

Keysight N8828A

40GBASE-CR4 and 100GBASE-CR10
Electrical Performance Validation and
Conformance Software

For Infiniium Oscilloscopes

Data Sheet

Introduction

Features

The N8828A 40GBASE-CR4 and 100GBASE-CR10 Ethernet electrical test software offers several features to simplify the validation of Ethernet designs:

- Setup wizard for quick and clear setup, configuration and test
- Wide range of 40GBASE-CR4 and 100GBASE-CR10 Ethernet electrical tests enabling standards conformance
- Accurate and repeatable results with Keysight Technologies Infiniium oscilloscopes
- Automated reporting in a comprehensive HTML format with margin analysis

With the 40GBASE-CR4 and 100GBASE CR10 Ethernet electrical test software, you can use the same oscilloscope you use for everyday debugging to perform automated testing and margin analysis based on the IEEE802.3 standard.



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Easy and Accurate 40GBASE-CR4 and 100GBASE-CR10 Ethernet Transmitter Design Validation and Debug

The Keysight Technologies, Inc. N8828A 40GBASE-CR4 and 100GBASE-CR10 Ethernet electrical performance validation and conformance software for Infiniium oscilloscopes provides you with an easy and accurate way to verify and debug your 40GBASE-CR4 and 100GBASE-CR10 Ethernet designs.

The Ethernet electrical test software allows you to automatically execute Ethernet physical-layer (PHY) electrical tests, and displays the results in a flexible report format. In addition to the measurement data, the report provides a margin analysis that shows how closely your device passed or failed each test.

The N8828A 40GBASE-CR4 and 100GBASE-CR10 Ethernet Compliance software performs a wide range of electrical tests required to meet the IEEE 802.3 Clause 85 Ethernet electrical specifications. To meet signal quality requirements, your product must successfully pass conformance testing based on these specifications. Performing these tests gives you confidence in your design. The N8828A 40GBASE-CR4 and 100GBASE-CR10 Ethernet compliance software helps you execute a wide subset of the conformance tests that can be measured with an oscilloscope.



N8828A 40GBASE-CR4 and 100GBASE-CR10 Compliance Application Software Saves You Time

The 40GBASE-CR4 and 100GBASE-CR10 Ethernet electrical test software saves you time by setting the stage for automatic execution of 40GBASE-CR4 and 100GBASE-CR10 electrical tests. Part of the difficulty of performing electrical tests for Ethernet transmitters is properly connecting to the oscilloscope, loading the proper setup files, and then analyzing the measured results by comparing them to limits published in the specification. The Ethernet electrical test software does much of this work for you. The 40GBASE-CR4 and 100GBASE-CR10 Ethernet electrical test software automatically configures the oscilloscope for each test, and it provides an informative results report that includes margin analysis indicating how close your product is to passing or failing that specification.

See Table 2 for a complete list of the measurements made by the 40GBASE-CR4 and 100GBASE-CR10 Ethernet electrical test software.

Easy test definition

The 40GBASE-CR4 and 100GBASE-CR10 Ethernet electrical test software extends the ease-of-use advantages of Keysight's Infiniium oscilloscopes to testing 40GBASE-CR4 and 100GBASE CR10 designs. The Keysight automated test engine walks you quickly through the steps required to define the tests you want to make, set up the tests, perform the tests, and view the test results. A setup page enables you to quickly make decisions from the outset regarding the choice of tests and perform functions that affect the testing task. The test selections available in the following steps are then filtered according to the choices made in the setup page. While selecting tests, you can select a category of tests all at once, or specify individual tests. You can save tests and configurations as project files and recall them later for quick testing and review of previous test results. Straightforward menus let you perform tests with a minimum of mouse clicks.

