Keysight Technologies
Migration from 8712/8714 Series to ENA 6 Series Network Analyzers

Technical Overview

KEYSIGHT 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...

Keysight Technologies Inc. is proud to introduce the ENA 6 series network analyzers, E5061B to our 8712/8714 series customers. Based on the latest in modern technology, the E5061B 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 E5061B and 8712/8714 series followed by a discussion on utilizing your existing software.

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Product Feature Comparison

The E5061B supports most of 8712/8714 series product features with added enhancements as shown in the summary chart below.

E5061B 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.

Product Comparison Chart

Item	E5061B-1xx/2xx RF NA Options	8712/8714
Test frequency	100 kHz to 1.5/3 GHz	300k to 1.3 GHz/3 GHz
Built-in test port	2 port T/R & S-para	2 port T/R & S-para
Dynamic range	> 120 dB (1 MHz to 3 GHz)	104 dB (T/R), 101 dB (S-para)
Trace noise	0.005 dBrms (3 kHz IF)	0.01 dBrms (250 Hz IF)
Max power source	+10 dBm (300 kHz to 3 GHz) +5 dBm (100 kHz to 3000 kHz)	9 dBm
IFBW	1 Hz to 300 kHz	15 Hz to 6.5 kHz
75 Ω test port Option	Yes	Yes
Built-in bias tee	No	No
Configuration test set	No	No
Measurement choice (Narrowband)	S11 to S22, absolute	S11 to S22, absolute
Sweep type	Liner/log/segment/power	Liner/power
Broadband detector	No	Yes
Frequency offset mode	No	No
Time domain analysis with gating	Yes (Optional)	No
Fault location analysis	Yes (Optional)	Yes (Optional)
Structural return loss (SRL)	Yes (Optional)	Yes (Optional)
Built-in programming	VBA	IBASIC
Ecal support	Yes (2/4 port, 75 Ω)	No
TRL/LRM Calibration	No	No
Power meter calibration	No	No
Adapter removal/characterization	Yes/No	No/No
Number of channel/trace	4-Apr	1/2, 2/1
Conversion	Z-reflect, Z-trans, Z-trans-shunt, Y-reflect, Y-trans, Y-trans-shunt, 1/S	Impedance magnitude
Balanced measurement	No	No
Embed./De-embedding	No	No
Port-Z conversion	No	No
LAN interface	Yes	Yes
Multi-port test set	No	87050E/85075C (2 to 12 pt)
Calibration, auto port extension	Yes	No
Equation editor	Yes	No
Frequency & test set upgradability	Yes	No
Touchscreen	Yes	No
Adapter removal/characterization or adapter removal/insertion	Yes	No

Measurement Performance Comparison

Wider dynamic range expands your measurement possibilities

E5061B 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 E5061B 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.

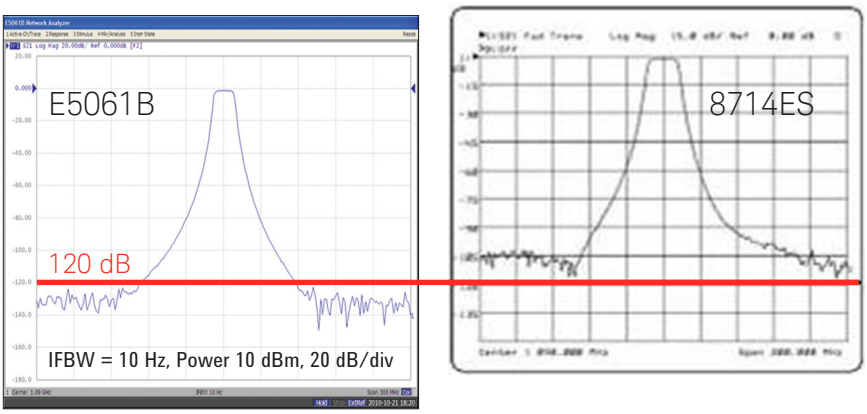


Figure 1. Dynamic range comparison

Lower trace noise increases measurement reliability

With enhanced synthesized source purity, the E5061B 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 E5061B. This trace noise enhancement allows you more stable measurements for increased reliability and product quality.

