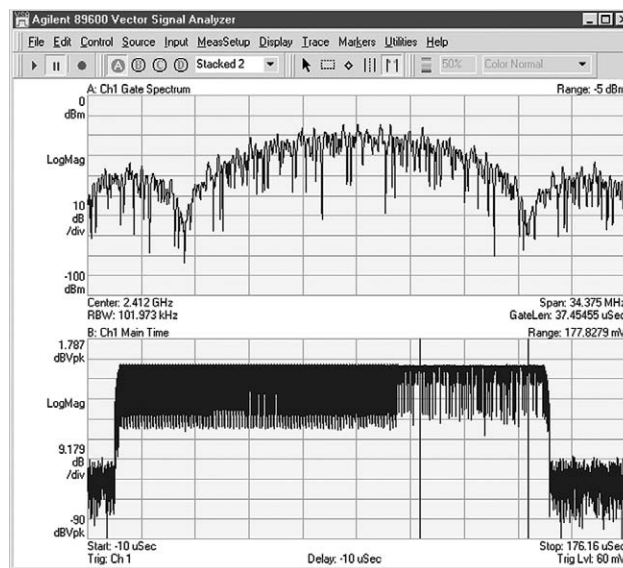


Figure 25. Time gating is a powerful tool for selective analysis of time waveforms. The time gate (two vertical lines in the lower trace) allows FFT analysis on only the payload portion of the waveform.

Agilent is an industry leader in base band, RF, and modulation quality measurements of WLAN signals. The 89600 VSA software WLAN analysis option offers:

- IEEE 802.11a OFDM modulation analysis
- IEEE 802.11b DSSS/CCK/PBCC modulation analysis
- IEEE 802.11g modulation analysis
- IEEE 802.11a/b/g standards-based testing

Two modes, DSSS/CCK/PBCC and OFDM, are offered with Option B7R. Use these modes together to analyze the IEEE 802.11g signals and use them separately to analyze IEEE 802.11b or IEEE 802.11a signals. For IEEE 802.n MIMO analysis, see Option B7Z.

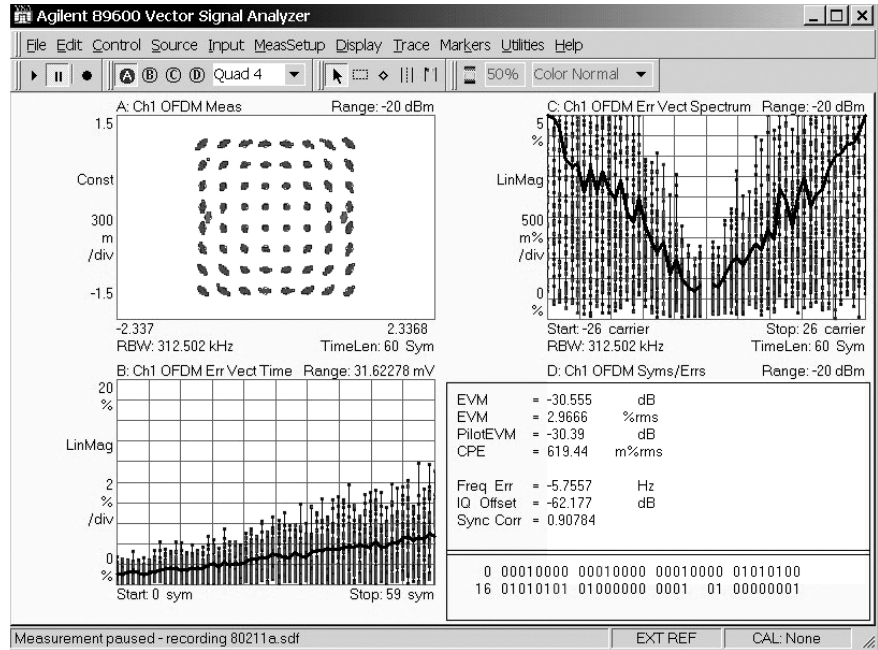


## IEEE 802.11b modulation analysis

Select the DSSS/CCK/PBCC mode and automatically detect, despread, descramble, and demodulate the payload in all four mandatory IEEE 802.11b formats (1, 2, 5.5, 11 Mbps). This mode handles the optional PBCC modes, the optional short preamble, and the CCK preamble of the CCK-OFDM format in IEEE 802.11g. Additionally, you can choose a root-raised-cosine (RRC) reference filter for applications requiring channel 14 support. Examine the constellation diagram, measure EVM, frequency error, quadrature error, gain imbalance, and more with Option B7R WLAN analysis option.

Use the time domain measurement capability to evaluate your signal's power versus time behavior. Use the time gating feature to analyze the spectrum of just a portion of the burst. All of these and more are available with the DSSS/CCK/PBCC mode for IEEE 802.11b analysis.

## IEEE 802.11a modulation analysis



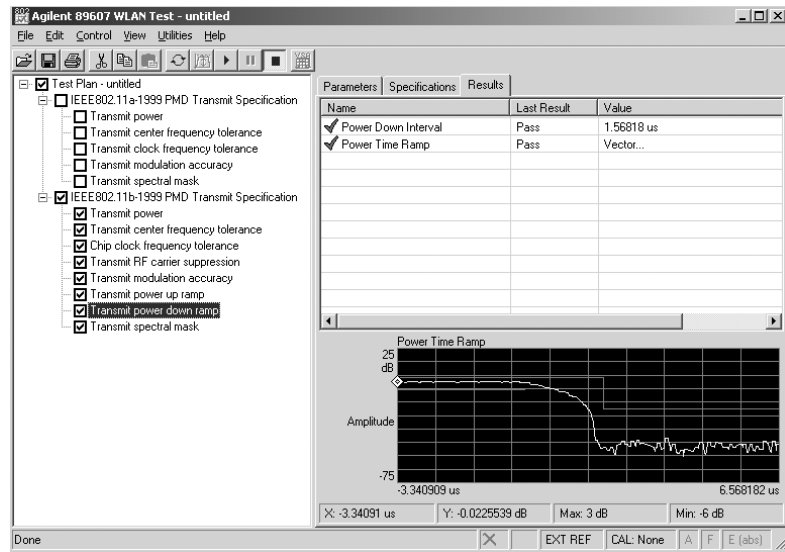
**Figure 26. View the EVM spectrum or EVM time of an IEEE 802.11a OFDM burst. The EVM spectrum error shows a 'V'-shaped pattern, indicating a timing error of some sort. The most likely causes are an I-Q time offset, or symbol clock error.**

Demodulate and analyze IEEE 802.11a, IEEE 802.11g, and HiperLAN2 compatible signals with the OFDM modulation analysis mode provided in Option B7R. This high performance capability supports demodulating OFDM bursts down to the bit level. Use the compound constellation display to automatically determine and display all modulation formats (BPSK, QPSK, 16QAM, 64QAM) present in the burst.

Evaluate modulation quality using EVM displays of the overall burst, of each symbol, or of each sub-carrier in a symbol. View all of this data in an efficient graphical display that reveals overall patterns in the EVM – a key to finding the root cause of signaling problems.

View the average phase and magnitude behavior of the pilot sub-carriers using the Common Pilot Error display. Measure the magnitude and phase settling of the OFDM burst using the preamble error display. These features provide you a powerful package for analyzing and troubleshooting OFDM signals.

