

# Agilent ENA Series 2, 3 and 4 Port RF Network Analyzers

E5070A 300 kHz to 3 GHz

E5071A 300 kHz to 8.5 GHz



## Enabling

- Multiport and balanced measurements
- Accelerated throughput
- High measurement accuracy
- Reduced cost of test



**Agilent Technologies**

## Fast and accurate multiport balanced test

The Agilent ENA Series of network analyzers perform fast and accurate RF component measurements on multiport devices such as duplexers and couplers. Multiple built-in test ports are available for both the E5070A (300 kHz to 3 GHz) and the E5071A (300 kHz to 8.5 GHz) models. The ENA Series offers built-in balanced measurements, matching circuit simulation and port characteristic impedance conversion, all of which deliver accurate measurement results for the most advanced RF components such as balanced SAW filters used for wireless handsets. These comprehensive test capabilities enable fast, accurate measurements and contribute to the reduction of the overall cost of test.



### Comprehensive measurements from an innovative platform:

- Built-in 2 to 4 test ports
- Fast multiport measurement
  - max 12.8  $\mu$ s/point
- Full 2 to 4-port calibration
- Balanced conversion
- High accuracy
  - 125 dB dynamic range\*
  - 0.001 dB rms trace noise
- Matching circuit simulation
- Port characteristic impedance conversion
- 9 measurement channels
- 9 traces per channel

\*Typical

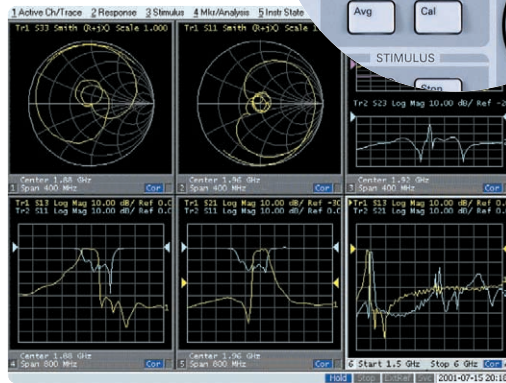
# Advanced architecture for multiport component test

Built-in 2 to 4 test ports provide simultaneous measurement of all signal paths for components with up to 4-ports. This advanced architecture minimizes the number of sweeps to complete a multiport S-parameter measurement and dramatically improves test throughput.



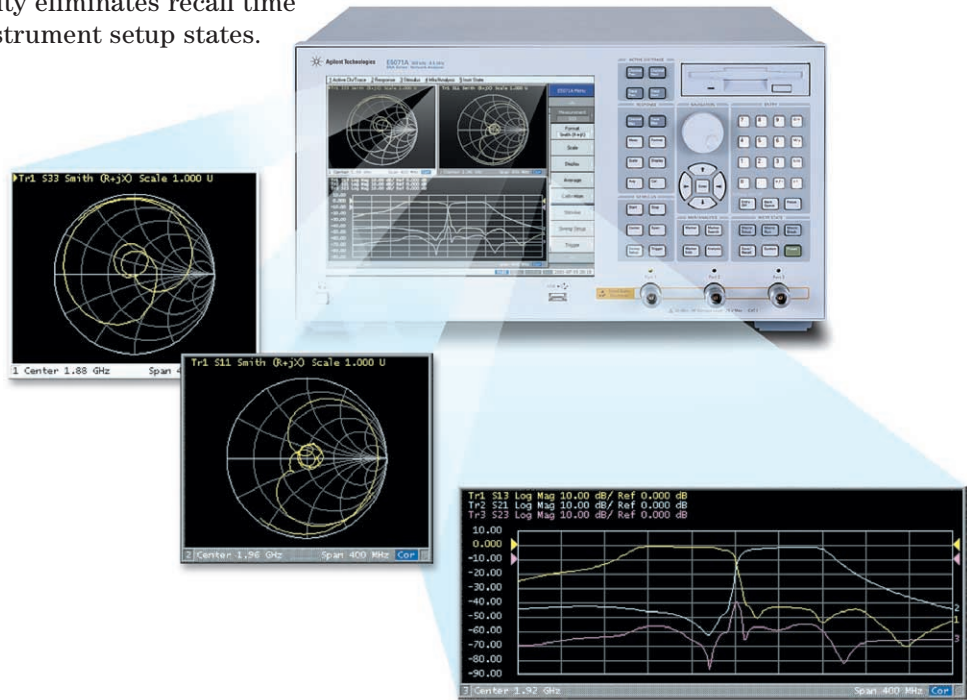
The ENA Series features built-in 2 to 4 test ports

The ENA Series holds up to 9 measurement channels in a single instrument state. Independent frequency list, calibration data, measurement parameters, trace layout, triggering and limit test are applied in each measurement channel which acts as if it is an independent network analyzer. This multi-channel capability eliminates recall time for sequencing multiple instrument setup states.



