

D90103CKC IEEE 802.3ck

Measurement and Conformance Application Software

Characterize IEEE 100/200/400 Gb/s (53.125GBaud PAM4)
Electrical TX Designs using Infiniium UXR-Series Oscilloscopes,



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Introduction

Several industry and IEEE standards Associations have defined an electrical specification for 100Gb/s over one copper lane on the Physical Medium Attachment (PMA) Sublayer & Physical layer. As an example, chip-to-chip or chip-to-module interface of 100/200/400 Gb/s designs, or backplane (KR) or shielded balanced copper cabling (CR) defined by IEEE P802.3ck.

The Keysight D90103CKC IEEE P802.3ck software is a measurement application for the Infiniium UXR-Series oscilloscopes designed to save you time and money performing the adaptive reference equalizers and 53Gbd PAM4 transmitter (TX) test measurements in an easy to use, test solution.



Keysight D90103CKC IEEE 802.3ck software

The Keysight D90103CKC IEEE 802.3ck software is a measurement application for the Infiniium UXR-Series oscilloscopes designed to save you time and money by automating the task of performing 53Gbd adaptive reference equalizer optimization and PAM4 transmitter (TX) test measurements in one automated tool set.

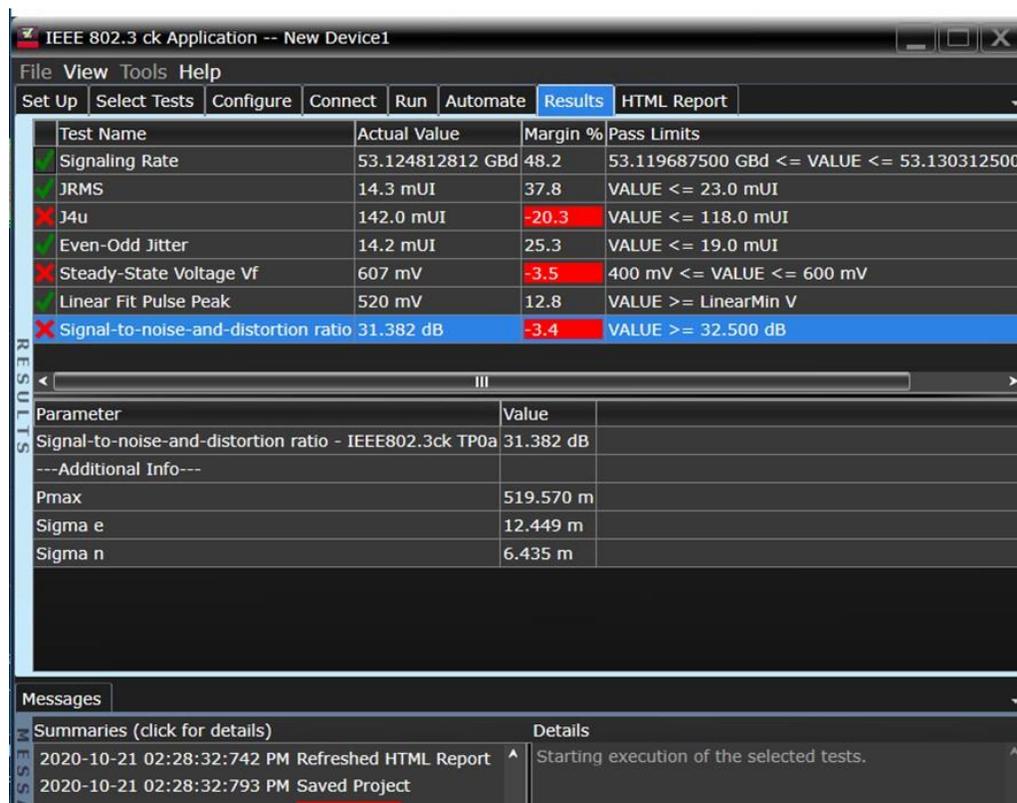


Figure 1. Example P802.3ck measurement results

Transform Complexity into Simplicity

The D90103CKC is an easy-to-use TX test application that:

- Saves time in understanding details of unique standards measurements
- Offers site to site consistency in uniform measurement results
- Reduces the time it takes to characterize your 53Gbd PAM4 design from hours to minutes
- Helps debug your device using custom configurations
- Allows you to quickly generate HTML reports that summarize the performance of your device

