

NETWORK ANALYZERS

Audio/Video/Baseband/IF Network Analyzer, 5 Hz to 200 MHz

HP 3577B

- High-speed/high-accuracy measurements
- .001 dB, .005 degree, 1 ps, and .001 Hz resolution
- Discrete sweep and limit lines
- Optional HP Instrument BASIC



HP 3577B



HP 3577B Network Analyzer

The HP 3577B is a high-performance, yet economical, two-channel network analyzer for use in both research and development and manufacturing. It is used to measure magnitude/phase, insertion loss, group delay, SWR, electrical length, and gain compression from 5 Hz to 200 MHz. When used with the HP 35676A/B reflection/transmission kit, it can also measure return loss, reflection coefficient, and impedance.

An optional third channel is available for use with the HP 35677A/B s-parameter test set or for measuring two devices simultaneously. When used with the HP 35677A/B, the HP 3577B can measure all four s-parameters and any of the parameters listed above without having to manually alter the test configuration. The HP 35677A is used for 50 ohm systems and the HP 35677B is used for 75 ohm systems.

When equipped with optional HP Instrument BASIC, the HP 3577B can execute user-written programs designed to automate measurement systems, compute parameters (such as pass band ripple and 3 dB bandwidth) or customize the user-interface. This includes system control of other HP-IB instruments and peripherals, such as plotters and printers, via the HP-IB. A programmable I/O port, located on the rear panel, extends HP Instrument BASIC control to non-HP-IB devices, such as device handlers, environmental chambers, and even the device-under-test itself.

Of course, the HP 3577B is fully programmable, either internally with HP Instrument BASIC, or externally via the Hewlett-Packard Interface Bus (HP-IB).

An optional high-stability frequency reference oven is available for those users not having an in-house frequency standard.

Unprecedented Measurement Precision

This network analyzer has the accuracy and resolution required to characterize the most demanding narrowband devices and the flexibility to quickly characterize wideband devices. Dynamic magnitude and phase accuracy are 0.02 dB and 0.2 degree, respectively. Device response can be examined in fine detail with 0.001 dB, 0.005 degree, and 1 ps resolution. A built-in synthesized LO and tracking generator provide superb frequency accuracy with 0.001 Hz resolution. The 100 dB plus dynamic range and -130 dBm noise floor meet the needs of the most demanding measurements.

Built-in three-term error correction removes errors due to directivity, frequency response, and source mismatch for one-port measurements. Similarly, vector normalization enhances the accuracy of two-port measurements.

High-Throughput for Manufacturing

The HP 3577B brings high-throughput network analysis to manufacturing without compromising accuracy. Using discrete sweep, the sweep time is typically reduced by a factor of twenty when compared to a traditional linear sweep. Operators select from 2 to 51 frequency points for measurement. High-frequency resolution is used only in important regions of the device response; less important regions are measured with few points or skipped completely. Sweep time is further reduced by selecting the optimum resolution bandwidth and settling time for each frequency point.

Evaluation of test results is completed in a tenth of a second using the limit test feature. Any combination of upper and lower limits, with up to 20 operator-defined segments, is allowed. Test results are compared to the limits at the end of each sweep, and PASS/FAIL is indicated both on the display and on the FAIL line of programmable I/O port.

Optional HP Instrument BASIC completes the high-throughput picture by providing fast, error-free instrument/test system configuration and control of non-HP-IB devices, such as device handlers.

Specifications Summary

Source

Frequency

Range: 5 Hz to 200 MHz

Resolution: 0.001 Hz

Stability (Opt 1 only/instrument on \geq 48 hrs):

$\pm 5 \times 10^{-8}$ /day, 0 to 55° C

Amplitude

Range: +15 dBm to -49 dBm (1.26 Vrms to 793 μ Vrms: 2dBV to -62 dBV) into a 50 Ω load

Resolution: 0.1 dB

Accuracy: ± 1 dB at +15 dBm and 100 kHz. Below +15 dBm, add the greater of ± 0.02 dB/dB or 0.2 dB

Flatness: 1.5 dBp-p from 5 Hz to 200 MHz

Impedance: 50 Ω ; > 20 dB return loss at all levels

RF output connector: 50 Ω Type N female

Sweep types: Linear, discrete, alternate, cw and log frequency; log amplitude

Sweep time: 100 ms/span to 6553 sec/span for frequency sweep; 1 ms/step to 16 s/step for amplitude sweep.