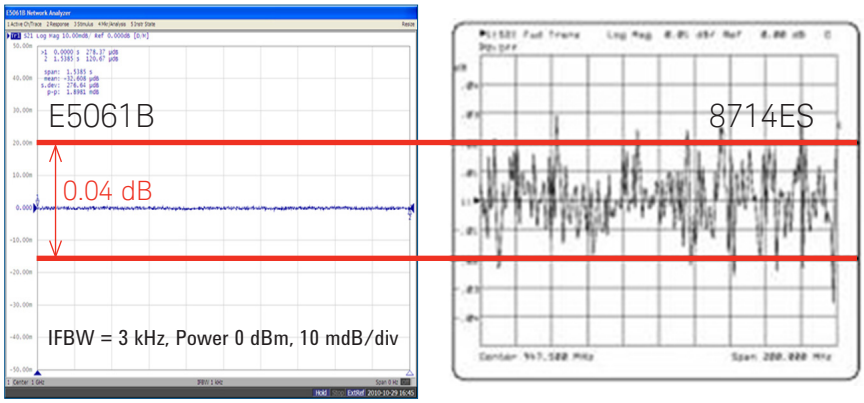


Figure 2. Trace noise comparison at 90 dB dynamic range

Faster sweep speed decreases your cost of test

Due to a powerful digital processing and enhanced circuit's performance, E5061B 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., Max IFBW), E5061B is approximately 8 times faster than 8712/14. For automated production lines the additional speed increases through-put and cuts down measurement cost per component.

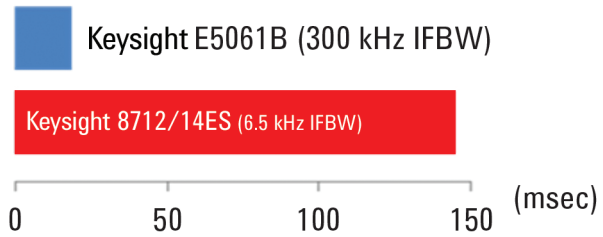
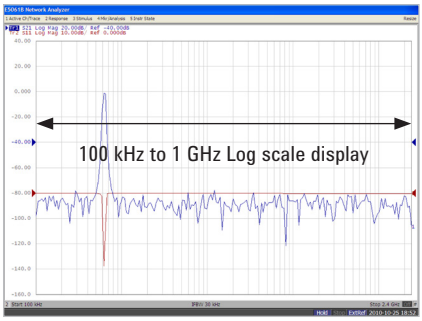


Figure 3. Sweep speed comparison

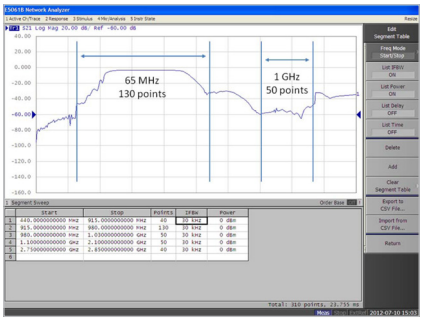
Log and segment sweeps provide measurement convenience

In addition to linear frequency and power sweep types (which are available in the 8712/8714), the E5061B 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.



Log sweep effectively shows characteristics



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, E5061B's 10.4-inch large color LCD display enables you to easily analyze a lot more information at once. The E5061B 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.

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, E5061B provides an easier and efficient method to evaluate devices.

