

NETWORK ANALYZERS

RF Network Analyzer, 300 kHz to 3 GHz

Model 8753A

623



- 300 kHz to 3 GHz
- Integrated 1 Hz resolution synthesized source
- Direct save/recall to an external disc drive
- Time domain analysis

- 100 dB of dynamic range
- Group delay and deviation from linear phase
- 0.001 dB, 0.01 deg, 0.01 nanosecond marker resolution
- Built-in accuracy enhancement



HP 8753A



Description

The HP 8753A provides excellent RF network measurements for the lab and production test areas. When combined with a test set, it yields a complete solution for characterizing the linear behavior of either active or passive networks, devices, or components from 300 kHz to 3 GHz. With two independent display channels available, you can simultaneously measure and display the reflection and transmission characteristics of the device under test. The easy-to-use soft-key selection of measurement functions allows you to quickly measure the magnitude, the phase, or group delay characteristics of your device under test. Directly measure the electrical length of a single device or phase match multiple devices. Data can be displayed in log magnitude, linear magnitude, SWR, phase, group delay, polar, real, or Smith Chart formats. The two independent display channels can be viewed separately or simultaneously in overlay or split screen formats.

The HP 8753A's integrated synthesized source provides >100 mw of output power, 1 Hz frequency resolution, and linear or logarithmic frequency sweeps.

All of the functions of the HP 8753A are completely programmable from an external computer through the Hewlett-Packard Interface Bus. Draw/label custom graphics onto the CRT of the HP 8753A using Hewlett-Packard Graphics Language commands. The entire CRT display - including the custom graphics - can be copied to a compatible HP-GL plotter or printer.

Excellent Performance

Digital signal processing allows the HP 8753A to measure signals over a wide 100 dB of dynamic range over the entire 300 kHz to 3 GHz frequency range. The tuned receiver yields a spurious free minimum sensitivity of -100 dBm. The HP 8753A also provides marker resolutions of 0.001 dB, 0.01 degree, and 0.01 nanoseconds. The IF processing and detection system contribute as little as ± 0.05 dB and ± 0.5 degree of dynamic accuracy uncertainty over a 50 dB measurement range.

Accuracy enhancement provides a means of reducing systematic residual errors (directivity, mismatch, frequency response, etc.) for the best measurement accuracy. By characterizing these systematic errors through the measurement of known standards, their effect on actual measurements can be minimized. Various levels of accuracy enhancement are possible—from a simple frequency response calibration to a full two-port calibration. Residual directivity can be improved to >50 dB, residual source and load match to >40 dB, and residual frequency response to <0.05 dB.

Hewlett-Packard supplies kits of measurement calibration standards for precision 7 mm, precision 3.5 mm, 50 Ω type N, and 75 Ω type N connector interfaces. The HP 8753A also provides the capability of measuring devices in other coaxial interfaces, given the proper calibration standards.

Outstanding Measurement Productivity

The HP 8753A provides the capability of substantially increasing measurement productivity. Reduce test times in high volume applications by defining test limits and letting the HP 8753A make the pass/fail decision when testing your devices. Limit lines can be completely defined from the front panel of the network analyzer and limit test conditions (pass or fail) are displayed on the CRT or can be determined over the HP-IB or from an accessible TTL output.

In addition, you can test your devices at only those frequencies at which you need data. Customize measurements by defining up to 30 different arbitrary CW frequencies or frequency sweep segments from the front panel of the network analyzer. Measured data can be displayed in either a swept format or listed on the CRT for easy viewing.

A full set of marker functions provide you with measurement information during your device adjustment cycle. Search for and track the maximum, the minimum, or a defined target value of the trace data. Directly measure and display a filter's center frequency, bandwidth, and Q through the use of a bandwidth function and internal processing.



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Obtain annotated hardcopies of measured data quickly on compatible Hewlett-Packard Graphics Language plotters and printers without the use of external computers. Save and recall instrument configurations including limit lines, frequency lists, and calibration data in internal memory or directly to a compatible external disc drive providing you with a quick return of your instrument state to previously defined measurement configurations.

Time Domain Analysis

The HP 8753A (with Option 010) has the capability of displaying the time domain response of a network, obtained by computing the Inverse Fourier Transform of the frequency domain response. The time domain response displays the reflection coefficient versus time, yielding the magnitude and location of each individual discontinuity of the network. It can also display the transmission coefficient versus time, yielding simulated transient response analysis of the network.

