NETWORK ANALYZERS

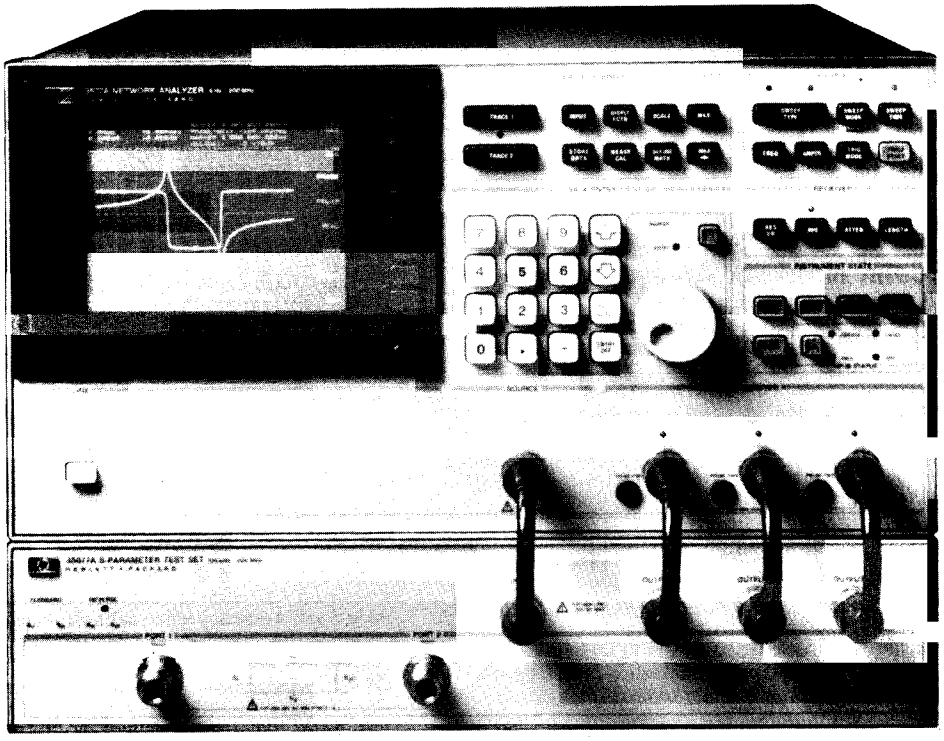
Audio/IF/RF Network Analyzer, 5Hz to 200MHz

Model 3577A

- 5 Hz to 200 MHz
- 100 dB dynamic range
- 0.001 Hz resolution
- ±0.02 dB dynamic accuracy
- Companion S-parameter test set
- Menu driven for operational simplicity
- Direct hard copy to plotter
- Internal calibration

HP-IB SYSTEMS

NEW



The HP 3577A Network Analyzer provides cost-effective, high performance network measurements from 5 Hz to 200 MHz for higher productivity in design and production. The companion HP 35677A/B S-Parameter Test Sets and full line of accessories ensure a complete measurement solution. Innovative analog and digital design are combined for superb accuracy, resolution and operational simplicity. Convenient soft-key selection of measurement functions allows you to quickly measure transfer functions, magnitude/phase, insertion loss/gain, attenuation, electrical length and gain compression. In addition, measurement of phase distortion parameters such as group delay and deviation from linear phase can be made with high resolution. With the HP 3577A's flexible receiver input impedances, you can measure in either 50-Ω or high impedance (1 MΩ) environments. Use the HP 35677A or HP 35677B S-Parameter Test Sets with the HP 3577A to make reflection measurements such as return loss, reflection coefficient and impedance in 50-Ω or 75-Ω systems, while simultaneously displaying transmission parameters.

Measurement Convenience

The built-in autoscale function puts the measurement on the screen quickly with a full scale display. Digital Display Markers with Marker –> Min or Max and Marker Offset capabilities provide accurate, high resolution read out of data points on a fully annotated dual trace display. Direct Digital Plot (using an HP graphics plotter without a computer) of displayed traces, graticule, annotation and marker data provides quick, cost-effective hard copy of measurement results. Nonvolatile Save/Recall Memory of five front panel instrument states is convenient for making rapid and repeatable measurements.

