Keysight Technologies
N8829A 100GBASE-KR4 Electrical Performance Validation and Conformance Software

For Infiniium Oscilloscopes

Data Sheet

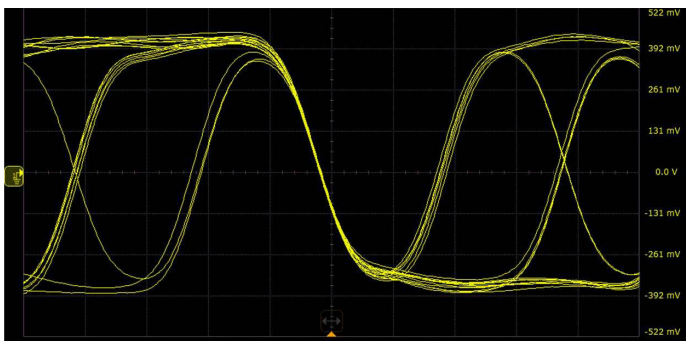
KEYSIGHT TECHNOLOGIES

Features

The N8829A 100GBASE-KR4 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 100GBASE-KR4 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 100GBASE-KR4 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 IEEE P802.3bj standard.



Easy and Accurate 100GBASE-KR4 Ethernet Transmitter Design Validation and Debug

The Keysight Technologies, Inc. N8829A 100GBASE-KR4 Ethernet electrical performance validation and conformance software for Infiniium oscilloscopes provides you with an easy and accurate way to verify and debug your 100GBASE-KR4 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 N8829A 100GBASE-KR4 Ethernet compliance software performs a wide range of electrical tests required to meet the IEEE P802.3bj 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 N8829A 100GBASE-KR4 Ethernet Compliance software helps you execute a wide subset of the conformance tests that can be measured with an oscilloscope.

N8829A 100GBASE-KR4 Compliance Application Software Saves You Time

The 100GBASE-KR4 Ethernet electrical test software saves you time by setting the stage for automatic execution of 100GBASE-KR4 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 100GBASE-KR4 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 100GBASE-KR4 Ethernet electrical test software.

Easy test definition

The 100GBASE-KR4 Ethernet electrical test software extends the ease-of-use advantages of Keysight's Infiniium oscilloscopes to testing 100GBASE-KR4 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.

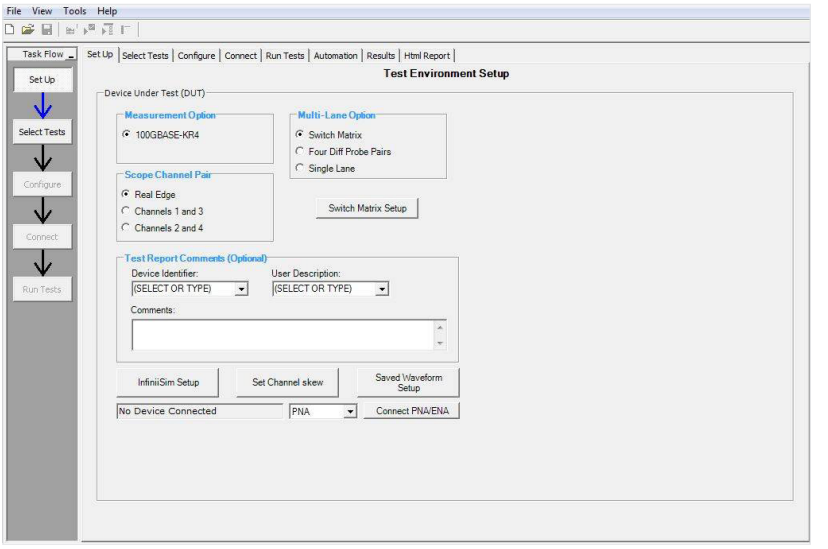


Figure 1. The clean interface allows you select 100GBASE-KR4test categories and test limits found in the IEEE P802.3bj specification.

