Cost Effective Solutions for Your Applications

Whether your application is in R&D, production, quality assurance, or incoming inspection, Agilent Technologies has the right impedance measurement solution for you. Agilent has a complete line of impedance test equipment and test accessories to help you task efficiently. When you choose an impedance measurement product from Agilent, you get more than accurate and reliable test results. Agilent offers:

**Complete solution**: Covering frequencies from 20 Hz to 3 GHz, Agilent’s impedance product line offers you the widest selection of equipment for your application. In addition, several third-party companies have complementary products designed to work with Agilent equipment for special applications. This brochure gives an overview of all the products you can choose from.

**Knowledge**: Agilent has decades of experience providing impedance measurement solutions. Years of experience and continuing technical innovations go into the design and manufacturing of each Agilent LCR meter and impedance analyzer. Agilent also has a list of technical publication to assist you in many different applications (see page 15 for full listing.)

**Convenience**: Any time you have an impedance measurement need, help is only one phone call away. Agilent offers three types of impedance measurement solutions as shown in Table 1. Calling Agilent will put you in contact with one of our trained engineers to help you find a solution.

### Table 1. Impedance measurement product type

<table>
<thead>
<tr>
<th>Product highlights</th>
<th>LCR meter</th>
<th>Impedance analyzer</th>
<th>Combination analyzer</th>
</tr>
</thead>
<tbody>
<tr>
<td>Frequency sweep capability</td>
<td>Spot</td>
<td>Continuous</td>
<td>Continuous</td>
</tr>
<tr>
<td>Display</td>
<td>Numeric only</td>
<td>Graphics</td>
<td>Graphics</td>
</tr>
<tr>
<td>Others</td>
<td>Handler interfaces</td>
<td>Equivalent circuit analysis built in</td>
<td>Equivalent circuit analysis built in, multiple functions in one instrument</td>
</tr>
<tr>
<td>Advantage</td>
<td>Lower-cost solution, ease of use, high speed</td>
<td>Frequency characteristics and resonant analysis, circuit modeling</td>
<td>Cost-effective, time-saving, and compact in size</td>
</tr>
</tbody>
</table>

Advanced measurement techniques for a wide range of applications

Figure 1 is a comparison of different measurement techniques used in Agilent’s LCR meter and impedance analyzers. As you can see, each technique has special measurement advantages:

- Auto-balancing bridge offers widest impedance measurement range with typical frequency range of 20 Hz to 110 MHz. This technique is best for low-frequency, general-purpose testing.
Table 2. Agilent impedance measurement products

