Agilent Technologies
E440xBU Option H70

User's and Service Guide

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E440xBU Option H70

User's and Service Guide

Use this manual with the User's and Service manuals for the following instruments:

E4401B\E4402B\E4404B\E4405B\E4407B
and
ESA-L Series E4411B\E4403B\E4408B

Agilent Technologies

Manufacturing Part Number: E4401-90035

Print Date: February 2008
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Warranty Statement

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Safety Notes

The following safety notes are used throughout this document. Familiarize yourself with each of these notes and its meaning before performing any of the procedures in this document.

WARNING	**Warning denotes a hazard. It calls attention to a procedure which, if not correctly performed or adhered to, could result in injury or loss of life. Do not proceed beyond a warning note until the indicated conditions are fully understood and met.**

CAUTION	Caution denotes a hazard. It calls attention to a procedure that, if not correctly performed or adhered to, could result in damage to or destruction of the instrument. Do not proceed beyond a caution sign until the indicated conditions are fully understood and met.

Definitions

- *Specifications* describe the performance of parameters covered by the product warranty (temperature –0 to 55 °C, unless otherwise noted.)
- *Typical* describes additional product performance information that is not covered by the product warranty. It is performance beyond specification that 80% of the units exhibit with a 95% confidence level over the temperature range 20 to 30 °C. Typical performance does not include measurement uncertainty.
- *Nominal* values indicate expected performance or describe product performance that is useful in the application of the product, but is not covered by the product warranty.
- *Characteristic Performance* describes performance parameter that the product is expected to meet before it leaves the factory, but is not verified in the field and is not covered by the product warranty. A characteristic includes the same guard bands as a specification.

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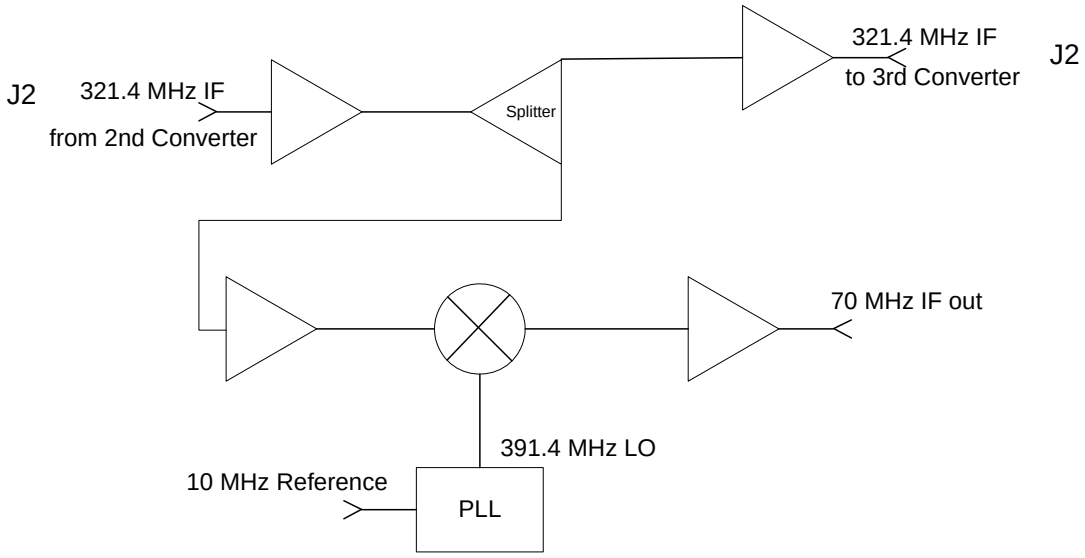
E440xBU Option H70

Description

The Agilent E440xB Option H70 provides an analog 70 MHz IF Output to the rear panel of the Economy Spectrum Analyzer (ESA) by down-converting the 321.4 MHz IF signal. The 70 MHz IF is always ON while the ESA is powered up.

