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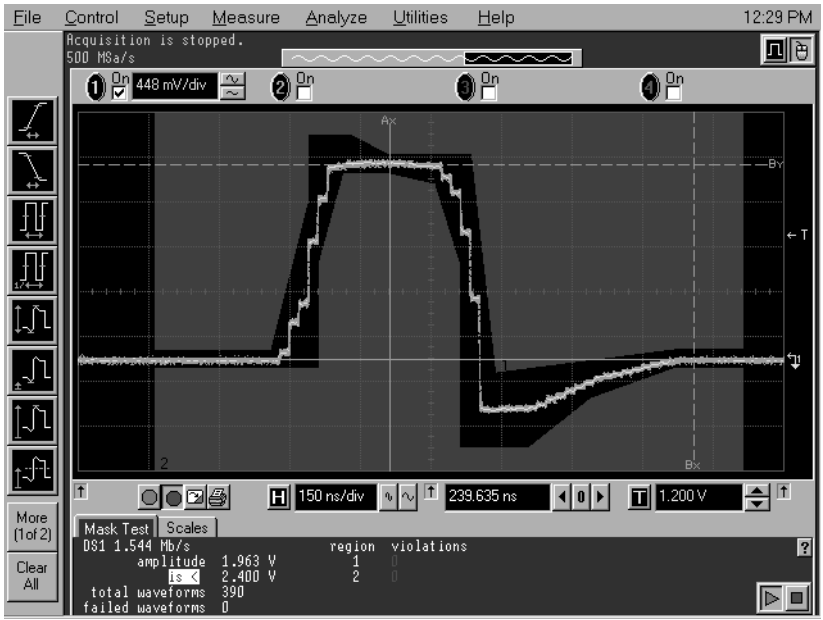
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Agilent Technologies

User's Guide

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E2621A and E2622A Probe Adapters for Infiniium Oscilloscopes

E2621A and E2622A Probe Adapters Descriptions

The E2621A and E2622A Probe Adapters provide a telecommunications interface to Infiniium Oscilloscopes.

- The E2621A ac-coupled, balanced adapter allows connection to differential communications waveforms by terminating the input into 100 Ω, 110 Ω or 120 Ω. It also adapts various connector styles (i.e., Bantam, RJ48C and Siemens) to the oscilloscope's 50 Ω BNC input. You can select the termination impedance using the built-in, three-way switch. The AutoProbe interface allows the Infiniium oscilloscope to recognize the E2621A, automatically configure itself to 50 Ω input impedance, and read the termination switch setting.
- The E2622A dc-coupled, unbalanced adapter allows you to connect communications waveforms such as DS3 and E3 to the oscilloscope's 50 Ω BNC input. The AutoProbe interface allows the Infiniium oscilloscope to recognize the E2622A and automatically configure itself to 50 Ω input impedance.

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Inspect the probe adapters

❑ Inspect the shipping container for damage.

Keep a damaged shipping container or cushioning material until the contents of the shipment have been checked for completeness and the probe has been checked mechanically and electrically.

❑ Check the accessories.

Accessories supplied with the probe are listed in "Accessories Supplied" in this manual.

- If the contents are incomplete or damaged, notify your Agilent Technologies Sales Office.

❑ Inspect the instrument.

- If there is mechanical damage or defect, or if the probes do not operate properly or pass calibration tests, notify your Agilent Technologies Sales Office.
- If the shipping container is damaged, or the cushioning materials show signs of stress, notify the carrier as well as your Agilent Technologies Sales Office. Keep the shipping materials for the carrier's inspection. The Agilent Technologies Sales Office will arrange for repair or replacement at Agilent Technologies' option without waiting for claim settlement.

Safety considerations

WARNING **SHOCK HAZARD!**



These probes are designed for use with oscilloscopes that have a common terminal at *GROUND POTENTIAL* (in accordance with OSHA requirements and the National Electric Code). Exposed metallic surfaces of the probe and the oscilloscope *MUST BE GROUNDED*. Failure to ground the common terminal during certain applications, such as those requiring the oscilloscope to be powered from an external battery, might expose the operator to an electrical shock hazard that could be lethal (depending on voltage and current conditions.)

