SIGNAL ANALYZERS

Vector Modulation Analysis, dc-350MHz, 50-200MHz

Models 8980A and 8981A

HP 8980A & HP 8981A

- Analyzes coherent phase and amplitude modulation.
- 350 MHz Q vs. I bandwidth.
- Markers for measuring phase, amplitude, and time.
- 12 bit digitizing for HP-IB measurements.

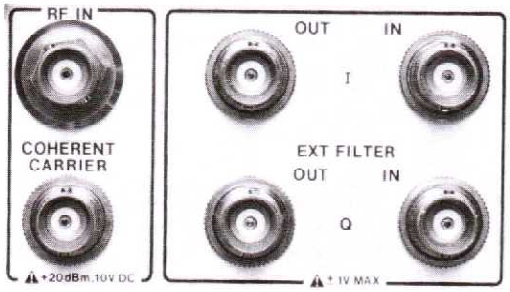
HP 8981A adds built-in I/Q demodulator with:

- 50 - 200 MHz modulated IF input frequency range.
- 100 MHz baseband bandwidth with external I/Q filters and 35 MHz with internal filters.
- Automatic internal/external demodulator calibration.

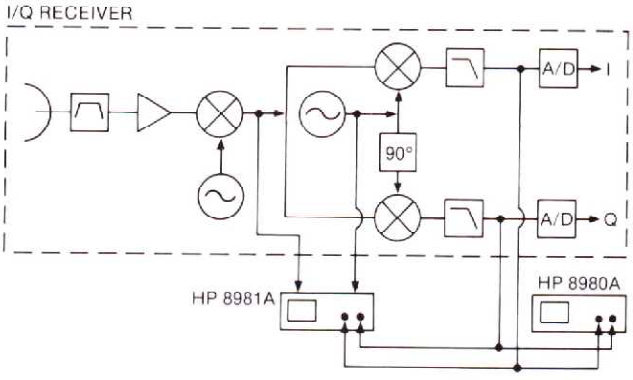
HP 8981A

NEW

DESIGNED FOR HP-IB SYSTEMS



HP 8981A rear panel contains the IF and coherent carrier inputs and ports for adding external I/Q filters.



The HP 8980A and HP 8981A analyze a signal's modulation in receivers using I/Q channels. The HP 8980A displays the I and Q analog baseband signals either on a vector diagram (Q versus I) or versus time. The HP 8981A, being a superset of the HP 8980A, also analyzes the analog I and Q signals, but because it contains a built in demodulator it can also take the IF signal and the coherent reference inputs. This gives the user flexibility to examine the changes in modulation down through the receiver chain and isolate fault areas quickly.

The HP 8981A contains internal 35MHz baseband I and Q filters. If the user desires to use their own filters, ports are provided on the back panel for them. The user can then switch between using the internal or external filters.

What is a Vector Analyzer or Vector Modulation Analyzer?

The HP 8980A Vector Analyzer is a calibrated baseband analyzer which connects to the I and Q outputs of your receiver's demodulator. The HP 8981A Vector Modulation Analyzer includes the same baseband analyzer, but adds a vector demodulator for IF measurements as well. It connects to the IF output of your transmitter and to the coherent reference. Both the instruments measure signal magnitude and phase of standard digital communication and radar signals. The instruments perform constellation analysis of quadrature error, lock angle error and closure. The design provides for quick, visual, intuitive measurements as well as giving quantitative data about a signal's modulation. These features allow a user to quickly identify problem sources and measure their magnitude.