The 70 MHz IF Output board is installed in the card cage between the A8A2 Second Converter IF OUT 321.4 MHz (J2) and the A8A1A1 Reference /Third Converter IF IN SMB 321.4 MHz (J2). Refer to Figure 1.

Figure 1 Block Diagram



Verifying the Shipment

After the test set has been unpacked, keep the original packaging materials so they can be used if you need to transport the instrument.Inspect the test set and all accessories for any signs of damage that may have occurred during shipment. If your test set or any accessories appear to be damaged or missing refer to “Contacting Agilent” on page 21.

Table 1 E440xBU Option H70 Accessories Supplied

Description	Agilent Part Number	Quantity
Screw	0515-0372	1
PC Board, H70	E4404-60034	1
Cable AY W “40”	E4440-60411	1
Cable AY W “51”	E4440-60422	1
Product Note	E4407-90025	1
Installation Guide	E4401-90035	1

Removal of Assemblies

Follow the steps as outlined in the Agilent ESA Spectrum Analyzer Service Guide:

1. Instrument outer case
2. Chassis Cover
3. Front Frame Assembly
4. LOIS Assembly
5. Vibration Support Bar

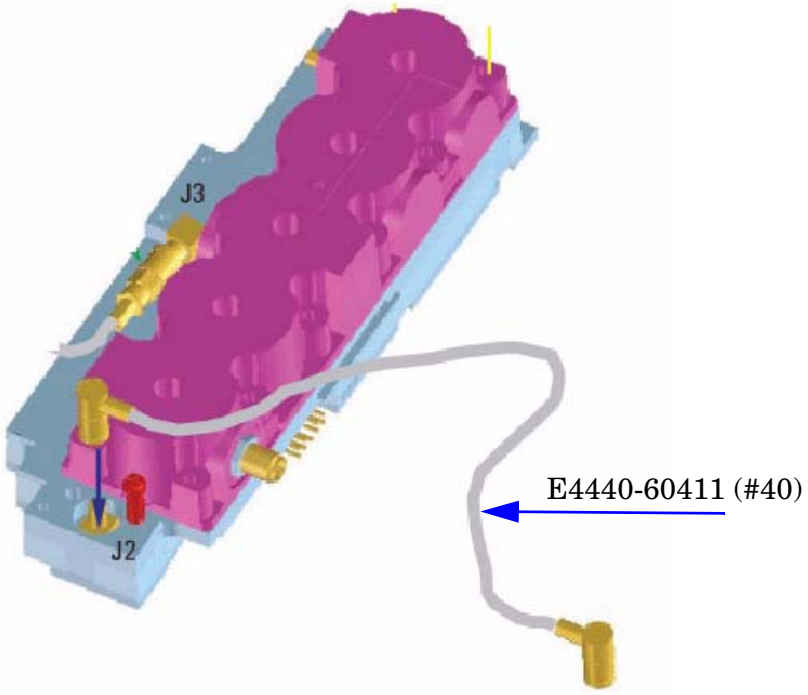
NOTE	You may view the computer based service training disk for the ESA Spectrum Analyzer (E4401-90262), for an automated visual aid in removal of these assemblies.

