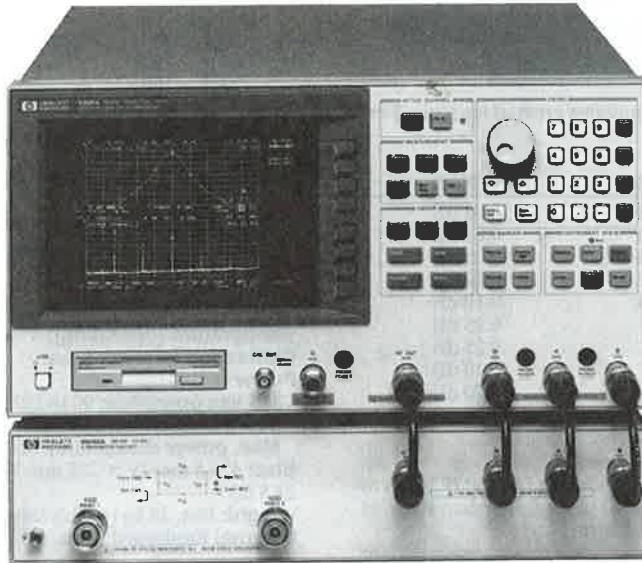


NETWORK/SPECTRUM ANALYZERS

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
- $\pm 0.05\text{dB}/\pm 0.3^\circ$ dynamic magnitude/phase accuracy
- Extremely fast narrow band spectrum measurement
- Impedance analysis option and test kit available
- $\pm 1.0\text{dB}$ 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 ± 0.05 dB and ± 0.3 deg 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 ± 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 narrow band 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 narrow band 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 μsec 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 $|Z|$, θ , 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 fixture. 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 341.

HP 4396A Specifications Summary

Network Measurement

Frequency Characteristics

Range: 100 kHz to 1.8 GHz

Resolution: 1 mHz

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

Output Characteristics

Power range: -60 to +20 dBm

Resolution: 0.1 dB

Level accuracy: ± 0.5 dB

Receiver Characteristics

Frequency range: 100 kHz to 1.8 GHz

Noise level: (10 Hz IFBW, ≥ 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	$< \pm 0.3$ dB
-10 to -70 dB	$< \pm 0.05$ dB
-80 dB	$< \pm 0.1$ dB
-90 dB	$< \pm 0.3$ dB
-100 dB	$< \pm 1.0$ dB
-110 dB	$< \pm 0.7$ dB typical
-120 dB	$< \pm 2.3$ 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	$< \pm 3$ deg
-10 dB	$< \pm 0.6$ deg
-20 to -70 dB	$< \pm 0.3$ deg
-80 dB	$< \pm 0.7$ deg
-90 dB	$< \pm 2.4$ deg
-100 dB	$< \pm 7$ deg
-110 dB	$< \pm 8$ deg typical
-120 dB	$< \pm 25$ 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(τ)	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: $< \pm 5.5$ ppm (Option 1D5: $< \pm 0.13$ ppm)

Resolution Bandwidth (RBW)

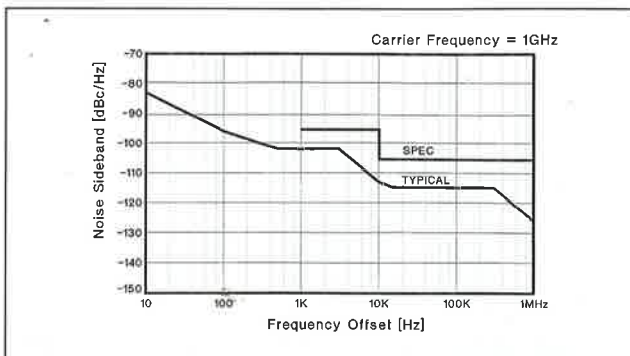
Range: 1 Hz to 3 MHz, 1-3-10 step

Selectivity (60 dB/3 dB):

RBW ≥ 10 kHz: < 10

RBW ≤ 3 kHz: < 3

Noise Sidebands



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

Impedance Measurement (Option 010)

Measurement Parameters: $|Z|$, θ_z , $|Y|$, θ_y , R, X, G, B, Cp, Cs, Lp, Ls, Rp, Rs, D, Q, $|\Gamma|$, θ_γ , Γ_x , Γ_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 +14 dBm

DC Bias: ± 40 V (20 mA maximum). (A 2 k Ω $\pm 5\%$ 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 Ω)/LOAD(50 Ω) calibration, OPEN/SHORT/LOAD compensation on test fixtures, port extension compensation

Accuracy (Supplemental Performance Characteristic): 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 \times 235 mm H \times 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
HP 4396A RF Network/Spectrum Analyzer	\$34,600
Opt 1C2 HP IBASIC	\$1,120
Opt 1D5 High Stability Frequency Reference	\$1,785
Opt 1D6 Time-Gated Spectrum Analysis	\$1,675
Opt 1D7 50 Ω to 75 Ω Spectrum Input Impedance Conversion	\$920
Opt 00M RGB Output	\$224
Opt 010 Impedance Measurement Function (Requires HP 43961A)	\$1,120
HP 43961A RF Impedance Test Kit (add test fixtures listed below)	\$2,805
HP 16191A Side Electrode SMD fixture (dc to 2 GHz)	\$2,475
HP 16192A Parallel Electrode SMD fixture (dc to 2 GHz)	\$1,980
HP 16193A Small Side Electrode SMD fixture (dc to 2 GHz)	\$2,225
HP 16092A Spring Clip fixture (dc to 500 MHz)	\$755