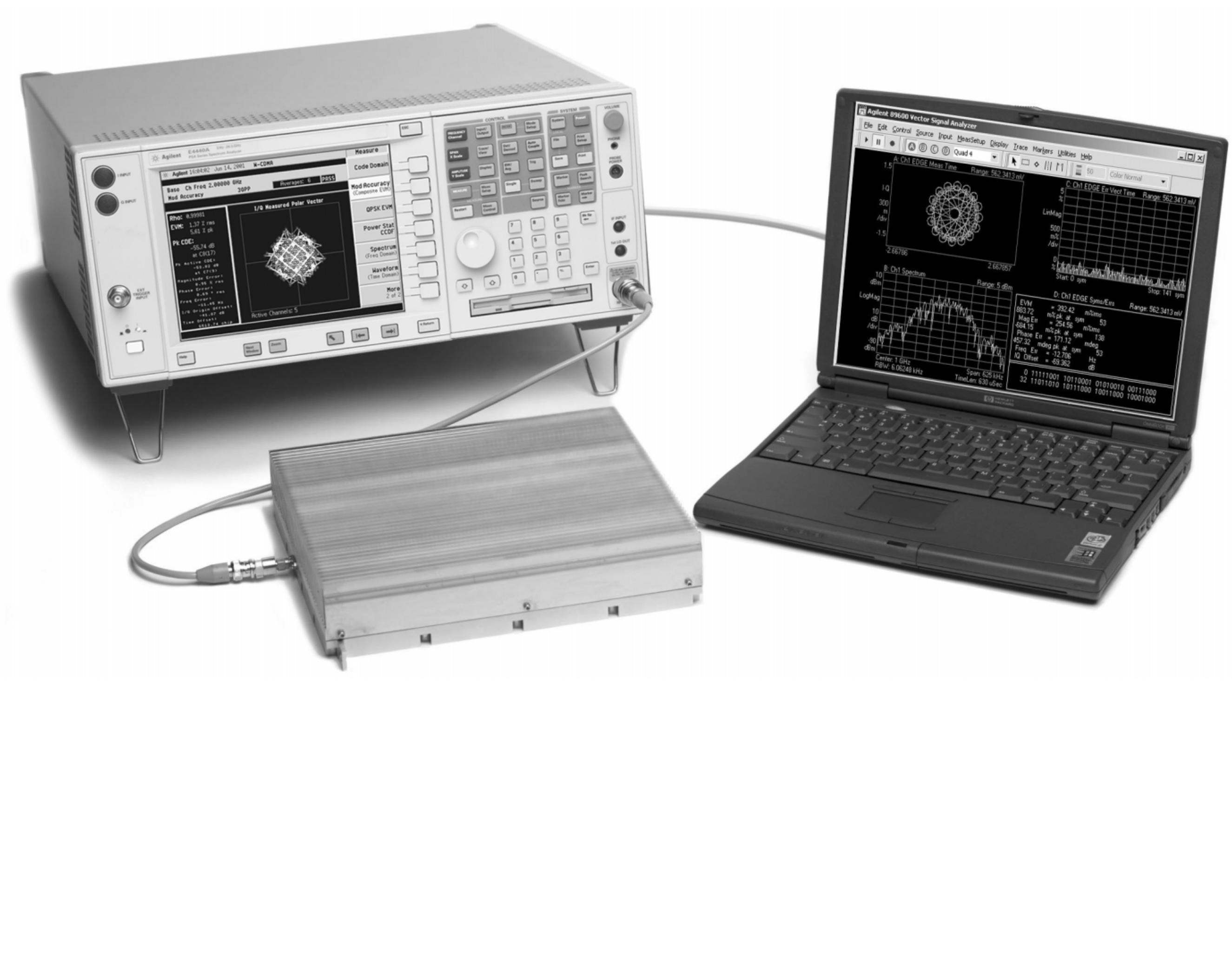
Agilent PSA Series
Spectrum Analyzer Performance Guide Using 89601A Vector Signal Analysis Software

Product Note



Agilent Technologies

Introduction

This guide characterizes the performance of the Agilent PSA Series spectrum analyzer and the Agilent 89601A vector signal analysis (VSA) software combination. Now all the features of the PSA Series — high-performance spectrum analysis, one-button advanced power measurements, and standards based digital modulation analysis — are combined with the flexible demodulation and analysis capabilities of the 89601A.

