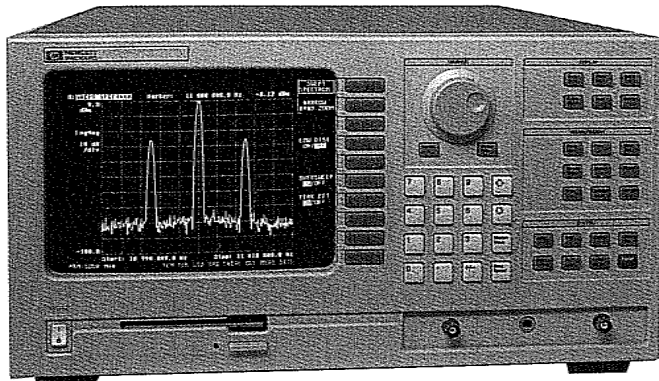


SIGNAL ANALYZERS

Spectrum/Network Analyzer, 10 Hz to 150 MHz

HP 3588A, 3589A

- Complete spectrum and vector network measurements (HP 3589A)
- Narrowband measurements hundreds of times faster
- Accuracy to 0.2 dB, spectrum; 0.05 dB, 1 degree network



HP 3588A Spectrum Analyzer



Complete Frequency Domain Analysis

The HP 3588A spectrum analyzer and HP 3589A spectrum/network analyzer provide comprehensive frequency domain measurements and cover the baseband through IF frequency range of 10 Hz to 150 MHz. The HP 3588A offers high performance spectrum measurements and simple scalar network measurements with its fully synthesized tracking generator. The HP 3589A adds complete vector network measurements, support for analysis of RF and microwave downconverted signals, accessory 50 Ω and 75 Ω S-parameter test sets, and optional time-gated spectrum analysis.

Full Network Capability

Because design tasks often require network or impedance measurements along with spectrum analysis, the HP 3589A provides a complete range of features and measurement accessories for comprehensive network analysis. Phase measurement functions include group delay, polar and Smith chart formats, and phase slope or electrical length compensation. All normal transmission measurements can be made in 50 Ω and 75 Ω environments by the standard HP 3589A. For audio or broadband analysis, the analyzer also performs log sweeps and adds a 1 M Ω input.

Both 50 Ω and 75 Ω test sets are available for complete two-port network analysis. The test set enables easy, accurate measurement of VSWR, return loss, impedance, directivity, and other transmission and reflection parameters. To ensure optimum accuracy through cables and fixtures, full measurement calibration/error-correction functions are provided, comparable to dedicated network analyzers.

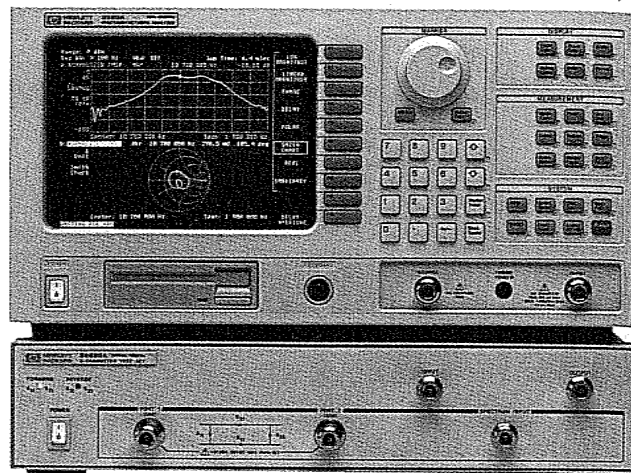
Unprecedented Speed and Resolution

Narrow resolution measurements with conventional swept-tuned analyzers typically require long measurement times, which can increase development time and test costs. In contrast, the HP 3588A/3589A set new standards in speed while providing much greater frequency resolution.

