Agilent
RF Network Analyzers
PNA Series

Configuration Guide

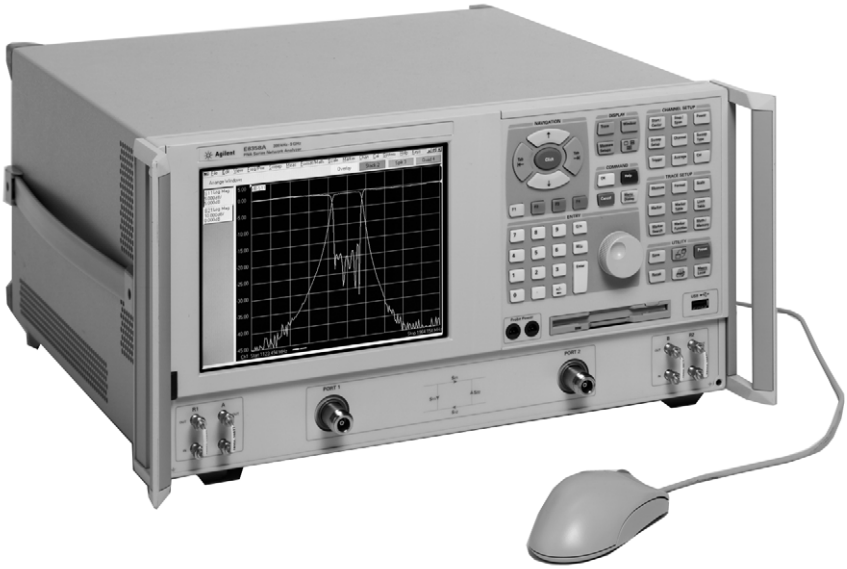
E8356A **300 kHz to 3 GHz**
E8357A **300 kHz to 6 GHz**
E8358A **300 kHz to 9 GHz**

System Configuration Summary

This summary lists the main components required to form a basic measurement system. Options or peripherals may be added to provide enhanced measurement and data storage capability.

Full S-parameter measurements

- ❒ **Agilent PNA Series network analyzer**
- ❒ **Test port cables, 50 ohms**
- ❒ **Calibration kit for applicable connector type**



This configuration guide describes standard configurations, options, accessories, upgrade kits and compatible peripherals for the PNA Series of vector network analyzers. This guide should be used with the Agilent PNA Series Technical Specifications for a complete description of these analyzers.

Agilent Technologies
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Agilent PNA Series

Each PNA Series instrument is an integrated network analyzer with a built-in LCD display, hard and floppy disk drives, S-parameter test set and synthesized source. The analyzer has two 50 ohm Type-N (f) test ports. Included with each instrument is a mouse, keyboard, CD-ROM containing a copy of the operating and programming manual set, a mini-parallel to parallel adapter, and a three-year return-to-Agilent service warranty.

- ❒ **E8356A** network analyzer, 300 kHz to 3 GHz
- ❒ **E8357A** network analyzer, 300 kHz to 6 GHz
- ❒ **E8358A** network analyzer, 300 kHz to 9 GHz

Options

- ❒ **Option 010** time-domain capability
  For viewing reflection and transmission responses in time or distance domain.
- ❒ **Option 015** configurable test set
  Adds front panel access to the source output and coupler input on both ports 1 and 2. 35 dB step attenuators are also added between the couplers and receivers. This capability provides the ability to improve measurement sensitivity for measuring low-level signals, or to add components and other peripheral instruments for a variety of measurement applications.
- ❒ **Option 1CM** rack mount kit
  Adds a rack mount (part number 5063-9216) and rail kit (E3663AC) for use without handles
- ❒ **Option 1CP** rack mount kit
  Adds a rack mount (part number 5063-9236) and rail kit (E3663AC) for use with previously supplied handles
- ❒ **Option AM8** CD-RW drive
  Adds an external read/write CD drive with a USB cable
- ❒ **Option B30** USB hub
  Adds a 4-port USB hub for connecting additional USB peripherals

Documentation

- ❒ **Option AVK** adds printed copy of User's and Programmer's documentation (part number E8356-90028)
- ❒ **Option 0BW** adds printed copy of assembly level service manual (part number E8356-90002)

