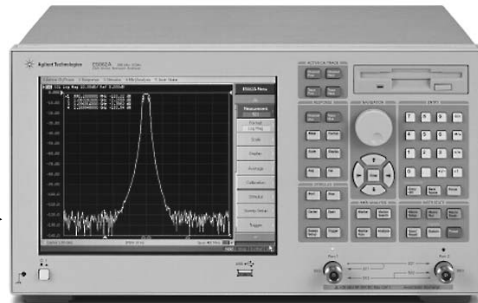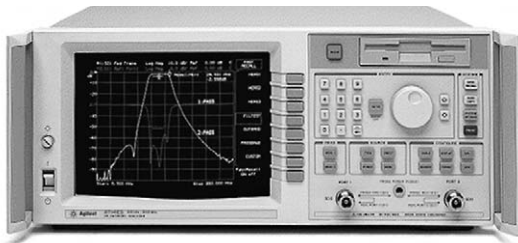# Agilent
Migration from 8712/8714 Series to ENA-L Network Analyzers

Technical Overview

The Standard Just Got Better!

Enhanced usability and performance
• Affordably priced
• Minimal software migration

Agilent Technologies

A new standard for low-cost basic RF network analysis

In the fast paced world of RF network analysis, we know how important it is to stay current and competitive...

Agilent is proud to introduce the ENA-L RF network analyzers (E5061, E5062A) to our 8712/8714 series customers. Based on the latest in modern technology, the ENA-L offers enhanced performance and powerful productivity features to improve your test and measurement efficiency, all at a price comparable to the 8712/8714 series.

This document provides key product feature comparisons of the ENA-L and 8712/8714 series followed by a discussion on utilizing your existing software.

Contents

Product Feature Comparison
- Measurement performance comparisons
- Enhanced usability and user interface
- 8712/8714 series features not included in the ENA-L

Utilizing Existing Software
- State file utilization
- Control program code utilization

Appendix 1. Product comparison chart
Appendix 2. Order configuration chart

Product Feature Comparison

The ENA-L supports most of 8712/8714 series product features with added enhancements as shown in the summary chart below.

ENA-L not only enhances fundamental performance such as sweep speed, dynamic range, trace noise, etc., but also provides many easy-to-use new features such as a large color LCD display, multi-channel, ECal support and more. Please refer to Appendix 1 for more detailed feature comparisons.

Feature comparison summary

	Features and compatibility		E5061A	E5062A	8714ES[1]	
Fundamental measurement performance	System impedance	☐	50/75 ohm	50/75 ohm	50 ohm	75 ohm
	Frequency range	✓	300 kHz to 1.5 GHz	300 kHz to 3 GHz	300 kHz to 3 GHz	
	Maximum power > 1GHz	✓	10 dBm		7 dBm[1]	4 dBm[1]
	Minimum power (with attenuator option)	☐	−5 dBm (−45 dBm)		−60 dBm[1]	−60 dBm[1]
	System dynamic range	✓	115 dB (300 kHz to 1 MHz),120 dB (1 MHz to 3 GHz)		101 dB[1]	96 dB[1]
	Sweep type	✓	Liner, Power, Log, Segment		Liner, Power	
	Trace noise	✓	0.005 dB rms @ 3 kHz IFBW		0.01 dB rms @250 Hz IFBW	
	85075C (Multi-port test set) support	☐	Yes		Yes	
	Broadband receiver	○	No		Yes	
	Absolute power measurement	○	No		Yes	
Usability	Number of channel	✓	4		2	
	Number of traces per channel	✓	4		1	
	Display	✓	10.4-inch color LCD		9-inch black and white	
	Touch screen display?	✓	Yes (Option 016)		No	
	ECal support	✓	Yes		No	

Features enhanced in ENA-L ✓

Features not supported in ENA-L ○

Same features in ENA-L ☐

[1] The 871X series' analog performance specification varies according to the models. Please refer to Appendix 1 for more details and additional models.

