

Agilent E5100A Network Analyzer 10 kHz to 180 MHz/300 MHz

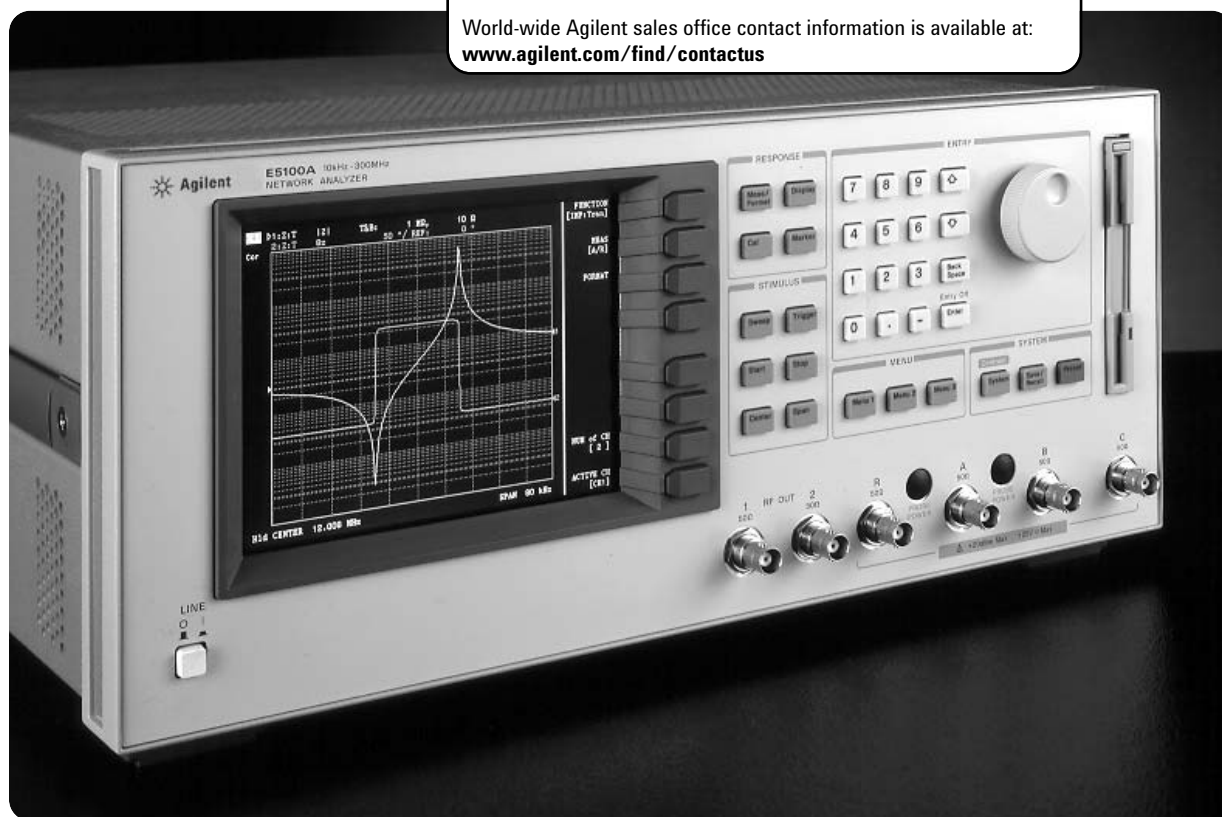
Technical Overview

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Agilent's fastest analyzer improves production capability and reduces costs.



Agilent Technologies

The Agilent Technologies E5100A network analyzer is most appropriately employed on production lines of electronic component manufacturers. They are especially well suited for crystal and ceramic resonator or filter manufacturers. These analyzers improve production line productivity with fast measurement speed, fast waveform analysis commands, and a high-speed processor. They provide faster measurements with lower fluctuations because of their low-noise performance and fine-resolution IFBW.

The E5100A (10 kHz to 180/300 MHz) is a versatile and affordable network analyzer with many functions and options to fit your particular needs with a minimal investment. You can choose the 300 MHz version or the low-priced 180 MHz version.

