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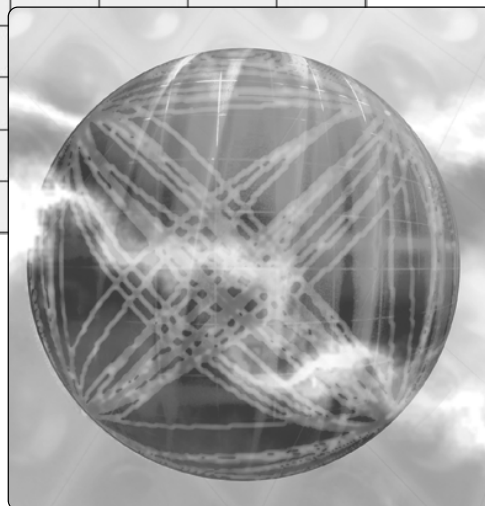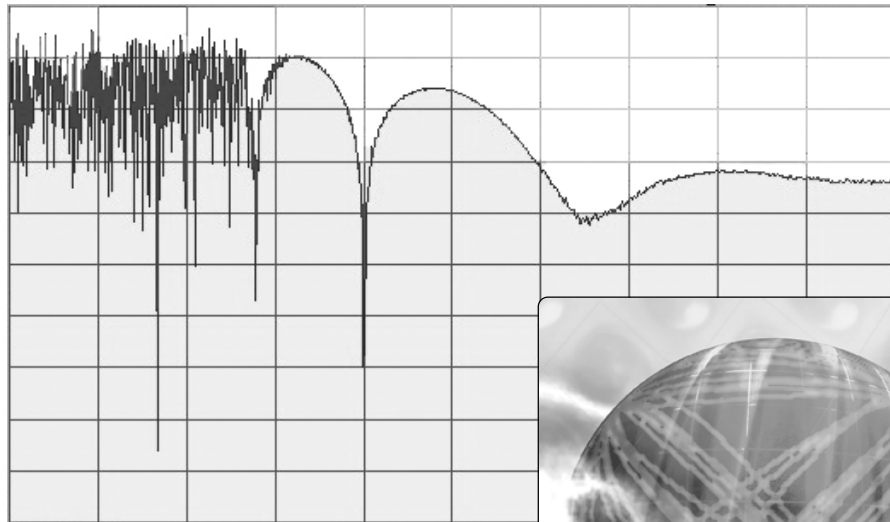## 89600 Series Vector Signal Analysis Software
89601A/89601AN/89601N12

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 decompose your signal, and then quickly identify and track down problems.

Agilent Technologies

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
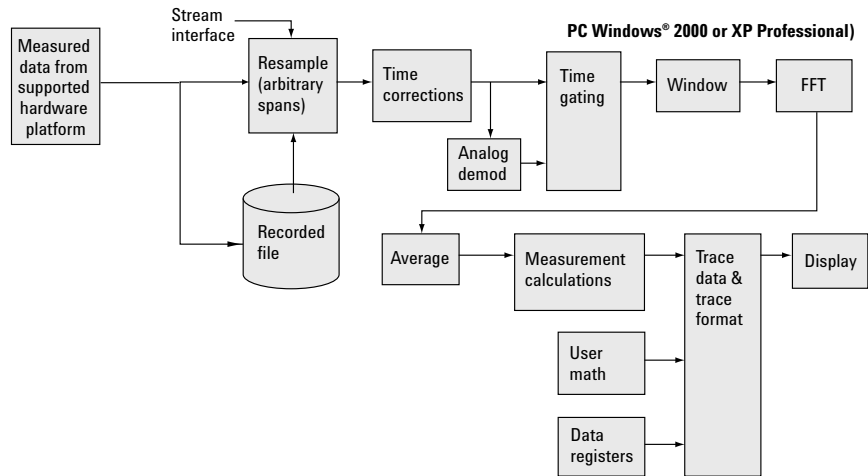

Figure 1. The VSA software architecture provides DSP demodulation algorithms with user-controlled modulation parameters for flexible demodulation of a range of new and emerging formats, including 3G, WLAN, and 802.16. Data can come from several sources, including multiple supported hardware platforms, recorded files, and stream data from Agilent EEsof'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 capabilities to uncover signal anomalies you couldn't see before—and really need to see and track down.

The 89600 VSA software connects your measurement hardware to your PC environment, using familiar, PC-based tools, and providing a tightly linked software/hardware design 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.
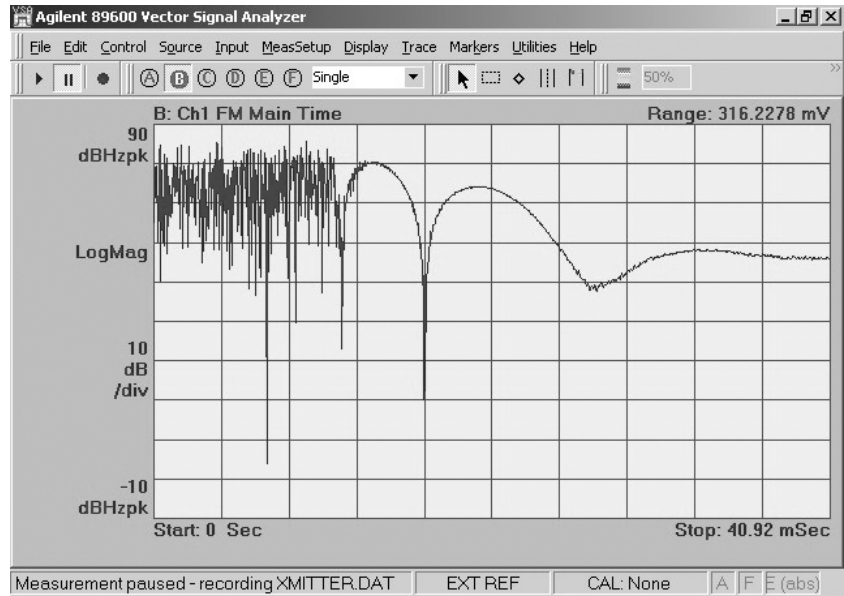
Precise analog demodulation