## IEEE 802.11a/b/g test suite



**Figure 27. One-button, standards-based measurements of your IEEE 802.11 signal quickly help you determine if the signal has any problems.**

Speed the process of testing your IEEE 802.11a/b/g signal to its standard with the WLAN test suite (supplied as part of the WLAN analysis Option B7R). This separate applet automatically executes standards-based transmitter tests of your signal. You specify the tests to perform, set the center frequency and other signal parameters, and the applet does the rest.

The tests provided in WLAN test suite include: transmit power, center frequency and symbol clock frequency tolerance, modulation accuracy, and spectral mask. Standards-based test limits are pre-programmed into the software, but can be modified as your need requires. You can even change the profile of the limit lines. Results are available as pass/fail or measured data, and are available to download to a spreadsheet, report, or a network.

## IEEE 802.11n MIMO Modulation Analysis (Option B7Z)

Analyzing an IEEE 802.11n MIMO signal is extraordinarily challenging because it is made up of multiple OFDM signals that transmit on the same frequency at the same time. The advanced troubleshooting and evaluation tool set provided by Agilent's IEEE 802.11n MIMO modulation analysis option is specifically designed to handle this challenge and more.

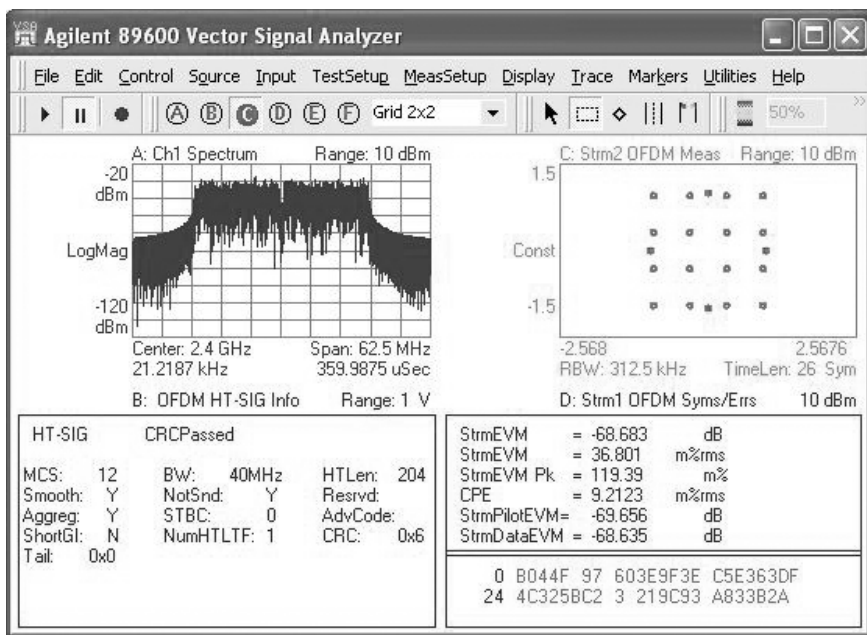


Figure 28. The two-channel analysis capability of the 89600 software allows you to see important parameters associated with each channel, individually or simultaneously.

## Two-channel measurements

MIMO evaluation and troubleshooting requires simultaneous two-channel signal acquisition and analysis. Most spectrum analyzers are only single-channel instruments. In contrast, digital scopes and Agilent's VXI-based modular vector signal analyzer have multiple channels and are well suited to the task.

The 89600 series VXI-based analyzers offer two channels of simultaneous signal acquisition and analysis with enough analysis bandwidth for both 20 MHz and 40 MHz 802.11n signals, 70 dB of dynamic range and up to 1 GB of signal capture memory.

Agilent's multi-channel Infiniium Series scopes offer up to 40 GSa digitizing to sample your 802.11n signal directly, without the need for down conversion. Analysis bandwidth is as high as 13 GHz, dynamic range is 40+ dB, memory depth is available up to 64 MSa, and their host of high performance time domain markers, triggering and displays help make these scopes a versatile choice for MIMO measurements.

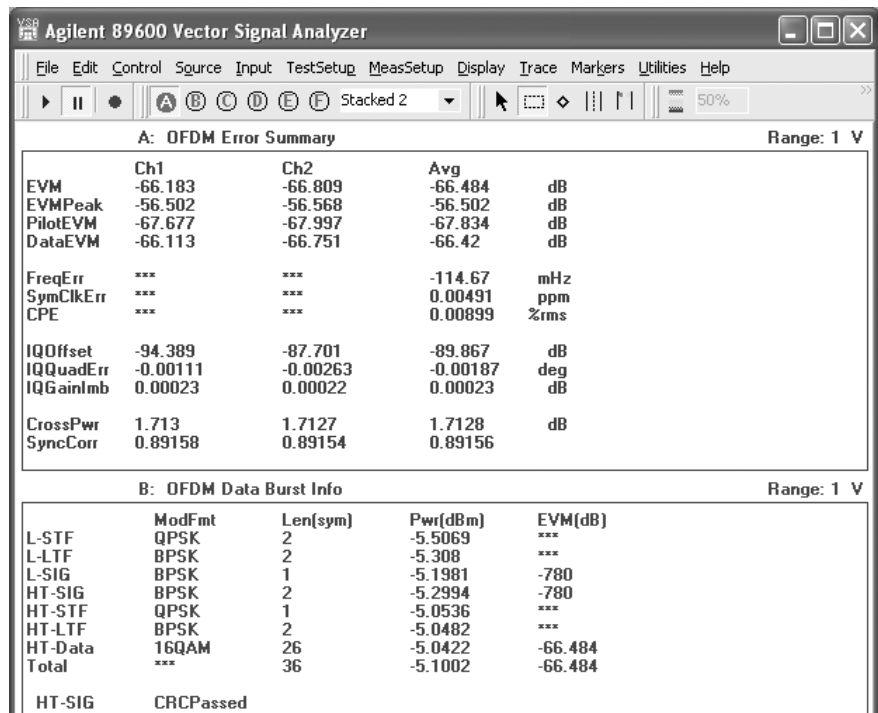


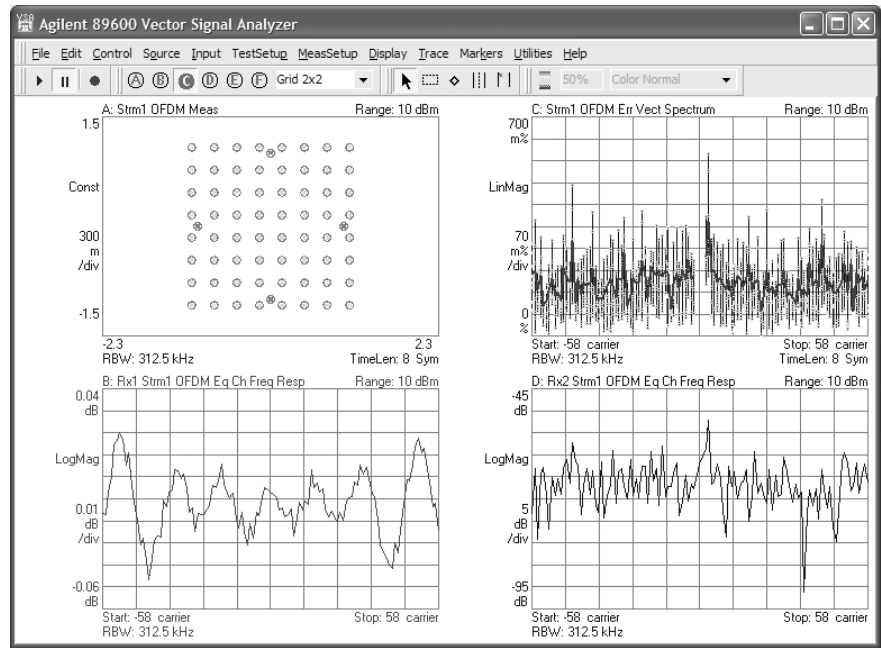
Figure 29. The error summary table presents information about each channel. The data burst table provides decoded bits for L-SIG and HT-SIG as well as power and error information.

