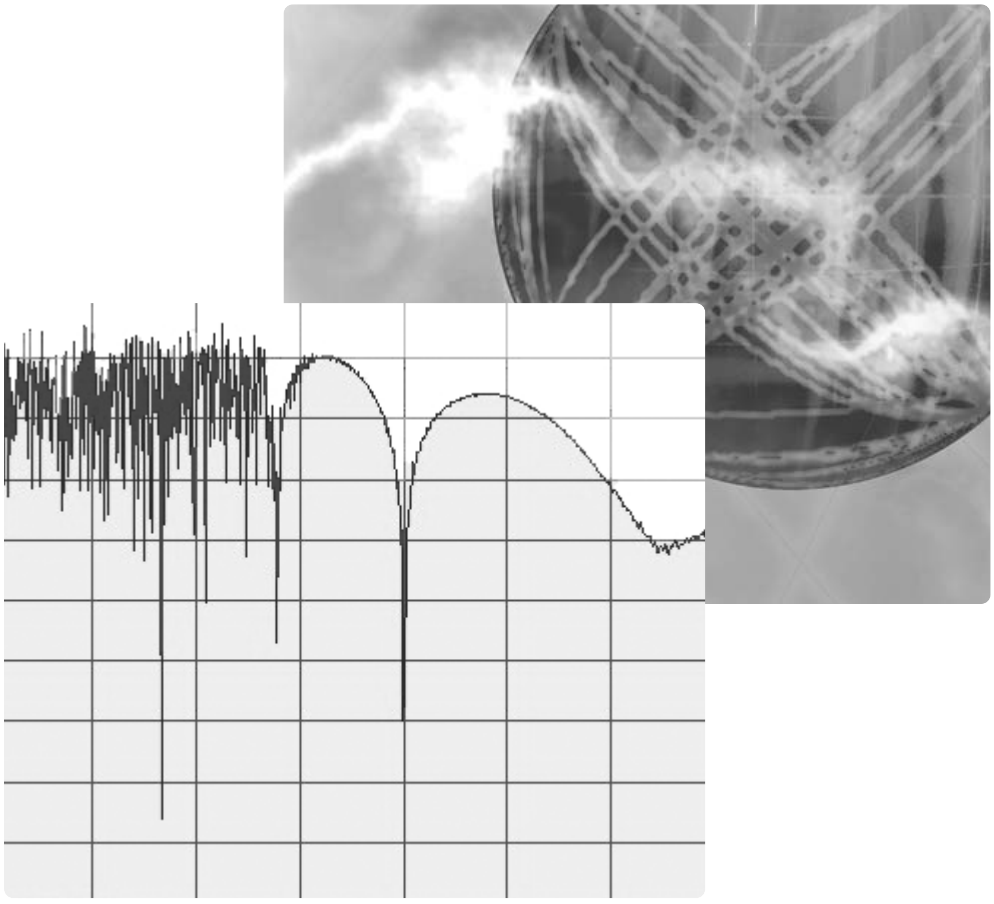
Agilent
89600 Series Vector Signal Analysis Software
89601A/89601AN/89601N12

Data Sheet



Agilent Technologies

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Introduction

The 89600 Series vector signal analysis software is designed to help baseband and RF design engineers measure, evaluate and troubleshoot complex (I/Q) modulated signals.

This software runs on a PC and works with a variety of hardware measurement platforms. These platforms include the 89600 VXI based vector signal analysis systems, the 89650S wideband vector signal analysis system with high performance spectrum analysis, the PSA high performance spectrum analyzers, the ESA general-purpose spectrum analyzers, the E4406A transmitter tester, plus Infiniium and 6000 Series oscilloscopes, and several Agilent logic analyzers. For more information, see the Option 300 Hardware Connectivity information. These platforms down convert and digitize the signal, provide signal capture capability, and move the data to the PC in a sequential stream of data blocks. The 89600 Series software processes the data in the time, frequency and modulation domains.

The following tables describe the capabilities of the 89600 Series vector signal analysis software and its options on these platforms and with the EEsof Advance Design System RF and microwave design and simulation software. Refer to the *Hardware Measurement Platforms for the 89600 Series Vector Signal Analysis Software*, Data Sheet, literature number 5989-1753EN, for performance specifications.

Basic Vector Signal Analysis (Option 200)

Time and waveform

The 89600 Series vector signal analyzers have two signal processing modes: base band and zoom. These two processing modes affect the appearance and the duration of input waveforms displayed by the 89600s. Most 89600 measurements are made with a non-zero start frequency, called the Zoom mode. In these cases, the time domain display shows a complex envelope representation of the input signal – that is, the magnitude and phase of the signal relative to the analyzer's center frequency. This provides a powerful capability to examine the base band components of a signal without the need to first demodulate it.

Base band mode refers to the special case where the measurement begins at 0 Hz. Here, the input signal is directly digitized and the waveform display shows the entire signal (carrier plus modulation), very much as an oscilloscope would.

Time record characteristics

In the 89600 VSA application, measurements are based on time records. A time record is a block of samples of the signal waveform from which time, frequency, and modulation domain data is derived. Time records have these characteristics:

Time record length (main time)

$$\frac{\text{(Number of frequency points} - 1)}{\text{Span with RBW mode set to arbitrary, auto-coupled}}$$

Time sample resolution

1/(k x span)
Where:
k = 2.56 for time data mode set to base band
k = 1.28 for all other modes (default) including zoom
Span = Currently selected frequency span

Time recording characteristics

In recording (time capture) mode the 89600 VSA application captures the incoming waveform gap-free into high-speed time capture memory. This data may then be replayed through the analyzer at full or reduced speed, saved to mass storage, or transferred to another software application.

When time analyzing the captured waveform, users may adjust measurement span and center frequency in order to zoom in on a signal, as long as the new measurement span lies entirely within the originally captured span.

Time recording memory size

Memory size is dependent on the hardware used. See hardware specifications for more information.

Measurement display and control

Triggering

Trigger types	
Spectrum application	(VXI hardware only) Free run, channel, external (separate trigger per frequency segment)
Vector signal analysis application	Free run, channel, IF magnitude, external
Pre-trigger delay resolution	Same as time capture sample resolution
Pre-trigger delay range	Hardware dependent.
Post-trigger delay resolution	Same as time capture sample resolution
Post-trigger delay range	Hardware dependent.
IF trigger	Used to trigger on in-band energy, where the trigger bandwidth is determined by the measurement span (rounded to the next higher cardinal span). *Specifications are dependent on the hardware used. See hardware specifications for more information.*
Trigger hold-off	Used to improve trigger repeatability on TDMA and other bursted signals. Once armed, trigger hold-off prevents re-triggering of the analyzer until a full hold-off period has elapsed.

Measurement display and control—*continued*

Hold-off resolution	Same as time capture sample resolution
Hold-off range	Hardware dependent.
External trigger	*External trigger is dependent on the hardware used. See hardware specifications for more information.*

Averaging

Types	
Spectrum application (VXI hardware only)	RMS (video), RMS (video) exponential, peak hold
Vector signal analysis application	RMS (video), RMS (video) exponential, peak hold, time, time exponential
Number of averages, maximum	$> 10^8$
Overlap processing	0 to 99.99%

Analog demodulation

AM demodulation	
Demodulator bandwidth	Same as selected measurement span
PM demodulation	
Carrier locking	Automatic
Demodulator bandwidth	Same as selected measurement span
FM demodulation	
Carrier locking	Automatic
Demodulator bandwidth	Same as selected measurement span

Time gating

Provides time-selective frequency domain analysis on any input or analog demodulated time-domain data. When gating is enabled, markers appear on the time data; gate position and length can be set directly. Independent gate delays can be set for each input channel. See "Time and waveform" specification for main time length and time resolution details.

Gate length, maximum	Main time length
Gate length, minimum	Window shape/(0.3 x frequency span) where window shape is: • Flat-top window 3.8 • Gaussian window 2.2 • Hanning window 1.5 • Uniform window 1.0

Markers

Types	Marker, offset, spectrogram, gate time
Search	Peak, next peak left, next peak right, peak lower, peak higher, minimum
Copy marker to	Start freq, stop freq, center freq, ref level, despread chan, offset to span, counter to center frequency
Marker functions	Peak signal track, frequency counter, band power, couple, zero offset, show offset and delta
Band power	Can be placed on any time, frequency, or demodulated trace for direct computation of band power, rms square root (of power), C/N, or C/No, computed within the selected portion of the data.
Occupied bandwidth (OBW)	Placed on spectrum traces only to dynamically compute the bandwidth required to provide x% of power in the band. User selectable from 0 to 100%
OBW results	Total power in span Power in OBW Power ratio (OBW/Span) OBW lower frequency OBW higher frequency OBW Centroid frequency Offset frequency (measurement center freq – centroid freq)

Measurement display and control—*continued*

Adjacent channel power	*Placed on spectrum traces only*
User-settable parameters	Center frequency and bandwidth of the carrier channel Offset frequency and bandwidth of each offset channel Reference offset allows offset channel to be centered anywhere on screen Hardware mixer level control (PSA, E4406, 89650S, 89600S options 040 and 041, only)
ACPR results	Pass/fail limits for each offset (applied to both lower and upper result) Carrier band power Power in both lower and upper offset bands for each frequency offset Power in both lower and upper offset bands for each frequency offset, relative to the carrier power (ACPR) Worst case (of the upper and lower offsets) ACPR for each frequency offset Pass/fail condition relative to user supplied thresholds

Limit lines

Compatibility	VSA application only
Limit tests	*Collection of limit lines applied to trace data*
Test edit features	Create, modify, delete, save, export, recall, import, copy
Test edit parameters	Unique name; limit line; collection of limit lines;
Type	User-defined, or saved trace
Display appearance	User-specified color for limit, fail limit, margin, fail margin
Number	One per each of six simultaneous trace displays
Marker results	Pass/fail status for limit and margin; worst-case failed point, or smallest-margin point if no failure; limit test status for all traces; limit line table with tabular results
Limit line editing	*Define, enter and edit a list of limit points*
Identification	User specified name
Settable line parameters	Upper, lower limit; limit margin
Line draw	One line, connected points; linear or log interpolation on x- and y-axis
Line display	Limit, margin, limit and margin
Trace failure display	In trace color, or user-settable fail color
Limit data X-domain	Frequency or time, only
Limit data Y-format	Linear, log
Limit data Y-unit	Auto, Peak, RMS, Power, mRMS
X-reference	Absolute, or relative (to center frequency or starting time)
Y-reference	Absolute, or relative to reference level
Limit point editing	*Sorted in ascending x-axis order*
Limit point attributes	X-axis, y-axis, connection flag
Number allowed	> 32,000 points
Programming	*All features controllable via COM API*
Limit test failure	Generates measurement status event
Other	Worst-case y axis and corresponding x-value available for each limit line