Measurement performance comparison

Wider dynamic range expands your measurement possibilities

ENA-L provides wide dynamic range of 120 dB (1 MHz to 3 GHz). In the 8712/8714 series, this level of performance cannot be provided even with T/R test set models. Compared to the 8714ES, the ENA-L has additional 19 dB of dynamic range. Higher dynamic range makes a significant difference for the precise evaluation of devices such as high rejection filters.
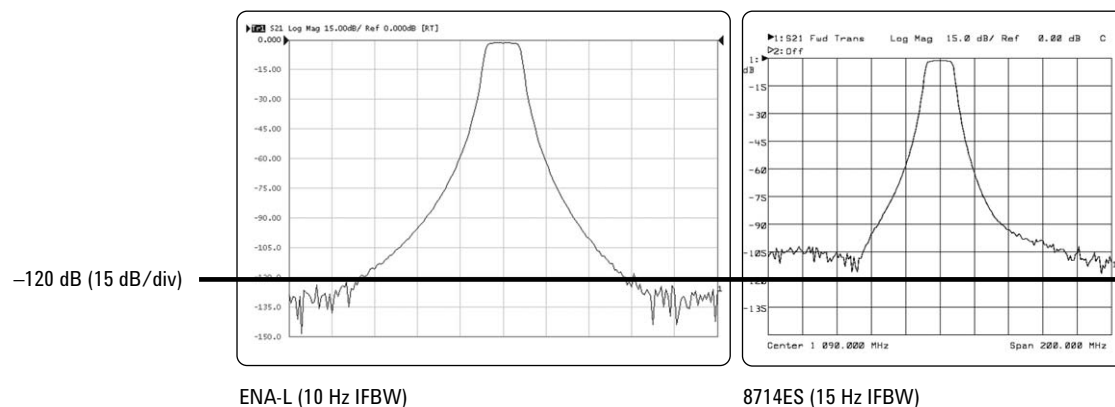
−120 dB (15 dB/div)

ENA-L (10 Hz IFBW)   8714ES (15 Hz IFBW)

Figure 1. Dynamic range comparison

Lower trace noise increases measurement reliability

With enhanced synthesized source purity, the ENA-L provides much lower trace noise than 8712/8714. For example, when both analyzers are set to get 90 dB dynamic range, trace noise is three times lower in the ENA-L. This trace noise enhancement allows you more stable measurements for increased reliability and product quality.
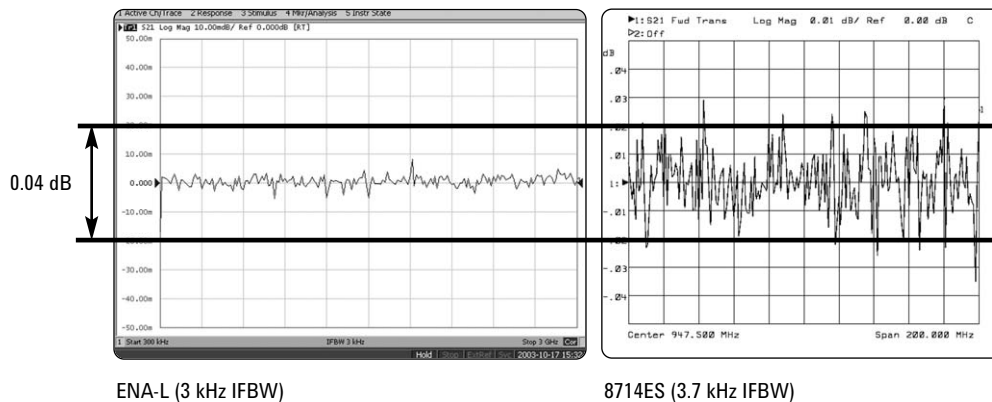
0.04 dB

ENA-L (3 kHz IFBW)   8714ES (3.7 kHz IFBW)

Figure 2. Trace noise comparison at 90 dB dynamic range

Faster sweep speed decreases your cost of test

Due to a powerful digital processing and enhanced circuit's performance, ENA-L provides faster sweep speed than the 8712/14 series. For example, with a typical setting for high volume filter production (201 points, full 2-port cal., 90 dB dynamic range), ENA-L is approximately 6 times faster than 8712/14. For automated production lines the additional speed increases through-put and cuts down measurement cost per component.