6 channel layout example

Up to 9 display windows representing each measurement channel may be observed simultaneously. Within each window, it is possible to display up to 9 traces. The layout of display windows and traces are easily selected from the various preset states.



Duplexer measurement using 3 channels

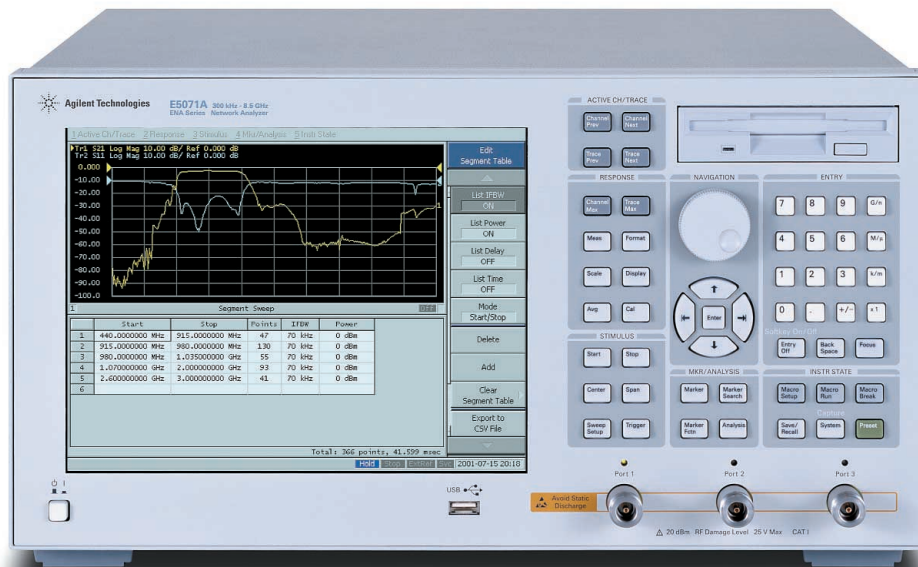


# Dedicated measurements for RF components used in wireless handsets

The ENA Series provides balanced conversion, and delivers mixed mode S-parameter measurements. This integrated measurement capability improves test throughput of balanced components such as RF SAW filters.

The matching circuit simulation re-calculates measured data to simulate characteristics of components including matching circuit at arbitrary port characteristic impedance. As a result, components can be accurately characterized to meet handset manufacturer requirements. In addition, there is no need to develop fixtures with physical matching circuit for each component. This reduces fixture development costs and maintenance efforts.

Segment sweep with order based display reduces measurement time across wide frequency band and provides better view of measurement results.



Segment sweep with order base display

# Enhanced performance and usability for manufacturing test

## Automated test

### Fast and accurate

Superior measurement performance of the ENA Series improves measurement quality and repeatability. It also allows fast measurement for high speed manufacturing test.

### Evolution of test automation

The evolution of built-in automation empowers the test development environment. Visual Basic® for Application (VBA) comes with the ENA Series and provides flexibility of test programs while significantly reducing test development time.

### Expanded choice of connectivity

The ENA Series expands the choice of connectivity to other test equipment, parts handler, external PCs and peripherals. GPIB, LAN, USB and handler I/O are available at no additional cost.

