

**HP 8510C
Network Analyzer
45 MHz to 110 GHz**



Unmatched excellence in
microwave network analysis

Excellence in network analysis with unmatched RF performance . . .

The HP 8510C Microwave Network Analyzer is the premier network analyzer system for magnitude, phase and group delay measurements from 45 MHz to 110 GHz. The HP 8510C is the continuation of a 25-year evolution in microwave network analyzer technology, delivering exceptional performance and capability while still being economical and easy-to-use.

The outstanding versatility of the HP 8510C Network Analyzer easily adapts to different measurement requirements without compromising performance. Just choose the appropriate system components to match the unique needs of your particular application. Broadband systems can be configured to 50 GHz in coax (extendable to 62.5 GHz for single connection, on-wafer banded measurements) and to 110 GHz in waveguide.



Have greater confidence in your designs and increase production throughput with the HP 8510C family of products.

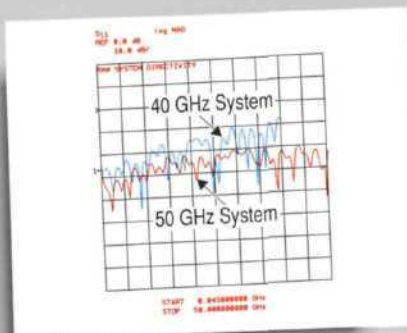
High dynamic range

With the HP 8517A test set, 10 dB more dynamic range is available to 50 GHz than is available above 40 GHz from any other network analyzer system. High test port output power and sensitivity directly affect both the accuracy and speed of your measurements. The high dynamic range coupled with the better raw directivity of the HP 8517A gives you new confidence in measurements to 50 GHz.

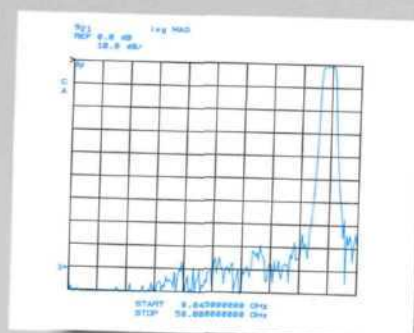
The superior performance of HP 8510C network analyzer systems can make you more competitive in today's demanding marketplace. Previously, the HP 8515A 26.5 GHz S-parameter test set defined the ultimate in high performance measurements. Now with the addition of the HP 8517A 50 GHz coaxial test set, the bandwidth of performance excellence has been doubled. You get both high performance and broadband frequency coverage with the HP 8510C 50 GHz network analyzer system.

Outstanding raw performance

The basis for this exceptional performance is the raw (or uncorrected) test port characteristics of Hewlett-Packard test sets. The intrinsic characteristics of the test set prior to calibration determine the improvement in overall calibration accuracy and longevity that can be achieved. The HP 8517A test set has an unprecedented 20 dB of raw directivity and 10 dB of raw source match to 50 GHz. In a typical lab environment, a 50 GHz calibration will remain valid for days, saving you valuable set-up time.



The no-compromise design of the HP 8517A test set provides better performance at 50 GHz than was previously available at 40 GHz.



Measurements to 50 GHz are enhanced by the high dynamic range of the HP 8517A.

Exceptional performance and versatility made simple

Large color display

Choose from different trace, graticule, text and background colors allowing you to quickly and easily interpret measurement results on this large 19 cm 16-color high-resolution display.

Four S-parameter display

View all four S-parameters on one display in a split or overlay format for complete characterization of your device at a glance, even while tuning.

Menus

Calibration flexibility

Choose from the most extensive selection of built-in error correction techniques available from any network analyzer.

Frequency/time/pulse profile domain

Enable transformations from the frequency domain to the time domain with Option 010, allowing you to see the effects of impedance discontinuities vs. distance. Pulse profile domain, Option 008, adds specialized hardware and optimized firmware features for making measurements of pulsed-RF responses.

Display

Store measured data into one of eight internal trace memories and then perform trace mathematics (+, -, x, ÷).

Versatile markers

Display five independent markers and their values simultaneously.

