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

- **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

- **10 MHz to 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
Performance

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.

10 MHz 20 GHz
10 MHz 40 GHz
10 MHz 50 GHz
10 MHz 67 GHz
10 MHz 110 GHz
Expandable to 325 GHz

Performance

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

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.

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

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

Antenna measurements

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

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

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
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.

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.

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

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

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
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
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.

Connectivity

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.
Easily enter limit line and segment sweep values.

View choices easily with drop-down menus.

Set up fundamental measurements quickly using front panel keys, or by using a mouse.

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.
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](http://www.agilent.com/find/plts)

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](http://www.agilent.com/find/materials)

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](http://www.agilent.com/find/eesof)

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

<table>
<thead>
<tr>
<th>Model</th>
<th>Frequency range</th>
<th>Number of ports</th>
<th>Connector type</th>
</tr>
</thead>
<tbody>
<tr>
<td>E8362/3/4B</td>
<td>10 MHz to 20/40/50 GHz</td>
<td>2</td>
<td>3.5/2.4/2.4 mm</td>
</tr>
<tr>
<td>E8361A</td>
<td>10 MHz to 67 GHz</td>
<td>2</td>
<td>1.85 mm</td>
</tr>
<tr>
<td>N5250A1</td>
<td>10 MHz to 110 GHz</td>
<td>2</td>
<td>1.0 mm</td>
</tr>
</tbody>
</table>

### Dynamic range (at test port)

<table>
<thead>
<tr>
<th>Model</th>
<th>Frequency</th>
<th>Dynamic range (dB)</th>
</tr>
</thead>
<tbody>
<tr>
<td>E8362/3/4B</td>
<td>10 MHz to 20 GHz</td>
<td>79 dB</td>
</tr>
<tr>
<td>E8361A</td>
<td>20 to 40 GHz</td>
<td>111 dB</td>
</tr>
<tr>
<td>N5250A1</td>
<td>50 Hz to 60 GHz</td>
<td>104 dB</td>
</tr>
</tbody>
</table>

### Dynamic range (receiver access)

<table>
<thead>
<tr>
<th>Model</th>
<th>Frequency</th>
<th>Dynamic range (dB)</th>
</tr>
</thead>
<tbody>
<tr>
<td>E8362/3/4B</td>
<td>10 MHz to 20 GHz</td>
<td>129 dB</td>
</tr>
<tr>
<td>E8361A</td>
<td>20 to 40 GHz</td>
<td>115 dB</td>
</tr>
<tr>
<td>N5250A1</td>
<td>50 Hz to 60 GHz</td>
<td>100 dB</td>
</tr>
</tbody>
</table>

### Trace noise (1kHz IF BW)

<table>
<thead>
<tr>
<th>Model</th>
<th>Frequency</th>
<th>Trace noise (dB)</th>
</tr>
</thead>
<tbody>
<tr>
<td>E8362/3/4B</td>
<td>500 MHz to 20 GHz</td>
<td>&lt; 0.006 dB rms</td>
</tr>
<tr>
<td>E8361A</td>
<td>200 MHz to 60 GHz</td>
<td>&lt; 0.006 dB rms</td>
</tr>
</tbody>
</table>

### Maximum output power

<table>
<thead>
<tr>
<th>Model</th>
<th>Frequency</th>
<th>Maximum output power (dBm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>E8362/3/4B</td>
<td>10 MHz to 20 GHz</td>
<td>+2 dBm</td>
</tr>
<tr>
<td>E8361A</td>
<td>200 MHz to 60 GHz</td>
<td>&lt; 0.006 dB rms</td>
</tr>
</tbody>
</table>

### Measurement speed (35 kHz IF bandwidth)

<table>
<thead>
<tr>
<th>Model</th>
<th>Frequency</th>
<th>Points</th>
<th>Cycle time (ms)</th>
<th>µs/point</th>
<th>Updates/second</th>
</tr>
</thead>
<tbody>
<tr>
<td>E8362B</td>
<td>10 MHz to 20 GHz</td>
<td>201</td>
<td>126</td>
<td>627</td>
<td>8</td>
</tr>
<tr>
<td>E8364B</td>
<td>10 MHz to 50 GHz</td>
<td>201</td>
<td>210</td>
<td>1045</td>
<td>5</td>
</tr>
<tr>
<td>E8361A</td>
<td>10 MHz to 67 GHz</td>
<td>201</td>
<td>244</td>
<td>1214</td>
<td>4</td>
</tr>
<tr>
<td>N5250A2</td>
<td>10 MHz to 110 GHz</td>
<td>201</td>
<td>500</td>
<td>2488</td>
<td>2</td>
</tr>
</tbody>
</table>

### Data transfer speed, 32-bit binary (ms)

<table>
<thead>
<tr>
<th>Model</th>
<th>Frequency</th>
<th>Data transfer speed (ms)</th>
</tr>
</thead>
<tbody>
<tr>
<td>COM</td>
<td>201 points</td>
<td>0.4 2</td>
</tr>
<tr>
<td>SCPI</td>
<td></td>
<td>1 30</td>
</tr>
<tr>
<td>DCOM</td>
<td></td>
<td>0.8 7</td>
</tr>
<tr>
<td>SCPI over GPIB</td>
<td>7 435</td>
<td>11</td>
</tr>
</tbody>
</table>
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@cascademicrotech.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
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