Faster measurements are made possible with these analyzers' full-digital resolution bandwidth filters. They offer an improved shape factor and sweep characteristics for measurements 4 to 40 times faster than those of conventional analyzers. A unique FFT "Narrowband Zoom" mode provides measurements up to 400 times faster and spans of 1 Hz to 40 KHz anywhere in the 150 MHz frequency range.

The HP 3589A also brings this speed and resolution to narrowband measurements at microwave frequencies, through enhanced features for interfacing with microwave analyzers, receivers, or downconverters.

- Optional time-gated spectrum analysis for burst signals (HP 3589A)
- Companion 2-port 50 Ω /75 Ω S-parameter test sets
- 80 to 112 dB dynamic range



HP 3589A Spectrum/Network Analyzer
HP 35689A S-Parameter Test Set



Burst Signal Analysis

Burst or time-varying signals are now found in applications as diverse as communications, disk drives, video, sonar, ultrasound, and optoelectronics. The time-gated spectrum analysis option of the HP 3589A is meant for just these dynamic signals. The analyzer can be triggered to measure only during the "valid" or desired portion of a complex signal, providing standard measurements such as signal-to-noise and distortion. Accurate measurement of these repetitive signal bursts is often impossible with a standard spectrum analyzer.

Measurement Automation and Convenience Features

Optional HP Instrument BASIC (a subset of HP BASIC) runs inside these analyzers to make repetitive measurements, create custom displays and test sequences, and even to control other instruments in a test system. Automatic programming is available with the "keystroke-recording" feature, which creates complete executable programs by remembering keys pressed during an actual measurement. The HP 3589A includes a set of disk utilities for PC analysis of measurement results and also includes a standard PC-style keyboard interface. Optional PC keyboards are available for the HP 3589A in a variety of languages.

Specifications Summary

Please see the 3588A and 3589A technical data sheets for full specifications. The following specifications apply from 0° to 55° C and from 10 Hz to 150 MHz.

Frequency Specifications

Frequency range: 0 Hz to 150 MHz; 1 MW input specified from 10 Hz to 40 MHz.

Frequency accuracy

Initial accuracy:

| | Without Opt 1D5 | With Opt 1D5 |
|--------------|--------------------|-----------------|
| 20° to 30° C | ±0.5 ppm | ±0.01 ppm |
| 0° to 55° C | ±3.0 ppm | ±0.07 ppm |
| Aging | ±0.25 ppm/mo. | ±0.125 ppm/mo. |

Frequency counter resolution: 0.1 Hz

Stability

Spectral purity: See chart below.

Noise sidebands: Less than -105 dBc when measured at a 1 kHz offset from CW signal and normalized to a 1 Hz noise-power bandwidth.

Drift/residual FM:

The HP 3589A uses a fully synthesized local oscillator and is phase-locked to the frequency reference throughout the sweep. See the frequency accuracy specifications stated earlier.

Amplitude Specifications

Amplitude measurement range:

(Maximum without degrading performance)

| | 50 Ω | 75 Ω | 1 M Ω |
|-----------------|-------------|-------------|--------------|
| Input dc: | ±3 Vdc | ±3 Vdc | ±25 Vdc |
| Measured input: | 20 dBm | 22 dBm | ±7 dBV |

Input range settings (characteristics only):

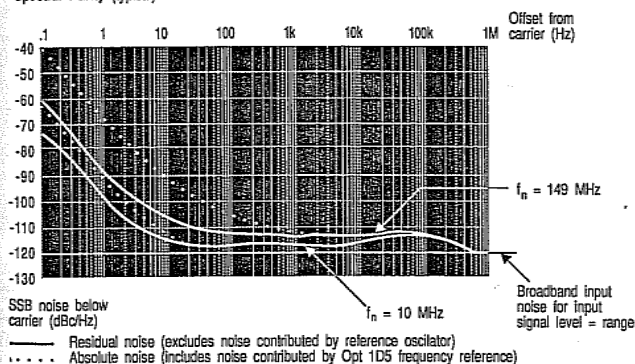
50 Ω input (in 10 dB steps): +20 dBm to -20 dBm

75 Ω input (in 10 dB steps): +21.76 dBm to -18.24 dBm, with included BNC adapter and automatic corrections.

