HP 89400 Series
Vector Signal Analyzers
Digital Video Modulation Analysis

Product Overview

Option AYH

Meeting the needs of both broadcast and cable system designers, the HP 89400 vector signal analyzers precisely characterize signals in the emerging modulation formats of the digital video industry, including both QAM and VSB.

With Option AYH, designers of advanced television systems and components can speed their designs to market with off-the-shelf, lab-quality vector signal measurements.

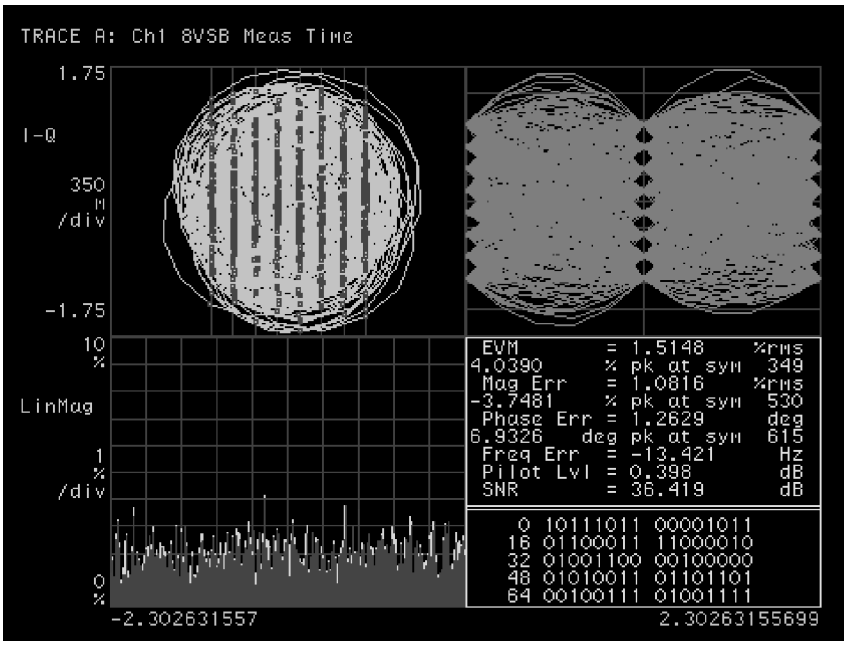
Modulation quality measurements

Optimizing system performance requires precise measures of signal quality. Vector signal analyzers characterize complex-modulated signals with both quantitative and qualitative tests.

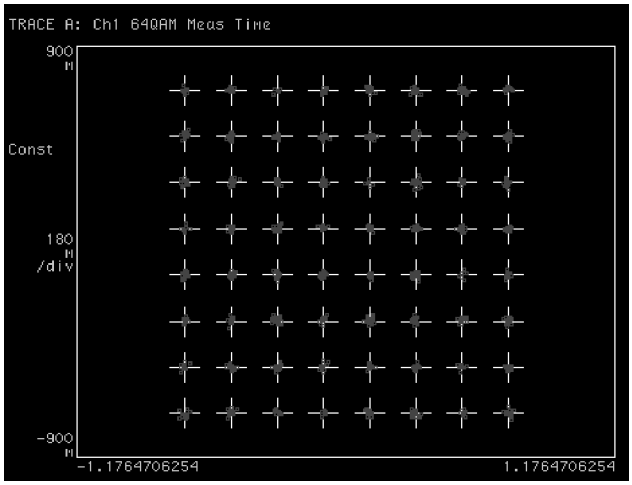
Error magnitude measurements portray the instantaneous vector difference between the input signal and an internally-generated reference containing the same data stream. Expressed as a time waveform, an error spectrum or a signal-to-noise ratio, error magnitude is sensitive and repeatable enough to reveal signal degradation caused by even individual system components. (For more information, see Product Note HP 89400-8, "Using Vector Modulation Analysis in the Troubleshooting and Design of Digital RF Communications Systems".)

