

# Agilent 8510 System Solutions



**Agilent Technologies**

Innovating the HP Way



**Your bridge to the future**

# Application guide

The guide below shows Agilent Technologies 8510-based system solutions and the key applications for which each solution is optimized. Building on our standard system solutions, we can provide customized, factory-integrated systems for complex or unique applications. We have the leading-edge technology to meet your challenges today and tomorrow.

		System Solutions					
Device Type	Application Segments						
		8510XF	85106	85118	85108	85107, 50 GHz & Below	Other System Solutions
Millimeter-wave components	<ul style="list-style-type: none"> <li>• collision warning radar</li> <li>• vehicle-to-vehicle link</li> <li>• wireless LAN</li> <li>• on-wafer measurements</li> <li>• waveguide measurements</li> <li>• digital transmission equipment</li> <li>• millimeter radar systems</li> </ul>	• • • • • •	• • • • •				•
High power components	<ul style="list-style-type: none"> <li>• amplifiers for radio base stations</li> <li>• SSPA<sup>1</sup>, LPA<sup>2</sup>, TWTA<sup>3</sup></li> </ul>			• •			•
RF and microwave components	<ul style="list-style-type: none"> <li>• communication equipment</li> <li>• satellite communication</li> <li>• device modeling</li> <li>• on-wafer pulsed measurements</li> <li>• pulsed radar</li> <li>• advanced material research</li> <li>• filter tuning/alignment</li> <li>• group delay measurements</li> <li>• calibration of standards</li> <li>• transmit/receive (T/R) module testing</li> </ul>	• •			• •	• • • • •	• • •
Lightwave components	<ul style="list-style-type: none"> <li>• lightwave measurements</li> </ul>					•	
Antennas	<ul style="list-style-type: none"> <li>• satellite communication</li> </ul>					•	•

<sup>1</sup>Solid-state power amplifiers (SSPA)  
<sup>2</sup>Linear power amplifiers (LPA)  
<sup>3</sup>Traveling wave tube amplifiers (TWTA)

**Test heads designed for highest performance**

Whether your measurement setup is coax or on-wafer, the test heads are designed for mounting close to the device- or wafer-under-test to minimize RF cable length. For the on-wafer configuration, the test heads are especially suited for mounting on top of the probe manipulators, where they are allowed to move with the probe tips. This eliminates any relative movement to yield the highest performance.

**On-wafer capability from our channel partner**

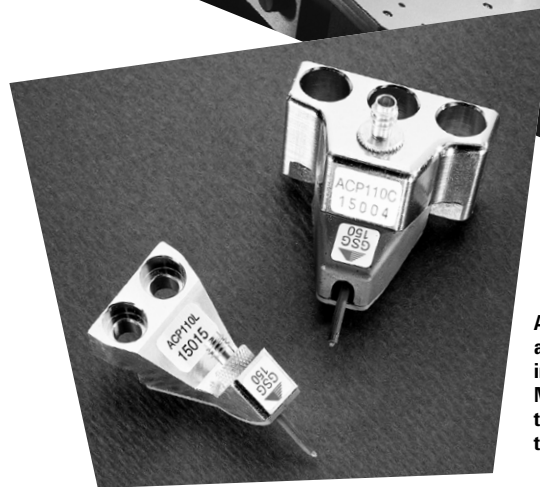
Agilent Technologies has been working closely with Cascade Microtech for over a decade to bring you excellent on-wafer measurement solutions. Agilent's measurement expertise and Cascade's expertise in wafer probing have combined to produce on-wafer solutions to meet your toughest measurement challenges.

To complement the 8510XF, Cascade Microtech has developed the ACP 110 probes with a 1.0 mm connector interface that offers probing from 45 MHz to 110 GHz with low insertion loss and superior accuracy. With calibration standards and coefficients available from Cascade Microtech, fully calibrated on-wafer measurements can be made from 45 MHz to 110 GHz with a single touchdown.

**Many upgrade possibilities**

Whatever Agilent 8510-based system you use, there is an upgrade path available to meet your needs. Depending on your current measurement setup, it may be a standard pre-configured upgrade or a customized upgrade.

