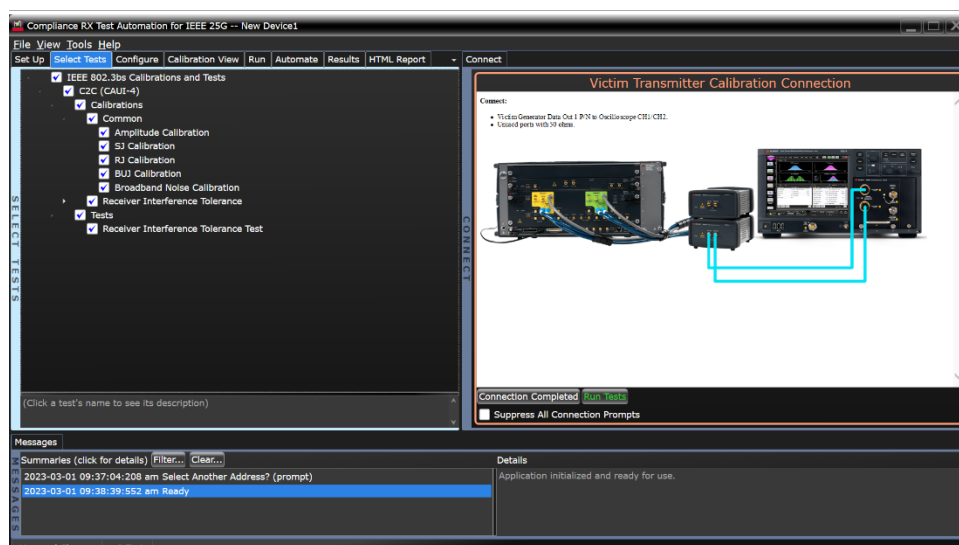


M8091BMCA

Receiver Conformance Test Application for IEEE 802.3bm

Introduction

Keysight M8091BMCA is an automated receiver test solution for IEEE 802.3bm and IEEE 802.3by C2M, C2C, KR and CR.



Key Features

- Supported standards include the following:
 - IEEE 802.3by Chip-to-module 25 Gigabit Attachment Unit Interface (25GAUI C2M) Annex 109B ¹
 - 109B.3.3 25GAUI C2M host input characteristics
 - 109B.3.4 25GAUI C2M module input characteristics
 - IEEE 802.3by Chip-to-chip 25 Gigabit Attachment Unit Interface (25GAUI C2C), Annex 109A ²
 - 109A.3.2 25GAUI C2C receiver characteristics
 - Clause 110. Physical Medium Dependent (PMD) sublayer and baseband medium, type 25GBASE-CR and 25GBASE-CR-S ³
 - Clause 110.8.4.1 Receiver input amplitude tolerance
 - Clause 110.8.4.2 Receiver interference tolerance test
 - Clause 111. Physical Medium Dependent (PMD) sublayer and baseband medium, type 25GBASE-KR and 25GBASE-KR-S ⁴
 - 111.8.3.1 Receiver interference tolerance
 - 111.8.3.2 Receiver jitter tolerance
- 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 M8091BMCA receiver conformance test application is designed to assist and simplify the stress signal calibration used for testing the inputs of CAUI-4 C2M (host and module) CAUI-4 C2C, KR and CR.

The conformance application provides a user interface menu with the flexibility to choose 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.

1. Follows Annex 83E Chip-to-module 100 Gb/s four-lane Attachment Unit Interface (CAUI-4) with some exceptions

i. 83E.3.4 CAUI-4 module input characteristics

ii. 83E.3.3 CAUI-4 host input characteristics

2. Follows Annex 83D Chip-to-chip 100 Gb/s four-lane Attachment Unit Interface (CAUI-4)

3. Follows clause 92.8.4 Receiver characteristics with some additions

No AN/LT is available for CR and KR. The receiver is allowed to control the transmitter equalizer coefficients, using the protocol defined in 92.7.12 or an equivalent process, to meet this requirement.

