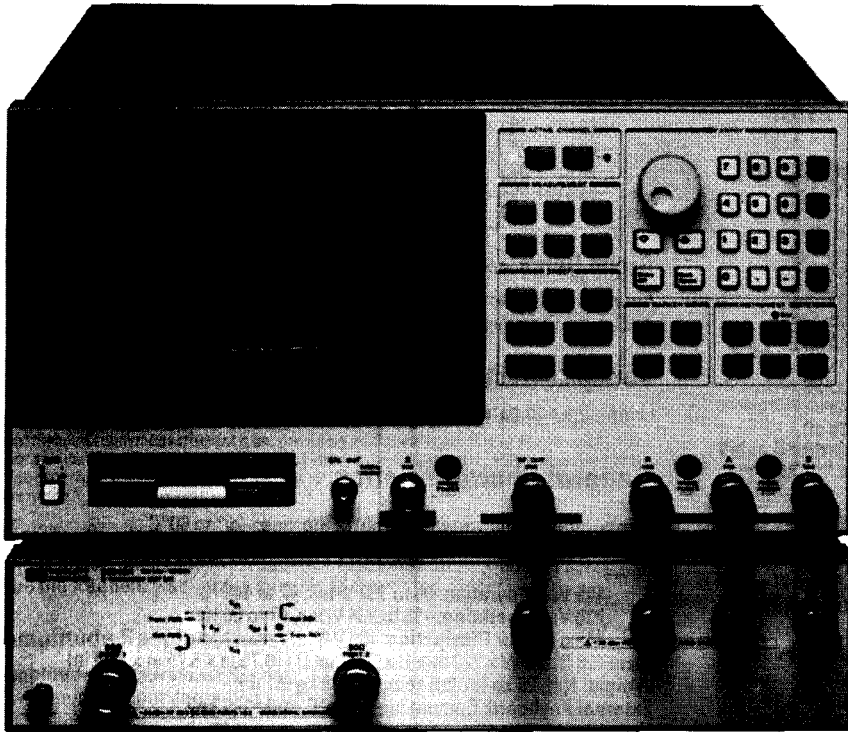


# NETWORK/SPECTRUM ANALYZERS

RF Network/Spectrum/Impedance Analyzer, 100 kHz to 1.8 GHz/2 Hz to 1.8 GHz  
HP 4396A

- Full-vector network and spectrum measurement and analysis
- Wide dynamic range network measurement with fast sweep speeds
- $\pm 0.05$  dB/ $\pm 0.3^\circ$  dynamic magnitude/phase accuracy
- Extremely fast narrowband spectrum measurement
- Impedance analysis option and test kit available
- $\pm 1.0$  dB overall level accuracy for spectrum analysis
- $-150$  dBm/Hz sensitivity for spectrum analysis
- HP Instrument BASIC option for easy test automation
- Time-gated spectrum analysis option
- Color CRT and built-in disk drive/RAM disk



HP 4396A with HP 85046A



## HP 4396A RF Network/Spectrum Analyzer

The HP 4396A provides excellent RF vector network, spectrum, and optional impedance measurements for lab and production applications. Gain, phase, group delay, distortion, spurious, CN, and noise measurements often required for evaluating components and circuits can be measured using one instrument. When combined with a test set, the HP 4396A provides reflection measurements, such as return loss, and SWR, and S parameters. As a vector network analyzer, the HP 4396A operates from 100 kHz to 1.8 GHz with 1 MHz resolution and its integrated synthesized source provides  $-60$  to  $+20$  dBm of output power with 0.1 dB resolution. The dynamic magnitude and phase accuracy are  $\pm 0.05$  dB and  $\pm 0.3^\circ$  so that it can accurately measure gain and group delay flatness, which are becoming more important in modern electronics systems.

As a spectrum analyzer, the HP 4396A operates from 2 Hz to 1.8 GHz with resolution bandwidths (RBWs) spanning 1 Hz to 3 MHz in a 1-3-10 sequence. A fully-synthesized local oscillator allows stable and accurate frequency analysis. Direct A/D conversion (no LOG amplifier is used) results in  $\pm 1.0$  dB overall level accuracy. Noise sidebands fall below  $-105$  dBc/Hz offset 10 kHz from carriers below 1 GHz, while sensitivity is  $-150$  dBm/Hz at 10 MHz and  $-147$  dBm at 1 GHz. In addition, with two independent display channels available, you can simultaneously view network and spectrum (or transmission and reflection) characteristics of the device under test in split-screen format. For example, an amplifier's frequency response (network measurement) and distortion (spectrum measurement) can be shown at the same time.