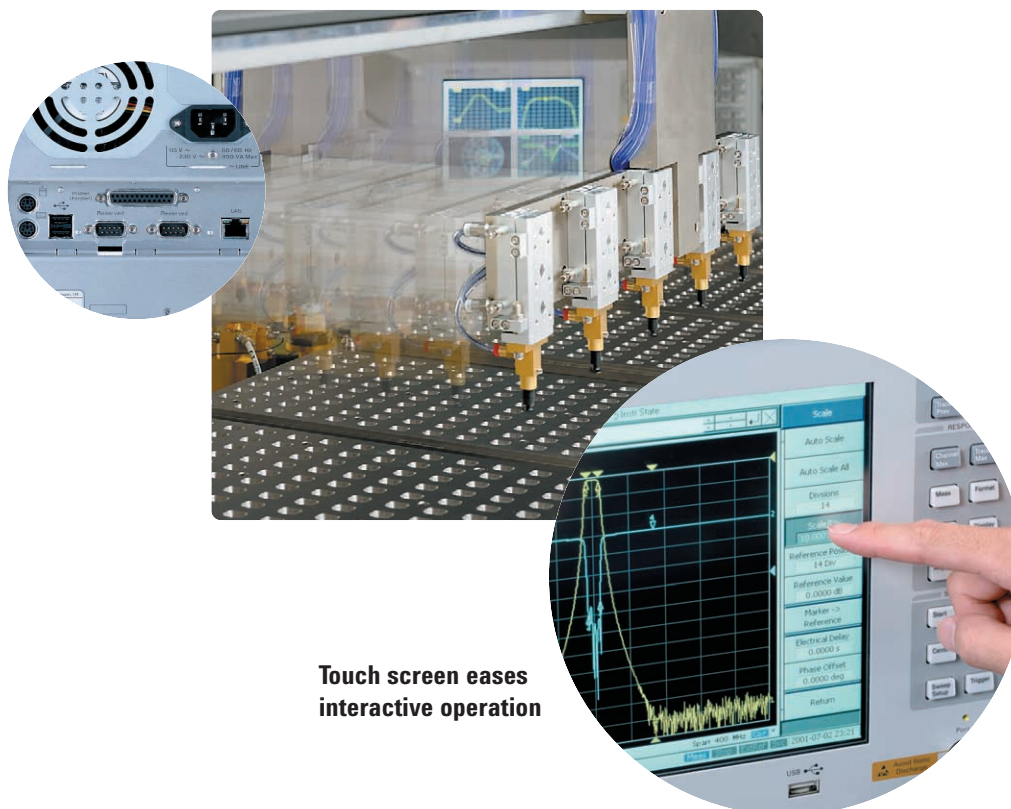
## Manual operation

### Designed for productivity

The ENA Series increases test engineer and operator productivity. A large LCD display provides clear views of multiple traces in multiple windows. In addition, an optional touch screen eases interactive operation and minimizes operational errors at tuning process of filter and duplexer manufacturing.

### Simplified operation

Dedicated keys are available to select and maximize the display window or trace. This allows an operator to quickly enlarge a measurement result.



Touch screen eases interactive operation

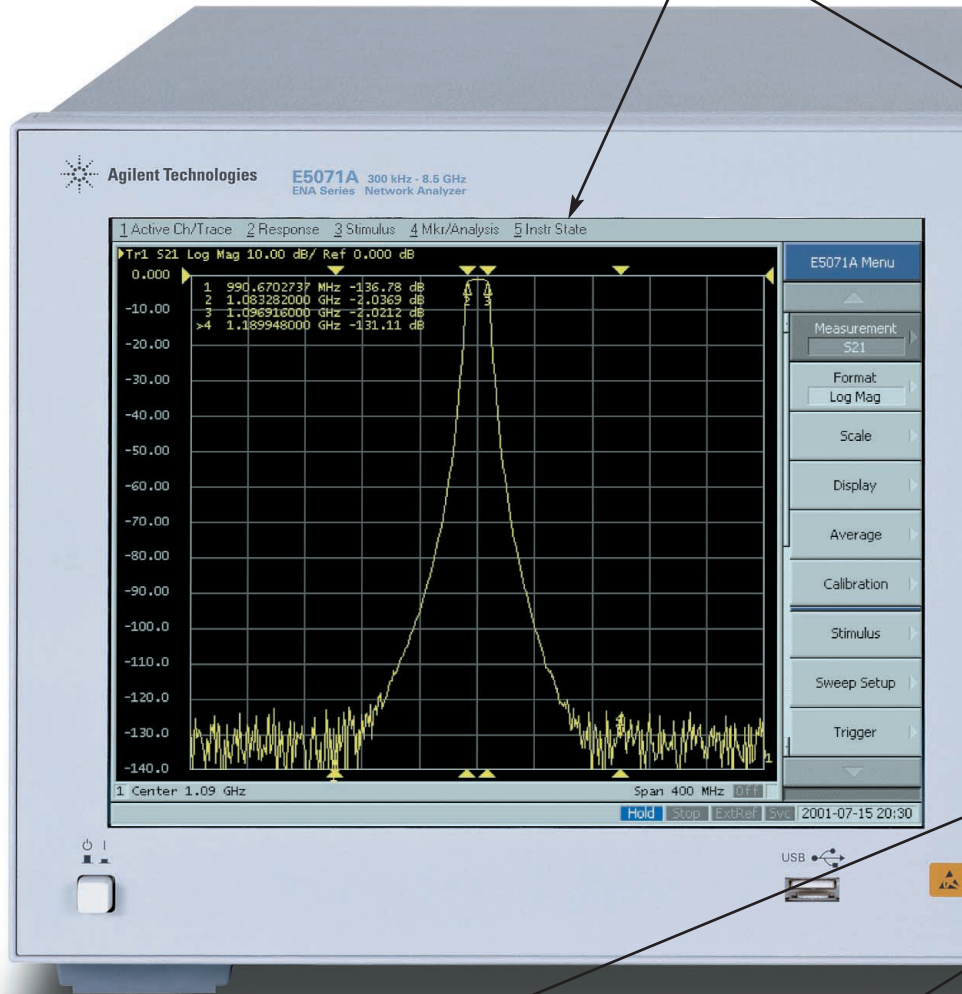
# Increasing throughput, enhancing measurement quality and easing usability