View all of the 100GBASE-KR4 Ethernet electrical tests in the GUI under selected tests

- Setup wizard for quick and clear setup, configuration and test
- See clearly all the 100GBASE-KR4 Ethernet electrical tests.
- Run single or multiple tests based on your needs.
- When a test us 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

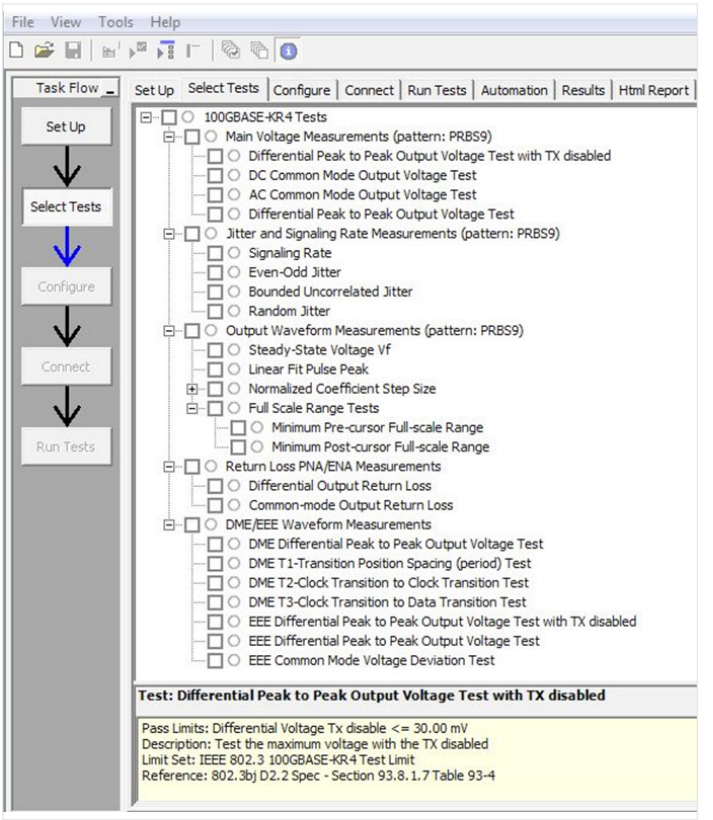


Figure 2. The Keysight automated test engine guides you quickly through selecting and configuring tests, setting up the connection, running the tests, and viewing the results. You can easily select individual tests or groups of tests with a mouse-click.

Configurability and Guided Connections

The N8829A 100GBASE-KR4 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. SMA cables or probes may be required to device under test to the Keysight Infiniium oscilloscope. See ordering information for more details.

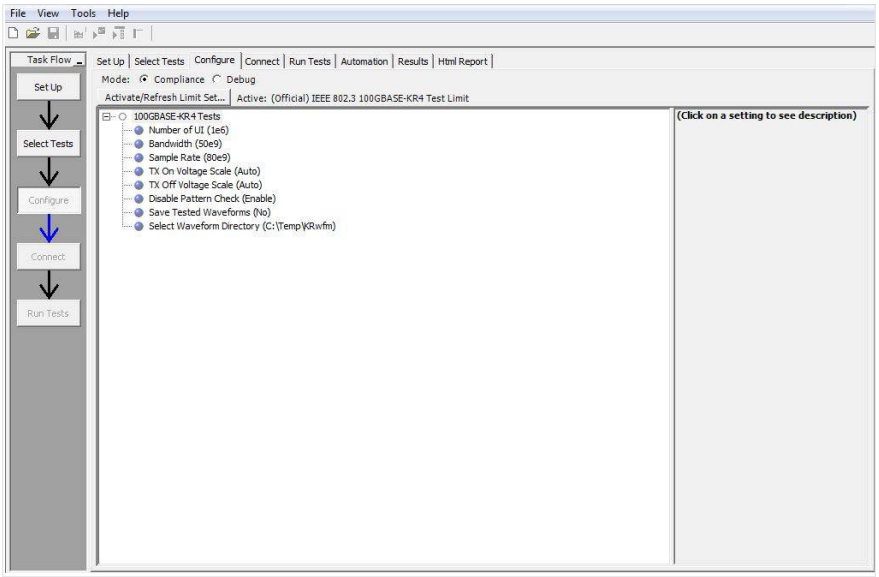


Figure 3. To set up tests, you define the device to test, its configuration, and how the oscilloscope is connected to it.