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.
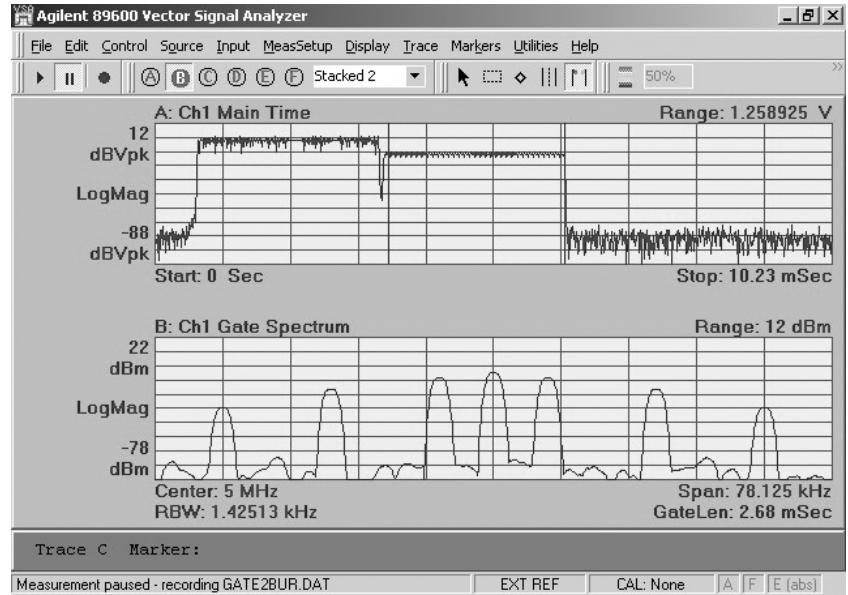
4

Flexible vector analysis tools

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.
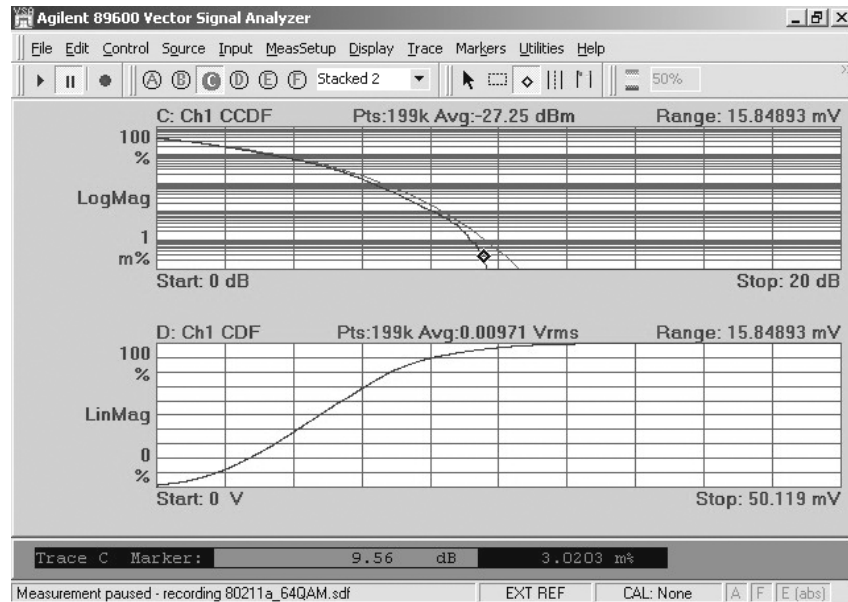

Figure 4. Both CCDF and CDF functions are available. The CCDF marker readout at the bottom of the display indicates that the signal exceeds 9.56 dB above the average signal level only .003% of the time, useful information when calculating design headroom.

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.

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.
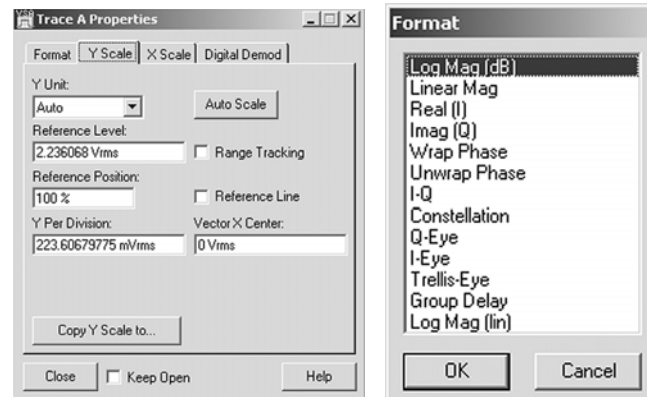
Display format and scaling

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.
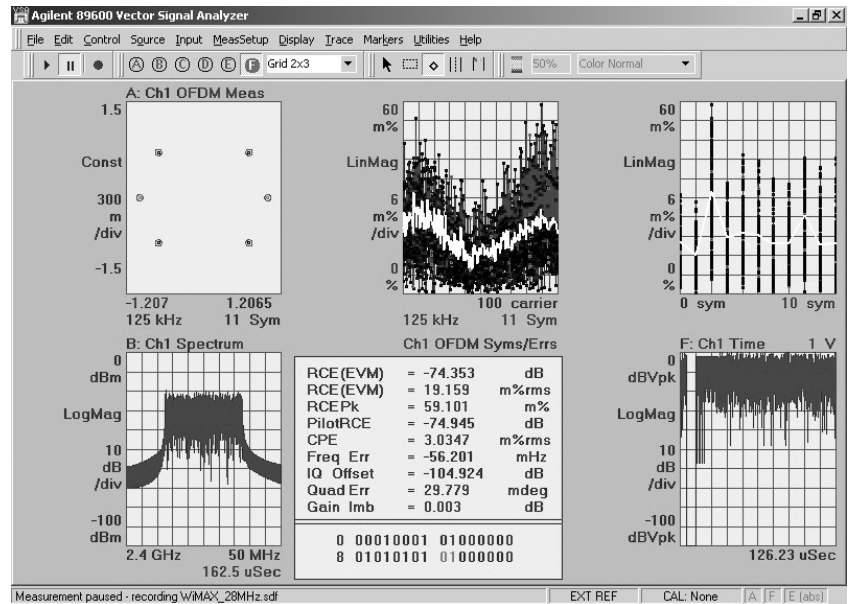
See 6 screen displays, simultaneously

Figure 6. Display 1, 2, 3, 4, or 6 displays, simultaneously. You can choose to have them appear stacked, or in a symmetrical grid.