Cleaning the probes

Clean the probe with a cloth dampened in mild soap and water and immediately wipe the probe with a dry cloth. Do not use petroleum based solvents to clean the probe.

Specifications

	E2621A	E2622A
Attenuation: †	14 dB (5X) ± 0.26 dB (3.0%) at 1 MHz	14 dB (5X) ± 0.17 dB (2%) (dc)
Bandwidth: (-3 dB) †	< 10 kHz to > 100 MHz	> 1.0 GHz
Risetime: †	< 3.5 nS (based on bandwidth)	< 350 pS (based on bandwidth)
Input Impedance: †		75 Ω ± 2% (dc)

Characteristics

	E2621A	E2622A
Attenuation: †	14 dB (5X) ± 0.42 dB (5%) 50 kHz to 30 MHz	
Electrical Standards:	DS-1, DS-1A, E-1, DS-1C, DS-2	D-1, D-2, DS-3, DS-4, STS-1, STS-3, STM-1, E-2, E-3, E-4.
Compliance with:	ANSI T1.102 ITU-T G.703	ANSI T1.102 ITU-T G.703
Input Coupling	ac coupled and transformer isolated	dc
Input Impedance: †	switch selectable, 100 Ω, 110 Ω or 120 Ω. ± 2.5% from 50 kHz to 30 MHz	
Maximum Input Voltage	CAT 1: Mains Isolated	< 5 V dc or ac rms (<333 mW), CAT 1
Differential Mode ac:	5 Vrms	
Differential Mode dc:	200 V	
Common Mode:	300 Vpeak	
Input Connection:	three-conductor Bantam female connector with 100 Ω nominal impedance	BNC female connector with 75 Ω nominal impedance
Temperature		
Operating	0 °C to +55 °C	0 °C to +55 °C
Storage	–40 °C to +70 °C	–40 °C to +70 °C
Humidity		
Operating	< 95% RH (noncondensing) at +40 °C	< 95% RH (noncondensing) at +40 °C
Storage	< 90% RH at +65 °C	< 90% RH at +65 °C
Altitude		
Operating	< 4600 m	< 4600 m
Storage	< 15300 m	< 15300 m

	E2621A	E2622A
Indoor Use		
Dimensions	350 mm x 23 mm x 28 mm (excluding Autoprobe contacts)	
Weight	75 gm	70 gm
Pollution Degree 2	Normally only non-conductive pollution occurs. Occasionally, however, a temporary conductivity caused by condensation must be expected.	

† Specifications and characteristics assume the probe adapter is terminated into a 50 Ohm 1% load.

Returning a probe to Agilent Technologies for service

Before shipping a probe to Agilent Technologies, contact your nearest Agilent Technologies Sales Office for additional details.

1 Write the following information on a tag and attach it to the probe.

- Name and address of owner
- Probe model number
- Probe serial number
- Description of the service required or failure indications

2 Remove all accessories from the probe.

Accessories include all cables. Do not include accessories unless they are associated with the failure symptoms.

3 Protect the probe by wrapping it in plastic or heavy paper.

Antistatic wrapping or packaging is strongly recommended.

4 Pack the probe in foam or other shock absorbing material and place it in a strong shipping container.

You can use the original shipping materials, or order materials from an Agilent Technologies Sales Office. If neither are available, place 3 to 4 inches of shock-absorbing material around the probe and place it in a box which minimizes shock during shipping.

5 Seal the shipping container securely.

6 Mark the shipping container as FRAGILE.

In any correspondence, refer to the probe by model number and full serial number.