For Advanced Receiver Design

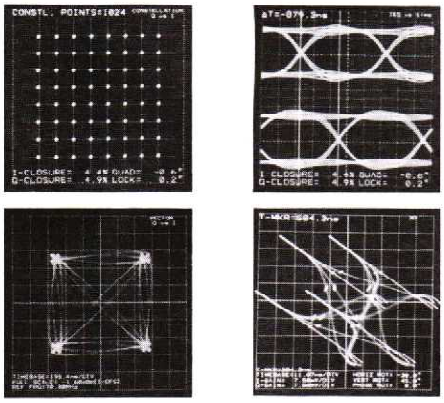
The HP 8980A/81A contains powerful aids which allow a user to make precise measurements on today's advanced digital communication and radar receivers. Communications advances, such as spectrally efficient, digital microwave radios, dictate new standards for performance testing and new methods for looking at signals. Traditionally tests have been made using an oscilloscope with eye diagrams. The HP 8980A/81A takes this testing one step further and provides, in addition to eye diagrams, wide-band Q vs. I diagrams. Many measurement features have been tailored for automatic radio testing, such as constellation analysis of common modulation formats and built in phase/magnitude markers.

Testing advanced radars largely consists of digitizing the I and Q channels and having a computer analyze the signals. The HP 8980A/8981A, with its real-time visual display of phase and magnitude, allows a user to make and view the measurements on the screen. Phase slopes and transients can be easily seen and quantified. The effects of adjustments on the receiver will be immediately seen, thus greatly reducing test and alignment time. The many standard features provide versatile and convenient measurements, allowing a user to isolate the source of errors instead of just making go/no go tests.

Demodulator Correction (HP 8981A only)

A powerful routine in the HP 8981A measures and corrects demodulator errors. This routine measures the internal demodulator's or an external demodulator's quadrature error, I/Q gain imbalance, and DC offsets. The display and digitized outputs can then be automatically adjusted to correct for these errors.

Digital Communication Signals



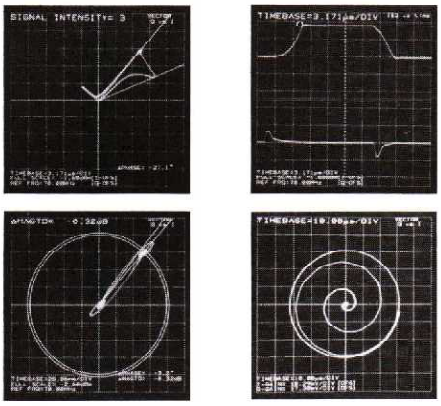
1. Constellation display of a 64 QAM signal. The signal is displayed Q versus I only at the time defined by the time marker, so you can mimic the effects of a digital microwave radio's "slicer" circuits. This display readily shows different types of distortion. The constellation analysis routine digitizes the signal and calculates I & Q closure, lock angle error, and quadrature error. The error values are displayed at the bottom of the screen. This analysis can be performed for QPSK, 9PRS, 16QAM, 25QAM, 256QAM, 49QAM, 49QPR, & 81QPR signals.

2. The I and Q channels displayed versus time here show the eye diagrams of the I and Q channels. By using the time and delta time markers the differential delay can be adjusted and measured. Also the point of maximum eye opening can be determined.

3. A vector display of a QPSK signal shows the transactions between the states whereas the constellation display shows only the states. The vector display is excellent for seeing how the phase and amplitude changes during transitions.

4. 3D display of a QPSK signal. Useful for visual, intuitive analysis of Q vs. I vs. time waveforms. The waveform can be rotated about any of the three axes.

Radar Signals



1. A simple coherent radar pulse displayed on a vector diagram. The phase transients at turn on and off, which can cause unwanted doppler shifts, are readily seen. The delta phase and magnitude markers easily qualify these shifts. A phasecoded pulse, such as a Barker code, can be displayed and the phase slopes can be measured.

2. If the pulse "on state" is aligned with the I axis, then I versus time will approximate the magnitude versus time of the pulse and the Q channel will approximate the incidental phase modulation of the pulse.

3. By using the vector display, signal phase and magnitude can be seen and measured. Here a pulse was passed through an amplifier and the phase and magnitude were marked. Then another amplifier of the same model was tested. The delta markers now indicate a phase difference of 3.2 degrees and a magnitude difference of .32 dB between the amplifiers. Thus different components can be matched to an original reference.

