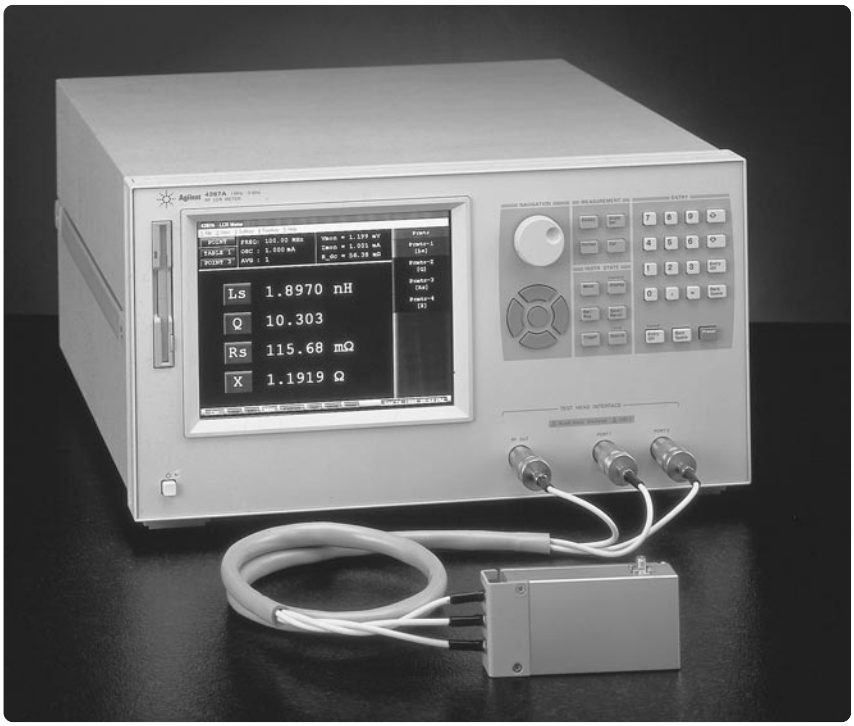
Agilent
4287A RF LCR Meter
1 MHz - 3 GHz

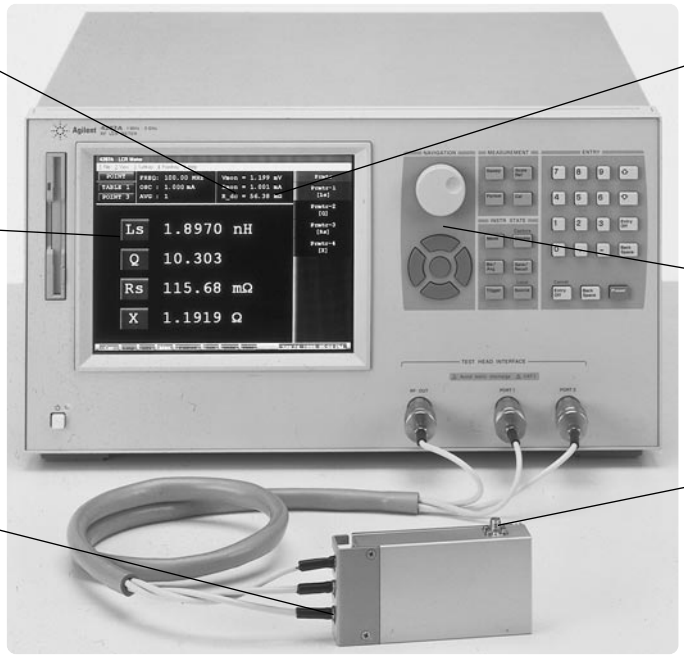
Technical Overview



Agilent Technologies

High-Speed RF LCR Meter Anticipating Next Generation Test Needs

The Agilent 4287A is a high performance RF LCR meter best fit to production line testing of devices such as SMD inductors and EMI filters, where impedance testing at high frequencies is required.



Signal-level monitor function
Monitors the test signal voltage or current applied to the device under test.