To order replaceable parts

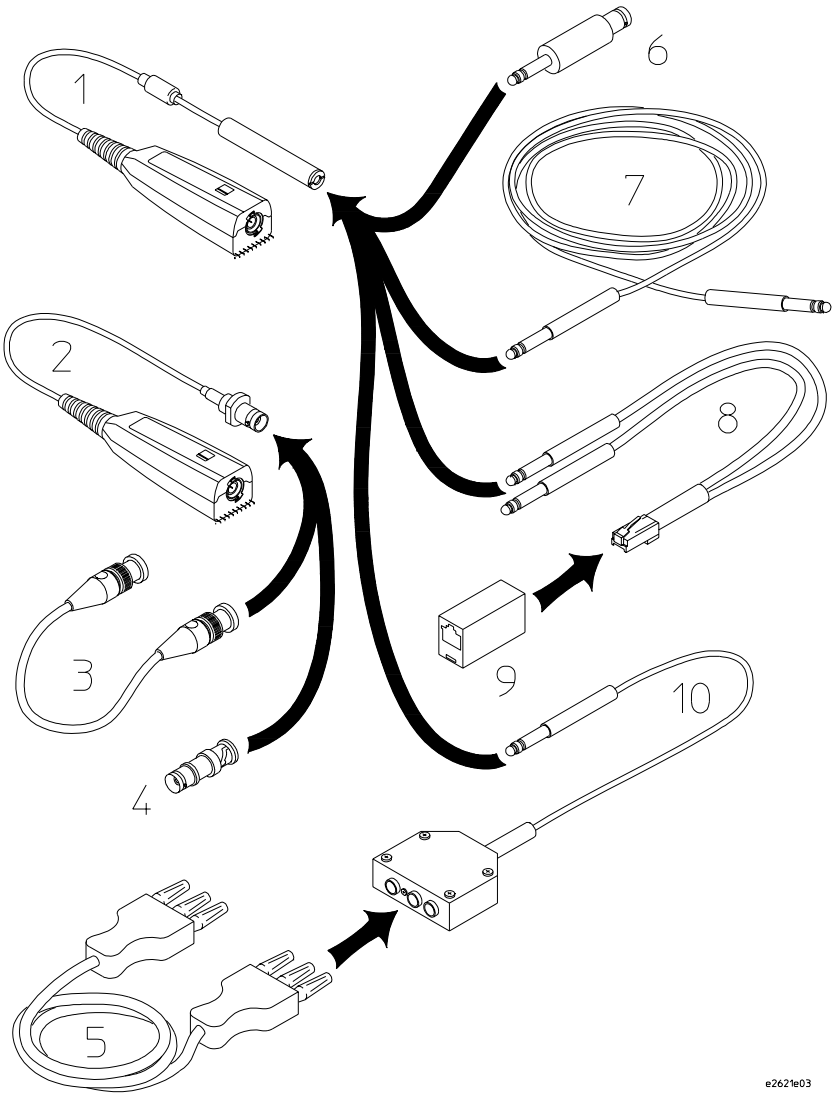
To order a replaceable part, in the United States call our toll-free hotline at 1-800-452-4844, or call your local Agilent Technologies Sales Office.

Available accessories

Use the figure on the next page and the following list to make connections using the probe accessories.

Item	Model	Description
1	E2621A	Differential to single ended adapter assembly, 50-Ohm BNC to Bantam (female)
2	E2622A	Single ended adapter assembly, 50-Ohm BNC to 75-Ohm BNC (female)
3	8120-1838	Cable, 50-Ohm BNC (male) to 50-Ohm BNC (male) Used for Calibration Testing
4	E2629A	Adapter, 50-Ohm BNC (female) to 75-Ohm BNC (male) Used for Calibration Testing
5	E2632A	Patch cord, Siemans (male) to Seimans (male), 3 foot (1 meter)
6	E2628A	Adapter, BNC to Bantam (male) Used for Calibration Testing
7	E2630A	Patch cord, Bantam (male) to Bantam (male), 6 foot (2 meter)
8	E2624A	Adapter cable, dual - Bantam (male) to RJ48
9	E2627A	Adapter, RJ48 (female) to RJ48 (female)
10	E2623A	Adapter cable, Bantam (male) to Siemens (female)

Adapter and accessory connections



Calibration Testing Procedures for E2621A

These procedures are used to test the warranted specifications for the E2621A. Use the equipment listed in the "Test Equipment Required" section to complete the calibration testing procedures.