Measurement display and control—*continued*

Trace math	*Trace math can be used to manipulate data on each measurement. Applications include user-defined measurement units, data correction, and normalization.*
Operands	Measurement data, data register, constants, $j\omega$
Operations	+, -, x, /, conjugate, magnitude, phase, real, imaginary, square, square root, FFT, inverse FFT, windowing, logarithm, exponential, peak value, reciprocal, phase unwrap, zero
Trace formats	Log mag (dB or linear), linear mag, real (I), real (Q), wrap phase, unwrap phase, I-Q, constellation, I-eye, Q-eye, trellis-eye, group delay
Trace layouts	1 to 6 traces on one, two, three, four, or six grids
Number of colors	User-definable color palette
Spectrogram display	
Adjustable parameters	
Height	Height of viewable portion of spectrogram; in number of scan or secs
Fixed height	Yes/no; sets maximum height of spectrogram based on height setting (vs. size of window)
Top trace	Time or scan value for the first (top) trace in the viewable portion of the spectrogram
Trace offset	Yes/no; when selected, the top trace of the spectrogram display will be the value shown in the Top Trace text box
Buffer depth	Specifies the maximum number of individual traces that will be stored and/or displayed
Color count	Specifies the number of colors used for spectrogram display; max 64
Enhance	Determines how colors are distributed in the color bar for spectrogram displays; default 50% (even distribution of colors in the color bar)
Map color scheme	Color normal, color reverse, grey normal, grey reverse, user-defined
Show spectrogram	Yes/no; enables spectrogram display for the active trace
Threshold	Sets threshold for the currently selected spectrogram display; useful for removing noise-floor clutter
Trace select	When a measurement is paused any trace in the trace buffer can be selected by trace number. The marker values and marker functions apply to selected trace.
Marker	Display of frequency, amplitude, and time since trigger for any point on selected trace. Offset marker shows the absolute value of second marker in time, frequency and amplitude. Delta shows the difference between the main marker and the offset marker in a status line.
Z-axis value	The z-axis value is the time the trace data was acquired relative to the start of the measurement. The z-axis value of the selected trace is displayed as the start of the marker readout.
Memory (characteristic)	Displays occupy PC memory at a rate of 128 traces/MB (401 frequency point traces).

Software interface

The 89600 VSA appears to other Windows® software as an ActiveX object. Implemented according to the industry-standard Component Object Model (COM), the software exposes a rich object model of properties, events, and methods, as described in the 89600 documentation.

Because all 89600 functionality is implemented within its software, direct programmatic access to the measurement front-end hardware is never necessary and is not supported. Software development environments that are capable of interacting with COM objects include Agilent VEE, Microsoft Visual Basic, Microsoft Visual C++, C#, MATLAB®, National Instruments LabVIEW, and others.

In addition, many end-user applications are able to interact directly with COM objects, using built-in macro languages such as Visual Basic for Applications (VBA). For example, in Microsoft Excel a VBA macro could be used to set up the instrument, collect the measurement data, and automatically graph the results.

Macro language

The analyzer's built-in Visual Basic script interpreter enables easy automation of many types of measurement and analysis tasks. Scripts may be developed using any text editor, or may be recorded automatically from a sequence of menu selections. Completed scripts may be named and integrated onto the analyzer's toolbar, allowing them to be launched with a single button press.

Remote displays

To operate the 89600 or view its display from a remote location, the use of commercially available remote PC software such as Microsoft NetMeeting or Symantec pcAnywhere is recommended.

Remote programming

Beginning with Microsoft Windows NT 4.0, COM objects on one PC are accessible from software running on another PC. This capability, known as Distributed COM (DCOM), makes the 89600 object model fully programmable from any other PC having network connectivity to the analyzer's host PC.

File formats

For storage and recall of measured or captured waveforms, spectra and other measurement results.

ASCII	Tab delimited (.txt), comma delimited (.csv)
Binary	Agilent standard data format (.sdf, .cap, .dat), Agilent E3238 search system time snapshot (.cap), time recording (.cap) files under 2 GB in size. Agilent N5110 signal generator files (.bin) under 2 GB in size.
MATLAB 4 and later	MAT-file (.mat)

Hardware Connectivity (Option 300)

Sources

The 89600 software can send signal capture files to external signal generators and analyze data from several types of signal acquisition hardware.

In source mode the 89600 VSA can control an Agilent signal generator via GPIB or LAN. Control is provided via the VSA GUI. Frequency and level control of CW signals is provided. Arbitrary signals may be downloaded from the time capture memory to the signal generator for replay. The same time record may be played over and over contiguously. A window function can be applied to smooth the start-up and finish of replay.

Compatible sources	ESG-D or ESG-DP (firmware version B.03.50 or later), with the Option E44xxA-UND internal dual arbitrary waveform generator (firmware version 1.2.92 or later). E4438C with internal base band generator Option E4438C-001, -002, -601, or -602. E8267C vector signal generator with Option E8267C-002, or -602 internal base band generator.
Signal types	CW (single frequency sine wave), arbitrary
Frequency range	Same as the signal generator used
Level range	–136 dBm to 20 dBm, 0.02 dBm steps

Signal acquisition hardware

The 89600 VSA software can be linked to Agilent's ESA-E series spectrum analyzers, PSA Series spectrum analyzers, 89600 VXI hardware, most of the Infiniium scopes, the 6000 Series scopes, the 16900 series and 1680/1690 Series of logic analyzers, the N4010, the E4406A transmitter tester, and the Agilent LXI synthetic instrument modules when configured as a spectrum analyzer, via instrument-specific interface such as LAN, GPIB, USB, or FireWire. Control is via the VSA GUI on a PC. Full VSA functionality is provided within the signal acquisition capabilities of the hardware with which it is working. See hardware specifications for more information, literature number 5989-1753EN.

See the following for more information on supported instruments:
How to measure digital baseband and IF signals using Agilent logic analyzers, literature part number 5989-2384EN; *Agilent logic analyzers and 89601A vector signal analysis software*, literature part number 5989-3359EN; *Infiniium oscilloscopes performance guide using the 89601A vector signal analysis software*, literature part number 5988-4096EN; *Using the 6000 series oscilloscopes with the 89600 vector signal analysis software*, literature part number 5989-4523EN

Vector Modulation Analysis (Option AYA)

Signal acquisition

Data block length	10 to 4,096 symbols, user adjustable
Samples per symbol	1 to 20, user adjustable
Symbol clock	Internally generated
Carrier lock	Internally generated
Triggering	Single/continuous, external, pulse search (searches data block for beginning of TDMA burst and performs analysis over selected burst length)
Data synchronization	User-selected synchronization words

Supported data formats

Carrier types	Continuous, pulsed (burst, such as TDMA)
Modulation formats	FSK: 2, 4, 8, 16 level (including GFSK) MSK (including GMSK) BPSK, QPSK, OQPSK, DQPSK, D8PSK, π/4DQPSK, 8PSK, 3π/8 8PSK (EDGE); QAM (absolute encoding): 16, 32, 64, 128, 256, 512, 1024 QAM (differential encoding per DVB standard): 16, 32, 64, 128, 256 APSK: 16, 16 w/DVB, 32, 32 w/DVB VSB: 8, 16

Single button pre-sets

Cellular	CDMA (base), CDMA (mobile), CDPD, EDGE, GSM, NADC, PDC, PHP (PHS), W-CDMA
Wireless networking	*Bluetooth*™, HiperLAN1 (HBR), HiperLAN1 (LBR), IEEE 802.11b, ZigBee 868 MHz, ZigBee 915 MHz, ZigBee 2450 MHz
Digital video	DTV8, DTV16, DVB16, DVB32, DVB64, DVB128, DVB256, DVB 16APSK, DVB 32APSK
Other	APCO 25, DECT, TETRA, VDL mode 3

Filtering

Filter types	Raised cosine, square-root raised cosine, IS-95 compatible, Gaussian, EDGE, low pass, rectangular, half-sine (reference filter only, for use with ZigBee), none
Filter length	40 symbols: VSB, QAM, and DVB-QAM for $\alpha < 0.2$ 20 symbols: all others
User-selectable alpha/BT	Continuously adjustable from 0.05 to 10
User-defined filters	User-defined impulse response, fixed 20 points/symbol Maximum 20 symbols in length or 401 points

Vector Modulation Analysis (Option AYA)—*continued*

Maximum symbol rate

Frequency span/(1 + α) (maximum symbol rate doubled for VSB modulation format). Symbol rate is limited only by the measurement span; that is, the entire signal must fit within the analyzer's currently selected frequency span.

Measurement results (formats other than FSK)

I-Q measured	Time, spectrum (filtered, carrier locked, symbol locked)
I-Q reference	Time spectrum (ideal, computed from detected symbols)
I-Q error versus time	Magnitude, phase (I-Q measured versus reference)
Error vector	Time, spectrum (vector difference between measured and reference)
Symbol table and error summary	Error vector magnitude is computed at symbol times only
Instantaneous	Time, spectrum, search time
Offset EVM	OQPSK only

Measurement results (FSK)

FSK measurement	Time, spectrum
FSK reference	Time, spectrum
Carrier error	Magnitude
FSK error	Time, spectrum

Display formats

The following trace formats are available for measured data and computed ideal reference data, with complete marker and scaling capabilities and automatic grid line adjustment to ideal symbol and constellation states.