Measurement Versatility

User-Defined Vector Math functions operate on measured data, constants and functions to present measurement results in the form you need. Multiple Display Formats with electronic graticules provide accurate display in rectangular, polar or Smith chart coordinates. Frequency Sweep (Logarithmic, Linear or Alternate) and Amplitude Sweep capabilities meet measurement needs in a wide range of applications. Accessories such as S-Parameter Test Sets, Power Splitters, Minimum Loss Pad, Cables, Calibration Kits, Transistor Fixtures, Adapters, and Current and Voltage Probes ensure a complete solution to your measurement needs.

HP-IB Programmability

The full measurement capability of the HP 3577A is programmable over the Hewlett-Packard Interface Bus (HP-IB). Automatic measurements are easy with the HP 3577A's simple programming codes that minimize software development time. Quickly access a single point or an entire trace of 401 data points in either fast binary or ASCII modes. Customize the CRT display via the HP-IB using the built-in graphics display capability to draw test limit lines, operator instructions or connection diagrams.

Built-in Accuracy Enhancements

Normalization enhances measurement accuracy by removing frequency response and other errors quickly with the push of a button. Vector Error Corrections are used to remove the effects of directivity, frequency response and source match for high accuracy reflection measurements. Vector Noise Averaging of both magnitude and phase reduces noise, making high resolution group delay and accurate low level measurements easy.

3577A Specifications

Source
Frequency Range: 5 Hz to 200 MHz
Frequency Resolution: 0.001 Hz
Stability: $\pm 5 \times 10^{-8}$/day, 0 to 55° C
Level Range: +15 dBm to −49 dBm (1.26Vrms to 793 μVrms; 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, alternate, cw and log frequency; log amplitude
Sweep Time: 100 ms/span to 200 ms span for frequency sweep; 1ms/step to 16 s/step for amplitude sweep
Sweep Modes: Continuous, single, manual.
Trigger Modes: Free run, immediate, line, external.

Receiver
Input Characteristics
Frequency Range: 5 Hz to 200 MHz.
Inputs: Three receiver inputs (A, B and R).
Input Impedance: Selectable 50 Ω with >25 dB return loss, or 1 MΩ in parallel with approximately 30 pF.
Input Connectors: 50 Ω Type N female.
Resolution Bandwidth: Selectable 1 kHz, 100 Hz, 10 Hz, or 1 Hz
Sensitivity (Due to noise and internal crosstalk between source and receiver inputs):

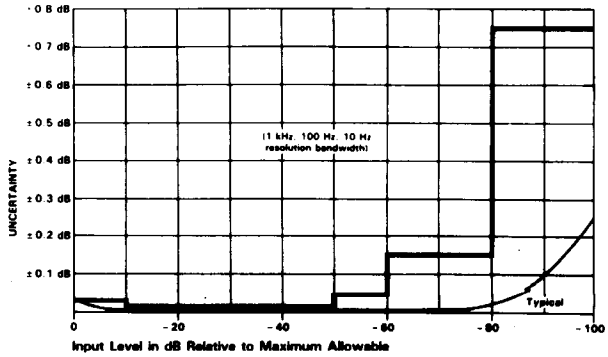
Resolution Bandwidth	Minimum Freq.	Minimum Freq. - 30 kHz		30 kHz - 200 MHz (50 Ω) 30 kHz - 20 MHz (1 MΩ)	
		Maximum Input Level		Maximum Input Level	
		0 dBm − 13 dBV (20 dB atten)	− 20 dBm − 33 dBV (0 dB atten)	0 dBm − 13 dBV (20 dB atten)	− 20 dBm − 33 dBV (0 dB atten)
1 Hz	100 Hz	− 110 dBm	− 130 dBm	− 110 dBm	− 130 dBm
10 Hz	100 Hz	− 100 dBm	− 120 dBm	− 110 dBm	− 130 dBm
100 Hz	500 Hz	− 90 dBm	− 110 dBm	− 105 dBm	− 125 dBm
1 kHz	5 kHz	− 80 dBm	− 100 dBm	− 95 dBm	− 115 dBm