4. Follows 93.8.2 Receiver characteristics with some additions

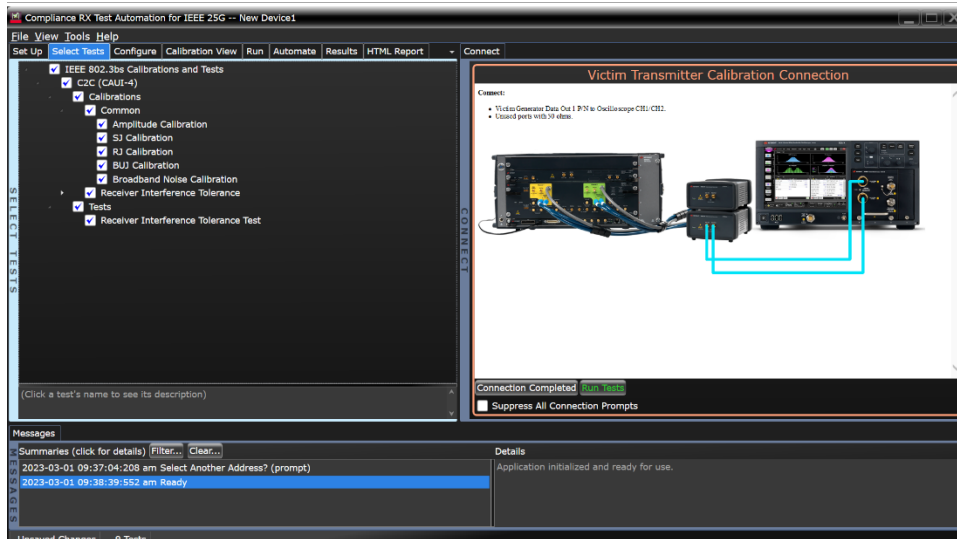


Figure 1. Graphical User Interface of the M8091BMCA Receiver Conformance Test Application

The test application utilizes the same framework for the graphical user interface like most Keysight transmitter 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.