**Agilent partners with Cascade Microtech to deliver superior on-wafer solutions.**



**ACP 110 probes with a 1.0 mm connector interface from Cascade Microtech enable single touchdown probing from 45 MHz to 110 GHz.**

# Agilent 8510XF

## Key Features:

- ❑ Broad frequency coverage – 45 MHz to 110 GHz – in a single sweep without frequency band breaks.
- ❑ Internal firmware provides single frequency sweep capability (external controller not required).
- ❑ Calibrates in both 1.0 mm coax and on-wafer.
- ❑ Test heads designed for convenient on-wafer and coax measurements.
- ❑ Dynamic range and measurement accuracy comparable to the performance from individual waveguide bands.

The 8510XF network analyzer system has been designed to measure broadband devices to 110 GHz, on-wafer or in-fixture, fully calibrated, in a single frequency sweep. By building on the 8510 network analyzer, the 8510XF system provides high measurement performance in frequency coverage, dynamic range and measurement accuracy.

## Single RF connection to 110 GHz

The 8510XF system provides frequency coverage from 45 MHz to 110 GHz in a single sweep with a single connection. Productivity is improved because you no longer need to set up, connect and disconnect as your measurements move from one frequency band to the next.

## Millimeter-wave measurements in 1.0 mm coax

With a single connection, fully error-corrected measurements to 110 GHz are made in 1.0 mm coax. Making millimeter-wave measurements in 1.0 mm coax delivers uncompromised performance and improved productivity compared to waveguide.

## Convenient millimeter-wave on-wafer measurements

The 8510XF system is designed for convenient on-wafer measurements. By using the 1.0 mm coax connector to interface with the 1.0 mm wafer probe, fully calibrated measurements with the highest measurement performance can be made to 110 GHz with a single touchdown on the wafer.

## Broadband calibration with built-in firmware

The built-in firmware of the 8510XF system enables you to perform a single calibration from 45 MHz to 110 GHz, either in coax or on-wafer. The single, broadband calibration can be applied to either broadband or narrowband devices.



Convenient on-wafer measurements with the 8510XF using a Cascade Microtech wafer probing station and APC 110 probes

# Millimeter-wave system

## Agilent 85106

### Key Features:

- ❑ Banded S-parameter measurements to 110 GHz with high speed, accuracy and dynamic range.
- ❑ Excellent dynamic range for more accurate, repeatable measurements.
- ❑ High output power delivers more power to the device-under-test without external amplifiers.
- ❑ System can be expanded to include coaxial and waveguide capabilities; with easy-to-use built-in RF switching, measurements can be made in coax below 50 GHz, and in waveguide above 50 GHz.

The 85106 network analyzer system is configured to make fast, accurate S-parameter measurements of waveguide components in four waveguide bands from 33 to 110 GHz.

### Calibration accuracy and stability improve productivity

Precision calibration standards for all bands permit full use of all built-in 8510 accuracy enhancement and data processing features. Because of the accuracy and stability of the 8510, your calibrations last longer, allowing you to measure more devices per calibration, improving productivity.

### Measurement convenience

All system functions, from setting up the measurement frequencies to calibration and measurement, are controlled directly from the 8510 front panel. The measurement results are displayed on the receiver CRT in the frequency and/or time domain. With the 8510 in multiple source mode, operating the 85106 system is as easy as using the microwave receiver.

### Coaxial and waveguide capabilities all in one

With the addition of a microwave test set and RF switching control hardware, the 85106 system may also be configured for coaxial measurements from 45 MHz to 50 GHz. A single system can cover the entire frequency range from 45 MHz to 110 GHz with convenient switching between coaxial and waveguide measurements.

This level of performance can be achieved by extending any existing 8510 microwave system to the millimeter-wave frequencies with additional hardware.

**Agilent 85106 flexibility provides coaxial and waveguide capabilities all in one system.**



Agilent 85106 configured for waveguide measurements



# High-power amplifier test system

## Agilent 85118

### Key Features:

- ❑ High RF power handling capability; up to 40 watts (+46 dBm) of output power from an amplifier can be handled. Higher-power options are also available for higher-power amplifiers.
- ❑ Single-connection multiple-measurement system architecture permits measurements of the amplifier under test, such as S-parameters (magnitude and phase response), noise figure, gain compression, and intermodulation distortion with one connection at high RF power levels.
- ❑ Adaptable and expandable system configurations to meet special measurement needs, such as high RF power levels within a particular frequency band, high throughput options, or system flexibility for high product mix manufacturing.