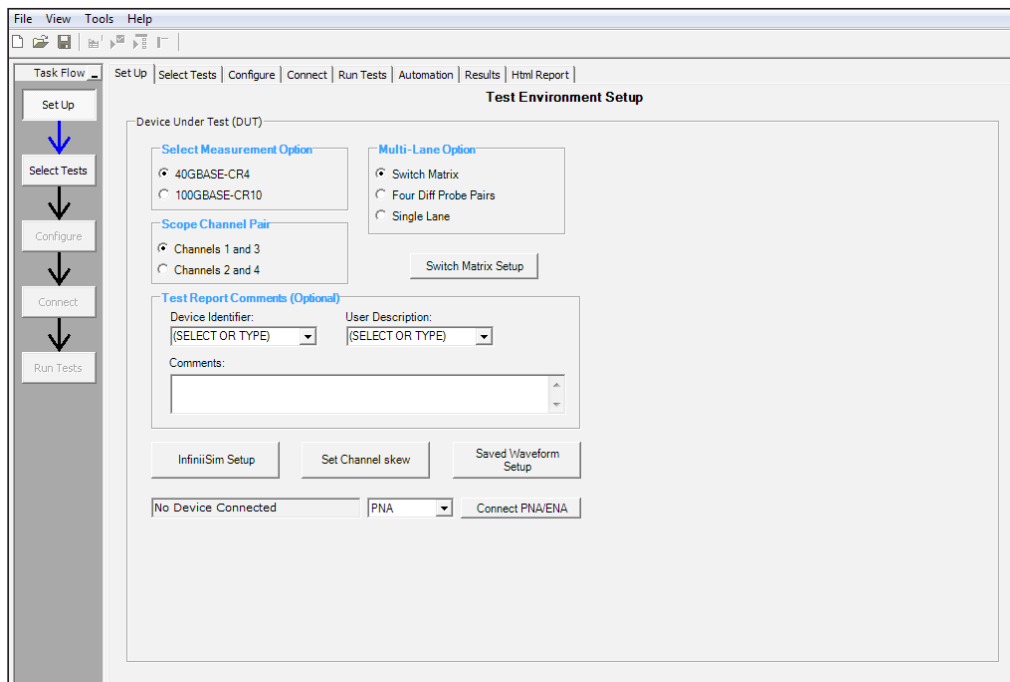


Figure 1. The clean interface allows you select 40GBASE-CR4 or 100GBASE-CR10 test categories and test limits found in the IEEE 802.3 specification. Multiple lanes can be tested using the optional switch matrix solution.



View all of the 40GBASE-CR4 and 100GBASE-CR10 Ethernet electrical tests in the GUI under selected tests

- Setup wizard for quick and clear setup, configuration, and test
- See clearly all the 40GBASE-CR4 and 100GBASE-CR10 Ethernet electrical tests
- Run single or multiple tests based on your needs
- When a test is highlighted, it will show the description of the test along with pass limits
- Accurate and repeatable results with Keysight Infiniium oscilloscopes
- Automated reporting in a comprehensive HTML format with margin analysis

