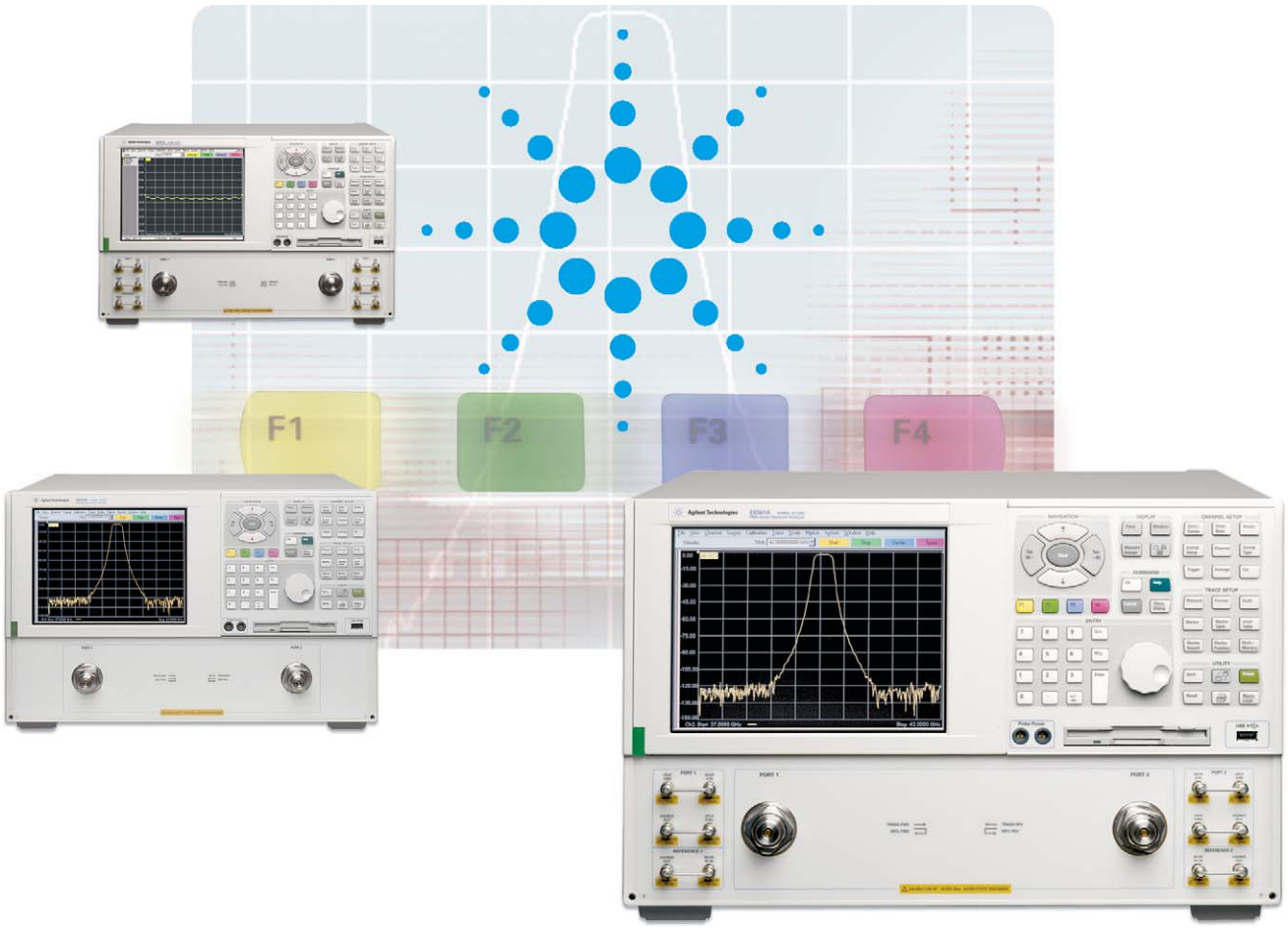
Agilent

PNA Network Analyzers

10 MHz to 110 GHz

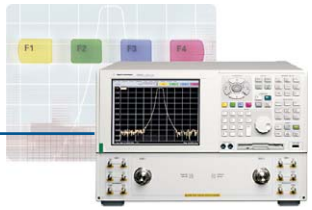


Meeting your measurement needs today and into the future...

- Exceptional performance
- Advanced automation
- Flexible connectivity
- Easy-to-use

Agilent Technologies

PNA Network Analyzers



Rapid and continuous changes in microwave and millimeter-wave technology present a growing challenge for designers and manufacturers. The Agilent PNA is a measurement platform that meets the challenge, with the right combination of fast sweep speeds, wide dynamic range, low trace noise, and flexible connectivity. Test your high-performance components with a fast, accurate network analyzer that meets your measurement needs now and well into the future.