Polar diagrams	
Constellation	Samples displayed only at symbol times
Vector	Display of trajectory between symbol times with 1 to 20 points/symbol
I-Q versus time	
I or Q only	Continuous versus time
Eye diagram	Adjustable from 0.1 to 40 symbols
Trellis diagram	Adjustable from 0.1 to 40 symbols
Error vector magnitude	Continuous versus time
Errors table	Measurements of modulation quality made automatically and displayed by the symbol/error trace type. RMS and peak values.
Formats other than FSK	Error vector magnitude, magnitude error, phase error, frequency error (carrier offset frequency), I-Q/origin offset, amplitude droop (PSK and MSK formats), SNR (8/16 VSB and QAM formats), quadrature error, gain imbalance *For VSB formats:* VSB pilot level is shown in dB relative to nominal. SNR is calculated from the real part of the error vector only. *For DVB formats:* EVM is calculated without removing IQ offset
FSK format	FSK error, magnitude error, carrier offset frequency, deviation

Vector Modulation Analysis (Option AYA)—*continued*

Display formats—*continued*

Symbols table (detected bits)	Bits are displayed in binary and grouped by symbol. Multiple pages can be scrolled for viewing large data blocks. The symbol marker (current symbol shown in inverse video) is coupled to measurement trace displays to identify states with corresponding bits. For modulation formats other than DVBQAM and MSK, bits are user-definable for absolute or differential symbol states.[1]

Adaptive equalizer

Removes the effects of linear distortion (i.e. non-flat frequency response, multipath, etc.) from modulation quality measurements. Equalizer performance is a function of the setup parameters (equalization filter length, convergence, taps/symbol) and the quality of the signal being equalized.

Type	Decision directed, LMS, feed-forward, equalization with adjustable convergence rate
Filter length	3 to 99 symbols, adjustable
Filter taps	1, 2, 4, 5, 10, or 20 taps/symbol
Measurement results provided	Equalizer impulse response, channel frequency response
Supported modulation formats	MSK, BPSK, QPSK, OQPSK, DQPSK, $\pi/4$DQPSK, 8PSK, D8PSK, 3 $\pi/8$ 8PSK (EDGE), 16QAM, 32QAM, 64QAM, 128QAM, 256QAM, 512QAM, 1024QAM, 8VSB, 16VSB, 16/32 APSK

3G Modulation Analysis Bundle (Option B7N)

Option B7N is an ordering convenience equivalent to options B7T, B7U, B7W, and B7X. It provides all the functionality listed below for those options.

W-CDMA/HSDPA Modulation Analysis (Option B7U)

Signal acquisition

Result length	Adjustable from 1 to 64 slots maximum. Actual value hardware dependent.
Samples per symbol	1
Triggering	Single/continuous, external
Measurement region	Length and offset adjustable within result length

Signal playback

Result length	Adjustable from 1 to 64 slots maximum. Actual value hardware dependent.
Capture length (gap-free analysis at 0% overlap; at 5 MHz span)	*Capture length is hardware dependent. See hardware specifications for more information.*

Adjustable parameters

Data format	Downlink, uplink
Single button presets	Downlink, uplink
Chip rate	Continuously adjustable
Measurement filter type	RRC, none
Filter alpha	Adjustable from 0.05 to 1
Scramble code	
Downlink	Adjustable from 0 to 511
Uplink	Adjustable from 0 to $2^{24} - 1$

1. Synchronization words are required to resolve carrier phase ambiguity in non-differential modulation formats.

W-CDMA/HSDPA Modulation Analysis (Option B7U)—*continued*

Adjustable parameters—*continued*

Scramble code offset (downlink)	Adjustable from 0 to 15
Scramble code type (downlink)	Standard, left, right
Sync type (downlink)	CPICH, SCH, antenna-2 CPICH, symbol-based
Test models supported (downlink)	Test models 1-5
Sync type (uplink)	DPCCH (slot format 0-5), PRACH message
Channel modulation scheme (downlink)	Auto-detect, QPSK, 16-QAM
Active channel threshold	Auto, Manual (0 dBc to -120 dBc)
Enable HSDPA analysis	Off, On
Gated active channel detection	Off, On
Test model	
None (Auto active channel detection)	
Test Model 1	16 DPCH, 32 DPCH, 64 DPCH (with or without S-CCPCH)
Test Model 2	With or without S-CCPCH
Test Model 3	16 DPCH, 32 DPCH (with or without S-CCPCH)
Test Model 4	With or without P-CPICH
Test Model 5[1]	2 HS-PDSCH with 6 DPCH, 4 HS-PDSCH with 14 DPCH, 8 HS-PDSCH with 30 DPCH
Gated modulation detection[1]	Off, On
Modulation scheme[1]	Auto, QPSK, 8PSK, 16QAM

Measurement results

Composite	*All code channels at once or all symbol rates taken together.*
Code domain power	Composite (all symbol rates together) Individual symbol rates (7.5, 15, 30, 60, 120, 240, 480, 960 ksps)
Code domain error	Composite (all symbol rates together) Individual symbol rates (7.5, 15, 30, 60, 120, 240, 480, 960 ksps)
I-Q measured	Time, spectrum
I-Q reference	Time, spectrum (reference computed from detected symbols)
I-Q error versus time	Magnitude and phase (IQ measured versus reference)
Error vector	Time, spectrum (vector difference between measured and reference symbol
Symbol table and error summary	EVM, magnitude error, phase error, rho, peak active CDE, peak CDE, trigger, frequency error, IQ (origin) offset, slot number
Code domain offset table	Timing and phase offset for each active code
Channel	*Individual code channels*
I-Q measured	Time
I-Q reference	Time (reference computed from detected symbols)
I-Q error versus time	Magnitude and phase (IQ measured versus reference symbol)
Error vector	Time (vector difference between measured and reference symbol)
Symbol table and error summary	EVM, magnitude error, phase error, slot number, pilot bits, tDPCH, modulation
Other measurement results	
Pre-demodulation	Time, spectrum

Display formats

CDP measurements results	I and Q shown separately on same trace for uplink
Channel measurement results	I and Q shown separately
Code order	Hadamard, bit reverse

1. Parameter used only when HSDPA analysis is enabled.

cdma2000®/1xEV-DV Modulation Analysis (Option B7T)

Signal acquisition

Result length	1 to 64 PCGs forward link; 1 and 48 PCGs reverse link maximum. Value hardware-dependent.
Samples per symbol	1
Triggering	Single/continuous, external
Measurement region	Length and offset adjustable within result length

Signal playback

Result length	Adjustable from 1 to 64 PCGs, forward link; 1 to 4 PCGs, reverse link maximum. Value hardware-dependent.
Capture length (gap-free analysis at 0% overlap; 2.6 MHz span)	*Capture length is dependent on hardware. See hardware specifications for more information.*

Adjustable parameters

Format	Forward, reverse
Single button presets	Forward, reverse
Chip rate	Continuously adjustable
Long code mask (reverse)	0
Base code length	64, 128
Channel modulation scheme (forward)	Auto, QPSK, 8PSK, 16QAM
Active channel threshold	Auto, manual (0 dBc to – 120 dBc)
Enable 1xEV-DV analysis	Off, On
Gated active channel detection	Off, On
Multi-carrier filter	Off, On
PN offset	0 x 64 to 511 x 64 chips
Wash code QOF	0,1,2,3
Defined active channels[1]	Off, On
Walsh code column index[1]	0,1,2,3
Walsh mask[1]	0 to 1111111111111 (binary)
F-PDCH0/1 number of codes[1]	F-PDCH0 + F-PDCH1 ≤ 28
F-PDCH0/1 modulation scheme[1]	QPSK, 8PSK, 16QAM
Gated modulation detection[1]	Off, On
Modulation scheme[1]	Auto, QPSK, 8PSK, 16QAM

1. Parameter is only used when 1xEV-DV analysis is enabled.

cdma2000/1xEV-DV Modulation Analysis (Option B7T)—*continued*

Measurement results

Composite	*All code channels at once or all symbol rates taken together.*
Code domain power	Composite (all symbol rates together) Individual symbol rates (9.6, 19.2, 38.4, 76.8, 153.6, 307.2 ksps)
Code domain error	Composite (all symbol rates together) Individual symbol rates (9.6, 19.2, 38.4, 76.8, 153.6, 307.2 ksps)
I-Q measured	Time, spectrum
I-Q reference	Time, spectrum (reference computed from detected symbols)
I-Q error versus time	Magnitude and phase (IQ measured versus reference)
Error vector	Time, spectrum (vector difference between measured and reference symbol point)
Symbol table and error summary	EVM, magnitude error, phase error, rho, peak active CDE, peak CDE, trigger, frequency error, IQ (origin) offset, PCG number
Code domain offset table	Timing and phase offset for each active code
Channel	*Individual code channels*
I-Q measured	Time
I-Q reference	Time (reference computed from detected symbols)
I-Q error versus time	Magnitude and phase (IQ measured versus reference symbol)
Error vector	Time (vector difference between measured and reference symbol)
Symbol table and error summary	EVM, magnitude error, phase error, PCG number, modulation format
Other measurement results	
Pre-demodulation	Time, spectrum

Display formats

CDP measurements results	I and Q shown separately on same trace
Channel measurement results	I and Q shown separately
Code order	Hadamard, bit reverse

1xEV-DO Modulation Analysis (Option B7W)

Signal acquisition

Result length	
Forward link	1 to 64 slots maximum. Value hardware dependent.
Reverse link	1 to 64 slots maximum. Value hardware dependent.
Samples per symbol	1
Triggering	Single/continuous, external
Measurement region (applies to CDP results)	Interval and offset adjustable within result length

Signal playback

Result length	
Forward link	1 to 64 slots maximum. Value hardware dependent.
Reverse link	1 to 64 slots maximum. Value hardware dependent.
Capture length (gap-free analysis at 0% overlap at 1.5 MHz span)	*Capture length is hardware dependent. See hardware specifications for more information.*