Testing interval

The calibration test procedures may be performed for incoming inspection of the instrument and should be performed periodically thereafter to ensure and maintain peak performance. The recommended calibration test interval is yearly. The amount of use, environmental conditions, and the user's experience concerns regarding the need for testing will contribute to your specific calibration test interval.

When you return the E2621A to Agilent Technologies for calibration test verification, a new certificate is provided which verifies that the probe performed within specified limits and against equipment which is traceable to the National Institute of Standards and Technology.

Test Equipment Required.

The equipment required for the calibration tests is listed in the table below. Any equipment satisfying the critical specifications listed may be substituted for the recommended model.

Equipment	Qty	Critical Specification	Agilent Part Number
Signal Generator	1	10 kHz to 1.2 GHz ± 1dB 50 Ω output impedance	8662A
Oscilloscope	1	>1.5 GHz Bandwidth Vrms measurement	54845 or 54846 [1]
Adjustable Attenuator	2	± 0.05 dB, DC to 1 GHz 0dB to 12dB, 1dB steps	355C[3]
Adapter	1	BNC to Bantam	E2628A [2]
BNC Cable	1	50 Ohm, 1.2 meter	8120-1840
BNC Cable	1	50 Ohm, 0.3 meter	8120-1838 [2]

[1] May not be substituted.

[2] Included in E2625A kit.

[3] Requires special calibration.

CAUTION Allow the test equipment to warm up for at least 15 minutes before starting the procedures. Failure to allow the test equipment to warm up may cause failure of functional verification.

E2621A Attenuation Verification

This calibration procedure will reference a traceable attenuator connected to a calibrated oscilloscope and compare it to the attenuated output of the E2621A on the same calibrated oscilloscope. The difference between the two measurements will be used to calculate the deviation from a traceable attenuator at specified frequencies.

Attenuation @ 1 MHz

1. Connect the signal generator output to the oscilloscope using a 50 Ω cable. Use the same cable for all the following tests (cable length is not critical).
2. On the oscilloscope, set the selected channel to measure ac Vrms. Set the test equipment as shown in the table below.

Oscilloscope	
Vertical Scale	500 mV/div
Input Z	50 Ω
Offset	0 V
Coupling	dc
Probe Attenuation	1:1
Horizontal Scale	1 μS/div
Sampling Mode	Equivalent Time
Averaging	16 Averages
Signal Generator	
Signal Type	Sine
Amplitude	1 V ± 0.05 Vrms
Frequency	1 MHz

3. Adjust the signal generator output amplitude for a mean value, as measured by the oscilloscope, of 1V ± 0.05 Vrms. Press [Clear Display] for fast updates of the mean value.
4. Connect the two adjustable attenuators between the signal generator and the oscilloscope and adjust the attenuation level to 14dB.
5. Set the Probe Attenuation to 5:1.
6. Press [Clear Display] and record mean Vrms. $V_{attenuator}$ = _____.
7. Remove the adjustable attenuators and BNC cable connected to the oscilloscope. Maintain the signal generator and oscilloscope settings.
8. Set the E2621A impedance switch to the 100 Ω position.
9. Install the E2621A Differential Adapter onto the oscilloscope. Connect the E2628A to the other end of the E2621A. Connect the BNC cable from the signal generator to the E2628A.

10 Set the Probe Attenuation to 5:1.
11 Press [Clear Display] and record mean Vrms. V_{probe} = _____.
12 Calculate the attenuation deviation:
Deviation @ 1 MHz = 20 LOG (V_{probe} / $V_{attenuator}$)
13 Enter the calculated Deviation @ 1 MHz on the test record under Measured Deviation.
14 Calculate the attenuation for the E2621A at 1 MHz:
Attenuation @ 1 MHz = 14dB + (Deviation @ 1 MHz)
15 Enter the calculated Attenuation @ 1 MHz on the test record under Calculated Attenuation.

Attenuation @ 10 kHz

1 Remove the E2621A. Connect the adjustable attenuators between the signal generator and the oscilloscope and adjust the attenuation level to 14dB.
2 Make the following changes to the test equipment setup (keep all other settings the same as in step 2).