Sweep modes: Continuous, single, manual

Trigger modes: Free run, immediate, line, external

Input Characteristics

Frequency range: 5 Hz to 200 MHz

Inputs: Two receiver inputs (A,R); third receiver input (B) is optional

Input impedance: Selectable 50 Ω with > 25 dB return loss, or 1 M Ω in parallel with approximately 30 pF.

Input connectors: 50 Ω Type N female.

Full scale input level: -13 dBV from 10 kHz to 200 MHz with internal 20 dB attenuators ON (0 dBm at 50 Ω).

Resolution bandwidth: Selectable 1 kHz, 100 Hz, 10 Hz, or 1 Hz.

Sensitivity (Due to noise and internal crosstalk between source and receiver inputs):

Resolution Bandwidth	30 kHz-200 MHz (50 Ω)	
	300 kHz-20 MHz (1 M Ω)	
	Internal 20 dB Attenuator ON	Internal 20 dB Attenuator OFF
10 Hz	-110 dBm	-130 dBm
100 Hz	-105 dBm	-125 dBm
1 kHz	-95 dBm	-115 dBm

Crosstalk > 100 dB isolation between inputs.
For 1 M Ω inputs, add 5 dB to table.

Magnitude characteristics

Range: Full scale input to sensitivity

Display units: dB, dBm, dBV, V, and linear ratio

Accuracy (at 100 kHz, 25° C, and full scale input)

Absolute (A, B, R): ± 0.2 dB

Ratio (A/R, B/R, A/B): ± 0.15 dB (50 Ω); ± 0.2 dB (1 M Ω)

Network Analyzers

Audio/Video/Baseband/IF Network Analyzer, 5 Hz to 200 MHz

HP 3577B, 35677A/B

287

Dynamic Accuracy

Error		Input Level Relative to Full Scale Input
Resolution Bandwidth		
1 kHz, 100 Hz, 10 Hz	1 Hz	
±.04 dB	±.04 dB	0 dB to -10 dB
±.02 dB	±.02 dB	-10 dB to -50 dB
±.05 dB	±.05 dB	-50 dB to -60 dB
±.15 dB	±.25 dB	-60 dB to -80 dB
±.75 dB	±.75 dB	-80 dB to -90 dB
±.75 dB	± 3.00 dB	-90 dB to -100 dB

Frequency response: (when driven from a 50 Ω source and with 50 Ω receiver input impedance)

Absolute (A,B,R): 0.3 dBpp from 20 Hz to 20 MHz; 0.6 dBpp from 5 Hz to 200 MHz.

Ratio (A/R, B/R, A/B): 0.3 dBpp from 20 Hz to 20 MHz; 0.4 dB from 5 Hz to 200 MHz.

Stability

Temperature: Typically $< \pm 0.02$ dB/°C

Time: Typically ± 0.05 dB/hour at 25° C

Phase characteristics (A/R, B/R, A/B)

Range: ± 180 degree

Accuracy: At 100 kHz, 25° C, and Full Scale Input: $\pm 2.0^\circ$

Dynamic Accuracy

Error	Input Level Relative to Full Scale Input
±.4 degree	0 dB to -10 dB
±.2 degree	-10 dB to -50 dB
±.5 degree	-50 dB to -60 dB
±1.5 degree	-60 dB to -80 dB
±7.5 degree	-80 dB to -100 dB

Temperature stability: Typically $< \pm 0.05$ degree/°C

Time stability: Typically $< \pm 0.05$ degree/hr at 25° C

Delay characteristics

Range: 1 ps to 20,000s

Resolution: 0.01 ns/div to 1000s/div

Normalized accuracy: $\frac{\text{Dynamic Phase Accuracy}}{360 \times \text{Aperture [Hz]}} + 2 \text{ ns}$

Aperture range: 0.5% to 16% of frequency span

Reference level: $\pm 10^3$ s

Limit test: Twenty segments for each trace per limit test. Delay between sweeps approximately 10 to 120 ms.