Agilent E5061A
35 ms

Agilent 8712ES
240 ms

Agilent E5061A verses Agilent 8712ES sweep speed comparison
with typical data (201 points, full 2-port cal., 90 dB dynamic range).

Figure 3. Sweep speed comparison

Log and segment sweeps provide measurement convenience

In addition to linear frequency and power sweep types (which are available in the 8712/8714), the ENA-L supports log and segment frequency.

• For the users who want to evaluate broadband devices such as cables or connectors, log frequency sweep helps you to recognize wide frequency characteristics at a glance.
• For the users with analyzers in a production line, segment sweep allows sweeps only at the frequencies you need for higher throughput.

300 kHz to 1 GHz Log scale display
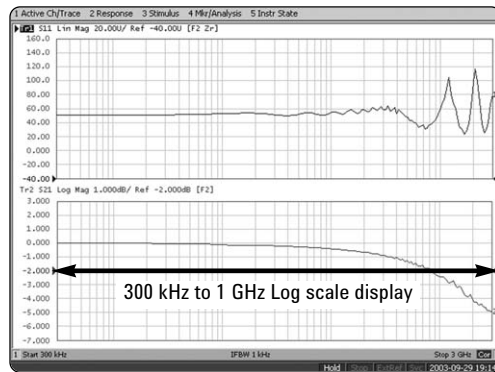
Log sweep effectively shows characteristics

65 MHz
130 points

1 GHz
50 points
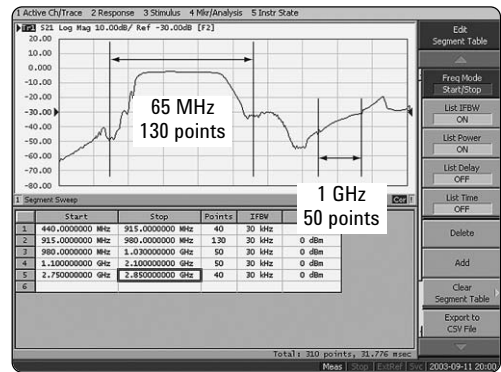
Segment sweep allows you to measure various intervals, ONLY the necessary frequencies.

Figure 4. Log and segment sweep

Enhanced usability and user interface

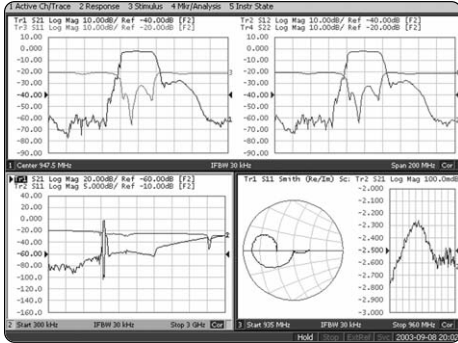**Larger display, more channels, and more traces adds measurement efficiency**
Compared with 8712/8714's 9-inch black and white display, ENA-L's 10.4-inch large color LCD display enables you to easily analyze a lot more information at once. The ENA-L also has an enhanced display capability that allows you to view "4 channels (settings) and 4 traces in each channel" compared to the 8712/8714's "2 channels and 1 trace in each channel". Hence users can measure up to 16 traces (parameters) with up to 4 different measurement conditions simultaneously!

For example, when measuring a band-pass filter, users can measure eight parameters in three different frequency ranges all at once as shown in the figure.

Figure 5. ENA-L displaying 3 channel (setting) and 8 traces mode

- **Channel 1: (Pass band)**
  Center 947.5 MHz, SPAN 200 MHz
  Parameter: S21, S12, S11, S22

- **Channel 2: (Wide band)**
  Start 300 kHz, Stop 3 GHz (SPAN 2.7 GHz)
  Parameter: S21, S11

- **Channel 3: (Very narrow band)**
  Start 935 MHz, Stop 960 MHz (SPAN 25 MHz)
  Parameter: S11, S21

With 8712/8714, users need to change their settings at least 4 times to measure the same parameters. In this way, ENA-L provides an easier and efficient method to evaluate devices.