Product overview

PSA Series

The PSA Series of high performance spectrum analyzers offers the best dynamic range, speed, accuracy and flexibility in spectrum analysis from Agilent. An all-digital IF section gives the PSA Series the performance required to make advanced spectrum measurements both in a traditional swept mode or with fast fourier transforms (FFT). A standard suite of power measurements with standards-based setups makes advanced measurements with one button press. Measure phase noise quickly and easily with the phase noise measurement personality or perform modulation analysis on a variety of standard 2G and 3G digital cellular communications formats with the digital communications measurement personalities.

89601A software

The 89601A vector signal analysis software is the heart of the 89600 Series PC-based VSAs. This software provides flexible tools for demodulating and analyzing even the most advanced digital formats, whether or not they are defined by an established standard. The features include variable block size signal acquisition with user-selectable pulse search and synch words, and a user-controllable adaptive equalizer.

User-selectable filter types include cosine (raised and square-root raised), Gaussian, and low-pass, all with user-selectable alpha/BT. Supported modulation formats for both continuous and burst carriers include FSK (2, 4, 8 and 16 level), BPSK, QPSK, OQPSK, DQPSK, D8PSK, π/4DQPSK, 8PSK, QAM (16 to 256 level), and VSB (8 and 16 level), EDGE and MSK.

In addition, the 89601A software provides signal capture and analysis features, capability to download signal capture files for playback through a signal generator, high-speed spectrogram displays, and cross–channel measurement results.

PSA/89601A combination

The PSA/89601A combination provides a comprehensive solution to almost any communications systems test problem. The PSA offers spur searches, accurate power measurements, and standards-based modulation analysis to test system and component performance. The 89601A expands on that with flexible modulation analysis tools to give insight into modulation errors and accelerate troubleshooting.

This combination can measure active signals or signals captured in PSA memory. Use the PSA with or without the 89601A software to examine signals to a desired degree of depth. Switching between the two modes of operation is facilitated by a quick disconnect/restart menu selection in the 89601A user interface.

The 89601A software runs on a PC connected to the PSA, via LAN, and provides hardware control, modulation analysis, and complete results displays. While operating the combination, the PSA is controlled entirely by the 89601A software.

Configuration overview

The PSA/89601A combination requires a PSA Series spectrum analyzer (models E4440A, E4443A, E4445A) with firmware version A.02.01 or later and Option B7J (digital demodulation hardware), the 89601A software (version 3.00 or later) with the vector signal analysis Option 100 and Option AYA for vector modulation analysis, and a PC with a LAN interface card. Detailed configuration requirements are provided in the appendix.

Feature availability

When the PSA is controlled by 89601A software, users have control of the following features of the spectrum analyzer using the software:

Frequency: the center frequency will be displayed on the 89601A software GUI
Span: ≤ 8 MHz
Input attenuator and ADC gain: available indirectly through the input range feature of the 89601A software
Triggering: IF magnitude, external front/rear, hold-off, level, delay and slope
External reference: selectable frequency (1 to 30 MHz)
Calibration
Overload detection

In addition, you can gain immediate, direct access to all of the PSA series spectrum analyzer's features by using the **Disconnect** capability on the VSA software's control menu.

When the 89601A software is used with a PSA, almost all of the features of the software and its options are available.

This includes:

- recording of time waveforms, allowing you to re-analyze signals and store them for future compar–isons
- complete set of of vector signal analysis and modulation analysis measurements and results
- flexible marker capabilities, including time gating, integrated band power, and offset (delta) markers
- flexible displays, including multiple trace displays, spectrogram, constellation, eye diagram, and error screens with powerful scaling
- link to the Agilent ESG-series signal source for integrated control of source signals
- complete save and recall of your signals, trace data, and measurement screens
- easy cut and paste to other PC applications

The 89601A software's swept spectrum application is not supported.

Performance

The following is a summary of the features and capabilities provided by the PSA/89601A combination. These are nominal values; they are not warranted.