## Excellent measurement accuracy

The Agilent ENA Series dramatically improves measurement accuracy and responds to current and future test needs. Because it performs up to 125 dB\* wide dynamic range at 10 Hz IFBW, the sweep speed can be faster at the required dynamic range. The trace noise is lowered to 0.001 dB rms at 3 kHz IFBW. It delivers accurate pass band ripple measurement of a filter. The ENA's excellent measurement performance improves test quality and repeatability as well as test throughput, which affect production yield and the overall cost of test.

## Ease of use

- Maximum 9 windows and 9 traces per window
- 10.4-inches color LCD
- Optional touch screen
- Windows styled pull down menu for mouse operation
- Channel/trace previous and next keys to select measurement result of interest
- Navigation keys



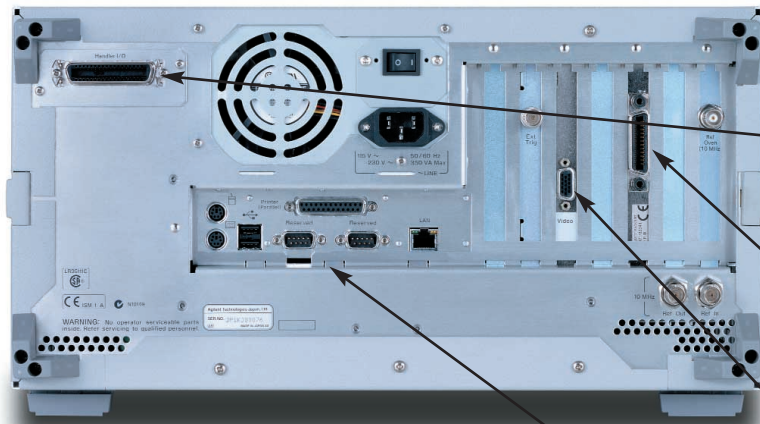
## Powerful analysis functions

- Marker analysis and marker function
- Balanced conversion
- Matching circuit simulation
- Port impedance conversion

## Advanced measurement

- Built-in 2 to 4 test ports
- Up to simultaneous 4 ports measurement
- Full 4-port calibration
- 125 dB @10 Hz IFBW wide dynamic range\*
- 0.001 dB rms @3 kHz BW low trace noise

\*Typical



### Handler I/O

- High speed handshake with parts handler
- Pass/Fail, test sequencing and user defined I/O signals

### GPIB interface

- Connection to the external PC controller
- Control external test equipment

### VGA output

- External display to enlarge measurement data and/or VBA® editor

### Peripheral ports

- USB (front x 1, rear x 1) for ECal and printer
- PS2 for mouse and keyboard
- Parallel interface for printer
- 10/100 Base-T LAN