(Optional) Touch screen offers intuitive operation
The ENA-L supports touch screen capability to helps users to control analyzers intuitively and easily.

Figure 6. Optional touch screen

Electronic Calibration (ECal) support reduces calibration time and operation errors
The ENA-L supports ECal modules, the latest in modern calibration tools. To perform full two-port calibration, ECal modules only require one set of connections with simple soft key operation. Users can calibrate their system faster and reduce the chance of operator error and wear on expensive connectors.

Figure 7. ECal module

Built-in VBA makes it easy to develop automated test programs

ENA-L adopts one of the most widely used programming languages, Visual Basic® for Application (VBA) as the built-in programming language instead of IBASIC used in the 8712/8714 series.

The ENA-L's VBA editor provides powerful and useful debug and edit functions. For example, as shown in Figure 8, the programming commands are automatically listed after the first character of the command is typed. Additionally, the editor indicates a typo by changing text color. And sentence structures are very simple to write. Thus users can code a program easily and decrease program development time dramatically compared to the 8712/8714 series.
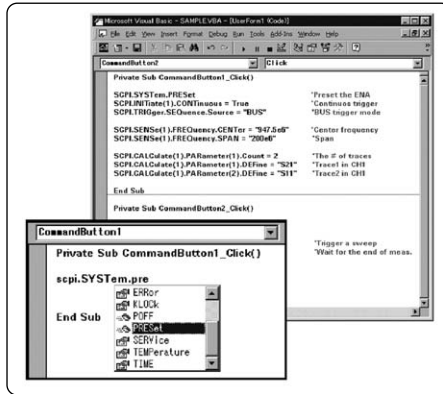
Figure 8. Powerful VBA editor example

VBA is also very useful for creating interactive test programs with a graphical user interface (GUI). As shown in Figure 9, users can create a GUI tailored to meet your specific measurement needs, which facilitates analyzer operation and reduces operator errors.
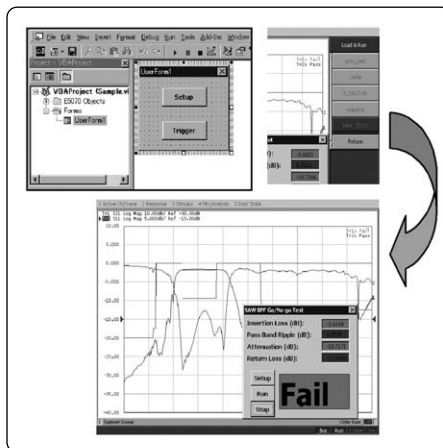
Figure 9. Custom graphical user interface created using VBA program

VBA also offers module level programming to help reduce development time. With the ENA-L, if you find convenient sample programs, you can utilize them in your own program by simply importing the necessary module.

**8712/8714 series'
measurement capability
not included in ENA-L**

The following features are not supported in the ENA-L:

• Broadband receiver capability
• Absolute power measurement capability

Utilizing Existing Software

Software resources, namely state files and control programs, are precious and it is costly to develop them from scratch for a new analyzer. Agilent provides two tools to minimize the cost of software migration: the State File Converter and Program Code Conversion Kit.

State file utilization - (State File Converter)

Agilent provides a State File Converter VBA program that can be run on the ENA-L. The program reads an 8712E/8714E series' state file, and sets up the ENA-L automatically. Because the ENA-L was designed for compatibility, the program supports most of the 8712/8714E settings. Supported and unsupported settings are described below:

Supported settings:

- Format[1]
- Stimulus[2]
- channel and trace setting[2]
- Parameter[1]
- Limit test
- Marker setting

- Self calibration
- Scale[1]
- Trigger source
- Multi-port test set setting
- Display annotation[1]

Un-supported settings:

- Calibration data
- Trace data
- Broadband measurement

- Absolute power measurement
- Marker limit
- Features that ENA-L does not have
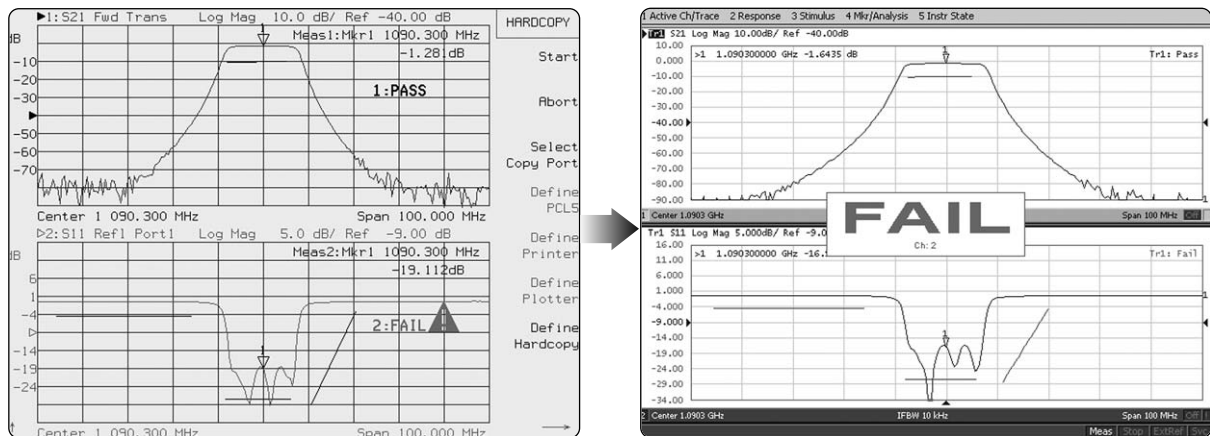
Figure 10. Conversion example with limit test and marker functions.

Note: Although the state file converter does not support 871xA, B, or C series state files, they can be converted to the 871xE series state files using an 871xE analyzer. Then they can be converted to the ENA-L state files with the converter.

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[1] Except for the related features that ENA-L doesn't have
[2] Following setting values need to be confirmed, because values are changed to the nearest or most suitable ones when the same setting is not available for the ENA-L: IF bandwidth, Power level, Power range, Attenuator setting, Channel/trace setting

Control program code utilization - (Program Code Conversion Kit)

Because of the same SCPI compliance, 8712/8714 series' 51 commands are seamlessly compatible with the ENA-L's commands. These commands include most of the basic commands, such as measurement parameter and stimulus setting commands. Further 174 commands are basically re-writable with the ENA-L's corresponding commands. These 225 commands cover most of network analyzer's control. Therefore, users are able to reuse their 8712/8714 series control programs with ENA-L with some modifications. To help modifications, Agilent provides a Program Code Conversion Kit consisting of a command comparison table (Excel file) and tips for code conversion.

The comparison table lists all 8712/8714 series commands with the following code conversion information so users can easily find proper actions:

- Compatibility level (A+ to D coded in various colors for easy reference)
- Corresponding ENA-L commands
- Quick help for conversion

Table 1. Command classification summary

Compatibility Level	Description	Qty.	Typical 8712/8714E series scpi commands
A+	Completely compatible	51	Frequency & power stimulus set, Scale, Marker on/off, Trigger, Average, NOP, Sweep time, etc.
A	1 equivalent command	37	Ref marker, Cal on/off
B	Multiple candidate commands type 1 more than 1 command are necessary	79	Format, Data query, Limit test, Calibration setting, Marker function
C	Multiple candidate commands type 2 some features are not supported	58	Test cal, Marker function, Status byte handling, Format
D	No equivalent commands	202	LAN control, Key control, Plotter control, Absolute measurement, Marker limit, etc.

The comparison table often provides enough information for code conversion for A level commands. However, in the case of the level B and C commands, you might also need to refer to the conversion tips or the analyzer's programmer's guide as suggested in the quick help.