Major specifications of the E5100A

Frequency range

10 kHz – 180 MHz/300 MHz

Power (One RF OUT)

–48 dBm to +22 dBm (option),
–9 dBm to +11 dBm (standard)

Measurement parameters

Gain (Amplitude Ratio), Phase, Group-Delay, Amplitude, Gain-Phase, Gain-Delay

IFBW

10 Hz – 30 kHz (1, 1.5, 2, 3, 4, 5, 8 steps)

Dynamic range

120 dB (1FBW = 1 kHz)

Dynamic accuracy

±0.05 dB, ±0.3 degrees

Measurement speed

0.04 ms/point (IFBW = 30 kHz, Ramp-sweep)

Display

6.5-inch (diag.) color LCD

Programming

Instrument BASIC

Mass storage

FDD and internal non-volatile memory

The E5100A adds value to resonator and filter production lines

0.04 ms/point measurement speed

This fast speed increases throughput and reduces testing costs.

Ramp sweep and step sweep

Ramp sweep provides fast measurements without dead-time between points. Step sweep improves accuracy and stability because the analyzer pauses for signal output and receiver settling before making a measurement.

Fine-resolution IFBW

Seven IFBW choices per decade provide the best compromise between measurement time and data stability.

Stable measurements

The low-noise design of the Agilent E5100A allows a 120 dB dynamic range and makes possible low-noise measurements. You get more stable data at wider IFBW settings.

Fast processing

A fast CPU shortens processing time and improves the total throughput. Waveform analysis commands and Instrument BASIC run even faster.

Note: For detailed specifications refer to the E5100A datasheet (publication number 5966-2888E).

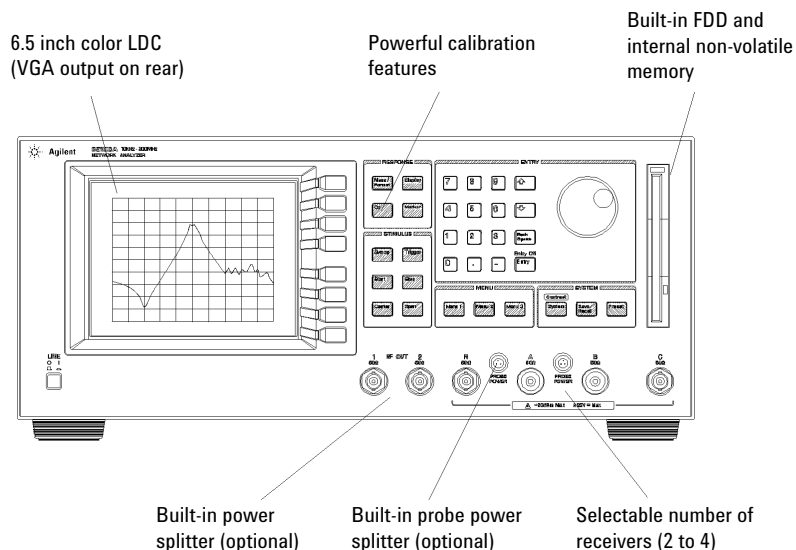


Figure 1. The E5100A analyzers offer 0.4 ms/point measurement speed.

Options add capabilities

Selectable number of receivers

The number of receivers on the E5100A can be tailored to your needs so that the best instrument configuration can be chosen for each production line. The E5100A 300 MHz version can have up to 4 receivers; the E5100A 180 MHz version can have up to 3 receivers.

Selectable source output

You can choose single, dual (built-in power splitter), or switched sources outputs.

50 Ω /1 M Ω switchable input impedance

Input impedance of receivers A and B can be changed to 50 Ω /1 M Ω , switchable. 50 Ω fixed configuration is also available.

Supports active probes

Probe power sockets are installed on the front panel. Input connectors on receivers A and B can be changed to type-N for connecting active probes. (Standard is BNC.)

Optical-isolated parallel I/O

A TTL-level parallel interface is standard for interfacing with auto-handlers. For noise immunity, an optical-isolated, open-collector parallel I/O is available.