Localization

The following options provide a translated, printed copy of User's documentation and an English printed copy of the Programmer's documentation. *Localized documentation will be available early 2001.*

- ❒ **Option ABD** German manual (part number E8356-90032)
- ❒ **Option ABE** Spanish manual (part number E8356-90031)
- ❒ **Option ABF** French manual (part number E8356-90029)
- ❒ **Option ABJ** Japanese manual (part number E8356-90030)

Certification options

- ❒ **Option UK6** Commercial calibration certificate with test data

Service and support options

- ❒ **Option W01** Converts three-year return-to-Agilent service warranty to one-year on-site service (check with your local Agilent sales or service office for availability in your area)
- ❒ **Option W31** Converts three-year return-to-Agilent service warranty to three-year on-site service (check with your local Agilent sales or service office for availability in your area)
- ❒ **Option W32** Three-year return-to-Agilent commercial calibration agreement
- ❒ **Option W34** Three-year return-to-Agilent standards-compliant calibration agreement
- ❒ **Option W50** Extends return-to-Agilent service warranty to 5 years
- ❒ **Option W51** Converts three-year return-to-Agilent service warranty to five-year on-site service (check with your local Agilent sales or service office for availability in your area)
- ❒ **Option W52** Five-year return-to-Agilent commercial calibration agreement
- ❒ **Option W54** Five-year return-to-Agilent standards-compliant calibration agreement

Measurement accessories

A complete line of RF test accessories can be found in the Agilent RF and Microwave Test Accessories Catalog (literature number 5968-4314EN) or by visiting **www.agilent.com/find/mta**

Accessories are available in these connector types: 50 ohm Type-N, 3.5 mm, 7 mm, and 7-16. Test port cables and a calibration kit should be added for a complete measurement system. A verification kit is used to verify corrected system performance.

Test-port cables

Test port cables are used to connect the network analyzer to the device under test.

- ❒ **N6314A** 50 ohm Type-N RF cable, 300 kHz to 9 GHz
  Includes one 610 mm (24 in) cable with male connectors (part number 8120-8862)
- ❒ **N6315A** 50 ohm Type-N RF cable, 300 kHz to 9 GHz
  Includes one 406 mm (16 in) cable with one male and one female connector (part number 8121-0027)
- ❒ **N3839A** 50 ohm Type-N RF cable, 300 kHz to 9 GHz
  Includes one 406 mm (16 in) cable with male connectors (part number 8121-0101)

Calibration kits

Mechanical calibration kits include standards, such as open/short circuits and loads, which are measured by the network analyzer for increased measurement accuracy.

Electronic calibration (ECal) kits replace mechanical calibration standards with one solid-state calibration module that is controlled by the network analyzer to present many different impedances to the test ports. A full two-port calibration can be performed quickly with a single connection. This technique reduces errors and connector wear and abrasion.

Choose a calibration kit for each connector type to be used.

Economy, includes:
- open standards (male and female)
- short standards (male and female)
- fixed-termination standards (male and female)
- in-series adapters

Standard, includes the devices in the economy kit and adds:
- connector tools

Precision, includes the devices in the economy kit and adds:
- 50 ohm airline for TRL calibration
- TRL adapters
- connector tools

For devices with Type-N connectors

Mechanical calibration kits

- ❒ **85032F** economy: 30 kHz to 9 GHz. Includes:
  85032-60017 Type-N (m) fixed load
  85032-60018 Type-N (f) fixed load
  85032-60013 Type-N (m) open
  85032-60014 Type-N (f) open
  85032-60016 Type-N (m) short
  85032-60015 Type-N (f) short
  - ❒ **Option 100** adds:
    85032-60021 Type-N (f) to Type-N (f) adapter
  - ❒ **Option 200** adds:
    85032-60019 Type-N (m) to Type-N (m) adapter
  - ❒ **Option 300** adds:
    85032-60020 Type-N (m) to Type-N (f) adapter
  - ❒ **Option 500** adds:
    85054-60001 Type-N (f) to 7 mm adapter (two included)
    85054-60009 Type-N (m) to 7 mm adapter (two included)