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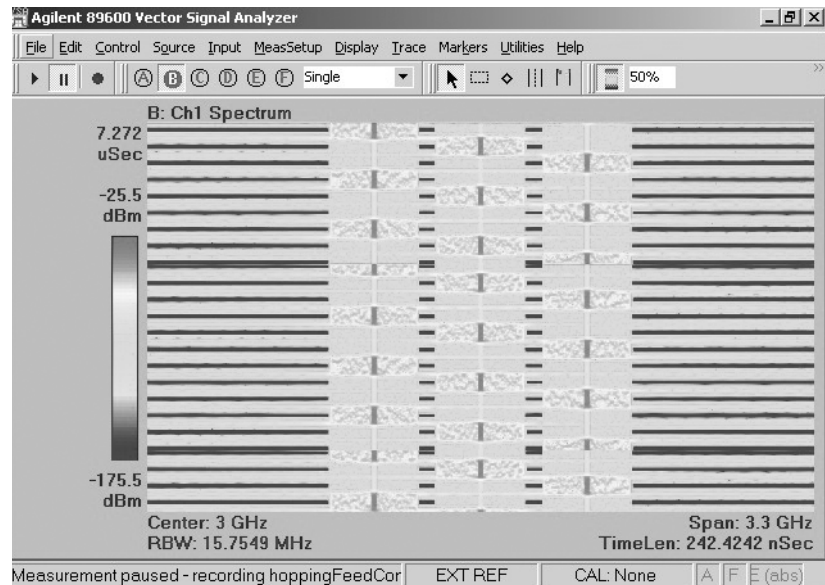
Figure 7. View the spectral behavior of wide bandwidth hopping signals over time using spectrogram displays. Grey-scale views provide even greater resolution.

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.

Signal capture and playback

Figure 8. The signal recording user interface is familiar and simple to use.
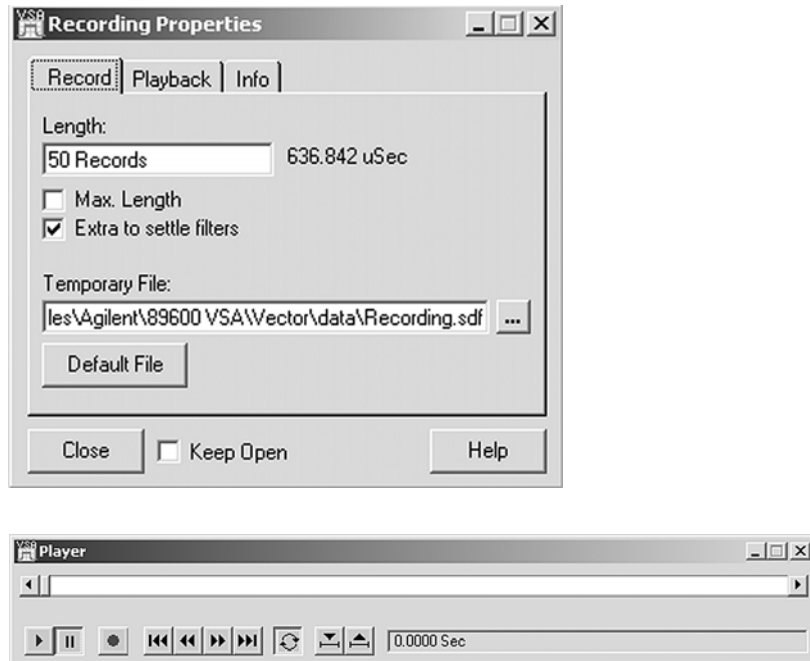
The 89600 VSA software lets you capture your digitized signal in your measurement hardware and transfer it directly to your PC's disk drive. You can play the signal back at a later time, import it into other applications, and create and play your own recording through an Agilent signal generator.

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

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 many features of the signal generator from the 89600 VSA software front panel.

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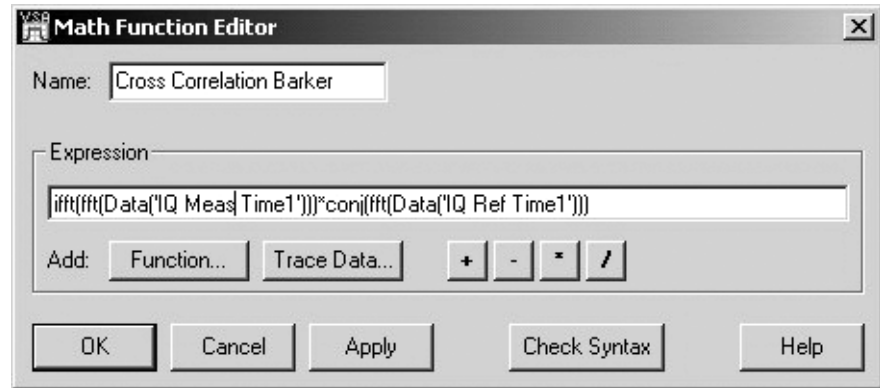
Figure 9. Create math functions for simple tasks like unit scaling, or for sophisticated new measurements like this Barker code cross correlation function.

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.

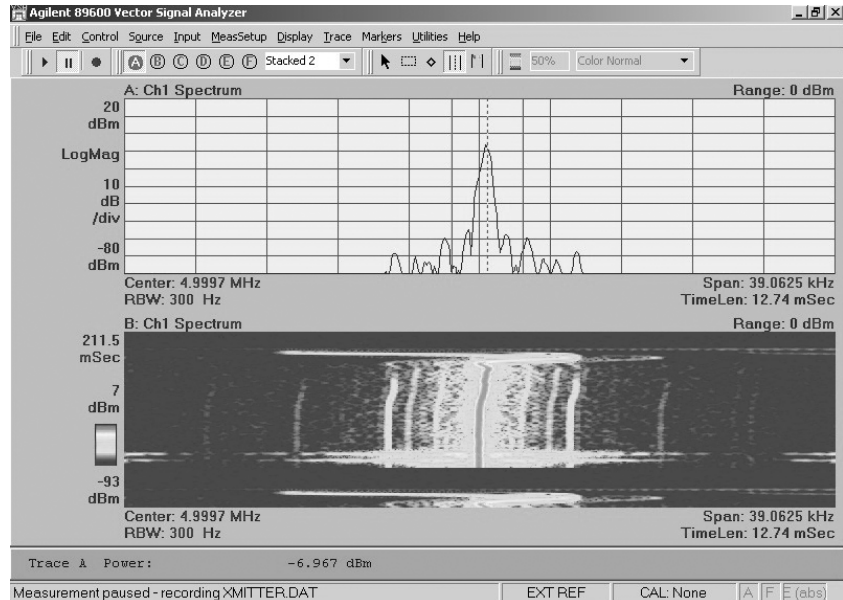## Easy-to-Use Windows Graphical User Interface

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 parameter and a hand 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.

Markers and band power measurements

To identify signals 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.

