

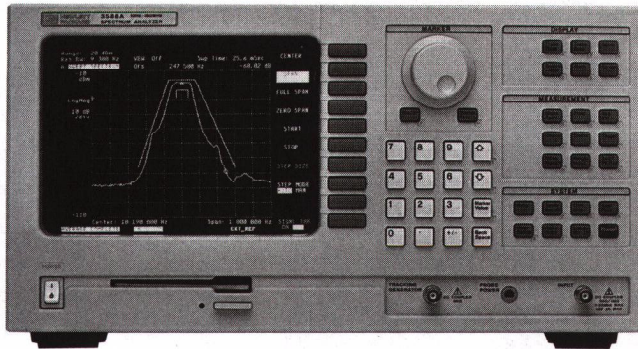
# SIGNAL ANALYZERS

## Spectrum/Network Analyzer, 10 Hz to 150 MHz

### HP 3588A, 3589A

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- 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
- Optional time-gated spectrum analysis for burst signals (HP 3589A)



HP 3588A  
HP Instrument Drivers



### HP 3588A Spectrum Analyzer

### HP 3589A Spectrum/Network 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  $\Omega$  and 75  $\Omega$  S-parameter test sets, and optional time-gated spectrum analysis.

#### 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.

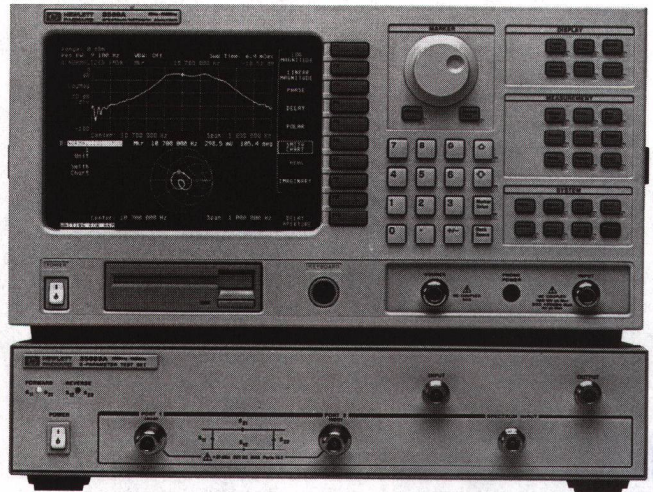
The HP 3589A also brings this speed and resolution to narrowband measurements at microwave frequencies, through enhanced features for interfacing with microwave analyzers, receivers or downconverters.

#### 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. Make all normal transmission measurements in 50  $\Omega$  and 75  $\Omega$  environments with the standard HP 3589A. For audio or broadband network analysis, the analyzer also performs log sweeps and adds a 1 M $\Omega$  input.

Both 50  $\Omega$  and 75  $\Omega$  test sets are available for complete two-port network analysis. The test sets enable 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.

- Companion 2-port 50  $\Omega$ /75  $\Omega$  S-parameter test sets
- 80 to 112 dB dynamic range



HP 3589A, 35689A



#### Burst-Signal Analysis

You can find burst or time-varying signals in applications as diverse as communications, disk drives, video, sonar, ultrasound, and opto-electronics. The time-gated spectrum analysis option of the HP 3589A is meant for just these dynamic signals. Trigger the analyzer 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. Automatically program the analyzer with the "keystroke-recording" feature, which creates complete executable and editable 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 connector. Optional PC keyboards are available for the HP 3589A in a variety of languages.

#### Specifications Summary

Please see the HP 3588A and HP 3589A technical data sheets for full specifications. The following specifications apply from 0° to 55°C and from 10 Hz to 40 MHz.

