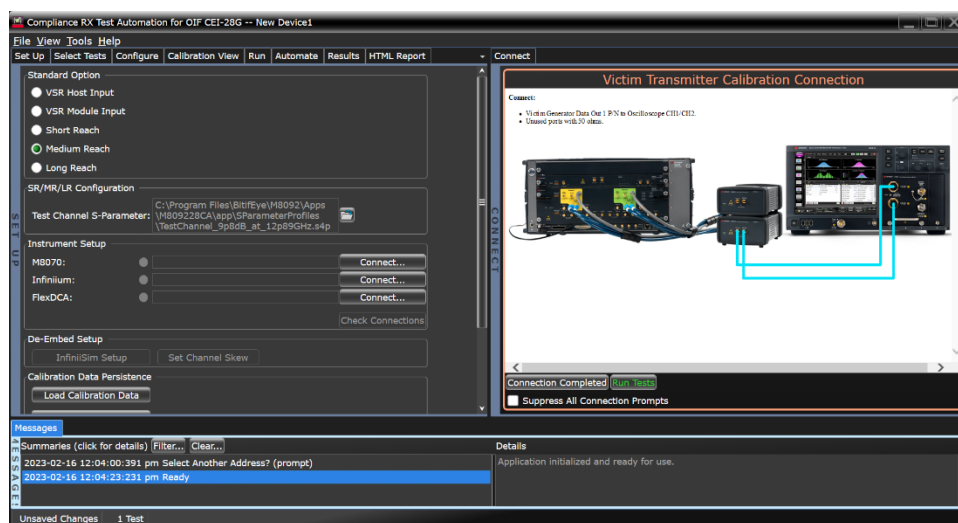


M809228CA

Receiver Conformance Test Application for OIF-CEI 3.1

Introduction

Keysight M809228CA is an automated receiver test solution for OIF CEI-28G-SR, CEI-28G-VSR, CEI-28G-MR, and CEI-25G-LR interfaces.



Key Features

- Supported standards include the following:
 - Clause 10 OIF-CEI 28G-SR- Short Reach Interface
 - Clause 11 OIF-CEI 25G-LR - Long Reach Interface
 - Clause 13 OIF-CEI 28G-VSR- Very Short Reach Interface
 - Clause 14 OIF-CEI 28G-MR - Medium Reach Interface
- Support a wide range of Keysight equipment (DCA sampling oscilloscopes, UXR real-time oscilloscope, DCA clock recovery devices, and M8040A BER Testers)
- Guided setup, automated stress signal calibration and conformance measurement
- HTML test report
- Data analytics enabled
- Choose between Node-locked, Transportable, Network, USB-dongle license types of the Perpetual License Term

Description

The Keysight M809228CA conformance receiver test application is designed to assist and simplify the stress signal calibration used for testing the inputs of OIF CEI-28G- VSR (host and module) as well as 28G-SR,-MR and 25G-LR interfaces.

The conformance application provides a user interface menu with the flexibility of choosing either compliance or debug mode. It reduces user interaction to a minimum and performs all required calibration routines and compliance testing automatically by remote controlling all required instruments. A wide range of hardware configurations is supported, thus protecting your investment.