The 85118 high-power amplifier test system is designed for the complete RF characterization and manufacturing test of power amplifiers used in communications systems.

### High-performance phase, group delay and distortion measurements

Key measurements for power amplifiers used in communications systems include phase linearity (transmission phase), absolute output power and group delay. Another important measurement is intermodulation distortion, since this measurement helps to ensure that requirements for in-band and out-of-band operation are met. This is especially important for digital communications systems, which use narrower channel spacing than analog systems. The 85118 test system is configured to provide high-performance, high-resolution phase, group delay and distortion measurements.

### Single-connection multiple-measurement solution

The 85118 test system combines the high-speed measurement capabilities of a microwave receiver with the S-parameter test set to provide CW or pulsed-RF, S-parameter and noise figure measurement capability. These flexible systems also permit spectrum analysis and measurement of S-parameters, noise figure, power and gain compression as a function of frequency, power level, device-under-test (DUT) state, and/or other programmable conditions.

### Complete solutions for your measurement needs

The 85118 test system can be customized depending on test requirement. Each test system includes complete automation software, allowing the system to be used in manufacturing environments where continuous operation in volume testing situations is required.



Fully automated testing of high power amplifiers with the Agilent 85118

# Pulsed-RF systems

## Agilent 85108

### Key Features:

- ❑ Wide dynamic range allows for accurate pulsed measurements at any duty cycle.
- ❑ Low duty cycles allow high-power measurements of on-wafer or in-fixture devices.
- ❑ By measuring high-performance devices under pulsed conditions, on-wafer or in chip form, production-process-related problems can be detected and solved early enough to improve yields and lower production costs.

The 85108 features a complete configuration for high-volume, high-power and pulsed-RF testing of components and devices at IF, RF and microwave frequencies. With a wider-bandwidth receiver, these systems perform pulse profile network analysis of devices that require a pulsed stimulus.

### Pulsed-RF measurements

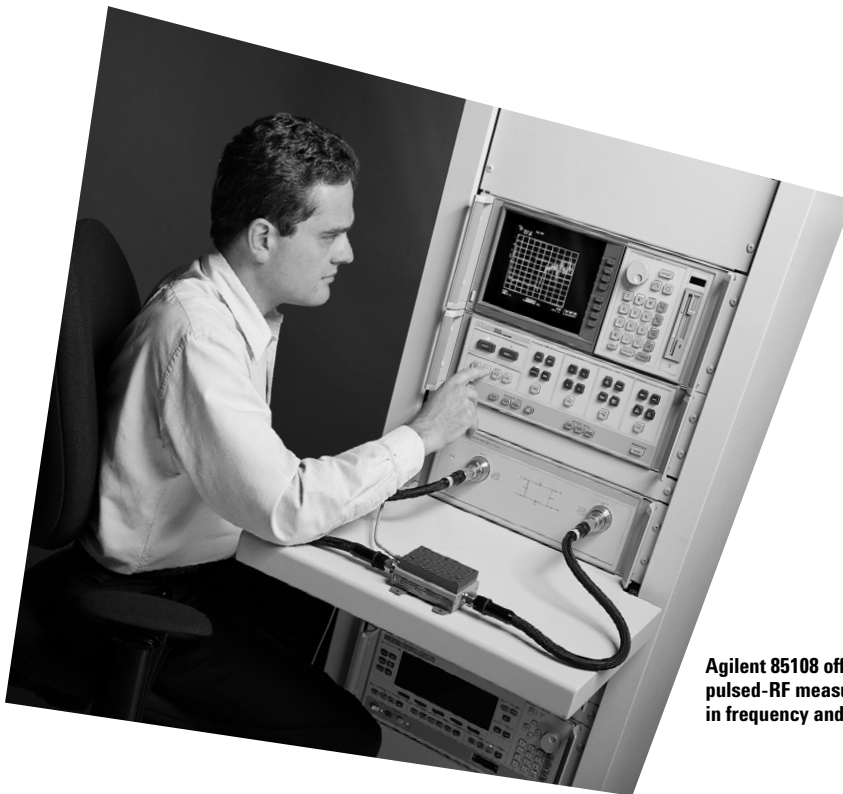
Using the 8510, with its wide IF bandwidth option, swept-frequency pulse testing can be achieved with the press of a single key, and in real time. In addition to swept-frequency testing, the 8510 also permits analysis of a device's dynamic behavior during a pulse, at a single RF frequency, using repetitive sampling.