Small-sized, lightweight

Shorter depth

The E5100A's short depth (425 mm) allows a larger work area in front of the instrument.

Lightweight

Weighing just 12 kg (typical), the analyzers are easy to move when production line layouts change.

Other features

PC-compatible external keyboard and external CRT

The external DIN keyboard and the external display output (VGA) are compatible with popular personal computers.

2-mode DOS floppy disk drive

The built-in FDD supports 2 modes: 720 kbyte (2DD), and 1.44 Mbyte (2HD) DOS formats.

The E5100A—a great fit for productions line final tests

During final tests, both precision and high-speed are required for better yield and better productivity. The Agilent E5100A makes high-quality, high-speed tests with its fine IFBW resolution and low-noise circuitry. Its convenient analysis and processing functions improve the productivity of final-test processes.

Low-cost 180 MHz version

The E5100A 180 MHz version is the economical solution for lower frequency applications. The test frequency range is 10 kHz to 180 MHz. It provides the same measurement performance and measurement speed as the 300 MHz version with lower prices.

Note: The frequency type of the E5100A (180 MHz or 300 MHz) is selected by specifying the receiver options.

Table 1. Comparison of E5100A versions

	E5100A 300 MHz version	E5100A 180 MHz version
Test frequency	10 kHz – 300 MHz	10 kHz – 180 MHz
Number of receivers	2 to 4 E5100A-200 E5100A-300 E5100A-400	2 to 3 E5100A-218 E5100A-318
Measurement points	2 to 1601	2 to 1601
List sweep	Yes	Yes
Dynamic range	120 dB	120 dB
Phase tracking DLD function	Yes (E5100A-023)	Yes (E5100A-823)
Evaporation monitor function	Yes (E5100A-022)	No

Resonator tests

High-speed evaluation using waveform analysis commands

The waveform analysis commands of the E5100A perform accurate parameter extraction in a very short time. For example, a single command simultaneously extracts resonant frequency and impedance. The analyzer also has other commands for complex tests of resonators, such as equivalent circuit analysis, peak-search, ripple-analysis, etc. (see Figure 2).

Phase Tracking function improves throughput of DLD measurement

The E5100A network analyzer with Opt.E5100A-823 and E5100A-023 is a good solution for measuring the drive level dependency (DLD) of crystals. This option provides a very quick measurement because it measures only the resonant frequency (Fr) and the resonant impedance (CI) as it sweeps the drive level (see Figure 4).

For crystal resonator tests with a PI network

The E5100A supports high-frequency crystal resonator tests using the 41900A/41901A PI network fixture. The E5100A with Opt. E5100A-618 and E5100A-600 has dual source output ports with different power levels. RF OUT-1 provides higher power for the receiver port A and RF OUT-2 provides lower power for the receiver port R. This capability allows the E5100A to apply a 1-mW drive level (when CI is 25 Ω) even when the PI network test fixture with large attenuation is used. In addition, it is not necessary to connect an external attenuator to the receiver port R.

Accuracy can be increased by eliminating residual impedance and stray admittance around the fixture using the transmission three-term calibration of the E5100A and the furnished calibration kits of the 41900A/41901A. Resonator tests with load capacitors can also be performed with the 41900A/41901A's load capacitor adapter kit.

[Watt] and [Amp] are available to set output power

The drive level of crystal resonators is normally defined as power [Watt] or current [Amp]. The E5100A has a convenient function to set the drive level in Watts or Amperes with nominal crystal impedance. No calculator is needed to convert dBm to Watt or Ampere.