Two independent display channels

Simultaneously display transmission and reflection measurements, magnitude and phase measurements, swept-frequency and time-domain measurements, or two different frequency ranges in real time.

Instrument state

Internal save/recall

Fast and convenient internal storage of up to eight different instrument states.

Hardcopy outputs with buffer

Create high-quality graphical or tabular data outputs via HP-IB or serial (RS-232) plotters or printers. The internal serial plotter/printer buffer enhances productivity by allowing you to continue with your next measurement while the data is being output.

Internal LIF/DOS 3.5-inch disk drive

Unlimited long-term storage of instrument states, calibration sets or data to disk is both fast and convenient. Transfer data to your HP 9000 Series 300 computers or CAE programs via the internal LIF disk format, or use the DOS disk format for compatibility with MS-DOS programs.

The time-saving user-interface has dark-colored front panel keys for basic functions and softkey menus for additional functions. Channel-/parameter-/format-/response-limited instrument states automatically recall the last settings so that you don't have to.

Stimulus

Easy, direct control of any HP 8360 Series Synthesized Sweeper or HP 8350B Sweep Oscillator. Choose from three different sweep modes (step, ramp, or frequency list) depending on your measurement speed and accuracy requirements.

Parameter

Select S11 or S22 for reflection (return loss) measurements and S21 or S12 for transmission (insertion loss/gain) measurements.

Format

View measured parameter data in a variety of formats: logarithmic magnitude, phase, group delay, Smith Chart, SWR, linear magnitude, $R + jX$ impedance, and more.

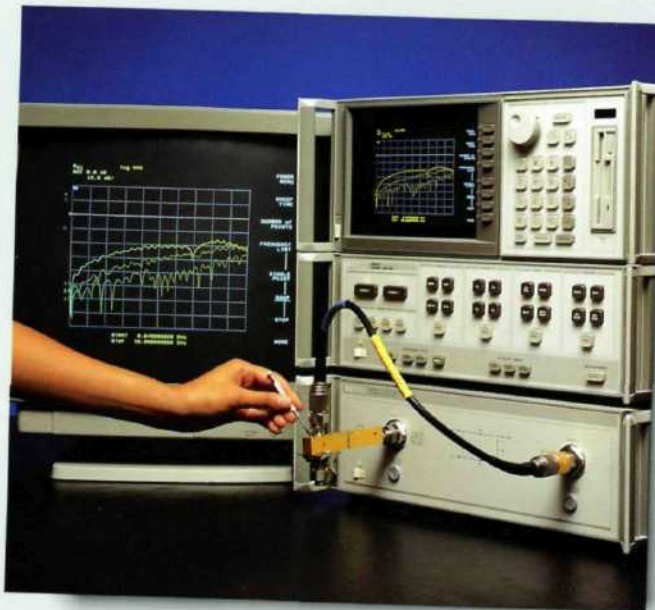
Response

Set the appropriate scaling, reference level, reference position, averaging, smoothing and electrical delay for your data.

MS-DOS® is a U.S. registered trademark of Microsoft Corporation.

Speed ...

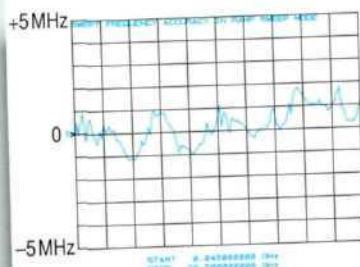
The 50 GHz couplers for the HP 8517A are tuned using ramp sweep mode for the fastest "real time" sweep update rate.



The HP 8510C is the only network analyzer to give you the choice of either a fast analog ramp sweep mode that is now more accurate, or an accurate synthesized step sweep mode that is now faster. This powerful combination is made possible by the HP 8360 Series Synthesized Sweepers which combine the best of a high-resolution synthesizer with a broadband sweep oscillator.

Ramp sweep

HP 8360 Series Synthesized Sweepers provide the fastest sweep mode available from any



The HP 8510C has a ramp sweep mode that is both fast and accurate ($\pm 0.1\%$ of span).

network analyzer. A fully error-corrected 201-point measurement can be made in under 500 msec with a ten-fold improvement in frequency accuracy when compared to previous synthesizers. The calibrated analog sweep mode allows you to make accurate, reliable measurements in "real time" so that you can tune your devices with greater confidence and higher throughput.