Oscilloscope	
Horizontal Scale	100 μS/div
Probe Attenuation	5:1
Input Z	50 Ω
Signal Generator	
Frequency	10 kHz

3 Press [Clear Display] and record mean Vrms. $V1_{10\ kHz}$ = _____.
4 Remove the adjustable attenuators and BNC cable from the oscilloscope. Maintain the signal generator and oscilloscope settings.
5 Install the E2621A Differential Adapter onto the oscilloscope. Connect the E2628A to the other end of the E2621A. Connect the BNC cable from the signal generator to the E2628A.
6 Set the Probe Attenuation to 5:1.
7 Press [Clear Display] and record the mean Vrms. $V2_{10\ kHz}$ = _____.
8 Calculate the deviation at 10 kHz:
Deviation 10kHz = 20 LOG ($V2_{10\ kHz}$ / $V1_{10\ kHz}$)
9 Enter the Deviation @ 10kHz on the test record under Measured Deviation.
10 Calculate the attenuation at 10 kHz:
Attenuation 10kHz = 14dB + (Deviation @ 10 kHz)

11 Enter the Attenuation @ 10 kHz on the test record under Calculated Attenuation.

Attenuation @ 100 MHz

1 Remove the E2621A from the setup. Connect the adjustable attenuators between the signal generator and the oscilloscope and adjust the attenuation level to 14dB.

2 Make the following changes to the test equipment setup (keep all other settings the same as in step 2).

Oscilloscope	
Horizontal Scale	10 nS/div
Probe Attenuation	5:1
Input Z	50 Ω
Signal Generator	
Frequency	100 MHz

3 Press [Clear Display] and record mean Vrms. $V1_{100\ MHz}$ = _____.

4 Remove the adjustable attenuators. Maintain the signal generator and oscilloscope settings.

5 Install the E2621A Differential Adapter onto the oscilloscope. Connect the E2628A to the other end of the E2621A. Connect the BNC cable from the signal generator to the E2628A.

6 Set the Probe Attenuation to 5:1.

7 Press [Clear Display] and record the mean Vrms. $V2_{100\ MHz}$ = _____.

8 Calculate the deviation at 100 MHz:

Deviation @ 100 mHz = 20 LOG ($V2_{100\ MHz}$ / $V1_{100\ MHz}$)

9 Enter the Deviation @ 100 MHz on the third line of the test record under Measured Deviation.

10 Calculate the attenuation for the E2621A at 100 MHz:

Attenuation @ 100 MHz = 14dB + (Deviation @ 100 MHz)

11 Enter the Attenuation 100 MHz on the test record under Calculated Attenuation.

Calibration Testing Procedures for E2622A

These procedures are used to test the warranted specifications for the E2622A. Use the equipment listed in the "Test Equipment Required" section to completed the calibration testing procedures.

Testing interval

The calibration test procedures may be performed for incoming inspection of the instrument and should be performed periodically thereafter to ensure and maintain peak performance. The recommended calibration test interval is yearly. The amount of use, environmental conditions, and the user's experience concerns regarding the need for testing will contribute to your specific calibration test interval.

When you return the E2622A to Agilent Technologies for calibration testing, a new certificate is provided which verifies that the probe performed within specified limits and against equipment which is traceable to the National Institute of Standards and Technology.

Test Equipment Required

The equipment required for the calibration testing is listed in the table below. Any equipment satisfying the critical specifications listed may be substituted for the recommended model.