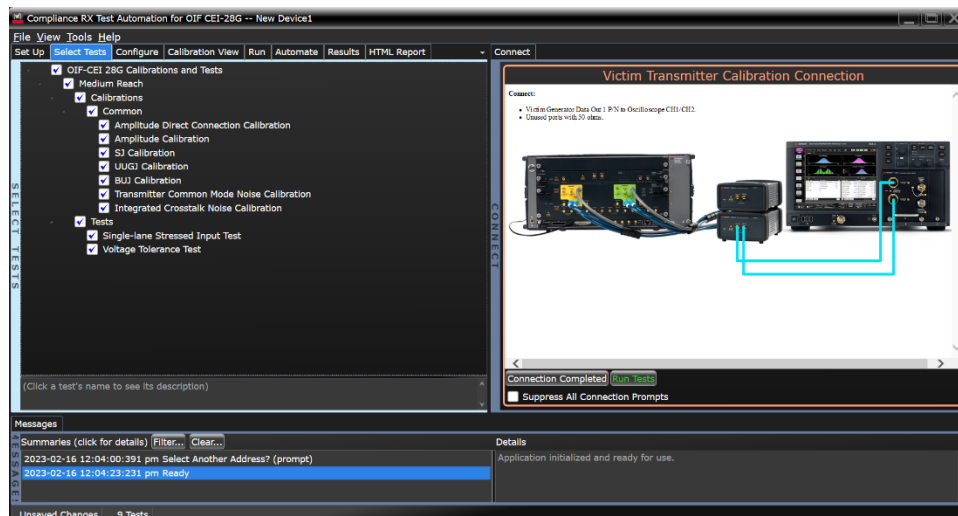


Figure 1. Graphical user interface of the M809228CA CEI-28G conformance receiver test application

The test application utilizes the same framework for the graphical user interface like most of Keysight transmitter test applications reducing training time by providing a common look and feel. When a user is required to perform setup changes, the user is guided by diagrams as well as text to minimize errors. Results of the individual calibration steps and tests are presented in tabular form as well as graphical form, where appropriate. Calibrations and test results can be stored in projects and recalled at a later point in time. The application can generate an HTML based test report.