### High-power device measurements

The 85108 pulsed-RF systems have been designed to measure high-power devices under both CW and pulsed conditions. These systems have the capability to provide the necessary RF drive level to the device-under-test. If needed, an amplifier can be added to boost the signal power level to the DUT. With the open-architecture design of the pulse test set, this amplifier can be placed behind the network analyzer test set's port 1 couplers to ensure that its effects are removed from the measurements during system calibration.

### Your system grows with you

A pulsed-RF system can be configured from any existing 8510 network analyzer system by adding pulsed-RF capability to the network analyzer and a pulse test set. In addition, other measurement capabilities such as spectral analysis, noise figure and load pull can be added easily without degrading the uncorrected performance of the basic system.



Agilent 85108 offers pulsed-RF measurements in frequency and time domain.



# 50 GHz vector network analyzer system

## Agilent 85107

### Key Features:

- ❑ S-parameter measurements to 50 GHz with high accuracy and speed. Measurements include, but are not limited to, gain, flatness, VSWR, group delay, gain compression and power.
- ❑ Excellent performance at 50 GHz. With Option 007, the port power level is  $-16$  dBm with 75 dB of dynamic range from 40 to 50 GHz, reducing the need for external amplification.
- ❑ Superior performance of the 8517 test set delivers exceptional confidence in all your measurements.

The 85107 vector network analyzer (VNA) system is a complete system configured with a 50 GHz synthesized sweeper and a 50 GHz S-parameter test set in a system rack. This system delivers uncompromised performance to 50 GHz.

### Outstanding performance

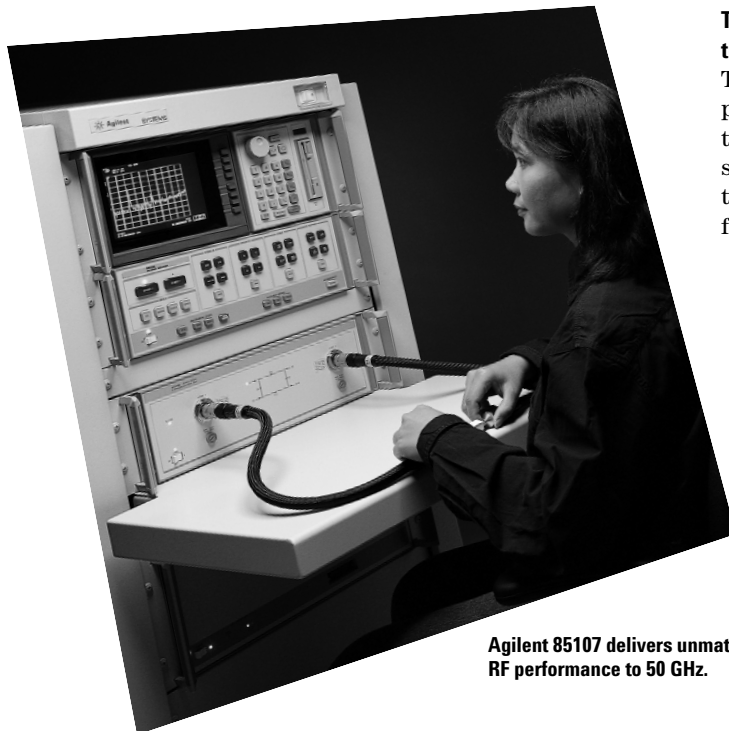
The basis for the 85107 VNA's excellent performance lies in the 8517 test set. This test set has exceptional raw (uncorrected) test port characteristics—20 dB of directivity and 16 dB of source match to 50 GHz. These intrinsic characteristics of the test set prior to calibration substantially improve the overall calibration accuracy and stability that can be achieved. These capabilities help to ensure a more precise characterization of amplifiers and active devices.

### High dynamic range

With the 8517 test set, 75 dB of dynamic range is available at 50 GHz. High test port output power and sensitivity directly affect both the accuracy and speed of your measurements. High dynamic range coupled with outstanding raw directivity gives you confidence in measurements to 50 GHz.