<table>
<thead>
<tr>
<th>Product type</th>
<th>Freq. range</th>
<th>Purpose</th>
<th>Model</th>
<th>Page</th>
<th>Frequency range (Hz)</th>
<th>Basic Z accuracy (%)</th>
<th>Measurement display range (Ω)</th>
<th>Feature</th>
<th>Measurement technique</th>
<th>Main application</th>
</tr>
</thead>
<tbody>
<tr>
<td>Impedance analyzer</td>
<td>RF</td>
<td>High performance /multi function</td>
<td>E4991A</td>
<td>4</td>
<td>1 M to 3 G</td>
<td>0.8</td>
<td>200 m to 20 k</td>
<td>A,B</td>
<td>RF I-V</td>
<td>LCR component, material, semiconductor</td>
</tr>
<tr>
<td></td>
<td>LF/HF</td>
<td>High performance /multi function probe measurement</td>
<td>4294A</td>
<td>4</td>
<td>40 to 110 M</td>
<td>0.08</td>
<td>25 m to 40 M</td>
<td>A,B</td>
<td>ABB</td>
<td>LCR component, material, semiconductor</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>4294A</td>
<td>4</td>
<td>40 to 110 M</td>
<td>1</td>
<td>50 m to 4 M</td>
<td>A,B</td>
<td>IV</td>
<td>LCR component, material, semiconductor</td>
</tr>
<tr>
<td>Combination analyzer</td>
<td>RF</td>
<td>Network/spectrum /impedance measurement</td>
<td>4396B</td>
<td>5</td>
<td>100 k to 1.8 G</td>
<td>3</td>
<td>2 to 5 k</td>
<td>A,B</td>
<td>RF I-V</td>
<td>LCR component, other passive component, active component, circuit analysis</td>
</tr>
<tr>
<td></td>
<td>HF</td>
<td>Network/spectrum /impedance measurement</td>
<td>4395A</td>
<td>5</td>
<td>100 k to 500 M</td>
<td>3</td>
<td>2 to 5 k</td>
<td>A,B</td>
<td>RF I-V</td>
<td>LCR component, other passive component, active component, circuit analysis</td>
</tr>
<tr>
<td>LCR meter</td>
<td>RF</td>
<td>High performance /multi function</td>
<td>4287A</td>
<td>6</td>
<td>1 M to 3 G</td>
<td>1</td>
<td>200 m to 3k</td>
<td>C</td>
<td>RF I-V</td>
<td>LCR component</td>
</tr>
<tr>
<td></td>
<td>HF</td>
<td>High performance /multi function</td>
<td>4285A</td>
<td>7</td>
<td>75 k to 30 M</td>
<td>0.1</td>
<td>0.01 m to 100 M</td>
<td>D</td>
<td>ABB</td>
<td>LCR component, material, semiconductor</td>
</tr>
<tr>
<td></td>
<td>LF</td>
<td>High performance /multi function</td>
<td>4980A</td>
<td>7</td>
<td>20 to 2 M</td>
<td>0.05</td>
<td>1.000000 a to 999.9999 E</td>
<td>D</td>
<td>ABB</td>
<td>LCR component, material, semiconductor</td>
</tr>
<tr>
<td></td>
<td>LF</td>
<td>Low-cost /multi function</td>
<td>4263B</td>
<td>8</td>
<td>100 to 100 k</td>
<td>0.1</td>
<td>0.01 m to 100 M</td>
<td>D</td>
<td>ABB</td>
<td>LCR component, transformer</td>
</tr>
<tr>
<td>Application specific</td>
<td>LF</td>
<td>For high-value capacitor measurement</td>
<td>4288A</td>
<td>9</td>
<td>120 &amp; 1 k only</td>
<td>0.18</td>
<td>0.1 p to 10 mF</td>
<td>D</td>
<td>ABB</td>
<td>MLCC</td>
</tr>
<tr>
<td></td>
<td>LF</td>
<td>For capacitor measurement</td>
<td>4288A</td>
<td>9</td>
<td>1 k and 1 M only</td>
<td>0.07</td>
<td>0.00001 p to 20 μF</td>
<td>D</td>
<td>ABB</td>
<td>Ceramic capacitor</td>
</tr>
<tr>
<td></td>
<td>LF</td>
<td>For milliohm measurement</td>
<td>4383B</td>
<td>8</td>
<td>1 k only</td>
<td>0.4</td>
<td>10 μ to 100 k</td>
<td>D</td>
<td>OTR</td>
<td>Connector, resistor</td>
</tr>
<tr>
<td>DC</td>
<td>For high resistance measurement</td>
<td>4339B</td>
<td>8, 9</td>
<td>DC only</td>
<td>0.6</td>
<td>1 k to 1.6X10¹⁸</td>
<td>D</td>
<td>OTR</td>
<td>Transformer, capacitor Capacitor</td>
<td></td>
</tr>
</tbody>
</table>

1. Basic Z accuracies are best-case values and vary depending on measurement conditions. See product data sheet for detail.
2. Capacitance measurement only.
3. Requires Option 4395A-010, 4396B-010, and 43961A.
4. Z range shows the 10% accuracy range.
5. Feature code: A: Built-in equivalent circuit analysis
   B: Frequency sweep with color LCD display
   C: Spot frequency with color LCD display
   D: Spot frequency with LCD display
   E: Spot frequency with audio display
   M: Spot frequency with calculation

How to use this selection guide

Table 2 is a summary of all of Agilent’s impedance products. It is designed to assist you in better comparing Agilent’s wide range of instrumentation and in choosing possible solutions for your applications, depending on your requirements in the following areas:

- Test frequency range
- Device type or application type
- Accuracy requirement (measurement technique)
- Any other special needs

If you find several possible solutions for your application, go to the corresponding pages to find more details about each product. Call Agilent if you need further assistance.
Impedance Analyzers

Impedance analyzers provide high measurement accuracy and sophisticated measurement functions:

• Frequency, DC bias, and AC voltage/current sweep capability lets you customize where and how test data will be taken.

• Built-in equivalent-circuit analysis computes a multi-element circuit model of the device under test.

• Color LCD/CRT can display multiple sets of measurement curves at the same time.

• Advanced calibration and compensation methods reduce measurement errors.

4294A precision impedance analyzer

• Highly accurate 4-terminal-pair impedance measurement in a wide frequency range of 40 Hz to 110 MHz. Extremely small variation in component characteristics can be precisely evaluated with sweep measurements of 0.08% basic accuracy.

• Best instrument for component evaluation like capacitors, inductors, resonators, semiconductors and for material evaluations like PC boards and toroidal cores. Improves evaluation efficiency with various measurement & analysis functions.

• In-circuit or grounded measurements with the 42941A Impedance Probe

• Built-in LAN interface

E4991A RF impedance/material analyzer

• Provides top-of-the-line solution for measuring impedance from 1 MHz to 3 GHz, with an optional material-test function for measuring permittivity and permeability.

• Ideal instrument for RF surface mount inductors, capacitors, PC board materials and magnetic toroids.