1xEV-DO Modulation Analysis (Option B7W)—*continued*

Supported formats	
Formats	Forward (BTS), reverse (AT)
Single-button presets	Forward, reverse
Other adjustable parameters	
Chip rate	Continuously adjustable
Analysis channel (forward)	Preamble, pilot, MAC, data
PN offset (forward)	Continuously adjustable from 0x64 to 511x64 chips
Preamble length (forward)	Adjustable from 0 to 1,024 chips or auto detection
Data modulation type (forward)	QPSK, 8PSK, 16QAM
Long code masks (reverse)	Continuously adjustable from 0x0000000000 to 0x3FFFFFFFFF
Measurement results	
Overall	
Error summary (forward)	Overall 1 and overall 2 results for: rho, EVM, magnitude error, phase error, frequency error, slot number, and IQ offset
Composite	*All code channels at once or all symbol rates taken together.*
Code domain power	All symbols taken together Individual symbol rates (9.6, 19.2, 38.4, 76.8, 153.6, 307.2 ksps)
Code domain error (reverse)	All symbols taken together Individual symbol rates (9.6, 19.2, 38.4, 76.8, 153.6, 307.2 ksps)
IQ measured	Time, spectrum
IQ reference	Time, spectrum
IQ error versus time	Magnitude and phase (IQ measured versus reference)
Error vector	Time, spectrum (vector difference between measured and reference)
Error summary (forward)	EVM, magnitude error, phase error, rho, frequency error, IQ offset, slot number, preamble length
Error summary (reverse)	EVM, magnitude error, phase error, rho, frequency error, IQ offset, slot number, peak CDE, pilot, RRI, ACK, DRC, data power
Channel	*Individual code channel, reverse only.*
IQ measured	Time
IQ reference	Time
IQ error versus time	Magnitude and phase (IQ measured versus reference)
Error vector	Time (vector difference between measured and reference)
Symbol table and error summary	EVM, magnitude error, phase error, slot number
Other	
Pre-demodulation	Time, spectrum
Display formats (characteristic)	
CDP measurement results	I and Q shown separately on same trace
Channel measurement results (reverse)	I and Q shown separately
Code order	Hadamard, bit reverse

TD-SCDMA Modulation Analysis (Option B7X)

Signal acquisition	
Result length	1 to 8 subframes maximum. Value hardware dependent.
Start boundary	Sub-frame, 2 frames
Time reference	Trigger point, downlink pilot, uplink pilot
Samples per symbol (code channel results)	1
Samples per chip (composite results)	1
Triggering	Single/continuous, external
Measurement region	Analysis timeslot selectable within first sub-frame
Signal playback	
Result length	1 to 8 subframes maximum. Value hardware dependent.
Capture length (gap-free analysis at 0% overlap at 1.6 MHz span)	*Capture length is hardware dependent. See hardware specifications for more information.*
Supported formats	
Standards supported	3GPP TDD 1.28 Mc/s option, Release 5.0.0, December 2003
Formats	Downlink, uplink
Single-button presets	3GPP N-TDD 1.28 Mcps
Modulation formats	QPSK, 16QAM, HSDPA/8PSK
Other adjustable parameters	
Chip rate	Continuously adjustable
Filter alpha	Continuously adjustable between 0.05 and 1.0
Downlink pilot sequence	0 to 31[1]
Uplink pilot sequence	0 to 255[1]
Scramble sequence	0 to 127[1]
Basic midamble sequence	0 to 127[1]
Midamble autodetect	Detects midamble code ID and sets Basic Midamble and Scrambling Code IDs (when in Midamble subframe synchronization mode)
Max users (selectable for each timeslot)	2, 4, 6, 8, 10, 12, 14, 16
Slot frequency reference	Pilot, midamble
Subframe synchronization	Pilot, midamble
Force code group settings	
Downlink pilot	Downlink pilot code ID acts as master to determine the Code Group states. Non-standard code ID sequence allocations also allowed via Code Group check boxes.
Any code	User-selected Code ID (downlink pilot, uplink pilot, scramble or basic midamble) determines master for Code Group states.
Measurement results	
Composite	*All code channels at once or all symbol rates taken together.*
Code domain power	All symbol rates and code channels taken together; individual symbol rates (80, 160, 320, 640, 1280 ksps)
Code domain error	All symbol rates and code channels taken together; individual symbol rates (80, 160, 320, 640, 1280 ksps)
IQ measured	Time, spectrum
IQ reference	Time, spectrum
IQ error versus time	Magnitude and phase (IQ measured versus reference)
Error vector	Time, spectrum (vector difference between measured and reference)
Error summary	EVM, magnitude error, phase error, rho, peak active CDE, peak CDE, frequency error, IQ offset, IQ skew, slot amplitude droop

1. Value subject to Force Code Group Setting.

TD-SCDMA Modulation Analysis (Option B7X)—*continued*

Channel	*Individual code channel*
IQ measured	Time
IQ reference	Time
IQ error versus time	Magnitude and phase (IQ measured versus reference)
Error vector	Time (vector difference between measured and reference)
Symbol table and error summary	EVM, magnitude error, phase error, code phase (degs), detected modulation, data bits
Layer	*All code channels at once*
Code domain power	All symbol rates taken together; individual symbol rates (80, 160, 320, 640, 1280 ksps)
Code domain error	All symbol rates taken together; individual symbol rates (80, 160, 320, 640, 1280 ksps)
Overall	
Time	Aligned analysis region; active timeslots highlighted
Filtered time	IQ time, RRC filtered, resampled to 4x chip rate
Gate time	Gated IQ time
Gate spectrum	Averaged and instantaneous
Gate PDF, CDF	PDF, CDF of gate time magnitude
Error summary	Timing error, total power, midamble power, and data power for each timeslot
Other	
Analysis timeslot	CCDF
Pre-demodulation	Time, spectrum, correction
Display formats	
Overall time measurement results	Active timeslots highlighted with background color
CDP and CDE measurement results	Active code channels highlighted by CDP layer color
Composite	
Trace data available	Error vector spectrum, error vector time, IQ magnitude error, IQ measured spectrum, IQ measured time, IQ phase error, IQ reference spectrum, IQ reference time, instantaneous IQ measured spectrum, instantaneous error vector spectrum, instantaneous reference spectrum
Error summary	Rho, EVM, magnitude error, phase error, frequency error, IQ offset, quadrature error, gain imbalance, peak active CDE, peak CDE, midamble rho, midamble EVM, midamble magnitude error, midamble phase error, midamble IQ offset, midamble quadrature error, midamble gain imbalance
Symbols	Table of symbol numbers and value

WLAN Modulation Analysis (Option B7R)

OFDM modulation analysis[1]

Signal acquisition

Supported standards	IEEE 802.11a, HiperLAN2, and IEEE 802.11g (OFDM)
Modulation format	BPSK, QPSK, 16QAM, 64QAM (auto detect or manual override)
Search length	*Maximum values. Actual value hardware dependent*
Minimum	Result length + 6 symbol times (24 µs)
Maximum	6,800 symbol times
Result length	Auto detect or adjustable from 1 to 1367 symbol times maximum; actual value hardware dependent
Triggering	Single/continuous, free-run/channel/external
Measurement region	Length and offset adjustable within result length

Signal playback

Result length	Auto detect or adjustable from 1 to 1,367 symbol times maximum; actual value hardware dependent
Capture length (gap-free analysis at 0% overlap; at 31.25 MHz span)	*Capture length is hardware dependent. See hardware specifications for more information.*

Adjustable parameters

Data format	IEEE 802.11a, HiperLAN2
Single button presets	IEEE 802.11a/g/OFDM, HiperLAN2, IEEE 802.11g DSSS-OFDM, IEEE 802.11a/g turbo mode, IEEE 802.11p DSRC, IEEE 802.11j 10 MHz
I-Q normalize	On/Off
Sub-carrier spacing	Continuously adjustable
Symbol timing adjust	Adjustable between 0 and guard interval
Guard interval	1/4, 1/8 (HiperLAN2 only), adjustable between 0 and 1 in 1/64 increments
Pilot tracking	Phase, amplitude, timing
Carriers to analyze	All, single, or pilots

Demodulation measurement results

I-Q measured	All carriers over all symbol times
I-Q reference	All carriers over all symbol times (reference computed from detected symbols)
Error vector	Time, spectrum (for each carrier and symbol in the frame)
RMS error vector	Time, spectrum
Common pilot error	Phase, magnitude
Symbol table and error summary	EVM, pilot EVM, CPE (common pilot error), IQ (origin) offset, frequency error, symbol clock error, sync correlation, number of symbols, modulation format, code rate, bit rate, IQ gain imbalance, IQ quadrature skew

Equalizer measurement results

Equalizer impulse response	Computed from preamble
Channel frequency response	Computed from preamble

Pre-demodulation measurement results

Time	Instantaneous
Spectrum	Instantaneous, average
Search time	Instantaneous

Display formats

Error vector spectrum	Error values for each symbol time plotted for each carrier
Error vector time	Error values for each carrier plotted for each symbol time

1. Not compatible with all supported hardware.

WLAN Modulation Analysis (Option B7R)—*continued*

DSSS modulation analysis

Signal acquisition

Modulation format	Auto detect or manual override: Barker1, Barker2, CCK5.5, CCK11, PBCC5.5, PBCC11, PBCC22, PBCC33
Preamble	Auto detect (short, long)
Pulse search length	Adjustable between result length and 25 ms maximum; actual value hardware dependent
Result length	Auto detect or adjust between 1 and 275,000 chips (25 ms) maximum; actual value hardware dependent
Triggering	Single/continuous, free-run, channel, external
Measurement region	Interval and offset adjustable within result length

Signal playback

Result length	Auto detect or adjustable between 1 and 275,000 chips (25 ms) maximum; actual value hardware dependent
Capture length (gap free analysis at 0% overlap; 34.375 MHz span)	*Capture length is dependent on hardware. See hardware specifications for more information.*

Supported formats

Formats	IEEE 802.11b including optional short preamble and optional PBCC modes; IEEE 802.11g including PBCC22 and PBCC33 modes
Single-button presets	DSSS/CCK/PBCC

Adjustable parameters

IQ normalize	On/off
Mirror frequency spectrum	On/off
Chip rate	Continuously adjustable
Clock adjust	Continuously adjustable between ±0.5 chips
Equalizer	On/Off
Equalizer filter length	3 to 99 chips
Descrambler mode	On/off, preamble only, preamble, header only
Reference filter	Rectangular, Gaussian, root raised cosine
Filter BT	.05 to 100

Demodulation measurement results

IQ measured	IQ measured time, IQ measured spectrum, instantaneous IQ measured spectrum
IQ reference	IQ reference time, IQ reference spectrum, instantaneous IQ reference spectrum
Other IQ error traces	IQ magnitude error, IQ phase error
Error vector	Error vector time, error vector spectrum, instantaneous error vector spectrum
Despread symbols	Preamble, header, data
Symbol and error table summary	IEEE 802.11b 1,000-chip peak EVM, EVM, magnitude error, phase error, IQ offset, frequency error, sync correlation, burst type, bit rate, number of data octets, data length