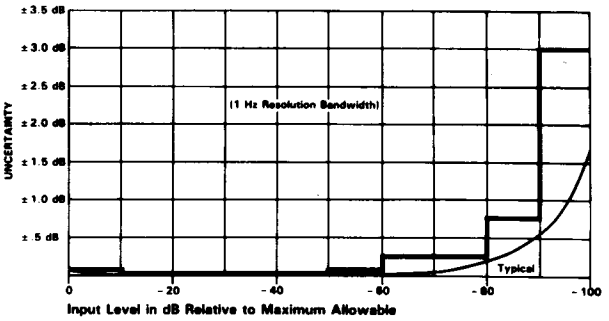
Crosstalk: >100dB isolation between inputs.
Electrical Length/Reference Plane Extension: Provides equivalent electrical line length, or delay at inputs A,B and R. Range: -3×10^8 m to $+3 \times 10^8$ m, or + 1 s to −1 s.
Resolution: 5 digits or 0.1 cm (3.3 ps) whichever is greater.
Accuracy: ±0.1 cm or ±0.02% whichever is greater.

Magnitude Characteristics
Range: Maximum Input Level to Sensitivity.
Resolution
Marker: 0.001 dB (log); 5 digits (linear).
Display: 0.01 dB/div to 20 dB/div (log absolute); 0.01 dB/div to 200 dB/div (log ratio); 0.1 nV/div to 10 V/div (linear absolute); 10^{-10}/div to 10^{20}/div (linear ratio).
Display Units: dB, dBm, dBV, V, and linear ratio.
Accuracy (at 100 kHz, 25°C, and Maximum Input Level)
Absolute (A,B,R): ±0.2 dB.
Ratio (A/R, B/R, A/B): ±0.15 dB (50 Ω); ±0.2 dB (1 MΩ).

Dynamic Accuracy:

Error: Resolution Bandwidth: 1 kHz, 100 Hz, 10 Hz	Error: Resolution Bandwidth: 1 Hz	Input Level Relative to Maximum Allowable
±.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[1] (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.

Reference Level
Range: −207 dBm to +33 dBm (−220 dBV to +20 dBV) (log absolute); −400 dB to +400 dB (log ratio); 0 V to 10 V (linear absolute); 0 to 10^{20} (linear ratio).
Resolution: 0.001 dB (log); 5 digits (linear).

Stability
Temperature: Typically <±0.02 dB/°C.
Time: Typically <±0.05 dB/hour at 25°C.

Phase Characteristics (A/R, B/R, A/B)
Range: ± 180 deg.
Resolution
Marker: 0.005 deg (0.0001 rad)
Display: 0.01 deg/div to 200 deg/div (0.00018 rad/div to 3.49 rad/div).
Accuracy (at 100 kHz, 25°C, and Maximum Input Level): ±2.0°.

NETWORK ANALYZERS

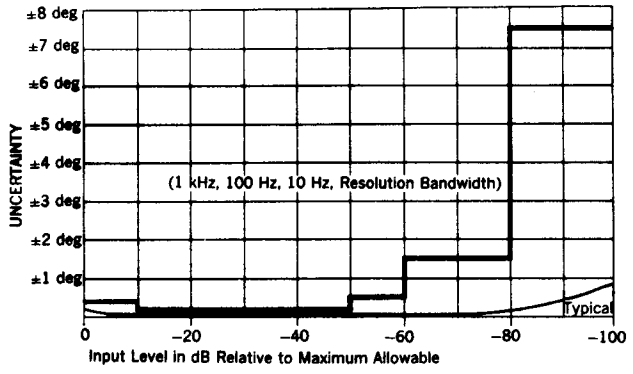
Audio/IF/RF Network Analyzer, S-Parameter Test Sets, Accessories

Model 3577A (Cont.), 35677 A/B, 35678 A/B, 35679 A/B

Dynamic Accuracy:

Error*	Input Level Relative to Maximum Allowable
± .4 deg	0 dB to −10 dB
± .2 deg	−10 dB to −50 dB
± .5 deg	−50 dB to −60 dB
± 1.5 deg	−60 dB to −80 dB
± 7.5 deg	−80 dB to −100 dB

*Specifications do not apply below −60 dB in a1 Hz Resolution Bandwidth



Resolution: 0.01°.
Stability
Temperature: Typically <±0.05 deg/°C.
Time: Typically <±0.05°/hour at 25°C.

Polar Characteristics

Range, Resolution, Display Units, Dynamic Accuracy, Frequency Response, Uncertainty, Crosstalk, Reference Level, and Stability specifications are the same as the corresponding magnitude and phase characteristics.