For quick visualization of modulation quality, the HP 89400 also provides traditional display formats such as eye and constellation diagrams. Finally, a data table display shows the actual demodulated binary data received for each measurement block.

Carrier lock and symbol clock synchronization are automatic with the HP 89400, meaning that an external carrier reference or clock input is never required. Variable-alpha Nyquist filters are built-in and easily configured via menu selections.



8VSB display shows constellation, eye, error magnitude and demodulated data.



64QAM signal analysis accommodates differential encoding for DVB systems, as well as absolute encoding.

Power and Waveform Measurements

With both time and frequency domain capability, HP 89400 vector signal analyzers show the behavior of complex signals in great detail and in a wide variety of formats.

Powerful cursor functions allow measurements to be time or frequency selective, or both. For example, to measure adjacent channel interference, position the spectrum cursors on the channel boundaries and select "Band Power" for a readout of the total integrated power. Or, to tie interference problems to a particular point in the time waveform, use the cursors to select the suspected waveform event, and select "Time Gating" to display the spectrum as it appears during just that interval.

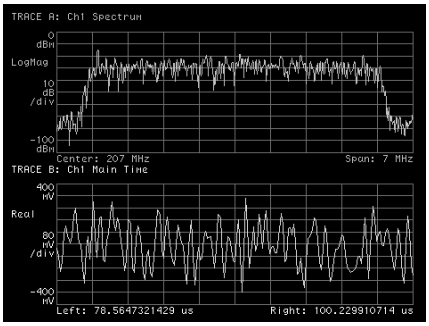
Measurements may be viewed in real time or captured gap-free in high speed sample memory. With Option AY9 (1 Megasample Time Capture), capture and save over 80 msec of full-bandwidth video signal for in-depth post-analysis.

Additional Measurements

Other digital modulation formats supported include FSK, BPSK, QPSK and MSK. Analog demodulation shows amplitude, frequency or phase variations versus time or frequency, and can be used to investigate transient or unintended signal modulation, including carrier phase noise.

A built-in signal source outputs sinewave, chirp, noise and arbitrary waveforms at baseband or (with Option AY8) at RF.

For a complete description of HP 89400 measurement capabilities, please refer to the HP 89400 series product brochure (HP publication #5963-3347E).



HP 89400 vector signal analyzers also provide a complete set of traditional spectrum and waveform measurements.

Operating Characteristics

Supported Products

Model Number	Frequency Range	Sensitivity	Maximum Bandwidth
HP 89410A	dc - 10 MHz	-144 dBm/Hz	10 MHz
HP 89440A	dc - 1.8 GHz	-145 dBm/Hz	8 MHz
HP 89441A	dc - 2.65 GHz	-160 dBm/Hz	7 MHz

Symbol Rates (Symbols/sec)
VSB formats:
10.762M nominal (adjustable)

QAM formats:
Rate < (Max. BW) / (1+ α)

examples:

Model Number	QAM α= 0.2	DVB α= 0.15
HP 89410A	<8.33M	<8.70M
HP 89440A	<6.67M	<6.96M
HP 89441A	<5.83M	<6.09M

Maximum Data Block Size
1 sample/symbol: 4096 sym.
5 samples/symbol: 819 sym.

Residual Error (instrument contributed)
QAM formats: symbol rate 5-7 MHz, .15 <α< .2, full-scale signal ≥ 25dBm:

≤ 1.0% EVM typ. (≤ 40 dB SNR)

VSB formats: symbol rate 10.762 MHz, α=.1152, full-scale signal ≥ 25dBm:

≤ 1.5% EVM typ. (≤ 36 dB SNR)

Modulation Formats:
8, 16VSB
16, 32, 64, 256QAM
16, 32, 64QAM (DVB)

Filter Shapes
Raised cosine, root raised cosine, Gaussian, rectangular, low pass, computed to ≥40 symbols in length

Alpha/BT continuously adjustable from 0.05 to 1.0

Required Options
AYA (vector mod. analysis)
UFG (extended RAM)

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