- ❒ **85054D** economy: 45 MHz to 18 GHz. Includes:
  85054-60025 Type-N (m) short
  85054-60026 Type-N (f) short
  85054-60027 Type-N (m) open
  85054-60028 Type-N (f) open
  85054-60031 Type-N (f) to 7 mm adapter
  85054-60032 Type-N (m) to 7 mm adapter
  85054-60037 Type-N (f) to Type-N (f) adapter
  85054-60038 Type-N (m) to Type-N (m) adapter
  85054-60046 Type-N (m) fixed load
  85054-60047 Type-N (f) fixed load

Electronic calibration kits

- ❒ **85092B** RF ECal: 30 kHz to 9 GHz. Includes:
  85092-60005 Type-N (f) to Type-N (m) RF ECal module
  - ❒ **Option 00M** substitutes module with:
    85092-60006 Type-N (m) to Type-N (m) RF ECal module
  - ❒ **Option 00F** substitutes module with:
    85092-60007 Type-N (f) to Type-N (f) RF ECal module
  - ❒ **Option 00A** adds:
    85054-60037 Type-N (f) to Type-N (f) adapter
    85054-60038 Type-N (m) to Type-N (m) adapter

For devices with 3.5 mm or SMA connectors

(see **Adapters** section for information about the Agilent 11878A 3.5 mm adapter kit)

Mechanical calibration kits

❒ **85033E** economy: 30 kHz to 9 GHz. Includes:
85033-60016 3.5 mm (m) load
85033-60017 3.5 mm (f) load
85033-60018 3.5 mm (m) open
85033-60019 3.5 mm (f) open
85033-60020 3.5 mm (m) short
85033-60021 3.5 mm (f) short
8710-1761 torque wrench
- ❒ **Option 100** adds:
  85027-60005 3.5 mm (f) to 3.5 mm (f) adapter
- ❒ **Option 200** adds:
  85027-60007 3.5 mm (m) to 3.5 mm (m) adapter
- ❒ **Option 300** adds:
  85027-60006 3.5 mm (m) to 3.5 mm (f) adapter
- ❒ **Option 400** adds:
  1250-1744 3.5 mm (f) to Type- N 50 ohm (m) adapter
  1250-1743 3.5 mm (m) to Type- N 50 ohm (m) adapter
  1250-1745 3.5 mm (f) to Type- N 50 ohm (f) adapter
  1250-1750 3.5 mm (m) to Type- N 50 ohm (f) adapter
- ❒ **Option 500** adds:
  1250-1746 3.5 mm (m) to 7 mm adapter (two included)
  1250-1747 3.5 mm (f) to 7 mm adapter (two included)

❒ **85052C** precision TRL: 45 MHz to 26.5 GHz. Includes:
00902-60003 3.5 mm (m) fixed load
00902-60004 3.5 mm (f) fixed load
85052-60006 3.5 mm (m) short
85052-60007 3.5 mm (f) short
85052-60008 3.5 mm (m) open
85052-60009 3.5 mm (f) open
85052-60032 3.5 mm (f) to 3.5 mm (f) adapter
85052-60033 3.5 mm (m) to 3.5 mm (m) adapter
85052-60034 3.5 mm (f) to 3.5 mm (m) adapter
85052-60035 3.5 mm short TRL line
85052-60036 3.5 mm long TRL line

❒ **85052D** economy: 45 MHz to 26.5 GHz. Includes:
00902-60003 3.5 mm (m) fixed load
00902-60004 3.5 mm (f) fixed load
85052-60006 3.5 mm (m) short
85052-60007 3.5 mm (f) short
85052-60008 3.5 mm (m) open
85052-60009 3.5 mm (f) open
85052-60012 3.5 mm (f) to 3.5 mm (f) adapter
85052-60013 3.5 mm (f) to 3.5 mm (m) adapter
85052-60014 3.5 mm (m) to 3.5 mm (m) adapter