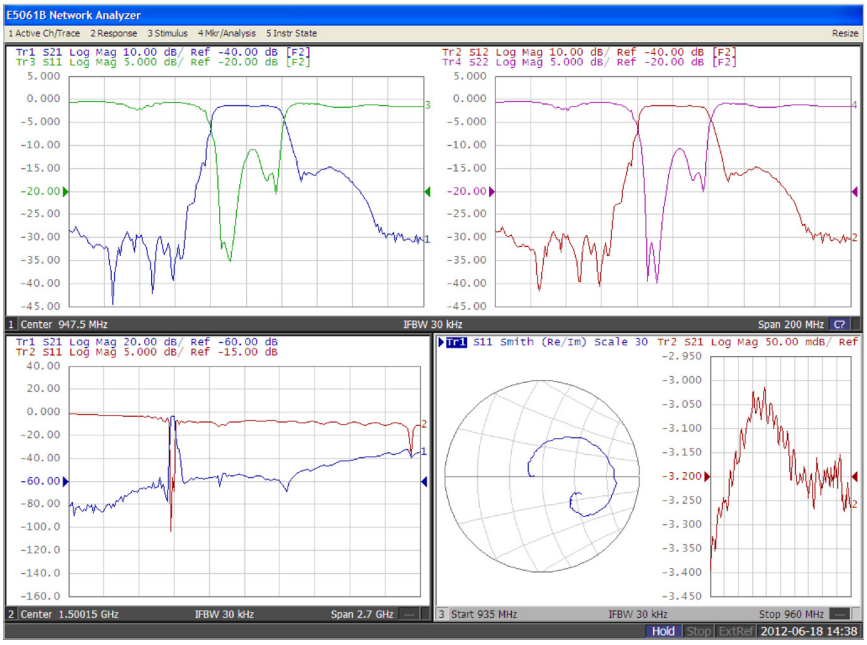


Figure 5. E5061B displaying 3 channel (setting) and 8 traces mode

Touch screen offers intuitive operation

The E5061B supports touch screen capability to helps users to control analyzers intuitively and easily.

Electronic Calibration (ECal) support reduces calibration time and operation errors

The E5061B 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 6. ECal module

Context sensitive Help useful for operation

The E5061B implements context sensitive Help in order for user can understand the function and operation easily. By click the softkey and press the Help button, the guideline of the softkey is display. Furthermore, context sensitivity help also allows user find SCPI command straightforwardly. The example of context sensitive help is shown as figure 7.

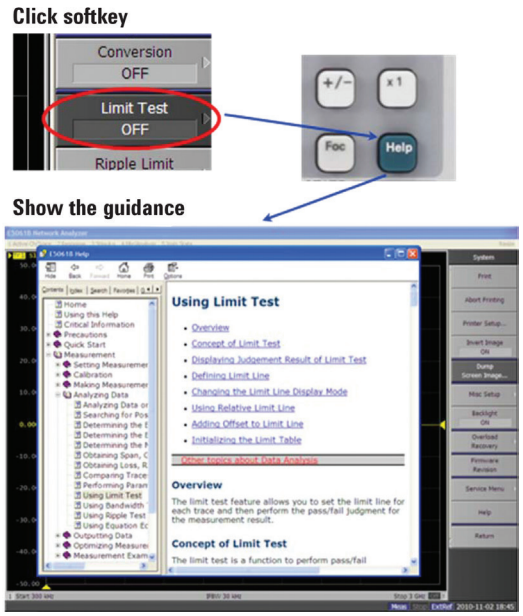


Figure 7. Example of context sensitive Help

Powerful Analysis Functions Improve Productivity

Equation editor

Equation Editor allows user to enter an algebraic equation of standard mathematical operators and functions, referencing data that is available in the E5061B. Once a valid equation is entered and enabled, the display of the active trace is replaced with the results of the equation, and updated in real-time as new data is acquired. For equations that can be expressed with Equation Editor's supported functions, operators, and data, there is no need for off-line processing in a separate program.