## 20/40 MHz bandwidths

IEEE 802.11n's high throughput formats demand more than 36 MHz of signal bandwidth. The 89601A's VXI and scope measurement platforms are up to the task.

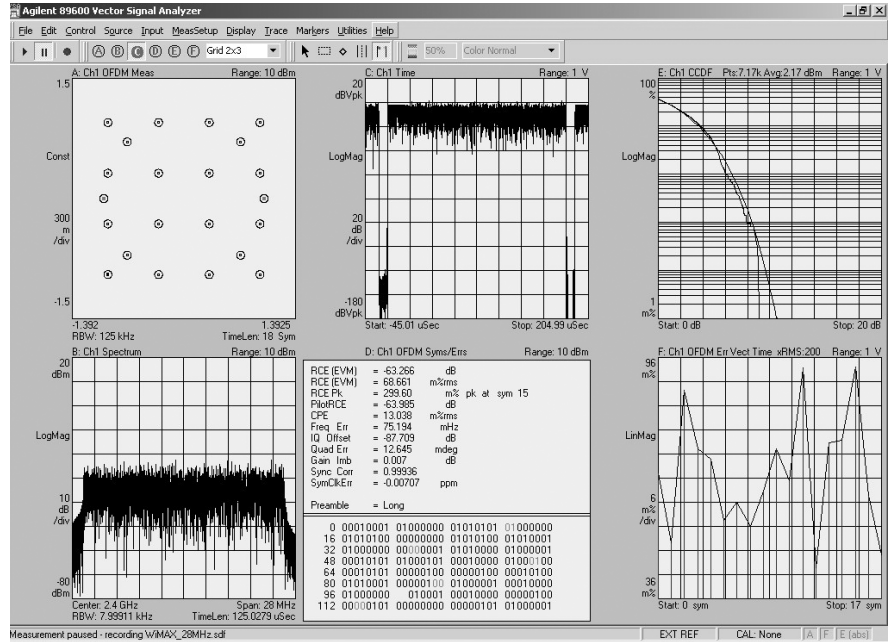
## All formats

Evaluate and troubleshoot all three IEEE 802.11n formats: legacy, mixed mode and green field. Measure EVM, I/Q parameters, and view the constellation of two spatial streams at once. Use coherence and cross correlation functions to quantify the impact one spatial stream has on the other. Read the contents of the L-SIG and HT-SIG fields. CCDF, power vs. time, and time gated measures are all provided. A new MIMO condition number trace provides a numeric method of comparing the equalizer channel response matrix maximum singular value to its minimum singular value. All of this and more are ready for you in this option.



**Figure 30. Measurement and error information on each spatial stream is available for two-channel measurements.**

# Comprehensive IEEE 802.16-2004 OFDM Analysis (Option B7S)



**Figure 31. Familiar and new tools combine to provide invaluable troubleshooting information. Here the six displays simultaneously show (l to r) I-Q constellation, time, CCDF, spectrum, modulation error summary, and error vector vs. time.**

Agilent is the industry leader in base band, RF, and modulation quality measurements for IEEE 802.16-2004 OFDM signals. Whether your measurements are on base band, IF or RF signals, or even simulated signals from ADS design simulations, the 89600 VSA software with Option B7S has the tools you need to troubleshoot your designs today.

Analyzing OFDM signals requires developers like you to think in the time and frequency domains simultaneously. You need OFDM-specific signal analysis tools to help you manipulate and break down the signal in order to effectively troubleshoot the situation. The 89600 vector signal analysis software helps you do this quickly and efficiently.

First, Option B7S provides comprehensive coverage of the IEEE 802.16-2004 standard:

- All IEEE 802.16-2004 modulation formats, including BPSK, QPSK, 16QAM, and 64QAM
- TDD, FDD, and H-FDD
- Uplink and downlink
- Bursted and continuous
- All frame lengths, guard intervals, and sampling factors
- Demodulation down to the raw bit level

Second, the software allows you to set up and adjust the demodulator for the best analysis of your signal.

- Automatically detect the signal modulation type on sub-carriers. You can also manually override the auto-detect feature for specific troubleshooting needs.
- Manually adjust the nominal signal bandwidth, guard interval, and sampling factor (Fs/BW ratio). Standard guard interval and sampling factors are provided.
- Adjust carrier pilot tracking to track amplitude, phase, or timing and identify errors that automatic pilot tracking can hide. These errors can cause you to inadvertently lower design margins.
- Verify your signal setup using the burst information provided—a text table conveniently shows burst power, modulation format, burst symbol length, and EVM.

The software also provides a wide range of error analysis measurements and displays. These include traditional spectrum analysis measurements such as:

- Band power
- Carrier-to-noise
- Peak-to-average power (CCDF)
- Amplitude
- Group delay

### OFDM- and IEEE 802.16-2004 specific measurements

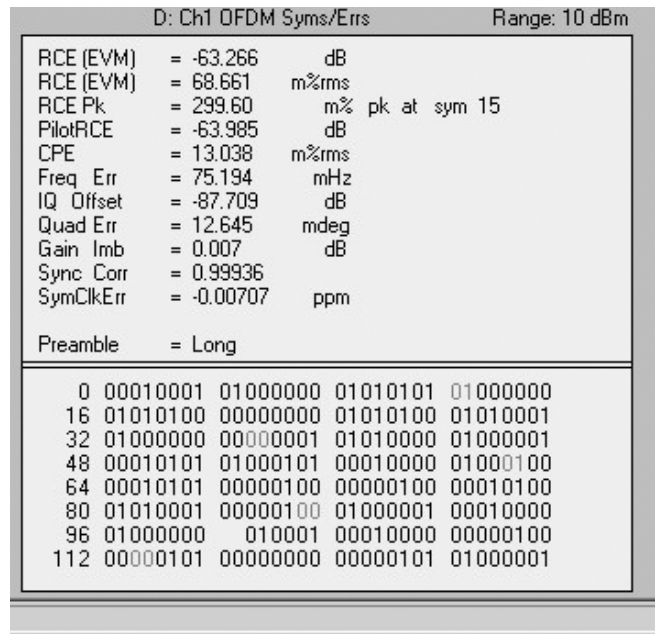


Figure 32. The modulation error analysis screen provides a wealth of information. Note that the RCE is provided in dB and %. The lower half of the display provides demodulated (encoded) bits. The pilot tones are shown in lighter colors. The error summary table also includes RCE for the pilot tones alone.