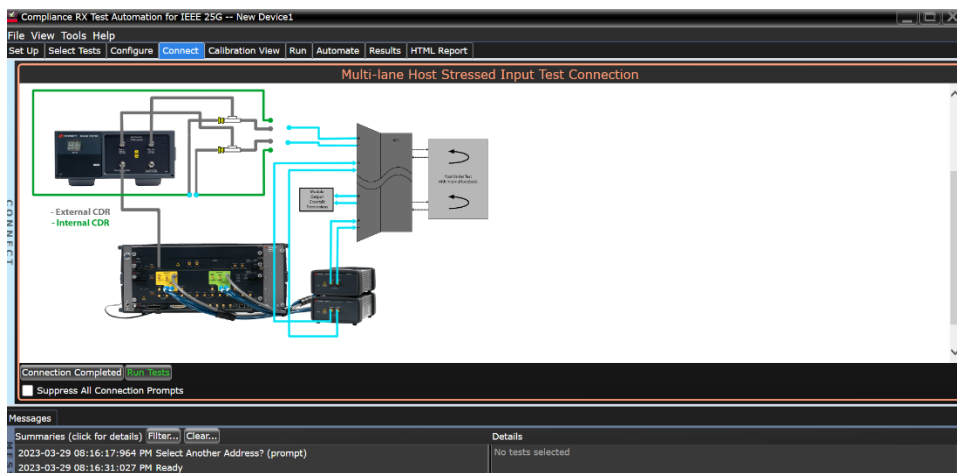


Figure 2. Connection diagram for 25G- Host receiver stress test

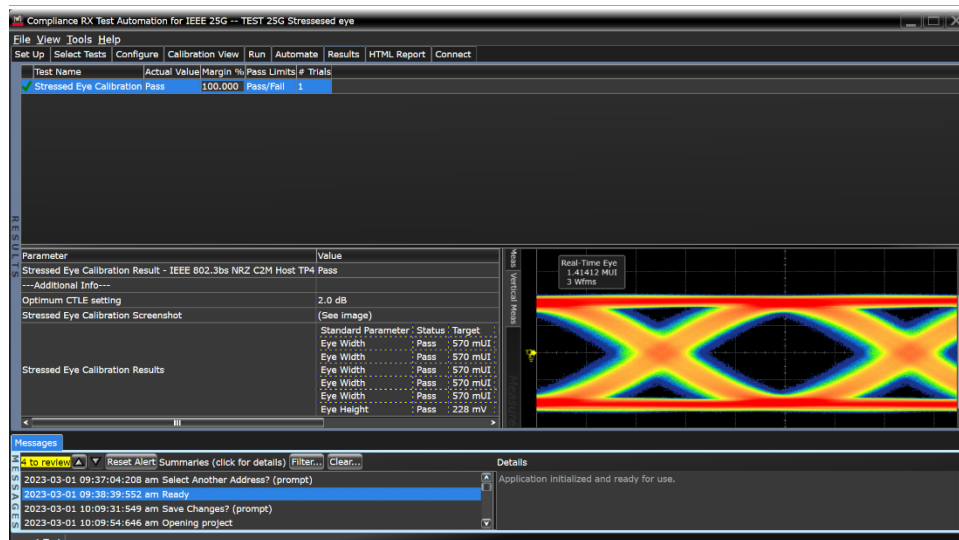


Figure 3. Results of the stress eye calibration procedure for 25G-C2M Host

Calibrations and Tests Covered by M8091BMCA Receiver

CAUI-4 C2M (Host and Module)

The Chip-to-Module (C2M) interface provides electrical characteristics and associated compliance points, which can be used to design systems with pluggable module interfaces. The 25GBASE C2M interface is based on a 25.78125 NRZ. The chip-to-module interface is defined using a specification and test methodology that is similar to that used for CEI-28G-VSR defined in OIF-CEI.

Testing C2M interfaces requires reference test fixtures, called compliance boards: Host Compliance Board (HCB) is used to access the host chip and the Module Compliance Board (MCB) is used to access the module chip. When connected together ("mated test fixtures") the resulting channel is expected to be close to a compliant channel between the host and module chips. (fig 4). QSFP and SFP+ test fixtures are common for 25G and CAUI-4 interfaces.