### Built-in automation control

- Macro Setup/Run/Break keys to control VBA® program

## Key specifications

Test frequency	300 kHz to 3 GHz (E5070A)		
	300 kHz to 8.5 GHz (E5071A)		
Max port output power			
without attenuator	-15 to 0 dBm		
with attenuator	-50 to 0 dBm		
Test set	S-parameter test set		
Number of test ports	2	3	4
Measurement parameters	$S_{11} - S_{22}$	$S_{11} - S_{33}$	$S_{11} - S_{44}$
	with balanced conversion      Mixed mode S-parameter		
IFBW	10 Hz to 80 kHz (1, 1.5, 2, 3, 4, 5, 7 step)		
Number of points	2 to 1601		
System dynamic range*	123 dB @10 Hz BW (3 MHz to 1.5 GHz)		
	125 dB @10 Hz BW (1.5 GHz to 6 GHz)		
	120 dB @10 Hz BW (6 GHz to 7.5 GHz)		
	113 dB @10 Hz BW (7.5 GHz to 8.5 GHz)		
	(Response & isolation calibration)		
Trace noise (magnitude)	0.001 dB rms @3 kHz BW (3 MHz to 4.2 GHz)		
	0.003 dB rms @3 kHz BW (4.2 GHz to 8.5 GHz)		
	(0 dBm source power, through measurement)		

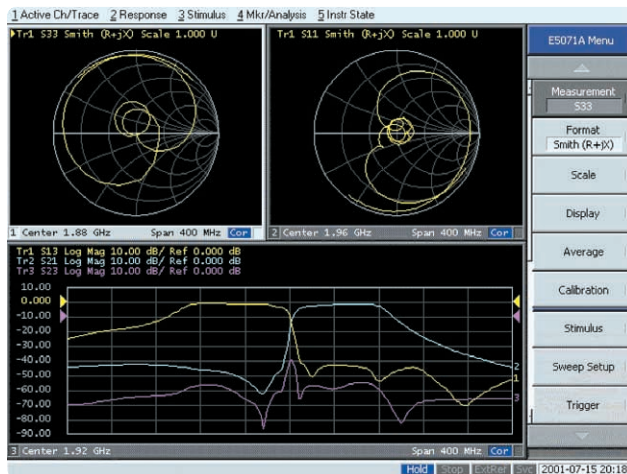
\*Typical



# Flexible display layout maximizes your test productivity

## Multi-window layout displays all measurement channels

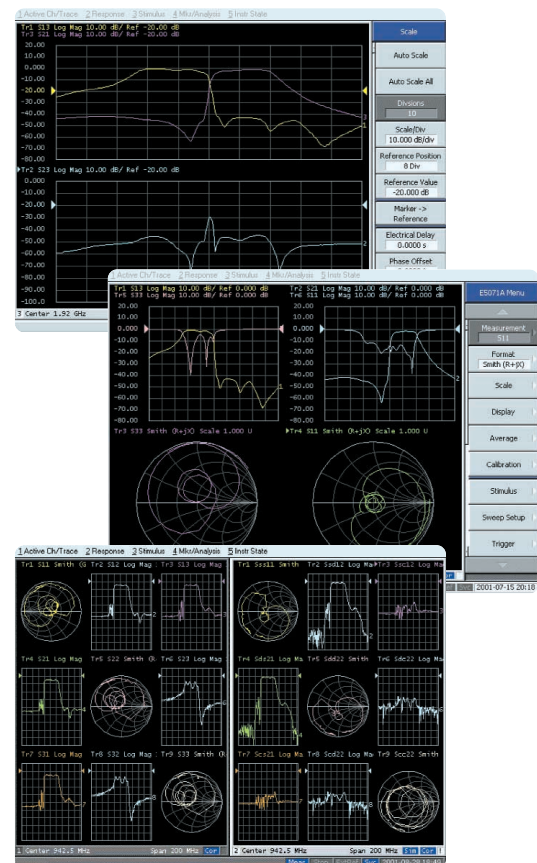
Measurement results require quick and clear observation, especially for multiport component test. The ENA Series can display 9 measurement channels simultaneously. For example, it is possible to use 3 channels for a duplexer measurement as shown in the duplexer measurement below. In most cases, each of these measurement channels requires individual sweep list, number of points (NOP), sweep type and test limits. The measurement result of all these channels needs to be displayed. The ENA Series provides flexible windows layout and displays up to 9 windows in the large LCD display. Operators can easily select from 14 pre-defined layouts using either soft keys, pull down menus or SCPI/COM commands. It is easy to monitor all measurement results in a variety of layouts that help to achieve increased test productivity.