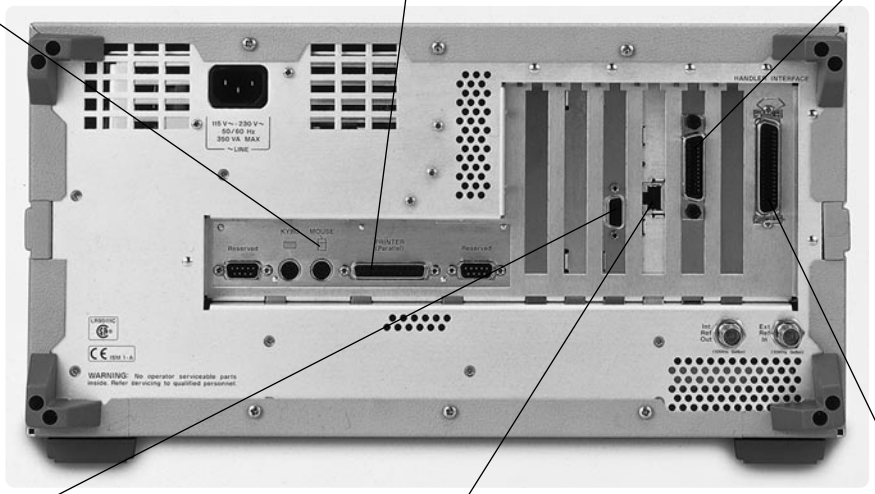
8.4 inch color LCD display
Selectable measurement parameters (4 parameters can be displayed simultaneously)

Small test head with 1m test cable
Extension to an automated component handler without introducing additional error

Rdc (DC resistance) measurement function
For contact check

Navigation keys and rotary knob
Support front panel operation without the mouse

3.5 mm (female) test port



Mouse and keyboard
Ease-of-use by simplifying measurement setup and programming

Centronics printer interface

GPIB interface

VGA monitor

LAN interface
For remote system control and transfer of data

Opto-isolated handler interface
Easy integration with an automatic component handler

The 4287A greatly increases manufacturing testing efficiency with fast measurement speeds (9 msec/point) and a statistical analysis function, among the other powerful functions, such as the built-in comparator function. In addition, the 4287A improves upon the measurement accuracy and impedance measurement range of previous RF LCR meters. These improvements are realized by advanced techniques in analog-circuit design. The 4287A achieves better measurement repeatability and stability, even at the low test-signal levels required for SMD inductor testing.

User-friendly interface

An object-oriented user interface that is navigable using the mouse, panel keys or keyboard simplifies complicated measurement setup procedures. Setups, including test frequency, signal level (also when using list-sweep), and limits for the multi-function comparator, can be performed and verified easily by editing the setup-tables. The setup editor has eight page tables and can store eight different setups. After the setup tables have been established, the active measurement setup can be chosen simply by selecting the corresponding number (1 through 8).