4. A demodulated SAW chirp signal on a vector display. The spiral effect is created by a phase change caused by the frequency ramp and the magnitude of the pulse sloping slowly up and down with cosine weighting.

HP 8980A and HP 8981A Specifications

I and Q Channels

Bandwidth (−3dB): 350 MHz dc coupled; approximately 1 kHz to 350 MHz, ac coupled.
Deflection Factor Range: 5 mV/div to 1 V/div, continuously adjustable; full scale in 10 divisions.
DC Vector Accuracy Using Internal ADC: ±1% of full scale (or 2mV if greater) ±1% of offset.
Maximum DC Coupled Input Voltage: ±5V peak.
Maximum AC Coupled Input Voltage: ±25 V dc; ±5 V peak ac.
Transition Time (10% to 90%): 1ns.
I-Q Crosstalk: −60 dB or 1% of full-scale peak, whichever is greater, dc to 350 MHz.
Input Termination: 50 ohms or 75 ohms.
Input Coupling: each channel independently: ac, dc, or ground (input disconnected).

Timing

Acquisition Method: repetitive sampling.
Time per Division Range: 500 ps/div to 2 ms/div, continuously adjustable.
Delay I & Q Range: 0 to 100 divisions for specified performance, 20 ms maximum.
Time/Division Accuracy: ±3%.

Triggering

Trigger Sources: selectable from external, internal I, internal Q, or LINE.
External Trigger Terminations: selectable 50 or 75 ohms.
ECL: 50 ohms or 75 ohms to −2V.
GND: 50 ohms or 75 ohms to gnd.
Internal I or Q Trigger Levels: selectable ac or dc internal coupling. Adjustable internal trigger levels.
Gate Operation: a rear panel input. Gate blanks the display and disables measurements asynchronously with the trigger rate.
Minimum Gate Pulse Width: 100 ns (on or off).
Digitizing Resolution: 12 bits.

Environment

Operating Temp.: 0° C to + 55° C (+32 to +131° F).
Non-operating Temp.: −40° C to +75° C (−4 to +167° F).
Operating Humidity: up to 95% relative humidity at +40° C.

Power Requirements

Voltage: 100, 120, 220, 240 Vac, −10% to +10%; 48-66 Hz.
Power: 245 watts, 320 VA maximum.

Dimensions: Package is 5¼ inch rack height, one module width 23D HP System II cabinet.
Weight: net approximately 20kg (45 lbs), shipping approximately 24 kg (53 lbs).

HP 8981A Demod Mode Specifications

Modulated IF Input Frequency Range: 50 MHz to 200 MHz.
Modulated IF Input Level Range: −5 dBm to −20 dBm.
Coherent Reference Input Frequency Range: 50 MHz to 200 MHz.
Coherent Reference Input Level Range: +10 dBm to −20 dBm.
Baseband Bandwidth (3 dB): 100 MHz with external filters. Supplemental characteristic of 35 MHz with internal filters.
Corrected Vector dc accuracy at 70 MHz: (typical from 50 to 200 MHz) <2% of full scale IF input.

Supplemental Characteristics

Quadrature Error: Corrected: <±5 deg. Uncorrected: <±1°.
I/Q Gain Imbalance (dc to 10 kHz): Corrected: <±0.1 dB. Uncorrected: <±0.25 dB.

Ordering Information

	Price
HP 8980A Vector Analyzer	$19,700
HP 8981A Vector Modulation Analyzer	$29,000
Option 907: Front handle kit	$65
Option 908: Rack flange kit	$35
Option 909: Rack flange and front handle kit	$90
Option 915: Add service manual	$45
Option 916: Add extra operating manual	$30
Option W03: 90 day on-site warranty conversion (where available)	$0
Option W30: 2 additional years of return to HP service HP 8980A $400, HP 8981A $600	
HP 11748A Active probe system	$2,995