PNA Network Analyzers

- < 26 µsec/point measurement speed
- 16,001 points per channel
- 32 independent measurement channels
- Windows® operating system
- User interface supports hardkeys, softkeys and mouse
- Embedded help system includes full manual, extensive measurement tutorials, and complete programming guide
- Advanced calibrations include:
  - Guided calibration
  - Optional electronic calibration (ECal) provides a precision, single connection, one to four port calibration
  - User-characterized ECal
  - Adapter removal
  - Unknown thru
  - Data-based calibration standards
  - Expanded calibration algorithm

10 MHz to 20/40/50/67 GHz

Features

- Integrated 2-port test set with 4 receivers – enables TRM/LRM calibration for the most accurate on-wafer, in-fixture, and waveguide measurements
- Mixer and converter measurements using frequency-offset mode
- Advanced mixer calibrations include:
  - Support for 2-port ECal
  - Vector-mixer calibration (VMC)
  - Scalar-mixer calibration (SMC)
- IMD and harmonic measurement capability

Options

- Configurable test set
- Extended power range and bias-tees
- Frequency-offset mode (FOM)
- Frequency converter measurement application (FCA)
- Time domain
- Receiver attenuators
- Reference-channel switch
- IF access
- Pulsed-RF capabilities

10 MHz to 110 GHz

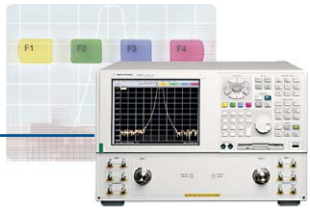
Features

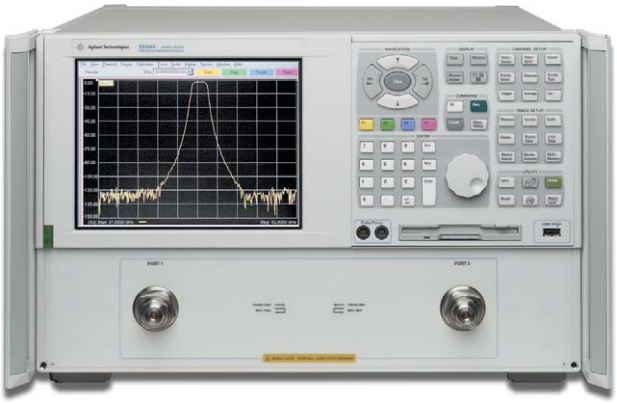
- Single continuous sweep from 10 MHz to 110 GHz – extendable to 325 GHz with external test heads
- Accurate biasing through tri-axial bias tees near test ports for precise device characterization

Options

- Time domain
- Bias-tees
- Bias-tees and attenuators

Performance





10 MHz — 20 GHz
10 MHz — 40 GHz
10 MHz — 50 GHz
10 MHz — 67 GHz[1]
10 MHz — 110 GHz
Expandable to 325 GHz →

High power measurements

- Use the configurable test set option to add your own external components in the measurement path.
- Internally controlled step attenuators in the source and/or receiver path allow you to make measurements over a wider power range.
- Bias-tees supply DC power to your active components.

Configurable test set: access signal paths for flexible configurations.

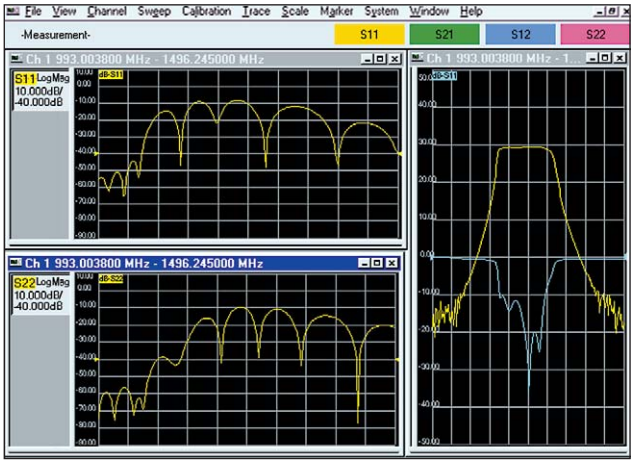
Performance

- Up to 122 dB dynamic range
- < 0.006 dB trace noise
- < 26 µsec/point measurement speed

Use TRL calibration for accurate in-fixture, on-wafer, or waveguide measurements.

High-rejection measurements

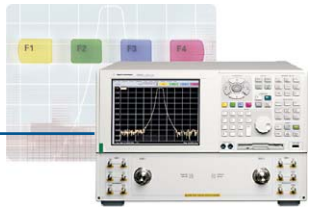
Use the configurable test set option to reverse the directional coupler to obtain maximum dynamic range at the test port with 12-term error correction.



Arrange windows for custom viewing or select standard viewing configurations.