Signal zoom

For a closer look at a signal, use the highlight box to zoom 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 math tools provide you with the basic capabilities to perform even MIMO-analysis:

- Correlation and cross-correlation
- Coherence and cross-channel coherence
- Frequency response
- Impulse response

Use these tools to develop and analyze complex multi-antenna, radar, or signal surveillance systems.

Check hardware specifications to determine if the hardware platform configurations support multiple channels.

Help text
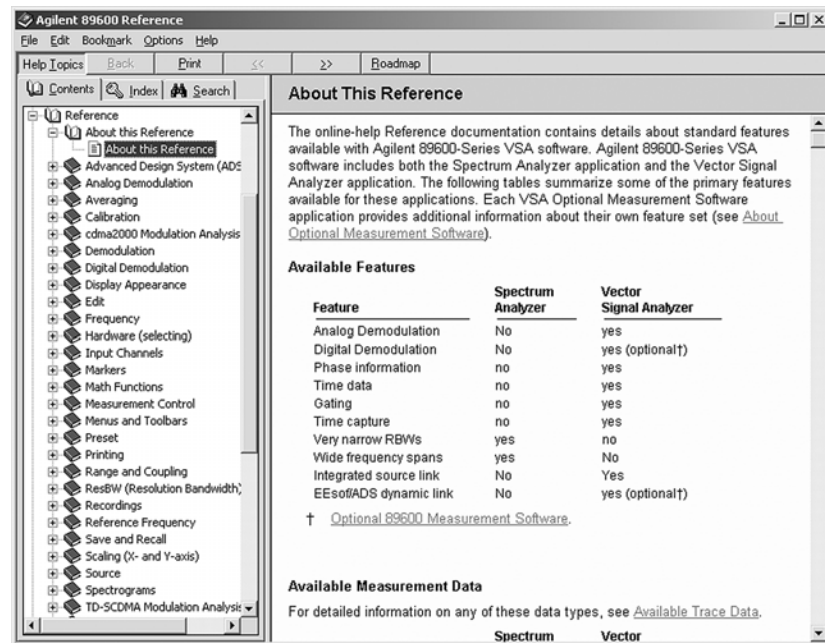

Figure 11. Everything, from reference information, to tutorials using recorded signals, to programming examples, is included in the incredibly comprehensive help text.

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, 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.

Four modulation analysis options are available:

- Option AYA flexible modulation analysis
- Option B7N 3G modulation analysis
- Option B7R WLAN modulation analysis
- Option B7S 802.16 OFDM modulation analysis.

The supported modulation formats are listed in the table on page 13.

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	*Bluetooth*[TM]
CDMA base	CDMA mobile
CDPD	DECT
DTV8	DTV16
DVB16	DVB32
DVB64	EDGE
GSM	HIPERLAN/1 (HBR)
HIPERLAN/1 (LBR)	NADC
PDC	PHP (PHS)
TETRA	WLAN (802.11b)
	VDL mode 3

General modulation formats, available with Option AYA
(With variable center frequency, symbol rate, filtering type and alpha/BT)

BPSK, 8PSK	FSK 2-, 4-, 8-, 16-level
QPSK	DQPSK
Pi/4 DQPSK	D8PSK
MSK type 1, type 2	Offset QPSK
QAM 16-, 32-, 64-, 128-	EDGE
VSB 8-, 16-	DVBQAM 16, 32, 64

Available with Option B7N
W-CDMA (3GPP); cdma2000® (3GPP2); TD-SCDMA; 1xEV-DO; HSDPA; 1xEV-DV

Available with Option B7R
WLAN (802.11a, b, g); WLAN (HIPERLAN/2)

Available with Option B7S
IEEE-802.16 (WiMAX)

Table 1. Choose from the 4 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.

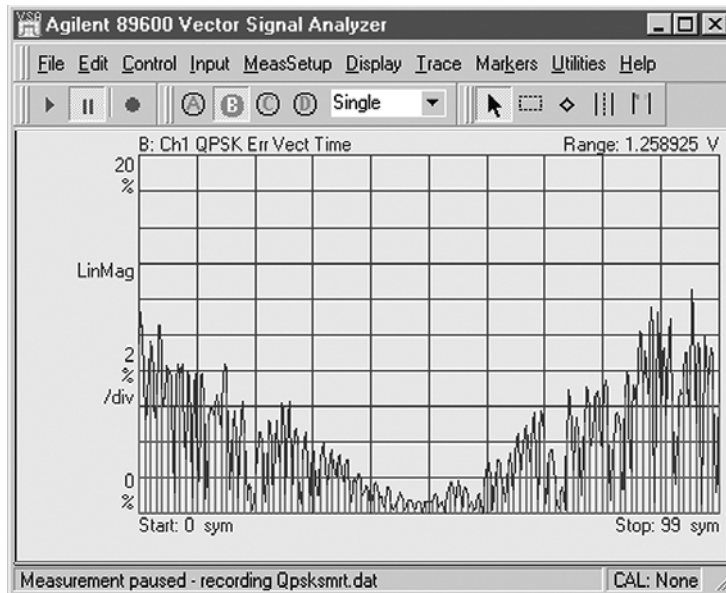## Unique error analysis tools highlight problems

Figure 12. The "v" shape in the EVM versus time display indicates a symbol clock timing error. Trace math can help determine the approximate clock rate.
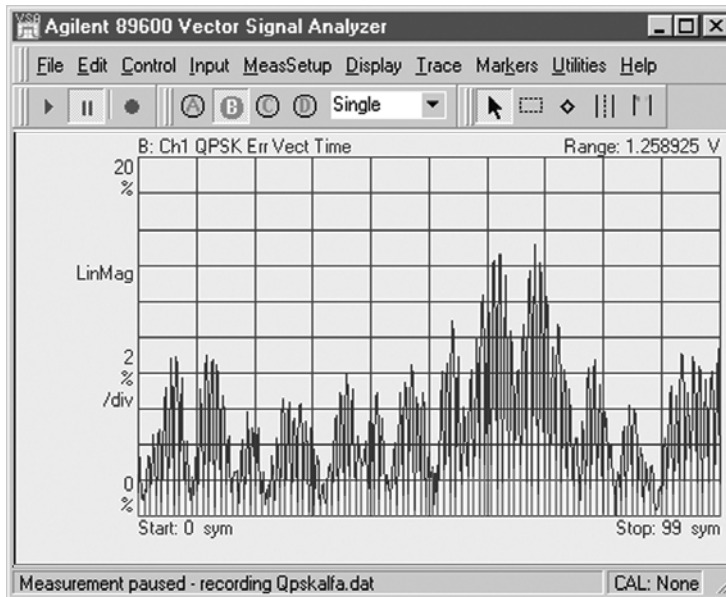
Figure 13. This signal shows higher EVM in between the symbols (shown in green) than at the symbol clock times (shown in red), a clear indication of filtering errors. Next you can try and determine the correction needed by using the adaptive equalization filter.