CAUTION	**Use ESD precautions when performing these installation procedures**

Installation

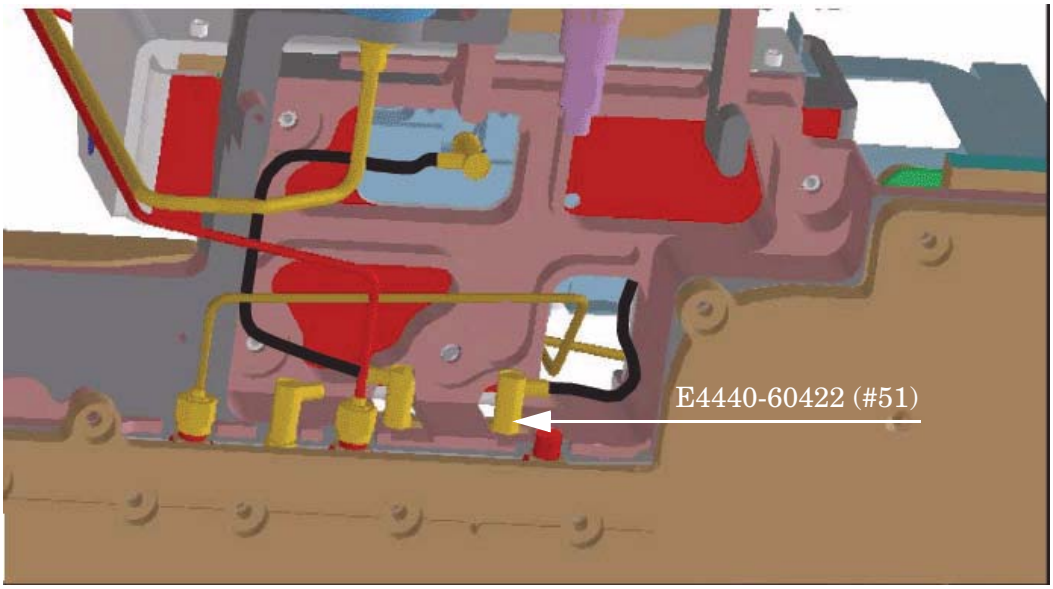
1. Connect the new cable (E4440-60411) from the 2nd Converter (J2). Route the cable through the instrument for later connection to the 70 MHz IF Board 321.4 MHz IF Input (J1).

Figure 2 Attachment of Cable to 2nd Converter



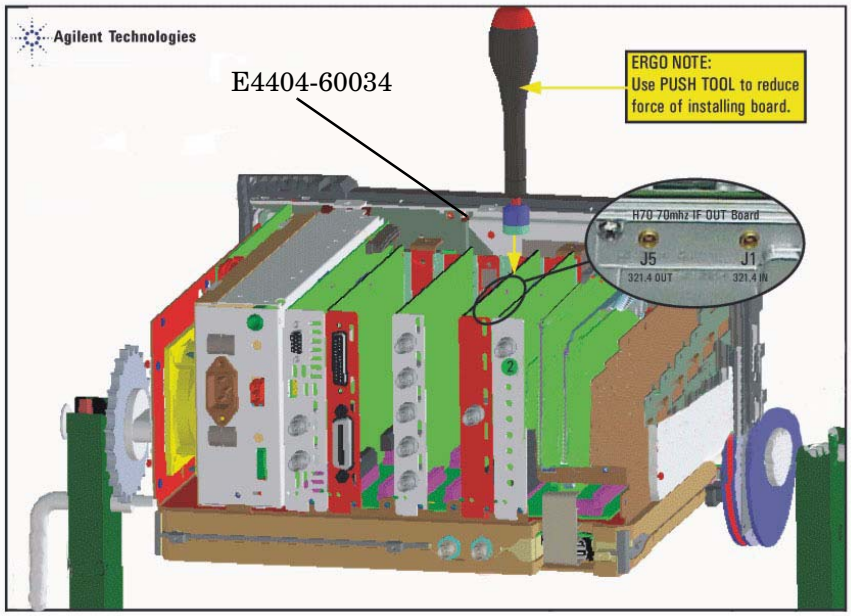
2. Connect the new cable (E4440-60422 #51) to the A8A1A1 Reference /Third Converter board IF INPUT SMB 321.4 MHz connector. Route the cable through the RF mid section for later connection to the 70 MHz IF Board 321.4 MHz IF OUTPUT (J5).

Figure 3 321.4 MHz IF cable to Third Converter



3. Insert the new 70MHz IF Board (E4404-60034) into option slot 5. Press the board firmly into the place and secure with screw (0515-0372).
4. Connect cable “40” (E4440-60411) to the 70 MHz IF board (J1) and cable “51” (E4440-60422) to the 70 MHz IF board (J5).

Figure 4 70 MHz IF Output Board



5. Reinstall the front frame assembly, vibration support, chassis cover, and instrument cover in reverse order of the removal process described in the ESA Service Guide.