New measurements specifically for OFDM and more specifically for IEEE 802.16-2004 signals include:

- Relative constellation error (RCE) in % or dB
- RCE vs. symbol number
- RCE vs. sub carrier number
- Equalizer frequency and impulse response
- Error vector spectrum/time, including RMS error vector
- Quadrature skew, gain imbalance, I-Q offset
- Frequency error
- Symbol clock error
- Common pilot error (CPE)

In addition, these tools let you analyze your signal selectively by time or frequency for troubleshooting and uncovering problems that you've never been able to see before.

For instance, with the demodulation off, use time gating markers to analyze the desired portions of the time trace or spectrum of the signal, e.g., the short training signal, signal estimation sequences, signal symbol, etc. You can apply many other measurements to the time-gated area. This is especially useful when making measurements like peak to average power, when you may want to measure only the data portion of the burst, since including the timing and estimation sequences can bias the value lower.

- Focus your modulation analysis to a subset of the symbols, i.e., time-selective analysis.
- Focus your modulation analysis on just a single carrier, i.e., frequency-selective analysis. By viewing the constellation for just one carrier, you can determine if an interferer is internally generated or coming from outside the system.



## IEEE 802.16 OFDMA Modulation Analysis (Option B7Y)

The 802.16 OFDMA PHY layer structure is the most complex structure for wireless networking. Option B7Y provides an advanced and comprehensive tool set to evaluate and troubleshoot signaling format. These tools work together to simplify analysis complexity.

### Comprehensive tool kit

Agilent's 802.16 OFDMA modulation analysis capabilities are comprehensive. Option B7Y covers PUSC, OPUSC, FUSC, OFUSC, and AMC zone types. It handles uplink and downlink forms, covers all bandwidths from 1.25 MHz through 28 MHz, and all FFT sizes are covered from 128 to 2048. Early versions of the standard as well as the ratified version of the standard can also be measured.

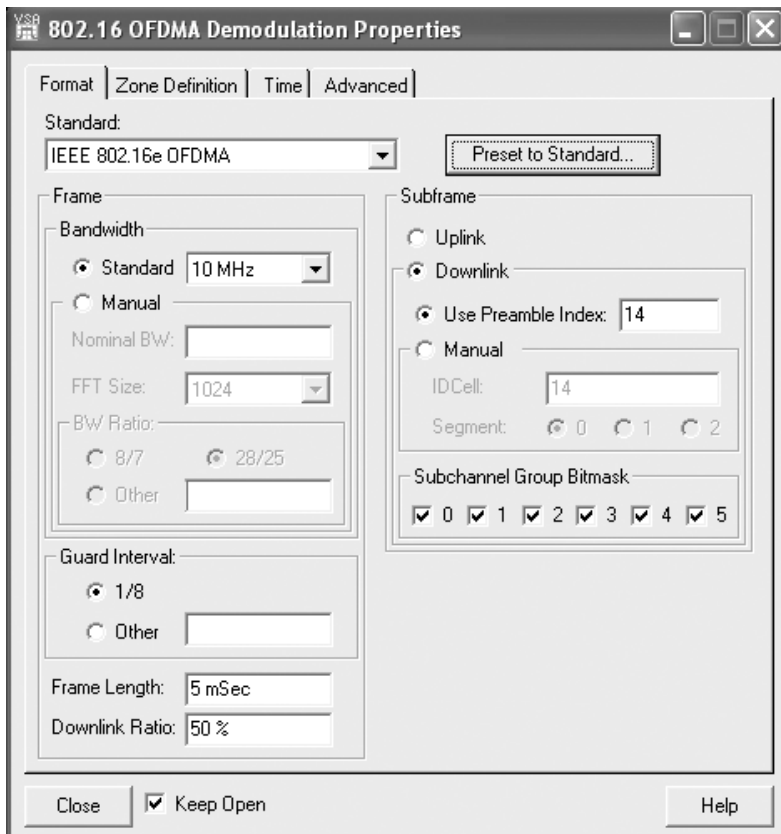


Figure 33. With the 89600 software, you have complete control of your signal analysis. Based on the standard bandwidth selected, many parameters are defaulted. However, they can be overridden manually for troubleshooting.

## PRBS status indicator

Pseudo random sequences play a big role in 802.16 OFDMA. At the physical layer they determine carrier and pilot position. If the receiver sees the wrong PRBS, it cannot demodulate the signal. If the Agilent 89600 VSA software detects the wrong PRBS, it automatically determines the signal's actual PRBS, displays it and demodulates the signal. Where other analyzers are stopped, the 89600 VSA software continues to work, providing the data you need to fix the problem.

## Synch correlation

The preamble is crucial for successful OFDMA demodulation. If it has the wrong pattern, successful demodulation is impossible. Clearly, knowing if this pattern is correct is important to understanding why the receiver is not demodulating the signal. Other analyzers offer no preamble pattern check. Agilent's OFDMA modulation analysis option offers the synch correlation (Sync Corr) indicator in the symbol/error table. This indicator compares the preamble's actual pattern to the pattern called out by the standard; low correlation indicates a problem in the pattern. Unlike other analyzers, Agilent's VSA software offers useful troubleshooting information on the physical layer structure even if it cannot successfully demodulate the signal.