Agilent 89600 VSAs offer sophisticated error analysis that lets you see both RF and DSP problems. The key is the EVM measurement. The EVM 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. These tools include EVM time, EVM spectrum, and adaptive equalization.

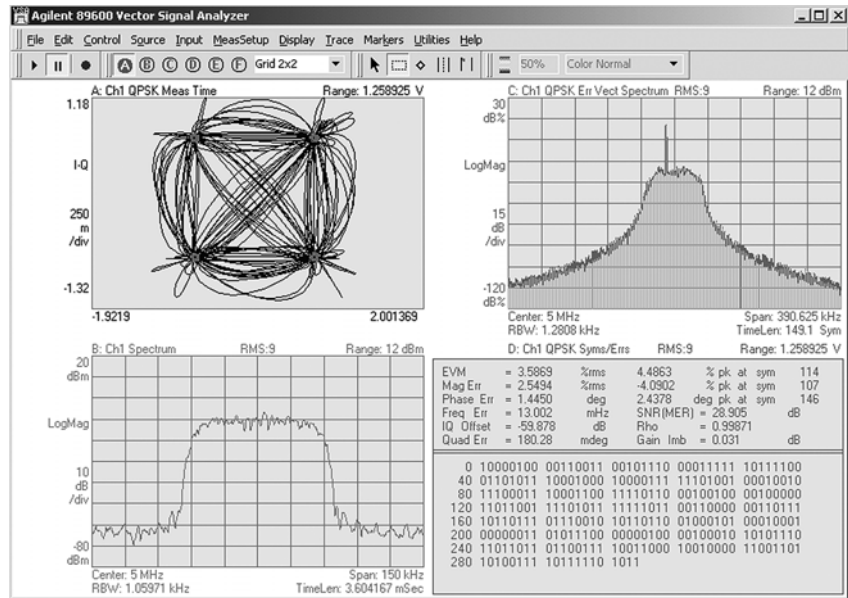## Error vector magnitude (EVM)

Figure 14. 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 EVM error signal to identify systematic impairments you couldn't otherwise see. Identify spurs coupling from other parts of the system by looking at the EVM 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.
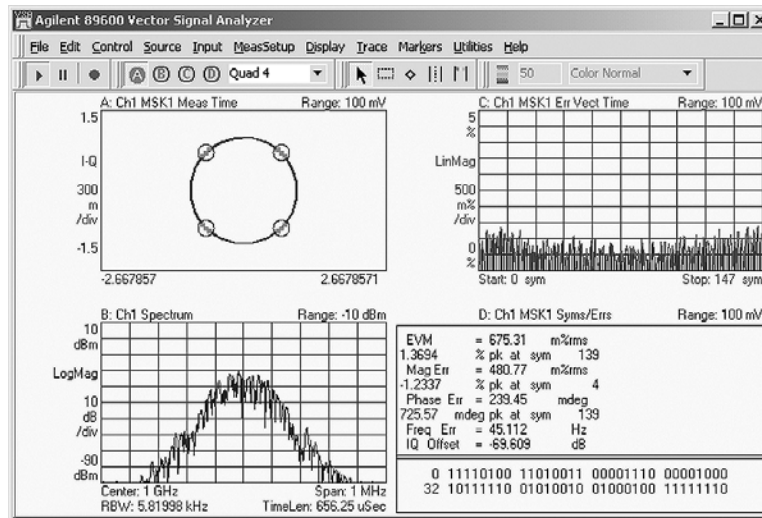
Flexible Modulation Analysis (Option AYA)

Figure 15. GSM signal MSK format with spectrum and EVM versus time.
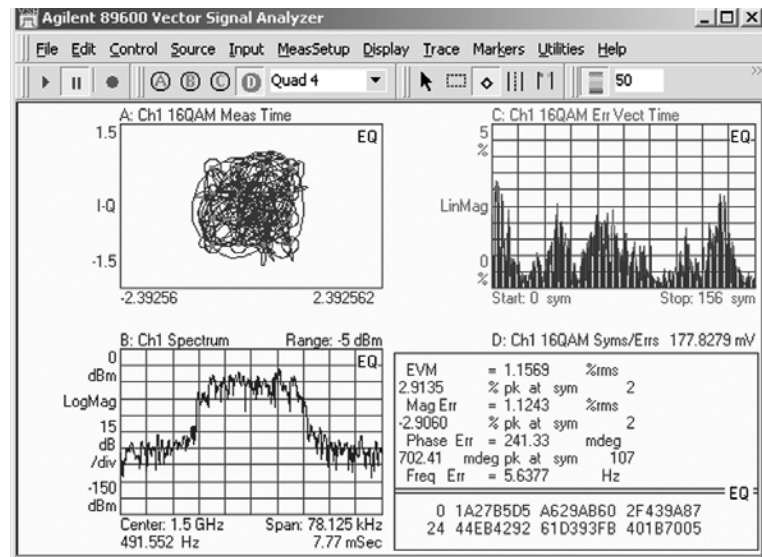
Figure 16. 16QAM signal with spectrum and error vector magnitude versus time display.

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, 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 (Option B7N)

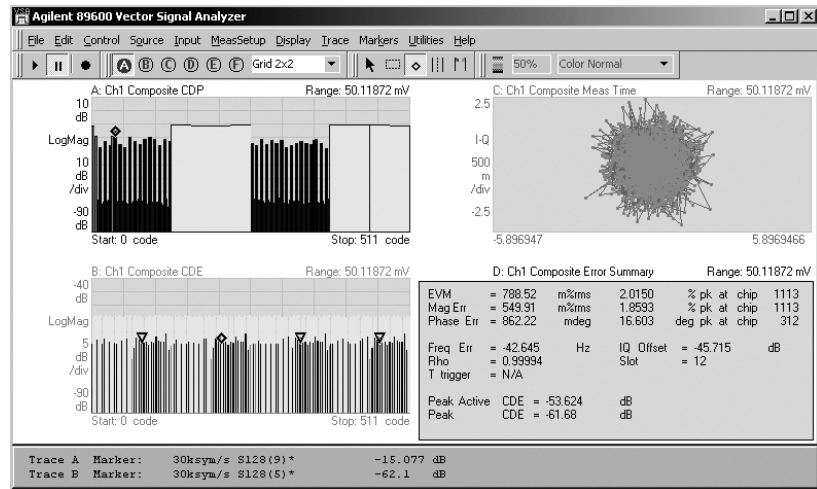**Figure 17. Analyze W-CDMA and HSDPA signals using the 89600. Here the 89600 displays show the code domain power and error of the composite signal in bit reverse (trace A) and Hadamard (trace B) channel order. The markers in trace B point to all parts of a single channel. Notice also, the composite 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.