The HP 8753A offers two time domain modes. The Low Pass mode provides the traditional Time Domain Reflectometer (TDR) measurement capability and gives the response of the network to a (mathematically-simulated) step or impulse response. This mode gives information of the type of impedance (R, L, C) present at the discontinuity. The Band Pass time domain mode, which has only the impulse stimulus, may be used over any frequency range to give the time domain response of frequency selective devices such as SAW filters or antennas.

Gating is another powerful time domain feature that may be used to selectively isolate a single response in time and then convert just that response back to the frequency domain. For reflection measurements, this provides the capability to view the return loss of individual portions of a high frequency component without disturbing the actual circuit. For transmission measurements, one can view the frequency and time domain responses of individual transmission paths.

The HP 8753A time domain capability can give great insight into the design of high frequency components. Simulated linear impulse analysis can provide useful information such as the step response of a linear amplifier or the multiple spurious signal paths associated with SAW devices. Another useful application is coax cable fault location. Locate the position and magnitude of a single fault to within mm's and resolve multiple responses to within cm's. Gating can be used in a variety of applications such as removing the effects of multi-path and ground clutter in antenna measurements.

HP 8753A Specifications Summary

Source

Frequency Characteristics

Frequency Range: 300 kHz to 3 GHz

Frequency Resolution: 1 Hz

Frequency Accuracy (25 C): ± 10 ppm

Output Characteristics

Power Range: -5 to +20 dBm

Power Accuracy (50 MHz, +10 dBm): ± 0.5 dB

Power Linearity (relative to +10 dBm, 25 ± 5 C):

-5 to +15 dBm: ± 0.2 dB

+15 to +20 dBm: ± 0.5 dB

Impedance: 50

Harmonics: ≤ -25 dBc (20 dBm output level)

typically ≤ -50 dBc (0 dBm output level)

Nonharmonics:

Mixer Related: ≤ -32 dBc (20 dBm output level)

typically ≤ -55 dBc (0 dBm output level)

Other Spurious:

$f < 135$ MHz: -60 dBc

$f \geq 135$ MHz: -60 dBc + $20 \cdot \log(f/135 \text{ MHz})$

Phase Noise (0 kHz offset in 1 Hz BW):

$f < 135$ MHz: -90 dBc

$f \geq 135$ MHz: -90 dBc + $20 \cdot \log(f/135 \text{ MHz})$

Receiver

Frequency Range: 300 kHz to 3 GHz

Inputs: A, B 100 dB dynamic range

Sensitivity (noise level):

3 kHz BW: -90 dBm

10 Hz BW: -100 dBm (typically -110 dBm)

Maximum Input Level: 0 dBm

Impedance: 50

Input Crosstalk:

300 kHz to 1 GHz: -100 dB

1 GHz to 3 GHz: -90 dB

Dynamic Accuracy: ± 0.05 dB, ± 0.5 deg over a 50 dB input range

Delay Characteristics:

Range: $1/2^*$ (1/minimum aperture)

Aperture: selectable (frequency span)/(# points - 1) to 20% of the frequency span

Resolution: 27.8/(aperture in Hz)

typically 0.01 nanoseconds

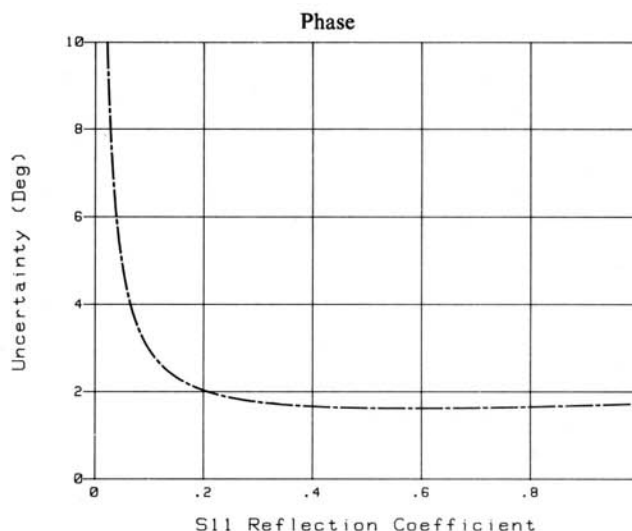
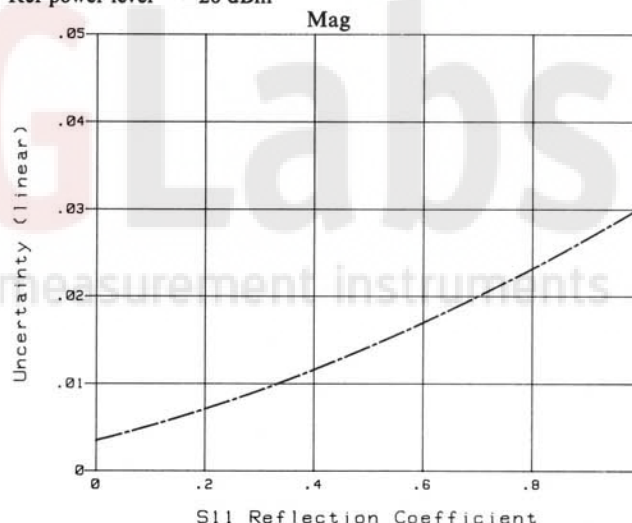
Accuracy: (phase accuracy)/(360*aperture in Hz)