Step sweep

For ultimate confidence in measurement performance, an alternative to the fast ramp sweep mode is an extremely accurate step sweep mode. In step sweep mode, the HP 8360 Series Synthesized Sweeper is tuned and phase-locked to each frequency point with 1 Hz of synthesized frequency resolution. Measurement speed in the new quick-step synthesized mode is now six times faster with the HP 8360 Series Synthesized Sweepers than with previous synthesizers, allowing increased throughput in final test. A 201-point data trace can be measured in 1.6 seconds.

Frequency list

Eliminate wasted time making measurements at frequencies you don't need. Fast and efficient testing can be accomplished at the frequency points that you specify with the frequency list mode of the HP 8510C. Frequency list segments can be either CW or swept, at any density, and they may even be overlapped or nested. With the HP 8510C, you can calibrate over all frequency list segments once, then later measure a single segment without having to re-calibrate.

SEG	START (GHz)	STOP (GHz)	POINTS
1	39.00000000	42.00000000	5
2	42.00000000	43.25000000	11
3	43.25000000	45.75000000	51
4	45.75000000	47.00000000	11
5	47.00000000	50.00000000	5

NUMBER OF LIST POINTS: 83

Specify up to 30 different arbitrary frequency list segments.

Accuracy . . .

The impressive performance of the HP 8510C allows you to make the most accurate measurements on the most challenging devices. Accuracy improvements made popular by the HP 8510B are still unmatched by any other network analyzer.

TRL/LRM calibration

TRL (Thru-Reflect-Line) is a precision two-port calibration technique which uses a thru connection, a reflective termination, and transmission lines as reference standards. TRL is useful for coaxial measurements where the highest accuracy is desired and for non-coaxial media such as waveguide and microstrip where traditional standards are not readily available. TRL is convenient since fewer and simpler standards are required. Hewlett-Packard offers 7 mm and 3.5 mm coaxial TRL calibration kits and X/P/K/R/Q/U/V/W-band waveguide TRL calibration kits.

Measurement accuracy is dependent upon the quality of the standards used. HP is continually refining the design and manufacture of its precision standards.

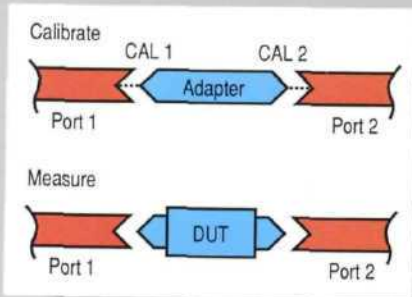
LRM (Line-Reflect-Match) is similar to TRL but uses true 50 ohm match standards instead of lines. Because LRM has no frequency bandwidth limitation and LRM standards are more convenient, it is the ideal calibration technique for both on-wafer and in-fixture applications. The HP 8510C offers the flexibility to easily adapt to your LRM standards.



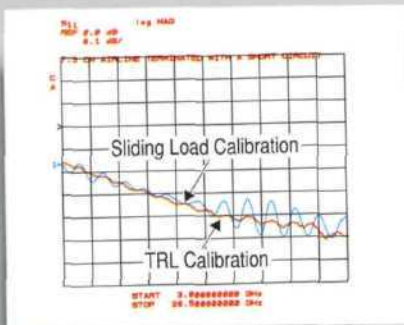
Using this technique, the response of the inserted adapter is completely characterized and removed from the measurement in a fully traceable and verifiable fashion.

Noninsertable calibration

Many common RF and microwave components are noninsertable and require you to insert or switch an adapter during calibration which adds an unknown uncertainty to the measurement. A device with female connectors on both ports is one example of a noninsertable device. The HP 8510C has an internal "adapter removal" feature for measuring noninsertable devices with exceptional accuracy.



The "adapter removal" capability is one of the many ways the HP 8510C simplifies challenging measurements.