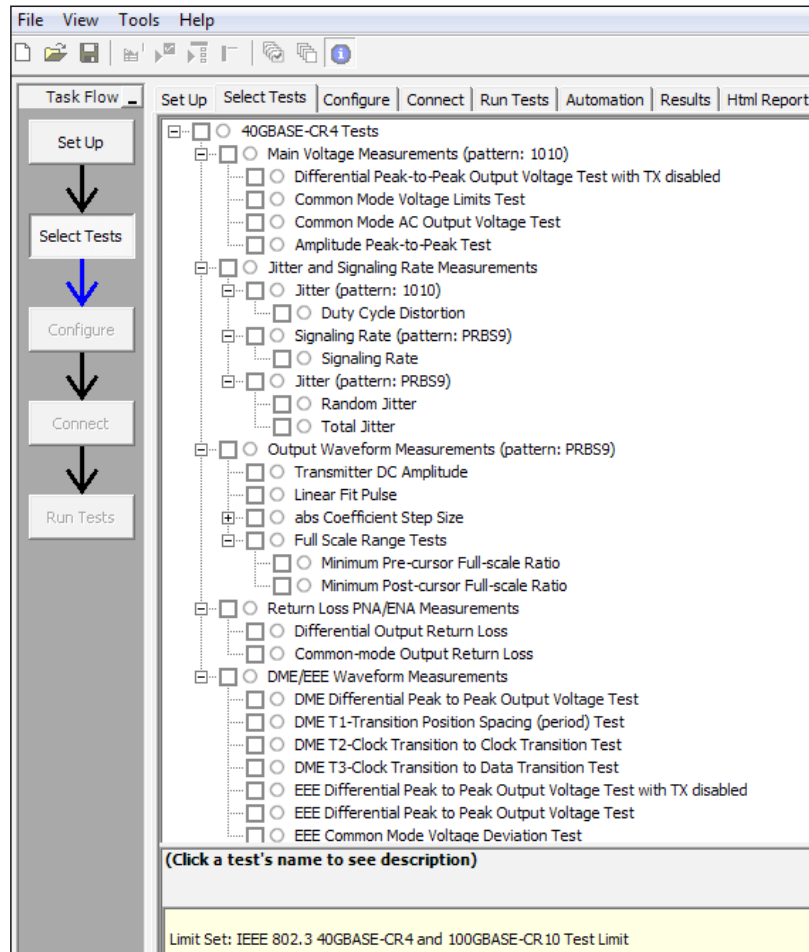


Figure 2. The Keysight automated test engine quickly guides you through selecting and configuring tests, setting up the connection, running the tests, and viewing the results. You can easily select individual tests or groups of tests with a mouse-click.



Configurability and Guided Connections

The N8828A 40GBASE-CR4 and 100GBASE-CR10 Ethernet electrical test software provides flexibility in your test setup. It guides you to make connection changes with hookup diagrams when the tests you select require it. You connect the oscilloscope to the device under test using Wilder test fixture www.wilder-tech.com. SMA cables may be required to attach the Wilder test fixtures to the Keysight Infiniium oscilloscope. See ordering information for more details.

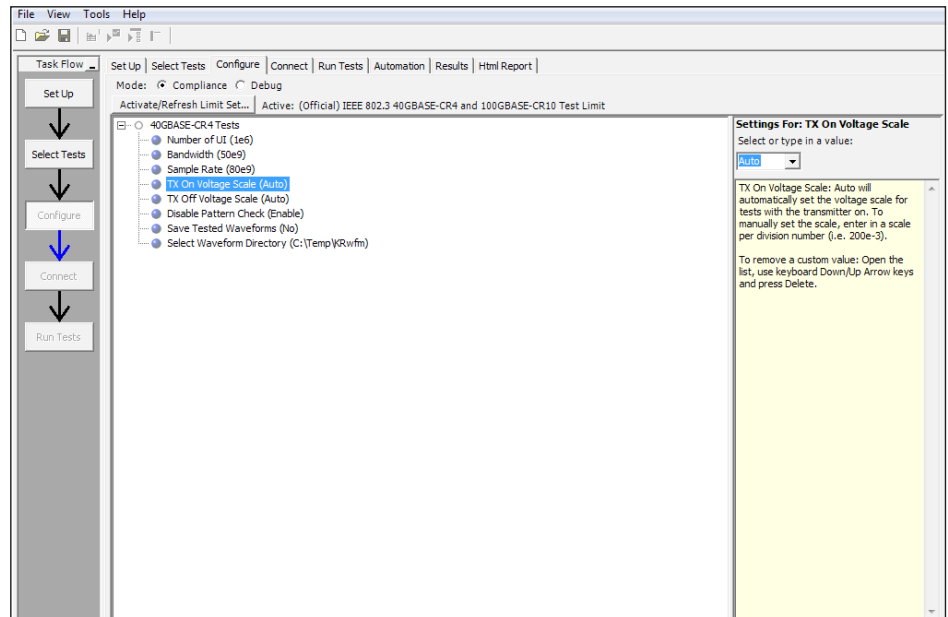


Figure 3. To set up tests, you define the device to test, its configuration, and how the oscilloscope is connected to it.