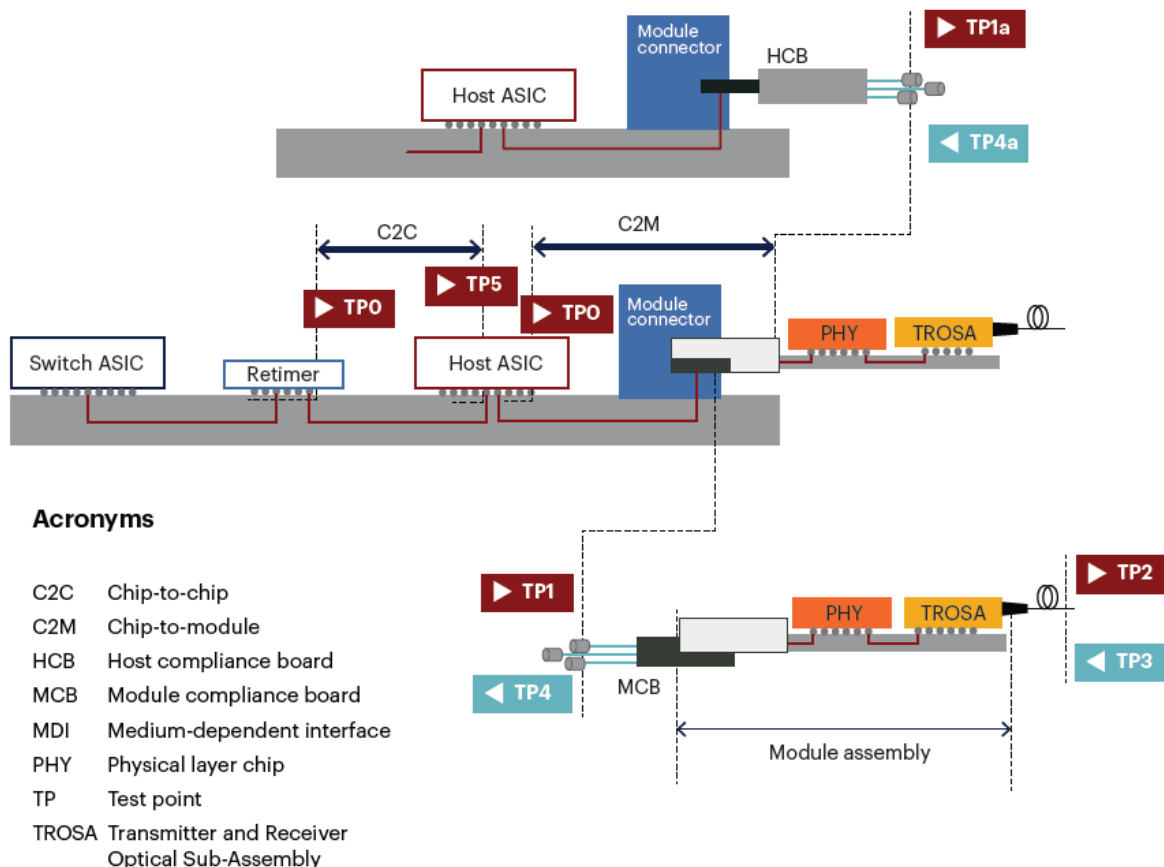


Figure 4. Test Points (TP) as defined by the IEEE 802.3 for the C2C and C2M interfaces

Keysight M8091BMCA Compliance Receiver Test Application provides the following calibrations and tests for 25GBASE C2M Host and Module following

- clause 109B.3.3 (83E.3.3.2, Host stressed input test) for the host input test
- clause 109B.3.4 (83E.3.4.1, Module stressed input test) for the module input test.

Calibration:

- Crosstalk Amplitude and Transition Time
- Amplitude
- Sinusoidal Jitter (SJ)
- Random and total Jitter (TJ, RJ)
- Stressed Eye

Tests:

- Stressed input
- Voltage tolerance
- Voltage tolerance

Example Setup for C2M Host Input Stress Eye Calibration

- Connect MCB and HCB
- Connect the X-Talk Generator's Data Out 2 P/N to TP1 P/N of MCB
- Terminate the TP1a P/N of HCB with 50 ohms
- Connect the Victim Generator's Data Out 1 P/N to TP4a P/N of HCB
- Connect the MCB TP4 P/N to Oscilloscope's Ch1/2 via Pick-Off
- Connect the data for clock recovery from Pick-Off

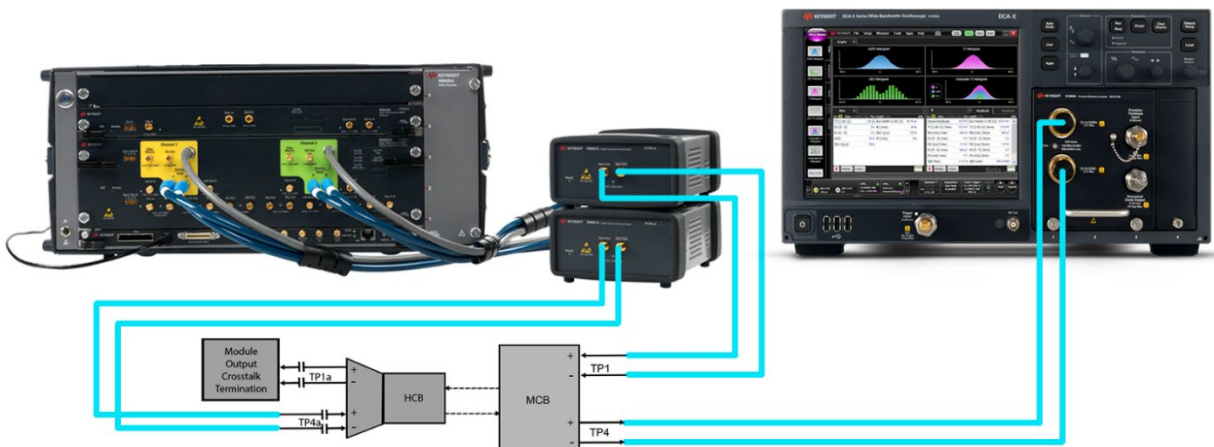


Figure 5. Setup configuration for C2M stress eye calibration (Host test)

25GBASE-C2C, 25GBASE-KR, 25GBASE-CR

The Chip-to-Chip (C2C), backplane (KR) and copper (CR) interface provides electrical characteristics and associated compliance points, which can be used to design SerDes interconnects. The target applications are listed in the table below.