Duplexer measurement

## Up to 9 traces can be displayed in an independent format

In addition to the display window layout, an operator can allocate multiple measurement parameters with a choice of trace format. The ENA Series displays up to 9 traces per display window. Trace format and allocation of each parameter are fully independent between display windows. Fourteen pre-defined layouts are available and trace can be overlaid if necessary.



Flexible window and trace layout



# Powerful built-in analysis functions solve the toughest test problems

The fixture simulator adds a powerful analysis engine to the ENA Series for RF component measurements and enables accurate characterization with flexible user defined fixture simulation capability.

## Characterize balanced components

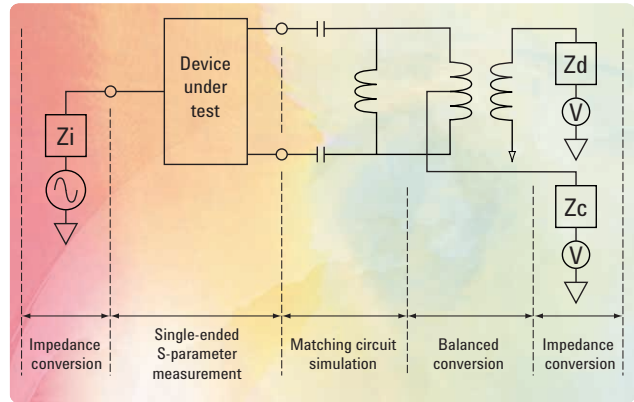
The fixture simulator provides high speed and accurate balance conversion inside the ENA Series. The conversion algorithm is compatible with Agilent balanced measurement system (Agilent N4444A) which is a proven solution in many industries. Mixed mode S-parameter can be measured and enable strict characterization of the components. In component manufacturing this high speed balanced measurement solution improves test quality and throughput dramatically. It also contributes to higher production yield and lowers the cost of test.

## Characterizing components with matching circuits

At times a component needs to be specified with matching circuit as it is used in the real circuit of the wireless handset. The ENA Series simply simulates characteristics with user defined matching circuit by selecting circuit topology with arbitrary values of inductance and capacitance. The S-parameter on touchstone format can also be applied for even more complicated matching circuit simulation.

## Characterizing non-50 Ω components

The port impedance of components is sometimes non-50 Ω, however a network analyzer is usually built with 50 Ω test port impedance. The fixture simulator mathematically converts the measurement result from 50 Ω to user defined port impedance.



Fixture Simulator capability block diagram



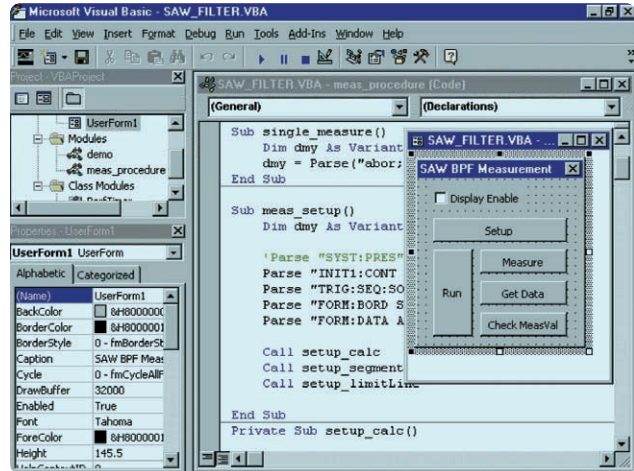
Mixed mode S-parameter measurement



# Evolution of test automation, built-in VBA

The ENA Series accelerates test development, expands customization capability and increase flexibility of test system integration. The VBA is a powerful programming language that brings new era of test automation. A test program can be developed in the ENA Series by using the built-in VBA editor. A large LCD is useful for programming and debugging. The ENA can be programmed using SCPI or COM in the VBA routine. This powerful programming tool helps you to accelerate test system development.