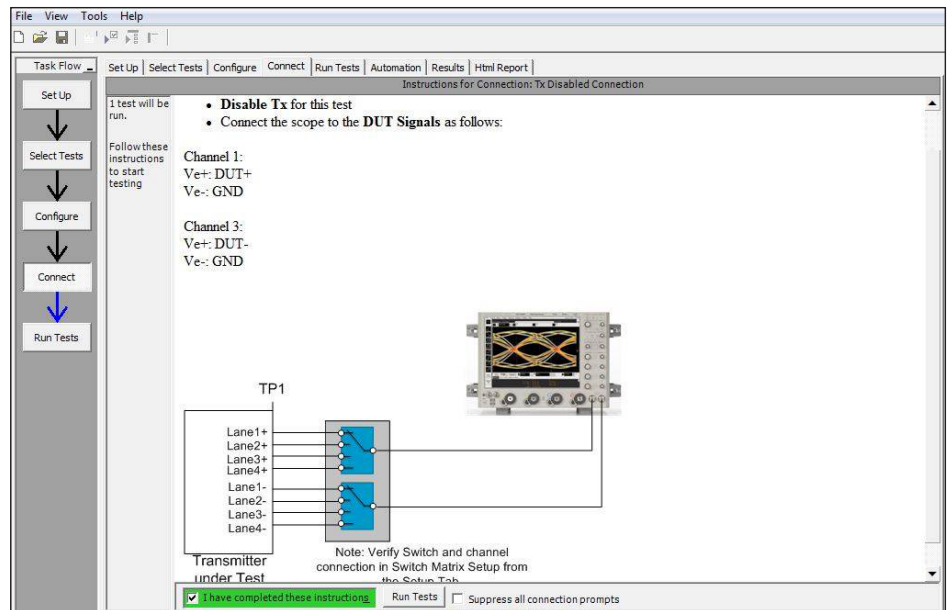


Figure 4. When you make multiple tests where the connections must be changed, the software prompts you with connection diagrams. Using the optional switch matrix hardware as shown in the diagram above can save time and completely eliminates cable reconnections.



Configurability and Guided Connections (Continued)

In addition to providing you with measurement results, the 40GBASE-CR4 and 100GBASE-CR10 Ethernet electrical test software provides a report format that shows you not only where your product passes or fails, but also reports how close you are to the limits specified for a particular test. You can select the margin test report parameter, which means you can specify the level at which warnings are issued to alert you to electrical tests where your product is operating close to the official test limit defined by the 40GBASE CR4 and 100GBASE-CR10 specification.

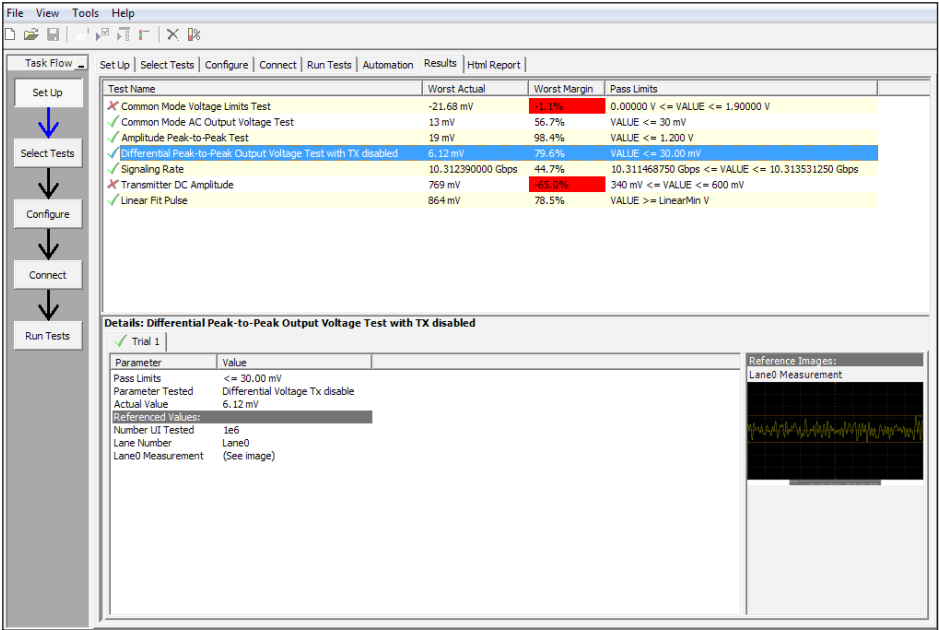


Figure 5. The 40GBASE-CR4 and 100GBASE-CR10 Ethernet electrical test software results screen shows a summary of the tests performed, pass/fail status, and margin. Clicking on a specific test also shows the test specification and a measurement waveform, if appropriate.