• Measurement parameters: |Z|, |Y|, θ, R, X, G, B, L, C, D, Q

• Optional material parameters: ε, ε’, ε“, µ, µ’, µ“

• Built-in LAN, GPIB interface
Network/Spectrum/Impedance Analyzers

These combination analyzers offer a cost-effective and time-saving alternative. Instead of buying a rack full of stand-alone test equipment and spending extra time to make them work together, you can get a combination analyzer that has all the functions you need and is ready to go when you press the power-on button. For impedance measurement, analyzers have the same advanced features as the impedance analyzers described on page 4.

4396B network/spectrum/impedance analyzer (with 43961A RF impedance test kit and Option 4396B-010)

- 1.8 GHz three-in-one analyzer with no sacrifice in performance.
- Advanced features for meeting your future test requirements: time gated spectrum analysis for pulsed signal analysis, digital resolution bandwidth for faster sweeps, and more.
- Saves you money and time for RF component and circuit analysis.
- Built-in IBASIC function
- Measurement parameters: $|Z|$, $|Y|$, $\theta$, $\Gamma$, $X$, $G$, $B$, $C$, $L$, $D$, $Q$

4395A network/spectrum/impedance analyzer (with 43961A RF impedance test kit and Option 4395A-010)

- 500 MHz three-in-one analyzer for components and circuit design up to 500 MHz.
- Advanced features for meeting your future test requirements: time gated spectrum analysis for pulsed signal analysis, digital resolution bandwidth for faster sweeps, and more.
- Best-valued bench-top tool for R&D
- Built-in IBASIC function
- Optional dc bias source
- Measurement parameters: $|Z|$, $|Y|$, $\theta$, $\Gamma$, $X$, $G$, $B$, $C$, $L$, $D$, $Q$
**Precision LCR Meters**

Designed for measurement precision and ease-of-use, this family of LCR meters fits both R&D and production applications. Although the LCR meters do not have all the sophisticated features as impedance analyzers, the LCR meters offer excellent performance at an affordable price:

- Wide selection of frequency range from 20 Hz to 3 GHz.
- Frequency list sweep for continual testing at multiple frequency points.
- Great for general-purpose testing of leaded components, surface-mount components, materials, and more.
- GPIB and handler interface for easy test automation in production environment.

**E4980A precision LCR meter**

- 20 Hz to 2 MHz
- 0.05% basic accuracy
- Option E4980A-001 adds ±20 Vrms test signal and ±40 V internal dc bias voltage
- For testing power inductors and transformers, choose Option E4980A-002, 42841A, and 42842A/B to get up to 20 A dc bias current

**4287A RF LCR meter**

- 3 GHz LCR meter for precisely testing actual characteristics of components at demanded RF operating frequencies.
- RF I-V technique provides a wide impedance range (0.2 Ω to 3 k Ω).
- 9 ms high speed measurement and 1% accuracy suitable for production testing.
- Highly stable measurement of low-inductance and excellent Q accuracy (6% @ Q=100, 100 MHz) for meeting chip inductor test requirements.
- Handler, GPIB and LAN interfaces
- Measurements parameter $|Z|$, $|Y|$, $\theta$, R, X, G, B, C, L, D, Q

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1. 40A dc bias current, when using 2 x 42841A and 1 x 42842B.
4284A precision LCR meter

• 20 Hz to 1 MHz
• 0.05% basic accuracy
• Option 4284A-001 adds ±40 V internal dc bias voltage
• For testing power inductors and transformers, choose Option 4284A-002, 42841A, and 42842A/B to get up to 20 A dc bias current
• Measurement parameters: |Z|, |Y|, θ, R, X, G, B, C, L, D, Q

4285A precision LCR meter

• 75 kHz to 30 MHz
• 0.1% basic accuracy
• Option 4285A-001 adds ±40 V dc bias voltage
• Option 4285A-002, 42841A, and 42842C provide up to 10 A dc bias current
• Measurement parameters: |Z|, |Y|, θ, R, X, G, B, C, L, D, Q

1. 40 A dc bias current, when using 2 x 42841A and 1 x 42842B.
Basic Products

The following products are designed for basic or special-purpose applications. Their features are optimized to achieve maximum performance for the particular applications.

4263B LCR meter

- Spot frequency testing at 100 Hz, 120 Hz, 1 kHz, 10 kHz, and 100 kHz (optional 20 kHz)
- Compact, easy-to-use, entry-level LCR meter
- Measurement parameters: $|Z|$, $|Y|$, $\theta$, $R$, $X$, $G$, $B$, $C$, $L$, $D$, $Q$
- Add N, M, DCR (Option 4263B-001) for transformer/Coil measurements
- Set signal level (20 mV to 1 Vrms) in 5 mVrms steps
- Monitor actual ac voltage and current levels
- Select the number of displayed digit (3, 4, or 5)

4338B milliohm meter

(10 $\mu\Omega$ to 100 k$\Omega$)