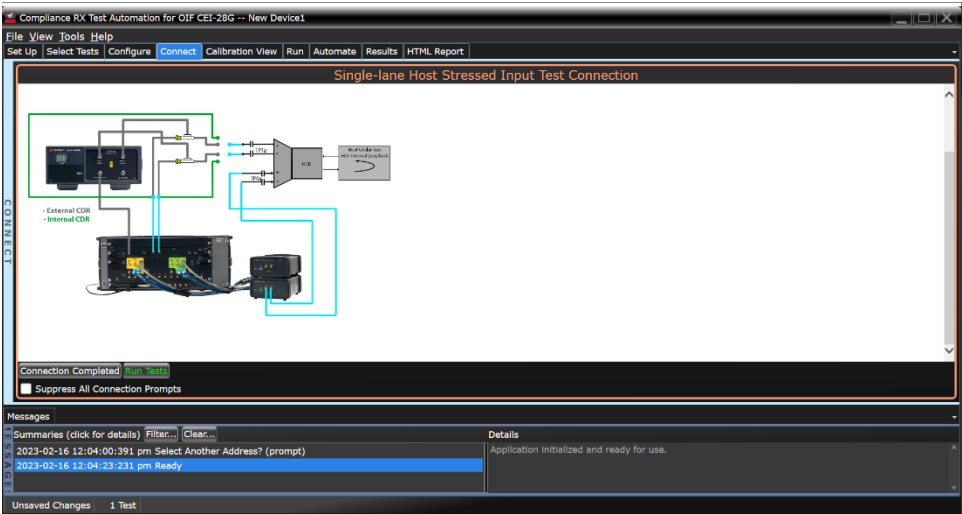


Figure 2. Connection diagram for 28G-VSR Host receiver stress test

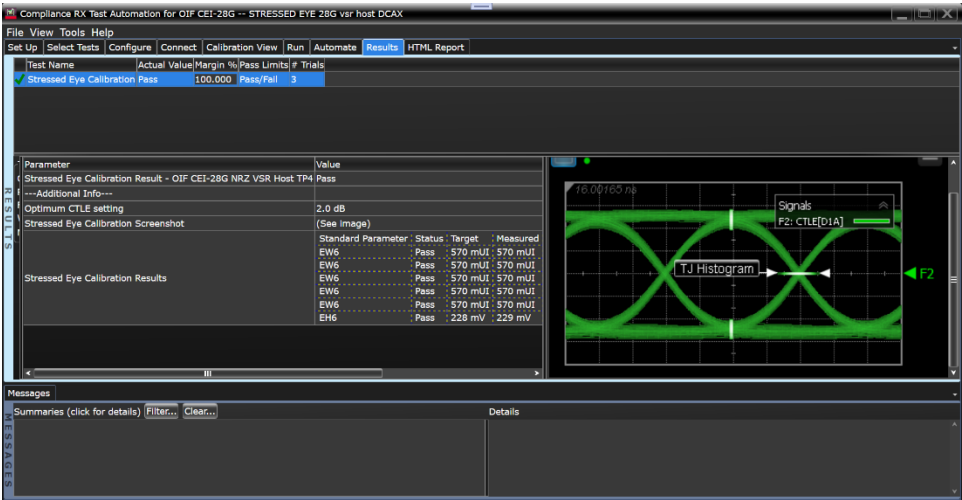


Figure 3. Results of the stress eye calibration procedure for 28G-VSR host

Calibrations and Tests Covered by M809228CA Receiver Test

CEI-28G-VSR (Host and Module)

The CEI 28G-VSR is a high-speed chip-to-module electrical interface with low-voltage logic. It is applicable for data lanes supporting bitrates from 19.60 to 28.10 Gsym/s using NRZ coding over printed circuit boards (PCB). The test transmission range has a minimum value of 100 mm for host PCB trace plus one connector and has a minimum value of 50 mm PCB trace module. The most common case is a host chip connected to a module chip via SFP+ or QSFP fixtures.

For more details, refer to “Implementation Agreement OIF-CEI-03.1”-Clause 13 CEI 28G -Very Short Reach (VSR) Interface”.

Keysight M809228CA Compliance Receiver Test Application provides the following calibrations and tests for 28G-VSR Host and Module compliance. All calibration steps are automated. The test application prompts the user whenever user interaction is required for connecting or modifying the test setup. Detailed connection diagrams and instructions are provided by the test application. The calibrations are implemented according to OIF-CEI-4.0 Common Electrical I/O (CEI) – Electrical and Jitter Interoperability Agreements, December 27, 2017 (Chapter 13)

- Crosstalk Amplitude
- Crosstalk Transition Time
- Amplitude
- Uncorrelated Unbounded Gaussian Jitter (UUGJ)
- Uncorrelated Bounded High Probability Jitter (UBHPJ)
- Sinusoidal Jitter (SJ)
- Stressed Eye

Test is implemented according to OIF-CEI-4.0 Common Electrical I/O (CEI) – Electrical and Jitter Interoperability Agreements, December 27, 2017 (Chapter 13)

- Stressed Input
- Voltage Tolerance
- 16.3.11 Voltage tolerance

Example Setup for VSR Host Input Stress Eye Calibration

- Connect MCB and HCB
- Connect the crosstalk generator's Data Out/ Data Out N to TP1 P/N.
- Connect termination via blocking capacitor to TP1a P/N of HCB
- Connect the victim generator's Data Out/ Data Out N to TP4a P/N via blocking capacitors
- Connect the oscilloscope's Channel 1/ Channel 2 to TP4 P/N

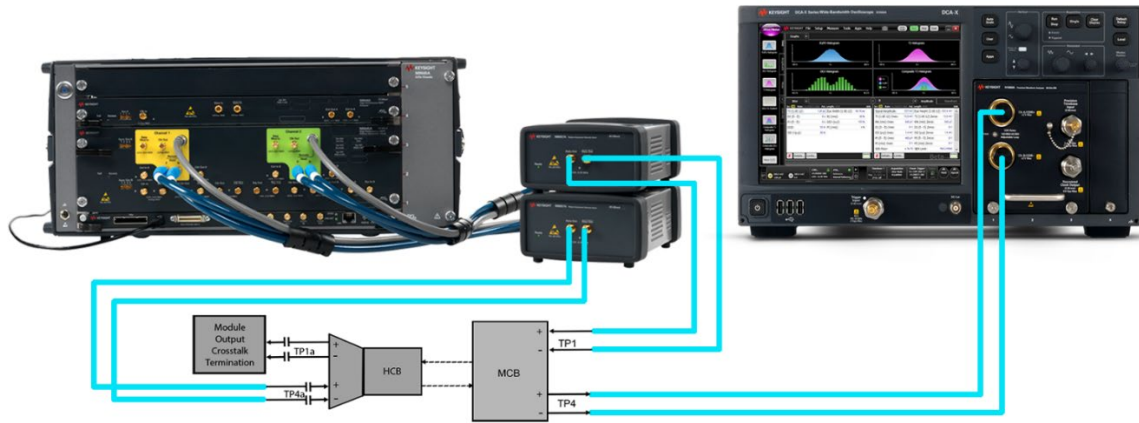


Figure 4. Setup configuration for VSR stress eye calibration (host test)