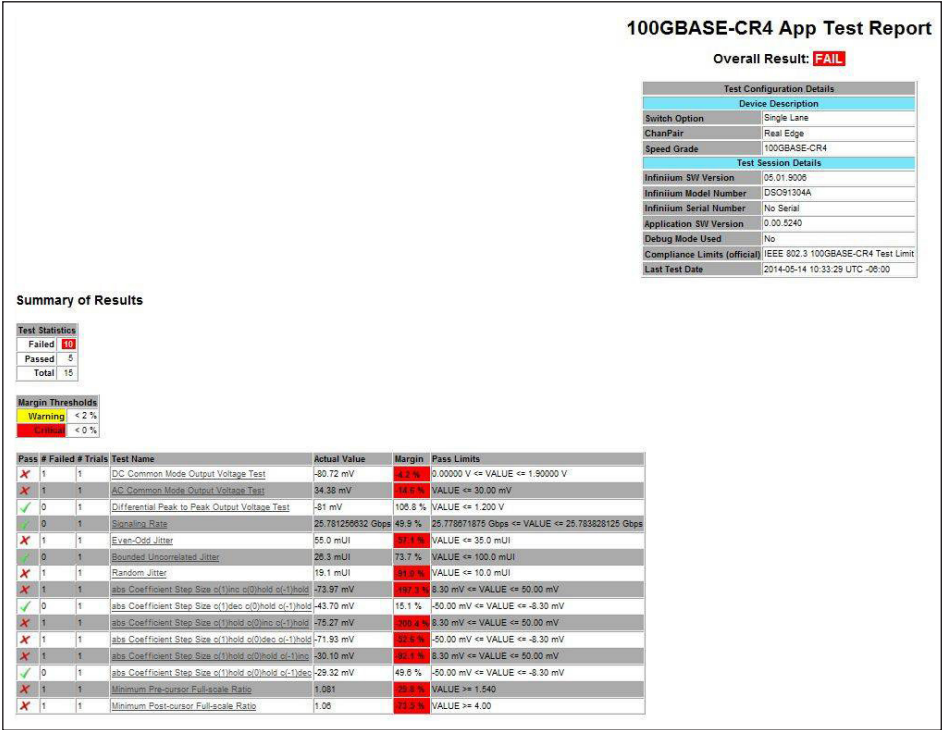


Figure 6. The 40GBASE-CR4 and 100GBASE-CR10 Ethernet electrical test software HTML report documents your test, indicates the pass/fail status, the test specification range, the measured values, and the margin.



Configurability and Guided Connections (Continued)