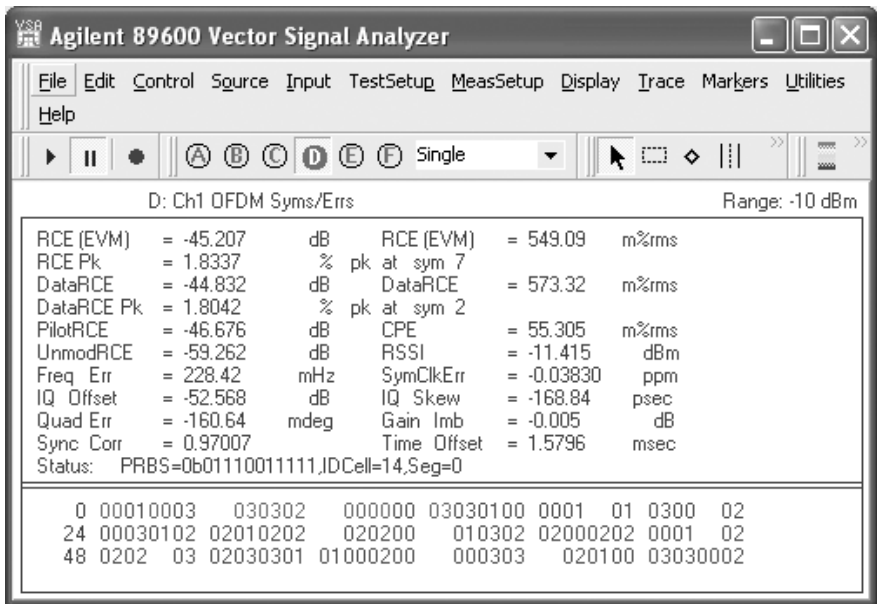


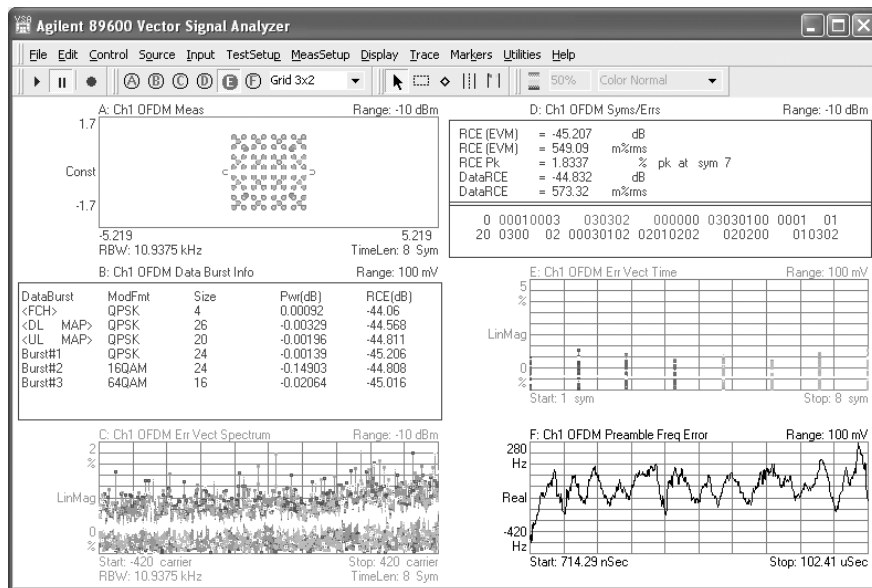
Figure 34. The symbols and errors table provides an overall look at the errors in the symbol. The 89600 software decodes the PRBS seed and presents the information it finds. Other important information, such as synch correlation, RCE of the data, pilots, and unmodulated carriers is also available.

## Measurements that work together

The 89600 VSA's OFDMA tools work together to simplify the complex analysis challenge presented by mobile WiMAX.

Measurement results are color coded by data burst, where appropriate. You can look at the compound constellation of a multi-burst data zone and tell at a glance if your data bursts are using the modulations you programmed. You are able to go to the error vector time display and easily determine which data burst an EVM spike belongs to.

The same works with the error vector spectrum display. Other analyzers make you move back and forth between measurements looking at symbol times and logical sub-carrier numbers to get the information you need, while Agilent uses color to simplify and streamline your analysis task. You can also couple markers across multiple displays to 'walk' through your signal and simultaneously look at its behavior in the time, frequency, modulation, and error domains.



**Figure 35. View up to six displays for a simultaneous view of time, frequency, modulation, and error information. All displays are color coded by burst. See error information across all carriers, or across all symbols, or delve into the preamble error trace, or investigate burst performance.**

## TEDS Modulation and Test (Option BHA)

Perform modulation analysis and standards-based tests for TETRA Enhanced Data Service (TEDS) signals. Measurements include ACP power versus time, composite reference power, peak frequency error, sub-carrier reference power, and more.

Option BHA demodulator parameters are user-definable, giving you the ability to customize the analyzer to measure and analyze non-ideal signals. User-definable parameters allow you to choose from four TEDS slot formats (normal downlink, normal uplink, random access uplink, and control uplink), three quadrature amplitude modulation (QAM) types (4 QAM, 16 QAM, 64 QAM), and four channel bandwidths (25 kHz, 50 kHz, 100 kHz, and 150 kHz).

For measurement and analysis, you can display traces for the composite signal (including error summaries) and traces for selected sub-carriers (such as constellation diagrams). Additional demodulation parameters let you adjust for search length and what to include for error vector magnitude (EVM) errors (such as header symbols, droop, and pilot tracking). Development parameters include filter alpha, time scale factor, and mirror frequency spectrum.

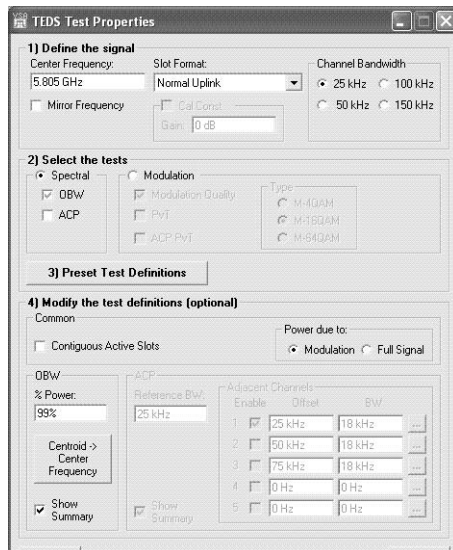
The Option BHA TEDS test adds five individual TEDS tests, within two test groups, to your vector signal analyzer software, including:

### Spectrum tests group

- Occupied Bandwidth (OBW) test
- Adjacent Channel Power (ACP) test

### Modulation tests group

- Modulation quality test
- Power versus Time (PvT) test
- Adjacent Channel Power versus Time (ACP PvT) test



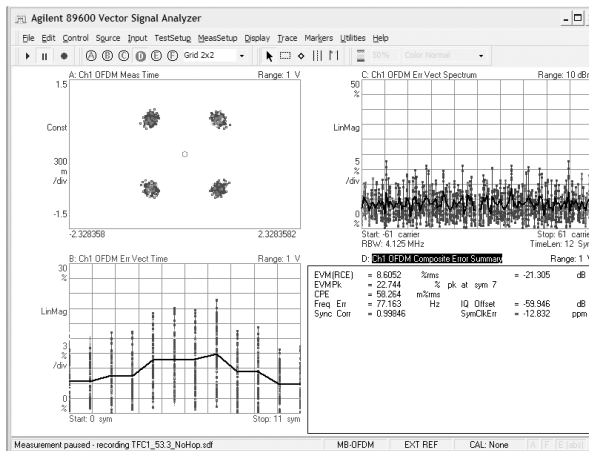
**Figure 36.** Define your TEDS test parameters with an easy-to-use menu setup. A test properties menu lets you set test parameters, select the test, preset test definitions, and even modify the test definitions if desired. Step-by-step configuration procedures are provided for each of the five TEDS tests. In addition, the test presets are defined for each of these tests.

## MB-OFDM ultra-wideband modulation analysis (Option BHB)

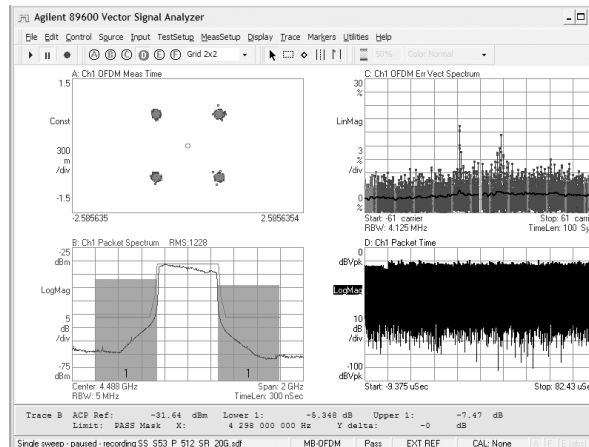
Troubleshoot your WiMedia-based multi-band OFDM ultra-wideband PHY layer signals, such as those in certified wireless USB, with the industry's most complete set of easy-to-use measurement tools, providing you with an unparalleled view into your PHY layer signals. Use Option BHB running on the high performance Agilent DSO80000 Series oscilloscopes to help you identify the root causes of problems, sooner.

Supporting all Time Frequency Codes (TFC), including FFI (non-hopped) and TFI (hopped) modes, Option BHB helps you analyze a wide range of formats, including QPSK modulation (utilized 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.