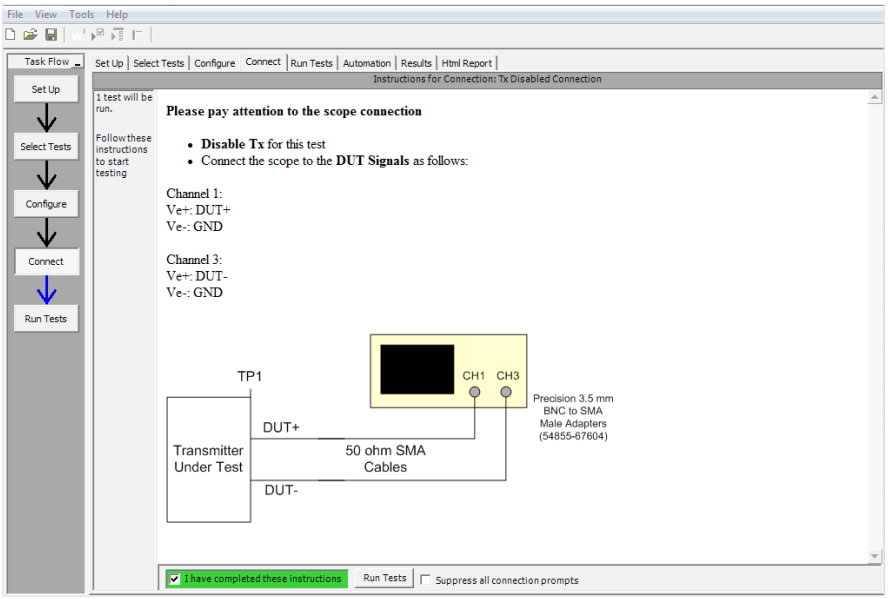


Figure 4. When you make multiple tests where the connections must be changed, the software prompts you with connection diagrams.

Configurability and Guided Connections (continued)

In addition to providing you with measurement results, the 100GBASE-KR4 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 100GBASE-KR4 specification.

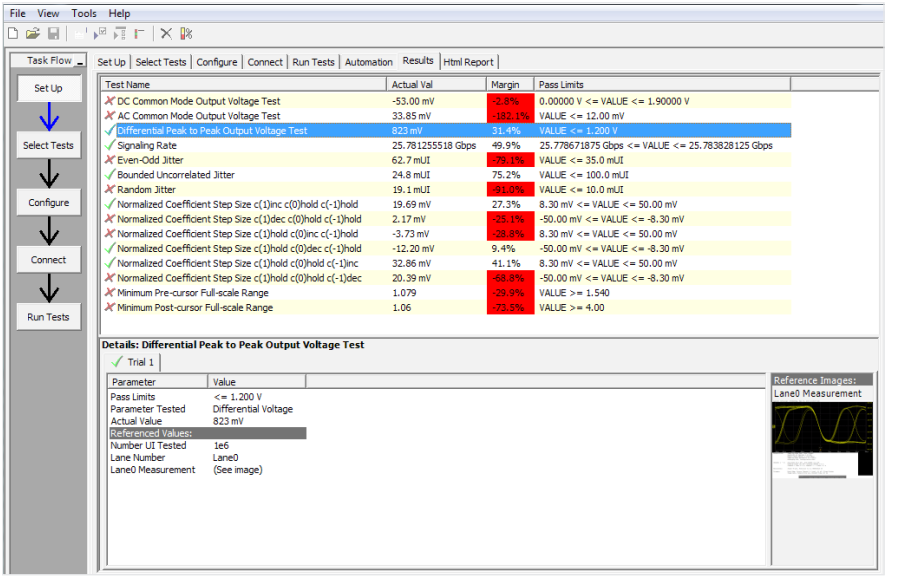


Figure 5. The 100GBASE-KR4 Ethernet electrical test software results screen shows a summary of the tests performed, pass/fail status, and margin. Clicking on a specific test also shows the test specification and a measurement waveform, if appropriate.