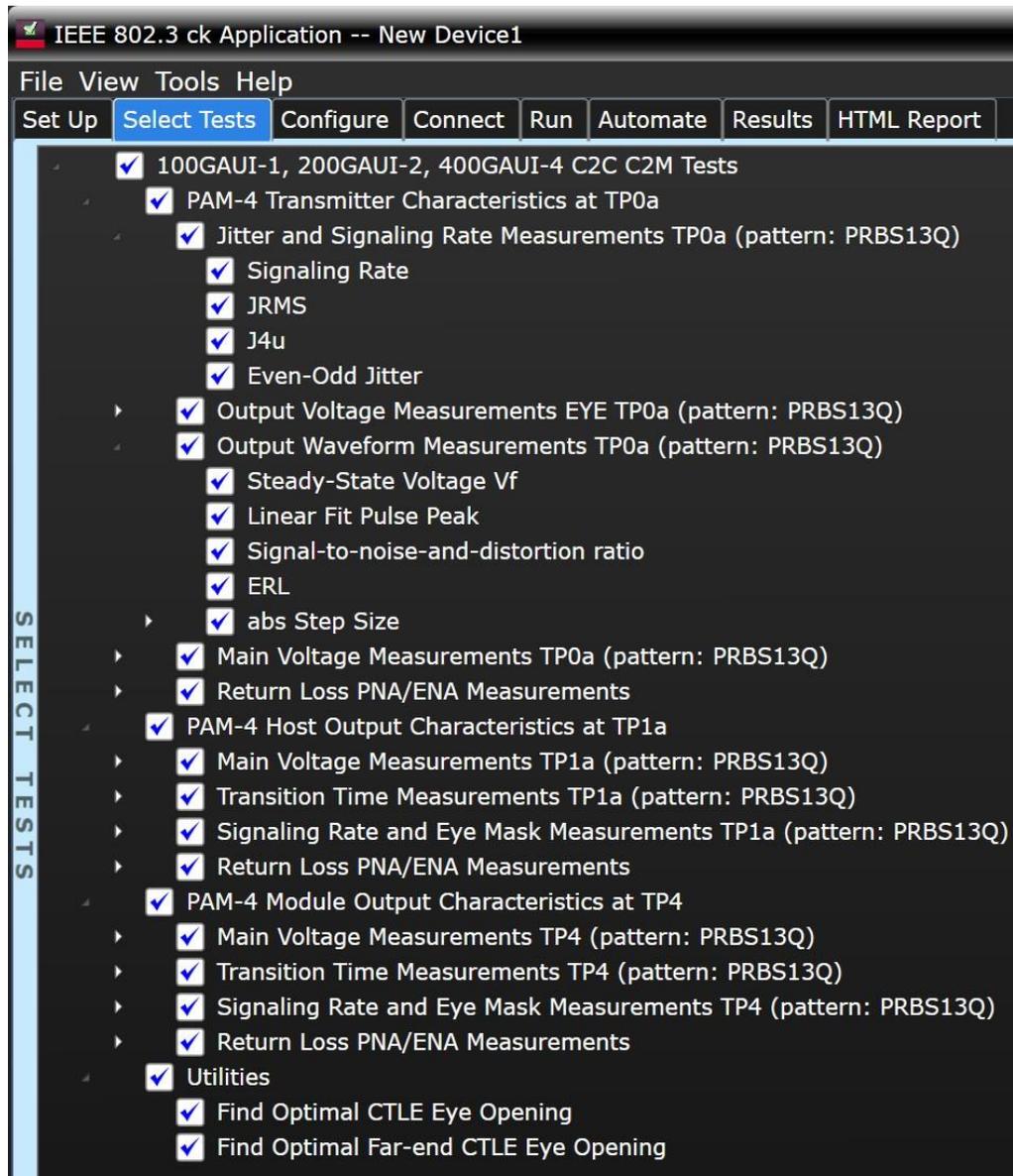
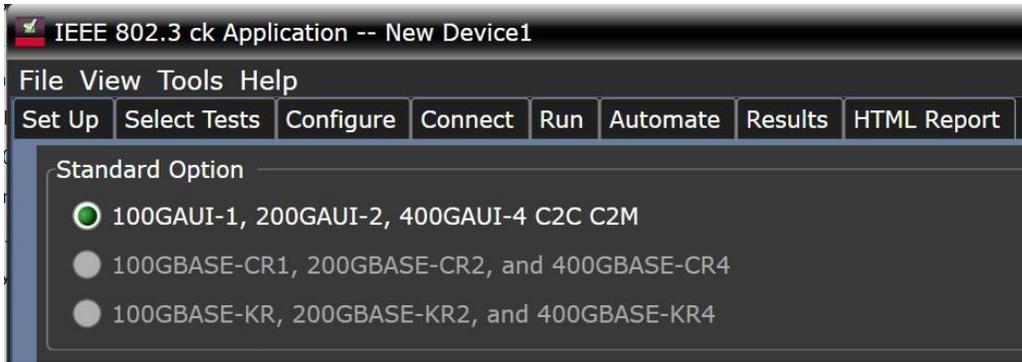


Figure 2. P802.3ck measurement selection

Select Industry-leading Hardware

D90103CKC application is specifically designed to leverage the hardware-based equalization and filter acceleration of the Infiniium UXR-Series of real-time oscilloscopes. The Infiniium UXR-Series is highly accurate on timing/jitter related measurements and supports an exceptionally precise PLL implementation achieved with advance signal processing.