	C2C	KR	CR
OIF-CEI equivalent	MR	LR	LR
interconnect Length (mm)	~250	~1000	<5000
Connector	1	2	2
Insertion loss at Nyquist (dB)	20	30 or 35	<35
Max BER	10e-15	10e-12 or 10e-5 ⁵	10e-5 ⁵
Max FLR	-	6.2×10^{-10}	6.2×10^{-10}

Testing C2C and KR interfaces requires a trace board acting as a test channel combined with a coupler (for interference injection) to be tested. In addition, CR interfaces requires reference test fixtures: the Host Compliance Board (HCB) is used to access the host chip, while a Module Compliance Board (MCB) can be used to inject the stress signal into the test channel when a copper cable instead of a trace board is used (fig 7). QSFP and SFP+ test fixtures are common for 25G and CAUI-4 interfaces. The C2C, KR and CR interfaces are tested using the channel operating margin (COM) methodology defined in the IEEE 802.3 Annex 93A. Note that *Link Training* as defined in 92.7.12 isn't used to optimize the transmitter equalizer coefficients to the device under test for CR and KR tests. Instead, the transmitter equalization (TX EQ) is based on the COM analysis and can be adjusted manually if required.

5. With RS(544, 514) forward error correction (FEC)

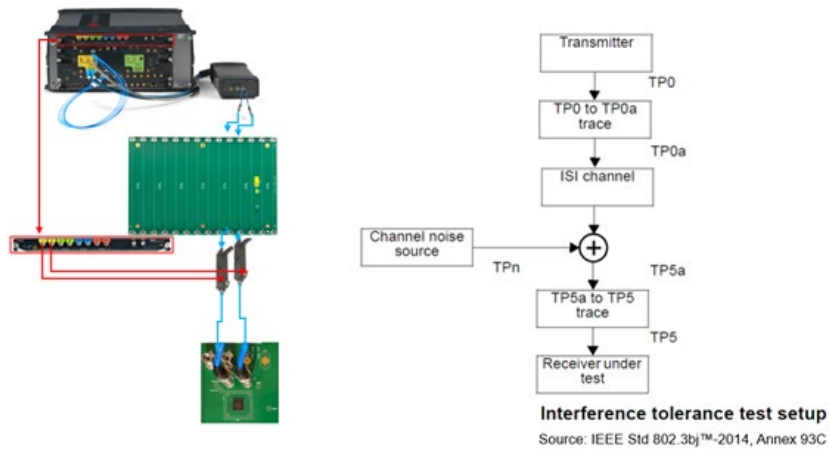


Figure 6. Setup for C2C/KR interface test

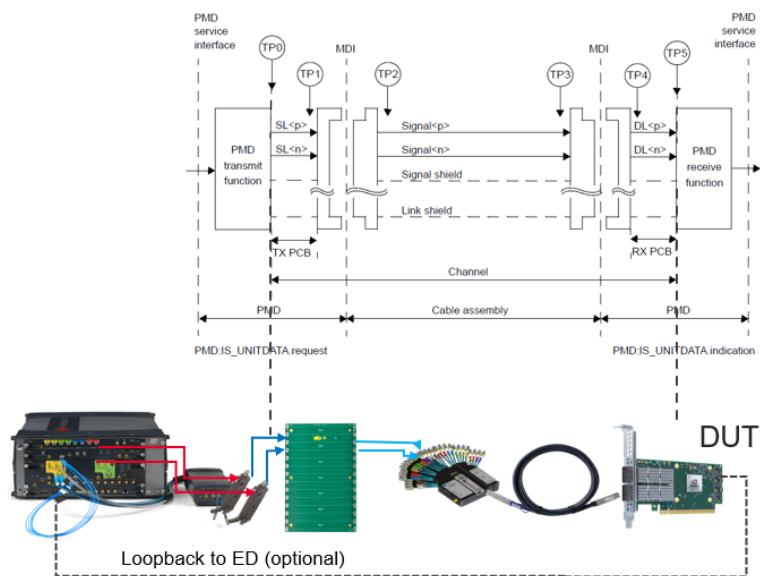


Figure 7. Setup for CR interface test

Keysight M8091BMCA Compliance Receiver Test Application provides the following calibrations and tests for 25GBASE C2M Host and Module following