Measurement Uncertainty

The following curves show the typical measurement uncertainty for devices with 7 mm connectors when using the HP 8753A with the HP 85046A s-parameter test set after full Accuracy Enhancement. The measurement uncertainty curves utilize an RSS model for the contribution of random errors such as noise and connector repeatability, and a worse case model for the contribution of dynamic accuracy and residual systematic errors.

Typical Reflection Uncertainty of One-Port Device

Ref power level = -20 dBm



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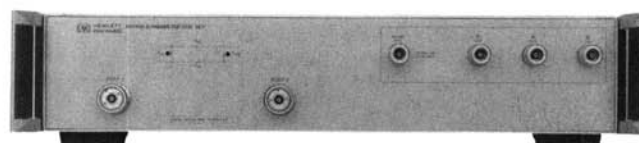
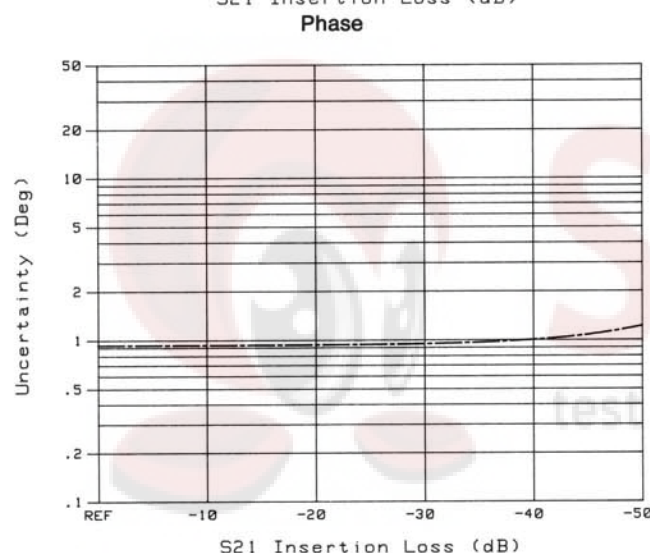
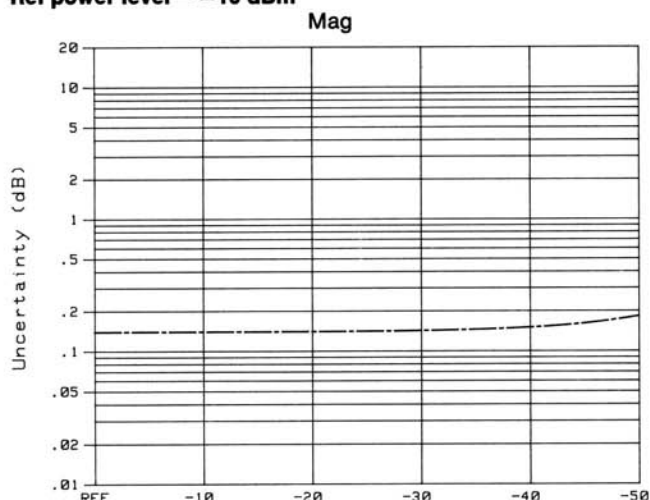
Accessories