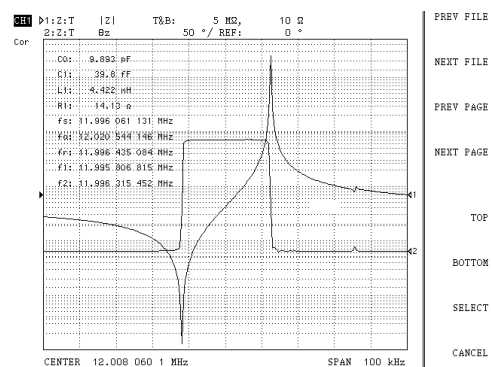


Figure 2. Example of equivalent circuit analysis of a resonator

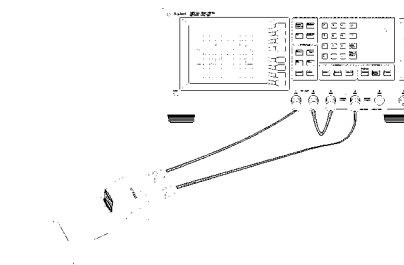


Figure 3. Crystal resonator test with a PI network

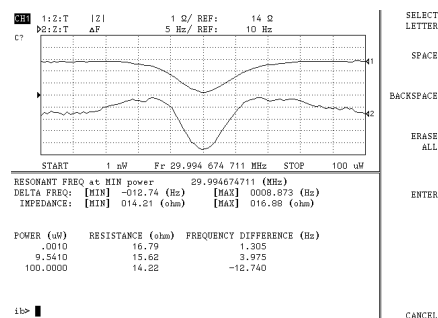


Figure 4. Example of DLD measurement using Opt. E5100A-823 and E5100A-023 phase tracking function

For filter tests

Effective filter tests using list sweep

The Agilent E5100A's list sweep capability reduces sweep time on filters. The test frequency range of filters varies depending on the rejection band, the pass band, and the user's specifications. The list sweep capability operates over various frequency ranges. The sweep frequency range is separated into segments, each of which can have an independent frequency range, number of sweep points, IFBW, and power level settings. By using list sweep, separate frequency bands can be measured in one sweep, or a different IFBW can be set for pass band and rejection band. Wide dynamic range measurements can be completed less time.

Efficient spurious detection

When detecting high-Q spurs, narrow-span sweeps are necessary after wide-span sweeps, but changing the span degrades the test throughput. The E5100A's short setup changing time improves test efficiency (see Figure 6).

Quick and easy filter parameter extraction

The E5100A can analyze data quickly using the built-in waveform analysis commands. These commands provide parameters within the pass band (such as insertion loss, 3 dB bandwidth) or parameters within the rejection band. Many commands for analyzing pass-band ripple or group-delay time are also available (see Figure 7).

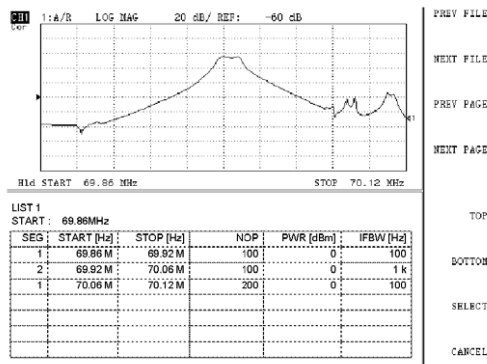


Figure 5. Example of list sweep for filter test

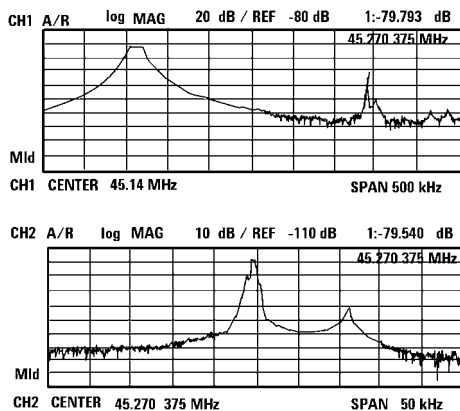


Figure 6. Spurious measurement results (top: wide span, bottom: narrower span)

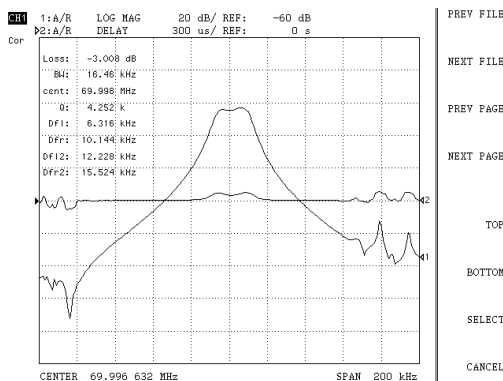


Figure 7. Built-in waveform analysis

Improving filter adjustment productivity

When manually adjusting filters, the E5100A's quick display of the filter response (waveform) and pass/fail results improve productivity. An external VGA monitor can be connected to the analyzer for an even larger display that reduces operator fatigue.