#### Frequency Specifications

**Frequency Range:** 0 Hz to 150 MHz; 1 M $\Omega$  input specified from 10 Hz to 150 MHz

#### Frequency Accuracy

	Without Option 1D5	With Option 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

To have a Hewlett-Packard representative help you place an order or to get more information call 1-800-452-4844

# SIGNAL ANALYZERS

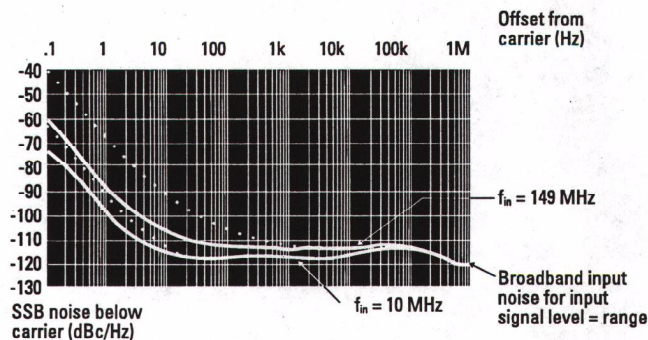
Spectrum/Network Analyzer, 10 Hz to 150 MHz (cont'd)

HP 3588A, 3589A

## Stability

**Spectral Purity:** See graph 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.



— Residual noise (excludes noise contributed by reference oscillator)  
 - - - Absolute noise (includes noise contributed by Opt 1D5 frequency reference)

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.

**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 $\Omega$	75 $\Omega$	1M $\Omega$
Input dc:	$\pm 3$ Vdc	$\pm 3$ Vdc	$\pm 25$ Vdc
Measured input:	20 dBm	22 dBm	$\pm 7$ dBV

**Input Range Settings** (characteristics only):

**50  $\Omega$  Input** (in 10 dB steps): +20 dBm to -20 dBm

**75  $\Omega$  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 $\Omega$  input** (in 10 dB steps; HP 3589A only): +7 dBV to -33 dBV

**Display Resolution:** 0.001 to 100 dB/div

**Marker Resolution:** 0.01 dB

**Display Units, 3588A:** dBm, Vrms, mVrms,  $\mu$ Vrms,  $\eta$ Vrms

**Display Units, 3589A:** dBm, Vrms, mVrms,  $\mu$ Vrms,  $\eta$ Vrms, dBV, dB $\mu$ V

**Input Port:** (Type-N connector)

**Return Loss:** >20 dB

**Impedance:** 50  $\Omega$ , 1 M $\Omega$ , (75  $\Omega$  with included adapter or optional minimum-loss pad)

## Source Specifications

**Source Port:** (Type-N connector)

**Return Loss:** >20 dB

**Impedance:** 50  $\Omega$  (75  $\Omega$  with included adapter or optional minimum-loss pad)

**Frequency:** 10 Hz to 150 MHz

**Amplitude:** +15 to -54.9 dBm (HP 3588A +10 to -59.9 dBm)

**Absolute Amplitude Accuracy:**  $\pm 1$  dB

**Frequency Response:**  $\pm 1$  dB

**Spurious:** Harmonic <-28 dBc; Non-harmonic, -40 dBc

## Spectrum Measurements

### Frequency

#### Frequency Span

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

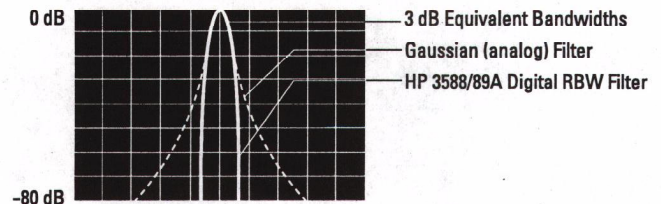
**Start/stop Frequency:** 0 Hz to 150 MHz

**Narrowband Zoom:** Range 1.23 Hz to 40 kHz in x2 steps

#### Resolution Bandwidth

**Swept:** 1.1 Hz to 17 kHz  $\pm 10\%$

**Narrowband Zoom:** (high accuracy mode): 11 mHz to 360 Hz



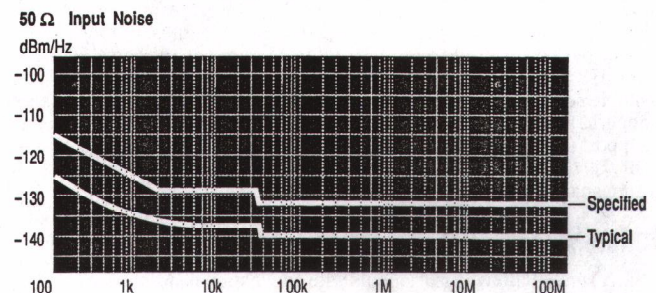
HP 3588A/3589A digital RBW filter shape (solid line) compared with a standard (Gaussian) analog RBW filter of equivalent 3 dB bandwidth.