This concludes the installation of the E440xBU Option H70 into the ESA instrument.

Typical Performance

Review Table 2 for the nominal characteristics of the 70 MHz IF Output of the E440xBU with the new Option H70 installed.

For all conversion loss parameters listed in Table 2, the attenuator setting is 0 dB. In highband, the preselector center routine must be performed to achieve the conversion loss listed in Table 2. If applicable, when Option 1DS (100 kHz to 3 GHz Preamp) is on, there will be a 28 dB to 30 dB of gain in the 70 MHz IF Output on the rear panel of the ESA. With the Preamp ON the conversion loss outlined in Table 2 will be +22 dB.

While performing the “Align All” routine on the ESA, the 70 MHz IF Output will be corrupted due to the systems variable gain circuit stepping through the alignment routine.

There are no flatness corrections for the 70 MHz IF Out.

Table 2 Typical Performance for the 70 MHz IF

Parameter	70 MHz IF
Frequency	70 MHz
Conversion Loss < 3 GHz	–6 dB (± 2 dB)
Conversion Loss > 3 GHz	–8 dB (± 6 dB)
IF Bandwidth[1]:	
Lowband < 3 GHz	30 MHz
Highband ≥ 3 GHz	30 to 60 MHz

1. Lowband has a fixed 30 MHz filter that determines the IF bandwidth. Highband IF bandwidth is dependent on the internal RF YIG filter.

Performance Test

Equipment

Gather the equipment listed in the following tables to verify the performance of the ESA amplitude at the 70 MHz IF Out on the rear panel.

Table 3 Equipment List

Description	Characteristics	Model
Signal Source Equipment		
Synthesized Sweeper	Frequency: Must sweep 100 MHz around 1 GHz Amplitude: –10 dBm	83620B
Analyzer Equipment		
Spectrum Analyzer	Upper Frequency Range: 2 GHz	8562E 8563E
Power Meter Equipment		
Power Meter	Absolute Accuracy: ±0.5% Resolution: 0.01 dB Reference Accuracy: 1.2%Power Reference Accuracy: ±0.9% Compatible with Agilent 8480 series power sensors dB relative mode	E4419B E4418A
Power Sensor	Frequency Range: 1 MHz to 4.0 GHz SWR at 50 MHz: ≤ 1.05 1 MHz to 4 GHz SWR: ≤ 1.22:1 Type-N (m), 50 Ω	8482A 8481A
Cables and Attenuators (as needed)		
APC 3.5 (m)(m) 2 required	DC to 26.5 GHz Length: ≤ 92 cm (36 in) Insertion Loss: ~2 dB	8120-4921
SMA	Low-loss, 1 meter	5064-5458

Table 4 50 Ω Adapters

Description	Characteristics	Model Number/ Part Number
Adapter, 3.5 (f) to 3.5 (f) Two required	VSWR: ≤ 1.05:1	83059B
BNC to dual banana		1251-0781
BNC Tee (f, m, f)		1250-0781
BNC (m) to SMA (f)	VSWR: ≤ 1.13:1	1250-1700
BNC (f) to SMA (m)		1250-1200
Type N (m) to 3.5 mm (m)	VSWR: ≤ 1.08:1	1250-1743
Type N (m) to APC 3.5 (f) (two required)	VSWR: ≤ 1.08:1	1250-1744
Type N (f) to APC 3.5 (f)	For the 83620B VSWR: 1.08:1	1250-1745
APC 3.5 (m) to APC 3. 5 (m) (two required)	VSWR: ≤ 1.12:1	1250-1748
APC 3.5 (f) to APC 3.5 (f)	Connector saver for 83630B VSWR: 1.15:1	1250-1749
Type N (f) to APC 3.5 (m) (two required)	VSWR: 1.08:1	1250-1750
Type N (f) to N (f)	VSWR: 1.03:1 ≤ 1.3 GHz ~1.15 ≤ 18 GHz	1250-1472
Type N (m) to BNC (m)		1250-1473
Type N (m) to N (m)	VSWR: 1.03:1 ≤ 1.3 GHz ~1.15 ≤ 18 GHz	1250-1475
Type N (m) to BNC (f)	VSWR: ≤ 1.03:1 ≤ 1.3 GHz ~1.15 ≤ 18 GHz	1250-1476
Type N (f) to BNC (m)	VSWR: 1.03:1 ≤ 1.3 GHz ~1.15 ≤ 18 GHz	1250-1477