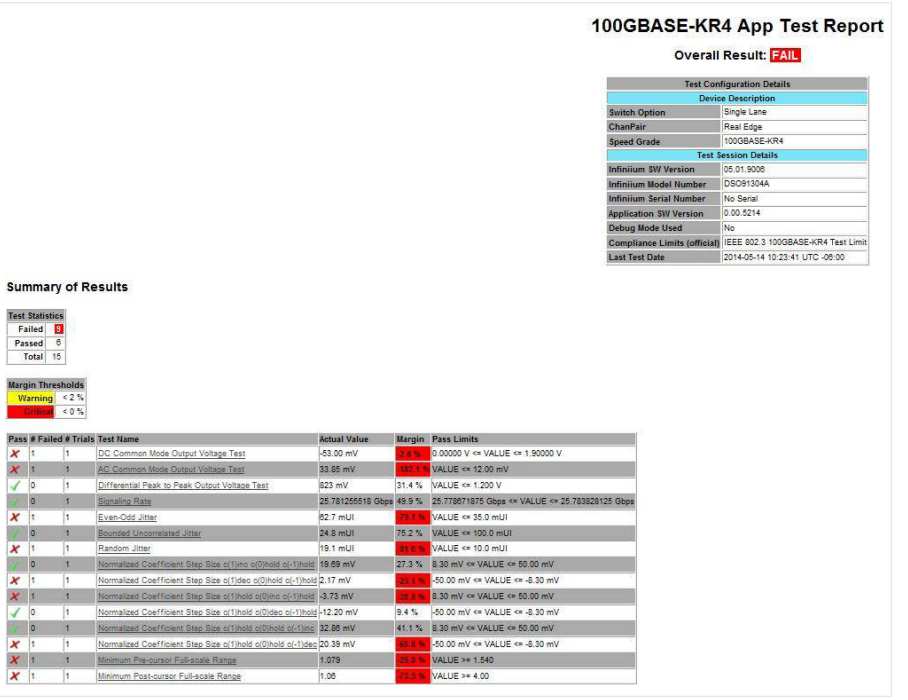


Figure 6. The 100GBASE-KR4 Ethernet electrical test software HTML report documents your test, indicates the pass/fail status, the test specification range, the measured values, and the margin.

Configurability and Guided Connections (continued)

Reports with margin analysis

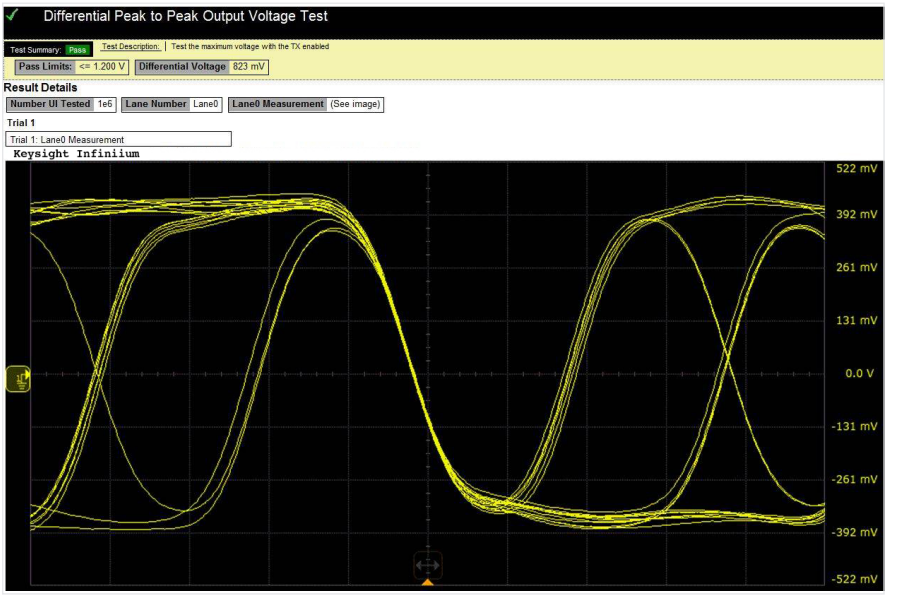


Figure 7. Additional details are available for each test, including the test limits, test description, and test results, including waveforms, if appropriate.

Summary of Results

Test Statistics	
Failed	9
Passed	6
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	-53.00 mV	-2.8 %	0.00000 V <= VALUE <= 1.90000 V
✗	1	1	AC Common Mode Output Voltage Test	33.85 mV	-182.1 %	VALUE <= 12.00 mV
✓	0	1	Differential Peak to Peak Output Voltage Test	823 mV	31.4 %	VALUE <= 1.200 V
✓	0	1	Signaling Rate	25.781255518 Gbps	49.9 %	25.778671875 Gbps <= VALUE <= 25.783828125 Gbps
✗	1	1	Even-Odd Jitter	62.7 mUI	-79.1 %	VALUE <= 35.0 mUI
✓	0	1	Bounded Uncorrelated Jitter	24.8 mUI	75.2 %	VALUE <= 100.0 mUI
✗	1	1	Random Jitter	19.1 mUI	-91.0 %	VALUE <= 10.0 mUI
✓	0	1	Normalized Coefficient Step Size c(1)inc c(0)hold c(-1)hold	19.69 mV	27.3 %	8.30 mV <= VALUE <= 50.00 mV
✗	1	1	Normalized Coefficient Step Size c(1)dec c(0)hold c(-1)hold	2.17 mV	-25.1 %	-50.00 mV <= VALUE <= -8.30 mV
✗	1	1	Normalized Coefficient Step Size c(1)hold c(0)inc c(-1)hold	-3.73 mV	-28.8 %	8.30 mV <= VALUE <= 50.00 mV
✓	0	1	Normalized Coefficient Step Size c(1)hold c(0)dec c(-1)hold	-12.20 mV	9.4 %	-50.00 mV <= VALUE <= -8.30 mV
✓	0	1	Normalized Coefficient Step Size c(1)hold c(0)hold c(-1)inc	32.86 mV	41.1 %	8.30 mV <= VALUE <= 50.00 mV
✗	1	1	Normalized Coefficient Step Size c(1)hold c(0)hold c(-1)dec	20.39 mV	-59.8 %	-50.00 mV <= VALUE <= -8.30 mV
✗	1	1	Minimum Pre-cursor Full-scale Range	1.079	-29.9 %	VALUE >= 1.540
✗	1	1	Minimum Post-cursor Full-scale Range	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.