Frequency range (all PSA Series models)	10 MHz to 3 GHz
Center-frequency tuning resolution	1 MHz
Frequency span range	<10 Hz to 8 MHz
Frequency points per span	
Calibrated points	51 to 102,401
Displayable points	51 to 131,072
Resolution bandwidth (RBW) The range of available RBW choices is a function of the selected frequency span and the number of calculated frequency points. Users may step through the available range in 1-3-10 sequence or directly enter an arbitrarily chosen bandwidth.	
Range	<1 Hz to 2.3 MHz
RBW shape factor The window choices below allow you to optimize the RBW shape as needed for best amplitude accuracy, dynamic range, or response to transient signal characteristics.	

Window	Selectivity (3:60 dB)	Passband flatness	Rejection
Flat top	0.41	0.01 dB	>95 dBc
Gaussian top	0.25	0.68 dB	>125 dBc
Hanning	0.11	1.5 dB	>31 dBc
Uniform	0.0014	4.0 dB	>13 dBc

Input range[1] (full scale, combines attenuator setting and ADC gain)	–18 dBm to +22 dBm in 1 dB steps
Dynamic range	
Third-order intermodulation distortion	< –70 dBc or < –90 dBfs, whichever is greater
Noise density	< –126 dBfs/Hz at 1 GHz
ADC overload	+9 dBfs at 1 GHz
Amplitude linearity No ADC dither	±0.03 dB (0 to –30 dBfs) ±0.1 dB (–30 to –50 dBfs)
IF residual responses	<–70 dBfs
IF spurious responses	<–70 dBfs
IF flatness	± 0.3 dB

1. PSA ADC gain is set to 6 dB and attenuator is set to [89601A range (in dBm) +18] dB

Time and waveform
(vector signal analyzer software)

Zoom measurements

The 89601A measurements are made with a non-zero start frequency, also 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 powerful capability to examine the baseband components of a signal without the need to first demodulate it.

Time record characteristics

In the 89601A software, measurements are based on time records. For example, blocks of waveform samples from which time, frequency and modulation domain data is derived. Time records have these characteristics:

Time record length	= (number of frequency points – 1)/span, with RBW mode set to arbitrary, auto-coupled.
Time sample resolution	= 1/(k x span), where k = 1.28

Time capture characteristics

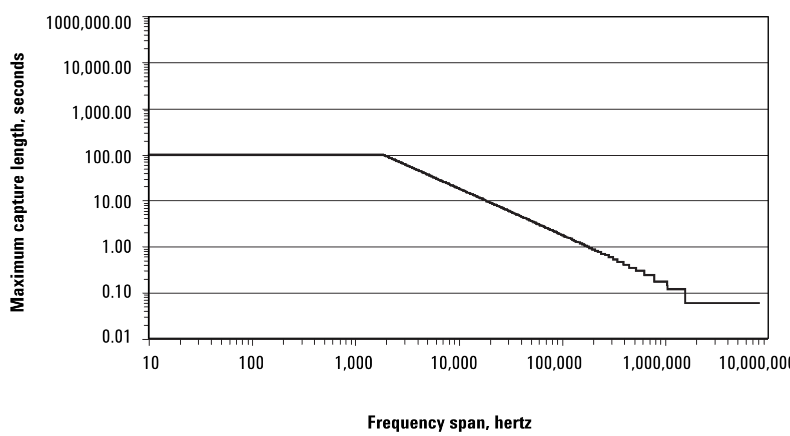
In time capture mode, the 89601A software captures the incoming waveform in real time (i.e. gap-free) into high-speed time capture memory. This data may then be replayed through the software at full or reduced speed, saved to mass storage, or transferred to another software application.

When post-analyzing the captured waveform, users may adjust measurement span and center frequency in order to zoom in on specific signals of interest, as long as the new measurement span lies entirely within the originally captured span.

Time capture memory size	900k samples, complex

During time capture, and for spans below 1.55 MHz the analyzer is internally set to the next highest cardinal span available in the PSA that equals or exceeds the currently displayed frequency span.
For spans above 1.55 MHz the analyzer span is set to 8 MHz.