1. Specified to 67 GHz, with operation to 70 GHz.

Flexibility

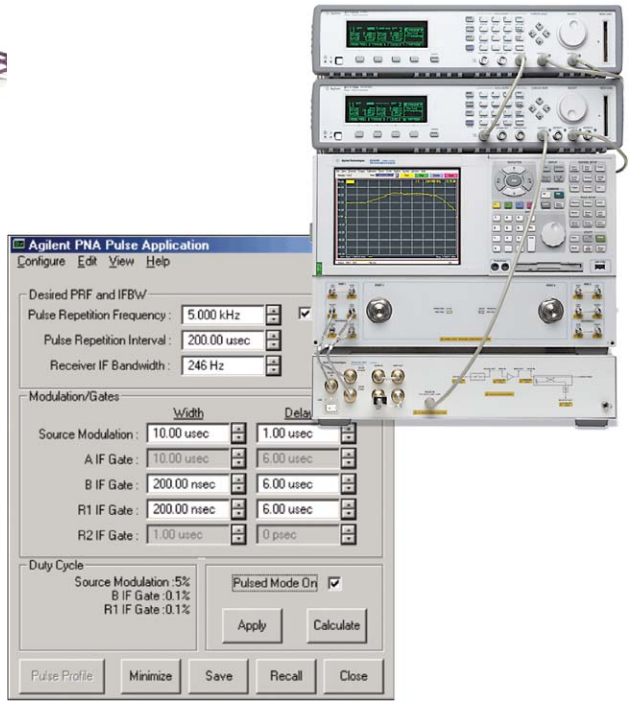


Millimeter-wave measurements

- The only bench-top, broadband system covering 10 MHz to 110 GHz!
- Frequency extension up to 325 GHz available with external test heads

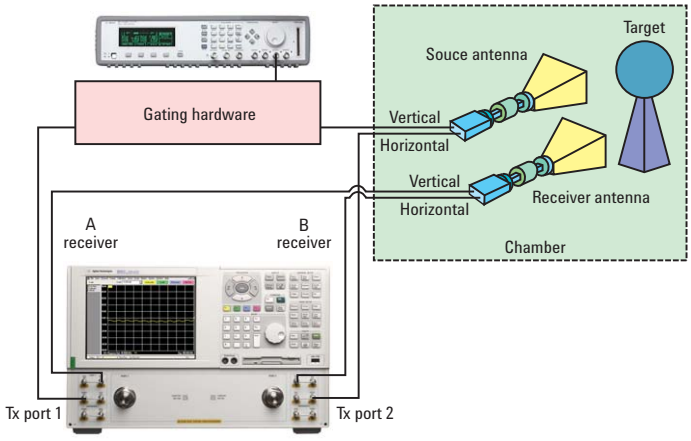
Pulsed-RF measurements

- Spectral-nulling technique offers superior dynamic range without compromising measurement speed
- Ideal for average, point-in-pulse and pulse profiling measurements with no lower limit on pulse widths



Antenna measurements

- Exceptional results with more points and faster measurement speed
- Forward and reverse sweeps available for near-field scans

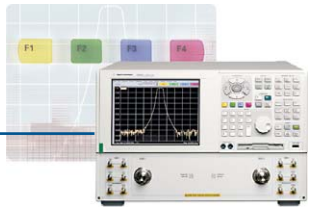


Pulse application makes measurement set up simple

Features include:

- Easy-to-use graphical user interface, enabling of IF gates, and control of pulse generators
- Automatic calculation of spectral-nulling parameters for optimal speed and performance

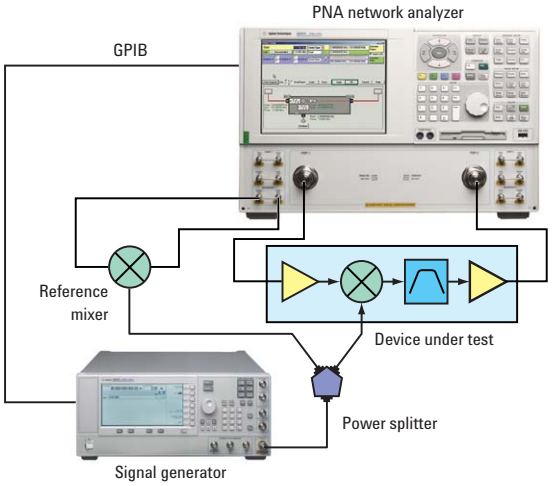
Capabilities



The frequency-offset capability for the PNA offers industry-leading accuracy and ease-of-use for measuring mixers and frequency converters.