Test Procedure For the 70 MHz IF Out

Amplitude Response

This test measures the ESA's amplitude response as a function of frequency. The test calculates the amplitude response relative to 50 MHz and the peak-to-peak response. A signal is applied to the analyzer at several frequencies. At each frequency the signal amplitude is adjusted to place the signal at approximately the same displayed amplitude. A power meter measures the signal amplitude.

Follow the steps below to prepare for the amplitude verification of the 70 MHz IF Output on the rear of the ESA.

1. **[Preset]** the E440xBU ESA and all the test equipment.
2. Run **Align All Now** on the ESA. Press: **[System]** > **Alignments** > **Align All Now**.
3. Initialize the test equipment parameters as follows.

Table 5 E440xBU ESA Signal Analyzer Setup

Parameter	Setting
Center Frequency	1 GHz
Span	0 Hz
Resolution Bandwidth	1 MHz
Attenuation	0 dB[1]
Frequency Reference	Internal

1. Select 0 dB since this setting will determine the IF output level relative to the input signal.

Table 6 Synthesized Sweeper Setup

Parameter	Settings
Frequency	1 GHz
Function	CW or Sine
Level	–10 dBm

4. Zero and calibrate the power sensor.
5. Connect the power sensor/power meter to the Type-N cable that is connected to the Source. Use an N (f) to N (f) adapter between the power sensor and the cable.
6. Adjust the Source **[Amplitude]** for a power meter reading of **–10 dBm**.

7. Disconnect the power sensor from the cable and connect the cable directly to the ESA RF Input.

NOTE If the ESA has Option BAB (APC 3.5 Input connector), use an APC 3.5 (f) to N (f) adapter between the ESA and the Type-N cable.

8. Connect the 70 MHz IF Out on the rear panel of the ESA to the RF Input on the spectrum analyzer. Use an SMA or APC 3.5 cable and appropriate adapters as needed.
9. Initialize the spectrum analyzer parameters as follows on Table 7.

Table 7 70 MHz Measurement Spectrum Analyzer Settings

Parameter	Setting
Center Frequency	70 MHz
Span	5 MHz
Resolution Bandwidth	1 MHz
Reference Level	0 dBm
Log Scale	5 dB/Div

10. Record the amplitude of the 70 MHz Output. The signal level should be –16 dBm (±2 dB). This equates to a 6 dB loss between the RF Input and the 70 MHz Output port.

Measuring the Bandwidth of the IF Output

This test measures the ESA's bandwidth at the 70 MHz output connector. A swept signal is applied to the analyzer and the bandwidth is measured using another analyzer.

1. While the spectrum analyzer is still connected to the 70 MHz IF Output connector on the rear of the ESA, configure the ESA and test equipment as follows:

Table 8 E440xBU ESA Signal Analyzer Setup

Parameter	Setting
Center Frequency	1 GHz
Span	0 Hz
Resolution Bandwidth	1 MHz
Attenuation	0 dB[1]
Frequency Reference	Internal

1. Choose 0 dB, this setting will determine the IF Out level, with respect to the input signal.

Table 9 Bandwidth Measurement Spectrum Analyzer Setup

Parameter	Settings
Center Frequency	70 MHz
Span	100 MHz
Res BW	3 MHz
Reference Level	0 dBm
Log Scale	5 dB/Div.
Trace	Max Hold

Table 10 Synthesized Sweeper Setup

Parameter	Settings
Start Frequency	950 MHz
Stop Frequency	1050 MHz
Function	CW or Sine
Level	–10 dBm