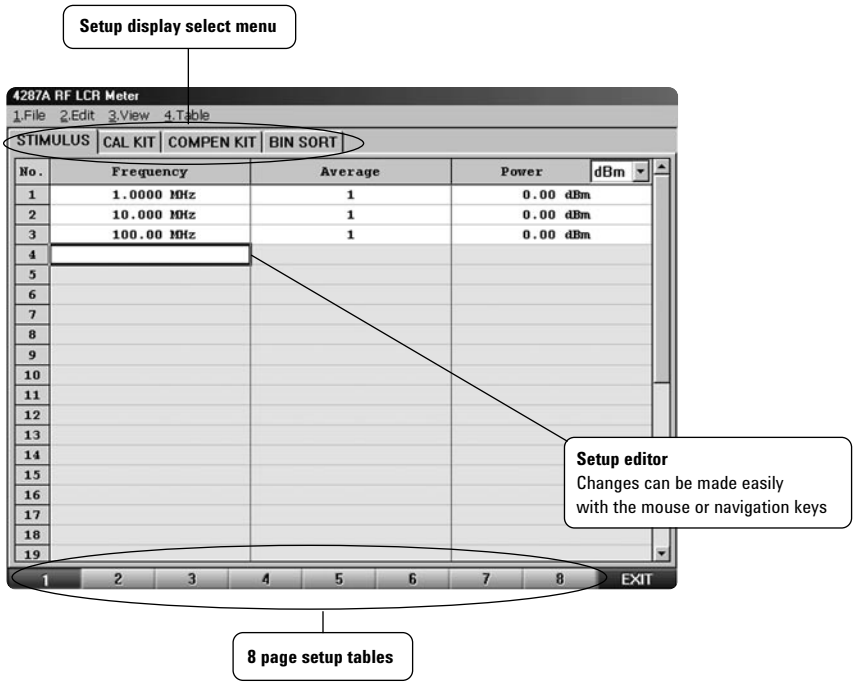


Figure 1. List sweep setup display

Key specifications

Test frequency	1 MHz - 3 GHz with 100 kHz resolution. With list-sweep, up to 32 points per sweep is available.
Impedance parameters	|Z|, θz (rad), θz (deg), |Y|, θy (rad), θy (deg), X, G, B, Ls, Lp, Cs, Cp, Rs, Rp, Q, D
Display resolutions	5 digits
Test signal level	V (open condition): 4.47 mVrms - 502 mVrms (447 mVrms when >1 GHz) I (short condition): 0.0894 mArms - 10 mArms (8.94 mArms when >1 GHz)
Basic accuracy	± 1.0%
Measurement range	200 mΩ to 3 kΩ (@1 MHz, accuracy ≤10%)
Measurement time	9 msec per point (max. speed)
Measurement terminal	3.5 mm (female)
Calibration and compensation	Open/short/load/low-loss capacitor calibration, fixture electrical length compensation, open/short compensation
Rdc measurement function	For contact check (on/off selectable)
Data storage devices	30 Mbyte solid-state mass storage (flash memory) or 2 Gbyte internal hard disk (select one of them as an option), and 1.44 Mbyte floppy disk
Interface	GPIB, LAN (10base-T/100base-TX automatically switched), and Opto-isolated handler interface

Improving Throughput and Quality In Production Line Testing

Accurate impedance measurement using the RF I-V measurement method

The 4287A uses the RF I-V measurement method for measuring impedance by measuring the current flowing through a device under test (DUT) and the voltage applied across the DUT. These measurements of current and voltage can be made over the entire measurement frequency range (to 3 GHz). RF I-V enables accurate measurement over a wide impedance range. The impedance measurement range is much wider than that of network analyzers. For a very small inductance, on the order of a few nH, this is a big advantage.

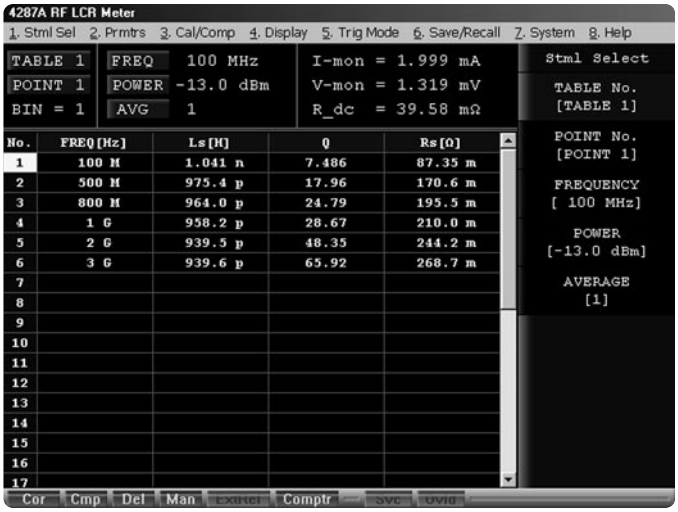


Figure 2. Accurate multiple frequency impedance measurements

Stable measurements at low signal levels with high speed

SMD inductors require testing with test currents on the order of 100 micro-amps. It is difficult to maintain high test-throughput with previous RF LCR meters, since many sequential measurements are required when averaging to reduce measurement variation. Measurement stability at low-test signal levels is improved with the 4287A making highly repeatable measurements possible. The 4287A can increase test throughput due to the decrease of the averaging factor.

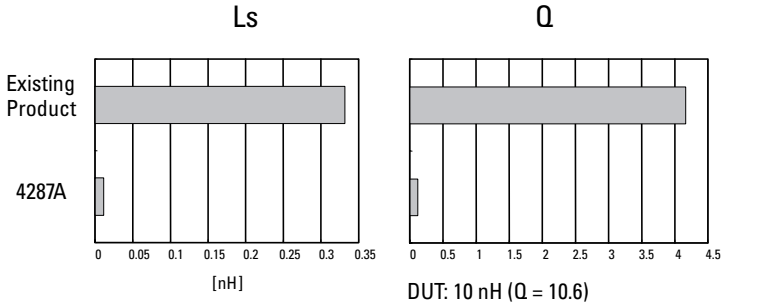


Figure 3. Stability comparison at low signal level

Contact check using the Rdc measurement function

Contact failure between a DUT and the measurement plane of an automatic component handler is a factor for bin sorting error in production line testing. Contact check using the built-in DC resistance measurement function improves the accuracy and efficiency of bin sorting.