The frequency-offset capability is implemented in an integrated hardware and firmware solution. The hardware lets you independently set the PNA's source and receiver frequencies for measuring:

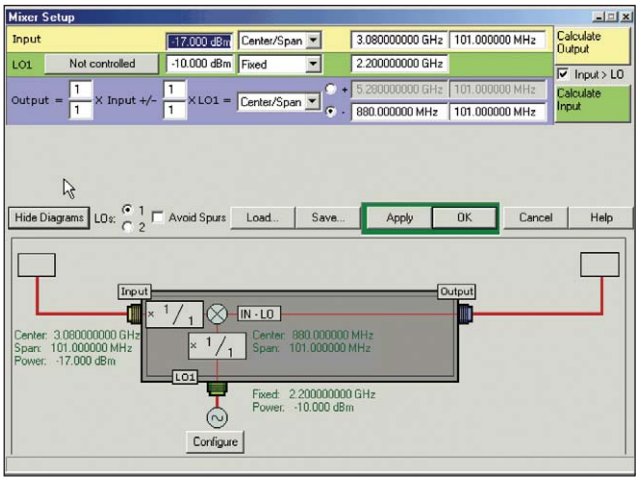
- Mixer conversion loss/gain
- Harmonic and spurious responses
- Intermodulation distortion (IMD)



Shown above is the measurement setup for vector-mixer calibrated magnitude and phase measurements. An internal reference switch automatically switches between S-parameter and frequency-offset measurements.

Mixer measurement suite

- Conversion loss/gain
  - Magnitude response
  - Phase response
  - Group delay
- Input match
- Output match
- Isolation
- Fixed-output magnitude
- Fixed-output phase
- Multi-stage converters



Frequency converter application (FCA)

The firmware automates mixer and frequency converter measurements. Features include:

- Easy-to-use graphical user interface and control of LO source and power-meter simplifies test setup
- Enhanced error correction improves measurement accuracy

Advanced mixer calibration techniques

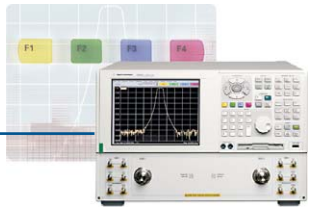
Patented vector-mixer calibration (VMC)

- Provides unparalleled accuracy for measurements of relative phase and absolute group delay
- Uses combination of SOLT standards and a reciprocal-mixer/IF-filter pair during calibration
- After calibration, both reciprocal and non-reciprocal mixers and converters can easily be measured

Scalar-mixer calibration (SMC)

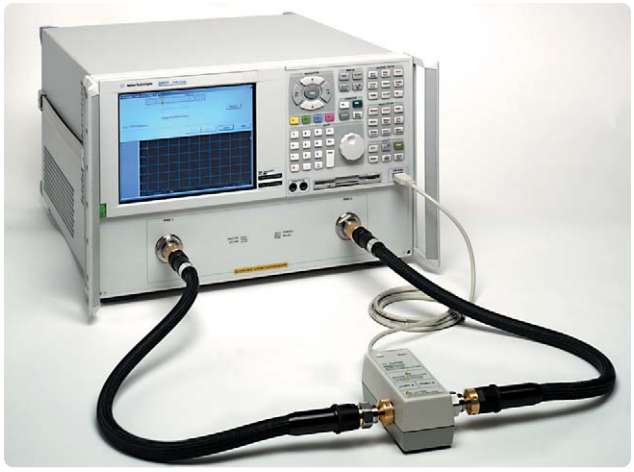
- Provides highest amplitude accuracy for measurements of conversion loss/gain
- Combines SOLT and power-meter calibration to deliver match-corrected amplitude measurements
- Simplest setup and calibration procedure

Throughput



Built for speed

Decreasing your test time is critical for your success in the marketplace. The PNA network analyzers are designed with maximum throughput in mind. Use a variety of powerful tools to optimize your measurement process.



Less than 9 seconds typical calibration times for 2-port calibration with 1601 points at 35 kHz IFBW.

Decrease calibration time with easy-to-use electronic calibration (ECal)

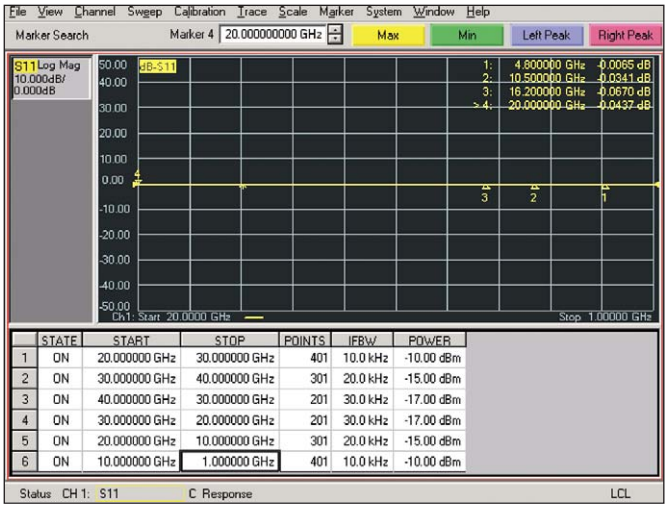
Perform fast, accurate, and repeatable automatic calibrations with Agilent's ECal modules. Control ECal directly from the analyzer. User-characterized ECal provides the flexibility to use adapters to customize ECal modules to meet your connector needs.