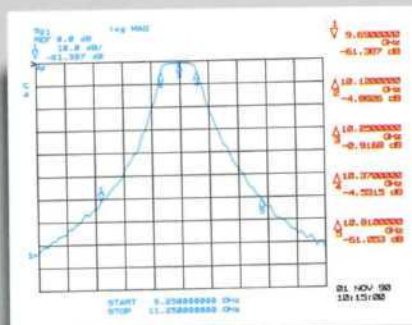
TRL calibration achieves accuracies never before seen with sliding load calibrations.

Usability . . .

Many convenience-oriented features have been designed into the HP 8510C with the user in mind, making it suitable for both the first-time and experienced user.

Four S-parameter color display

The large color display of the HP 8510C makes interpretation of your data easier with full control of color choices for the trace, graticule, text and background for optimum viewing. The four S-parameter display gives you a complete characterization of your device at a glance in either a split graticule or overlay display mode. The HP 8510C allows you to tune and see all four S-parameters change in real-time on a single full-size graticule.



Display five independent markers and their values simultaneously.



The HP 8510C simplifies measurements to make you more productive.

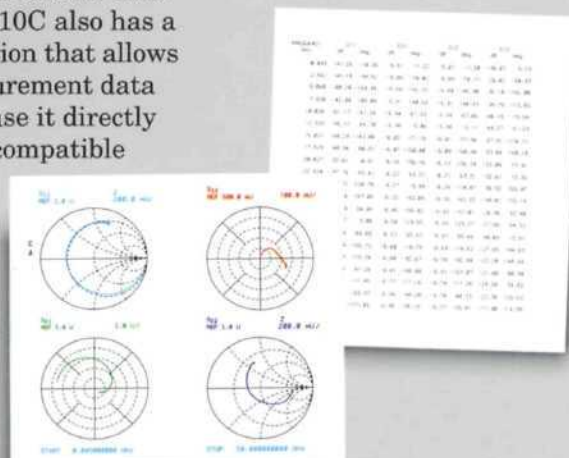
Internal 3.5-inch disk drive

The internal 3.5-inch disk drive allows additional storage of everything from trace data to complete machine states. With the HP 8510C, you choose the format of the data that you save to disk. LIF is the internal format that is ideal for saving and recalling data to and from the HP 8510C. LIF format is also used by HP 9000 Series 300 computers and for transferring device measurement data to your Computer Aided Engineering (CAE) programs for circuit simulation. The HP 8510C also has a DOS format selection that allows you to store measurement data to disk and then use it directly in your MS-DOS compatible programs.

Create high-quality graphical or tabular data outputs with a single keystroke.

Hardcopy outputs

Output data directly to an HP-IB or serial (RS-232) plotter or printer using the default format settings or customize your own format for maximum flexibility. The productivity-enhancing internal buffer for both serial plotters or printers frees the front panel so that you don't have to wait for the hardcopy output to finish before you begin your next measurement. The real-time clock lets you time/date stamp your hardcopy outputs, calibration sets and measurement data for fool-proof record-keeping.



RF and microwave components

Millimeter-wave components

Time domain

TEST POINT POWER

-10 dBm

No Flatness Correction Applied

Flatness Correction Applied

START 0.000000000000
STOP 10.000000000000

Maintain constant input power to amplifiers with the test port power flatness correction capability of the HP 8510C.

Frequency-translation devices

Simplify measurements of frequency-translation devices by taking advantage of the HP 8510C multiple source mode which controls two sources (RF and LO) and the network analyzer receiver (test set). Mixer conversion loss and relative phase measurements are made relative to a reference mixer using the HP 8511 Frequency Converter.

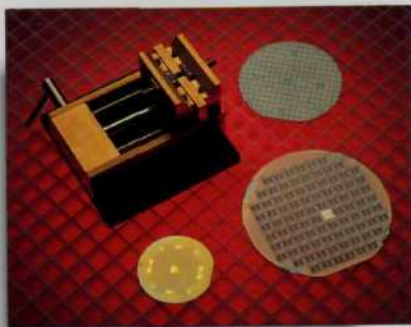
On-wafer discrete and MMIC devices

Fully characterize your on-wafer devices with the highest performance over a broad 45 MHz to 50 GHz frequency range with the HP 85107B network analyzer system coupled with a wafer probing station*. Extend your system to 62.5 GHz with the HP 85109B On-Wafer Network Analyzer System which provides measurement capability from 45 MHz to 62.5 GHz with a single connection to the wafer probes.