Equalizer measurement results	*Equalizer impulse response, channel frequency response*
Equalizer impulse response	Computed from preamble
Channel frequency response	Computed from preamble

Pre-demodulation measurement results

Time	Main raw, search
Spectrum	Instantaneous
Other	CCDF, CDF, PDF

Display formats

Error vector spectrum	Error values for each symbol time plotted for each carrier
Error vector time	Error values for each carrier plotted for each symbol time

IEEE 802.11n MIMO Modulation Analysis (Option B7Z)

Signal acquisition	*Note that not all supported hardware is compatible with all bandwidths and channel configurations*
Standards supported	IEEE P802.11n HT (20 MHz, 40 MHz)
Data sub-carrier modulation formats	BPSK, QPSK, 16QAM, 64QAM, 256QAM
Data sub-carrier modulation detect	Auto-detect, manual override, or read from HT-SIG
Spatial streams supported	1 or 2
Spatial streams detect	Auto-detect, manual override, or read from HT-SIG
Guard interval	1/8; 1/4; or user-settable
Guard interval detect	Auto-detect, manual override, or read from HT-SIG
Channel usage	Channel 1 only; channel 2 only; channels 1 and 2
Adjustable parameters	
Time parameters	
Search length	Adjustable; default 1 ms; minimum must be longer than maximum result length
Result length	Number of OFDM data symbols after the preamble to analyze. May be auto-detected, manually specified, or read from the HT-SIG. Max is 20,000 symbols
Measurement interval	Adjustable; must be less than or equal to the maximum result length
Measurement offset	Adjustable; specifies the portion of the result length to analyze and display
Advanced parameters	
IQ normalize	On/off; determines whether to normalize IQ meas, IQ ref, error vector time, and error vector spectrum displays
Mirror frequency spectrum	On/off; determines whether to do a frequency inversion before synchronizing and demodulating signal
Subcarrier spacing	Specifies spacing between OFDM subcarriers, in Hz
Symbol time adjust	Allows user-adjust of the symbol timing used when demodulating
Subcarrier select	Specifies which OFDM carriers are analyzed; user can select all, pilots only, or choose a single subcarrier
Pilot tracking	Phase, amplitude, timing
Equalizer training	Train on channel estimation sequence, (or channel estimation sequence plus data for single data stream measurements)
FFT length	64 or 128
Measurement results	*The following results are available for each input channel*
CCDF	Complementary cumulative distribution function of the time trace
CDF	Cumulative distribution function of the time trace
Correction	Shows frequency domain correction applied to the raw measured time data to ensure that the input hardware has a flat frequency response
Instantaneous spectrum	Frequency spectrum of the current time trace, with no averaging
PDF	Probability density function of the time trace
Preamble frequency error	Frequency error versus time, during the the preamble (initial 16 µs of burst)
Raw main time	Block data acquired by the hardware, before any software time-domain corrections or any software re-zooming or re-sampling
Search time	Shows block of data that was acquired and searched through for an RF burst
Spectrum	Frequency spectrum of the time trace, including averaging, if any
Time	Block of data detected by pulse search; serves as input to demodulation analysis

IEEE 802.11n MIMO Modulation Analysis (Option B7Z)—*continued*

These results are available for each spatial stream

Common pilot error	Shows the common pilot error (phase and magnitude), with one point per OFDM symbol
Error vector spectrum	Shows the error vector by subcarrier for every OFDM symbol time analyzed
Error vector time	Shows the error vector by OFDM symbol time for every subcarrier
IQ measured	IQ measured data, with one point per subcarrier per analyzed OFDM symbol time; includes multiple modulation formats if present
IQ reference	IQ reference data, with one point per subcarrier per analyzed OFDM symbol time; includes multiple modulation formats if present
RMS error vector spectrum	Instantaneous RMS averaged error vector, shown with one point per subcarrier, calculated for current scan only
RMS error vector time	RMS averaged error vector, shown with one point per OFDM symbol analyzed
Symbols/Errs Table	Shows raw OFDM detected symbols plus error measurements
Stream EVM	dB, or %rms
Stream EVM Pk	dB, or %rms
Stream Pilot EVM	dB
CPE	%rms
Stream Data EVM	dB

When there is only one spatial stream, there is only one set of the following for each input channel.
When there are two spatial streams, there are two sets of the following for each input channel.

Equalizer channel frequency response	Reciprocal of the equalizer frequency response; one point per subcarrier
Equalizer impulse response	Result length = 4 x FFT length
Instantaneous equalizer channel frequency response	Non-averaged version of the equalizer channel frequency response trace

The following measurements require two input channels.

Coherence	Indicates the similarity between two signals
Cross correlation	Determines time delays of a common signal between two different paths
Cross spectrum	Cross power spectrum of ch1 and ch2
OFDM Error Summary Table	**There is only one set of the following results, regardless of the number of channels. Otherwise, there is one set of results for each input channel.*
Frequency error	Average, Hz*
Symbol clock error	Average, ppm*
CPE	Average, % rms*
EVM	RMS level of the error vector, averaged overall subcarriers and all analyzed OFDM symbols; in dB; ch1, ch2, avg
EVM peak	Peak EVM, averaged over all subcarriers and all analyzed OFDM symbols; in dB; ch1, ch2, avg
Pilot EVM	RMS level of the error vector computed just at the pilot subcarriers, averaged over all OFDM symbols; in dB; ch1, ch2, avg
Data EVM	RMS EVM of just the data subcarriers, averaged overall OFDM symbols; in dB; ch1, ch2, avg
IQ offset	Carrier leakage, as measured during the HT-LTF portion of the preamble; in unitless power ratio; ch1, ch2, avg
IQ quadrature error	Quadrature skew, in degrees; ch1, ch2, avg
IQ gain imbalance	Ratio of the gain of the in-phase portion of the signal to the gain of the quadrature phase portion of the signal; in dB; ch1, ch2, avg
Cross power	dB; ch1, ch2, avg
Sync correlation	Correlation coefficient between the measured preamble and ideal preamble; computed on the initial L-STF part of the preamble

IEEE 802.11n MIMO Modulation Analysis (Option B7Z)—*continued*

OFDM Data Burst Info	*Listing of fields found in the L-SIG and HT-SIG symbols*
Symbols detected	L-LTF, L-STF, L-SIG, HT-SIG, HT-STF, HT-LTF, HT-Data, HT-SIG CRC pass/fail
Data provided	Modulation format, length (in symbols), power (dBm), EVM (dB); total information for length, power, and EVM
OFDM HT-SIG information	Decoded bits for HT-SIG
Modulation & coding scheme	
BW	20 MHz or 40 MHz
Length	Number of bytes in frame
Reserved ones	Verify all values = 1
Aggregation	Yes if PPDU in data portion of packet contains an A-MPDU; No, otherwise
STBC	Indicates the difference between the number of transmit chains used and the number of spatial stream indicated by the MCS
Advanced coding	Yes = advanced coding; No = BCC
Short GI	Indicates that the short GI is used after the HT training
Number of HT-LTF	0 to 3
CRC	CRC of bits 0 to 23 in HT-SIG1 and bits 0 to 9 in HT-SIG2
Tail bits	Verify 0 value (used to terminate the trellis of the convolutional coder)
Smooth	Indicates whether channel estimate smoothing is allowed; yes/no
NotSnd	Indicates if the packet is not a sounding packet; yes/no
OFDM Eq MIMO condition number	Ratio of equalizer channel response matrix max singular value to min singular value

IEEE 802.16-2004 OFDM Modulation Analysis (Option B7S)

General specifications[1]

Signal acquisition

Supported standards	IEEE 802.16-2004
Supported modes	Uplink and downlink; continuous and burst; TDD, FDD, H-FDD
Modulation formats	BPSK (pilots only), QPSK, 16QAM, 64QAM (auto detect, manual input)

OFDM parameters

Bandwidth	Settable, nominal per standard
Fs/BW ratio	Settable to 8/7, 57/50, 86/75, 144/125, 316/275, or arbitrary between 0.5 and 2.0
Equalizer training	Via channel estimation sequence in preamble; or estimation sequence plus data
Sub carrier selection	Selectable all; or one of sub carrier # -100 to +100 (0 not allowed); or pilot sub carriers only
Subchannel index	1 to 31 (for uplink signal analysis)

Measurement parameters

Result length	Auto-detected, or manually adjustable
Search length	Adjustable, limits may depend on input hardware
Pilot sub carrier tracking	Amplitude, phase, timing
Symbol timing	Adjustable from –(guard interval)/100 to 0
Averaging	RMS, RMS exponential
Span	Constrained to within approximately 10x signal bandwidth

OFDM trace results

Burst info	Text table containing information on burst power, modulation format, EVM, and length in symbols
Common pilot error	One point analyzed per OFDM symbol
Equalizer channel frequency response	One point per sub carrier; frequency response shown dependent on equalizer training value selected; also differential and instantaneous differential traces available
Equalizer impulse response	Result length = 4 x FFT length
Error vector spectrum	One point per sub carrier per analyzed OFDM symbol time
Error vector time	One point per sub carrier per analyzed OFDM symbol time
IQ measured data	One point per sub carrier per analyzed OFDM symbol time; all modulation formats shown
IQ reference data	One point per sub carrier per analyzed OFDM symbol time; all modulation formats shown
Preamble frequency error	Frequency error vs. time, during the preamble (including during all the long preamble)
RMS averaged error vector spectrum	One point per sub carrier
RMS averaged error vector time	One point per OFDM symbol analyzed
Symbols/error	Error summary with raw OFDM detected symbols

1. Not all supported hardware is compatible with all bandwidths.

IEEE 802.16-2004 OFDM Modulation Analysis (Option B7S) General specifications[1]——*continued*

Additional trace results

CCDF	Cumulative complementary distribution function of time trace; extra time data before start and after end of burst not included
CDF	Complementary distribution function of time trace; extra time data before start and after end of burst not included
Correction	Frequency domain correction applied to raw measured time data
Instantaneous spectrum	Frequency spectrum of the time trace
PDF	Probability density function of time trace
Raw main time	Block data acquired by hardware, including extra data for filter settling
Search time	Block data acquired and searched for an RF burst
Spectrum	Frequency spectrum of time trace, or averaged time if averaging on
Time	Block data detected by pulse search