Various two and four-port modules cover the 300 kHz to 67 GHz[1] range in the following connector types (some available with mixed-connectors):

- 1.85 mm
- 2.4 mm
- 2.92 mm
- 3.5 mm
- 7 mm
- 7-16
- Type-N

Dramatically increase throughput with segment sweep mode

Optimize each sweep by collecting data at frequency segments you define. Specify each segment with the optimal number of points, IF bandwidth and power level for increased speed and dynamic range. Optimize display resolution by selecting "X-Axis Point Spacing" to draw evenly spaced measurement data for non-contiguous frequency bands.



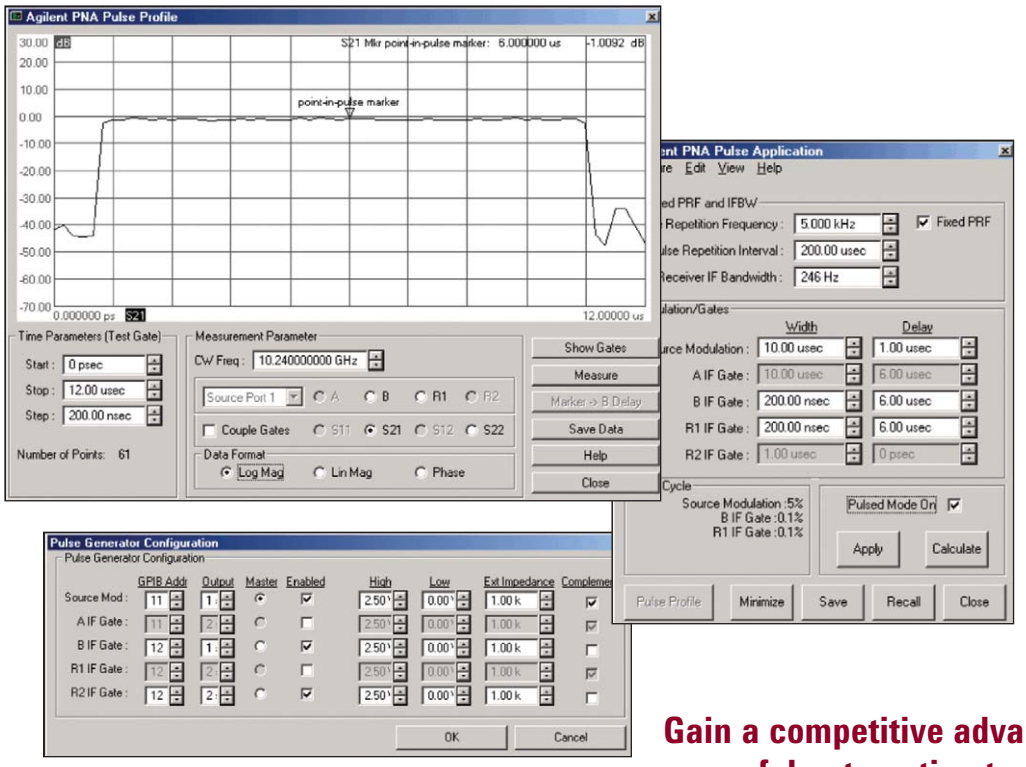
Arbitrary segment sweep enables forward and reverse sweeps as defined by the user

Arbitrary segment sweep allows users to enter into the segment sweep table any combination of the following:

- Non-contiguous frequency bands
- Segments with overlapping frequencies
- Reverse sweeps where the stop frequency is set to be less than the start frequency

1. Specified to 67 GHz, with operation to 70 GHz.

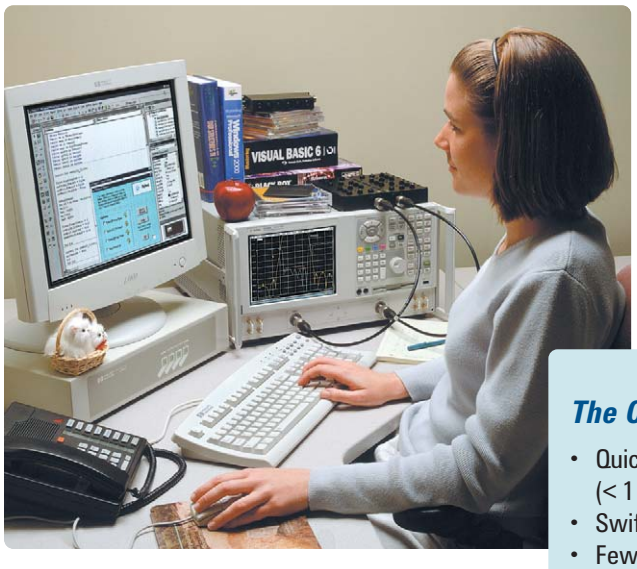
Automation



Gain a competitive advantage with powerful automation tools

Automated test is yet another method to eliminate valuable seconds from your test processes. Use the flexible automation environment to lower your cost-of-test.