CEI-28G-SR, CEI-28G-MR and CEI-25G-LR

The SR, MR and LR clauses specify the requirements for high-speed point-to-point electrical interfaces using NRZ coding. The reference channel is expected to be a differential copper trace on PCB with or without connectors. The target applications are listed below.

	SR	MR	LR
Speed (Gsym/s)	19.90 to 28.05	19.90 to 28.05	19.90 to 25.8
PCB Length (mm)	0-300	500	686
Connector	1	1	2
Insertion loss at Nyquist (dB)	15.5	20	25.5
Max BER	10e-15	10e-15	10e-15

Keysight M809228CA Compliance Receiver Test Application provides the following calibrations and tests for CEI-28G-SR, CEI-28G-MR and CEI-25G-LR. The transmitter and receiver tests follow the same procedures for all three interfaces.

Calibrations are implemented according to OIF-CEI-4.0 Common Electrical I/O (CEI) – Electrical and Jitter Interoperability Agreements, December 27, 2017 (Chapter 10 for SR, Chapter 11 for LR, Chapter 14 for MR)

- Amplitude Direct Connection
- Amplitude
- Uncorrelated Unbounded Gaussian Jitter (UUGJ)
- Uncorrelated Bounded High Probability Jitter (UBHPJ)
- Sinusoidal Jitter (SJ)
- Transmitter Common Mode Noise
- Integrated Crosstalk Noise

Test is implemented according to OIF-CEI-4.0 Common Electrical I/O (CEI) – Electrical and Jitter Interoperability Agreements, December 27, 2017 (Chapter 10 for SR, Chapter 11 for LR, Chapter 14 for MR)

- Stressed Input
- Voltage Tolerance

Example Setup for SR/MR/LR Stressed Input Calibration

- Set the device to loopback
- Connect the victim generator to power combiner via blocking capacitors
- Connect the noise generator's Data Out 1 to power combiner of victim generator Data Out
- Connect the noise generator's Data Out 4 to power combiner of victim generator Data Out N
- Connect the power combiner of Data Out/ Data Out N to Test point T P/N
- Connect the victim analyzer's Data In/ Data In N to Test point of looped back signal P/N