Electronic calibration kits

❒ **85093B** RF ECal: 30 kHz to 9 GHz. Includes:
85093-60005 3.5 mm (f) to 3.5 mm (m) RF ECal module
- ❒ **Option 00M** substitutes module with:
  85093-60006 3.5 mm (m) to 3.5 mm (m) RF ECal module
- ❒ **Option 00F** substitutes module with:
  85093-60007 3.5 mm (f) to 3.5 mm (f) RF ECal module
- ❒ **Option 00A** adds:
  85052-60012 3.5 mm (f) to 3.5 mm (f) adapter
  85052-60014 3.5 mm (m) to 3.5 mm (m) adapter

For devices with 7 mm connectors

(see A**dapters** section for information about Agilent 7 mm adapters)

Mechanical calibration kits

❒ **85031B** economy: 30 kHz to 6 GHz. Includes:
00909-60008 7 mm coax termination
85031-60001 7 mm open/short

❒ **85050C** precision TRL: 45 MHz to 18 GHz. Includes:
00909-60008 7 mm coax termination
85050-60003 7 mm to 7 mm airline
85050-60005 7 mm to 7 mm TRL adapter
85050-60006 7 mm fixed broadband load
85050-80008 7 mm short
85050-80009 7 mm short collet
85050-80010 7 mm open

❒ **85050D** economy: 45 MHz to 18 GHz. Includes:
85050-60006 7 mm fixed broadband load
85050-80007 7 mm short
85050-80010 7 mm open

Electronic calibration kits

❒ **85091B** RF ECal: 30 kHz to 9 GHz. Includes:
85091-60003 7 mm to 7 mm RF ECal module

For devices with 7-16 connectors

(see **Adapters** section for information about the Agilent 11906B 7-16 to Type-N adapter kit)

Mechanical calibration kits

❒ **85038A** standard: 30 kHz to 7.5 GHz. Includes:
85038-80002 7-16 (f) open
85038-80003 7-16 (m) open
85038-80004 7-16 (f) short
85038-80005 7-16 (m) short
85038-80006 7-16 (f) fixed load
85038-80007 7-16 (m) fixed load
8710-2175 torque wrench
8710-2174 open-end wrench

❒ **85038F** economy: 30 kHz to 7.5 GHz. Includes:
85038-80002 7-16 (f) open
85038-80004 7-16 (f) short
85038-80006 7-16 (f) fixed load
11906-80016 7-16 (f) to 7-16 (f) adapter

❒ **85038M** economy: 30 kHz to 7.5 GHz. Includes:
85038-80003 7-16 (m) open
85038-80005 7-16 (m) short
85038-80007 7-16 (m) fixed load
11906-80015 7-16 (m) to 7-16 (m) adapter

Electronic calibration kits

❒ **85098B** RF ECal: 30 kHz to 7.5 GHz. Includes:
85098-60005 7-16 (m) to 7-16 (f) RF ECal module
  ❒ **Option 00F** substitutes module with:
  85098-60007 7-16 (f) to 7-16 (f) RF ECal module
  ❒ **Option 00M** substitutes module with:
  85098-60006 7-16 (m) to 7-16 (m) RF ECal module
  ❒ **Option 00A** adds:
  11906-80015 7-16 (m) to 7-16 (m) adapter
  11906-80016 7-16 (f) to 7-16 (f) adapter

Verification Kits

All Agilent Technologies verification kits include:
- precision Z_o airline
- mismatched airline
- fixed attenuators
- traceable measured data and uncertainties

❒ **85055A** 300 kHz to 18 GHz Type-N kit
Includes attenuators and mismatch attenuator with data on a 3.5 inch disk for use in confirming accuracy enhanced system measurement performance, traceable to national standards. Test procedure is provided in the service manual.

❒ **85053B** 300 kHz to 26.5 GHz 3.5 mm kit
Includes attenuators and mismatch attenuator with data on a 3.5 inch disk for use in confirming accuracy enhanced system measurement performance, traceable to national standards. Test procedure is provided in the service manual.