In regards to level D commands, there is no equivalent ENA-L command. Although approximately 55% of these commands are covered by alternative methods such as the front panel menu or the VBA program. Another 25% are miscellaneous features, such as additional display annotation and maintenance commands. The last 20% are features that ENA-L does not have such as absolute power or broadband measurement capability. For these, to avoid unnecessary work, it is recommended to either use an alternative method or do not convert these commands.

The code conversion tips complement the comparison table by providing conversion information and programming examples for typical items that need additional explanation for efficient conversion. The conversion tool includes the following topics:

- Channel and trace settings
- Trigger system structure
- Data collection
- Limit test setting
- Status byte register handling

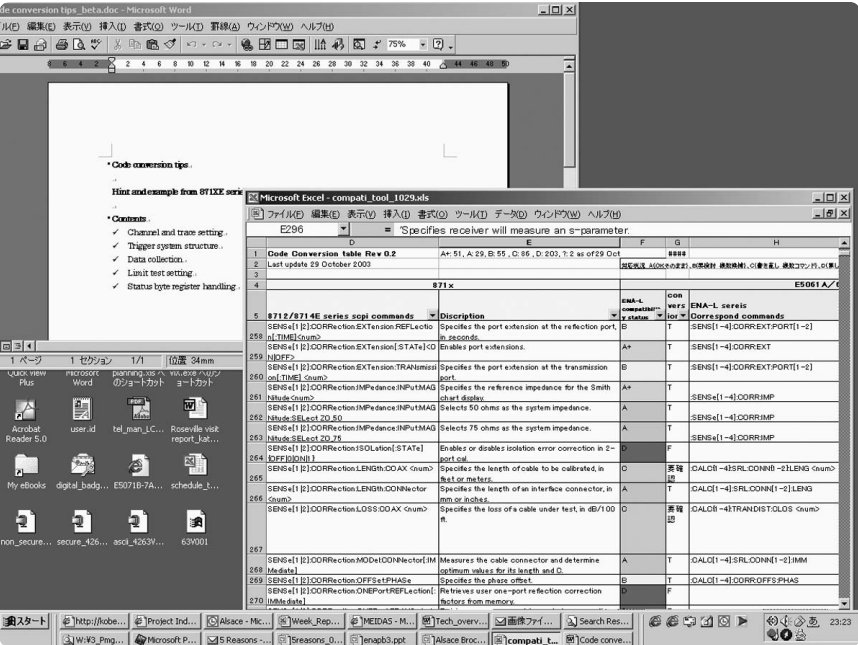**Figure 11. Comparison table and conversion tips**

Take advantage of the ENA-L's performance

The enhanced usability and performance of the ENA-L network analyzer provides our 8712/8714 users with even greater value than ever before. Take advantage of Agilent's migration tools, to help you improve your overall efficiency and cost of test by upgrading to the most advanced RF general-purpose network analyzer.