Reports with margin analysis

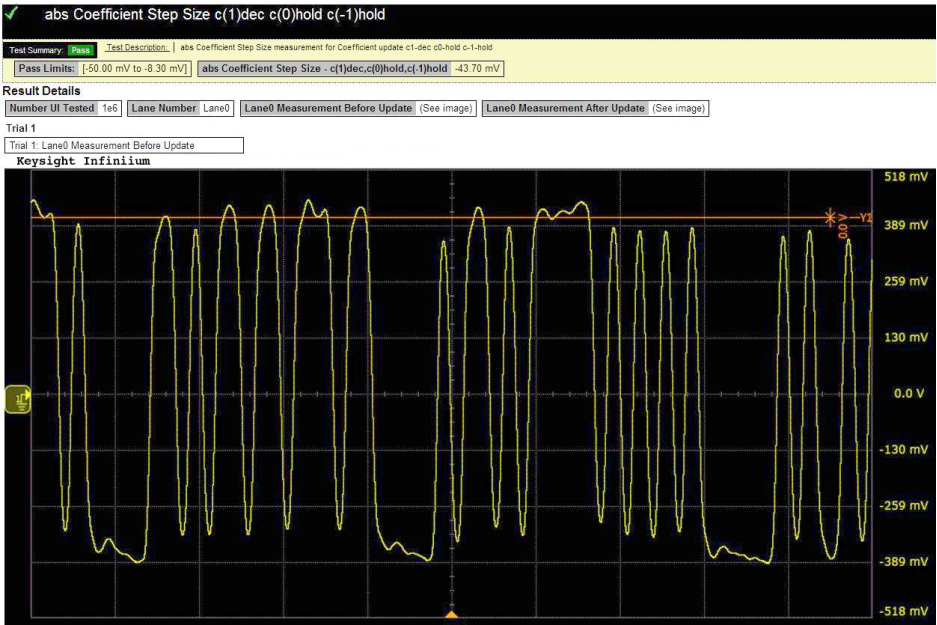


Figure 7. Additional details are available for each test, including the test limits, test description, and test results, including waveforms, if appropriate.

Summary of Results

Test Statistics	
Failed	10
Passed	5
Total	15

Margin Thresholds	
Warning	< 2 %
Critical	< 0 %

Pass #	Failed #	Trials	Test Name	Actual Value	Margin	Pass Limits
✗	1	1	DC Common Mode Output Voltage Test	-80.72 mV	4.2 %	0.00000 V <= VALUE <= 1.90000 V
✗	1	1	AC Common Mode Output Voltage Test	34.38 mV	14.6 %	VALUE <= 30.00 mV
✓	0	1	Differential Peak to Peak Output Voltage Test	-81 mV	106.8 %	VALUE <= 1.200 V
✓	0	1	Signaling Rate	25.781258632 Gbps	49.9 %	25.778671875 Gbps <= VALUE <= 25.783828125 Gbps
✗	1	1	Even-Odd Jitter	55.0 mUI	37.1 %	VALUE <= 35.0 mUI
✓	0	1	Bounded Uncorrelated Jitter	28.3 mUI	73.7 %	VALUE <= 100.0 mUI
✗	1	1	Random Jitter	19.1 mUI	31.0 %	VALUE <= 10.0 mUI
✗	1	1	abs Coefficient Step Size c(1)inc c(0)hold c(-1)hold	-73.97 mV	197.3 %	8.30 mV <= VALUE <= 50.00 mV
✓	0	1	abs Coefficient Step Size c(1)dec c(0)hold c(-1)hold	-43.70 mV	15.1 %	-50.00 mV <= VALUE <= -8.30 mV
✗	1	1	abs Coefficient Step Size c(1)hold c(0)inc c(-1)hold	-75.27 mV	200.4 %	8.30 mV <= VALUE <= 50.00 mV
✗	1	1	abs Coefficient Step Size c(1)hold c(0)dec c(-1)hold	-71.93 mV	32.6 %	-50.00 mV <= VALUE <= -8.30 mV
✗	1	1	abs Coefficient Step Size c(1)hold c(0)hold c(-1)inc	-30.10 mV	32.1 %	8.30 mV <= VALUE <= 50.00 mV
✓	0	1	abs Coefficient Step Size c(1)hold c(0)hold c(-1)dec	-29.32 mV	49.6 %	-50.00 mV <= VALUE <= -8.30 mV
✗	1	1	Minimum Pre-cursor Full-scale Ratio	1.081	25.8 %	VALUE >= 1.540
✗	1	1	Minimum Post-cursor Full-scale Ratio	1.06	73.5 %	VALUE >= 4.00

Figure 8. How close your device comes to passing or failing a test is indicated as a percentage in the margin field. A result highlighted in yellow or red indicates that your device has tripped the margin threshold level for a warning or failure.



Switch Matrix – Support for Multi-Lane Channels

The Keysight switch matrix software option for the compliance application, used together with switch matrix hardware, enables fully automated testing for multi-lane digital bus interfaces. The benefits of this automated switching solution include:

- Eliminate reconnections, which saves time and reduces errors through automating test setup for each lane of a multi-lane bus.
- Maintain accuracy with the use of unique N2809A PrecisionProbe or N5465A InfiniiSim features to compensate for switch path losses and skew.
- Customize testing by using remote programming interface and the N5467A user-defined application tool for device control, instrument control and test customization.