General Characteristics

Traces

Number of traces: Two simultaneous traces may be present with a rectangular graticule. One trace with polar or Smith graticules.

Markers: Each trace has one main marker and an offset marker.

Graticules

Rectangular graticule: 0% to 100% full scale deflection in 0.05% increments. Logarithmic and linear.

Polar/Smith chart graticule: ± 500 degree in 0.001 degree increments.

Limit test

Twenty segments for each trace per limit test. Delay between sweeps approximately 10 to 120 ms.

Noise averaging

Type: Exponentially weighted vector averaging on successive sweep data.

Averaging factor: Selectable 1 (off), 4, 8, 16, 32, 64, 128, 256.

Linear phase slope compensation: Provides linear phase slope offset of $-72,000$ degree/span to $+72,000$ degree/span.

Calibration

Transmission: Both traces can be normalized to measured data with full accuracy and resolution.

Reflection: Corrects for directivity, frequency response, and source match errors.

Programming

Remote programming: Via the Hewlett-Packard Interface Bus (HP-IB). The HP 35677A/B S-parameter test sets are programmable through the HP 3577A interface only.

Plotter control: Directly compatible with HP-IB graphics plotters that use Hewlett-Packard Graphics Language (HP-GL) with listen-only capability.

Save/recall: Front-panel setups can be stored in non-volatile memory locations 1 through 5. Last state is saved when power is removed.

Operating conditions

Temperature: 0° C to +55° C.

Relative humidity: $< 95\%$ at 40° C.

Altitude: $< 4,572$ m (15,000 ft).

Non-operating conditions

Temperature: -40° C to $+75^\circ$ C.

Altitude: $< 15,240$ m (50,000 ft).

Power: 115 V $\pm 10\%$, -25% (47 Hz to 440 Hz), or 230 V $\pm 10\%$, -15% (47 Hz to 66 Hz), 450 VA maximum.

Weight: 31 kg (67 lb) net; 41 kg (90 lb) shipping.

Size: 222 mm H \times 426 mm W \times 578 mm D (8.7 in \times 16.75 in \times 22.75 in).

HP 35677A/B S-Parameter Test Set

The HP 35677A/B test set is used to make transmission and reflection measurements in both the forward and reverse directions. The only setup required is to connect the device-under-test to the two measurement ports. Even reverse measurements can be made without changing device connections. The HP 35677A is used for 50-ohm systems and the HP 35677B is used for 75-ohm systems.

HP 35677A/B S-Parameter Test Set Specifications

Frequency range: 100 kHz to 200 MHz

Test port impedance

HP 35677A: 50 Ω; HP 35677B: 75 Ω

Directivity: > 40 dB

Frequency response

Transmission (S₂₁, S₁₂): ± 1 dB, ± 5 degrees

Reflection (S₁₁, S₂₂): ± 1 dB, ± 5 degrees

Port match

Test ports 1, 2: HP 35677A, > 26 dB; HP 35677B, > 24 dB

Test ports 1, 2 open/short ratio: HP 35677A, $< \pm 0.75$ dB magnitude and $< \pm 5$ degrees phase; HP 35677B, $< \pm 1$ dB magnitude and $< \pm 7.5$ degrees phase

Input port: > 20 dB return loss

Output ports A, B, and R: > 26 dB return loss

Test port isolation: > 100 dB

Connectors

Input port and output ports A, B, and R: 50 Ω Type N female. Test Ports 1 and 2: HP 35677A, 50 Ω Type N female; HP 35677B, 75 Ω Type N female.

dc bias inputs: BNC female, rear panel

dc bias range: Typically ± 30 Vdc and ± 20 mA with some degradation of RF specifications; 200 mA damage level.

Accessories Supplied

4 ea. 190-mm (7.5 in) 50 Ω cables with type N male connectors for connection to HP 3577B (HP 8120-4387)

1 ea. test set interconnect cable to HP 3577B (HP 35677-61620)

1 ea. rear-panel lock foot kit (HP 5061-0099).

1 ea. service manual (HP 35677-90010).