Certain IEEE 100G C2M measurements require an input referred noise floor of 1.28mV RMS which depending on the measurement signal level, can be exceeded on the UXR. Due to the noise sensitivity of these operations, users should be cognitive of the relative benefits of a N1000A DCA-X sampling oscilloscope compared to the Infiniium UXR-Series oscilloscope in interpreting the results and accuracy of these automated IEEE C2M measurements.

The family of 53.125GBaud measurements found in 100GAUI, C2M, C2C, KR-n and CR-n require a 4th order Bessel-Thomson Display channel response (4BTR) at 40GHz, tracked out to -9dB. This 4BTR tracking generally requires a UXR with 59GHz of bandwidth to accommodate. Lower bandwidth Infiniium UXR-Series oscilloscopes can be used with a higher measurement error consideration. Higher bandwidth Infiniium UXR-Series oscilloscopes will be digital filter constrained to this spec mandated 40GHz 4BTR, rolling off to -9dB on a Bessel-Thomson channel response at 59GHz.



Figure 3. Infiniium UXR-Series Oscilloscope, recommended for P802.3ck electrical conformance.

Recommended oscilloscope

The IEEE802.3ck (100GAUI, C2M, C2C, KR-n, CR-n) physical layer conformance test automation measurements require an acquisition channel response that is constrained to 59GHz. Use of an instrument with bandwidth below 50GHz is not recommended.

Data rates	Minimum bandwidth (Brickwall)	Minimum channels	Compatible real-time oscilloscopes
53.125 GBd PAM4	59 GHz	2	UXR

Note: For IEEE802.3ck the waveform is observed through a fourth-order Bessel-Thomson response filter with a bandwidth of 40 GHz at -3dB, tracked out the -9dB level at 59GHz.

Ordering Information

Model number	Description	Note
D90103CKC	PIEEE802.3ck Conformance Test Application Software	Required
D9010PAMA	Pulse Amplitude Modulation PAM-N Analysis Software	Required
D9020ASIA	Advanced Signal Integrity Software (EQ, InfiniiSim Advanced)	Required
D9020JITA	EZJIT Complete - Jitter and Vertical Noise Analysis Software	Required

Example of Hardware Configuration

Model number	Description	Quantity
UXR0502A UXR0504A UXR0592A UXR0592AP XR0594A UXR0594AP UXR0702A UXR0702AP UXR0704AP UXR0802A UXR0804A UXR1002A UXR1004A UXR1102A UXR1104A	50-110 GHz Infiniium UXR-series oscilloscope Recommended 59GHz systems	1

Select the Desired Software Test Suite

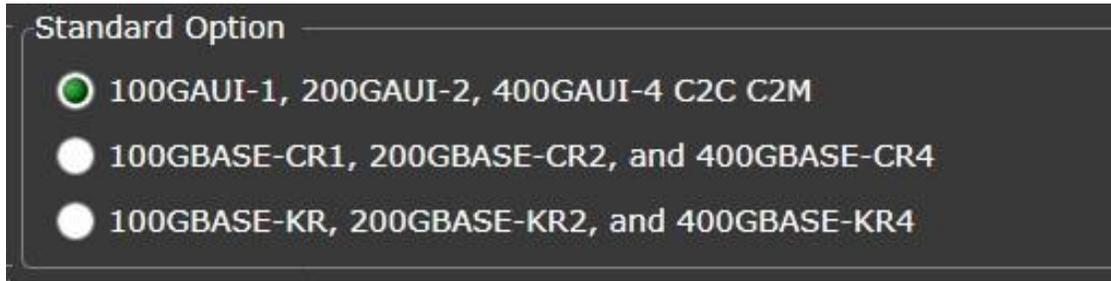


Figure 4. Standard option of D90103CKC IEEE802.3ck TX SW application

The D90103CKC IEEE 802.3ck TX test application covers PAM4 transmitter measurements outlined in IEEE 802.3ck specifications. The tests are sorted conveniently by clause. Click on the desired test group, and the appropriate tests are offered in Select Tests (factory-installed options shown).

The D90103CKC test application covers most TX tests outlined in the tables below. For a comprehensive and up-to-date list of specific tests covered by the application, download the D90103CKC application from www.keysight.com, install it on an Infiniium UXR-Series oscilloscope, and run the application in time trial mode.