- 1 kHz ac measurement with selectable test signal current from 1 $\mu$A to 10 mA
- Designed for ultra-low resistance measurements of switches, batteries, relays, cables, connectors, and PC boards.
- Measurement parameters: $R$, $X$, $|Z|$, $L$, $Q$
- Contact check function for reliable tests.
- Select the number of displayed digits (3, 4, or 5)

4339B high-resistance meter

- Test voltage: 0.1 to 1000 Vdc
- Measurement range: $R$: $1 \times 10^3 \Omega$ to $1.6 \times 10^{16} \Omega$, $I$: 60 fA to 100 $\mu$A
- Great solution for evaluating leakage current and insulation resistance of components.
- Can be programmed to measure surface and volume resistivity.
- Measurement parameters: $I$, $R$, surface, and volume resistivity
- Contact check function for reliable tests.
Capacitance Meters

4268A 120 Hz/1 kHz capacitance meter
- Suitable for high value multi-layer ceramic capacitor testing
- 120 Hz and 1 kHz test frequencies
- Constant test signal level and 25 msec high speed measurement by newly-developed high speed auto level control function.
- Measurement parameters: C, D, Q, ESR, G

4288A 1 kHz/1 MHz capacitance meter
- Two standard frequencies (1 kHz and 1 MHz) for capacitor testing
- Measurement speed and accuracy optimized for production testing
- Measurement parameters: C, D, Q, ESR, G

E4981A 120 Hz/1k Hz/1 MHz capacitance meter
- 120 Hz, 1 kHz and 1 MHz test frequencies
- High speed measurement: 2.3 ms (1 MHz), 3.0 ms (1 kHz), 11.0 ms (120 Hz)
- Basic accuracy C: 0.07%, D 0.0005
- Handler and Scanner interfaces suitable for production testing.
- Measurement parameters: C, D, Q, ESR, G

4349B 4-channel high-resistance meter
- 4-channel simultaneous testing
- Fast contact check function for reliable testing
- Measurement range:
  - R: $1 \times 10^2 \Omega$ to $1.0 \times 10^{15} \Omega$
  - I: 1 pA to 100 µA

Others

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1. The 4349B has 4-measurement channels, with no internal dc source. An external dc source is required.
Test Fixtures and Accessories (Four-Terminal-Pair)

Basic test fixtures

16034E SMD/chip test fixture
Frequency: ≤ 40 MHz
Maximum dc bias: ±40 V

16034G small SMD/chip test fixture
Frequency: ≤ 110 MHz
Maximum dc bias: ±40 V

16034H SMD/chip test fixture
Frequency: ≤ 110 MHz
Maximum dc bias: ±40 V
Suitable for array-type devices

16043-60011 test fixture
16043-60012 test fixture
Frequency: ≤ 110 MHz
Maximum dc bias: ±40 V

16044A SMD Kelvin contact test fixture
Frequency: ≤ 10 MHz
Maximum dc bias: ±40 V

16334A SMD/chip tweezers
Frequency: ≤ 15 MHz
Maximum dc bias: ±42 V

16047A/D axial & radial test fixture
Frequency: A: ≤ 13 MHz, D: ≤ 40 MHz
Maximum dc bias: A: ±35 V, D: ±40 V

16047E test fixture
Frequency: ≤ 110 MHz
Maximum dc bias: ±40 V

16089A/B/C/D/E clip leads
Connector type: A/B/C/E: Kelvin
D: alligator
Frequency: 5 Hz to 100 kHz
Cable length: A/B/C/D: 0.94 m
E: 1.3 m
Test Fixtures and Accessories (Four-Terminal-Pair)

External DC bias fixtures

16065A axial and radial test fixture with safety cover

*Frequency:* 50 Hz to 2 MHz
*Maximum externally supplied dc bias:* ±200 V
Blocking capacitor of 5.6 μF is connected in series with the Hc terminal

16065C external bias adapter

*Frequency:* 50 Hz to 1 MHz
*Maximum externally supplied dc bias:* ±40 V
Blocking capacitor of 50 μF is connected in series with the Hc terminal

Test leads

16048A/D/E BNC test leads

*Frequency:* A: ≤ 30 MHz, D: ≤ 30 MHz, E: ≤ 1 MHz
*Cable length:* A: 0.94 m, D: 1.89 m, E: 3.8 m
*Maximum dc bias:* ±40 V

16048G/H BNC test leads

*Frequency:* ≤ 110 MHz
*Cable length:* G: 1 m, H: 2 m
*Maximum dc bias:* ±40 V
*Use with only 4294A*

16048-60030 SMC test leads

*Frequency:* ≤ 30 MHz
*Cable length:* 0.94 m
*Maximum dc bias:* ±40 V

16033-60001: SMC male connector plate

Terminal adapters

42942A four-terminal-pair to 7 mm terminal adapter

*Frequency:* ≤ 110 MHz
*Maximum dc bias:* ±40 V
*Use with only 4294A*

16085B four-terminal-pair to 7 mm terminal adapter

*Frequency:* ≤ 40 MHz
*Maximum dc bias:* ±40 V
Test Fixtures and Accessories (Four-Terminal-Pair)