Fixtured devices and circuits

At the chip or package level, fixturing is required to interface to the device. With the HP 8510C, remove the fixture's effects mathematically (de-embedding) or use in-fixture calibration standards.

*Available from Cascade Microtech Inc., Beaverton, Oregon, U.S.A.



LRM is the ideal HP 8510C calibration technique for both on-wafer and in-fixture measurements.

Hewlett-Packard's own compact antenna test range is used in the development of new antenna test and RCS products.

Single Connection Multiple Measurement (SCMM) systems for on-wafer or in-fixture multi-mode stimulus/response environments coordinate network analysis, noise figure, power and spectrum analysis measurements with a single device connection.

Pulsed-RF components

The HP 85108A Pulsed-RF Network Analyzer System allows you to characterize the magnitude and phase response of pulsed-RF components from 2 to 20 GHz with pulse widths as short as 1 μ sec. It is the only truly asynchronous system able to measure any point within a pulse.

Dielectric materials

Non-destructively determine the complex dielectric constant of solid or liquid materials from 200 MHz to 20 GHz with the HP 85070A Dielectric Probe Kit. Or combine the HP 8510C with the HP 85071A Materials Measurement Software to determine the permittivity and permeability of materials that are loaded into transmission lines for measurement capability from 500 MHz to 110 GHz.



Antenna pattern and RCS

Measure antenna patterns under far-field conditions with exceptional performance and configuration flexibility with the HP 85301 Antenna Measurement System. CW pattern measurement rates in excess of 2000 points/sec speed data acquisition, and remoteable fundamental mixer modules ensure high sensitivity for fast and accurate measurements. The HP 8510C Network Analyzer also delivers excellent performance for radar cross section (RCS) measurements of low-observable targets.

Lightwave components

Make state-of-the-art lightwave modulation tests with the HP 8510C and the HP 83420A Lightwave Test Set. Perform measurements of optical, electrical, and opto-electrical components at modulation frequencies from 130 MHz to 20 GHz.

With every HP 8510C purchase, you receive two enrollments to the HP 8510 User's Course to bring you up to speed with hands-on knowledge of the HP 8510C's full capabilities. An HP 8510 Advanced Programming Course is also available to aid you in automating your measurements. In addition, HP Applications Engineers are ready to assist you with specialized training or applications software development.

All HP 8510C systems include a one-year on-site warranty. Pre-configured systems also include installation at no extra charge. Option W31 adds two additional years of on-site service to most HP 8510C system components for added protection of your investment at a low fixed cost.

Verification of the performance of an HP 8510C system is accomplished in a traceable manner. Each device in a Hewlett-Packard verification kit is supplied with data and measurement uncertainties that are traceable to the National Institute of Standards and Technology (NIST). In addition, the verification kit may be certified to meet US MIL STD 45662A requirements.

Other HP 8510 Literature

- HP 8510C Technical Data Sheet
- HP 8510C Ordering Guide
- HP 85103C/D Upgrade Brochure
- HP 8510C Users Guide

HP 8510 Product Notes

- PN 8510-2 Radar Cross Section Measurements
- PN 8510-3 Materials Measurements
- PN 8510-6 On-wafer Measurements
- PN 8510-7 Frequency Translation Device Measurements
- PN 8510-8 TRL Calibration
- PN 8510-13 Noninsertable Device Measurements
- PN 8510-14 Multiple Test Sets
- PN 8510-15 Lightwave Component Measurements
- PN 8510-16 Test Port Power Flatness Correction

HP 8510 Application Notes

- AN 374-1 Antenna Pattern Measurements

HP 8510 Programming Notes

- Introductory Programming Guide

For more information, call
your local HP sales office
listed in your telephone
directory.

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