For more detailed information on this option, including features and specifications, see *“Agilent 89600 Series VSA Software MB-OFDM Ultra-wideband Technical Overview and Self-Guided Demo,”* literature part number, 5989-5452EN for information on this and other Agilent products or go to [www.agilent.com/find/vscope](http://www.agilent.com/find/vscope).



**Figure 37.** Option BHB MB-OFDM ultra-wideband modulation analysis offers detailed error analysis down to the individual carrier (Trace C, upper right) or individual symbol (Trace B, lower left). For an overall view, composite errors are shown in the table (Trace D, lower right).



**Figure 38.** Use the powerful ACP calculation markers and limit lines on the packet spectrum displays to perform important spectral measurements.

## **Add World-Class Modulation Analysis to Agilent Spectrum Analyzers, Oscilloscopes, and More (Option 300)**

Link the 89600 software to any one of a variety of Agilent instruments to sample your signal. Connection to the instruments is via GPIB, FireWire (IEEE 1394), LAN or USB.

### **ESA-E Series spectrum analyzers**

The ESA-E Series general-purpose, portable spectrum analyzers offer a wide range of performance, features, and flexibility with up to 26.5 GHz tuning range and 10 MHz of analysis bandwidth. Measurement control is via GPIB.

### **PSA Series high-performance spectrum analyzers**

The Agilent PSA Series offers high performance spectrum analysis up to 50 GHz with powerful one-button measurements, a versatile feature set, a leading-edge combination of flexibility, speed, accuracy, dynamic range and up to 80 MHz of analysis bandwidth. Measurement control is via LAN, GPIB, or USB.

For convenience in ordering, the 89650S wide bandwidth VSA with high performance spectrum analysis is available. It pairs one of three high performance PSA Series spectrum analyzers with either a 40 MHz (Option 140) or 80 MHz (Option 122) wide bandwidth IF and the 89601A VSA software.

### **Infiniium scopes**

Combine the software with Agilent's Infiniium oscilloscopes (many models) to analyze super wide bandwidth signals. The oscilloscopes provide up to 13 GHz of analysis bandwidth and are well suited to digitizing down-converted satellite, LMDS, and MMDS signals, as well as WiMedia-based UWB or other extremely broadband signals. Two-channel Infiniium scopes can also make the coherent two-channel MIMO measurements needed for IEEE 802.11n. The digitized signals are transferred via GPIB, USB, or LAN to the PC running the 89600 software where the frequency, time, and modulation analysis tools of the 89600 can be used to evaluate and troubleshoot the signal. For convenience, the 89600 VSA software can run internal to many of the Infiniium models.

## **6000 Series scopes**

The low price of 6000 Series oscilloscopes combined with the measurement flexibility of the 89600 VSA software creates a powerful and affordable tool. Choose from a range of input channels, bandwidth and memory depth.

## **Modular VXI analysis hardware**

Used as part of Agilent's 89600 Series vector signal analyzer family, this versatile combination of modules offers 36 MHz of analysis bandwidth, 6 GHz tuning range in a compact 4-slot VXI mainframe.

Configurations include 1- or 2-channel base band, 1- or 2-channel IF inputs, or 1- or 2-channel RF inputs at 2.7 or 6.0 GHz. In addition, base-band inputs can be added to any RF system for ch1+ j\*ch2 analysis (BBIQ).

## **E4406A VSA transmitter tester**

Connect Agilent's E4406A VSA transmitter tester with the 89600 software and you have two high-performance instruments: a superior multi-format standards-based transmitter tester and a high-performance flexible digital demodulation and analysis tool.

## **N4010 wireless connectivity test set**

The N4010 is a test set designed to quickly and accurately measure emerging wireless connectivity formats in the 2.4 and 5 GHz bands. The N4010 offers bandwidth selections of up to 40 MHz, making the N4010 an ideal test platform for *Bluetooth*, including EDR Tx/Rx, WLAN, and ZigBee measurements. The N4010 with *Bluetooth* Option 101 is an effective measurement tool for development, integration, pre-qualification, and volume manufacturing.

## **Synthetic Instruments**

Agilent's synthetic instruments offer the highest-performing LAN-based modular instrumentation with the smallest footprint for automated test systems. The 89600 VSA software supports the N8201 26.5 GHz performance downconverter synthetic instrument module and the N8221 30 MS/s IF digitizer synthetic instrument module when they are used together to make an LXI (LAN extensions for instrumentation) spectrum analyzer.

## **Agilent 16900 or 1680/1690 Series Logic Analyzers**

As the block diagrams of cellular, wireless networking, radar, and other systems utilizing digital modulation become more digital, analyzing the signal quality becomes more difficult. The Agilent 16900 or 1680/1690 Series logic analyzers can send digital data harvested from these digital blocks to the 89600 VSA software. Then the software can interpret the data as digitized analog information for measurement and display of the signal using the wealth of tools available. No longer do you need to download data to homegrown math routines in order to check the demodulation or other signal parameters. Instead, you can take advantage of the 89600 software's consistent measurements and displays, as well as the same GUI with which your team has become familiar. Use your time to work on product design, not measurement design.

The VSA software can run in an external PC, or in the case of the Agilent 16900 Series logic analyzer, in the logic analyzer itself. Set up your logic analyzer to collect the data, and then use the 89600 VSA software's measurements and displays to investigate the behavior of your signal before and after it transitions from digital to analog, or vice versa.

For additional information, see *“How to Measure Digital Baseband and IF Signals Using Agilent Logic Analyzers with 89600 VSA Software”* (literature number 5989-2384EN).

For information on using a logic analyzer and the 89600 VSA software to capture and analyze serial data, go to [www.agilent.com/find/dvsa](http://www.agilent.com/find/dvsa).

### **Two channel operation**

For use when you need cross channel or I + jQ results, the software supports two channel configurations based on the VXI modular hardware and Agilent Infiniium or 6000 Series multi-channel scope models. 2-channel operation is also supported with the PSA Series spectrum analyzers for use with the 89604A/N distortion test suite application.



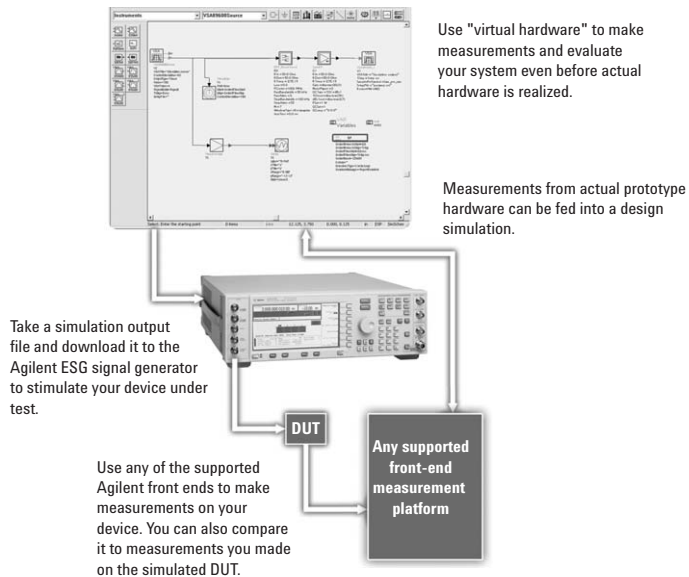
## Agilent Connected Solutions (Option 105, ADS Connectivity)

The powerful, PC-based 89600 Series VSA software enables tight, interactive integration with Agilent EEsof's Advanced Design System to analyze computational data from a simulation. Dynamically link the 89600 software to any point in the digital model to analyze data by simply dragging the VSA icon to the desired spot in the schematic.