### The premier measurement solution to 50 GHz

The 85107 delivers unmatched RF performance to 50 GHz. Combining the 85107 with a wafer probing station allows on-wafer devices to be fully characterized over the frequency range of 45 MHz to 50 GHz.



Agilent 85107 delivers unmatched RF performance to 50 GHz.

# Solutions below 50 GHz

There are three 8510 systems available below 50 GHz. Two systems are configured for S-parameter measurements, and the third is for lightwave component measurements. These systems deliver uncompromised measurement performance, and numerous upgrade paths are available.

In addition to the Agilent 8510 system solutions, Agilent offers the 8720 vector network analyzer family.



**20 GHz Agilent 8510 benchtop system**



**50 GHz lightwave component analysis system**

## **26.5 GHz S-parameter measurement system**

The 26.5 GHz 8510 system is configured with the 8515 26.5 GHz S-parameter test set and an 83631 synthesizer in a system rack. The 8515 S-parameter test set offers superior uncorrected performance up to 26.5 GHz. Its uncorrected directivity is outstanding, providing exceptional stability and long-term calibration accuracy.

## **20.0 GHz S-parameter measurement system**

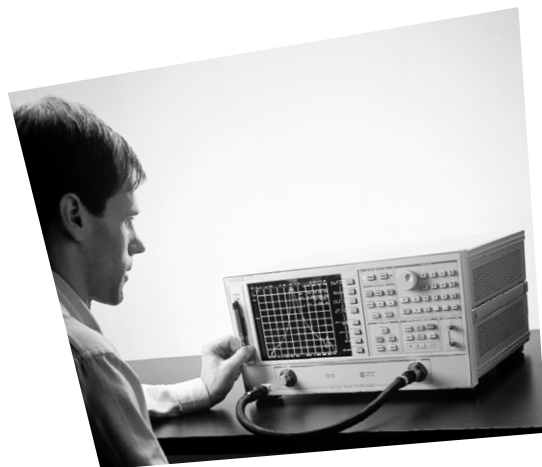
The 20 GHz 8510 system is a benchtop system configured with the 8514 20 GHz S-parameter test set and an 83621 synthesizer. This system delivers wide dynamic range and high output power for measurements up to 20 GHz. The system components will fit on a benchtop to save space, or they can be mounted in a system rack (system racks are available separately).

## **Lightwave component measurements**

The 8510 network analyzer can be configured to measure the modulation amplitude and phase of optical modulators and receivers to 20 GHz or 50 GHz. The 8510 can be extended to become a 20 GHz lightwave component analyzer system by adding the 83420 lightwave test set, a system controller and software. A 50 GHz lightwave component analysis system can be configured by incorporating an 8510, a specially-developed lightwave test set, a system controller and software. Both systems perform calibrated electro-optical (E/O and O/E), optical (O/O) and electrical (E/E) transmission and reflection measurements using a calibrated, swept signal-modulating optical source (either 1300 or 1550 nm). Both frequency and distance/time-domain measurements are available.

## **Agilent 8720 vector network analyzer family, 50 MHz to 40 GHz**

The 8720 vector network analyzer family combines a fast synthesized source, tuned receiver and S-parameter test set in a single, fully-integrated instrument. Quickly and accurately, this compact instrument measures magnitude, phase and group delay of all four S-parameters, in addition to absolute output power of microwave components. Configurations are available for high power, high dynamic range, time domain, frequency translation and non-coaxial measurements. The 8720 analyzers have the performance and flexibility needed to solve difficult measurement problems and cut test times.



**Agilent 8720 vector network analyzer, a single, fully-integrated instrument**

# Other Agilent system solutions

## Transmit/Receive (T/R) module test

To be competitive in today's T/R module market, manufacturers need to test modules in many phase and amplitude states and still maintain high throughput. Agilent's T/R module test solution includes a high-speed S-parameter test station using a single-connection multiple-measurement (SCMM) architecture. SCMM permits all measurements to be made with a single connection to the DUT. Measurement capabilities include fully error-corrected S-parameters in either CW or pulsed-RF conditions, input/output VSWR, high-power gain, error-corrected noise figure, spectrum analysis (including harmonic distortion and spur measurement), absolute power, and power-added efficiency. Frequency coverage spans from 45 MHz to 50 GHz.