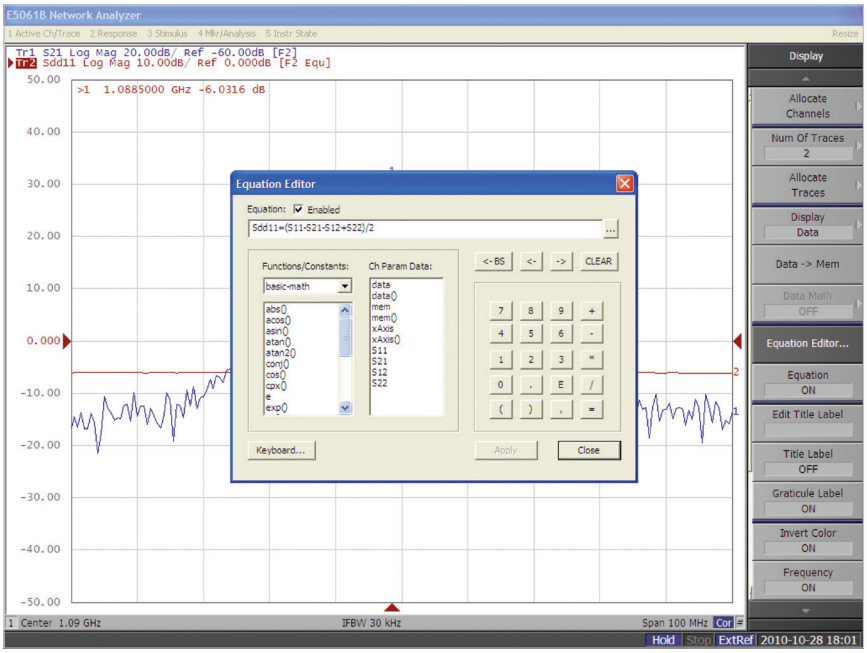


Figure 8. Equation editor of the E5061B

Limit Test

The limit test feature allows user to set the limit line for each trace and then perform the pass/fail judgment for measurement result. In the limit test, if the upper limit or lower limit indicated by limit line is not exceed, the judgment result is pass; if it is exceeds the judgment result is fail for all measurement points on the trace. Measurement points in a stimulus range with no limit are judged as pass.

User define the limit line by specifying the stimulus value (begin stimulus) and response value (begin response) of the beginning point, the stimulus value (End stimulus) and response value (End Response) of the end point, and type (lower limit/upper limit).

When the limit test is ON, the fail measurement pointes are displayed in red on the screen and the trace's pass/fail judgment result based on the results of individual measurement points is also displayed.

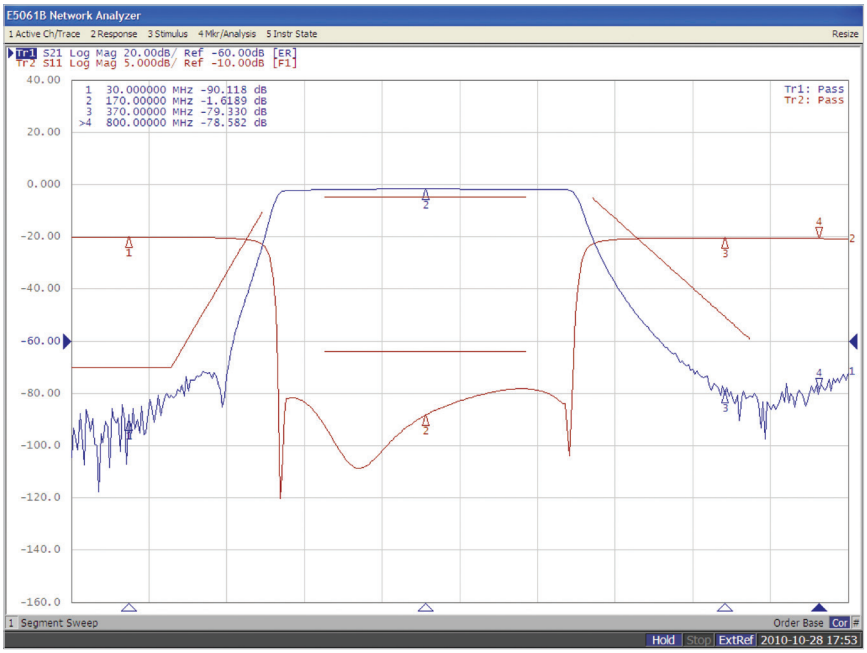


Figure 9. Example limit test of the E5061B

(Optional) Time domain analysis with time gating and structural return loss (SRL) analysis

The time gating function is available in the time domain/fault-location analysis function. This enables you to eliminate mismatch errors caused by test fixtures when testing CATV cables.