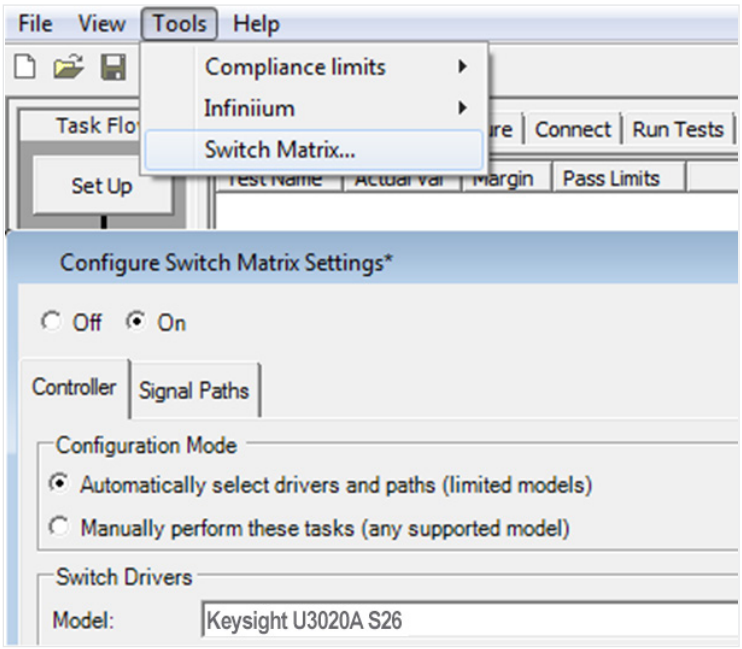


Figure 9. Switch matrix software feature enabled in the compliance application.

Switch matrix hardware

Please contact Keysight for latest switch matrix information.

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.

N8829A 100GBASE-KR4 Ethernet compliance tests

Specification IEEE P802.3bj Clause 93

Differential Peak-to-Peak Output Voltage Test with TX disabled
Common Mode Voltage Test
Differential Peak-to-Peak Output Voltage Test
Duty Cycle Distortion
Data Rate Mean
Random Jitter (RJ)
Deterministic Jitter (DDJ)
Total Jitter (TJ)
Transmission Time (20%-80%) – Rising Edge
Transmission Time (20%-80%) – Falling Edge
Coefficient Update c(1)inc c(0)Hold c(-1)Hold
- V1 - Coefficient Update inc-hold-hold
- V2 - Coefficient Update inc-hold-hold
- V3 - Coefficient Update inc-hold-hold

Coefficient Update c(1)dec c(0)Hold c(-1)Hold
- V1 - Coefficient Update dec-hold-hold
- V2 - Coefficient Update dec-hold-hold
- V3 - Coefficient Update dec-hold-hold

Coefficient Update c(1)Hold c(0) inc c(-1)Hold
- V1 - Coefficient Update hold-inc-hold
- V2 - Coefficient Update hold-inc-hold
- V3 - Coefficient Update hold-inc-hold

Coefficient Update c(1)Hold c(0) dec c(-1)Hold
- V1 - Coefficient Update hold-dec-hold
- V2 - Coefficient Update hold-dec-hold
- V3 - Coefficient Update hold-dec-hold

Coefficient Update c(1) Hold c(0)Hold c(-1) inc
- V1 - Coefficient Update hold-hold-inc
- V2 - Coefficient Update hold-hold-inc
- V3 - Coefficient Update hold-hold-inc