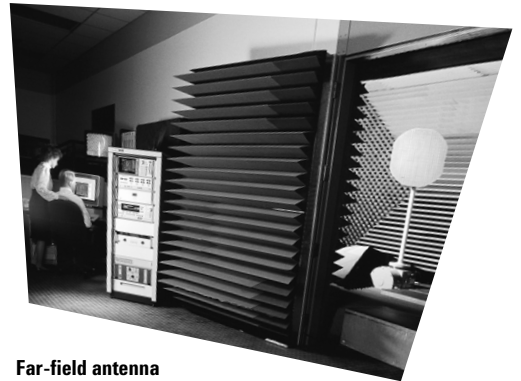
## Device modeling systems

Agilent's device modeling system capability consists of complete, integrated systems of test hardware and modeling software. These systems provide the accurate device model parameters needed to simulate circuit performance in SPICE or Agilent's Advanced Design System. Circuit simulations are only as accurate as the device models used, and Agilent's device modeling systems are designed to accurately and efficiently extract model parameters used to simulate DC and high frequency performance.

Agilent offers two CW systems (RF and microwave) and a pulsed system. The CW modeling systems combine an 8510 (or an 87xx) network analyzer system with a DC current-versus-voltage (I-V) subsystem. The pulsed modeling system combines an 8510 pulsed-RF network analyzer system with a pulsed-DC I-V subsystem. By pulsing the bias and RF stimuli to the device during characterization, self-heating can be controlled. This makes it possible to develop new models that incorporate thermal effects, improving circuit simulation accuracy.

## Antenna pattern and RCS measurements

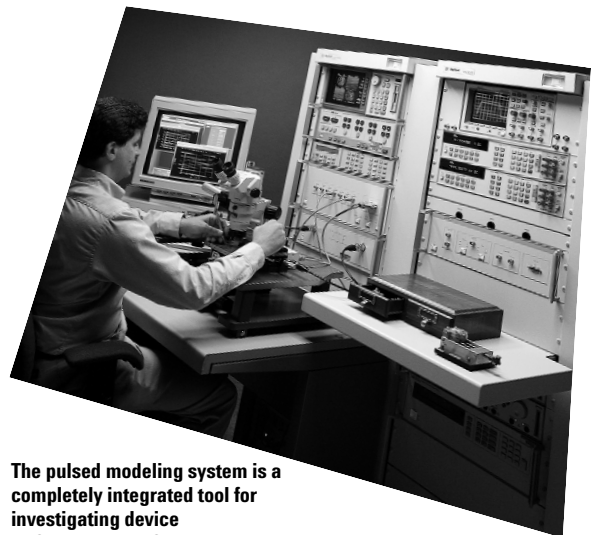
Building upon the advanced design and proven hardware of the popular, high-performance 8510 network analyzer, Agilent's antenna and RCS measurement systems offer exceptional performance and configuration flexibility to meet all of your far-field, near-field and radar cross section (RCS) measurement needs today and in the future.



Far-field antenna measurements are one of the capabilities of the Agilent antenna measurement system.



Agilent 85120 test system provides high throughput testing of transmit/receive (T/R) modules.



The pulsed modeling system is a completely integrated tool for investigating device self-heating and for developing new thermal models.