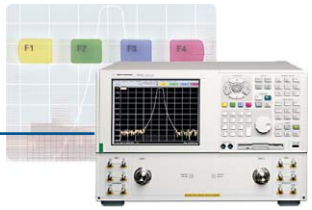
- Control the analyzer using SCPI commands, or gain the speed and connectivity advantage of COM/DCOM.
- Execute code directly from the analyzer, or from an external PC through LAN or GPIB.
- Develop code in programming environments such as Visual Basic®, Visual Basic .NET, Visual C++, Visual C++ .NET, Agilent-VEE, or LabView.



The COM/DCOM advantage

- Quick data transfer rate
  (< 1 ms COM, 57 ms SCPI over GPIB; 1601 points)
- Swift command execution
- Fewer lines of code
- Re-use rather than re-write objects

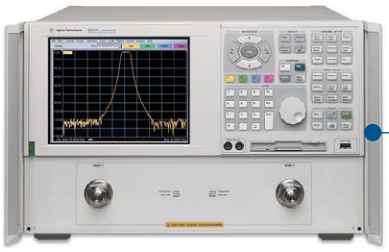
Connectivity

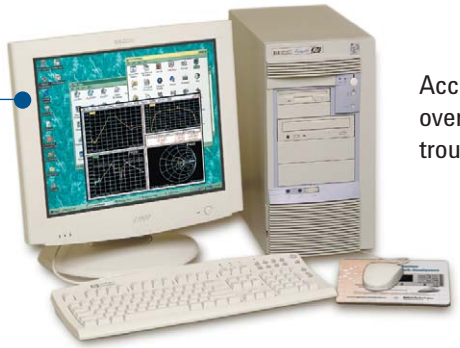


Achieve a new level of integration with Agilent Open

Agilent Open simplifies the process of connecting and programming test systems to help engineers design, validate and manufacture products. More information is available at **www.agilent.com/find/open**

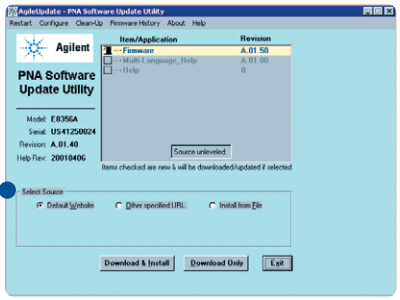
Standard features and an integrated Windows operating system give you maximum connectivity choices. Use a variety of I/O interfaces including GPIB, USB, LAN, and parallel connections.

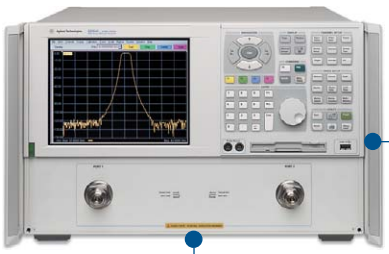




Access the analyzer over LAN for remote troubleshooting.

Use the analyzer's AgileUpdate to alert you to new features or new functionality available for free download to any PNA Series analyzer.





Send results to local or networked printers.

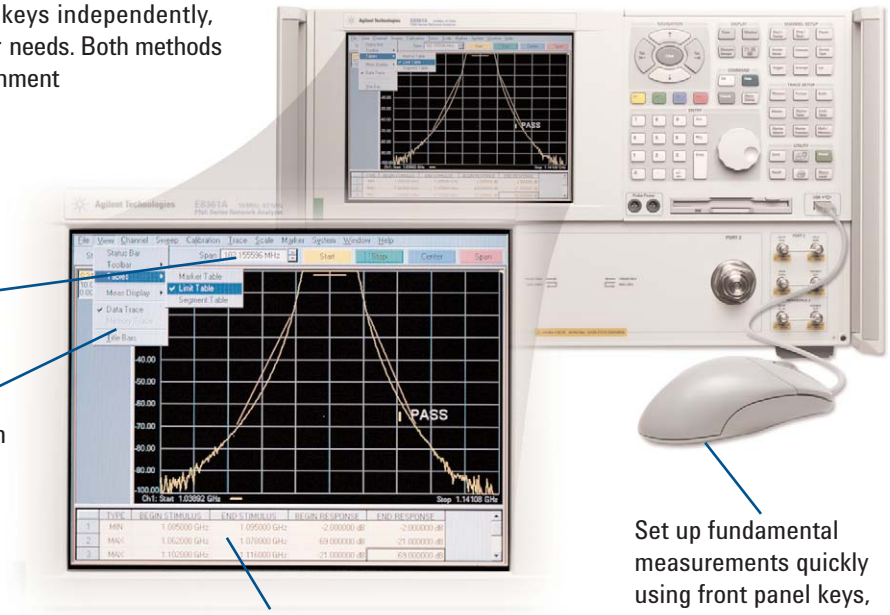
Control additional test equipment directly from the analyzer.