W-CDMA/HSDPA

Measure, evaluate and troubleshoot your W-CDMA and HSDPA signals with the tools in Option B7N. 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.
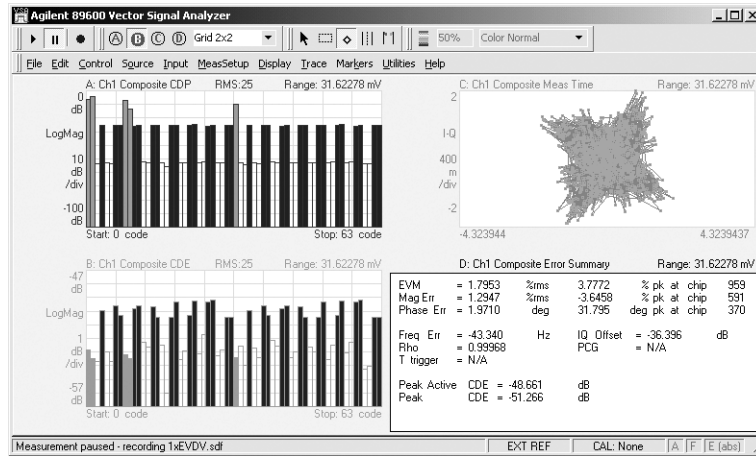
cdma2000/1xEV-DV

Figure 18. Use the extensive 89600 Option B7N 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 B7N 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
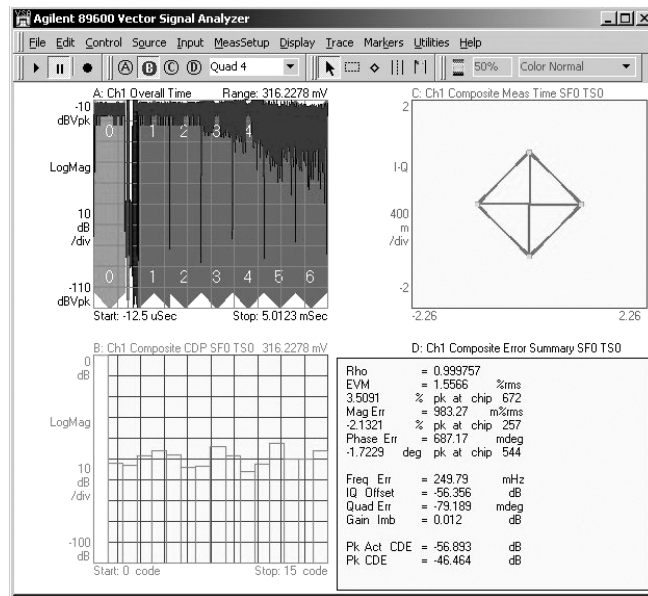
Figure 19. Composite TD-SCDMA modulation analysis.

Troubleshoot and analyze your time division synchronous code domain multiple access (TD-SCDMA) modulation and RF performance with the enhanced 3G option (B7N) to Agilent's 89600 VSA software.

With 1.28 Mcps functionality, this analysis package handles the TSM version of TD-SCDMA. 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

Figure 20. Multiple views of a composite 1xEV-DO signal.

Measure and analyze 1xEV-DO modulated signals with the capabilities offered as part of Option B7N. 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.
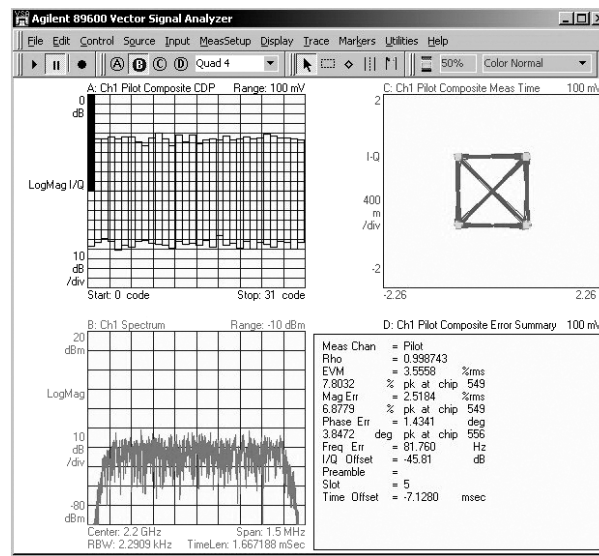
The advanced technology demodulator used in this option does not require coherent carrier signals, or symbol-clock timing signals, and comes with an internal IS-2000 filter. All you have to do is enter carrier frequency, chip rate, reverse/forward link direction, and set the long code mask. The analyzer 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.

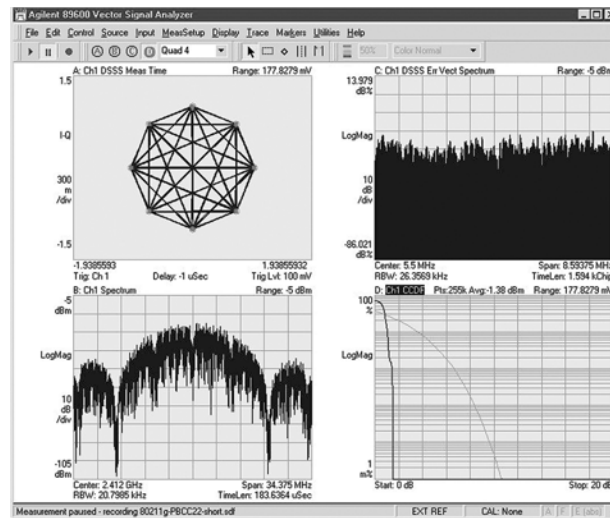## Market Leading WLAN Analysis (Option B7R)

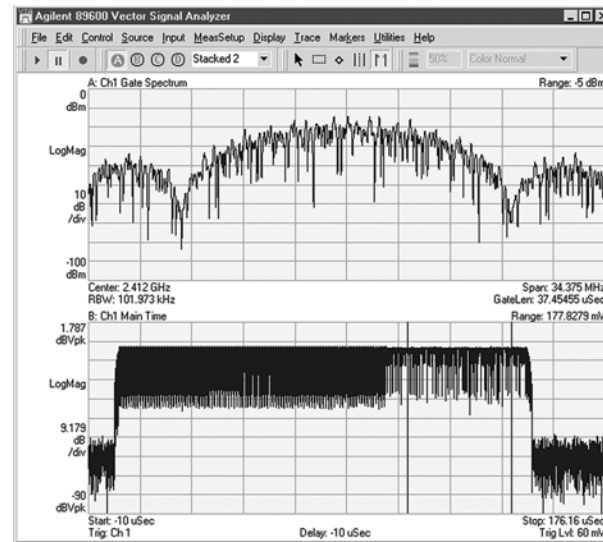Figure 21. Demodulate the optional PBCC modes of 802.11g.