### Extremely Fast Spectrum Measurement

The HP 4396A features a stepped Fast Fourier Transform (FFT) digital-signal-processing (DSP) technique for 20 to 100 times faster narrowband spectrum measurement than swept-tuned spectrum analyzers. The

stepped FFT is performed when the resolution bandwidth (RBW) is set at 3 kHz or below. For example, with a 30 Hz RBW and 10 kHz span, the HP 4396A has a sweep time of 400 ms, while swept-tuned spectrum analyzers take a few tens of seconds. The stepped FFT can greatly improve the efficiency of narrowband spectrum measurement such as frequency tuning of a VCO or CN measurements.

### Time-Gated Spectrum Analysis

With Option 1D6, the HP 4396A offers time-gated spectrum analysis capability to capture and measure repetitive burst signals in video, disk drives, communication equipment, and more. The minimum gate length is  $2\mu$  sec so that even narrow-burst signals can be analyzed.

### Impedance Measurement Function and RF Impedance Test Kit

A full-featured impedance measurement function (useful for quick-check general-purpose impedance applications) can be added to the HP 4396A by adding Option 010 and the HP 43961A RF impedance test kit. Covering from 100 kHz to 1.8 GHz, impedance parameters  $|Z|$ ,  $\theta$ , C, L, Q, D, and more, are directly measured and displayed on the CRT. The basic impedance accuracy (typical value) is 3%. The HP 43961A RF impedance test kit is designed for the HP 4396A and is required to utilize the features of Option 010. An APC-7\* connector is mounted on this kit for easy connection to an appropriate impedance test figure. A wide variety of HP fixtures can be used with the test kit, including the new surface-mount-device (SMD) fixtures used with the new HP 4291A RF impedance/material analyzer. For higher accuracy, complete impedance analysis over the widest impedance ranges, and temperature effects evaluation, the HP 4291A impedance/material analyzer is recommended. See page 346.

## HP 4396A Specifications Summary

### Network Measurement

#### Frequency Characteristics

**Range:** 100 kHz to 1.8 GHz  
**Resolution:** 1 mHz  
**Accuracy:**  $\leq \pm 5.5$  ppm (Option 1D5:  $\leq \pm 0.13$  ppm)

#### Output Characteristics

**Power Range:** -60 to +20 dBm  
**Resolution:** 0.1 dB  
**Level Accuracy:**  $\pm 0.5$  dB

#### Receiver Characteristics

**Frequency Range:** 100 kHz to 1.8 GHz  
**Noise Level:** (10 Hz IFBW,  $\geq 10$  MHz,  $f$ =frequency in GHz)  
 $< (-125 + 3 \times f)$  dBm (A, B inputs)  
 $< (-100 + 3 \times f)$  dBm (R input)

**Full Scale Input Level:** -5 dBm (A, B), +20 dBm (R)

**IF Bandwidth (Hz):** 10, 30, 100, 300, 1k, 3k, 10k, 40k

#### Dynamic Accuracy

##### Magnitude Dynamic Accuracy:

Input level (relative to full scale input level)	
0 dB	$\leq \pm 0.3$ dB
-10 to -70 dB	$\leq \pm 0.05$ dB
-80 dB	$\leq \pm 0.1$ dB
-90 dB	$\leq \pm 0.3$ dB
-100 dB	$\leq \pm 1.0$ dB
-110 dB	$\leq \pm 0.7$ dB typical
-120 dB	$\leq \pm 2.3$ dB typical

@23  $\pm$  5° C, IFBW 10 Hz, R input = -35 dBm

##### Phase Dynamic Accuracy:

Input level (relative to full scale input level)	
0 dB	$\leq \pm 3$ deg
-10 dB	$\leq \pm 0.6$ deg
-20 to -70 dB	$\leq \pm 0.3$ deg
-80 dB	$\leq \pm 0.7$ deg
-90 dB	$\leq \pm 2.4$ deg
-100 dB	$\leq \pm 7$ deg
-110 dB	$\leq \pm 8$ deg typical
-120 dB	$\leq \pm 25$ deg typical

@23  $\pm$  5° C, IFBW 10 Hz, R input = -35 dBm

##### Measurement Throughput Summary (IFBW 40 kHz, ms)

Measurement (uncorrected)	Number of points			
	51	201	401	801
(1) Magnitude	30	80	150	280
(2) Phase	30	90	160	310
(3) Group delay ( $\tau$ )	35	120	220	420
(4) Magnitude and phase	45	150	290	560
(5) Magnitude and group delay	55	180	350	680
(6) Magnitude/return loss	45	140	270	530