Adapters

❒ **11853A** 50 ohm Type-N accessory kit. Includes:
1250-1472 Type-N (f) to Type-N (f) adapter (two included)
1250-1475 Type-N (m) to Type-N (m) adapter (two included)
11511A Type-N (f) short
11512A Type-N (m) short
❒ **11878A** Type-N to 3.5 mm adapter kit. Includes:
1250-1744 3.5 mm (f) to Type-N 50 ohm (m) adapter
1250-1743 3.5 mm (m) to Type-N 50 ohm (m) adapter
1250-1745 3.5 mm (f) to Type-N 50 ohm (f) adapter
1250-1750 3.5 mm (m) to Type-N 50 ohm (f) adapter
❒ **11524A** 7 mm to Type-N (f) adapter
❒ **11525A** 7 mm to Type-N (m) adapter
❒ **11906A** 7-16 to 7-16. Includes:
7-16 (m) to 7-16 (m) adapter
7-16 (f) to 7-16 (f) adapter
7-16 (m) to 7-16 (f) adapter (two included)
❒ **11906B** 7-16 to Type-N. Includes:
Type-N (m) to 7-16 (m) adapter
Type-N (f) to 7-16 (f) adapter
Type-N (f) to 7-16 (m) adapter
Type-N (m) to 7-16 (f) adapter
❒ **11854A** 50 ohm BNC accessory kit. Includes:
1250-0929 BNC (m) short
1250-1473 BNC (m) to Type-N (m) adapter (two included)
1250-1474 BNC (f) to Type-N (f) adapter (two included)
1250-1476 BNC (f) to Type-N (m) adapter (two included)
1250-1477 BNC (m) to Type-N (f) adapter (two included)

General accessories

Probe

❒ **85024A** high-frequency probe
Provides high-impedance in-circuit test capability from 300 kHz to 3 GHz.

Power meters and sensors

Recommended for self support, adjustments and performance tests to verify proper instrument operation.

❒ **E4418B** single-channel power meter
❒ **E4419B** dual-channel power meter
❒ **8482A** power sensor, 100 kHz to 4.2 GHz, Type-N (m), 100 mW
❒ **E4412A** CW power sensor, 10 MHz to 18 GHz, Type-N (m), 200 mW

Amplifiers[1]

❒ **8347A** RF power amplifier, 100 kHz to 3 GHz, 25 dB gain, power out: +20 dBm
❒ **83006A** power amplifier, 10 MHz to 26.5 GHz, 20 dB gain, power out: +18dBm to 10 GHz or +16 dBm to 20 GHz or +14 dBm to 26.5 GHz
❒ **83017A** power amplifier, 50 MHz to 26.5 GHz, 25 dB gain, power out: +20 dBm to 20 GHz, or +15 dBm to 26.5 GHz
❒ **83018A** power amplifier, 2 to 26.5 GHz, 27 dB gain to 20 GHz or 23 dB to 26.5 GHz, power out: +24 dBm to 20 GHz or +21 dBm to 26.5 GHz
❒ **83020A** power amplifier, 2 to 26.5 GHz, 30 dB gain to 20 GHz or 27 dB to 26.5 GHz, power out: +30 dBm to 20 GHz or +26 dBm to 26.5 GHz

Couplers

❒ **87300B** coaxial coupler, 1 to 20 GHz, SMA (f), 10 dB coupling
❒ **87300C** coaxial coupler, 1 to 26.5 GHz, 3.5 mm (f), 10 dB coupling

Equipment racks and case

❒ **5063-9223** rack mount flange kit, for use with handles; includes handles[2]
❒ **5063-9216** rack mount kit, for use without handles; may be ordered as option 1CM
❒ **5063-9236** rack mount kit, for use with previously supplied handles; may be ordered as option 1CP
❒ **E3663AC** rail kit, included with option 1CM and 1CP.
❒ **9211-2658** transit case

1. RF connectors: 3.5 mm (f) on RF input and output; BNC (f) detector out. Type-N (f) on RF input and output for 8347A
2. A PNA Series analyzer is supplied with handles.

Peripherals

The following peripherals may be used with the E8356A, E8357A, and E8358A. Other peripherals not listed here may also be compatible with these instruments.

CD-ROM Drive

❒ USB-compatible CD-ROM drive

Monitors

❒ VGA-compatible monitor

Printers

❒ USB, LAN, parallel or serial printers with Microsoft® Windows® 2000 printer driver

Interface cables

Choose the appropriate cables to connect each peripheral to the network analyzer.