8753A Series

625



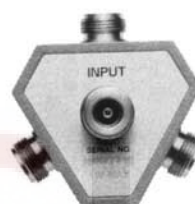
Typical Transmission Uncertainty of a Low Loss Device Ref power level = -10 dBm



HP 85046A



HP 85044A



HP 11850C



HP 11851B



HP 11857D



HP 11852B

HP 8753A Accessories

HP 85044A 50 Ohm Transmission/Reflection Test Set HP 85044B 75 Ohm Transmission/Reflection Test Set

The HP 85044 A/B Transmission/Reflection test sets provide the capability to simultaneously measure the impedance and transmission characteristics of 50 and 75 ohm devices. Two-port devices must be physically turned around to measure their reverse direction characteristics. Test port connectors are precision 7 mm and 75 ohm type N (f), respectively.

Specifications	HP 85044A	HP 85044B
Impedance:	50 ohms	75 ohms
Frequency Range:	300 kHz to 3 GHz	300 kHz to 2 GHz
Directivity:	35 dB to 1.3 GHz 30 dB to 3.0 GHz	35 dB to 1.3 GHz 30 dB to 2.0 GHz

Typical Tracking:

Transmission Magnitude, Phase¹:

.3 MHz to 2.0 MHz	±1.5 dB, ±10°	±1.5 dB, ±10°
2.0 MHz to F _{max} ²	±1.5 dB, ±10°	±1.5 dB, ±10°

Reflection Magnitude, Phase¹:

.3 MHz to 2.0 MHz	±1.5 dB, ±25°	±1.0 dB, ±25°
2.0 MHz to F _{max}	±1.5 dB, ±10°	±1.0 dB, ±10°

Effective Source Match:

(Test Ports):

.3 MHz to 2.0 MHz	14 dB	14 dB
2.0 MHz to 1.3 GHz	20 dB	17 dB
1.3 GHz to F _{max}	16 dB	16 dB

Port Match:

Incident and Refl:	HP 85044A	HP 85046A
.3 MHz to 1.3 GHz	18 dB	18 dB
1.3 GHz to F _{max}	13 dB	13 dB

RF Input:

.3 MHz to 1.3 GHz	17 dB	17 dB
1.3 GHz to F _{max}	12 dB	12 dB

RF Connectors:

Test Port:

All others:

Includes:

precision 7 mm 75 ohm type N (f)
50 ohm type N (f) 50 ohm type N (f)
HP 85044A—one precision 7 mm to
50 ohm type N (f) adapter;
HP 85044B—one HP 11852B
minimum loss pad.

Recommended

Accessories:

Dimensions:

Weight:

HP 11851B RF cable kit
615H x 101 W x 204 mm D
(2.44 x 7.5 x 8.0 in)
net 1.7 kg (3.8 lb)

¹Degrees, specified as deviation from linear phase.
²F_{max} is the upper frequency limit of the associated test set.



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Accessories (con't.)

8753A Series

HP 85046A/B S-Parameter Test Set

The HP 85046A/B s-parameter test sets provide the capability to measure impedance and transmission characteristics (including s-parameters) of 2 port devices in either direction with a single connection. The test sets are controlled from the HP 8753A and include a programmable step attenuator. Test port connectors are precision 7 mm and 75 ohm type N (f) respectively. Both connectors can be adapted to other interfaces with the appropriate precision adapters.

Specifications

	HP 85046A	HP 85046B
Impedance:	50 ohms	75 ohms
Frequency Range:	300 kHz to 3 GHz	300 kHz to 2 GHz
Directivity:	35 dB to 1.3 GHz 30 dB to 3.0 GHz	35 dB to 1.3 GHz 30 dB to 2.0 GHz

Typical Tracking:

Transmission Magnitude, Phase¹:

.3 MHz to 2.0 MHz	±1.5 dB, ±20°	±1.5 dB, ±20°
2.0 MHz to F _{max} ²	±1.5 dB, ±10°	±1.5 dB, ±10°

Reflection Magnitude, Phase¹:

.3 MHz to 2.0 MHz	±1.5 dB, ±25°	±1.5 dB, ±25°
2.0 MHz to F _{max}	±1.5 dB, ±10°	±1.5 dB, ±10°

Effective Source Match:

(Test Ports):

.3 MHz to 2.0 MHz	14 dB	14 dB
2.0 MHz to 1.3 GHz	20 dB	17 dB
1.3 GHz to F _{max}	16 dB	16 dB

Port Match:

R, A, B:

.3 MHz to 1.3 GHz	18 dB	18 dB
1.3 GHz to F _{max}	13 dB	13 dB

RF Input:

.3 MHz to 1.3 GHz	17 dB	17 dB
1.3 GHz to F _{max}	12 dB	12 dB

RF Connectors:

Port 1, 2:

precision 7 mm 75 ohm type N (f)

All others:

50 ohm type N (f)

Includes:

Four 190 mm (7.5") cables with type N (m) connectors for connection to the HP 8753A. One HP 8753A test set interconnect cable.