IEEE 802.3ck 100Gb/s, 200 Gb/s and 400 Gb/s Operation

IEEE Reference	Description 1,2
120F.3.1	100GAUI-1, 200GAUI-2 and 400GAUI-4 C2C transmitter characteristics
120G.3.1	100GAUI-1, 200GAUI-2 and 400GAUI-4 C2M host output characteristics
120G.3.2	100GAUI-1, 200GAUI-2 and 400GAUI-4 C2M module output characteristics
162.9.3	Transmitter characteristics, 100GBASE-CR1, 200GBASE-CR2, and 400GBASE-CR4
163.9.2	Transmitter characteristics, 100GBASE-KR1, 200GBASE-KR2, and 400GBASE-KR4

Configure Your Measurements

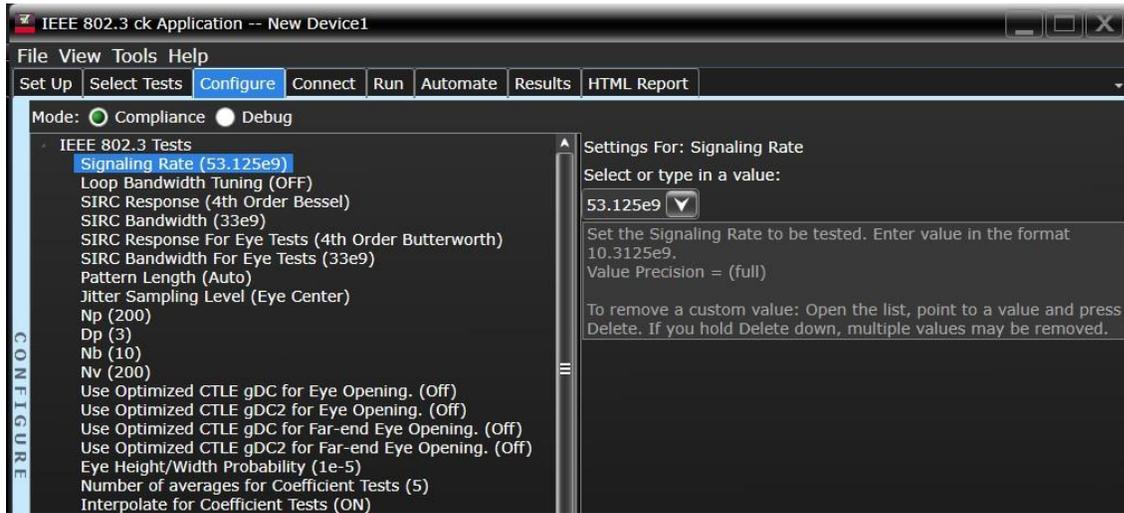


Figure 5. Standard “Compliance” limits and “Debug” configuration for non-standard applications

Customize parameters that are specific to your setup, such as signaling rate, CTLE gDC & gDC2 setting. Use default values or enter your own settings including number of waveforms taken, type of pattern, and pattern symbol length. Choose Compliance mode to test within limits or choose Debug mode to test to your custom limits and adjust other test parameters.

TheD90103CKC IEEE 802.3ck TX test application provides comprehensive coverage of PAM4 tests that are specific to the clause you are testing. You may click on all available tests, a group of tests, or select individual tests to run. The full test name appears in the test list and is also shown in the test results and reports. A description of the test and reference to the Standard is shown for each test.

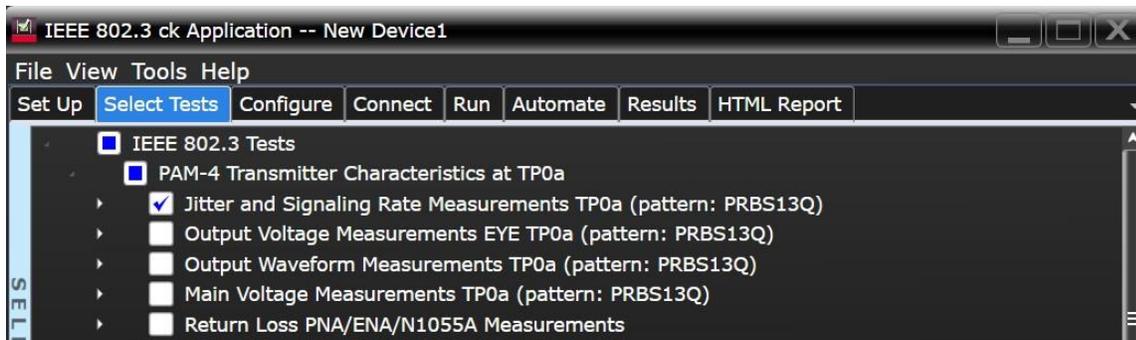


Figure 6. Measurement tree structure illustrating selection choices at TP0a test point with details collapsed