Accurate automated testing by advanced calibration

It is very important to eliminate complicated error elements caused from the use of test fixtures and cables that extend the test head of the 4287A. This is especially true for measurements that use an automated component handler. Accurate measurements, which correlate well with results obtained from manual testing, can be achieved at the measurement plane of a test fixture by performing open/short/load calibration with a “working” load standard.

In other words, open/short/load calibration, at the measurement plane is dependent solely on the value assigned to the “working standard” by manual testing of that component. Since different calibration standard reference values can independently be set at each list sweep frequency, multi-frequency measurements can be made accurately with this reliable calibration function

Multi-function comparator

The 4287A is equipped with a multi-function comparator to meet a wide variety of testing needs. The comparator setup display is formatted as a table. Each row represents a bin number, and each column represents the sorting conditions for each bin. When all sorting conditions set for a bin are satisfied, the judgement result is sorted to the bin. There are thirteen bins, with four limit values for each bin. Conditions such as frequency and measurement parameters can be set independently in each column, enabling the 4287A to meet various sorting needs, including different parameters at different measurement frequencies.

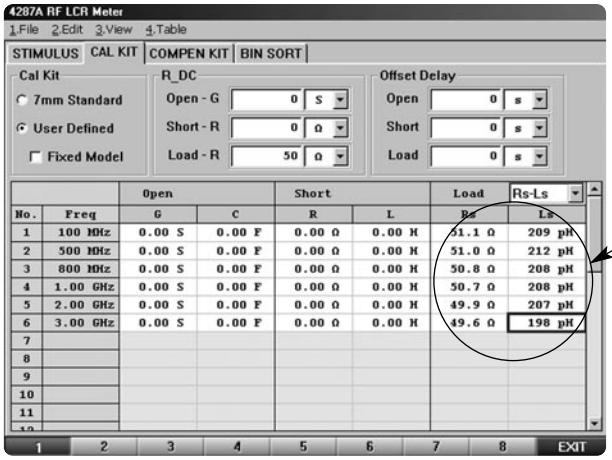


Figure 4. Calibration standard data setup display

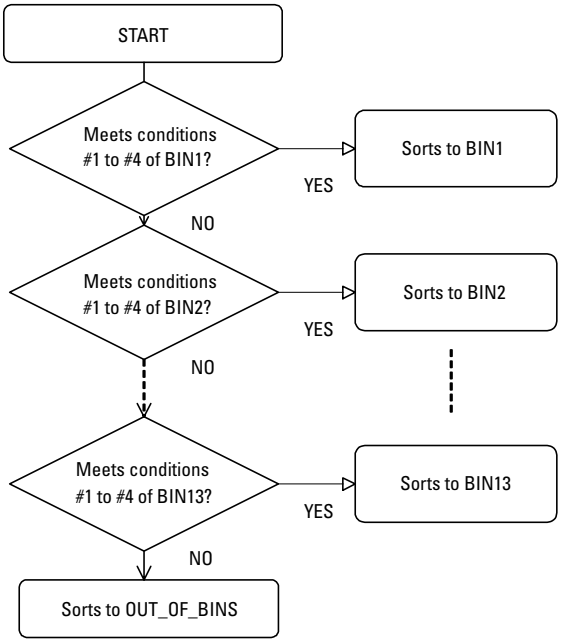


Figure 5. Bin-sort sequence

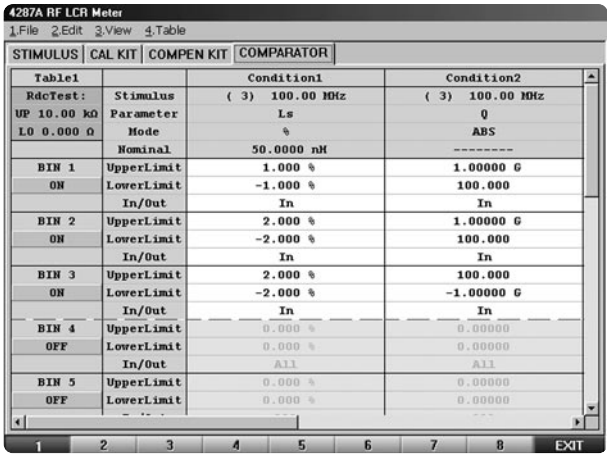


Figure 6. Comparator setup display

Statistical functions

The 4287A is equipped with functions to statistically analyze data. These functions improve the efficiency of the data acquisition required in quality control.

The statistical analysis function calculates the following statistical parameters for as many as 240000 measurement points. Original measurement results for the statistical analysis function can be obtained via LAN interface.

- Examples of normal data (non-failure)