- Clause 109B.3.3 (83E.3.3.2, Host stressed input test) for the host input test
- Clause 109B.3.4 (83E.3.4.1, Module stressed input test) for the module input test.

Calibration:

- Crosstalk Amplitude and Transition Time
- Amplitude
- Sinusoidal Jitter (SJ)
- Random Jitter (RJ)
- Broadband noise
- Channel characterization S
- Transmitter characterization
- Rx calibration using COM

Tests ⁶:

- Receiver interference tolerance
- Receiver jitter tolerance

Example of Setup for CR Calibrations

- Connect the Victim generator's Data Out 1 P/N to the power combiners via blocking capacitors.
- Connect the Noise generator's Data Out 1 P/N to the power combiner of victim generator Data Out P/N.
- Connect the power combiner of Data Out P/N to the Oscilloscope's Ch1/2.
- Terminate the X-Talk Generator's Data Out 2 P/N with 50 ohms.

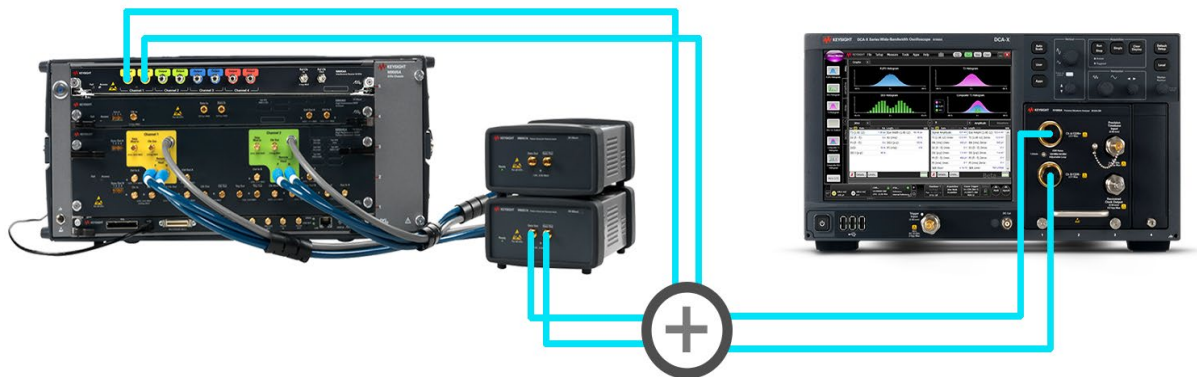


Figure 8. Setup configuration for CR calibrations

6. Note that C2C/CR and LR are tested for low loss and high loss channels.

Example of Setup for CR Interference Tolerance Test

- Connect Host Device and Test channel (Frequency dependent attenuator, test fixture and cable assembly).
- Set the Device to Loopback.
- Connect the Victim generator's Data Out 1 P/N to the power combiners via blocking capacitors.
- Connect the Noise generator's Data Out 1 P/N to the power combiner of victim generator Data Out P/N.
- Connect the power combiner of Data Out P/N to Tx test reference of Test channel.
- Internal CDR
 - Connect the Victim Analyzer's Data In P/N to Test point of looped back Rx under test signal P/N.
- External CDR
 - Connect the Recovered Clock Out from Clock Recovery to Victim Analyzer's Clk In.
 - Connect the Victim Analyzer's Data In P/N to Test point of looped back Rx under test signal P/N via Pick-Off.
 - Connect the Data for clock recovery from pickoffs.
- Terminate the X-Talk Generator's Data Out 2 P/N with 50 ohms