Material measurements

16451B dielectric test fixture
*Measurement parameters:* capacitance (C), dissipation factor (D), and dielectric constant ($\varepsilon_r', \varepsilon_r''$)
*Material-under-test size:*
  - thickness: $\leq$ 10 mm
  - diameter: 10 to 56 mm
*Frequency:* $\leq$ 30 MHz

16452A liquid test fixture
*Measurement parameter:* capacitance (C), dielectric constant ($\varepsilon_r', \varepsilon_r''$) Liquid sample
*Quantity:* $\leq$ 6.8 ml
*Frequency:* 20 Hz to 30 MHz

Others

42941A impedance probe kit
*Frequency:* 40 Hz to 100 MHz
*Maximum dc bias:* $\pm$40 V
*Probe cable length:* 1.5 m
*Use with only 4294A

16060A transformer test fixture
*Frequency:* dc to 100 kHz
*Use with only 4263B

Balanced/unbalanced converters

16314-60011 balanced/unbalanced
4-terminal converter
*Frequency:* 100 Hz to 10 MHz
*Connectors:* 4 BNCs (unbal.), 2 signal terminals (bal.) & 1 ground terminal
*Characteristic Z:* 50 Ω

16315-60011 50 Ω balanced/
50 Ω unbalanced converter
*Frequency:* 100 Hz to 10 MHz
*16316A 100 Ω Balanced/50 Ω
Unbalanced Converter
*Frequency:* 100 Hz to 10 MHz
*16317A 600 Ω Balanced/50 Ω
Unbalanced Converter
*Frequency:* 100 Hz to 3 MHz

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1. All have 1 BNC connector (unbalanced) and 2 signal terminals (balanced) and 1 ground terminal.
Test Fixtures and Accessories (7-mm Terminal)

**RF SMD/chip components**

16196A/B/C/D SMD test fixture
Coaxial fixture for parallel electrode SMDs.
*Frequency:* dc to 3 GHz
*Maximum dc bias:* ±40 V
Applicable SMD size:
- 16196A: 1.6 mm x 0.8 mm
- 16196B: 1.0 mm x 0.5 mm
- 16196C: 0.6 mm x 0.3 mm
- 16196D: 0.4 mm x 0.2 mm

16197A bottom-electrode SMD test fixture
*Frequency:* dc to 3 GHz
*Maximum dc bias:* ±40 V

16092A axial, radial, and SMD test fixture
*Frequency:* ≤ 500 MHz
*Maximum dc bias:* ±40 V

16192A parallel-electrode SMD test fixture
*Frequency:* dc to 2 GHz
*Maximum dc bias:* ±40 V

16194A high temperature component test fixture
*Frequency:* dc to 2 GHz
*Maximum dc bias:* ±40 V
*Operating temperature:* -55 °C to +200 °C

16200B external DC bias adapter
*Frequency:* 1 MHz to 1 GHz
*External dc bias:* up to 5 A, ±40 V

**Material measurements**

16453A dielectric test fixture
*Frequency:* 1 MHz to 1 GHz
*Sample size (smooth sheets only):*
  - thickness: 0.3 mm to 3 mm
  - diameter: ≥ 15 mm

16454A magnetic test fixtures
*Frequency:* 1 kHz to 1 GHz
*Sample size (toroids only):*
  - height: ≤ 8.5 mm
  - inner diameter: ≥ 3.1 mm
  - outer diameter: ≤ 20 mm
Simplify and Improve Your Measurements with Agilent's Test Accessories

Selecting a test fixture is as important as selecting the right instrument. Agilent offers a wide range of accessories for axial, radial, and SMD/Chip devices. In addition, a variety of test leads are available to simplify remote testing and systems applications. External test fixtures with safety covers are also available.

You will improve your measurement results with the proper test fixture.

- more reliable and repeatable measurement
- higher through-put
- fewer handling errors
- tighter test limits
- better measurement accuracy

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### Table 3. Test accessories/fixtures