❒ **10833A GPIB** cable, 1.0 m (3.3 ft)
❒ **10833B GPIB** cable, 2.0 m (6.6 ft)
❒ **10833D GPIB** cable, 0.5 m (1.6 ft)
❒ **HP C2950A** Centronics (parallel) printer cable, 2.0 m (6.6 ft)

Upgrade kits

Upgrade kits for the E8356A, E8357A, E8358A

Upgrade kits are available to add options after initial purchase. To order an upgrade kit for an E8356A, E8357A, E8358A, order the analyzer's model number followed by a "U", then indicate the option to be added:

❒ **Option 010** time-domain upgrade kit (part number E8356-60101)
The serial number of the E8356A, E8357A, or E8358A to be retrofitted must be specified when ordering this kit. Installation is not included
❒ **Option 015** configurable test set upgrade kit (part number E8356-60102) Includes installation at an Agilent service center
❒ **Option AM8** CD RW drive
Includes an external read/write CD drive with a USB cable
❒ **Option B30** USB hub
Includes a 4-port USB hub for connecting additional USB peripherals
❒ **Option 099** firmware upgrade (part number E8356-60103)
Provides the latest revision of firmware for the PNA Series on CD-ROM. Firmware is user-installable. Installation requires USB CD-ROM drive or external computer connected via LAN. The latest firmware is also available from our web site. Visit our web page at **www.agilent.com/find/pna**

Upgrades requiring model number changes are addressed on a special handling quotation basis. Contact your local Agilent sales or service office for further information.

Literature and information

PNA Series Brochure, 5968-8472E
PNA Series Technical Specifications, 5980-1236E

Application and product notes

Literature number

Application Development with the Agilent PNA Series of Network Analyzers
literature number 5980-2666ENUS
Understanding and Improving Network Analyzer Dynamic Range Application Note 1363-1
literature number 5980-2778EN
The "Need for Speed" in Component Manufacturing Test
literature number 5980-2783EN
Generate Component Data Sheets with Agilent's BenchLinkXL
literature number 5980-2781EN
Connectivity Advances in a LAN-enabled Instrument
literature number 5980-2782EN
De-embedding and Embedding S-parameter Networks Using the PNA Series Network Analyzer Application Note 1364-1
literature number 5980-2784EN
Advanced Filter Tuning Using Time Domain Application Note 1287-10
literature number 5980-2785EN
Understanding the Fundamental Principles of Vector Network Analysis Application Note 1287-1
literature number 5965-7707E
Exploring the Architectures of Network Analyzers Application Note 1287-2
literature number 5965-7708E
Applying Error Correction to Network Analyzer Measurements Application Note 1287-3
literature number 5965-7709E
Network Analyzer Measurements: Filter and Amplifier Examples Application Note 1287-4
literature number 5965-7710E
Improving Throughput in Network Analyzer Applications Application Note 1287-5
literature number 5966-3317E
Using a Network Analyzer to Characterize High-Power Components Application Note 1287-6
literature number 5966-3319E
Simplified Filter Tuning Using Time-Domain Analysis Application Note 1287-8
literature number 5968-5328E
In-Fixture Measurements Using Vector Network Analyzers Application Note 1287-9
literature number 5968-5329E
8 Hints for Making Better Network Analyzer Measurements Application Note 1291-1
literature number 5965-8166E

Key Web Resources

Visit our component manufacturer industry area at:
www.agilent.com/find/component_test

Visit the PNA Series home page at:
www.agilent.com/find/pna

Most application and product notes may be downloaded from our web site at:
www.agilent.com/find/tmappnotes/apps

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 underlay 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 contacting 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.

For more assistance with your test and measurement needs go to

www.agilent.com/find/assist

Or contact the test and measurement experts at Agilent Technologies
(During normal business hours)

United States:
(tel) 1 800 452 4844

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(tel) 1 877 894 4414
(fax) (905) 206 4120

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Japan:
(tel) (81) 426 56 7832
(fax) (81) 426 56 7840

Latin America:
(tel) (305) 267 4245
(fax) (305) 267 4286

Australia:
(tel) 1 800 629 485
(fax) (61 3) 9272 0749

New Zealand:
(tel) 0 800 738 378
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Innovating the HP Way