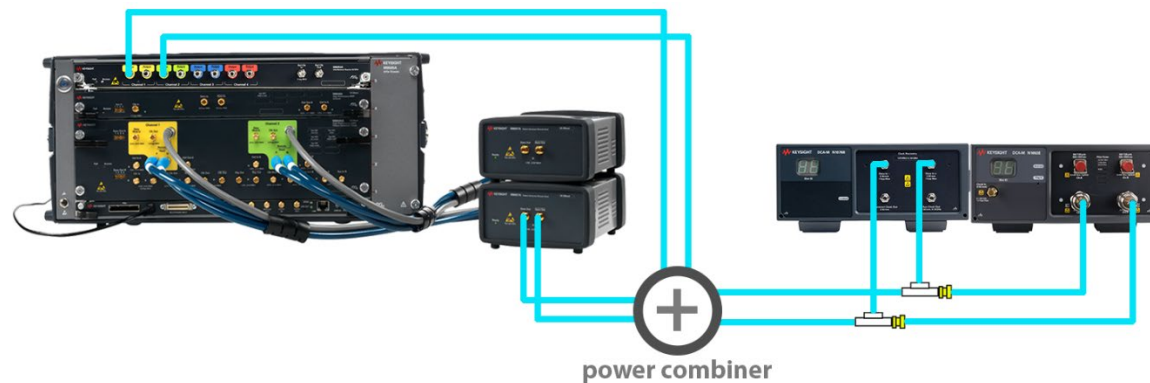


Figure 5. Setup configuration for SR/MR/LR stressed input calibration

Setup for SR/MR/LR Receiver Interference and Jitter Tolerance Test

- Set Device to Loopback.
- Victim Generator Data Out 1 P/N to test point T P/N of ISI channel.
- ISI channel test point T P/N to thru path of matched directional coupler pair.
- Noise Generator Data Out 1 P/N to couple path of matched directional coupler pair.
- Directional coupler Data Out P/N to Test point T P/N of Receiver test fixture.
- Receiver test fixture Test point T P/N to Receiver under test.
- Victim Analyzer Data In P/N to Test point of looped back signal P/N via Pick-Off.
- Recovered Clock Out from Clock Recovery to Victim Analyzer Clk In.
- Unused ports with 50 ohms.

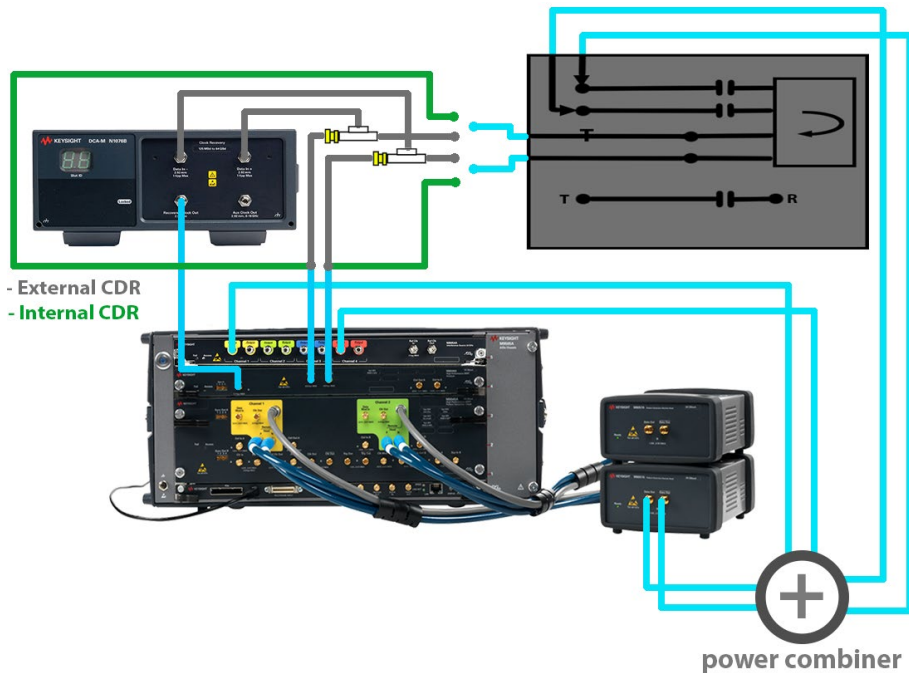


Figure 6. Setup configuration for single-lane stressed input test and voltage tolerance test.

Configuration Guide

Following table below shows the required equipment for each standard option under -OIF-CEI 3.1. Required Instrument configuration and required software options are listed in the following section.

Equipment Type	VSR	SR/MR/LR
Victim pattern generator	M8045A	
Crosstalk generator	M8045A 2nd channel or 3rd party crosstalk generator	N/A
Interference source	N/A	M8054A or M8195A or M8196A
Victim error detector	M8046A or DCI (DUT control interface)	
Clock recovery for	M8046A - 0A4 (internal CDR) or N107xA / N1076B / N1077A / N1078A	
Oscilloscope	N1000A + N1060A or	
	N1092C/E or N1094A/B + N1076B/ N1077A/ N1078A or	
	UXR-Series oscilloscopes with 59GHz bandwidth & above	