For in-process testing of filters and resonators

For blank crystal tests

The demand for higher-frequency crystal components is growing, which means blank crystals are thinner. When an oscillator and a frequency counter are used to test these higher-frequency crystals, the results aren't accurate. The E5100A's fast measurement speed of 0.04 ms/pt and fast waveform analysis commands improves crystal test productivity.

For vacuum evaporation testing (frequency adjustment) of crystals

The E5100A is an ideal process-monitoring tool for the vacuum evaporation process of crystal resonators and filters. It outputs information necessary to control the process in a real-time manner, so evaporation chamber throughput and adjustment accuracy can be improved. Option E5100A-022, the evaporation monitoring function, is a good solution for adjustment of crystal resonators.

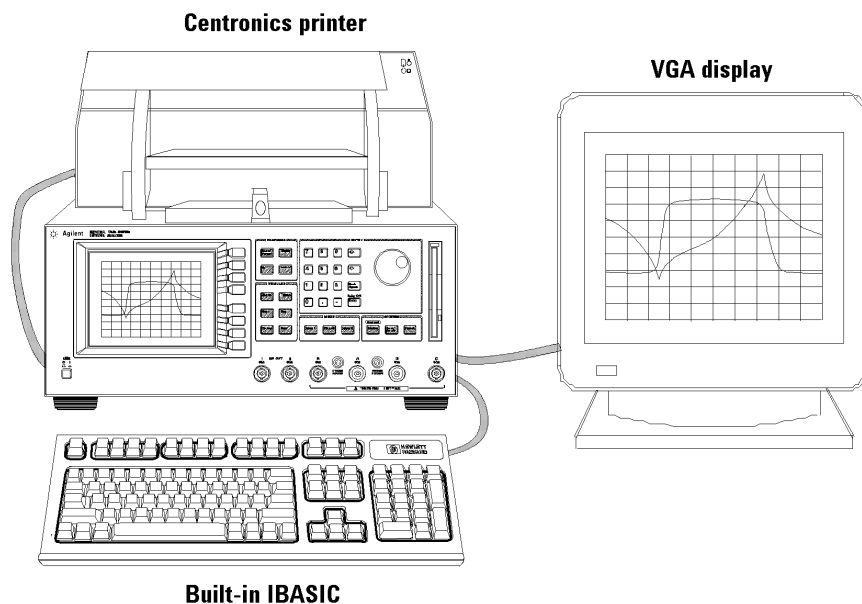


Figure 8. An external monitor can be used to reduce operator eye strain and fatigue.

For other applications

Incoming inspection

The Agilent E5100A can be used for incoming inspection of filters and resonators. When inspecting many kinds of devices, the built-in floppy disk drive and non-volatile-memory are useful for saving and recalling test conditions, calibration data, and test data.

Adjustments of active components and electronic circuits

The E5100A's fast sweep allows rapid adjustments of filter circuitry or active devices such as amplifiers or modulators.

Ordering Information

Agilent E5100A network analyzer

Furnished accessory

Power cable

Configuration guide

Choose option group <A> or , depending on your measurement needs. Then choose the appropriate options within the chosen group. Lastly, choose the appropriate options from the option group <C>.