<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
<th>Frequency Limits</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>16034E</td>
<td>SMD/chip test fixture</td>
<td>DC-40 MHz</td>
<td></td>
</tr>
<tr>
<td>16034G</td>
<td>SMD/chip test fixture, small</td>
<td>DC-110 MHz</td>
<td></td>
</tr>
<tr>
<td>16034H</td>
<td>SMD/chip test fixture, general</td>
<td>DC-110 MHz</td>
<td></td>
</tr>
<tr>
<td>16043-60011/60012</td>
<td>3-terminal SMD test fixture</td>
<td>DC-110 MHz</td>
<td></td>
</tr>
<tr>
<td>16044A</td>
<td>SMD/chip test fixture, Kelvin contacts, 10 MHz</td>
<td>DC-10 MHz</td>
<td></td>
</tr>
<tr>
<td>16047A</td>
<td>Axial and radial test fixture</td>
<td>DC-13 MHz</td>
<td></td>
</tr>
<tr>
<td>16047D</td>
<td>Axial and radial test fixture</td>
<td>DC-40 MHz</td>
<td></td>
</tr>
<tr>
<td>16047E</td>
<td>Axial and radial test fixture, 110 MHz</td>
<td>DC-110 MHz</td>
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<tr>
<td>16048A</td>
<td>One meter test leads, BNC</td>
<td>DC-30 MHz</td>
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<tr>
<td>16048-60030</td>
<td>One meter test leads, SMC</td>
<td>DC-30 MHz</td>
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<tr>
<td>16048D</td>
<td>Two meter test leads, BNC</td>
<td>DC-30 MHz</td>
<td></td>
</tr>
<tr>
<td>16048E</td>
<td>Four meter test leads, BNC</td>
<td>DC-1 MHz</td>
<td></td>
</tr>
<tr>
<td>16048G</td>
<td>One meter test leads, BNC, 110 MHz</td>
<td>DC-110 MHz</td>
<td></td>
</tr>
<tr>
<td>16048H</td>
<td>Two meter test leads, BNC, 110 MHz</td>
<td>DC-110 MHz</td>
<td></td>
</tr>
<tr>
<td>16060A</td>
<td>Transformer test fixture</td>
<td>DC-100 kHz</td>
<td></td>
</tr>
<tr>
<td>16065A</td>
<td>Ext. voltage bias with safety cover (&lt;=200 vdc)</td>
<td>50 Hz-2 MHz</td>
<td></td>
</tr>
<tr>
<td>16065C</td>
<td>External bias adapter (&lt;=40 vdc)</td>
<td>50 Hz-1 MHz</td>
<td></td>
</tr>
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<td>16085B</td>
<td>Four-terminal pair to 7-mm adapter</td>
<td>DC-40 MHz</td>
<td></td>
</tr>
<tr>
<td>1609A/B/C/D/E</td>
<td>Kelvin clip leads</td>
<td>5 Hz-100 kHz</td>
<td></td>
</tr>
<tr>
<td>16092A</td>
<td>RF spring clip: axial, radial and SMD</td>
<td>DC-500 MHz</td>
<td></td>
</tr>
<tr>
<td>16094-65000</td>
<td>RF probe tip/adapter</td>
<td>DC-125 MHz</td>
<td></td>
</tr>
<tr>
<td>16095A</td>
<td>LF impedance probe</td>
<td>DC-13 MHz</td>
<td></td>
</tr>
<tr>
<td>1612A</td>
<td>Parallel electrode SMD test fixture</td>
<td>DC-2 GHz</td>
<td></td>
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<tr>
<td>1614A</td>
<td>High temperature component test fixture</td>
<td>DC-2 GHz</td>
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<tr>
<td>1616A/B/C/D</td>
<td>Parallel electrode SMD test fixture</td>
<td>DC-3 GHz</td>
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<td>1617A</td>
<td>Bottom electrode SMD test fixture</td>
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<tr>
<td>1620B</td>
<td>External DC bias adapter</td>
<td>1 MHz-1 GHz</td>
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<tr>
<td>16314-60011</td>
<td>4-terminal balun (50 Ω bal. to 50 Ω unbal.)</td>
<td>100 Hz-10 MHz</td>
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<td>16315-60011</td>
<td>One terminal (BNC) Balun (50 Ω bal. to 50 Ω unbal.)</td>
<td>100 Hz-10 MHz</td>
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<td>16334A</td>
<td>SMD/chip tweezer</td>
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<tr>
<td>16451B</td>
<td>Dielectric material test fixture</td>
<td>5 Hz-30 MHz</td>
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<tr>
<td>16452A</td>
<td>Liquid test fixture</td>
<td>20 Hz-30 MHz</td>
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<td>16453A</td>
<td>Dielectric material test fixture</td>
<td>1 MHz-1 GHz</td>
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<td>16454A</td>
<td>Magnetic material test fixture</td>
<td>1 kHz-1 GHz</td>
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<tr>
<td>42842A/B</td>
<td>High bias current 20 A/40A test fixture</td>
<td>20 Hz-1 MHz</td>
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<tr>
<td>42842C</td>
<td>High bias current 10 A test fixture</td>
<td>75 kHz-30 MHz</td>
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<td>42941A</td>
<td>Impedance probe kit</td>
<td>DC-110 MHz</td>
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<tr>
<td>42942A</td>
<td>Four-terminal pair to 7-mm adapter</td>
<td>DC-110 MHz</td>
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</tbody>
</table>

**Note:** Refer to the accessory descriptions for frequency and operational limits.

1. Compatible when used in conjunction with 16085B.
2. 7-mm cable is required
3. Do not connect the ground lead to the instrument
4. 3.5-mm (M) to 7-mm adapter is required

For additional product information and literature, visit our Accessories Web site: [www.agilent.com/find/accessories](http://www.agilent.com/find/accessories)
Helping you make better measurements

Agilent’s application knowledge can help you make better measurements. Use the matrix below to select the Agilent Application Notes of interest. For copies of these Application Notes, contact your local Agilent Technologies sales office. *8 Hints for successful Impedance Measurement (P/N 5968-1947E)* and *The Impedance Measurement Handbook (P/N 5950-3000)* are comprehensive guides to impedance measurements.