Recommended

Accessories:

HP 11857D cables HP 11857B cables

Dimensions:

90 H x 426 W x 553 mm D
(3.5 x 16.75 x 21.5 in.)

Weight:

9.1 kg (20 lb)

¹Degrees, specified as deviation from linear phase.

²F_{max} is the upper frequency limit of the associated test set.

HP 11850C/D Three-Way Power Splitters

Specifications

	HP 11850C	HP 11850D
Impedance:	50 ohms	75 ohms
Frequency Range:	DC to 3 GHz	DC to 2 GHz
Tracking:	±.25 dB, +3°	±.2 dB, ±2.5°
Equivalent Source Match (ratio or leveling)	30 dB @ 1.3 GHz 20 dB @ 3 GHz	30 dB @ 1.3 GHz 20 dB @ 3 GHz
Nominal Insertion Loss:	9.5 dB +1 dB/GHz	7.8 dB

Input Port Match:

DC to 1.3 GHz	20 dB	20 dB
1.3 GHz to F _{max} ¹	10 dB	10 dB

Maximum Operating

Level:

+20 dBm +20 dBm

Damage Level:

+30 dBm +30 dBm

RF Connectors:

RF Input:

50 ohm type N (f) 50 ohm type N (f)

All Others:

50 ohm type N (f)

Includes:

3 ea HP 11852B
50 to 75 ohm
min. loss pads

Recommended

HP 11851B RF Cable Kit

Accessories:

¹F_{max} is the upper frequency limit of the associated power splitter.

HP 11851B RF Cable Kit

General: three 610 mm (24 in.) 50 Ω cables phase matched to 4° at 1.3 GHz and one cable 860 mm (34 in.). Connectors are Type N Male. Recommended for use with HP 85044A/B Transmission/Reflection Test Set and HP 11850C/D Power Splitter.

Weight: net, 0.91 kg (2 lb); shipping, 1.36 kg (3 lb).

HP 11852B 50 Ω/75 Ω Minimum Loss Pad

General: the HP 11852B is a low SWR minimum loss pad required for transmission measurements on 75 Ω devices with HP 8753A receiver (50 Ω).

Frequency range: dc to 2.0 GHz.

Insertion loss: 5.7 dB.

Return loss: 75 Ω typically ≥30 dB. 50 Ω typically ≥26 dB.

Maximum input power: 250 mW (+24 dBm).

Connectors: 50 Ω Type N female and 75 Ω Type N male.

Size: 14 D x 70 mm L (0.56" x 2.75").

Weight: net, 0.11 kg (4 oz); shipping, 0.26 kg (9 oz).

HP 11853A 50 Ω Type N Accessory Kit

General: the HP 11853A furnishes the RF components required for measurement of devices with 50Ω Type N Connectors using the HP 11850C, 85044A, or 85046A. Kit contains a Type N Female short, a Type N Male short, two Type N Male barrels, two Type N Female barrels and storage case.

Weight: net, 0.91 kg (2 lb); shipping, 1.36 kg (3 lb).

HP 11854A 50 Ω BNC Accessory Kit

General: the HP 11854A furnishes the RF components required for measurement of devices with 50Ω BNC Connectors using the HP 11850C, 85044A, or 85046A. Kit contains two Type N Male to BNC Female adapters, two Type N Male to BNC Male adapters, two Type N Female to BNC Female adapters, two Type N Female to BNC Male adapters, a BNC Male short and storage case.

Weight: net, 1.13 kg (2½ lb).

HP 11855A 75 Ω Type N Accessory Kit

General: the HP 11855A provides the RF connecting hardware generally required for measurement of devices with 75 Ω Type N connectors using the HP 85044B, 85046B or 11850D. Kit contains two 75 Ω Type N Male barrels, two Type N Female barrels, a 75 Ω Type N Female short, a 75 Ω Type N Male short, a 75 Ω Type N Male termination, and storage case.