Since the VSA measurement software resides on a PC, it performs equally well analyzing measured data from the VXI mainframe or computational data produced by an ADS model.

You can record measured or computed data from ADS with the 89600 Series software and play it back for further analysis. All of the software features and functionality are available to make measurements on your design simulations.

### **"Virtual hardware"— uncover system problems before hardware even exists**



Link real-world signals acquired by the 89600 to the ADS simulation to provide an actual signal environment for your designs.

With Option 105, you can substitute simulation results for real DUT measurements, or provide real hardware measurements as data input to simulations.

With Connected Solutions instrument links, you can use ADS simulation results to create signals and output them via the Agilent ESG signal generator. Use this to provide a signal source to your prototype hardware. This is useful when a) the signal type involves a new standard or modulation format; b) when you want to understand what changes to the previous hardware design stage imply to the next; or c) when one hardware stage is physically realized before others are available. Once it physically exists, hardware can be measured with the 89600 VSA software connected to a supported measurement platform, and compared to the simulation if desired.

Conversely, you can measure the output of real prototype hardware with the 89600 VSA, and use it to provide a source signal to a simulation. This is useful when you want to provide a source signal that is based on actual measurements on physical hardware.

Use this mix and match of simulated and measured results to evaluate your system – even with missing hardware.

## **Optimize Your Resources with Flexible Licensing Capability**

Take advantage of Agilent's flexible licensing capability for the 89600 Series vector signal analysis software. A software license is the key that unlocks the powerful measurement capability of the 89600 software on your PC.

Floating, node-locked, and limited term license are available, depending on your need. Let us help you choose the type of licensing that offers you the best value for your measurement needs.

### **Node-locked license (89601A)**

Whether in the office or away, with node-locked licensing your software will always be ready to run. Install the license key directly on your PC, and your software is activated regardless of your network connectivity.

- Collect data in the lab and perform the analysis anywhere with your portable PC.
- Take your results with you to show to colleagues and engineering partners.
- Easily move your measurement hardware and software around the office.
- Your software license may be moved from one PC to another via floppy disk or LAN.

Your permanent node-locked license includes 12 months of software update subscription service. You may purchase an additional 12 months at initial order.

## **Floating license (89601AN)**

Floating license capability allows many users to share licenses. A license installed on the license server is available to any PC that is connected to the network. The standard license server is a PC, and may be the same PC running the VSA software. Install the software on as many PCs as you like, and the number of licenses that reside on the network determines the number of users at any moment.

When one user exits the software, that license becomes available for another user. Permanent floating licenses facilitate sharing of software so you can:

- Reduce cost by getting more usage from fewer licenses.
- Maximize the use of each software license.
- Increase productivity with all users operating the software from their own PC.

Floating licenses are ideal when working with design environments such as Agilent's EEsof Advanced Design System (ADS) design tools, and for development environments where the data is taken in one lab and analyzed in another.

While software subscription update service is not included, you can purchase up to 24 months at your initial order.

## **Limited term floating license (89601N12)**

Agilent also offers a 12-month limited term floating license. If your need is temporary, you can acquire this limited term license to operate the software at a significant cost savings.

This license is valid for 12 months and includes all the benefits of a floating license, all software options, and 12 months of software update subscription service.

## **Software update subscription service (89601AS/89601ASN)**

Keep your software up-to-date with the software update subscription service. As a major new version of software becomes available, subscribers will automatically receive it. Some new releases require a new license level. The only way to get access to those new features, including ordering options, is to be a software update subscriber. You will receive the new software CD, along with new licenses authorizing access to the new software revision license level.

Order your update subscription service for the number of months you need, typically twelve, with a maximum of twenty-four months.

## **Running Your Software**

The 89600 Series vector signal analysis software runs on either a desktop or laptop PC and is connected to the supported hardware front ends via LAN, GPIB, LAN/GPIB gateway, a USB/GPIB converter, USB, or an IEEE 1394 (FireWire) interface, depending on the hardware selected. When used to analyze Agilent EEsof ADS design simulations, of course, the software resides on the same PC as ADS. In some cases, for example certain Infiniium scopes and logic analyzer models, the software can run on the instrument's internal computer.

You can use your own PC as long as it meets the requirements outlined in the "User-supplied PC requirements" section of this guide. Some hardware configurations allow you to purchase a laptop PC from Agilent. See the hardware selection guide for more information.

Both Windows 2000 and Windows XP Pro operating systems are currently supported.

## **Help in Getting Started**

Take advantage of Agilent's worldwide organization of trained specialists to help you get up and running quickly. They can help you with the many new and advanced features of the 89600 software and supported linked hardware.

We highly recommend that you unleash the full potential of the software by ordering the 1-day start up assistance.

Also recommended is additional phone service support with the remote productivity assistance.

For application-based training, Agilent provides specialized classes on digital radio troubleshooting, WLAN, and more.

Finally, your Agilent technical consultant will be happy to talk to you about your additional custom training needs.

## Ordering Information

### 89601A

Vector signal analysis software, including 1-year of software update subscription service

#### Options

*Option 200 required*

89601A-200	Basic vector signal analysis software
89601A-300	Hardware connectivity
89601A-AYA	Flexible modulation analysis
89601A-B7N	3G modulation analysis bundle
89601A-B7T	cdma2000/1xEV-DV modulation analysis
89601A-B7U	W-CDMA/HSDPA modulation analysis
89601A-B7W	1xEV-DO modulation analysis
89601A-B7X	TD-SCDMA modulation analysis
89601A-B7R	WLAN modulation analysis
89601A-B7S	IEEE 802.16-2004 OFDM modulation analysis
89601A-B7Y	IEEE 802.16 OFDMA modulation analysis
89601A-B7Z	IEEE 802.11n modulation analysis
89601A-BHA	TETRA modulation analysis and test
89601A-BHB	MB-OFDM ultra-wideband modulation analysis
89601A-105	Dynamic link to EEsos/ADS

### 89601AN

Vector signal analysis software (floating license for 1 server)

#### Options

*Note: multiple quantities of one option may be ordered per each server. Option 200 required. Every user must have Option 200, so the maximum quantity of any option may not exceed the quantity of Option 200. For multiple servers, order additional 89601AN.*

89601AN-200	Basic vector signal analysis software
89601AN-300	Hardware connectivity
89601AN-AYA	Flexible modulation analysis
89601AN-B7N	3G modulation analysis bundle
89601AN-B7T	cdma2000/1xEV-DV modulation analysis
89601AN-B7U	W-CDMA/HSDPA modulation analysis
89601AN-B7W	1xEV-DO modulation analysis
89601AN-B7X	TD-SCDMA modulation analysis
89601AN-B7R	WLAN modulation analysis
89601AN-B7S	IEEE 802.16-2004 OFDM modulation analysis
89601AN-B7Y	IEEE 802.16 OFDMA modulation analysis
89601AN-B7Z	IEEE 802.11n MIMO modulation analysis
89601AN-BHA	TEDS modulation analysis and test
89601AN-BHB	MB-OFDM ultra-wideband modulation analysis
89601AN-105	Dynamic link to EEsos/ADS

## Ordering Information *(continued)*

### 89601N12

Vector signal analysis software, 12-month limited-term package floating license for 1 server; includes 1-year software update subscription.