Beginning with the basics it contains in-depth practical advice to help you make better measurements. These documents answer many commonly asked questions. To get your copy, contact your local Agilent Technologies sales office.

### Table 4. List of application notes

<table>
<thead>
<tr>
<th>Kind</th>
<th>Number</th>
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<th>Product</th>
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<tr>
<td>OT</td>
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<td>Accessories Selection Guide For Impedance Measurement</td>
<td>General</td>
<td>5965-4792E</td>
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<tr>
<td>AN</td>
<td>346-2</td>
<td>Balanced Circuit Measurement with an Impedance Analyzer/LCR Meter/Network Analyzer</td>
<td>General AN</td>
<td>5091-4480E</td>
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<td>Effective Impedance Measurement Using OPEN/SHORT/LOAD Correction</td>
<td>General AN</td>
<td>5091-6553E</td>
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<td>AN</td>
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<td>8 Hints for Successful Impedance Measurements</td>
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<tr>
<td>PN</td>
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<td>16196A/B/C/D Correlating RF Impedance Measurements When Using SMD Test Fixtures</td>
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<td>5980-1336E</td>
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<tr>
<td>AN</td>
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<td>Effective Transformer/LF Coil Testing</td>
<td>4263B</td>
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<tr>
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<td>Effective Electrolytic Capacitors Testing</td>
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<td>AN</td>
<td>1224-5</td>
<td>Effective Multi-tap Transformer Measurement using a Scanner and the 4263B LCR Meter</td>
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<tr>
<td>AN</td>
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<td>Optimizing Electronic Component and Material Impedance Measurements</td>
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<td>Impedance Measurements of Magnetic Heads Using Constant Current</td>
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<td>Multi-frequency C-V Measurements of Semiconductors</td>
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<td>AN</td>
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<td>Impedance Testing Using Scanner</td>
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<td>5950-2975</td>
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<td>AN</td>
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<td>Measurement of Capacitance Characteristics of Liquid Crystal Cell</td>
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<td>Improve Electronic Product Quality and Performance with Agilent Precision LCR Meters</td>
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<td>Measurement of Impedance of Magnetic Heads</td>
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<td>Reliable Electronic Component Evaluation and Circuit Design with the 4294A 110 MHz Precision Impedance Analyzer</td>
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<td>5968-4505E</td>
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<td>PN</td>
<td>4294-2</td>
<td>New Technologies For Accurate Impedance Measurements (40 Hz to 110 MHz)</td>
<td>4294A</td>
<td>5968-4506E</td>
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<td>PN</td>
<td>4294-3</td>
<td>Evaluation of MOS Capacitor Oxide C-V Characteristics Using the 4294A</td>
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<td>5988-5102E</td>
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<td>PN</td>
<td>E4991A-1</td>
<td>New Generation Analyzer Offers Exceptional and Powerful Analysis Functions for RF Impedance Measurement</td>
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<td>5988-0200E</td>
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<td>PN</td>
<td>E4991A-2</td>
<td>Achieving Fast Cycle Time Using an Electronic Design Automation (EDA) Tool and the E4991A RF Impedance/Material Analyzer</td>
<td>E4991A</td>
<td>5988-3029E</td>
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<td>AN</td>
<td>1369-1</td>
<td>Solutions for Measuring Permittivity and Permeability with LCR Meters and Impedance Analyzers</td>
<td>E4991A</td>
<td>5980-2802E</td>
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<td>AN</td>
<td>1369-2</td>
<td>Advanced Impedance Measurement Capability of the RF I-V Method Compared to the Network Analysis Method</td>
<td>E4991A</td>
<td>5988-0728E</td>
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<td>AN</td>
<td>1369-3</td>
<td>Accurate Impedance Measurement with Cascade Microtech Probe System</td>
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<tr>
<td>AN</td>
<td>1305-1</td>
<td>Contact Resistance and Insulation Resistance Measurements of Electro-Mechanical Components</td>
<td>4338B/4339B</td>
<td>5968-0325E</td>
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<td>AN</td>
<td>1288-1</td>
<td>Combining Network and Spectrum Analysis and IBASIC to Improve Device Characterization and Test Time</td>
<td>4396B</td>
<td>5965-7056E</td>
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<td>AN</td>
<td>1288-2</td>
<td>Configuring the 4396B 1.8 GHz Network/Spectrum Impedance Analyzer for D/E Testing</td>
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<td>AN</td>
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<td>How to Characterize CATV Amplifiers Effectively</td>
<td>4396B</td>
<td>5965-9434E</td>
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<td>How to Measure Noise Accurately Using the Agilent Combination Analyzers</td>
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<td>4395A Network/Spectrum/Impedance Analyzer Switching Power Supply Evaluation</td>
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<td>AN</td>
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<td>Network, Spectrum and Impedance Evaluation of Electronic Circuits and Components</td>
<td>4395A</td>
<td>5967-5942E</td>
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Complementary Products and Accessories