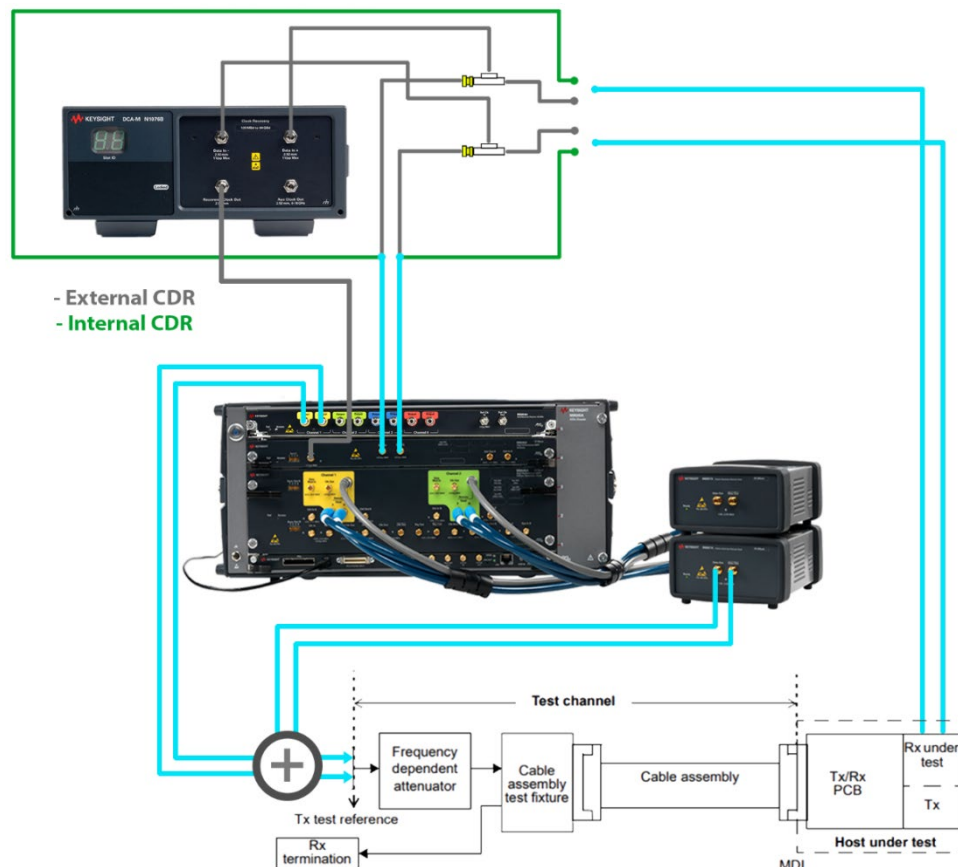


Figure 9. Setup configuration for CR Interference Tolerance Test

Setup for C2C/KR Receiver Interference and Jitter Tolerance Test

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

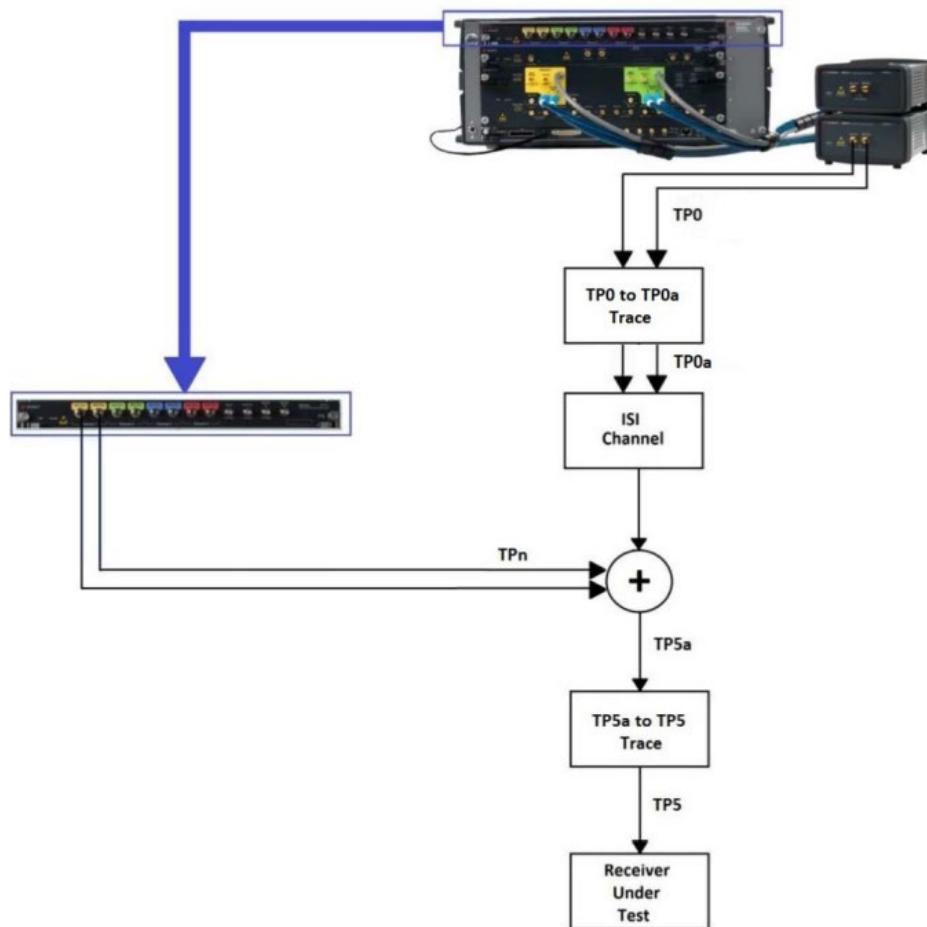


Figure 10. Setup configuration for C2C/KR Receiver Interference and Jitter Tolerance Test

Configuration Guide

The following table below shows the required equipment for each standard option under IEEE 802.3bm and 802.3by. Required Instrument configuration and required software options are listed in the following section.

Equipment Type	C2M	C2C/KR/CR
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	
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-001	Arbitrary waveform generator, 1 channel, 65 GSa/s
• M8196A-001	Arbitrary waveform generator, 1 channel, 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
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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, 1.85 mm (m) to 1.85 mm (m), 0.15 m, 699 ps delay $\pm$ 1 ps (2 for each M8057B remote head and 2 for noise injection recommended)
11636C	11636C Power Divider, DC To 50 GHz, 2.4 mm (2 required for integrated crosstalk injection for CR)
M8045A-802	Matched directional coupler pair, 50 GHz, 13 dB, 2.4 mm (for C2C and KR)
M8046A-801	Cable, length 0.5 m
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
M8049A-003	ISI channel board, seven traces from 9.1 to 22.3 inches
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