+ 25.72 dBm to -14.28 dBm, with minimum loss pad (option) and automatic corrections

1 M Ω input (in 10 dB steps; HP 3589A only): +7 dBV to -33 dBV

Spectral Purity (typical)



Note: Equivalent noise bandwidth is narrower than 1 Hz for spans below 150 Hz with the narrowband zoom measurement type, providing additional reduction in phase noise from that shown. This maintains good dynamic range, even for extremely small offset frequencies in narrow spans. Noise is reduced by $10 \cdot \log [1/\text{noise bandwidth}]$ dBc relative to the graph.

Display resolution: 0.001 to 100 dB/div

Marker resolution: 0.01 dB

Display units: dBm, dBV, Vrms

Input port: (Type-N connector)

Return loss: > 20 dB

Impedance: 50 Ω , 1 M Ω , (75 Ω with included adapter or optional minimum-loss pad)

Source Specifications

Source port: (Type-N connector)

Return loss: > 20 dB

Impedance: 50 Ω (75 Ω with included adapter or optional minimum loss pad)

Frequency: 10 Hz to 150 MHz

Amplitude: +15 to -54.9 dBm (HP 3588A max. = +10 dBm)

Absolute amplitude accuracy: ±1 dB

Frequency response: ±1 dB

Spurious: Harmonic < -30 dBc; Non-harmonic, < -40 dBc

Spectrum Measurements

Frequency

Frequency span

Swept: Range 10 Hz to 150 MHz, and zero span

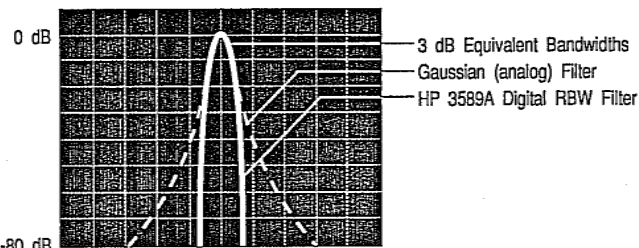
Start/stop frequency: 0 Hz to 150 MHz

Narrowband zoom: Range 1.23 Hz to 40 kHz in $\times 2$ steps

Resolution bandwidth

Swept: 1.1 Hz to 17 kHz

Narrowband zoom: (high-accuracy mode): 11 mHz to 360 Hz



HP 3589A digital RBW filter shape (solid line) compared with a standard (Gaussian) analog RBW filter of equivalent 3 dB bandwidth.

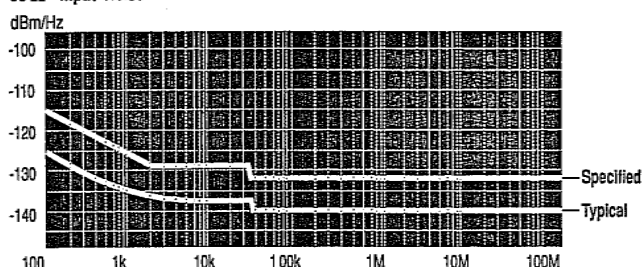
Video bandwidth: Entered in frequency values which are coupled to the current RBW and are from $(1.54 \cdot \text{RBW})$ to $(0.012 \cdot \text{RBW})$ in seven steps, and off.

Amplitude

Dynamic range

A/D overload level: > 2 dB (relative to selected range)

50 Ω Input Noise



Noise level: (dBm/Hz using the marker noise function)

Specified for swept spectrum mode, with 50 W input, range set to -20 dBm and low-distortion mode off.

Note: Equivalent noise bandwidth is narrower than 1 Hz for spans below 150 Hz with the narrowband zoom measurement type, providing additional reduction in noise from that shown.