2. Select **[Max Hold]** on the spectrum analyzer. While the sweeper is sweeping, the bandwidth response of the
   70 MHz output will be displayed on the spectrum analyzer. Allow enough sweeps to fill the bandwidth display.
3. Press **[Peak Search]** on the spectrum analyzer to place a marker on the peak of the response.
4. Press **[Marker Delta]** on the spectrum analyzer and adjust the Delta Marker down the skirt of the response to the 3 dB point.
5. Press **[Marker Delta]** again and adjust the Delta Marker back through the peak response and down the other skirt until the marker amplitude reads **0 dB**. The Marker Delta frequency is the 3 dB bandwidth of the output port.
6. Refer to the "Typical Performance" on page 8 to verify the results of your tests.

Safety and Regulatory Information

Introduction

Review this product and related documentation to familiarize yourself with safety markings and instructions before you operate the instrument. The documentation contains information and warnings that must be followed by the user to ensure safe operation and to maintain the product in a safe condition.

Cleaning the Instrument

WARNING **To prevent electrical shock, disconnect the instrument from mains before cleaning. Use a dry cloth or one slightly dampened with water to clean the external case parts. Do not attempt to clean internally.**

Connector Care and Cleaning

Cleaning connectors with alcohol shall only be done with the instrument power cord removed, and in a well ventilated area. Allow all residue alcohol moisture to evaporate and the fumes to dissipate prior to energizing the instrument.

WARNING **Keep isopropyl alcohol away from heat, sparks, and flame. Store in a tightly closed container. It is extremely flammable. In case of fire, use alcohol foam, dry chemical, or carbon dioxide; water may be ineffective.**

Use isopropyl alcohol with adequate ventilation and avoid contact with eyes, skin, and clothing. It causes skin irritation, may cause eye damage, and is harmful if swallowed or inhaled. It may be harmful if absorbed through the skin. Wash thoroughly after handling.

In case of spill, soak up the sand or earth. Flush spill area with water. Dispose of isopropyl alcohol in accordance with all applicable federal, state, and local environmental regulations.

Declaration of Conformity

For a copy of the manufacturer's Declaration of Conformity for this apparatus, contact your local Agilent Technologies office or sales representative. Refer to "Contacting Agilent" on page 21.

Statement of Compliance

This instrument has been designed and tested in accordance with IEC Publication 1010, Safety Requirements for Electronic Measuring Apparatus, and has been supplied in a safe condition. The instruction documentation contains information and warnings which must be followed by the user to ensure safe operation and to maintain the instrument in a safe condition.

General Safety Considerations

Safety Earth Ground

WARNING **This is a Safety Class I product (provided with a protective earthing ground incorporated in the power cord). The mains plug shall only be inserted in a socket outlet provided with a protective earth contact. Any interruption of the protective conductor, inside or outside of the instrument, will make the instrument dangerous. Intentional interruption is prohibited.**

Before Applying Power

Verify that the product is configured to match the available main power source. If this product is to be powered by autotransformer, make sure the common terminal is connected to the neutral (grounded) side of the ac power supply.

Cautions applicable to this instrument.

CAUTION Always use the three-prong ac power cord supplied with this instrument. Failure to ensure adequate earth grounding (by not using this cord) can cause instrument damage.

CAUTION This product is designed for use in Installation Category II and Pollution Degree 2 per IEC 61010 Second Edition and 664 respectively.

CAUTION This instrument has autoranging line voltage input; be sure the supply voltage is within the specified range.

CAUTION Ventilation Requirements: When installing the instrument in a cabinet, the convection into and out of the instrument must not be restricted. The ambient temperature (outside the cabinet) must be less than the maximum operating temperature of the instrument by 4 °C for every 100 watts dissipated in the cabinet. If the total power dissipated in the cabinet is greater than 800 watts, forced convection must be used.

Servicing

Warnings applicable to this instrument.