Time capture length versus span



Measurement, display and control

Triggering	
Trigger types	
Vector signal analyzer application	Free run, IF magnitude, external front/rear
Pre-trigger delay range	100 ms or time capture length, whichever is shorter
Post-trigger delay range	500 ms

Averaging	
Number of averages, maximum	$>10^8$
Overlap averaging	0% to 99.99%
Average types	
Vector signal analyzer application	rms (video), rms (video) exponential, peak hold, time, time exponential

Analog demodulation	
Demodulation types	AM, PM, FM with auto carrier locking provided for PM or FM
Demodulator bandwidth	Same as selected measurement span
AM demodulation (typical)	
Accuracy	±1%
Dynamic range	60 dB (100%) for a pure AM signal
Cross demodulation	< 0.3% AM on an FM signal with 10 kHz modulation, 200 kHz deviation
PM demodulation (typical)	
Accuracy	±3 degrees
Dynamic range	60 dB (rad) for a pure PM signal
Cross demodulation	< 1 degree PM on an 80% AM signal
FM demodulation (typical)	
Accuracy	±1% of span
Dynamic range	60 dB (Hz) for a pure FM signal
Cross demodulation	< 0.5% of span FM on an 80% AM signal

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 specifications for main time length and time resolution details.

Gate length, maximum	Main time length
Gate length, minimum	= window shape / (0.3 x freq. span) where window shape is equal to: Flat-top window 3.8 Gaussian-top window 2.2 Hanning window 1.5 Uniform window 1.0

Marker functions

Peak signal track, frequency counter, band power

Band power markers

Markers 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.

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

	Display formats			
Trace data	**Vector signal analysis (demodulation OFF)**	**Vector signal analysis (analog demodulation)**	**Vector modulation analysis (option AYA)**	**W-CDMA and cdma2000 modulation analysis (option B7N)**
Autocorrelation	•	•		
Complementary cumulative distribution function	•	•		
Cumulative distribution function	•	•		
Channel frequency response			•	
Code domain error				•
Code domain power				•
Composite errors				•
Correction	•	•	•	
Counter zoom	•	•		
Error vector spectrum			•	•
Error vector time			•	•
Equalizer impulse response			•	
Gate time	•	•		
Instantaneous main time	•	•		
Instantaneous spectrum	•	•	•	•
IQ magnitude error			•	•
IQ measurement spectrum			•	•
IQ measurement time			•	•
IQ phase error			•	•
IQ reference spectrum			•	•
IQ reference time			•	•
Main time	•	•		
Probability density function	•	•		
Power spectral density	•	•		
Search time			•	
Spectrum	•	•	•	•
Symbols/errors			•	•
Time			•	•

Trace formats	Log mag (dB or linear), linear mag, real(I), imag(Q), wrap phase, unwrap phase, I-Q, constellation, Q-eye, I-eye, trellis-eye, group delay
Trace layouts	1–4 traces on one, two or four grids
Number of colors	User-definable palette
Spectrogram display	
Types	Color – normal and reversed Monochrome – normal and reversed User colormap – 1 total
Adjustable parameters	Number of colors Enhancement (color-amplitude weighting) Threshold
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.
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 part of the marker readout.
Memory (characteristic)	Displays occupy memory at a rate of 128 traces/Mbyte (for traces of 401 frequency points).

Software interface

The 89601A software 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 fully described in the 89601A documentation.

Software development environments that are capable of interacting with COM objects include Agilent VEE, Microsoft® Visual Basic®, Microsoft Visual 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 89601A's built-in Visual Basic script interpreter allows many types of measurement and analysis tasks to be easily automated. 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 PSA/89601A combination or view its displays from a remote location, the use of commercially-available remote PC software such as Microsoft NetMeeting® or Symantec PCAnywhere® is recommended. The 89601A software can also operate PSA remotely via LAN networking.

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)
Binary	Agilent E3238 time snapshot (.cap) and time recording (.cap) files under 2 gigasamples in size. No additional calibration
MATLAB 5	MAT-file (.mat)
MATLAB 4 and prior	MAT-file (.mat)

Source

In source mode the 89601A software can control a 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 start-up and finish of replay.

Compatible sources	ESG-D or ESG-DP (firmware version B.03.50 or later), with the Option UND internal dual arbitrary waveform generator (firmware version 1.2.92 or later)
Signal types	CW (fixed frequency sinewave) Arbitrary
Frequency range	Determined by signal generator
Level range	–136 dBm to 20 dBm in 0.02 dBm steps

For all other specifications see the technical data sheet for the signal generator used.