Weight: net, 0.91 kg (2 lb); shipping, 1.36 kg (3 lb).

HP 11856A 75 Ω BNC Accessory Kit

General: the HP 11856A provides the RF connecting hardware generally required for measurement of devices with 75 Ω BNC connectors using the HP 85044B, 11850D, or 85046B. Kit contains two Type N Male to BNC Female adapters, two Type N Male to BNC Male adapters, two Type N Female to BNC Female adapters, two Type N Female to BNC Male adapters, a BNC Male short, a 75 Ω BNC Male termination, and storage case.

Weight: net, 0.91 kg (2 lb); shipping, 1.36 kg (3 lb).



HP 85031B



HP 85032B



HP 85033C



HP 85036B

HP 11857D 50 Ω APC-7 Test Port Extension Cables

General: two precision 61 cm (24 in.) cables, phase matched to 2° at 1.3 GHz for use with HP 85046 A S-parameter test set. Connectors are 50 Ω APC-7.

Weight: net, 0.91 kg (2 lb); shipping, 2.3 kg (5 lb).

HP 11857B 75 Ω Type N Test Port Extension Cables

General: two precision 61 cm (24 in.) cables, phase matched to 2° at 1.3 GHz for use with HP 85046B S-parameter test set. One cable has 75 Ω Type N Male connectors on both ends; the other has one Type N Male and one Type N Female connector.

Weight: net, 0.91 kg (2 lb); shipping, 2.3 kg (5 lb).

HP 11858A Transistor Fixture Adapter

General: the HP 11858A adapts the HP 11600B and 11602B transistor fixtures (vertical test port configuration) to the HP 85046A S-parameter test set. Connectors are APC-7.

Weight: net, 0.91 kg (2 lb); shipping, 1.36 kg (3 lb).

Calibration Kits

Accuracy enhancement procedures characterize the systematic errors of the measurement system by measuring known devices (standards) on the system over the frequency range of interest. The calibration kits in the HP 8753A family contain precision standards with which to characterize the systematic errors of a HP 8753A measurement system. These standards have been optimized for the 300 kHz to 3 GHz frequency range and are available in various connector types that are compatible with the HP 8753A.

HP 85031B 7 mm Calibration Kit

The HP 85031B 7 mm calibration kit contains a set of precision 7 mm fixed terminations, an open circuit, and a short circuit used to calibrate the HP 8753A and its 50 ohm test sets for measurement of devices with precision 7 mm connectors.

HP 85032B 50 Ω Type N Calibration Kit

The HP 85032B Calibration Kit contains precision 50 Ω type N standards used to calibrate the HP 8753A and its 50 Ω test sets for measurement of devices with 50 Ω type N connectors. Precision phase-matched 7 mm to 50 Ω type N adapters are included for accurate measurements of non-insertable devices. Standards include fixed terminations, open circuits, and short circuits.

HP 85033C 3.5 mm Calibration Kit

The HP 85033C Calibration Kit contains precision 3.5 mm standards used to calibrate the HP 8753A and its 50 Ω test sets for measurement of devices with 3.5 mm and SMA connectors. Standards include fixed terminations, open circuits, and short circuits. Precision 7 mm to 3.5 mm adapters are included for accurate measurements of non-insertable devices.

HP 85036B 75 Ω type N Calibration Kit

The HP 85036B Calibration Kit contains precision 75 Ω type N standards used to calibrate the HP 8753A and its 75 Ω test sets for measurement of devices with 75 Ω type N connectors. Standards include fixed terminations, open circuits, and short circuits. Precision phase-matched adapters are included for accurate measurements of non-insertable devices.

Verification Kits

Measuring known devices, other than the calibration standards, is a convenient way of verifying that the HP 8753A measurement system is operating properly.

HP 85029A 7 mm Verification Kit

The HP 85029A Verification Kit contains a set of precision 7 mm devices, with data traceable to NBS, used to verify the calibrated performance of an HP 8753A measurement system. The devices have precision 7 mm connectors and include a 20 dB pad, a 50 dB pad and a mismatch attenuator. Verification process requires only an HP 85031B calibration kit, an HP 85029A verification kits and an external 3.5" disc (HP 9122S or HP 9122D) connected to the HP 8753A.