Error information/results

CPE RMS	RMS level of (CPE-1), where CPE is the complex correction value detected during pilot tracking
RCE RMS	RMS level of the relative constellation error vector, % or dB
RCE peak	Peak level of the relative constellation error vector, % or dB
RCE peak symbol	OFDM symbol number where RCE peak was detected
Frequency error	Averaged measured carrier frequency minus analyzer center frequency
IQ gain imbalance	Ratio of I (in-phase) to Q (quadrature phase), dB
IQ offset	Carrier leakage measured during channel estimation sequence portion of preamble, dB
IQ quadrature error	Quadrature skew, degrees
Pilot EVM	RMS EVM level for pilot sub carriers, averaged over all analyzed OFDM symbols
Preamble type	Detected preamble: short, long, STC, AAS; also will display non-standard preamble consisting of optional P4x64 sequence followed by one of the P_{even}, P_{odd}, P_{aas}, or P_{all} sequences
Symbol clock error	Timing error, ppm
Sync correlation	Correlation coefficient between measured and ideal preamble

1. Not all supported hardware is compatible with all bandwidths.

IEEE 802.16 OFDMA Modulation Analysis (Option B7Y)[1]

Signal acquisition setup

Standards supported	IEEE 802.16 OFDMA, includes IEEE 802.16-2004, IEEE 802.16-2004/Cor1, IEEE Std 802.16e; P802.16 OFDMA includes IEEE 802.16-2004, P802.16-2004/Cor1/D2, P802.16e/D7 (includes PRBS definition and DL-PUSC subchannel mapping differences)
Single-button presets	802.16e:10 MHz; 802.16e:5 MHz; WiBRO
Timing diagram	Visualization aid showing result length, frame offset, frame length, zone offset, zone length
Result length	Determines how many frames are included in the acquisition, 1 to 64; maximum value hardware dependent
Frame offset	Specifies which frame within the result length will be used for analysis
Define manual measurement region	
Measurement offset	Units of symbol-times; limited by zone or data burst definition
Measurement interval	Units of symbol-times; limited by zone or data burst definition
Pre-demod waveform	Determines what time record information to include in time domain displays and calculations. User selectable from frame, zone, or measurement region.
Include extra time in pre-demod traces	On/off; Specifies whether an extra 10% of time domain data is present before and after the pre-demod region in the time trace. Useful for observing transitions before and after an analysis region which may be affecting results.
Synch search	Automatic, or define manual sync search offset
Pulse search	On/off
Mirror frequency spectrum	On/off
IQ normalize	On/off
Symbol timing adjust	%
Use default settings	Automatically switches between uplink and downlink default parameters
Pilot tracking	Select any or all: amplitude, phase, timing; available even if PRBS mismatch
Equalizer training	On channel estimation sequence only, or channel estimation sequence and data ,or channel estimation sequence and pilots
Subcarrier select	All, subset; only applies for uniform zone (data burst analysis off)
Subset offset	Specifies starting subcarrier number; value dependent on analysis zone type and FFT size
Subset interval	Specifies the number of adjacent subcarriers to analyze starting with the value listed in subcarrier offset
Include inactive subchannels in EVM	On/off; only applicable to data burst analysis

1. Not all supported hardware is compatible with all bandwidths.

IEEE 802.16 OFDMA Modulation Analysis (Option B7Y)—*continued*

Frame definition

Frame length	User settable, 2 ms to 20 ms
Nominal BW	1.25, 3.5, 4.375, 5, 7, 8.75, 10, 14, 15, 17.5, 20, 28 MHz
BW ratio	8/7, 28/25 or user-settable for troubleshooting
FFT size	128, 512, 1024, 2048; or user-settable for troubleshooting
Guard interval	1/8 default, user settable from 0 to 1.0
Enforce standard BW	Locks BW ratio, and FFT size to nominal BW; can be overridden for troubleshooting
Downlink ratio	0-100%; defines start of uplink subframe
Data tone modulation	Manual (from burst definition), or auto-detect
Formats supported	BPSK (pilots only), QPSK, 16QAM, 64QAM
Subframe analysis	Uplink (mobile transmitter), downlink (basestation)
Supported modes	Zone OFDM analysis without subchannelization; Data burst analysis with predefined data bursts for UL and DL
Downlink definition	
Preamble index	0 to 113
Override preamble values	Yes/no. If yes, then IDCell and segment data entered are used for analysis. If no, then the preamble index is used exclusively.
IDCell	Starting IDCell value for the frame, usually derived from preamble; 0 to 31
Segment	0, 1, or 2; only one segment may be analyzed at a time; usually derived from preamble
Subchannel group bitmask	User selectable on/off values to represent 6-bit bitmask specifying which subchannel groups can be used to define DL-PUSC data bursts

Zone definition

Define zone	Via map file, recalled setup file, import of N7615A Signal Studio OFDMA setup file, or GUI; edit downlink or uplink zones
Map file operations	New, edit, delete, export, import, copy from
Use defined boosting levels	Yes/no; specifies whether reference power level for data burst analysis is derived from the boosting levels in the data burst definitions, or from the measured power of the data bursts; downlink only
Data burst analysis	Yes/no
Downlink zone edit	Define uniform zone or zone with data burst analysis
Name	User-input
Type	PUSC, FUSC, OFUSC, AMC
Length	1 to (maximum symbol time permitted by frame length and downlink ratio), constrained by symbol Offset
Offset	1 to (maximum symbol time permitted by frame length and downlink ratio minus 1); parameter coupled to Length
PermBase	0 to 31; or override PermBase with IDCell value
Prbs ID	0, 1, 2, or 3
Use all subchannels	Yes/no
Active	Yes/no
Locked	Yes/no; only applies to editing map files

IEEE 802.16 OFDMA Modulation Analysis (Option B7Y)—*continued*

Zone definition—*continued*

Uplink zone edit	Define uniform zone or zone with data burst analysis
Name	User-input
Type	PUSC, OPUSC, AMC
Length	1 to (maximum symbol time permitted by frame length and downlink ratio), constrained by Offset
Offset	1 to (maximum symbol time permitted by frame length and downlink ratio minus 1)
Perm base	0 to 69
Active	Yes/no
Locked	Yes/no; only applies to editing map files

Data burst analysis

Burst type	Downlink, uplink
Uplink PUSC	Normal, CDMA, or PAPR allocation definitions
Downlink PUSC	Normal, FCH, or DL-MAP allocation definitions
All other uplink/downlink	Normal
Burst edit operations	New, delete, rename
Zone definition grid	GUI display of symbol index vs. subchannel for each data burst; display dependent on multiple zone parameters. All defined bursts within a zone shown. Automatic accommodation of Normal, FCH and DLMAP burst definitions in DL-PUSC zones, and Normal, CDMA and PAPR regions in UL-PUSC zones; burst definition via mouse or fill-in form
Burst define parameters	
Data modulation format	QPSK, 16QAM, 64QAM
Boosting level	–12 dB to 9 dB, in 3 dB steps; downlink only
Active	Yes/no
Burst shape	Rectangular, wrapped; visual display on data burst definition grid
Burst type	Normal; CDMA, PAPR (uplink PUSC only)
Include inactive subchannels	Yes/no; specifies whether inactive suchannels are included in OFDMA trace results

IEEE 802.16 OFDMA Modulation Analysis (Option B7Y)—*continued*

OFDMA trace results	*IEEE 802.16 OFDMA traces are similar to other OFDM traces, but with distinct differences which will cause the traces to look different. One difference is that pilot tones shift from symbol-time to symbol-time. So, when analyzing a single subcarrier, some tones may be pilot tones, while others may be data tones. The difference is annotated using data point coloring. Further, in data burst analysis mode, subchannelization is distributed across subcarriers and OFDM symbols, so the trace results below may be sparse, with blanked points at OFDM symbol/subcarrier locations which are not in the defined analysis region.*
Chan Freq Resp Adj Diff	Adjacent subcarrier power difference in dB
Data burst info	For each data burst analyzed, and only when data burst analysis is active: burst name, modulation format, size, power, RCE, data RCE
Common pilot error (CPE)	Common pilot error trace vs. symbol: RMS magnitude value or phase error value
Equalizer channel frequency response	Measured equalizer frequency response; dependent on subframe type and equalizer training mode
Equalizer impulse response	Impulse response of the equalization filter.
Error vector spectrum	Signal RCE (EVM) vs. carrier, shown for all symbols
Error vector time	Signal RCE (EVM) vs. symbol, shown for all carriers
Inst eq chan freq resp	Equalizer channel frequency response with no averaging
Inst ch freq resp adj diff	Instantaneous channel frequency response adjacent difference; the unaveraged Ch Freq Resp Adj Difference.
IQ measured	Measured IQ symbol values of the subcarriers. There is one complex value for each subcarrier for each symbol-time in the burst.
IQ reference	Reference IQ symbol values of the subcarriers. There is one complex value for each subcarrier for each symbol-time in the burst.
Preamble frequency error	Total frequency error during the preamble; for downlink analysis only
RMS error vector spectrum	RMS average of signal RCE (EVM) vs. carrier, shown for all symbols
RMS error vector time	RMS average of signal RCE (EVM) vs. symbol, shown for all carriers
Symbol/errors table	Error summary table with raw OFDM detected symbols, color-coded by data burst index

IEEE 802.16 OFDMA Modulation Analysis (Option B7Y)—*continued*

Additional trace results

CCDF	Cumulative complementary distribution function of time trace
CDF	Complementary distribution function of time trace
Correction	Shows the correction curve used to correct for the frequency response of the input hardware and input digital filtering
Instantaneous spectrum	Instantaneous (pre-demodulated) spectrum of the input signal
PDF	Probability density function of the time trace
Raw main time	Time data before any software time-domain corrections, and before any software re-zooming or re-sampling
Search time	Acquired time data used to search for the RF envelope pulse
Spectrum	Spectrum of the input signal, derived from pre-demodulated time data
Time	Time record before digital demodulation and after pulse search, as defined by measurement region parameters