Spurious Responses

General spurious: Unless specifically mentioned in other spurious specifications, spurious responses are < -70 dBc (< -80 dBc typical) for signal levels equal to input range.

Harmonic distortion:

50 Ω and 75 Ω inputs: < -80 dBc (< -90 dBc typical)

1 M Ω input: < -75 dBc (< -80 dBc typical)

Intermodulation distortion:

50 and 75 Ω inputs: < -80 dBc (< -90 dBc typical)

1 M Ω input: < -75 dBc (< -80 dBc typical)

Residual Responses: Below -110 dBm on the -20 dBm range

Amplitude Accuracy

Measurement accuracy is determined by the sum of full-scale absolute accuracy and scale fidelity (linearity). For measurements made at full-scale (signal level = range), only full-scale accuracy need be considered. Recalibration due to change in center or manual frequency is not required for the accuracy shown.

SIGNAL ANALYZERS

Spectrum/Network Analyzer, 10 Hz to 150 MHz (cont'd)

HP 3588A, HP 3589A

Full-scale absolute accuracy:

(Applies over entire 0° to 55° C temperature range.)

Accuracy is specified for manual frequency or for sweeps in which sweep time is increased by a factor of four. Add ± 0.1 dB for auto-coupled sweep times.

| | 10 Hz | 100 Hz | 30 kHz | 300 kHz | 40 MHz | 150 MHz |
|---------------------|--------------|--------------|--------------|--------------|--------------|---------|
| 50 Ω Input | ± 2.5 dB | ± 1.0 dB | ± 0.5 dB | ± 0.4 dB | ± 0.5 dB | |
| 50 Ω Typical | ± 1 dB | ± 0.5 dB | | ± 0.2 dB | | |
| 75 Ω Input | ± 2.5 dB | ± 1.0 dB | | ± 0.8 dB | | |
| 1 M Ω Input | ± 2.5 dB | ± 1.0 dB | | ± 0.6 dB | | |

Scale fidelity (linearity) maximum cumulative error of log scale. Levels are relative to the specified range.

| Level | Incremental | Typical |
|-----------------|-------------|---------|
| 0 to -30 dB | <0.05 dB | 0.02 dB |
| -30 to -40 dB | <0.1 dB | 0.03 dB |
| -40 to -50 dB | <0.3 dB | 0.05 dB |
| -50 to -60 dB | <0.5 dB | 0.10 dB |
| -60 to -70 dB | <0.7 dB | 0.10 dB |
| -70 to -80 dB | — | 0.25 dB |
| -80 to -90 dB | — | 0.25 dB |
| -90 to -100 dB | — | 0.40 dB |
| -100 to -110 dB | — | 0.70 dB |
| -110 to -120 dB | — | 4.00 dB |

Sweep Characteristics

Linear sweep spectrum: The oversweep mode and digital IF filters of the HP 3589A provide sweep times 4 to 40 times faster than those of analog swept analyzers, without increased error.

Narrowband zoom:

Measurement speed: > 7 measurements/s (for spans ≥ 10 kHz)

Gated sweep:

(HP 3589A Opt 1D6 only; not available in narrowband zoom mode.) Gate length and trigger delay:

| RBW (Hz) | Gate Length Minimum (ms) | Gate Length Maximum (ms) | Edge Trigger Default Delay* (ms) |
|----------|--------------------------|--------------------------|----------------------------------|
| 17000 | 0.02 | 131 | 0.13 |
| 9100 | 0.04 | 131 | 0.2 |
| 4600 | 0.08 | 131 | 0.38 |

(For other bandwidths, see HP 3589A Technical Data Sheet.)

Network Measurements (HP 3588A only)

Frequency

Linear sweep: For span and RBW, see swept spectrum mode.

Log sweep: Start/stop frequency: 10 Hz to 150 MHz.