#### Options

*Required. Multiple 801 options may be ordered per server.  
For multiple servers, order additional 89601N12*

89601N12-801

Twelve-month floating license software package including VSA software options -200, -300, -105, -AYA, -B7N, -B7R, -B7S, -B7Y, -B7Z, -BHA, -BHB

### 89601AS

Additional software update subscription service

#### Notes

*Twelve-month minimum required. Twenty-four-month maximum coverage, total. Since 1-year is provided free at initial purchase, there is a 12-month maximum at initial purchase. Renewal orders have a 24-month maximum.*

*See [www.agilent.com/find/89600](http://www.agilent.com/find/89600) and click on "Software Update Subscription Service" for descriptions of actual product and option structure.*

### 89601ASN

Software update subscription service for 1 server (floating license)

#### Notes

*Twelve-month minimum required on new standalone or renewal 89601AS orders. Twenty-four month maximum coverage, total.*

*See [www.agilent.com/find/89600](http://www.agilent.com/find/89600) and click on "Software Update Subscription Service" for descriptions of actual product and option structure.*

## Product Upgrades

You may order any of the options after purchase. Depending on your software revision, purchase of 1-year 89601AS/ASN software update subscription service may be required. Because of this, when purchasing an upgrade, please indicate to your sales representative that you are doing so.

## Product Support and Training

Agilent provides both product-specific and application training, as well as specialized consulting services. Of particular interest are the following:

PS-S20-01	One day of start-up assistance ( <b>recommended</b> )
PS-S10	Phone assistance ( <b>six hours recommended</b> )
PS-T10-896xx	89600 users' course
PS-T11-896xx	Digital radio troubleshooting
PS-T12-896xx	Wireless LAN technology fundamentals
R1362A-250	VSA wireless LAN measurements

The 89600 users' course and W-LAN technology fundamentals are classes available on-site at your location. The VSA wireless LAN measurements and productivity assistance products are consulting services tailored to your needs.

## User-Supplied PC Requirements

The 89600 Series VSAs require a PC to control the hardware and display results. You can use your PC for this task. The following are the minimum requirements for a user-supplied PC. For best immunity to electrostatic discharge (ESD), use a desktop PC.

Any laptop or desktop PC may be used to run the 89600 VSA software, as long as it meets or exceeds the following minimum requirements<sup>1</sup>:

	Desktop	Laptop
<b>CPU</b>	600 MHz Pentium® or AMD-K6 (> 2 GHz recommended)	> 600 MHz Pentium or AMD-K6 (> 2 GHz recommended)
<b>Empty slots</b>	1 PCI-bus slot (two recommended—VXI hardware only)	1 CardBus Type II slot (Integrated Firewire recommended for VXI hardware only)
<b>RAM</b>	512 MB (1 GB recommended)	512 MB (1 GB recommended)
<b>Video RAM</b>	4 MB (16 MB recommended)	4 MB (16 MB recommended)
<b>Hard disk space</b>	300 MB available	300 MB available
<b>Operating system</b>	Microsoft Windows 2000®, SP2, or XP Professional®	Microsoft Windows 2000, SP2, or XP Professional
<b>Additional drives</b>	CDROM to load the software; license transfer requires 3.5 inch floppy drive, network access, or a USB memory stick.	CDROM to load the software; license transfer requires 3.5 inch floppy drive, network access, or a USB memory stick.
<b>Interface support</b>	LAN, GPIB, USB or FireWire <sup>2</sup> interface (Interface is platform-dependent; see the Data Sheet, <i>Hardware Measurement Platforms for the 89600 VSA Software</i> ), literature number 5989-1753EN	LAN, GPIB, USB or FireWire <sup>2</sup> interface (Interface is platform-dependent; see the Data Sheet, <i>Hardware Measurement Platforms for the 89600 VSA Software</i> ), literature number 5989-1753EN

1. Requirements for use with some Agilent Infiniium oscilloscopes are different. See the application note *Infiniium Oscilloscopes Performance Guide Using VSA Software*, literature number 5988-4096EN.

2. For a list of supported IEEE 1394 (FireWire) interfaces, visit [www.agilent.com/find/89600](http://www.agilent.com/find/89600) and search the FAQ's for information on "What type of IEEE 1394 interface can I use in my computer to connect to the 89600S VXI hardware?".



## Related Literature

*89600S Vector Signal Analyzer CD*, literature number 5980-1989E

*89600 Series Vector Signal Analysis Software 89601A/89601AN/  
89601N12*, Data Sheet, literature number 5989-1786EN

*Hardware Measurement Platforms for the Agilent 89600 Series  
Vector Signal Analysis Software*, Data Sheet,  
literature number 5989-1753EN

*89600 Series VSA software for MB-OFDM Ultra-wideband*,  
Technical Overview and Self-guided Demonstration,  
literature number 5989-5452EN

*89600 Series Vector Signal Analyzers, VXI Configuration Guide*,  
literature number 5968-9350E

*Agilent Technologies Solutions for MB-OFDM Ultra-wideband*,  
Application Note, literature number 5989-5280EN

*Using the 89600 VSA software with Infiniium Series Oscilloscopes*,  
Application Note, literature number 5988-4096EN

*89650S Wideband Vector Signal Analyzer System with High  
Performance Spectrum Analysis*, Technical Overview,  
literature number 5989-0871EN

*89650S Wideband Vector Signal Analyzer System with High  
Performance Spectrum Analysis*, Configuration Guide,  
literature number 5989-1435EN

*89607A WLAN Test Suite Software*, Technical Overview,  
literature number 5988-9574EN

*89604A Distortion Test Suite Software*, Technical Overview,  
literature number 5988-7812EN

## Related Web Resources

For more information, visit: [www.agilent.com/find/89600](http://www.agilent.com/find/89600)

[www.agilent.com/find/vsascope](http://www.agilent.com/find/vsascope) for information on using 89600 VSA software with an oscilloscope

[www.agilent.com/find/dvsa](http://www.agilent.com/find/dvsa) for information on using 89600 VSA software with a logic analyzer



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### Agilent Technologies' Test and Measurement Support, Services, and Assistance

Agilent Technologies aims to maximize the value you receive, while minimizing your risk and problems. We strive to ensure that you get the test and measurement capabilities you paid for and obtain the support you need. Our extensive support resources and services can help you choose the right Agilent products for your applications and apply them successfully. Every instrument and system we sell has a global warranty. Two concepts underlie Agilent's overall support policy: "Our Promise" and "Your Advantage."

#### Our Promise

Our Promise means your Agilent test and measurement equipment will meet its advertised performance and functionality. When you are choosing new equipment, we will help you with product information, including realistic performance specifications and practical recommendations from experienced test engineers. When you receive your new Agilent equipment, we can help verify that it works properly and help with initial product operation.

#### Your Advantage

Your Advantage means that Agilent offers a wide range of additional expert test and measurement services, which you can purchase according to your unique technical and business needs. Solve problems efficiently and gain a competitive edge by contracting with us for calibration, extra-cost upgrades, out-of-warranty repairs, and onsite education and training, as well as design, system integration, project management, and other professional engineering services. Experienced Agilent engineers and technicians worldwide can help you maximize your productivity, optimize the return on investment of your Agilent instruments and systems, and obtain dependable measurement accuracy for the life of those products.

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