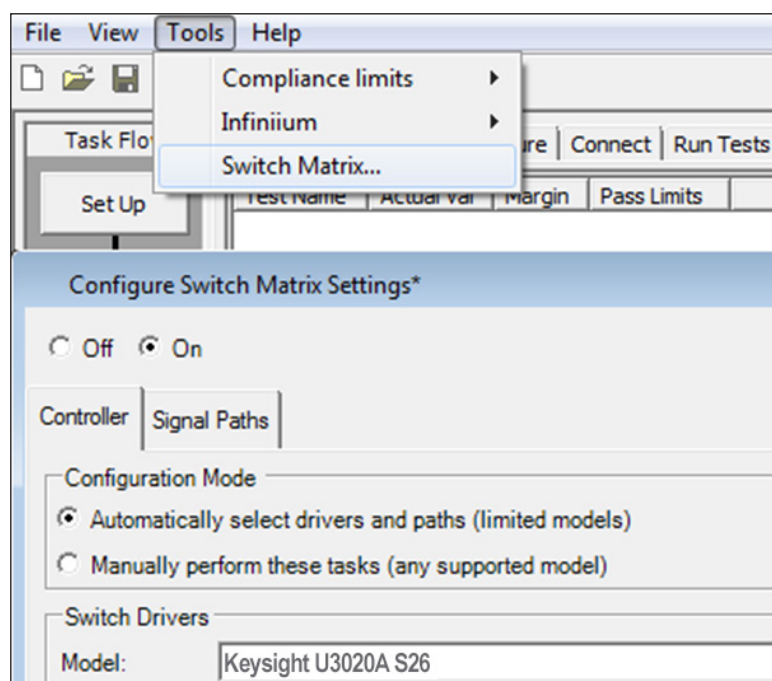


Figure 9. Switch matrix software feature enabled in the compliance application.

Switched matrix hardware

Keysight U3020A S26 or BitIfEye BIT2100.

More information of the switching solution and configuration, visit www.keysight.com/find/switching and the Keysight application note with the publication number 5991-2375EN.



Figure 10. Automated testing for multi-lane digital bus interface through switching solution switch matrix.



N8828A 40GBASE-CR4 and 100GBASE-CR10 Ethernet Compliance Test

Specification IEEE 802.3 40GBASE-CR4 and 100G-BASE-CR10

Clause 85

- Differential Peak-to-Peak Output Voltage Test with TX disabled
- Common Mode Voltage Limits Test
- Common Mode AC Output Voltage Test
- Amplitude Peak-to-Peak Test
- Duty Cycle Distortion
- Signaling Rate
- Random Jitter (RJ)
- Total Jitter (TJ)
- Transmitter DC Amplitude
- Linear Fit Pulse
- Abs Coefficient Step Size c(1)inc c(0)Hold c(-1)Hold
- Abs Coefficient Step Size c(1)dec c(0)Hold c(-1)Hold
- Abs Coefficient Step Size c(1)Hold c(0) inc c(-1)Hold
- Abs Coefficient Step Size c(1)Hold c(0) dec c(-1)Hold
- Abs Coefficient Step Size c(1) Hold c(0)Hold c(-1) inc
- Abs Coefficient Step Size c(1)Hold c(0)Hold c(-1) dec
- Minimum Pre-Cursor Full-Scale Ratio
- Minimum Post-Cursor Full-Scale Ratio
- Differential Output Return Loss
- Common-mode Output Return Loss
- DME Differential Peak to Peak Output Voltage Test
- DME T1-Transitions Position Spacing (period) Test
- DME T2-Clock Transition to Clock Transition Test
- DME T3-Clock Transition to Data Transition Test
- EEE Differential Peak to Peak Output Voltage Test with TX disabled
- EEE Differential Peak to Peak Output Voltage Test
- EEE Common Mode Voltage Deviation Test

Measurement Requirements

To use the N8828A Ethernet electrical performance validation and conformance software on your Infiniium oscilloscope, you will need oscilloscope probes and probe heads, and other test accessories depending on the Ethernet standard and test suites you want to perform.