HP 85043B

The HP 85043B systems cabinet has been ergonomically designed specifically for the HP 8753A and the HP 85046A/B s-parameter test sets. The 122 cm (48-inch) system cabinet includes a bookcase, a drawer, and a convenient work surface.



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Accessories (con't.)

8753A Series

Service and Support Products

Service and support products are available for HP 8753A measurement systems. These on-site support products require a specific 50 ohm two-port measurement configuration.¹ Additional on-site support products and return-to-HP support products are available for this and other system configurations. Contact your local HP sales office for availability and price.

HP 8753A System On-Site Service

+23N Support Product

On-Site Installation and System Verification

Have your HP 8753A system¹ installed and certified NBS traceable by a qualified HP Customer Engineer at your location.

+02B Support Product

On-Site Service and System Verification

A qualified HP Customer Engineer will provide next day on-site response service for your HP 8753A system.¹ Two PM's and two system verifications (certified NBS traceable) are included. Option W03 for each product in the system¹ must be specified for this service.

+23G Support Product

On-Site System Verification

A qualified HP Customer Engineer will verify your HP 8753A system¹ operation and will provide you with a "Certificate of Traceability" with data traceable to NBS.

Option W03 On-Site Warranty

Converts the standard one-year return-to-HP warranty of the system¹ component to 90 days of on-site warranty. On-site service is available only on the specific 50 ohm two-port measurement system,¹ thus to convert warranty, each system component must be ordered with Option W03.

HP 8753A Return-to-HP Service

HP 8753A Option W30 3-Year Extended Return-to-HP Support

Adds two additional years of return-to-HP support to your normal one year return-to-HP warranty for the HP 8753A network analyzer (does not include test sets, cables, or calibration kits). Return-to-HP support does not include annual maintenance or calibrations of the network analyzer.

¹The specific 50 ohm two-port measurement system includes the HP 8753A, the HP 85046A S-parameter test set, the HP 85031B 7 mm calibration kit, and the HP 11857D 7 mm test port extension cable set. This is a minimum configuration required for on-site verification.

Ordering Information

	Price
HP 8753A Network Analyzer	\$23,500
Option 010 Time Domain	\$4,500
Option 908 Rack Mounting Kit (without handles)	\$40
Option 910 Extra Manuals	\$75
Option 913 Rack Mounting Kit	\$40
Option W03 On-Site Warranty Conversion	\$0
Option W30 Three-Year Extended Return-to-HP Support	\$600
HP 85046A 50Ω S-Parameter Test Set	\$7,000
Option 908 Rack Mounting Kit (without handles)	\$40
Option 913 Rack Mounting Kit	\$40
Option W03 On-Site Warranty Conversion	\$0
Option W30 Three-Year Extended Return-to-HP Support	\$250
HP 85046B 75Ω S-Parameter Test Set	\$7,500
Option 908 Rack Mounting Kit (without handles)	\$40
Option 913 Rack Mounting Kit	\$40
Option W30 Three-Year Extended Return-to-HP Support	\$250
HP 85044A 50Ω Transmission/Reflection Test Set	\$3,000
Option W30 Three-Year Extended Return-to-HP Support	\$60
HP 85044B 75Ω Transmission/Reflection Test Set	\$3,500
Option W30 Three-Year Extended Return-to-HP Support	\$60
HP 85029A Precision 7 mm Verification Kit	\$1,500
HP 85031B Precision 7 mm Calibration Kit	\$1,000
HP 85032B 50Ω type N Calibration Kit	\$1,500
HP 85033C Precision 3.5 mm Calibration Kit	\$2,500
HP 85036B 75Ω type N Calibration Kit	\$1,650
HP 85043B Systems Rack	\$2,300
HP 85033A SMA Kit	\$755
HP 11850C 50Ω Power Splitter	\$900
HP 11850D 75Ω Power Splitter	\$1,400
HP 11851B type N RF Cable Kit	\$800
HP 11852B 50 to 75Ω Minimum Loss Pad	\$250
HP 11853A 50Ω type N Accessory Kit	\$305
HP 11854A 50Ω BNC Accessory Kit	\$265
HP 11855A 75Ω type N Accessory Kit	\$305
HP 11856A 75Ω BNC Accessory Kit	\$365
HP 11857B 75Ω type N Test Port Extension Cables	\$1,455
HP 11857D 50Ω APC-7 Test Port Extension Cables	\$1,050
HP 11858A Transistor Fixture Adapter	\$980