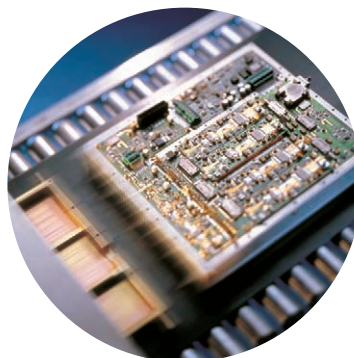
In addition, a custom user interface can be easily developed with the graphical programming features of VBA. This allows the limit test results and/or test instruction to be displayed and helps to avoid operational errors.



Built in VBA editor



Customized user interface using VBA



At times measurement parameters need to be calculated mathematically or processed statistically after the data is acquired. The VBA is also useful for such post processing. Unique analysis functions are easily implemented using various VBA functions. This expands analysis capability of the test equipment and fully meets test needs.

# Improving measurement accuracy and productivity of error correction

## Error correction of multiport device measurement

The error correction is critical for multiport device, especially for low loss and non-isolated devices such as couplers and balanced filters. When the full 2-port error correction is applied to such 3 or 4-port devices, the port match characteristics of non-corrected ports affect measurement results. The ENA Series provides full 2, 3 and 4-port calibration and improves measurement accuracy of multiport devices.



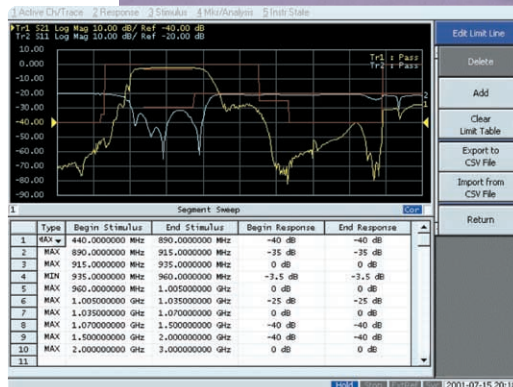
## Reducing calibration time using ECal

The ENA supports Agilent electronic calibration kits (ECal). The ECal automatically performs calibration procedure and minimizes operational errors. The ECal module can be controlled by the ENA Series via USB interface without an external PC. The front USB port is available for the ECal module and it is easy to connect to a rack mounted analyzer.



## Windows-styled user interface increases productivity

For the segment sweep and/or limit test, detailed stimulus and limit values are at times troublesome and time consuming. The built-in table editor within the ENA Series makes it easier to fulfill all of necessary values for segment sweep and limit test. These values can be exported and imported to and from csv files.



Imported limit table values from CSV file



# Service and support

The ease-of-use and performance of the ENA Series network analyzers is only a part of what is available from Agilent Technologies. In a constantly changing environment, Agilent's ability to understand your business needs and quickly provide the latest end-to-end service and support solution, gives you the certainty and confidence to accelerate the development and deployment of winning technologies for you and your customers. Contact your local Agilent Sales or Support Desk regarding these service & support products:

- Calibration services
- Up-front repair options
- Technical consulting
- Process consulting
- Education and training

For on-line information about Agilent's service and support products visit:

[www.agilent.com/find/tm\\_services](http://www.agilent.com/find/tm_services)

## Ordering information

E5070A	300 kHz to 3 GHz Network Analyzer
E5071A	300 kHz to 8.5 GHz Network Analyzer
Opt.213	2-port S-parameter test set, standard power range (-15 to 0 dBm)
Opt.214	2-port S-parameter test set, extended power range (-50 to 0 dBm)
Opt.313	3-port S-parameter test set, standard power range (-15 to 0 dBm)
Opt.314	3-port S-parameter test set, extended power range (-50 to 0 dBm)
Opt.413	4-port S-parameter test set, standard power range (-15 to 0 dBm)
Opt.414	4-port S-parameter test set, extended power range (-50 to 0 dBm)
Opt.016	Touch screen color LCD
Opt.1E5	High stability frequency reference

## Online

For additional information on the ENA Series visit:

[www.agilent.com/find/ena](http://www.agilent.com/find/ena)

To sign up for online product update and application information:

[www.agilent.com/find/notifyme](http://www.agilent.com/find/notifyme)

## Literature

*ENA Series Technical Specifications*, Publication number 5988-3780EN

By internet, phone, or fax, get assistance with all your test and measurement needs.

### Online Assistance

[www.agilent.com/find/assist](http://www.agilent.com/find/assist)

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