Ordering Information

Recommended oscilloscopes

The 40GBASE-CR4 and 100GBASE-CR10 compliance software is compatible with Keysight Infiniium Series oscilloscopes with operating software revision 4.20 or higher. For oscilloscopes with earlier revisions, free upgrade software is available at: www.keysight.com/find/scope-apps-sw.

Standard	Data rate	Minimum bandwidth	Minimum channels	Compatible oscilloscopes
40BASE-CR4 and 100BASE-CR10	40 Gb/s 100 Gb/s	25 GHz	2	Infiniium 90000 and Z-Series

Recommended probes and fixtures

Model number	Description
QSFP+-TPA-HCB-P	Wilder Technologies QSFP+ Plug Adapter
QSFP+-TPA-MCB-R	Wilder Technologies QSFP+ Receptacle Adapter

Wilder Fixtures are based on either host and/or module testing. They can either be order together or separately depending on customer needs and application. www.wilder-tech.com

Switch matrix

Model number	Description
U3020AS26	Keysight switch matrix
Or BIT-4000-2198-0	BitfEye BIT-2100 switch

Accessories

Model number	Description
1250-1158 (qty. 8)	Adapter, SMA (f) to SMA (f)
N2812A (qty. 10)	High-performance input cable, 2.92 mm connectors, 1 m length
1810-0118 (as needed)	SMA (m) 50 Ω termination

Software options

Application	License type		Infiniium Z-Series	Infiniium 90000 and 90000 Q-Series
40GBASE-CR4 and 100GBASE-CR10	Fixed	Factory-installed	N8828A-1FP	Option 084
		User-installed	N8828A-1FP	N8828A-1NL
	Floating	Transportable	N8828A-1TP	N8828A-1TP ^{1,2}
		Server-based		N5435A-081
Switch matrix option	Fixed	Factory-installed	N8890A-1FP	Option 097
		User-installed	N8890A-1FP	N8890A-1FP
	Floating	Transportable	N8890A-1TP	N8890A-1TP ^{1,2}
		Server-based		N5435A-124

1. Requires software 5.00 and above.

2. Software 4.30 or above requires Windows 7. N2753A Infiniium Windows XP to 7 OS upgrade kit (oscilloscope already has M890 motherboard). N2754A Infiniium Windows XP to 7 OS and M890 motherboard upgrade kit (oscilloscope without M890 motherboard). Verify the M890 motherboard using the procedure found in the Windows 7 upgrade kit data sheet with the publication number 5990-8569EN.



Related Literature

Publication title	Publication number
<i>Infiniium 90000 Series Oscilloscopes - Data Sheet</i>	5989-7819EN
<i>N5435A Infiniium Server-Based License for Infiniium Oscilloscopes - Data Sheet</i>	5989-6937EN
<i>E2688A, N5384A High-Speed Serial Data Analysis and Clock Recovery Software - Data Sheet</i>	5989-0108EN
<i>Infiniium 9000 Series Oscilloscopes - Data Sheet</i>	5990-3746EN
<i>Infiniium 90000 X-Series Oscilloscopes - Data Sheet</i>	5990-5271EN



www.axiestandard.org

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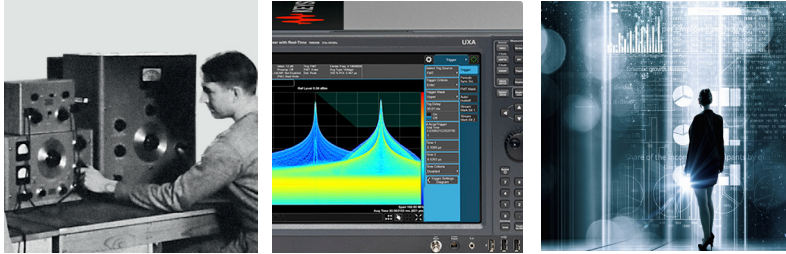
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Published in USA, December 1, 2017
5991-4910EN
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