The SRL feature is designed to measure cable impedance and structural return loss. Cable impedance is the ratio of voltage to current of a signal traveling in one direction down the cable, Structural return loss is the ratio of incident signal to reflected signal in a cable, referenced to the cable's impedance.

Figure 10. structural return loss (SRL) measurement

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

E5061B 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 E5061B's VBA editor provides powerful and useful debug and edit functions. For example, as shown in Figure 11, 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.

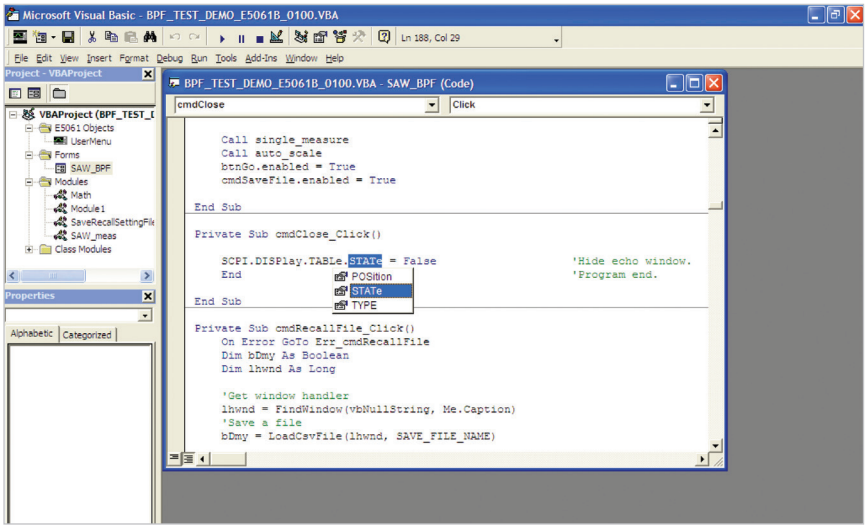


Figure 11. Powerful VBA editor example

VBA is also very useful for creating interactive test programs with a graphical user interface (GUI). As shown in Figure 12, users can create a GUI tailored to meet your specific measurement needs, which facilitates analyzer operation and reduces operator errors.

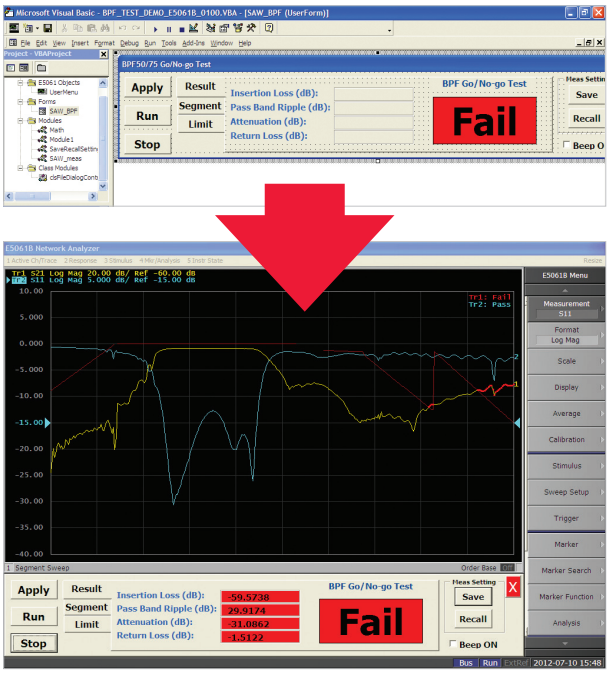


Figure 12. Custom graphical user interface created using VBA program

8712/8714 Series' Measurement Capability Not Included In E5061B

The following features are not supported in the E5061B:

- Broadband receiver capability
- 87075C/87050E Multiport test set

Utilizing Existing Software

Control program code utilization - (Program Code Conversion Kit)

Because of the same SCPI compliance, 8712/8714 series' 51 commands are seamlessly compatible with the E5061B's commands. These commands include most of the basic commands, such as measurement parameter and stimulus setting commands. Further 167 commands are basically re-writable with the E5061B's corresponding commands. These 218 commands cover most of network analyzer's control. Therefore, users are able to reuse their 8712/8714 series control programs with E5061B with some modifications. To help modifications, Keysight 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 E5061B commands
- Quick help for conversion

Table 1. Command classification summary

Compatibility Level	Descriptions	Quantity	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	32	Ref marker, Cal on/off
B	Multiple candidate commands type 1 more than 1 command are necessary	77	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	209	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 E5061B 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 E5061B does not have such as multiport 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

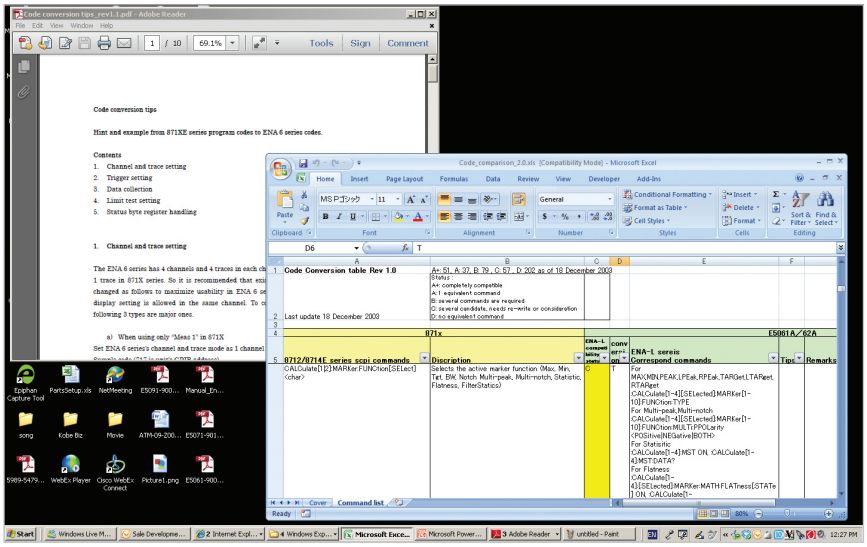


Figure 13. Comparison table and conversion tips

Take Advantage Of The E5061B's Performance

The enhanced usability and performance of the E5061B network analyzer provides our 8712/8714 users with even greater value than ever before. Take advantage of Keysight'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.
Order Configuration Chart: 8712/8714E Series vs. E5061B

Instrument and test set options

	Test set	Model number	System impedance	E5061B Solution
8712 series 300 kHz to 1.3 GHz	Transmission reflection test set (T/R test set)	8712ET	50 Ω	E5061B-115
			75 Ω (Option 1EC)	E5061B-117
	S-parameter test set	8712ES	50 Ω	E5061B-115
			75 Ω (Option 1EC)	E5061B-117
8714 series 300 kHz to 3 GHz	Transmission reflection test set (T/R test set)	8714ET	50 Ω	E5061B-135
			75 Ω (Option 1EC)	E5061B-137
	S-parameter test set	8714ES	50 Ω	E5061B-235
			75 Ω (Option 1EC)	E5061B-237

Additional feature options

8712/8714 series options	Descriptions	E5061B Options	Descriptions
871xET-1E1	Add step attenuator for extended power range	N/A	N/A
871xxx-100	Add Fault location/SRL	E5061B-100	Add Fault location analysis
871xxx-101	Add Fault location/SRL plus transport case	N/A	N/A

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