Equipment	Qty	Critical Specification	Agilent Part Number
Signal Generator	1	10 kHz to 1.2 GHz ± 1dB 50 Ω output impedance	8662A
Oscilloscope	1	>1.5 GHz Bandwidth Vrms measurement	54845 or 54846 [1]
Adjustable Attenuator	2	± 0.05 dB, DC to 1 GHz 0dB to 12dB, 1dB steps	355C[3]
Power Supply	1	1.0 Vdc ± 0.001 V Stability	E3632A
Multimeter	1	2 Vdc ± 0.1%, 100 Ω ± 0.1%	34401A
50 Ω Feedthrough	1	50 Ω ± 1.0%	10100C
BNC Barrel	1	BNC (f) to BNC (f)	E9622A
BNC Union	1	BNC (m) to BNC (m)	9624A
Adapter	1	BNC (f) to Dual Banana (m)	1251-2277
Adapter	1	-5.7 dB, 75 Ω BNC (m) to 50 Ω BNC (f)	E2629A [2]
BNC Cable	1	50 Ohm, 1.2 meter	8120-1840
BNC Cable	1	50 Ohm, 0.3 meter	8120-1838 [2]

[1] May not be substituted.
[2] Included in E2625A kit.
[3] Requires special calibration.

CAUTION Allow the test equipment to warm up for at least 15 minutes before starting the procedures. Failure to allow the test equipment to warm up may cause failure of performance verification.

These verification procedures will reference traceable instrumentation and a calibrated oscilloscope to verify the performance of the E2622A. The measured and calculated results must be within the published specification.

Attenuation

This procedure measures the input and output voltage and uses the measurements to calculate the attenuation of the E2622A.

1 Connect the DC power supply to the multimeter using BNC-to-Banana Plug adapters, a 50 Ohm Feedthrough, and a 50 Ohm BNC cable.

CAUTION Do not exceed 2 Vdc from the power supply.

2 Set the multimeter to measure dc Volts and adjust the power supply for a 1.0 ± 0.010 V reading on the multimeter.
3 Record this multimeter value. V_{input} = _____
4 Disconnect the BNC cable from the 50 Ohm feedthrough connected to the multimeter.
5 Connect the oscilloscope end (output) of the E2622A to the 50 Ohm feedthrough connected to the multimeter.
6 Connect the free end of the BNC cable to the input end of the E2622A (input).
7 Record the multimeter value. V_{probe} = _____.
8 Calculate the attenuation.
Attenuation = 20 LOG (V_{probe} / V_{input})
9 Enter the Attenuation on the test record under Test Results.

Input Impedance

This procedure will terminate the output and measure the input resistance of the E2622A.

1 Connect the 50 Ohm feedthrough to the oscilloscope end (output) of the E2622A.
2 Set the multimeter to measure 2-wire Ohms.
3 Connect the input end of the E2622A to the multimeter using the BNC-to-BNC union and a BNC-to-Banana Plug.
4 Record the multimeter value. R_{input} = _____.
5 Enter the Input Impedance on the test record under Test Results.

Bandwidth

This procedure compares the attenuation of the system containing a precision attenuator to the attenuation of the system with the E2622A and E2629A replacing the precision attenuator. The attenuation of the E2629A is known so the attenuation of the E2622A at the 1 GHz cutoff frequency can be calculated.

1 Connect the signal generator to the adjustable attenuator with the 1 meter BNC cable. Connect the other end of the attenuator to the input channel of the oscilloscope using the 0.3 meter BNC cable.

2 On the oscilloscope, press [Default Setup] and then set both instruments according to the table below.

Oscilloscope	
Vertical Scale	200 mV/div
Input Z	50 Ω
Offset	0 V
Coupling	dc
Probe Attenuation	5:1
Horizontal Scale	1 μS/div
Sampling Mode	Equivalent Time
Averaging	16 Averages
Signal Generator	
Signal Type	Sine
Amplitude	0.750 V ± 0.05 Vrms *
Frequency	1 MHz

* Signal Generator Output terminated in 50 Ohms.

3 Set the attenuation to 22 dB and set the oscilloscope to measure ac Vrms from the entire display.

4 Press [Clear Display] and record mean Vrms. $V1_{Attenuator}$ = _____.

5 Change the frequency of the signal generator to 1 GHz and the horizontal scale of the oscilloscope to 1 nS/div.

6 Press [Clear Display] and record the mean Vrms. $V2_{Attenuator}$ = _____.

7 Maintain the signal generator and oscilloscope settings but remove the adjustable attenuator and BNC cable from the oscilloscope.