Option AYA
Vector modulation analysis

Signal acquisition Note: Signal acquisition does not require an external carrier or symbol clock	
Data block length	Adjustable to 4096 symbols
Samples per symbol	1–20
Symbol clock	Internally generated
Carrier lock	Internally locked
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 modulation formats	
Carrier types	Continuous and pulsed/burst (such as TDMA)
Modulation formats	2, 4, 8 and 16 level FSK (including GFSK) MSK (including GMSK) QAM implementations of: BPSK, QPSK, OQPSK, DQPSK, D8PSK, π/4DQPSK, 8PSK, $\frac{3\pi}{8}$ 8PSK (EDGE) 16QAM, 32QAM, 64QAM, 128QAM, 256QAM (absolute encoding) 16QAM, 32QAM, 64QAM (differential encoding per DVB standard) 8VSB, 16VSB
Single-button presets for	**Cellular:** CDMA (base), CDMA (mobile), CDPD, EDGE, GSM. NADC, PDC, PHP (PHS), W-CDMA **Wireless networking:** *Bluetooth*™, HIPERLAN/1 (HBR), HIPERLAN/1 (LBR), 802.11b, HIPERLAN/2, 802.11a **Digital Video:** DTV8, DTV16, DVB16, DVB32, DVB64 **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, none
Filter length	40 symbols: VSB; QAM and DVB-QAM where α <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

Maximum symbol rate

Symbol rate is limited only by the measurement span; that is, the entire signal must fit within the analyzer's currently selected frequency span. Example: with raised-cosine filtering

Max symbol rate* = $\frac{\text{frequency span}}{1 + \alpha}$

* Maximum symbol rate doubled for VSB modulation format.

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

Measurement results (FSK)	
FSK measured	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 or constellation states.

Polar diagrams	
Constellation	Samples displayed only at symbol times
Vector	Display of trajectory between symbol times with 1–20 points/symbol

I or Q versus time	
Eye diagrams	Adjustable from 0.1 to 40 symbols
Trellis diagrams	Adjustable from 0.1 to 40 symbols
Continuous error vector magnitude versus time	
Continuous I or Q versus time	

Error summary (formats other than FSK)

Measured rms and peak values of the following:	Error vector magnitude, magnitude error, phase error, frequency error (carrier offset frequency), I-Q offset, amplitude droop (PSK and MSK formats), SNR (8/16VSB 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.

Error summary (FSK)

Measured rms and peak values of the following:	FSK error, magnitude error, carrier offset frequency, deviation

Detected bits (symbol table)

Binary bits are displayed and grouped by symbols. Multiple pages can be scrolled for viewing large data blocks. Symbol marker (current symbol shown as inverse video) is coupled to measurement trace displays to identify states with corresponding bits. For formats other than DVBQAM and MSK, bits are user-definable for absolute states or differential transitions.

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

Accuracy

Formats other than FSK, 8/16VSB and OQPSK. Averaging = 10 (typical)

Conditions: Specifications apply for a full scale signal, fully contained in the selected measurement span, random data sequence, range ≥ –18 dBm, start frequency ≥15% of span, alpha/BT ≥0.3*, and symbol rate ≥1 kHz. For symbol rates less than 1kHz accuracy may be limited by phase noise.

* 0.3 ≤ alpha ≤ 0.7 offset QPSK

Residual errors (result = 150 symbols, averages = 10)

Residual EVM	
span ≤100 kHz	<0.5% rms
span ≤1 MHz	<0.5% rms
span ≤8 MHz	<1.0% rms
Magnitude error	
span ≤100 kHz	0.5% rms
span ≤1 MHz	0.5% rms
span ≤8 MHz	1.0% rms
Phase error (For modulation formats with equal symbol amplitudes)	
span ≤100 kHz	0.3° rms
span ≤1 MHz	0.4° rms
span ≤8 MHz	0.6° rms
Frequency error (added to frequency accuracy if applicable)	symbol rate/500,000
I-Q/origin offset	–60 dB or better