OFDM Error Table

Common pilot error (CPE)	RMS level of the common pilot error trace data minus 1 expressed as a percentage of an ideal signal
Frequency error	Carrier frequency error relative to the analyzer's center frequency
IQ offset	Carrier leakage
IQ gain imbalance	Compares the gain of the I signal with the gain of the Q signal
IQ quadrature error	Orthogonal error between the I and Q signals
IQ skew	Deviation in path length between I and Q branches (sec)
Pilot RCE	RMS value of the Error Vector Magnitudes (in dB) of the pilot subcarriers for all symbols over the entire burst
Unmodulated RCE	Quantifies the amount of noise present in the unallocated subcarriers (data burst analysis only)
RSSI	Received signal strength indicator based on preamble power for active segment; for downlink signal only
RCE (EVM)	RMS level of the Error Vector Magnitude, averaged over all active subcarriers and all detected OFDM symbols in the analysis region; dB or %rms
RCE peak	Peak level of the Error Vector Magnitude, over all subcarriers and all detected OFDM symbols in the analysis region
Status	Analyzer automatically detects the PRBS seed value and provides information on PRBS match to register definition per standard and setup parameters
Data RCE	RCE measurement excluding pilot carriers
Data RCE peak	Peak level of RCE measurement excluding pilot carriers
Sync correlation	Correlation coefficient between the measured preamble and an ideal preamble (downlink); normalized CP auto-correlation (uplink)
Symbol clock error	Difference between the ideal and actual symbol clock frequency in ppm
Time offset	Provides the time (in sec) between the trigger location and the start of the analysis frame

TEDS (TETRA Enhanced Data Services) modulation analysis and test (Option BHA)

Modulation parameters–all slot formats

RF sub-carriers	Number of carriers	Channel bandwidth	Analysis sub-carriers (descriptors)
	8	25 kHz	–4, –3, –2, –1, +1, +2, +3, +4
	16	50 kHz	–8, –7, –6, –5, –4, –3, –2, –1, +1, +2, +3, +4, +5, +6, +7, +8
	32	100 kHz	–16, –15, ...–3, –2, –1, +1, +2, +3, ...+15, +16
	48	150 kHz	–24, –23, ...–3, –2, –1, +1, +2, +3, ...+23, +24
Sub-carrier spacing	2.7 kHz		
Sub-carrier symbol rate	2400 sym/s		
Symbol filter	Root Raised Cosine (RRC) with alpha = 0.2		
Demodulation	Coherent (pilot symbol assisted)		
Frame rate	32 slots/frame		
Slot interleave	Variable		
Bits per symbol	4QAM	16QAM	64QAM
	2	4	6

Slot format-specific parameters

	Normal downlink	Normal uplink	Random access uplink	Control uplink
Channel bandwidth	25 kHz, 50 kHz, 100 kHz, 150 kHz	25 kHz, 50 kHz, 100 kHz, 150 kHz	25 kHz only	25 kHz, 50 kHz, 100 kHz, 150 kHz
Modulation type	M-4 QAM M-16 QAM M-64 QAM	M-4 QAM M-16 QAM M-64 QAM	M-4 QAM	M-4 QAM M-16 QAM M-64 QAM
Minimum search length	14.167msec (85/6 ms)	14.167msec (85/6 ms)	7.083msec (85/12 ms)	7.083msec (85/12 ms)
Number of symbols (per sub-carrier)	34	31	14	14

Demodulation setup parameters

Format

Preset to standard	Normal uplink, normal downlink, random access uplink, control uplink
Channel bandwidth	25 kHz, 50 kHz, 100 kHz, 150 kHz
Slot format	Normal uplink, normal downlink, random access uplink, control uplink
Mirror frequency spectrum	Allows correct demodulation of frequency spectrums that are mirrored (flipped) about the center frequency

Analysis

Analysis sub-carrier	–24 to +24, dependent on channel bandwidth
Modulation type	M-4 QAM, M-16 QAM, M-64 QAM, dependent on slot format
Search length	Time length used for searching for particular signal characteristics

TEDS (TETRA Enhanced Data Services) modulation analysis and test (Option BHA)— *continued*

Advanced

Extend frequency lock range	Increases frequency lock range for analysis by an additional ±20kHz
Filter alpha	Root raised cosine (Nyquist) filter alpha used to process the output of the corresponding sub-carrier symbol generator
Include droop	On/off; include droop correction
Include header symbols	On/off; includes header symbols in EVM calculations
Include sync/pilot symbols	On/off; includes synchronization and pilot symbols in EVM calculations
IQ normalize	On/off; includes IQ normalize corrections into measurements and analysis;
Pilot tracking	On/off; includes pilot tracking in EVM calculations
PvT off analysis time	Length (in time) of a signal viewed before (pre) and after (post) the burst
Time scale factor	0.001 to 1000; scales the timebase of signal

ACP PvT adjustments

ACP alpha	Alpha for ACP filter in ACP PvT measurement
ACP bandwidth	Bandwidth for ACP PvT filter
ACP offset	Frequency offset from the carrier center frequency for ACP PvT filter

Trace data

Channel trace data	*Time and frequency trace data from pre-demodulated time record data*
ACP PvT Summary	Summary of the adjacent channel powers over time for both the upper and lower channels
ACP upper and lower PvT Time	Time display of the upper or the lower adjacent channels
Correction	Values that are applied to the acquired data to compensate for phase and magnitude anomalies detected during calibration
Instantaneous spectrum	Most recent spectrum measurement, before averaging
Main time	Time record samples from which time, frequency, and modulation domain data is derived
PvT summary	Summary of the composite signal power levels; includes reference power, overall slot power, burst power, and power-off levels
PvT time	Non-complex time display with time=0 aligned to the first symbol of the burst
Raw main time	Raw data from the input hardware or recorded signal
Search time	Time-data acquired and searched through for pulse
Spectrum	Frequency spectrum of time data, averaged if averaging on
Composite trace data	*Combined data from all TEDS sub-carriers*
Error summary	Error summary for the composite TEDS signal
Syms	Summary of all the symbols for the selected slot format

TEDS (TETRA Enhanced Data Services) modulation analysis and test (Option BHA)— *continued*

Sub-carrier trace data	*Single TEDS sub-carrier selected for analysis*
Error summary	Error summary for a selected analysis sub-carrier
Error vector time	Error vector time for a specified analysis sub-carrier on a symbol-by-symbol basis
IQ mag error	IQ magnitude time error for a selected analysis sub-carrier on a symbol-by-symbol basis
IQ meas time	All symbols for a selected analysis sub-carrier
IQ phase error	IQ phase error for a selected analysis sub-carrier on a symbol-by-symbol basis
IQ ref time	Sequence of ideal I and Q states for a specific analysis sub-carrier
Overlaid trace data	*Trace data for all TEDS sub-carriers (not individual sub-carriers)*
Error vector spectrum	Error vector spectrum of analysis sub-carriers (in green), overlaid with an average trace (in white)
Error vector time	Error vector time of analysis sub-carriers (in green), overlaid with an average trace (in white)
IQ mag error	IQ magnitude error for every sub-carrier symbol on a symbol-by-symbol basis, overlaid with an average trace (in white)
IQ meas time	All sub-carrier symbols
IQ phase error	IQ phase error for every sub-carrier symbol on a symbol-by-symbol basis, overlaid with an average trace (in white)
IQ ref time	Sequence of ideal I and Q states as a composite of all sub-carriers
TEDS tests	*Configures 89600 VSA software to make standards-based measurements; preset test definitions; customizable*
Occupied bandwidth test	Shows bandwidth in which a defined percentage of the total transmitter power is contained. Summary data provided
Adjacent channel power test	Calculates a ratio between power in a reference band and one or more adjacent bands. User control for up to 3 adjacent channel bands available
Modulation quality overview	Shows summary of the composite EVM in %rms; displayed as overlaid measurement time with composite error summary
Power versus time test	Shows slot power at specific time intervals during the slot burst
Adjacent channel power versus time test	Shows ratio between power in a reference band and one or more adjacent bands at specific time intervals during the slot burst

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

Signal acquisition	
Standards supported	Release 1.1 (July 14, 2005) "MultiBand OFDM Physical Layer Specification" published by the MultiBand OFDM Alliance in cooperation with the WiMedia Alliance
Presets	Determined by TFC
Data rate (Mb/s)	
PSDU (data)	53.3, 80, 106.7, 160, 200, 320, 400, 480
Header	39.4
Modulation format	
Data rates ≤ 200 Mb/s	QPSK
Data rates > 200 Mb/s	Dual carrier modulation
Header	QPSK
Preamble	Standard–30 symbols; Burst–18 symbols; includes 6 symbol channel estimation sequence
Time Frequency Code (TFC)	1-4 (TFI–hopping); 5-7 (FFI–non-hopping)
Time Parameters	
Search length	Time length used when searching for packet
Result length	Number of symbol times after the preamble which are to be available for EVM analysis, defining the packet length
Payload octets	Same as result length minus the header, but in octets
Measurement offset	Number of symbol times from the start of the PLCP Header at which to begin EVM analysis
Measurement interval	The number of symbol times to include in analysis after the measurement offset
Packet parameters	*Apply to analysis provided in the Composite/low/Mid/High Packet time displays and corresponding spectrum traces*
Packet average RBW	RBW of Hanning window used in overlap-window-FFT-RMS processing; defaults to 5 MHz, as called out by standard for Spectral Mask and ACPR tests
Pre-symbol time	Defines beginning of time gate for each symbol in a given band; applies to low/mid/high packet time and spectrum displays; default 0 symbol-times per standard for Spectral Mask and ACPR tests
Post symbol time	Defines the end of time gate for each symbol in a given band; applies to low/mid/high packet time and spectrum displays; default 0.194 per standard
Pre-packet time	Additional time shown before first symbol of packet; applies to all packet displays; default 0 symbol-times per standard for Spectral Mask and ACPR tests
Post-packet time	Additional time shown after last symbol of packet; applies to all packet displays; default 0 symbol-times per standard for Spectral Mask and ACPR tests

MB-OFDM ultra-wideband modulation analysis (Option BHB)—*continued*

Advanced parameters

IQ normalize	On/off; enables IQ normalize function, which sets the outermost state of the ideal constellation diagram to magnitude of one
Mirror frequency spectrum	On/off; specifies whether to do frequency inversion before attempting to demodulate the signal; allows demodulation of frequency spectrums that are mirrored (flipped) about the center frequency
Pulse search	On/off; tells demodulator to search for amplitude rise at beginning of packet, ignoring "off times" between symbols
Phase track average length	1-1000 symbol-times; sets the length of the average used in tracking phase changes during demodulation
Hopping enable	On/off; default on; when off, synchronization pattern of selected TFC is used, but signal is assumed to occupy only one band