8 Install the E2622A onto the oscilloscope and connect the E2629A Adapter to the input of the E2622A and the BNC cable connected to the signal generator.

9 Set the probe attenuation to 5:1.

10 Press [Clear Display] and record the mean Vrms. $V2_{Probe}$ = _____.

11 Change the frequency of the signal generator to 1 MHz and the horizontal scale of the oscilloscope to 1 uS/div.

12 Press [Clear Display] and record the mean Vrms. $V1_{Probe}$ = _____.

13 Calculate Bandwidth:

$$Bandwidth = 20\log\left(\frac{V2_{probe}}{V1_{probe}}\right) - 20\log\left(\frac{V2_{Attenuator}}{V1_{Attenuator}}\right)$$

14 Enter the Bandwidth on the test record under Test Results.

Calibration Test Record

Agilent Technologies	**E2621A/E2622A**
Serial No. _____	Tested by _____
Recommended test interval - 1 Year	Work Order No. _____
Next scheduled test _____	Date _____
	Temperature _____

E2621A

Test	**Limits**	**Results Measured Deviation**	**Results Calculated Attenuation**
Attenuation @ 1 MHz	14.0 dB ± 0.26 dB	_____	_____
Attenuation @ 10 kHz	14.0 dB ≤ 3 dB	_____	_____
Attenuation @ 100 MHz	14.0 dB ≤ 3 dB	_____	_____

E2622A

Test	**Limits**	**Test Results**
Attenuation	14.0 dB ± 0.17 dB	_____
Input Impedance	75 Ω ± 2.0%	_____
Bandwidth	< – 3 dB, dc to 1 GHz	_____

Safety Notices

This apparatus has been designed and tested in accordance with IEC Publication 1010, Safety Requirements for Measuring Apparatus, and has been supplied in a safe condition. This is a Safety Class I instrument (provided with terminal for protective earthing). Before applying power, verify that the correct safety precautions are taken (see the following warnings). In addition, note the external markings on the instrument that are described under "Safety Symbols."

Warnings

• Before turning on the instrument, you must connect the protective earth terminal of the instrument to the protective conductor of the (mains) power cord. The mains plug shall only be inserted in a socket outlet provided with a protective earth contact. You must not negate the protective action by using an extension cord (power cable) without a protective conductor (grounding). Grounding one conductor of a two-conductor outlet is not sufficient protection.

• Only fuses with the required rated current, voltage, and specified type (normal blow, time delay, etc.) should be used. Do not use repaired fuses or short-circuited fuseholders. To do so could cause a shock or fire hazard.

• If you energize this instrument by an auto transformer (for voltage reduction or mains isolation), the common terminal must be connected to the earth terminal of the power source.

• Whenever it is likely that the ground protection is impaired, you must make the instrument inoperative and secure it against any unintended operation.

• Service instructions are for trained service personnel. To avoid dangerous electric shock, do not perform any service unless qualified to do so. Do not attempt internal service or adjustment unless another person, capable of rendering first aid and resuscitation, is present.

• Do not install substitute parts or perform any unauthorized modification to the instrument.

• Capacitors inside the instrument may retain a charge even if the instrument is disconnected from its source of supply.

• Do not operate the instrument in the presence of flammable gasses or fumes. Operation of any electrical instrument in such an environment constitutes a definite safety hazard.

• Do not use the instrument in a manner not specified by the manufacturer.

To clean the instrument

If the instrument requires cleaning: (1) Remove power from the instrument. (2) Clean the external surfaces of the instrument with a soft cloth dampened with a mixture of mild detergent and water. (3) Make sure that the instrument is completely dry before reconnecting it to a power source.

Safety Symbols



Instruction manual symbol: the product is marked with this symbol when it is necessary for you to refer to the instruction manual in order to protect against damage to the product..



Hazardous voltage symbol.



Earth terminal symbol: Used to indicate a circuit common connected to grounded chassis.

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Agilent Technologies

User's Guide

Agilent Technologies
Printed in the USA

Manual Part Number
E2621-92003



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