M8091BMCA -1xx	RX Conformance test application for IEEE 802.3bm
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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
• Microsoft Office 2010 or higher
• Keysight DCA-X and DCA-M oscilloscopes FW rev. A.07.00.763
• Keysight UXR oscilloscope FW rev. 11.40.00105
• MATLAB Compiler Runtime R2017a (9.2)

Remote Programming

The M8091BMCA Receiver Conformance 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 [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 [M8091BSCA Electrical Receiver Conformance Test Application for IEEE 802.3bs/cd](#) speeds up and simplifies the stress signal calibration used for testing the inputs of 200GAUI-4 and 400GAUI-8.

The [N1091CKCA Electrical TX Test Software for IEEE 802.3ck](#) (100/200/400 Gb/s for the sampling oscilloscopes offer automated transmitted testing for IEEE PAM-4 based electrical outputs.

The [D90103CKC Electrical TX Test Software for IEEE 802.3ck](#) (100/200/400 Gb/s for the real-time oscilloscopes offer automated transmitter testing for IEEE PAM4-based electrical outputs.

The [M8091CKCA Electrical Receiver Conformance Test Application for IEEE 802.3ck](#) enables accurate and repeatable receiver test procedures following the IEEE 802.3ck Draft 3.3 recommendations to ensure interoperability between datacom interfaces with a lane rate of 106 Gbps.

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.



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