Amplitude

Dynamic range

Sensitivity: Dynamic range limitation due to noise level and internal crosstalk between the source and receiver.

| Impedance | 10 Hz-30 KHz | 30 kHz-40 MHz | 40 MHz-150 MHz |
|------------------------|--------------|---------------|----------------|
| 50/75 Ω | 80 dB | 100 dB | 100 dB |
| 50/75 Ω typical | 85 dB | 110 dB | 110 dB |
| 1 M Ω | 75 dB | 100 dB | — |

Accuracy - Ratio Amplitude and Phase

Dynamic accuracy: At stable temperature following a 2 hour warm-up, and within 5 minutes of normalization. (Typical within one minute of normalization.)

| Level (dB) | Accuracy (dB) | Accuracy (deg) | Typical (dB) | Typical (deg) |
|-------------|---------------|----------------|--------------|---------------|
| 0 to -5 | <0.05 | <1.0 | <0.05 | 0.2 |
| -5 to -30 | <0.10 | <1.5 | 0.10 | 0.5 |
| -30 to -40 | <0.15 | <2.0 | 0.10 | 1.0 |
| -40 to -50 | <0.35 | <3.0 | 0.10 | 1.0 |
| -50 to -60 | <0.55 | <4.0 | 0.15 | 1.5 |
| -60 to -70 | <0.75 | <6.0 | 0.15 | 2.5 |
| -70 to -80 | — | — | 0.30 | — |
| -80 to -90 | — | — | 0.30 | — |
| -90 to -100 | — | — | 0.45 | — |

Group Delay (not available with log sweep):

Aperture frequency: 0.5% to 16% of span in 2x steps

Accuracy: Dynamic phase acc./((360° aperture frequency) ± 1 ns

Sweep Characteristics

Linear, log, and gated sweeps are available; see technical data sheet.

General Characteristics

Temperature (operating): 5° to 50° C; Storage: -20° to 60° C

Calibration interval: 1 year

Power:

115 Vac operation: 90 to 132 Vrms, 47 to 440 Hz

230 Vac operation: 198 to 264 Vrms, 47 to 66 Hz

Max. power dissipation: 450 VA

Weight: Net, 28 kg (62 lb); shipping, 38 kg (81 lb)

Dimensions:

222 mm H \times 425.5 mm W \times 630 mm D (8.75 in \times 16.75 in \times 24.8 in)

External keyboard: Compatible with PC-style 101 key

HP 35689A/B S-Parameter Test Sets

Frequency range: 100 kHz to 150 MHz

Test port impedance: HP 35689A, 50 Ω ; HP 35689B, 75 Ω

Directivity: > 40 dB

Spectrum port insertion loss: <0.5 dB typical (HP 35689A)

Power:

115 Vac operation: 90 to 132 Vrms, 47 to 66 Hz

230 Vac operation: 198 to 264 Vrms, 47 to 66 Hz

Weight: Net, 7.8 kg (17 lb); shipping, 11.5 kg (25 lb)

Dimensions: 90 mm H \times 426 mm W \times 584 mm D (3.5 in \times 16.75 in \times 22.75 in)

Ordering Information

HP 3588A Spectrum Analyzer

Opt 001 High-Stab. Freq. Reference

Opt 003 Add 2 MByte Memory

Opt 1C2 HP Instrument BASIC

HP 3589A Spectrum/Network Analyzer

Opt 1D5 High-Stab. Freq. Reference

Opt 1D6 Time-Gated Spectrum Analysis

Opt 1C1 Add 2 MByte Memory

Opt 1C2 HP Instrument BASIC

Opt 1D7 50 Ω to 75 Ω Minimum Loss Pads

Opt PC-Style 101-Key Keyboard

(Available keyboard versions include US, German, Spanish, French, UK, Italian, and Swedish)

HP 35689A 50 Ω S-Parameter Test Set

HP 35689B 75 Ω S-Parameter Test Set

Price

\$19,300

\$850

\$1,500

\$500

\$21,750

\$850

\$1,500

\$1,500

\$500

\$900

\$170

\$3,650

\$4,000