  Cumulative normal samples, mean, maximum, minimum, standard deviation, and 3 σ/mean
- Examples of failure analysis
  Cumulative failure samples, cumulative Rdc failures, cumulative overload samples
- Total number of normal/failure data

Data storage

The 4287A built-in data storage includes a 3.5 inch floppy disk drive as well as either a solid-state mass storage device (flash memory) or a hard disk drive. These powerful storage devices permit save and recall of measurement setup parameters (instrument state) and measurement data. In addition, measurement setup parameters and data can be transferred between the 4287A and an external computer via the GPIB or LAN interface.

Interfacing with an automated component handler

The measurement plane can be extended from the front panel of the instrument to the measurement stage with the 1 m test cable and the small size test head. Note that the measurement accuracy is specified at the test head. It is possible to extend the test cable an additional meter with a 1m extension cable. In addition, connection to an external computer or an automated component handler can be accomplished via the GPIB interface and the opto-isolated handler interface. The LAN interface enables network communication, and greatly empowers massive data transfer to a remote computer.

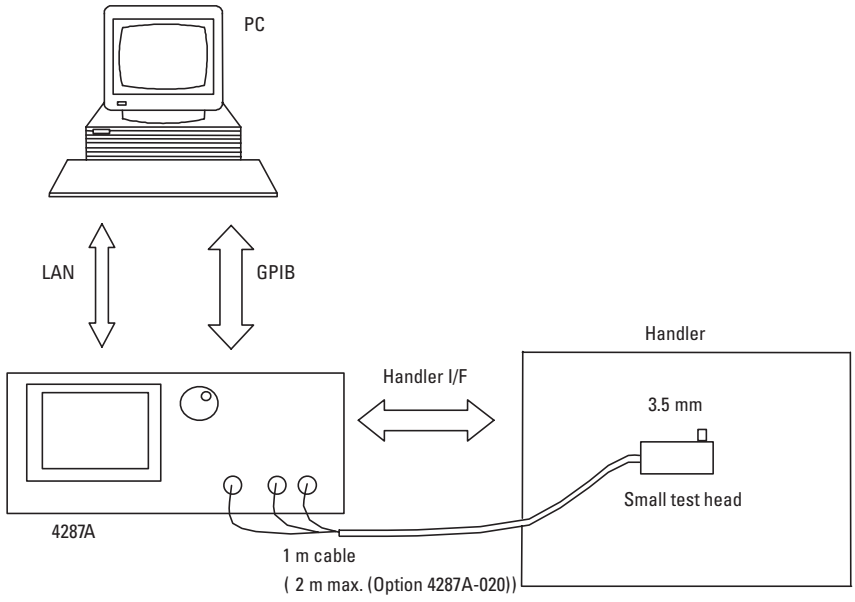


Figure 7. Handler system example with the 4287A

Research and Development of Next Generation Devices and Improving Reliable Quality Control

The accurate impedance measurement capability of the 4287A with the various kinds of test accessories offers you total measurement solutions for the areas of research and development, as well as quality control.

Accurate impedance evaluation up to 3GHz

Characterization of components at operating frequencies in excess of 2 GHz is becoming common due to the development and evaluation of RF SMD inductors used in wireless communication equipment. The 4287A employs the RF I-V measurement method of measuring impedance by measuring the current flowing through a device under test (DUT) and the voltage applied across the DUT. The 4287A enables accurate measurement over an impedance range much wider than that of network analyzers (reflection coefficient method).