Minimum Required Instrument Configuration

M8040A 64 GBaud High-Performance BERT

M8040A-BU2	Bundle consisting of one M9505A 5-slot AXIe Chassis plus control module with USB option
M8045A	Pattern generator and clock module 32/64 Gbaud, 3 slot AXIe
• M8045A-G32	Pattern generator one channel NRZ, data rate up to 32 GBaud (requires remote head, e.g. M8057A)
• M8045A-0G2	Second channel, hardware and license (requires remote head, e.g. M8057B) – recommended but not mandatory
• M8045A-0G3	Advanced jitter sources for receiver characterization, module-wide license
• M8045A-0G4	De-emphasis, module-wide license
• M8057B-FG	Remote head for M8045A pattern generator, 1 channel, two remote heads are needed
M8046A	Analyzer module, 32/64 Gbaud, 1-slot AXIe
• M8046A-A32	Analyzer, one channel, data rate up to 32 GBaud, NRZ
• M8046A-0A4	Clock recovery for 32 Gbaud, license
M8070B	System software for M8000 series of BERT test solutions
M8070ADVB-1xx	Advanced measurement package for M8000 Series of BERT test solutions (node-locked, transportable, floating or USB license)

Choose on N107xx Clock Recovery if M8046A-0A4 Option is Not Selected

N1076A/ N1077A	Electrical/optical clock recovery
• N107xA-232	Supported input rates: 50 MBd to 32 GBd
• N1076A-CR1	Clock recovery phase matching kit for N1076A electrical
• N1076A-2P2	Microwave pick-off tee 2.4 mm connectors, matched pair
• 11900B	2.4 mm female to 2.4 mm female adapter
• 83059A	Coaxial adapter, 3.5 mm male-male
• N1027A-2P8	Microwave pick-off tee 1.85mm connectors, matched pair
• M8046A-802	Matched cable pair 2.4 mm (m) to 2.4 mm (m), two matched cable pairs are required
N1076B/ N1078A	Electrical/optical clock recovery
• N107xx-232	Supported input rates: 125 MBd to 32 GBd
• N1076B-CR1	Clock recovery phase matching kit for N1076B electrical
• N1027A-2P8	Microwave pick-off tee 1.85 mm connectors, matched pair
• 11900B	2.4 mm female to 2.4 mm female adapter
• 83059A	Coaxial adapter, 3.5 mm male-male
• M8046A-802	Matched cable pair 2.4 mm (m) to 2.4 mm (m), two matched cable pairs are required

Select an Interference Source for SR/MR/LR Application

• M8054A	Interference source 32 GHz or
• M8195A-002	Arbitrary waveform generator, 2 channels, 65 GSa/s
• M8196A-002	Arbitrary waveform generator, 2 channels, 92 GSa/s

Select DCA Configuration – N1000A + N1060A DCA-X or DCA-M + N1076B/ 77A/ 78A

N1000A	DCA-X wide-bandwidth oscilloscope mainframe
• N1000A-PLK	Pattern lock trigger hardware model
N1060A	Precision waveform analyzer
• N1060A-050	Two 50 GHz channels
• N1060A-EVA	Equalizer integrated variable
• N1060A-232	Supported input rates: 125 MBd to 32 GBd
• N1060A-PTB	Precision timebase, ultra-low random jitter
• N1060A-JSA	Jitter spectrum analysis and clock recovery emulation
OR	
N109X	DCA-M optical and electrical sampling oscilloscopes
• N1092C	DCA-M sampling oscilloscope (one optical and two electrical channels)
• N1092E	DCA-M sampling oscilloscope (two optical and two electrical channels)
• N1094A	DCA-M sampling oscilloscope (two electrical channels)
• N1094B	DCA-M sampling oscilloscope (four electrical channels)

FlexDCA N1000-Series System Software – Choose DCA Options or R&D Package

DCA options	
N1010AT-200	Enhanced jitter analysis SW
N1010AT-201	Advanced waveform analysis
N1010AT-SIM	InfiniiSim-DCA (embedding/de-embedding of cables or fixtures)
R&D package	
N1010100A	Research and development package for FlexDCA DCA-X mainframe minimum configuration

Select UXR Configuration if DCA Options are Not Selected

• UXR0592A/B	59GHz, 2-CH, 1.85 mm input Infiniium UXR-Series real-time Oscilloscope
• D9320ASIA	Advanced signal integrity software (EQ, InfiniiSimAdv, crosstalk)
• D9320JITA	Jitter, vertical and phase noise analysis software for 90000, V-, Z- and UXR-series oscilloscopes