Send test data to a central file server.

Easy-to-Use

Configure measurements easily with intuitive user interface

Navigate the analyzer efficiently using front panel keys or with a mouse. Use a mouse or hard keys independently, or in combination to best suit your needs. Both methods are optimized in the Windows environment for fast, intuitive operation.

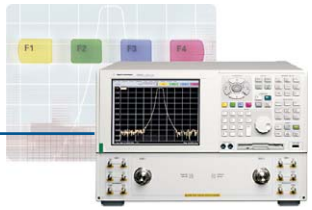


Answers when and where you need them with embedded help

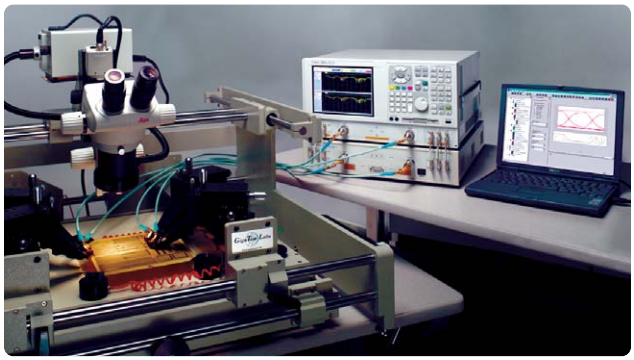
Accelerate learning with context-sensitive help and robust tutorials. Use on-line help to quickly reference programming and user documentation in French, German, Japanese, Chinese, Spanish or English languages.[1] You can bookmark important topics for easy reference.

1. Non-English versions may not include latest features.

Total Solutions



Physical layer test system



Agilent physical layer test systems provide the highest accuracy and most comprehensive tool set for characterizing differential interconnects such as high-speed backplanes, cables, connectors, IC packages, and controlled impedance traces on circuit boards.

Key features include:

- Multiport S-parameter and TDR/TDT measurements
- Single-ended, differential-, common-, and mixed-mode analysis in frequency and time domains
- Eye diagram analysis with PRBS or user-defined data patterns
- RLCG transmission-line parameter extraction

For more information visit: **www.agilent.com/find/plts**

Device modeling system

Agilent PNA network analyzers can be integrated into a fully automated device modeling system, which offers complete DC to RF device characterization and modeling.

For more information visit: **www.agilent.com/find/eesof**

Material measurements

Measuring the dielectric properties of materials is easy with Agilent's 85070E High Temperature Dielectric Probe Kit, and 85071E Materials Measurement Software.

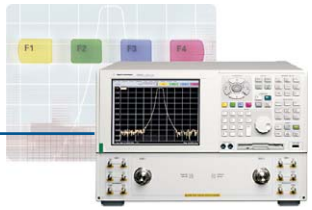
- Measure complex permittivity and permeability across a broad frequency range
- View data in real, imaginary, loss tangent, and Cole-Cole formats
- Advanced calibration techniques improve accuracy and make measurement setup fast and easy

For more information visit: **www.agilent.com/find/materials**

The PNA Series combines powerful features with the benefit of Windows to provide maximum measurement flexibility and versatility.

- Configure up to 32 independent measurement channels to eliminate the need for multiple instrument state recalls.
- 16,001 points per channel.
- Display up to 16 windows.
- Display up to 4 active traces in each window.
- Select 10 coupled or fully-independent markers per trace.

Key Specifications



Model	E8362/3/4B	E8361A	N5250A[1]
Frequency range	**10 MHz to 20/40/50 GHz**	**10 MHz to 67 GHz**	**10 MHz to 110 GHz**
Number of ports	2	2	2
Connector type	3.5/2.4/2.4 mm	1.85 mm	1.0 mm
Dynamic range (at test port)[1]			
10 to 45 MHz	79 dB	61 dB	63 dB
45 MHz to 2 GHz	94 to 119 dB	87 to 111 dB	94 to 120 dB
2 to 20 GHz	122 dB	111 dB	111 dB
20 to 40 GHz	110 dB	104 dB	92 dB
40 to 50 GHz	104 dB	96 dB	84 dB
50 to 60 GHz	–	97 dB	80 dB
60 to 70 GHz	–	94 dB	68 dB
Dynamic range (receiver access)[1]			
10 to 45 MHz	129 dB	99 dB	–
45 MHz to 2 GHz	132 dB	102 to 125 dB	–
2 to 20 GHz	136 dB	125 dB	–
20 to 40 GHz	119 dB	115 dB	–
40 to 50 GHz	111 dB	109 dB	–
50 to 60 GHz	–	107 dB	–
60 to 70 GHz	–	100 dB	–
Trace noise (1kHz IF BW)[1]			
500 MHz to 50 GHz	< 0.006 dB rms < 0.1 deg rms	< 0.006 dB rms < 0.1 deg rms	– –
Maximum output power[1]			
10 to 45 MHz	+2 dBm	-9 dB	-8 dB
45 MHz to 10 GHz	+5 dBm	-3 dB	-3 dB
10 to 20 GHz	+3 dBm	-2 dB	-5 dB
20 to 40 GHz	-4 dBm	-2 dB	-10 dB
40 to 45 GHz	-5 dBm	-7 dB	-15 dB
45 to 50 GHz	-10 dBm	-1 dB	-12 dB
50 to 60 GHz	–	-3 dB	-17 dB
60 to 70 GHz	–	-5 dB	-22 dB
70 to 110 GHz	–	–	-8 dB