- ☐ Choose ONE and ONLY one (Options are mutually exclusive)
- ☐ Choose any combination

<A> For crystal resonator test function

- ☐ E5100A-600 300MHz X'tal resonator test w/PI-network
- ☐ E5100A-618 180MHz X'tal resonator test w/PI-network

 For generic test (including ceramic resonator test, filter test) function

For an RF out port option

- ☐ E5100A-001 One RF OUT port
- ☐ E5100A-002 Two RF OUT ports, built-in power splitter
- ☐ E5100A-003 Two RF OUT ports, switched single output
- ☐ E5100A-801 Power extended one RF OUT port
- ☐ E5100A-802 Power extended Two RF OUT ports, built-in power splitter
- ☐ E5100A-803 Power extended Two RF OUT ports, switched single output

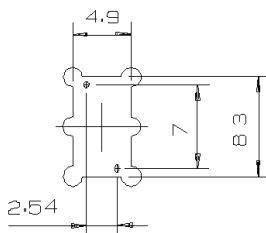
For a number of ports option

- ☐ E5100A-200 300MHz, 2 receivers, ports R and A
- ☐ E5100A-218 180MHz, 2 receivers, ports R and A
- ☐ E5100A-300 300MHz, 3 receivers, ports R, A and B
- ☐ E5100A-318 180MHz, 3 receivers, ports R, A and B
- ☐ E5100A-400 300MHz, 4 receivers, ports R, A, B and C

For a connector type option

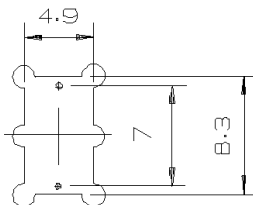
- ☐ E5100A-701 Type-BNC 50 Ω input connector on port A
- ☐ E5100A-702 Type-BNC 50 Ω input connector ports A and B
- ☐ E5100A-703 Type-BNC 50/1 M Ω selectable input on port A
- ☐ E5100A-704 Type-BNC 50/1 M Ω selectable input on port A and B

Option 41901A-010, 011
QIAJ-QS06 4-TERMINAL

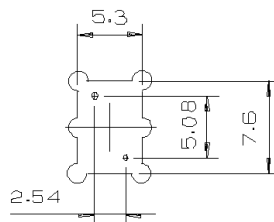


Unit:mm

Option 41901A-020, 021
QIAJ-QS06 2-TERMINAL



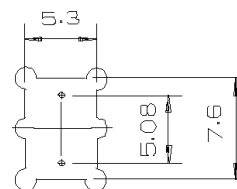
Option 41901A-030, 031
QIAJ-QS07 4-TERMINAL



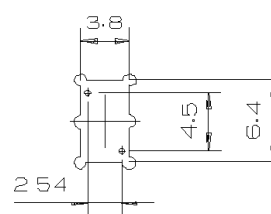
- ☐ E5100A-705 Type-N 50 Ω input connector on port A
- ☐ E5100A-706 Type-N 50 Ω input connectors, ports A and B
- ☐ E5100A-707 Type-N 50/1 M Ω selectable input on port A
- ☐ E5100A-708 Type-N 50/1 M Ω selectable inputs, port A and B

Note: Options E5100A-701, 703, 705, and 707 are for Options E5100A-200 and 218 only. Options E5100A-702, 704, 706, and 708 are for Options E5100A-300, 318 and 400 only. Options E5100A-703, 704, 707, and 708 cannot be ordered with Option E5100A-003 or 803.

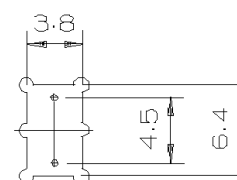
Option 41901A-040, 041
QIAJ-QS07 2-TERMINAL



Option 41901A-050, 051
QIAJ-QS08 4-TERMINAL



Option 41901A-060, 061
QIAJ-QS08 2-TERMINAL



1. Manual is not furnished as standard. (add)

Figure 9. Applicable DUT size and contact pin position of 41901A

<C> For common functions step**For a special measurement function option**

- ☐ E5100A-022 Evaporation monitoring function (300 MHz option only)
- ☐ E5100A-023 Phase tracking function for 300 MHz ver.
- ☐ E5100A-823 Phase tracking function for 180 MHz ver.