# System flexibility and versatility offer you options for today and tomorrow

## Performance and convenience

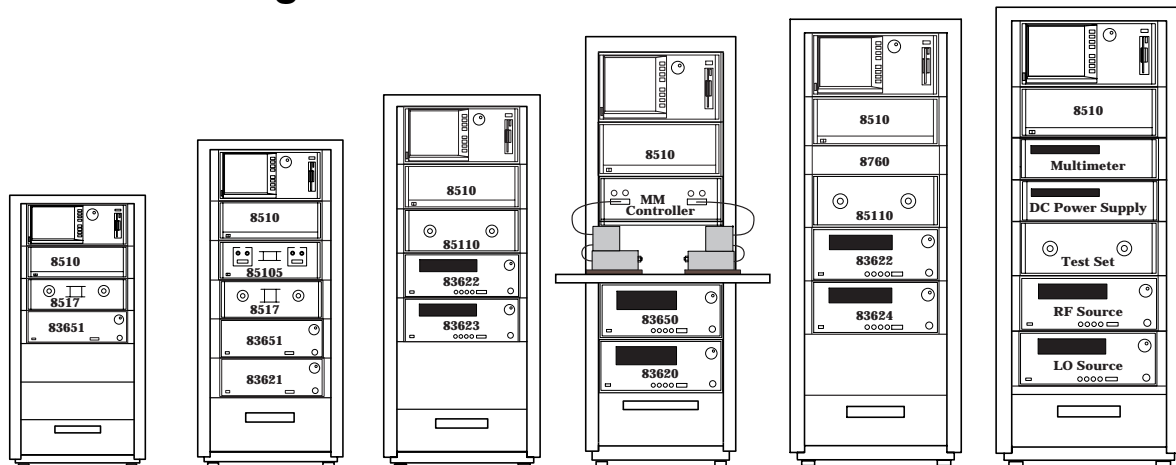
The 8510 is the foundation from which to expand your capability for future applications, and continues to be the best network analyzer investment that you can make.

To protect your investment in an 8510, any version of this instrument can be updated to the latest, state-of-the-art 8510 using upgrade packages. Upgrade packages typically include a hardware and firmware upgrade, and on-site installation. These upgrades are performed in a matter of hours, so you'll be up and running quickly with all new capabilities.

## Versatility that can be tailored to your unique requirements

The 8510 network analyzer easily adapts to different measurement requirements without compromising performance; from basic component testing to on-wafer probing, pulsed device characterization, and antenna and RCS measurements. Just choose the appropriate system components to match the needs of your particular application. Any existing 8510 network analyzer system can be reconfigured into a different system to meet new measurement needs.

## Agilent 8510 SYSTEM SOLUTIONS



85107	85106	85108	8510XF	85118	Other System Solutions
Satellite communication	On-wafer measurements	On-wafer pulsed measurements	Collision warning radar	Amplifiers for radio base stations	On-wafer, CW/pulsed, measurements
Advanced material research	Waveguide measurements	Pulsed radar	Communication equipment	Solid-state power amp. (SSPA)	Amplifier test systems
Filter tuning, or alignment	Millimeter radar systems		Wireless LAN	Linear power amplifiers (LPA)	Satellite communication
Group delay measurements	Collision warning radar		On-wafer, CW/pulsed, measurements	Traveling wave tube amp. (TWTA)	Transmit/receive (T/R) module test
Calibration of standards			Millimeter radar systems		Device modeling, parameter extraction
Lightwave measurements			Vehicle-to-vehicle link		
Antenna measurements			Digital transmission equipment		

# System solutions

Complete system solutions to meet your ever-changing measurement challenges

Agilent has unsurpassed expertise in RF and microwave measurements, with decades of experience creating some of the industry's finest test systems, instruments and software. We are dedicated to providing innovative, reliable system solutions for a wide range of measurement needs. These solutions incorporate the necessary hardware, software, customized fixturing and on-going support to form a complete single-source answer to your measurement challenges.

Whether your needs are for coverage within a particular frequency band at high RF power levels, minimum test time for high throughput, system flexibility for high-mix manufacturing, or simply long-term upgradability and system support, Agilent can provide a system that meets your development and production test requirements.

From software integration to installation and training, Agilent offers a complete range of services to implement the test solution. We'll work with you to define the best combination of resources to get the job done quickly and correctly. Complete test system solutions let you focus your engineering and management resources on the successful development of your business.

## Agilent channel partners provide additional expertise

Agilent also has a network of value-added third-party integrators that specialize in specific test and measurement applications. Agilent will employ these integrators as needed to provide a complete test system solution to your measurement needs. For example, Agilent partners with ATN Microwave, Inc. to provide fully-configured load pull systems for large-signal device characterization.