WARNING	**To prevent electrical shock, disconnect the instrument from the mains before cleaning. Use a dry cloth or one slightly dampened with water to clean the external case parts. Do not attempt to clean internally.**

WARNING	**For continued protection against fire hazard replace line fuse only with same type and rating: Fuse 3.15A/250V, Part Number 2110-0655** **The use of other fuses or material is prohibited.**

WARNING	**This is a Safety Class I product (provided with a protective earthing ground incorporated in the power cord). The mains plug shall be inserted only into a socket outlet provided with a protective earth contact. Any interruption of the protective conductor, inside or outside the product is likely to make the product dangerous. Intentional interruption is prohibited.**

WARNING	**These servicing instructions are for use by qualified personnel only.**

WARNING	**The opening of covers or removal of parts is likely to expose dangerous voltages. Disconnect the instrument from all voltage sources while it is being opened.**

WARNING	**This product is designed for use in Installation Category II and Pollution Degree 2 per IEC 61010-1: 2001.**

WARNING	**No operator serviceable parts inside. Refer servicing to qualified personnel.**

WARNING	**If this product is not used as specified, the protection provided by the equipment could be impaired. This product must be used in a normal condition (in which all means for protection are intact) only.**

Regulatory Information

This section contains information that is required by various government regulatory agencies.

Instrument Markings

The instruction documentation symbol. The product is marked with this symbol when it is necessary for the user to refer to the instructions in the documentation.

This symbol indicates that the instrument requires alternating current (ac) input.

This symbol indicates separate collection for electrical and electronic equipment, mandated under EU law as of August 13, 2005. All electric and electronic equipment are required to be separated from normal waste for disposal (Reference WEEE Directive, 2002/96/EC).

This symbol indicates that the power line switch is ON.

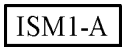
This symbol indicates that the power line switch is in the STANDBY position.

This symbol indicates that the power line switch is in the OFF position.

This symbol is used to identify a terminal which is internally connected to the product frame or chassis.

The CE mark is a registered trademark of the European Community. (If accompanied by a year, it is when the design was proven.)

The CSA mark is a registered trademark of the Canadian Standards Association. This instrument complies with Canada: CSA 22.2 No. 000000061010-1, Second Edition.



This is a symbol of an Industrial Scientific and Medical Group 1 Class A product.

This is a marking to indicate product compliance with the Canadian Interference-Causing Equipment Standard (ICES-001).

Direct Current.

This is a required mark signifying compliance with an EMC requirement. The C-Tick mark is a registered trademark of the Australian Spectrum Management Agency.

China RoHS regulations include requirements related to packaging, and require compliance to China standard GB18455-2001.

This symbol indicates compliance with the China RoHS regulations for paper/fiberboard packaging.

Compliance with Canadian EMC Requirements

This ISM device complies with Canadian ICES-001.
Cet appareil ISM est conforme a la norme NMB du Canada.

Compliance with German FTZ Emissions Requirements

This product complies with the German FTZ 526/527 Radiated Emissions and Conducted Emission requirements.

Compliance with German Noise Requirements

This is to declare that this instrument is in conformance with the German Regulation on Noise Declaration for Machines (Laermangabe nach der Maschinenlaermrerordnung-3. GSGV Deutschland).

Acoustic Noise Emission/Geraeuschemission	
LpA<70 dB	Lpa<70 dB
Operator Position	am Arbeitsplatz
Normal Operation	normaler Betrieb
per ISO 7779	nach DIN 45635 t. 19