Note: Option E5100A-022 is for Options E5100A-200, 300, 400, and 600 only. Option E5100A-023 is for Options E5100A-200, 300, 400, and 600 only and can't order with Option E5100A-823. Option E5100A-823 is for Options E5100A-218, 318, and 618 only and can't order with Option E5100A-023.

For an I/O option

- ☐ E5100A-804 Parallel I/O standard
- ☐ E5100A-005 Parallel I/O mode A (8 bit I/O)
- ☐ E5100A-006 Parallel I/O mode B (24 bit I/O)
- ☐ E5100A-007 Opto-isolated parallel I/O (24 bit I/O)

For a frequency reference option

- ☐ E5100A-800 Standard frequency reference
- ☐ E5100A-1D5 High stability frequency reference

For the IBASIC option

- ☐ E5100A-UKR Delete instrument BASIC

For a PC style keyboard

- ☐ E5100A-1F0 PC style keyboard -U.S. version

For a rack mount accessories

- ☐ E5100A-1CM Rackmount kit
- ☐ E5100A-1CN Handle kit
- ☐ E5100A-1CP Rackmount and handle kit

For a language of the manual¹

- ☐ E5100A-ABA U.S. - English localization
- ☐ E5100A-ABJ Japan - Japanese localization
- ☐ E5100A-0BW Add service manual

Accessories

- ☐ 41800A Active probe
- ☐ 41802A 1 M Ω input adapter

41900A PI-network test fixture

- ☐ Option 41900A-001 Variable CL adapter kit

41901A SMD PI-network test fixture**Fixed CL adapter options¹**

- ☐ Option 41901A-010 Attachment kit QIAJ-QS06 4-terminal type (fixed)
- ☐ Option 41901A-020 Attachment kit QIAJ-QS06 2-terminal type (fixed)
- ☐ Option 41901A-030 Attachment kit QIAJ-QS07 4-terminal type (fixed)
- ☐ Option 41901A-040 Attachment kit QIAJ-QS07 2-terminal type (fixed)
- ☐ Option 41901A-050 Attachment kit QIAJ-QS08 4-terminal type (fixed)
- ☐ Option 41901A-060 Attachment kit QIAJ-QS08 2-terminal type (fixed)

Variable CL adapter options²

- ☐ Option 41901A-011 Attachment kit QIAJ-QS06 4-terminal type (variable)
- ☐ Option 41901A-021 Attachment kit QIAJ-QS06 2-terminal type (variable)
- ☐ Option 41901A-031 Attachment kit QIAJ-QS07 4-terminal type (variable)
- ☐ Option 41901A-041 Attachment kit QIAJ-QS07 2-terminal type (variable)
- ☐ Option 41901A-051 Attachment kit QIAJ-QS08 4-terminal type (variable)
- ☐ Option 41901A-061 Attachment kit QIAJ-QS08 2-terminal type (variable)
- ☐ 87512A Transmission/reflection test kit
- ☐ 11850C 50 Ω three-way power splitter

1. These options include a contact board, 22 fixed CL boards, a device positioner and calibration standard (short and 50 Ω).

2. These options include a variable CL board and SMD capacitors. They don't include a contact board, so this option should be ordered with the correspond option from Option 41901A-010 to 41901A-060.



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Our Promise

Our Promise means your Agilent test and measurement equipment will meet its advertised performance and functionality. When you are choosing new equipment, we will help you with product information, including realistic performance specifications and practical recommendations from experienced test engineers. When you receive your new Agilent equipment, we can help verify that it works properly and help with initial product operation.

Your Advantage

Your Advantage means that Agilent offers a wide range of additional expert test and measurement services, which you can purchase according to your unique technical and business needs. Solve problems efficiently and gain a competitive edge by contracting with us for calibration, extra-cost upgrades, out-of-warranty repairs, and onsite education and training, as well as design, system integration, project management, and other professional engineering services. Experienced Agilent engineers and technicians worldwide can help you maximize your productivity, optimize the return on investment of your Agilent instruments and systems, and obtain dependable measurement accuracy for the life of those products.

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Printed in USA, July 13, 2006
5968-1873E



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