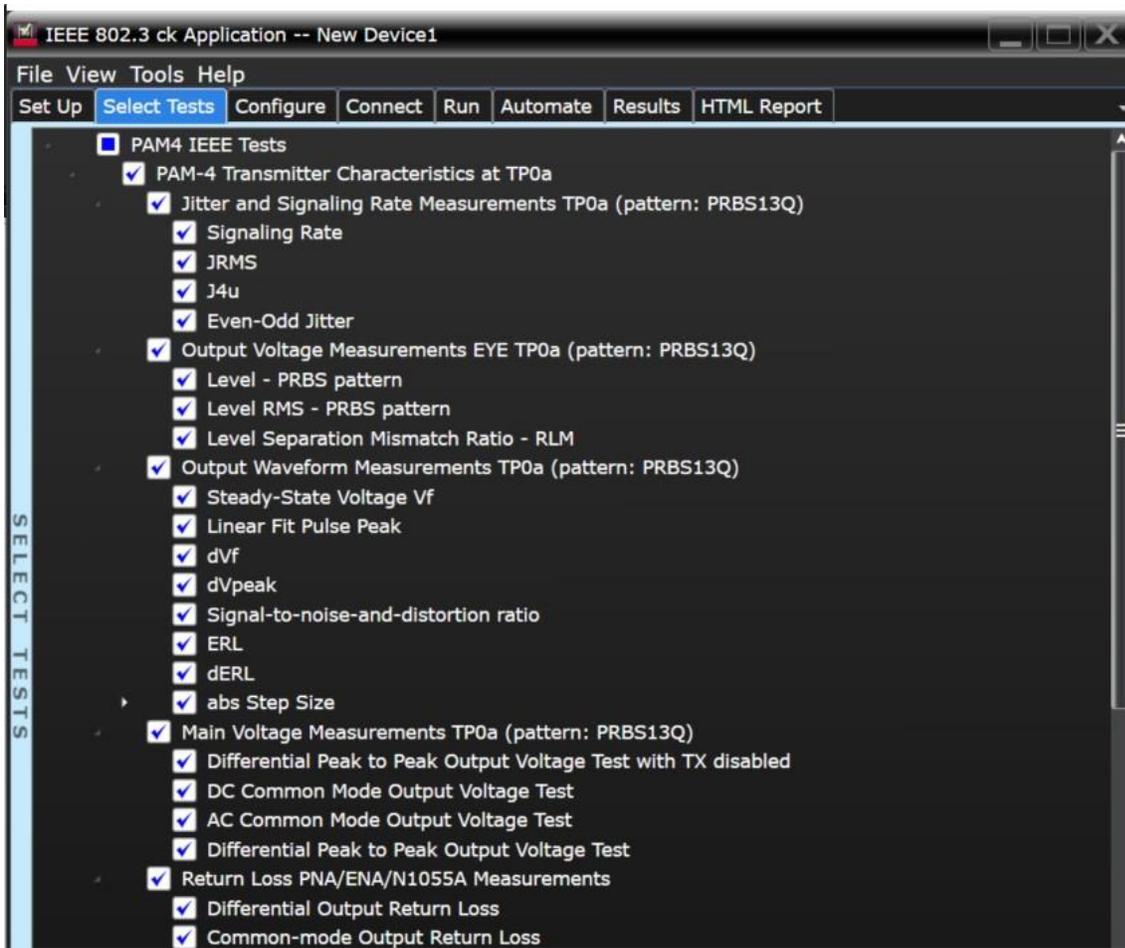


Figure 7. Advancing into the measurement tree structure with details expanded

Automated Return Loss Measurements

When used in conjunction with an N1055A TDR module or vector network analyzer (ENA or PNA), the D90103CKC IEEE802.3ck compliance application performs differential and common mode return loss measurements.

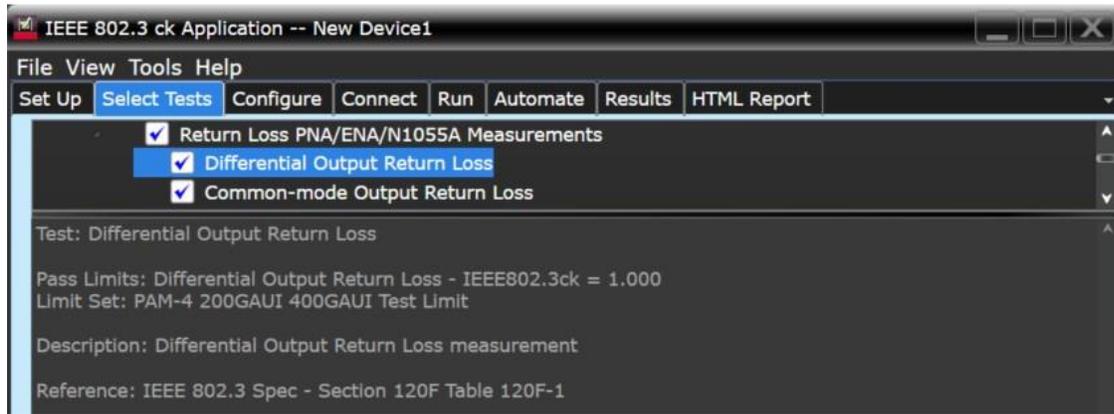


Figure 8. Return loss measurement selection of D90103CKC IEEE802.3ck TX SW application