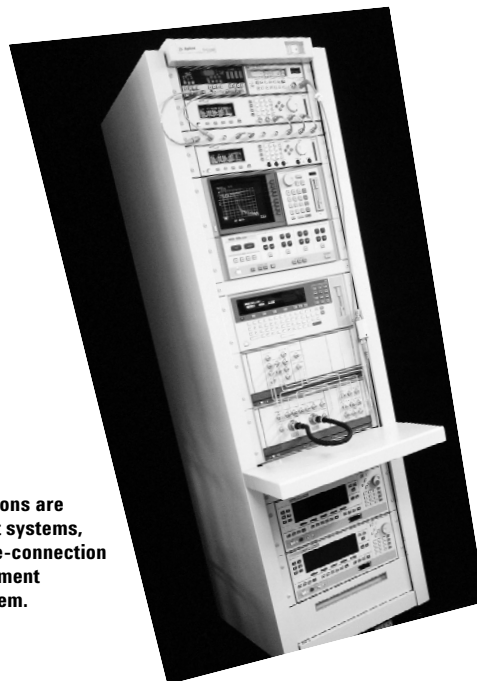
## System support services

System support is as critical as design, components and integration. From the moment you begin to work with us to define your system needs, our support team is part of the process. Our engineers identify your requirements from a thorough understanding of how your business operates. We then tailor a support plan that includes information about system installation and verification; support options and training; and who to call if the need arises.

From preventative maintenance that minimizes downtime to rapid-response parts replacement that gets you back on-line quickly if problems do occur, we'll be there for you. You'll be supported by Agilent's global network. We can even arrange support for non-Agilent equipment, giving you the convenience of single-vendor service. Support offered depends on system requirements.



Agilent partners with ATN Microwave to provide load pull systems. Shown here are the electronic load modules (ELM), the electronic mainframe (EM) and a signal conditioning module (SCM) from ATN Microwave that are typically integrated into a load pull system.



Customized solutions are available for most systems, as with this single-connection multiple-measurement (SCMM) test system.

## For More Information

Please request the following literature for additional information:

Literature	Pub. number
<i>Agilent 8510 Network Analyzer, Color Brochure</i>	5091-8970E
<i>Agilent 8510 Family Network Analyzer, Configuration Guide</i>	5091-8967E
<i>Agilent 8510 Family Network Analyzer, Data Sheet</i>	5091-8484E
<i>Agilent 85103 Upgrade Packages to the Agilent 8510</i>	5091-8969E
<i>Agilent 85106 Millimeter-wave Network Analyzer System, Product Overview</i>	5964-4229E
<i>Agilent 85108 Series Network Analyzer Systems, Product Overview</i>	5091-8965E
<i>Agilent 8510XF 110 GHz Single-Sweep Systems, Product Overview</i>	5965-9888E
<i>Agilent 85118 Series High-Power Amplifier Test Systems, Product Overview</i>	5963-9930E
<i>Agilent 85120 Series T/R Module Automated Test Systems, Product Overview</i>	5965-2974E
<i>Agilent 8530 Microwave Receiver, Color Brochure</i>	5091-0699E

## Agilent Technologies' Test and Measurement Support, Services, and Assistance

Agilent Technologies aims to maximize the value you receive, while minimizing your risk and problems. We strive to ensure that you get the test and measurement capabilities you paid for and obtain the support you need. Our extensive support resources and services can help you choose the right Agilent products for your applications and apply them successfully. Every instrument and system we sell has a global warranty. Support is available for at least five years beyond the production life of the product. Two concepts underlie Agilent's overall support policy: "Our Promise" and "Your Advantage."

### Our Promise

"Our Promise" means your Agilent test and measurement equipment will meet its advertised performance and functionality. When you are choosing new equipment, we will help you with product information, including realistic performance specifications and practical recommendations from experienced test engineers. When you use Agilent equipment, we can verify that it works properly, help with product operation, and provide basic measurement assistance for the use of specified capabilities, at no extra cost upon request. Many self-help tools are available.

### Your Advantage

"Your Advantage" means that Agilent offers a wide range of additional expert test and measurement services, which you can purchase according to your unique technical and business needs. Solve problems efficiently and gain a competitive edge by contracting with us for calibration, extra-cost upgrades, out-of-warranty repairs, and on-site education and training, as well as design, system integration, project management, and other professional services. Experienced Agilent engineers and technicians worldwide can help you maximize your productivity, optimize the return on investment of your Agilent instruments and systems, and obtain dependable measurement accuracy for the life of those products.

**Get assistance with all your test and measurement needs at:**  
[www.agilent.com/find/assist](http://www.agilent.com/find/assist)

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