Figure 22. 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:

- 802.11a OFDM modulation analysis
- 802.11b DSSS/CCK/PBCC modulation analysis
- 802.11g modulation analysis
- 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 802.11g signals and use them separately to analyze 802.11b or 802.11a signals.

802.11b modulation analysis

Select the DSSS/CCK/PBCC mode and automatically detect, despread, descramble, and demodulate the payload in all four mandatory 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 802.11g. 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 gate time 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 802.11b analysis.
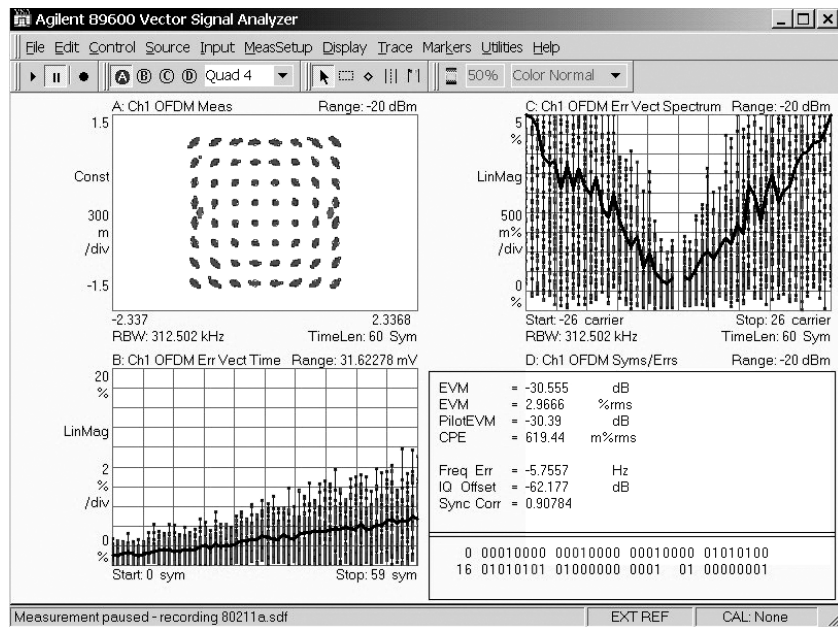
802.11a modulation analysis

Figure 23. View the EVM spectrum or EVM time of an 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 802.11a, 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.

802.11a/b/g test suite
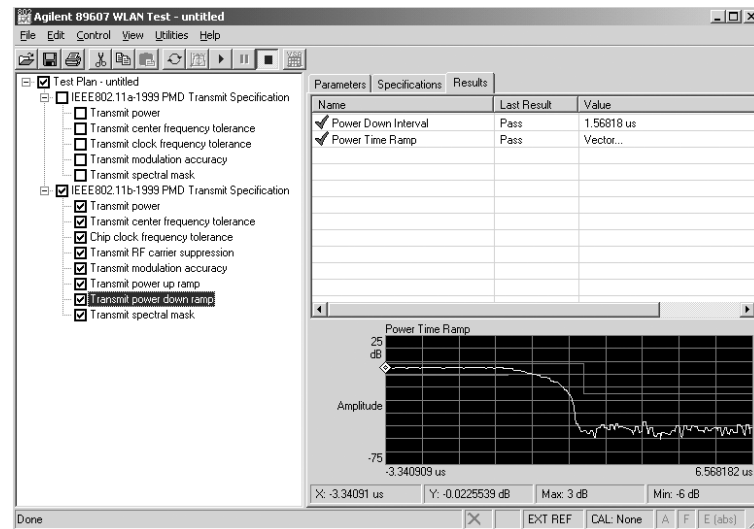
Figure 24. One-button, standards-based measurements of your 802.11 signal quickly help you determine if the signal has any problems.

Speed the process of testing your 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.

Comprehensive 802.16-2004 OFDM (WiMAX) Analysis (Option B7S)
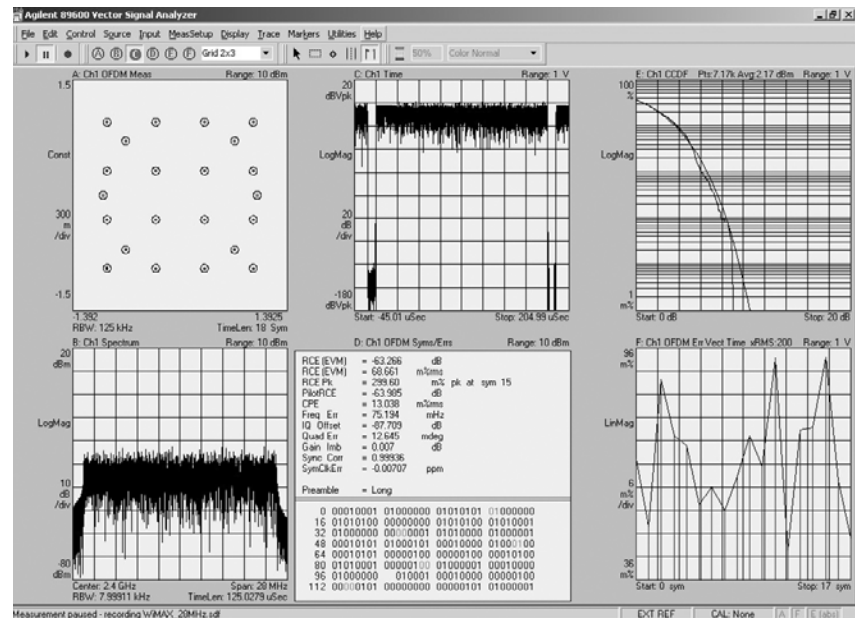
Figure 25. Familiar and new tools combine to provide invaluable troubleshooting information.
Here the 6 displays simultaneously show (l to r) I-Q constellation, time, CCDF, spectrum,
modulation error summary, and error vector vs. time.