### Spectrum Measurement

#### Frequency Characteristics

**Frequency Range:** 2 Hz to 1.8 GHz

#### Frequency Reference

**Accuracy:**  $\leq \pm 5.5$  ppm (Option 1D5:  $\leq \pm 0.13$  ppm)

#### Resolution Bandwidth (RBW)

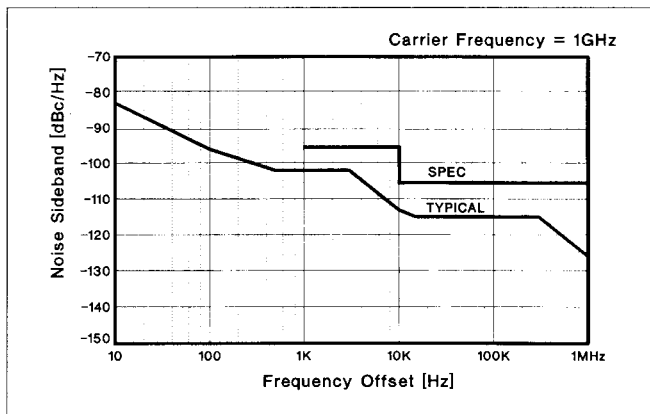
**Range:** 1 Hz to 3 MHz, 1-3-10 step

#### Selectivity (60 dB/3 dB)

RBW  $\geq 10$  kHz:  $< 10$

RBW  $\leq 3$  kHz:  $< 3$

### Noise Sidebands



Noise sidebands normalized to 1 Hz RBW versus offset from carrier (typical)

### Impedance Measurement (Option 010)

**Measurement Parameters:**  $|Z|$ ,  $\theta_z$ ,  $|Y|$ ,  $\theta_y$ , R, X, G, B, Cp, Cs, Lp, Ls, Rp, Rs, D, Q,  $|\Gamma|$ ,  $\theta_\gamma$ ,  $\Gamma_x$ ,  $\Gamma_y$

**Frequency Range:** 100 kHz to 1.8 GHz

**Measurement Port:** APC-7 on the HP 43961A Test Kit

**Source Level at DUT:** -66 to +44 dBm

**DC Bias:**  $\pm 40$  V (20 mA maximum). (A 2 k $\Omega$   $\pm 5\%$  internal resistor is used for dc bias current limitation. An external dc bias source is required.)  
**Connector:** BNC (f) on HP 43961A.

**Calibration:** OPEN(0 S)/SHORT (0  $\Omega$ )/LOAD(50  $\Omega$ ) calibration, OPEN/SHORT/LOAD compensation on test fixtures, port extension compensation

**Accuracy (Supplemental Performance Characteristics):** 3% basic accuracy at 23°  $\pm$  5° C, after OPEN/SHORT/LOAD calibration

### General Characteristics

**Operating Temperature/Humidity:** 0° to 55° C, 15% < RH < 95%

**Storage Temperature:** -40° to -65° C

**Power Requirement:** 100/120/220/240 V  $\pm 10\%$ , 47 to 66 Hz, 500 VA max.

**Weight:** 27.2 kg (60 lb) typical

**Size:** 425 mm W x 235 mm H x 553 mm D

### Key Literature

HP 4396A 1.86 GHz Network/Spectrum Analyzer Data Sheet, p/n 5091-5189E

HP 4396A Option 010 Impedance Measurement Function and HP 43961A RF Test Kit, Product Overview, p/n 5962-7971E

### Ordering Information

	Price
<b>HP 4396A</b> RF Network/Spectrum Analyzer	\$30,000
<b>Opt 1C2</b> HP IBASIC	+\$975
<b>Opt 1D5</b> High-Stability Frequency Reference	+\$1,555
<b>Opt 1D6</b> Time-Gated Spectrum Analysis	+\$1,455
<b>Opt 1D7</b> 50 $\Omega$ to 75 $\Omega$ Spectrum Input Impedance Conversion	+\$800
<b>Opt 00M</b> RGB Output	+\$195
<b>Opt 010</b> Impedance Measurement Function (Requires HP 43961A)	+\$975
<b>HP 43961A</b> RF Impedance Test Kit (add test fixtures listed below)	\$2,805
<b>HP 16191A</b> Side Electrode SMD fixture (dc to 2 GHz)	\$2,475
<b>HP 16192A</b> Parallel Electrode SMD fixture (dc to 2 GHz)	\$1,980
<b>HP 16193A</b> Small Side Electrode SMD fixture (dc to 2 GHz)	\$2,225
<b>HP 16092A</b> Spring-Clip Fixture (dc to 500 MHz)	\$755