To help you find a complete solution, we have listed the following companies that make complementary products or specialized accessories for Agilent’s impedance measurement products. Please contact each company directly if you are interested in its products. (Agilent does not make any special endorsement of these companies’ products; this list is for reference only.)

<table>
<thead>
<tr>
<th>Company name</th>
<th>Product specialty/ expertise</th>
<th>Web site address</th>
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<tbody>
<tr>
<td>Cascade RF and microwave probers and accessories for semiconductor and IC applications.</td>
<td><a href="http://www.cascademicrotech.com/">www.cascademicrotech.com/</a></td>
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<tr>
<td>Inter-continental Microwave (ICM) Automated device handling systems, RF and microwave test fixtures and non-coaxial calibration standards.</td>
<td><a href="http://www.icmicrowave.com/">www.icmicrowave.com/</a></td>
<td></td>
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<tr>
<td>North Hills Signal Processing Wide-band transformers (baluns) for balanced measurement.</td>
<td><a href="http://www.northhills-sp.com/">www.northhills-sp.com/</a></td>
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<tr>
<td>Espec/ ESPEC Corp. (America) Temperature chamber for component and material testing.</td>
<td><a href="http://www.espec.com/">www.espec.com/</a> <a href="http://www.espec.co.jp/english">www.espec.co.jp/english</a></td>
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<tr>
<td>BH Electronics</td>
<td>Wideband transformers</td>
<td><a href="http://www.bhelectronics.com/">www.bhelectronics.com/</a></td>
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<tr>
<td>ArumoTech (Asia)</td>
<td>Custom test fixtures</td>
<td><a href="http://www.arumotech.co.jp/">www.arumotech.co.jp/</a></td>
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Agilent Web Resources

LCR Meters:  
www.agilent.com/find/lcmeters

Impedance Analyzers:  
www.agilent.com/find/impedance

RF & MW test accessories:  
www.agilent.com/find/accessories

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

Agilent Direct  
www.agilent.com/find/agilentdirect
Quickly choose and use your test equipment solutions with confidence.

LXI  
www.lxistandard.org
LXI is the LAN-based successor to GPIB, providing faster, more efficient connectivity. Agilent is a founding member of the LXI consortium.

www.agilent.com

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

Americas

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<tr>
<th>Country</th>
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<tr>
<td>Canada</td>
<td>(877) 894-4414</td>
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<tr>
<td>Latin America</td>
<td>305 269 7500</td>
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<td>United States</td>
<td>(800) 829-4444</td>
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Asia Pacific

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<tr>
<td>China</td>
<td>800 810 0189</td>
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<td>Hong Kong</td>
<td>800 938 693</td>
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<tr>
<td>India</td>
<td>1 800 112 929</td>
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<tr>
<td>Japan</td>
<td>0120 (421) 345</td>
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<tr>
<td>Korea</td>
<td>080 769 0800</td>
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<td>Malaysia</td>
<td>1 800 888 848</td>
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<td>Singapore</td>
<td>1 800 375 8100</td>
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<tr>
<td>Taiwan</td>
<td>0800 047 866</td>
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<td>Thailand</td>
<td>1 800 226 008</td>
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Europe & Middle East

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<tr>
<td>Belgium</td>
<td>32 (0) 2 404 93 40</td>
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<tr>
<td>Denmark</td>
<td>45 70 13 15 15</td>
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<tr>
<td>Finland</td>
<td>358 (0) 10 855 2100</td>
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<tr>
<td>France</td>
<td>0825 010 700*</td>
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<tr>
<td>Germany</td>
<td>07031 464 6333</td>
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<tr>
<td>Ireland</td>
<td>1890 924 204</td>
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<tr>
<td>Israel</td>
<td>972-3-9288-504/544</td>
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<tr>
<td>Italy</td>
<td>39 02 92 60 8484</td>
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<tr>
<td>Netherlands</td>
<td>31 (0) 20 547 2111</td>
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<tr>
<td>Spain</td>
<td>34 (91) 631 3300</td>
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<td>Sweden</td>
<td>0200-88 22 55</td>
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<td>Switzerland</td>
<td>0800 80 53 53</td>
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<tr>
<td>United Kingdom</td>
<td>44 (0) 118 9276201</td>
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Other European Countries:  
www.agilent.com/find/contactus

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