– Not available

Measurement speed (35 kHz IF bandwidth)

Model	Frequency	Points	Cycle time (ms)[2]	µs/point	Updates/second
E8362B	10 MHz to 20 GHz	201	126	627	8
E8363B	10 MHz to 40 GHz	201	185	920	6
E8364B	10 MHz to 50 GHz	201	210	1045	5
E8361A	10 MHz to 67 GHz	201	244	1214	4
N5250A[3]	10 MHz to 110 GHz	201	500	2488	2

Data transfer speed, 32-bit binary (ms)[4]

	201 points	16,001 points
COM[5]	0.4	2
SCPI[5]	1	30
DCOM[6]	0.8	7
SCPI over GPIB[6]	7	435

1. Typical performance below 45 MHz and above 67 GHz. All N5250A numbers are typical.
2. Typical performance includes retrace and band-switching times with response calibration. Two-port calibration approximately doubles cycle time.
3. 10 kHz IF bandwidth.
4. Typical performance.
5. Program executed in PNA.
6. Program executed on an external PC.

Key web resources

Visit our PNA Series home page for additional literature and product information:
www.agilent.com/find/pna

RF and microwave test accessories:
www.agilent.com/find/accessories

Electronic calibration (ECal):
www.agilent.com/find/ecal

Wireless component manufacturer industry:
www.agilent.com/find/wireless

Service and support products:
www.agilent.com/find/tm_services

Aerospace defense industry:
www.agilent.com/find/ad

Agilent Email Updates

www.agilent.com/find/emailupdates
Get the latest information on the products and applications you select.

Agilent Open

About Agilent Open

Agilent Open simplifies the process of connecting and programming test systems to help engineers design, validate and manufacture electronic products. Agilent combines a broad range of system-ready instruments, open industry software, PC-standard I/O and global support to accelerate test system development. For more information, see:
www.Agilent.com/find/Open

Expand your measurement capabilities with Agilent-qualified Channel Partners.

Our Channel Partners offer accessories and measurement solutions that extend your network analysis capabilities.

For information about test fixtures and part handlers, contact:
Inter-Continental Microwave
Telephone: (408) 727-1596
Fax: (408) 727-0105
Web site: www.icmicrowave.com
E-mail: icmfixture@aol.com

For information about probing equipment and accessories, contact:
Cascade Microtech, Inc
Telephone: (503) 601-1000
Fax: (503) 601-1002
Web site: www.cascademicrotech.com
E-mail: sales@cmicro.com

For information about load pull and noise parameter systems, cal kits, and tuners, contact:
Maury Microwave Corporation
Telephone: (909) 987-4715
Fax: (909) 987-1112
Web site: www.maurymw.com
E-mail: maury@maurymw.com

Probe station (page 3) courtesy of Cascade Microtech, Inc.

Probe station (page 10) courtesy of GigaTest Labs.

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. 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 receive your new Agilent equipment, we can help verify that it works properly and help with initial product operation.

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 onsite education and training, as well as design, system integration, project management, and other professional engineering 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.

Agilent T&M Software and Connectivity
Agilent's Test and Measurement software and connectivity products, solutions and developer network allows you to take time out of connecting your instruments to your computer with tools based on PC standards, so you can focus on your tasks, not on your connections. Visit
www.agilent.com/find/connectivity
for more information.

For more information on Agilent Technologies' products, applications or services, please contact your local Agilent office. The complete list is available at:

www.agilent.com/find/contactus

Phone or Fax

United States:
(tel) 800 829 4444
(fax) 800 829 4433
Canada:
(tel) 877 894 4414
(fax) 800 746 4866
China:
(tel) 800 810 0189
(fax) 800 820 2816
Europe:
(tel) 31 20 547 2111
Japan:
(tel) (81) 426 56 7832
(fax) (81) 426 56 7840
Korea:
(tel) (080) 769 0800
(fax) (080)769 0900
Latin America:
(tel) (305) 269 7500
Taiwan:
(tel) 0800 047 866
(fax) 0800 286 331
Other Asia Pacific Countries:
(tel) (65) 6375 8100
(fax) (65) 6755 0042
Email: tm_ap@agilent.com
Contacts revised: 1/12/05

Product specifications and descriptions in this document subject to change without notice.

Printed in USA, April 21, 2005
5968-8472E

Agilent Technologies