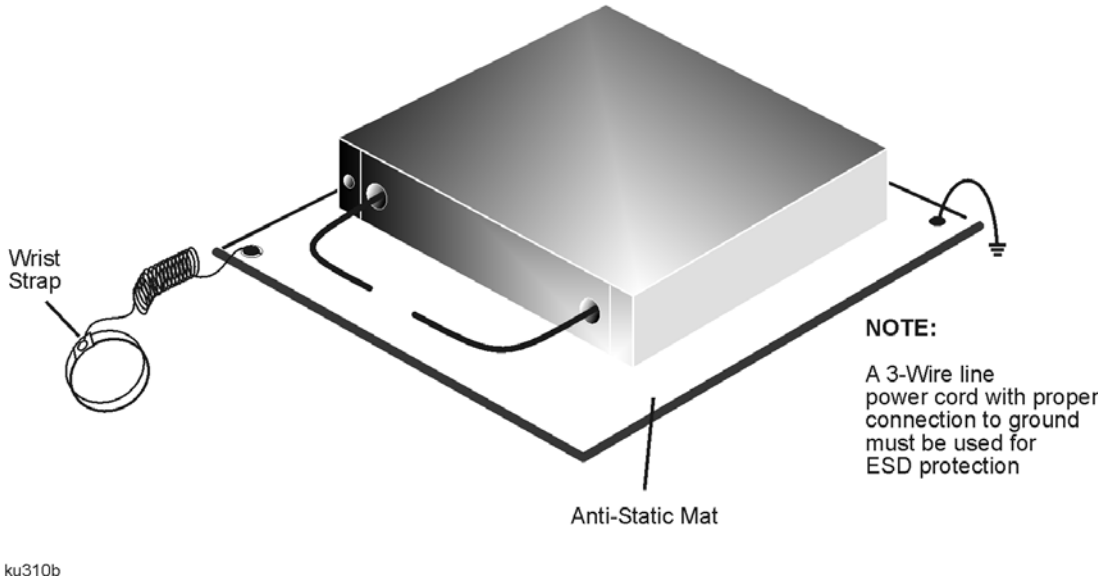
Electrostatic Discharge Protection

Protection against electrostatic discharge (ESD) is essential while removing assemblies from or connecting cables to the network analyzer. Static electricity can build up on your body and can easily damage sensitive internal circuit elements when discharged. Static discharges too small to be felt can cause permanent damage. To prevent damage to the instrument:

- *always* have a grounded, conductive table mat (9300-0797) in front of your test equipment.
- *always* wear a grounded wrist strap (9300-1367) with grounding cord (9300-0980), connected to a grounded conductive table mat, having a 1 MΩ resistor in series with it, when handling components and assemblies or when making connections.
- *always* wear a heel strap (9300-1126) when working in an area with a conductive floor. If you are uncertain about the conductivity of your floor, wear a heel strap.
- *always* ground yourself before you clean, inspect, or make a connection to a static-sensitive device or test port. You can, for example, grasp the grounded outer shell of the test port or cable connector briefly.
- *always* ground the center conductor of a test cable before making a connection to the analyzer test port or other static-sensitive device. This can be done as follows:

  1. Connect a short (from your calibration kit) to one end of the cable to short the center conductor to the outer conductor.
  2. While wearing a grounded wrist strap, grasp the outer shell of the cable connector.
  3. Connect the other end of the cable to the test port and remove the short from the cable.

Figure 5 ESD Protection Setup



Agilent Support, Services, and Assistance

Service and Support Options

The analyzer's standard warranty is a one-year return to Agilent Technologies service warranty.

NOTE There are many other repair and calibration options available from the Agilent Technologies support organization. These options cover a range of service agreements with varying response times. Contact Agilent for additional information on available service agreements for this product. Refer to "Contacting Agilent" on page 21.

Contacting Agilent

Assistance with test and measurements needs and information or finding a local Agilent office are available on the Web at:
http://www.agilent.com/find/assist

If you do not have access to the Internet, please contact your Agilent field engineer.

NOTE In any correspondence or telephone conversation, refer to the Agilent product by its model number and full serial number. With this information, the Agilent representative can determine whether your product is still within its warranty period.

Shipping Your Analyzer to Agilent for Service or Repair

IMPORTANT Agilent Technologies reserves the right to reformat or replace the internal hard disk drive in your analyzer as part of its repair. This will erase all user information stored on the hard disk. It is imperative, therefore, that you make a backup copy of your critical test data located on the analyzer's hard disk before shipping it to Agilent for repair.

If you wish to send your network analyzer to Agilent Technologies for service or repair:

- Include a complete description of the service requested or of the failure and a description of any failed test and any error message.
- Ship the analyzer using the original or comparable antistatic packaging materials.
- Contact Agilent for instructions on where to ship your analyzer.