Coefficient Update c(1)Hold c(0)Hold c(-1) dec
- V1 - Coefficient Update hold-hold-dec
- V2 - Coefficient Update hold-hold-dec
- V3 - Coefficient Update hold-hold-dec

Coefficient Status c(1)Dis c(0)Min c(-1) Dis
- Rpre – Coefficient Status dis-min-dis
- Rpst – Coefficient Status dis-min-dis
- V2 – Coefficient Status dis-min-dis
- Delta V2(Additional) – Coefficient Status dis-min-dis
- Delta V5(Additional) – Coefficient Status dis-min-dis
- (V1+V4)/V1(Additional) – Coefficient Status dis-min-dis
- (V2+V5)/V2(Additional) – Coefficient Status dis-min-dis
- (V3+V6)/V3(Additional) – Coefficient Status dis-min-dis

N8829A 100GBASE-KR4 Ethernet compliance tests (continued)

Specification IEEE P802.3bj Clause 93 (continued)

Coefficient Status c(1)Dis c(0)Max c(-1) Dis
- Rpre – Coefficient Status dis-max-dis
- Rpst – Coefficient Status dis-max-dis
- V2 – Coefficient Status dis-min-dis
- Delta V2(Additional) – Coefficient Status dis-max-dis
- Delta V5(Additional) – Coefficient Status dis-max-dis
- (V1+V4)/V1(Additional) – Coefficient Status dis-max-dis
- (V2+V5)/V2(Additional) – Coefficient Status dis-max-dis
- (V3+V6)/V3(Additional) – Coefficient Status dis-max-dis

Coefficient Status c(1)Min c(0)Min c(-1) Dis
- Rpre – Coefficient Status min-min-dis
- Rpst – Coefficient Status min-min-dis
- V2 – Coefficient Status min-min-dis
- Delta V2(Additional) – Coefficient Status min-min-dis
- Delta V5(Additional) – Coefficient Status min-min-dis
- (V1+V4)/V1(Additional) – Coefficient Status min-min-dis
- (V2+V5)/V2(Additional) – Coefficient Status min-min-dis
- (V3+V6)/V3(Additional) – Coefficient Status min-min-dis

Coefficient Status c(1)Dis c(0)Min c(-1) Min
- Rpre – Coefficient Status dis-min-min
- Rpst – Coefficient Status dis-min-min
- V2 – Coefficient Status dis-min-min
- Delta V2(Additional) – Coefficient Status dis-min-min
- Delta V5(Additional) – Coefficient Status dis-min-min
- (V1+V4)/V1(Additional) – Coefficient Status dis-min-min
- (V2+V5)/V2(Additional) – Coefficient Status dis-min-min
- (V3+V6)/V3(Additional) – Coefficient Status dis-min-min

Transmitter Output Waveform “Information Only” Measurements
- V1 Result
- V2 Result
- V3 Result
- V4 Result
- V5 Result
- V6 Result
- Delta V2 Result
- Delta V5 Result
- Rpre Result
- Rpst Result

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
Initialize State Rpre
Initialize State Rpst

Measurement Requirements

To use the N8829A 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 100GBASE-KR4 compliance software is compatible with Keysight Infiniium Series oscilloscopes running Windows 7 with operating software revision 5.02 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
100BASE-KR4	100 Gb/s	63 GHz	2	Infiniium Q-Series

Recommended probes and fixtures

Model number	Description
N2812B (2 required)	Keysight 33 GHz precision cable

Switch matrix

Contact Keysight for the latest switch matrix solution.

Accessories

Model number	Description
85058-60114 (2 required)	Adapter, SMA (f) to SMA (f)

Software options

Application	License type		Infiniium Z-Series	Infiniium Q-Series
100GBASE-KR4	Fixed	Factory-installed	N8829A-1FP	Option 085
		User-installed	N8829A-1FP	N8829A-1NL
	Floating	Transportable	N8829A-1TP	N8829A-1TP[1,2]
		Server-based	N5435A-079	

Application	License type		Infiniium Z-Series	Infiniium Q-Series
Switch matrix option	Fixed	Factory-installed	N8829A-7FP	Option 710
		User-installed	N8829A-7FP	N8829A-7NL
	Floating	Transportable	N8829A-7TP	N8829A-7TP[1,2]
		Server-based	N5435A-710	

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

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www.lxistandard.org
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Related Literature

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

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