Full Scale Magnitude Range
Absolute (A,B,R): 0.1 nV to 10 V
Ratio (A/R, B/R, A/B): 10^{-10} to 10^{20}

Real Imaginary Characteristics

Range, Dynamic Accuracy, Frequency Response, Uncertainty, Crosstalk, Stability specifications are the same as the corresponding magnitude and phase characteristics.

Resolution
Marker: 5 digits
Display: 0.1 nV/div to 10 V/div for absolute; 10^{-10} to 10^{20} for ratio

Reference Level
Range: ± 10 V for absolute: $\pm 10^{20}$ for ratio
Resolution: 5 digits

Delay Characteristics
Normalized Accuracy:

$$\frac{\text{Dynamic Phase Accuracy}}{360 \times \text{Aperture [Hz]}} \pm 2\text{ns}$$

Reference Level
Range: $\pm 10^3$s.
Resolution: 5 digits.

Display Characteristics

Annotation: Start/stop, center/span or CW frequency, source level, scale/div, reference level, delay aperture, marker data, and soft key functions.
Graticules: Rectangular logarithmic and linear, polar, and Smith. All graticules are electronically generated.
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. Markers indicate data at corresponding trace coordinates in the same units as used to set the Reference Level. Markers can be used to modify certain display parameters. Marker resolution is the same as horizontal display resolution.

Reference Line Position
Rectangular Graticule: 0% to 100% full scale deflection in 0.05% increments.
Polar/Smith Chart Graticule: ±500 deg in 0.001 deg increments.
Data Storage: Measured data can be stored in vector format in non-volatile storage registers D1, D2, D3, D4. Stored data can be redisplayed later or operated on with Vector Math.
Vector Math: Input Magnitude and Phase Data, Stored Data, and User Defined Constants and Functions can be mathematically combined into expressions which define displayed or stored data. Mathematical operations are: add, subtract, multiply, and divide.

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.

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°/span to +72,000°/span.

Programming Characteristics

Capability: Remote programming is via the Hewlett-Packard Interface Bus (HP-IB). The HP 35677A/B S-Parameter Test Sets are programmable through the HP 3577A interface only.
Interface Functions: SH1, AH1, T5, TE0, L4, LE0, SR1, RL1, PP1, DC1, DT1, C0, E1. For more on these codes refer to the HP-IB section of this catalog.
Output Data Transfer Time: 401 data points (single parameter) can be transferred directly to an HP 200 series computer in Basic language as follows:
ASCII mode: Typically 1500 ms.
Binary floating point mode: Typically 160 ms.
Graphics Capabilities: 12 lines of text with 40 alphanumeric characters per line, and high resolution line vectors can be displayed through HP-IB commands.

General Characteristics

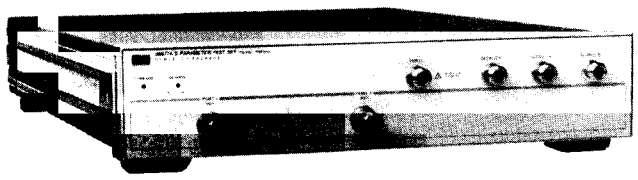
External Reference Frequency Input
Frequency: 10 MHz/N. N is an interger from 1 to 100.
Level: 0 dBm ± 10 dB, nominal.
Impedance: 50 Ω, nominal.
Connector: BNC female, rear panel.
Reference Frequency Output
Frequency: 10 MHz.
Level: Typically 0 dBm.
Impedance: 50 Ω, nominal.
Connector: BNC female, rear panel.
External Trigger: Triggers on negative TTL transition or contact closure to ground.
Connector: BNC female, rear panel.
Plotter Control: Directly compatible with HP-IB graphics plotters that use Hewlett-Packard Graphics Language (HP-GL) with listen only capability. HP 7470A, HP 7475A, HP 7550A, HP 7090A
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°C.
Altitude: <15,240 m (50,000 ft).
Power: 115V +10%, −25% (47 Hz to 440 Hz), or 230 V +10%, −15% (47 Hz to 66 Hz), 450 VA maximum.
Weight: 31 kg (67 lb) net; 41 kg (90 lb) shipping.
Dimensions: 222 mm H x 426 mm W x 578 mm D (8.75 in. x 16.75 in. x 22.75 in.).