Automated Tuning for Optimal Eye Opening

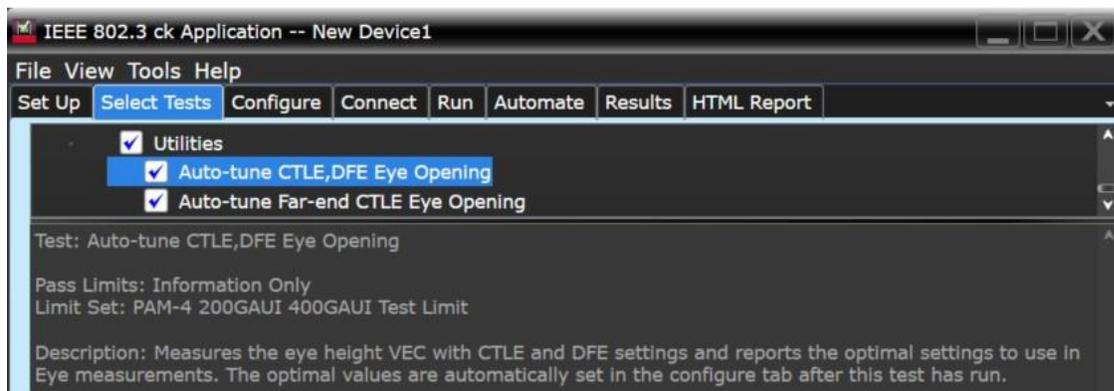


Figure 9. P802.3ck Reference Receiver CTLE and DFE auto-tune utilities

The D90103CKC IEEE802.3ck TX test application provides utility test, to finds the optimal eye opening for eye mask measurement at C2M's TP1a & TP4 (Far-End). It performs the tuning on the CTLE & DFE based on the CTLE gDC & gDC2 setting in configure tab, measures the eye height & VEC & reports all the eye measurement results for the sequenced CTLE settings. You can select to run all the CTLE permutations or narrow the CTLE search window to restrict the search window and improve the overall time to answer.

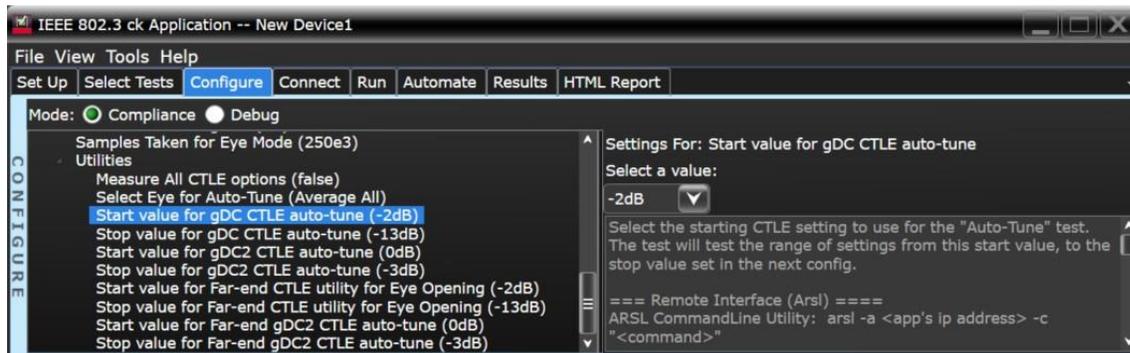


Figure 10. Reference Equalizer CTLE and DFE auto-tune scan window controls

The following illustrates typical Auto-tune utility results

Auto-tune						
gDC	gDC2	DFE taps	Pulse main cursor	VEC	Eye height	Eye width
-2	0	0.1,0,0.006,0	NA	4.41dB	114.7mV	312.6mUI
-2	-0.5	0.102,0,0.005,0	NA	4.31dB	118.3mV	352.1mUI
-2	-1	0.103,0,0.006,0	NA	4.24dB	117mV	347.4mUI
-5	0	0.102,0,0.006,0	NA	4.08dB	88.3mV	337mUI
-5	-0.5	0.102,0,0.005,0	NA	3.97dB	87.3mV	356.3mUI

User-defined Test Limit Editor

At the time of publishing this datasheet, the P802.3ck project is at revision Draft 1.3. Various limits are still classified as TBD and others are actively being revised by the IEEE working group. Users have an easy to use editor permitting revisions to the conformal test limit pass/fail thresholds.