Agilent is the industry leader in base band, RF, and modulation quality measurements for IEEE-802.16-2004 (WiMAX) 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 WiMAX 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 WiMAX 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 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
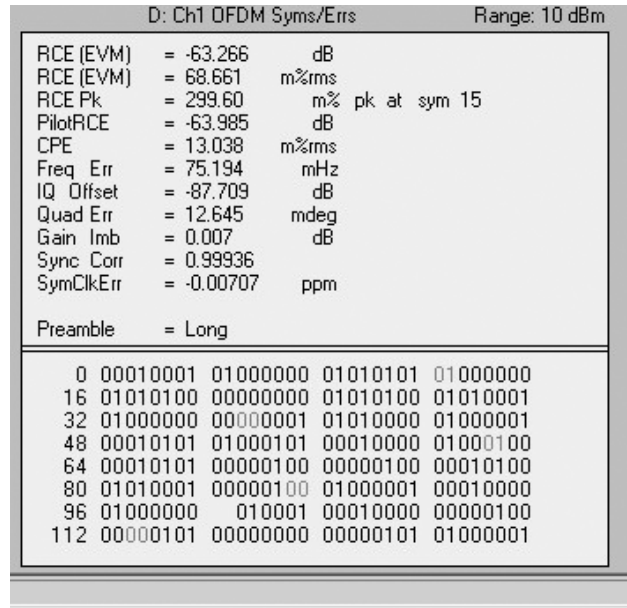- Group delay

OFDM- and WiMAX-specific measurements

Figure 26. 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.

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New measurements specifically for OFDM and more specifically for WiMAX 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.

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), or LAN.

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 or GPIB.

For convenience in ordering, the 89650S 80 MHz VSA system is available. It pairs the E4440A 26.5 GHz spectrum analyzer with its 80 MHz wideband digitizer (Option 122) and the 89600 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 6 GHz of analysis bandwidth and are well suited to digitizing down-converted satellite, LMDS, and MMDS signals. The digitized signals are transferred via GPIB 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.

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 2.65 or 6.0 GHz. In addition, BBIQ inputs can be added to any RF systems.

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.

Two channel operation

For faster measurements and to work with non-bursted signal types, the software supports two channel configurations based on the PSA Series spectrum analyzers or VXI modular hardware.

N4010A wireless connectivity test set

The N4010A is a test set designed to quickly and accurately measure emerging wireless connectivity formats in the 2.4 GHz band. The N4010A offers two bandwidth selections of 5 and 22 MHz, making the N4010A an ideal test platform for *Bluetooth* and WLAN RF measurements. The N4010A with *Bluetooth* Option 101 is an effective measurement tool for development, integration, pre-qualification, and volume manufacturing.

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

Use "virtual hardware" to make measurements and evaluate your system even when hardware is missing.

Measurements from actual prototype hardware can be fed into a design simulation.

Take a simulation output file and download it to the Agilent ESG signal generator to stimulate your device under test.

DUT

Any supported front-end measurement platform

Use any of the supported Agilent front ends to make measurements on your device. You can also compare it to measurements you made on the simulated DUT.

Link real-world signals recorded with 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. 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.

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 to LAN gateway, 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.

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 2000 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
89601A-B7R	WLAN modulation analysis
89601A-B7S	802.16 OFDM modulation analysis
89601A-105	Dynamic link to EEsof/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
89601AN-B7R	WLAN modulation analysis
89601AN-B7S	802.16 OFDM modulation analysis
89601AN-105	Dynamic link to EEsof/ADS

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

89601AS	Additional software update subscription service
Options	Twelve-month minimum required (12 Option 0RU). 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.
89601AS-0RU	One-month software coverage

89601ASN	Software update subscription service for 1 server (floating license)
Options	Options 875 and 0RU required. The number of 875 options must match the number of Option 200 installed on server. Option 0RU: 12-month minimum required per Option 875. Twenty-four-month maximum coverage.
89601ASN-875	Subscription service for one 89601AN-200 floating license
89601ASN-0RU	One-month software coverage

Product Upgrades

You may order any of the options after purchase. For future options or to get the most current versions of these options, you must be at the current shipping revision of software. If you are not, purchase of 1-year of 89601AS/ASN is required (qty 12 –0RU). 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 **(recommended)**
PS-S10	Phone assistance **(6 hours recommended)**
PS-T10-896xx	89600 users' course
PS-T11-896xx	Digital radio troubleshooting
PS-T12-896xx	Wireless LAN technology fundamentals
R1362A-250 V	SA 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.

	Desktop	Laptop
CPU	180 MHz Pentium® or AMD-K6 (> 300 MHz recommended)	> 300 MHz Pentium or AMD-K6
Empty slots	1 CardBus Type II slot (Two recommended)	1 CardBus Type II slot (Two recommended)
RAM	192 MB (256 MB recommended)	192 MB (256 MB recommended)
Video RAM	4 MB (8 MB recommended)	4 MB (8 MB recommended)
Hard disk space	200 MB available	200 MB available
Operating system	Microsoft Windows 2000, SP2, or XP Professional	Microsoft Windows 2000, SP2, or XP Professional
Additional drives	CDROM or 3.5 inch floppy (if no network access available)	CDROM or 3.5 inch floppy (if no network access available)
Interface support	IEEE-1394-1995[1]	IEEE-1394-1995[1]

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1. For a list of supported interfaces, see **www.agilent.com/find/iolib** or contact your local Agilent call center or sales office. IEEE-1394 interface required for VXI hardware only.

Related Literature

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

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

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

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

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

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

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

5988-7812EN   *89604A Distortion Test Suite Software, Version 4.0, Technical Overvie*w

Related Web Resources

For more information, visit: www.agilent.com/find/89600

Agilent Email Updates

www.agilent.com/find/emailupdates
Get the latest information on the products and applications you select.

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. Support is available for at least five years beyond the production life of the product. 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.

Agilent T&M Software and Connectivity

Agilent's Test and Measurement software and connectivity products, solutions and developer network allows you to take time out of connecting your instruments to your computer with tools based on PC standards, so you can focus on your tasks, not on your connections. Visit **www.agilent.com/find/connectivity** for more information.

For more information on Agilent Technologies' products, applications or services, please contact your local Agilent office. The complete list is available at:

www.agilent.com/find/contactus

Product specifications and descriptions in this document subject to change without notice.

Agilent Technologies