Accessories (Recommended)

M8045A-801	Short cable (2 for each M8057B recommended)
M8045A-802	Matched directional coupler pair, 50 GHz, 13 dB, 2.4 mm (for MR and LR)
11636C	11636C Power Divider, DC to 25.6GHz (2 required for integrated crosstalk injection)
M8046A-802	Cable, 2.92 mm (m) to 2.92 mm (m), Length 0.5 m(to error detector)
M8195A-810	Cable, 2.92 mm (m) to 2.92 mm (m), length 0.85 m (for crosstalk injection)
M8195A-820	Coaxial termination 50 Ω DC to 26.5 GHz, 3.5 mm (male) (2 required)
SP0610A	Wilder QSFP28 100Gbps MCB 3.5mm Receptacle Test Adapter
SP0611A	Wilder QSFP28 100Gbps 3.5mm Plug Test Adapter
M8049A-002	ISI channel board, nine traces from 0.8 to 8.0 inches (required for VSR module)
M8049A-003	ISI channel board, seven traces from 9.1 to 22.3 inches (required for SR/MR/LR Modules)
Y1901B	Adapter, 1.0 mm ruggedized (f) to 1.85 mm (f), DC to 67 GHz
N2125A	Infiniium UXR Real-Time Oscilloscope Calibration Module, 1 mm

M809228CA Software Configuration

M809228CA -1xx	RX Conformance test application for OIF-CEI 3.1
----------------	---

Minimum PC Configuration

The PC running the application should meet following requirements:

PC Hardware Requirements

• Operating system	Microsoft Windows 10 Version 1809 (64 bit) and above
• Memory	8 GB RAM minimum
• Monitor resolution	WXGA+ (1140 x 900) minimum

PC Software Requirements

• Keysight IO Library Suite Rev 18.1 • Keysight License Manager 5 and Keysight License Manager 6 • M8070B system software for M8000 series ◦ Ver. 9.5.350.6 ◦ M8070ADVB Advanced Measurement Package for M8000 Series - Ver. 1.1.550.2 ◦ M8195A soft front panel version 3.6 or M8196A soft front panel version 2.1.13.0 • Microsoft Office 2010 or higher • Keysight DCA-X and DCA-M oscilloscopes FW rev. A.07.00.763 • Keysight UXR oscilloscope FW rev. 11.50.0040 • MATLAB Compiler Runtime R2017a (9.2) • Microsoft Excel rev. 2021, English	
--	--

Remote Programming

The M809228CA Conformance Receiver Test Application is part of Keysight's Digital Test Apps and can be programmed via ARSL, any .NET language or through the LabVIEW graphical programming interface. For more information, see www.keysight.com/find/rpi.

Related Products

The [N4917BACA Optical Receiver Stress Test](#) addresses the test needs for testing optical receiver following IEEE 100GBASE optical interfaces and it provides repeatable calibration of the optical stressed eye, saving hours of calibration time compared to manual calibration.

The [M8091BMCA Electrical Receiver Conformance Test Application for IEEE 802.3bm](#) speeds up and simplifies the stress signal calibration used for testing the inputs of CAUI-4 interfaces

The [M8091BSCA Electrical Receiver Conformance Test Application for IEEE 802](#) speeds up and simplifies the stress signal calibration used for testing the inputs of 200GAUI-4 and 400GAUI-8.

The [N109256CB TX Test Automation SW Application for OIF-CEI 4.0](#) for the sampling oscilloscopes and the [N6473A OIF-CEI 4.0 Compliance Application for Infinium real-time oscilloscopes](#) offer automated transmitter testing for CEI-56G-VSR host or module, CEI-56G-MR and CEI-56G-LR outputs.

Keysight enables innovators to push the boundaries of engineering by quickly solving design, emulation, and test challenges to create the best product experiences. Start your innovation journey at www.keysight.com.



This information is subject to change without notice. © Keysight Technologies, 2023 - 2026, Published in USA, June 4, 2026, 3123-1222.EN