Total measurement solution

When electronic components are evaluated, the test accessories should be suitable for their shape and size for accurate impedance measurements. Agilent offers various kinds of 7-mm test fixtures, which are compatible with the 4287A. You can select the appropriate one for your device's size, shape, and application. The 16196A, B and C SMD test fixtures, developed with a co-axial structure, make RF impedance measurements to 3 GHz possible. The 16196A, B and C correspond to the chip sizes, 1608 (mm)/0603 (inch), 1005 (mm)/0402 (inch), and 0603 (mm)/0201 (inch), respectively.

The repeatable DUT positioning capability and reliable contacts enable stable measurement results, and reduce the possibility of operator induced error. Evaluation of SMD inductors to 3 GHz, which has been difficult to implement so far, can easily be performed with good repeatability by using the 4287A with the 16196A/B/C test fixtures. When the 16200B is used with the 4287A, a 7-mm test fixture, and an external dc bias source, dc bias current can be applied to devices such as the EMI filter (up to 1GHz).

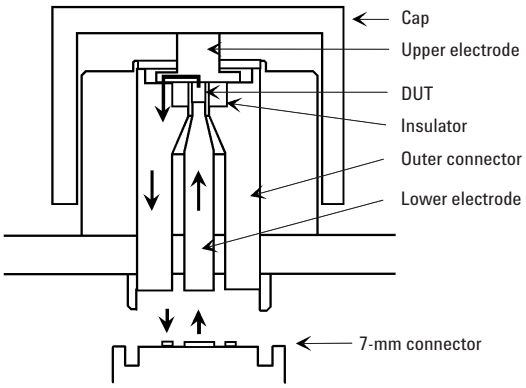


Figure 8. Cross-sectional drawing of 16196A/B/C

Figure 9. Total measurement solution example (with 16196A)

Advanced Features For Precise and Versatile Analysis

Powerful calibration and compensation functions

For manual measurements, a low-loss capacitor as a phase calibration standard, in addition to open/short/load calibration, improves the accuracy of Q measurements as shown. In addition to calibration, electrical length compensation for a fixture with open/short compensation fully correct measurement error caused by use of a test fixture. These functions realize high absolute measurement accuracy at the measurement plane, which in turn empowers accurate measurement of working standards.

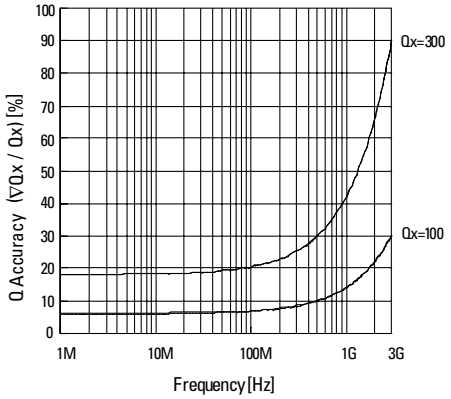


Figure 10. Q accuracy @ 7-mm port (typical)

Calibration wizard function

The 4287A offers you the sophisticated calibration/ compensation method, calibration wizard function. The calibration wizard function eliminates errors of troublesome calibration/ compensation procedures, and it allows you to easily make the 4287A ready to measure accurately.

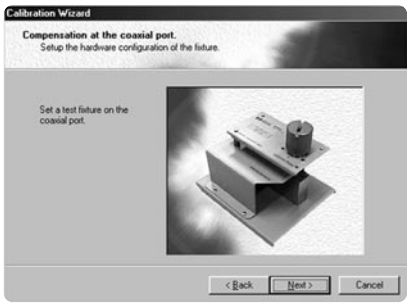


Figure 11. Calibration wizard (fixture connection after calibration)

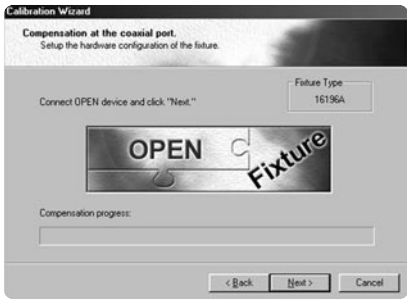


Figure 12. Calibration wizard (open compensation)

Frequency characteristics by using list sweep function

In the area of research and development, the frequency characteristics of the device can be required for their circuit demands. The 4287A's list sweep functions enable impedance measurements at a maximum of 256 multiple frequency points (= 32 points max./table x 8 table max.). By using an external PC, spreadsheet software, and LAN interface, the frequency characteristics can be plotted in a graph as shown below.