**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

#### Noise Level

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



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

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

**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  $\Omega$  and 75  $\Omega$  Inputs:** <-80 dBc (<-90 dBc typical)

**1 M $\Omega$  Input:** <-75 dBc (<-80 dBc typical)

#### Intermodulation Distortion

**50  $\Omega$  and 75  $\Omega$  Inputs:** <-80 dBc (<-90 dBc typical)

**1 M $\Omega$  Input:** <-75 dBc (<-80 dBc typical)

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

**A/D Overload Level:** >2 dB (relative to selected 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. Re-calibration due to change in center or manual frequency is not required for the accuracy shown.

**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  $\pm 0.1$  dB for auto-coupled sweep times.

	10 Hz	100 Hz	30 kHz	300 kHz	40 MHz	150 MHz
50 $\Omega$ Input	$\pm 2.5$ dB	$\pm 1.0$ dB	$\pm 0.5$ dB	$\pm 0.4$ dB	$\pm 0.5$ dB	
50 $\Omega$ Typical	$\pm 1$ dB	$\pm 0.5$ dB		$\pm 0.2$ dB		
75 $\Omega$ Input	$\pm 2.5$ dB	$\pm 1.0$ dB		$\pm 0.8$ dB		
1 M $\Omega$ Input	$\pm 2.5$ dB	$\pm 1.25$ dB	$\pm 0.6$ 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	.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  $\geq 10$  kHz)**Gated Sweep:** (HP 3589A Option 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 3589A 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 to 30 kHz	30 kHz to 40 MHz	40 MHz to 150 MHz
50/75 $\Omega$	80 dB	100 dB	100 dB
50/75 $\Omega$ typical	85 dB	110 dB	110 dB
1 M $\Omega$	75 dB	100 dB	—

**Accuracy—Ratio Amplitude and Phase****Dynamic Accuracy:** At stable temperature following a two-hour warmup, 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./ $(360^\circ \times \text{aperture frequency}) \pm 1$  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**Size:** 425.5 mm W x 222 mm H x 630 mm D (16.75 in x 8.75 in x 24.8 in)**Weight:** Net, 28 kg (62 lb); shipping, 38 kg (81 lb)**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  $\Omega$ ; HP 35689B, 75  $\Omega$ **Directivity:** >40 dB**Spectrum Port Insertion Loss:** <0.5 dB typical (HP 35689A)**Power:****115 Vac Operation:** 90 to 132 V rms, 47 to 66 Hz**230 Vac Operation:** 198 to 264 V rms, 47 to 66 Hz**Size:** 426 mm W x 90 mm H x 584 mm D (16.75 in x 3.5 in x 22.75 in)**Weight:** Net, 7.8 kg (17 lb); shipping, 11.5 kg (25 lb)**Key Literature**

HP 3588A Product Brochure, p/n 5952-0605

HP 3589A Technical Data Sheet, p/n 5091-1400E

HP 3589A Product Brochure, p/n 5091-1522E

**Ordering Information****HP 3588A Spectrum Analyzer****Opt 001** High-Stability Freq. Reference**Opt 003** Add 2 MB Memory**Opt 1C2** HP Instrument BASIC**HP 3589A Spectrum/Network Analyzer****Opt 1D5** High-Stability Freq. Reference**Opt 1D6** Time-Gated Spectrum Analysis**Opt 1C1** Add 2 MB Memory**Opt 1C2** HP Instrument BASIC**Opt 1D7** 50  $\Omega$  to 75  $\Omega$  Minimum Loss Pads**Opt PC-style** 101-Key Keyboard

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

**HP 35689A** 50  $\Omega$  S-Parameter Test Set**HP 35689B** 75  $\Omega$  S-Parameter Test Set**Price**

\$24,000

+\$865

+\$1,530

+\$510

\$24,750

+\$865

+\$1,530

+\$510

+\$920

+\$173

\$3,725

\$4,080