Trace data

Composite	*Includes results from all bands*
Error vector spectrum	Error vector spectrum of the combined Low, Mid, High Bands
RMS error vector spectrum	RMS average EVM across each subcarrier for *all* symbols within the measurement interval
Common pilot error	Difference between the measured and ideal pilot subcarrier symbols
IQ measurement spectrum	Subcarrier-domain trace that shows the measured IQ symbol values of the subcarriers across the selected symbol-times (bursts) for all low, mid, and high bands combined
IQ measurement time	Symbol-domain trace that shows IQ constellation diagram for the combined high, low, and mid band_IDs
IQ reference spectrum	Subcarrier-domain trace that shows ideal IQ symbol values of subcarriers across the selected symbol-times (bursts) for all low, mid, and high bands combined
Error summary table	*Composite results*
EVM RMS	RMS level of the EVM averaged over all subcarriers and all detected OFDM symbols, computed as a percentage (%rms)
EVM peak at symbol	Peak EVM level over all subcarriers and all detected OFDM symbols, in percentage RCE (%) along with number of symbol where EVM Pk occurred
Frequency error	Error between carrier frequency, relative to analyzer's center frequency
Symbol clock error	Difference between ideal and actual symbol clock frequency, (ppm)
I/Q offset	Magnitude of carrier feedthrough signal, as measured during channel estimation sequence portion of preamble
Common pilot error (RMS)	RMS level of common pilot error trace data, expressed as percentage of ideal signal
Sync correlation	Correlation coefficient between measured preamble and ideal preamble
Packet time	Shows packet waveform across full frequency span
Packet Spectrum	Shows combined packet spectrum across full frequency span
Preamble phase err	Phase error in the preamble, in degrees

MB-OFDM ultra-wideband modulation analysis (Option BHB)—*continued*

Band-specific demodulation traces	*Available for high, mid, and low bands, displayable simultaneously*
Error vector spectrum	Error vector spectrum of the high band, low band, or mid band, separately
Error vector time	For a given band, shows a series of vertical lines where each line represents a band burst of 122 sub-carriers organized by magnitude of the error vector time
Packet time	Shows packet waveform for selected band for hopping sequence determined by time-frequency code
Packet spectrum	Shows just the selected band's spectrum portion of the composite spectrum for analysis
IQ meas	Subcarrier-domain trace showing measured IQ values of subcarriers across the selected symbol-times (bursts) for the selected band
Band error summary table	*Results apply to selected band*
Band	Low, mid, high
CPE	RMS level of common pilot error trace data, minus 1, expressed as percentage of ideal signal
EVM	EVM averaged over all subcarriers and all detected OFDM symbols, in %rms
EVM	RMS level of EVM averaged over all subcarriers and all detected OFDM symbols, and is computed in decibels (dB)
EVM Pk	Peak EVM level over all subcarriers and all detected OFDM symbols, in percentage RCE (%) along with number of symbol where EVM Pk occurred
Frequency error	Error between carrier frequency, relative to analyzer's center frequency, in Hz
IQ offset	Magnitude of carrier feedthrough signal, as measured during channel estimation sequence, in dB
Non-demodulation traces	
Raw main time	Time data that was acquired by the hardware, including any extra acquisition to allow for filter settling
Search time	Shows time-data before pulse search and demodulation; is the acquired time data used to search for the burst
Time	Shows the time record used for EVM analysis
Spectrum	Shows averaged frequency spectrum of Time trace used for EVM analysis
Instantaneous spectrum	Shows frequency spectrum of the Time trace used for EVM analysis
CDF	Displays the Cumulative Density Function for the selected input channel
CCDF	Displays the Complementary Cumulative Density Function for the selected input channel
PDF	Shows the Probability Density Function
Correction	Shows the correction curve used to correct for frequency response of input hardware and digital filtering

ACPR measurements

A new reference offset used with the existing standard Adjacent Channel Power marker capabilities allows the markers to be centered anywhere on the screen. This allows ACPR measurements per the WiMedia test specifications to be made on low and high hopped bands.

Spectral mask measurements

The limit test functionality has been enhanced to allow its Y Reference to track the output of a measurement, allowing MB-OFDM Spectral Mask measurements to be made with the top of the mask always positioned at the highest point in the carrier band, in compliance with the WiMedia test specifications

Dynamic Link to EEsof ADS (Option 105)

Source component

This option links the 89600 VSA with design simulations running on the Agilent EEsof Advanced Design System providing real-time, interactive analysis of results. It adds vector signal analyzer sink and source components to the Agilent Ptolemy simulation environment. When a simulation is run, the 89600 software is automatically launched.

The VSA sink component analyzes waveform data from a simulation. Its user interface and measurement functions are the same in this mode as for hardware-based measurements. The VSA source component outputs measurement data to a simulation. Its input data can be from a recording or hardware. Front-end hardware need not be present when using either component unless live measurements are to be sourced into a simulation.

ADS version required	ADS 2001 or later
ADS output data types supported	
Data	Timed Frequency Demod errors Complex scalar Float scalar Integer scalar
Control	Data gap indicator
VSA input modes	Hardware, recording
VSA analysis range	Dependent on input mode and hardware installed
VSA component parameters (user settable)	VSATitle ControlSimulation OutputType Pause VSATrace Tstep SetUpFile RecordingFile SetUpUse AutoCapture DefaultHardware AllPoints

Dynamic Link to EEsof ADS (Option 105)—*continued*

VSA component parameters (passed to ADS, timed output only)	Carrier frequency Tstep

Sink component

ADS version required	ADS 1.5 or later
ADS input data types supported	Float Complex Timed – base band Timed – ComplexEnv
VSA input modes	Single channel, dual channel, I + jQ
VSA analysis range	
Carrier frequency	DC to > 1 THz
Tstep (sample time)	$< 10^{-12}$ to $> 10^{3}$ seconds
VSA component parameters (user settable)	VSATitle Tstep SamplesPerSymbol RestoreHW SetupFile Start Stop TclTkMode RecordMode SetFreqProp
VSA component parameters (passed from ADS)	Carrier frequency Tstep Data type
Number of VSAs that can run concurrently	
ADS version 1.5 and later	20
ADS version 1.3	1
ADS components	
Required ADS components	
EEsof Design Environment	E8900A/AN
EEsof Data Display	E8901A/AN
EEsof Ptolemy Simulator	E8823AZ/E8823ANZ
Recommended ADS configuration	
EEsof Communication System Designer Pro	E8851A/AN
EEsof Communication System Designer Premier	E8852A/AN

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 (includes B7T, B7U, B7W, B7X)
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 MIMO modulation analysis
89601A-BHA	TEDS modulation and test
89601A-BHB	MB-OFDM ultra-wideband 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 bundle (includes B7T, B7U, B7W, B7X)
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 and test
89601AN-BHB	MB-OFDM ultra-wideband modulation analysis
89601AN-105	Dynamic link to EEsof/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 *Twelve-month minimum required on new standalone or renewal 89601AS orders. Twenty-four month maximum coverage, total. Since 1-year is provided free at initial purchase of the 89601A, there is a 12-month maximum when purchased with the 89601A. Renewal orders have a 24-month maximum. See* ***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) *Twenty-four-month maximum coverage. See* ***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 (quantity 12-option 0RU) 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.

When you purchase an option to an upgrade, you will receive an option license for the current software revision that you own. For that reason, not all revisions of software support all options. The upgrade options table provides a list of the options and the minimum software revision levels required.

89601A customers must purchase one year of the 89601AS software update subscription service to upgrade to the most current version of software if they do not meet the minimum software version.

To upgrade to the current revision of software, 89601AN customers must purchase at least one year of 89601ASN update service to support each new upgrade option desired.

Upgrade options

Upgrade option desired	Minimum 89600 software revision level required for upgrade	Comments
-105 ADS connectivity	1.0	
-200 basic VSA	1.0	Since Option 200 is required for all new orders, it cannot be purchased as an upgrade option Note 1
-300 hardware connectivity	5.0	Note 1
-AYA flexible modulation analysis	1.0	Note 1
-B7N 3G modulation analysis	2.0	Significant product enhancements occurred at revision 5.2; customers are urged to purchase update subscription service
-B7R WLAN modulation analysis	3.0	Note 1
-B7S IEEE 802.16-2004 modulation analysis	5.3	
-B7T cdma2000/1xEV-DV modulation analysis	6.1	
-B7U WCDMA/HSDPA modulation analysis	6.1	
-B7W 1xEV-DO modulation analysis	6.1	
-B7X TD-SCDMA modulation analysis	6.1	
-B7Y IEEE 802.16 OFDMA modulation analysis	6.1	
-B7Z IEEE 802.11n MIMO modulation analysis	6.2	
-BHA TEDS modulation analysis and test	6.3	
-BHB MB-OFDM ultra-wideband modulation analysis	6.3	

Notes:
1. Significant product enhancements have occurred since the initial release. Customers more than 1 revision level below the current revision are encouraged to purchase an update subscription service.

For additional information on product upgrades, go to **www.agilent.com/find/saupgrades** and look for *"How do I upgrade my 89600 Vector Signal Analyzer?".* Complete information on software upgrades and revision history are available there.

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 **(Six hours recommended)**
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[1]:

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

1. Requirements for use with some Agilent Infiniium oscilloscopes are different. See the application note Infiniium Oscilloscopes Performance Guide Using VSA Software, literature part number 5988-4096EN.
2. For a list of supported IEEE 1394 (FireWire) interfaces, visit **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,
Technical Overview, literature number 5989-1679EN

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

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

89600 series VSA software for MB-OFDM Ultra-Wideband,
Technical Overview and Self-Guided Demonstration, literature number 5989-5452EN

Infiniium Oscilloscopes Performance Guide Using 89600 VSA Software,
Application Note, literature number 5988-4096EN

6000 Series Oscilloscopes Performance Guide Using 89600 VSA Software,
Application Note, literature number 5989-4523EN

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**

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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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