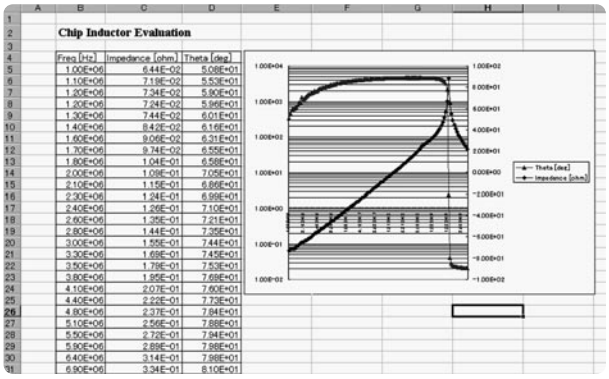


Figure 13. Frequency characteristics plot using spreadsheet software

Ordering Information

4287A RF LCR meter

Furnished accessories:

1 m test cable with test head
*Agilent 16195B 7-mm calibration kit, 16195B 7-mm calibration kit, 3.5-mm to 7-mm adapter, a keyboard, a mouse, a power cable, and an operation manual are not furnished as standard.

Options

4287A-004	Add working standard set[1]
4287A-010	Hard-disk drive mass storage
4287A-011	Solid-state mass storage (must choose either 4287A-010 or 4287A-011)
4287A-020	Add test fixture extension cable set (1 m)
4287A-700	16195B calibration kit[2]
4287A-710	Test fixture stand
4287A-720	3.5-mm to 7-mm coaxial adapter
4287A-810	Add keyboard
4287A-820	Add mouse
4287A-A6J	ANSI Z540 compliant calibration

Manual options

4287A-ABJ	Japan-Japanese localization
4287A-ABA	U.S.-English localization
4287A-0BW	Add service manual

Cabinet options

4287A-1CM	Rack flange kit
4287A-1CN	Front handle kit
4287A-1CP	Handle/rack mount kit

Note:
1. This is used to calibrate the 4287A at the handler DUT contacts. It consists of shorting bars, and 51.0 Ω chip resistors. (SMD size: 1.0 x 0.5 mm, 1.6 x 0.8 mm, 2.0 x 1.2 mm, 3.2 x 1.6 mm)
2. The 16195B is used to calibrate the 4287A at the 7-mm calibration plane by using the 3.5-mm to 7-mm adapter. It consists of open, short, load, and low-loss capacitor standards.

Accessories

16196A/B/C SMD test fixture

- Frequency range: DC to 3 GHz
- Connector: 7-mm
- Operating temperature range:
  –55 °C to +85 °C
- Accommodate SMD sizes:
- 16196A: 1608 (mm)/0603 (inch)
- 16196B: 1005 (mm)/0402 (inch)
- 16196C: 0603 (mm)/0201 (inch)

Figure 14. 16196A/B/C

16191A/16192A/16193A SMD test fixture

- Operating frequency: DC to 2 GHz
- Accommodated SMD size:
  See Figure 15.

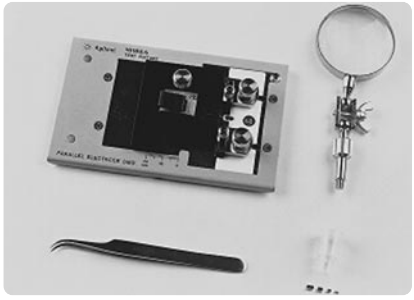


Figure 15. 16191A/16192A

16197A SMD test fixture

- Frequency range: DC to 3 GHz
- Connector: 7-mm
- Operating temperature range:
  55 °C to +85 °C
- Accommodate SMD sizes:
  3216 (mm)/1210 (inch)
  3216 (mm)/1206 (inch)
  2012 (mm)/0805 (inch)
  1608 (mm)/0603 (inch)
  1005 (mm)/0402 (inch)

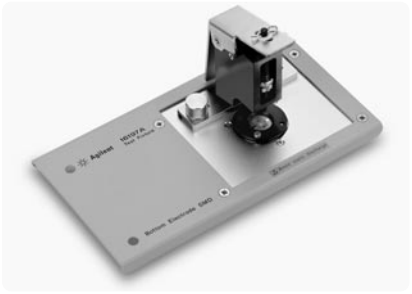


Figure 16. 16197A

16194A High temperature component fixture

- Operating frequency: DC to 2 GHz
- Operating temperature range:
  –55 °C to +200 °C
- Accommodated SMD size:
  See Figure 17.