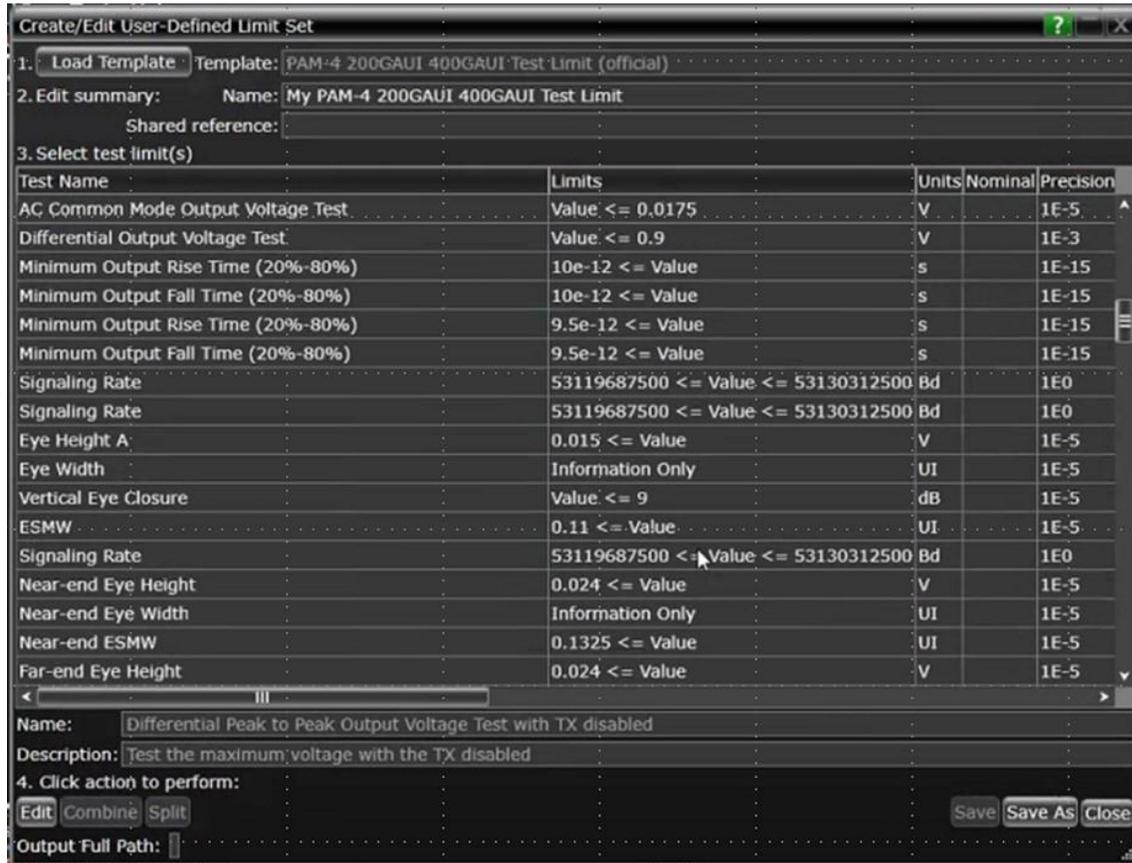


Figure 11. User re-configurable Pass/Fail limits tables

Guided Connection Diagrams for Easy Setup

Simply follow the steps to connect and configure your device under test and click Run Tests. The 90103CKC IEEE 802.3ck TX test application automatically configures and controls your supported Infiniium UXR-Series oscilloscope.