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 (S_{21}, S_{12}): ±1 dB, ±5°.
Reflection (S11, S22): ± 1 dB, ± 5°.
Port Match
Test Ports 1, 2: HP 35677A, >26 dB; HP 35677B, >24 dB.
Test Ports 1, 2 open/short ratio: HP 35677A, < ±0.75 dB magnitude and < ±5 ° phase; HP 35677B, < ± 1 dB magnitude and < ± 7.5° phase.
Input Port: >20 dB return loss.
Output Ports A, B, and R: >26 dB return loss.
Test Port Isolation: > 100 dB.
Insertion Loss
RF Input to Test Port 1 or 2: HP 35677A, typically 13 dB; HP 35677B, typically 19 dB.
RF Input to Output Ports A, B, or R: HP 35677A, typically 19 dB; HP 35677B, typically 31 dB.

Test Port Reciprocity:

Transmission (S_{21}, S_{12}): typically < ±0.5 dB magnitude and < ±5 ° phase.
Reflection (S_{11}, S_{22}): Typically < ±0.5 dB magnitude and <±5 ° phase.
Incident Power Ratio (Test Port 1 to Test Port 2): Typically < ±1.5 dB.
RF Input Maximum Operating Level: +25 dBm or ± 30 Vdc.
RF Input Damage Level: +27 dBm or ±30 Vdc.
Port 1 or 2 Damage Level: +27 dBm or ±30 Vdc.
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 °radation 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 3577A (HP Part No. 8120-4387).
1 ea. Test Set interconnect cable to HP 3577A (HP Part No. 35677-61620).
1 ea. Rear Panel Lock Foot Kit (HP Part No. 5061-0099).
1 ea. Service Manual (HP Part No. 35677-90010).

Recommended Accessories

HP 35677A: HP 35678A 50 Ω Type N Calibration Kit; HP 35679A 50 Ω Type N Test Port Extension Cables.
HP 35677B: HP 35678B 75 Ω Type N Calibration Kit; HP 35679B 75 Ω Type N Test Port Extension Cables.
Programming: The HP 35677A/B are completely controlled through the HP 3577A using the HP 3577A interconnect cable. All programming is accomplished through the HP 3577A HP-IB interface.
Power: All power is obtained through the HP 3577A interconnect cable.
Weight: 6 kg (13 lb) net; 12 kg (12 lb) shipping.
Dimensions: 90 mm H x 426 mm W x 584 mm D (3.5 in. x 16.75 in. x 22.75 in.). Add 1⅛ inch to depth to include front panel connectors.

Accessories

HP 35678A/B Calibration Kits
The HP 35678A and HP 35678B are used with the HP 35677A/B to make vector error corrections for high accuracy reflection measurements in 50 Ω Type N and 75 Ω Type N connector systems, respectively. These standards and adapters are supplied with a convenient storage case.

HP 35679A/B Test Port Extension Cables

The HP 35679A and HP 35679B are used to extend test ports for measurement of devices having any two port geometry in either 50 or 75 Ω systems. The HP 35679A is used with the HP 35677A, HP 11850A/B and the HP 11667A. The HP 35679B is used with the HP 35677B. The HP 3577A is also compatible with most oscilloscope probes, the HP 1120 active probe, HP 11667A and HP 11850A/B power splitters, HP 11852A minimum loss pad, and the HP 11853A, HP 11854A, HP 11855A and HP 11856A accessory kits.

Ordering Information	Price
HP 3577A Network Analyzer	$23,500
Option 907: Front handle kit	add $ 75
Option 908: Rack mount kit	add $ 40
Option 909: Rack mount and front handle kit	add $100
Option 910: Extra operating and service manuals	add $240
Service Accessory Kit	$250
HP 35677A S-Parameter test set (50 Ω)	$ 3,500
HP 35677B S-Parameter test set (75 Ω)	$ 3,500
Option 907 front handle kit	add $ 49
Option 908 rack mount kit	add $ 25
Option 909 rack mount and front handle kit	add $ 60
Option 910 extra service manual	add $ 45
HP 35678A 50 Ω calibration kit	$750
HP 35678B 75 Ω calibration kit	$1,400
HP 35679A 50 Ω type N test port extension cables	$500
HP 35679B 75 Ω type N test port extension cables	$1,650