Appendix 1. Product comparison chart

		E5061A	E5062A	8712 ET		8712ES		8714ET		8714ES	
	System impedance	50/75 ohm	50/75 ohm	50 ohm	75 ohm	50 ohm	75 ohm	50 ohm	75 ohm	50 ohm	75 ohm
✓	**Frequency range**	300 kHz to 1.5 GHz	300 kHz to 3 GHz	300 kHz to 1.3 GHz				300 kHz to 3 GHz			
	Maximum power > 1 GHz (without attenuator option)	10 dBm		12 dBm (13 dBm)	9 dBm (10 dBm)	10 dBm	7 dBm	9 dBm (10 dBm)	6 dBm (7 dBm)	7 dBm	4 dBm
	Minimum power (without attenuator option)	−45 dBm (−5 dBm)		−60 dBm (−0 dBm)	−60 dBm (−3 dBm)	−60 dBm	−60 dBm	−60 dBm (−5 dBm)	−60 dBm (−8 dBm)	−60 dBm	−60 dBm
✓	**System dynamic range (without attenuator option)**	115 dB (300 kHz to 1 MHz), 120 dB (1 MHz to 3 GHz)		115 dB	110 dB	104 dB	99 dB	112 dB (114 dB)	107 dB (110 dB)	101 dB	96 dB
✓	**Sweep type**	Liner, Power, Log, Segment		Liner, Power							
✓	**Speed[1]**	35 ms		240 ms							
✓	**Trace noise**	0.005 dB rms @ 3 kHz IFBW		0.06 dB p-p @ 4 kHz IFBW (typical)							
	Synthesized source	Yes (1Hz res.)		Yes (1Hz res.)							
	Fault location	Yes (Option 100)		Yes (Option 100)							
	SRL	Yes (Option 100)		Yes (Option 100)							
	85075C (Multi-port test set support)	Yes		Yes							
○	**Broadband receiver**	No		Yes							
○	**Absolute power measurement**	No		Yes							
✓	**No. of channels**	4		2							
✓	**No. of traces per channel**	4		1							
✓	**Display**	10.4 inch color LCD		9 inch black and white monitor							
✓	**Touch screen operational**	Yes (Option 016)		No							
✓	**Marker**	Yes (max 10)		Yes (max 8)							
✓	**ECal support**	Yes		No							
	External VGA color monitor	Yes		Yes							
	Limit test	Yes		Yes							
	Marker - gain slope and flatness	Yes		Yes							
	Instrument state save/recall	Yes		Yes							
	Test set/self calibration for 87075C	Yes		Yes							
○	**Code compatibility for 871x**	No (Command comparison table for the 871xE series is available)		Yes							
○	**Barcode-reading support**	No		Yes							
○	**Point trigger**	No		Yes							
○	**Marker limit test**	No		Yes							
○	**Keystroke recorder for IBASIC**	No		Yes							
✓	**HDD**	Yes (10 GB)		No							
✓	**LAN**	Yes (100 base)		Yes (10 base)							
✓	**Handler I/O**	Yes		No							
	FDD	Yes		Yes							
○	**Probe power**	No		Yes							
○	**Transport case (Opt 101)**	No		Yes							
○	**USER TTL**	No (Handler I/O can be used)		Yes							
○	**AUX IN**	No		Yes							
○	**Serial I/O**	No		Yes							

Fundamental measurement performance (left vertical label), *Usability* (left vertical label), *Peripheral/Equipment* (left vertical label)

✓   **Features enhanced in ENA-L**

○   **Features not supported in ENA-L**

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[1] 201 points, full 2-port cal., 90 dB dynamic range.

Appendix 2.
Order configuration chart: 8712/8714E series vs. ENA-L

Instrument and test set options

	Test set	Model number	System impedance	ENA-L Solution
8712 series 300 kHz to 1.3 GHz	Transmission reflection test set (T/R test set)	8712ET	50 ohm	E5061A-150
			75 ohm (Option 1EC)	E5061A-175
	S-parameter test set	8712ES	50 ohm	E5061A-250
			75 ohm (Option 1EC)	E5061A-275
8714 series 300 kHz to 3 GHz	Transmission Reflection test set (T/R test set)	8714ET	50 ohm	E5062A-150
			75 ohm (Option 1EC)	E5062A-175
	S-parameter test set	8714ES	50 ohm	E5062A-250
			75 ohm (Option 1EC)	E5062A-275

Additional feature options

8712/8714 series options	Descriptions	ENA-L Options	Descriptions
871xET-1E1	Add step attenuator for extended power range	E506xA-1E1[1]	Extended power range
871xxx-100	Add Fault location / SRL	E506xA-100	Add Fault location analysis
871xxx-101	Add Fault location/SRL plus transport case	N/A	N/A
N/A	–	E506xA-016	Touch screen color LCD

871xxx=8712ET/8712ES/8714ET/8714ES
E506xA=E5061A/E5062A

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[1] Extended power range is standard for E506xA-2xx S-parameter test set.

Web Resources

For additional ENA-L product information
and literature visit our Web site:

www.agilent.com/find/ena

For additional electronic calibration (ECal)
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