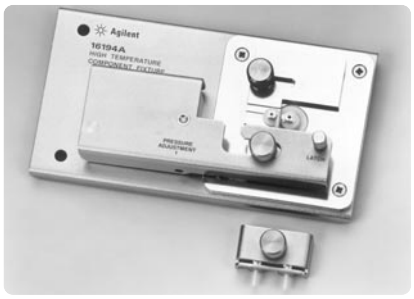


Figure 17. 16194A

16200B External DC bias adapter

- Operating frequency: 1 MHz to 1 GHz
- External DC bias: 5 A max, 40 V
  (at the BNC connector from the external dc bias source)
- Operating temperature range:
  0 °C to +55 °C

Figure 18. 16200B

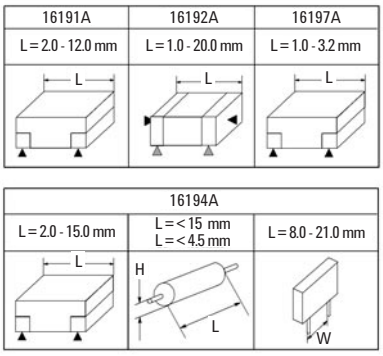


Figure 19. Accommodated SMD size

Ordering Information

Accessories[1]

16196A[2]	Parallel electrode SMD test fixture
Option 16196A-710	Add magnifying lens and tweezers
Option 16196A-ABA	U.S. - English localization
Option 16196A-ABJ	Japan - Japanese localization
16196B[2]	Parallel electrode SMD test fixture
Option 16196B-710	Add magnifying lens and tweezers
Option 16196B-ABA	U.S. - English localization
Option 16196B-ABJ	Japan - Japanese localization
16196C[2]	Parallel electrode SMD test fixture
Option 16196C-710	Add magnifying lens and tweezers
Option 16196C-ABA	U.S. - English localization
Option 16196C-ABJ	Japan - Japanese localization
16197A[2]	Bottom electrode SMD test fixture
Option 16197A-001	Add 0201 (inch)/0603 (mm) device guide set
Option 16197A-ABA	U.S. - English localization
Option 16197A-ABJ	Japan - Japanese localization
16191A[3]	Side electrode SMD test fixture
Option 16191A-010	EIA/EIAJ industry sized short bar set
Option 16191A-701	Short bars set (1 x 1 x 2.4, 1.6 x 2.4 x 2, 3.2 x 2.4 x 2.4, 4.5 x 2.4 x 2.4) mm
Option 16191A-710	Add magnifying lens and tweezers
16192A[3]	Parallel electrode SMD test fixture
Option 16192A-010	EIA/EIAJ industry sized short bar set
Option 16192A-701	Short bars set (1 x 1 x 2.4, 1.6 x 2.4 x 2, 3.2 x 2.4 x 2.4, 4.5 x 2.4 x 2.4) mm
Option 16192A-710	Add magnifying lens and tweezers
16194A[3]	High temperature component fixture
Option 16194A-010	EIA/EIAJ industry sized short bar set
Option 16194A-701	Short bars set (1 x 1 x 2.4, 1.6 x 2.4 x 2, 3.2 x 2.4 x 2.4, 4.5 x 2.4 x 2.4) mm
16200B	External DC bias adapter
16190B[4]	Performance test kit, 7-mm

Note:

1. Manual is not furnished as standard.
2. Must specify one of language options (ABA or ABJ) for operation manual for shipment with product. For 16196A/B/C, magnifying lens and tweezers are not furnished as standard.
3. Short bar set is not furnished as standard. Magnifying lens and tweezers are not furnished as standard.
4. This kit includes an open, a short, a 50 Ω terminations, and an air line for the performance test to verify the impedance accuracy.

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