Video modulation formats Applies for RF and composite (I+jQ) modes only	
Residual errors (typical) 8/16 VSB: Symbol rate = 10.762 MHz, α = 0.115, 7 MHz span, full-scale signal, range ≥–18 dBm, result length = 800, averages = 10	
Residual EVM	≤ 1.5% (SNR ≥ 36 dB)
16, 32, 64 or 256 QAM: Symbol rate = 6.9 MHz, α = 0.15, 8 MHz span, full-scale signal, range ≥–18 dBm, result length = 800, averages = 10	
Residual EVM	≤ 1.0% (SNR ≥ 40 dB)

Adaptive equalizer	
Removes the effects of linear distortion (e.g. 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.	
Equalizer type	
Decision-directed, LMS, feed-forward equalization with adjustable convergence rate	
Filter length	3–99 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, π/4DQPSK, 8PSK, 16QAM, 32QAM, 64QAM, 128QAM, 256QAM, 8VSB, 16VSB, $\frac{3\pi}{8}$ 8PSK (EDGE), D8PSK

Option B7N
W-CDMA and cdma2000 modulation analysis
(requires vector modulation analysis, option AYA)

W-CDMA modulation analysis	
Signal acquisition (characteristic)	
Result length	Adjustable between 1 and 64 slots
Samples per symbol	1
Triggering	Single/continuous, external
Measurement region	Length and offset adjustable within result length
Signal playback (characteristic) Baseband or RF modes only	
Result length	Adjustable between 1 and 64 slots
Capture length (gap-free analysis at 0% overlap; at 5 MHz span)	88 slots
Supported formats (characteristic)	
Formats	Downlink, uplink
Single-button presets	Downlink, uplink
Other adjustable parameters (characteristic)	
Chip rate	Continuously adjustable
User-selectable alpha	Continuously adjustable between 0.05 and 1
Scramble code (downlink)	Continuously adjustable between 0 and 511
Scramble code (uplink)	Continuously adjustable between 0 and $2^{24} - 1$
Scramble offset (downlink)	Continuously adjustable between 0 and 15
Scramble type (downlink)	Standard, left, right
Sync type (downlink)	CPICH, SCH
Measurement results (characteristic)	
Composite (all code channels at once or all symbol rates taken together)	
Code domain power	All symbol rates together Individual symbol rates (7.5, 15, 30, 60, 120, 240, 480, 960 ksps)
Code domain error	Composite (all symbol rates taken together) Individual symbol rates (7.5, 15, 30, 60, 120, 240, 480, 960 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)
Composite errors	Summary of EVM, magnitude error, phase error, rho, peak active CDE, peak CDE, Ttrigger, frequency error, IQ offset, slot number
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	Summary of EVM, magnitude error, phase error, slot number, pilot bits, tDPCH
Other	
Pre-demodulation	Time, spectrum

Display formats (characteristic)	
CDP measurement results	I and Q shown separately on same trace for uplink
Channel measurement results	I and Q show separately
Code order	Hadamard, bit reverse
Other	Same as option AYA
Accuracy (typical) (Input range within 5 dB of total signal power)	
Code domain	
CDP accuracy	±0.3 dB (spread channel power within 20 dB of total power)
Symbol power versus time	±0.3 dB (spread channel power within 20 dB of total power averaged over a slot)
Composite EVM	
EVM floor	1.5% or less for pilot only
EVM floor	1.5% or less for test model 1 with 16 DPCH signal
Frequency error	
Range (CPICH sync type)	±500 Hz
Accuracy	±10 Hz

cdma2000 modulation analysis		
Signal acquisition (characteristic)		
Result length (adjustable)	Forward link Reverse link	1–64 PCG 1–48 PCG
Samples per symbol	1	
Triggering	Single/continuous, external	
Measurement region	Length and offset adjustable within result length	
Signal playback (characteristic)		
Result length	Forward link Reverse link	1–64 PCG 1–48 PCG
Capture length (gap-free analysis at 0% overlap; at 1.5 MHz span)		94 PCG
Supported formats (characteristic)		
Formats	Forward, reverse	
Single-button presets for	Forward, reverse	
Other adjustable parameters (characteristic)		
Chip rate	Continuously adjustable	
Long code mask (reverse)	0	
Base code length	64, 128	