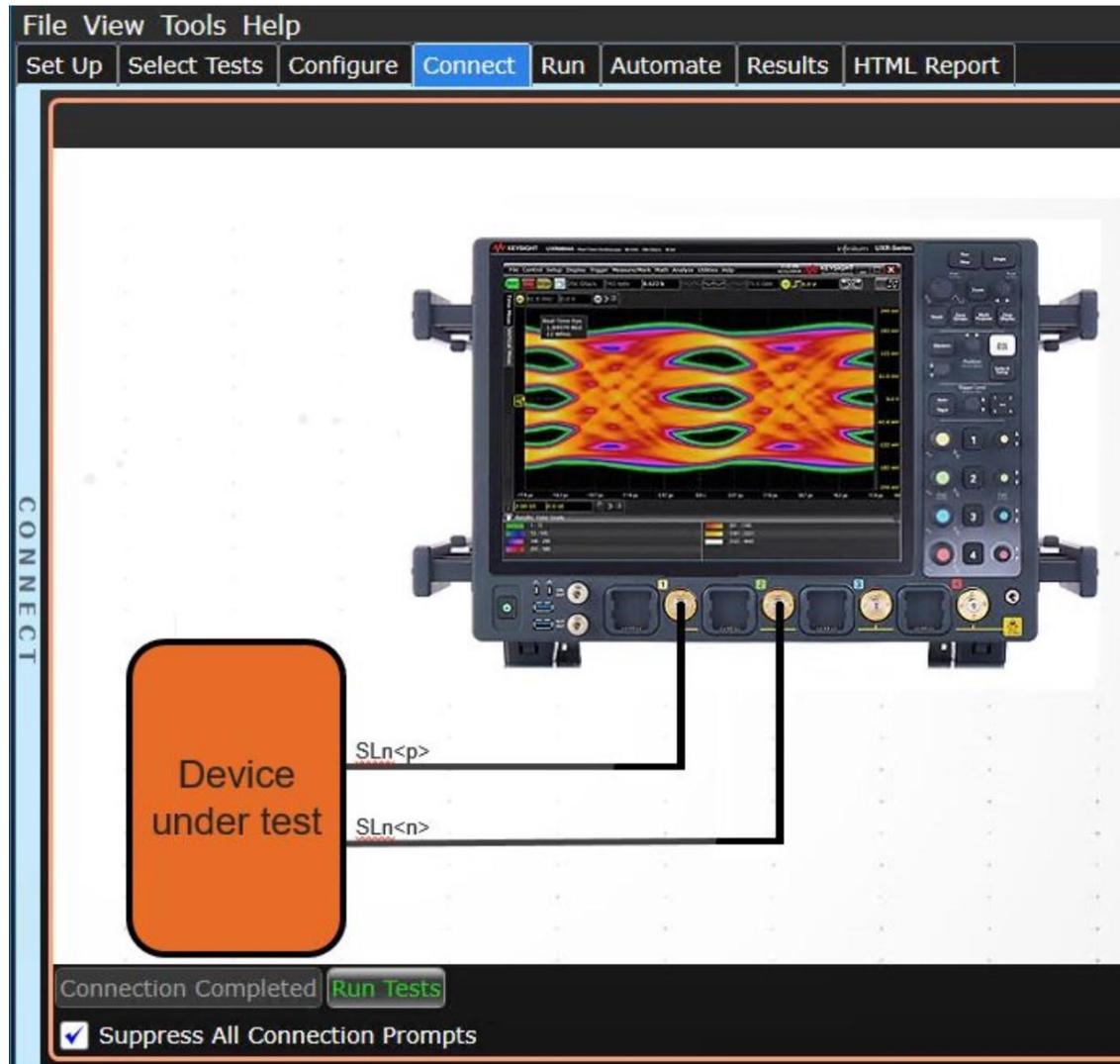


Figure 12. Typical application connection guide illustrating recommended setup

More Features Streamline Development

Your team members and your customers are interested in the performance of your device. Share a test results report with them that shows the test conditions, summary of pass/fail, summary of all tests, and details for each test. Many include a test-specific screen shot of the measured parameter.

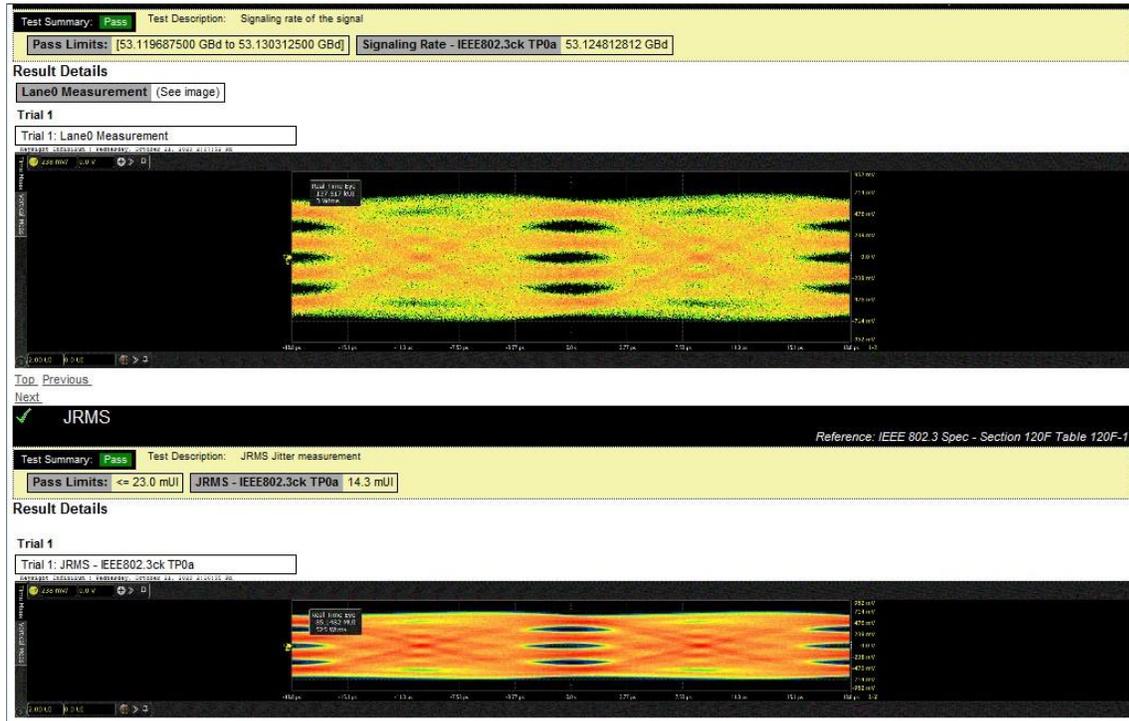


Figure 13. Typical test report and measurement details

Infiniium UXR-Series Oscilloscope Firmware Version Dependencies

Advances in CTLE and DFE capabilities essential for 802.3ck reference equalization are required in UXR FW Version : [10.25.01001](#) | [Release Notes](#)

Learn more at: www.keysight.com

For more information on Keysight Technologies' products, applications or services, please contact your local Keysight office. The complete list is available at: www.keysight.com/find/contactus