Measurement results (characteristic)	
Composite (all code channels at once or all symbol rates taken together)	
Code domain power	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 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)
Composite errors	Summary of EVM, magnitude error, phase error, rho, peak active CDE, peak CDE, Ttrigger, frequency error, IQ offset, slot number
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	Summary of EVM, magnitude error, phase error, slot number, pilot bits, tDPCH
Other	
Pre-demodulation	Time, spectrum
Display formats (characteristic)	
CDP measurement results	I and Q shown separately on same trace for uplink
Channel measurement results	I and Q show separately
Code order	Hadamard, bit reverse
Other	Same as option AYA
Accuracy (typical) (Input range within 5 dB of total signal power)	
Code domain	
CDP accuracy	±0.3 dB (spread channel power within 20 dB of total power)
Symbol power versus time	±0.3 dB (spread channel power within 20 dB of total power averaged over a slot)
Composite EVM	
EVM floor	1.5% or less for pilot only
EVM floor	1.5% or less for test model 1 with 16 DPCH signal
Frequency error	
Range (CPICH sync type)	±500 Hz
Accuracy	±10 Hz

Option 105
Dynamic links to EEsof ADS

This option links the 89601A VSA with design simulations running on the Agilent EEsof Advanced Design System (ADS), 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 89601A 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.

Source component

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

Sink component

ADS version required	ADS 1.3 or later
ADS input data types supported	Float Complex Timed – baseband 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
Required ADS components	
EESof Design Environment	E8900A/AN
EESof Data Display	E8901A/AN
EESof Ptolemy Simulator	E8823A/AN
Recommended ADS configurations:	
EESof Communication System Designer Pro	E8851A/AN
EESof Communication System Designer Premiere	E8852A/AN

Appendix A: Configuration requirements

The PSA/89601A combination requires a PSA Series spectrum analyzer and the 89601A vector signal analysis software, each with required options, a PC to run the software, and interface cables. The following are the detailed configuration requirements for each item.

PSA Series spectrum analyzer
The PSA Series spectrum analyzers (models E4440A, E4443A, E4445A) require option B7J, the digital demodulation hardware, to interface with the 89601A. Additionally, firmware version A.02.01 or later is required.

89601A vector signal analysis software
The 89601A software requires vector signal analysis, version 3.00 or later, Option 100, and vector signal analysis, Option AYA. Option B7N is required to analyze W-CDMA and cdma2000 signals. Option B7R 802.11a OFDM modulation analysis is not recommended due to bandwidth constraints.

PC for 89601A software
A laptop or desktop PC may be used as long as it meets or exceeds the following minimum requirements[2]:

- >300 MHz Pentium® or AMD-K6,
- 192 MB RAM (256 MB recommended)
- 4 MB video RAM (8 MB recommended)
- hard disk with 100 MB of available space
- Microsoft Windows 2000® (laptop only) or Windows NT 4.0 (service pack 5, or greater required)
- CD-ROM drive (can be provided via network access), 3.5-inch floppy disk drive (can be provided via network access)
- LAN interface

PC to PSA interface
The PSA supports LAN I/O. Using a LAN cross-over cable is recommended (available from Agilent, part number 8121-0545) for the PC. Figure 1 shows how to make the physical connections.

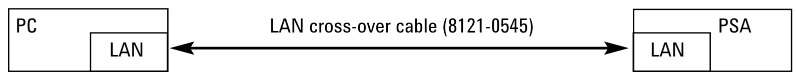


Figure 1. Point-to-point LAN connection. The PC and the PSA may also be connected to a multipoint LAN network.

2. For best immunity from electrostatic discharge (ESD), use a desktop PC.

Related literature

89600 Series Wide-Bandwidth Vector Signal Analyzer, brochure
literature number 5980-0723E

89610A, dc-40 MHz, Vector Signal Analyzer, data sheet
literature number 5980-1259E

89640A, dc-2700 MHz, Vector Signal Analyzer, data sheet
literature number 5980-1258E

PSA Series – The Next Generation, brochure
literature number 5980-1283E

PSA Series, data sheet
literature number 5980-1284E

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Printed in USA June 12, 2002
5988-5015EN

Agilent Technologies