

N1095BSCA Optical TX Test Software for IEEE 802.3bs/cd

Characterize IEEE 50/100/200/400 Gb/s Optical TX Designs using N109X DCA-M Oscilloscopes



The **Keysight N1095BSCA** Optical TX Test software for IEEE 802.3bs/cd is a measurement application for the DCA-M equivalent-time sampling oscilloscopes designed to save you time and money by automating the task of performing optical PAM4 transmitter (TX) test measurements

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Introduction

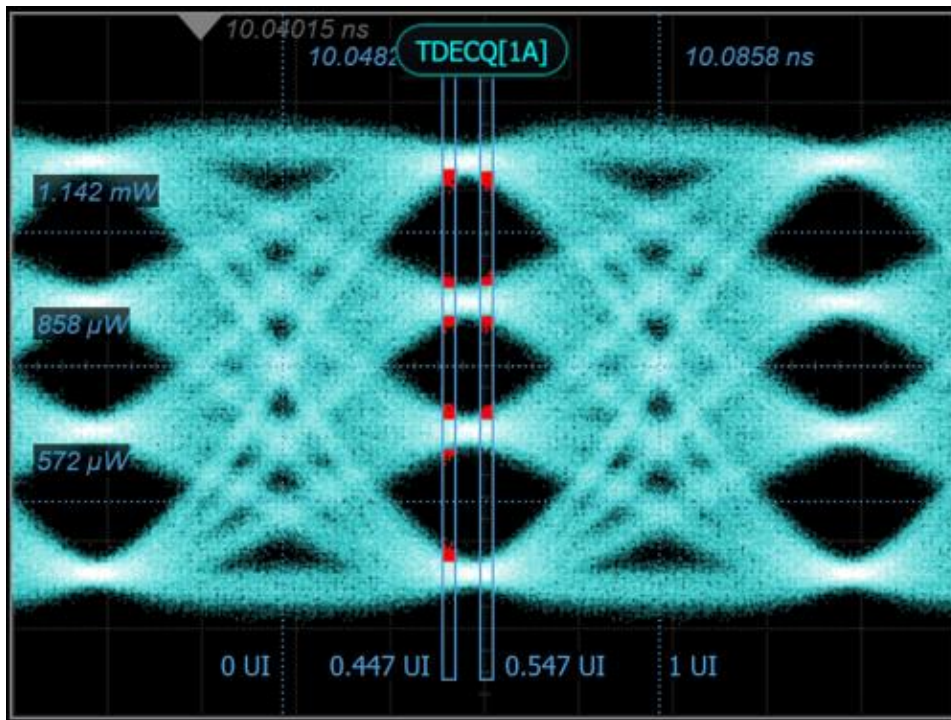
Several industry and standards bodies have adopted pulse amplitude modulation 4-level (PAM4) technology to increase throughput within a given bandwidth compared to Non-Return-to-Zero (NRZ) technology. As an example, PAM4 technology is used in 50/100/200 Gb/s designs defined by IEEE 802.3cd, and in 200/400 Gb/s designs defined in IEEE 802.3bs.

The Keysight N1095BSCA Optical TX Test software for IEEE 802.3bs/cd is a measurement application for the DCA-M equivalent-time sampling oscilloscopes designed to save you time and money by automating the task of performing optical PAM4 transmitter (TX) test measurements.

Transform Complexity into Simplicity

The N1095BSCA is an easy-to-use optical TX test application that:

1. Saves time in understanding details of standards
2. Reduces the time it takes to characterize your optical PAM4 design
3. Helps debug your device using custom configurations
4. Allows you to quickly generate HTML reports that summarize the performance of your device



Select Industry-leading Hardware

Configure your oscilloscope for single or multi-channel capability. The N1095BSCA software application supports the N1092X DCA-M Optical Reference Receiver (1-4 channels) and the N1078A Clock Recovery instrument, or the N1092A/B with integrated clock recovery. For more hardware configuration details, refer to the Ordering Guide in this document.



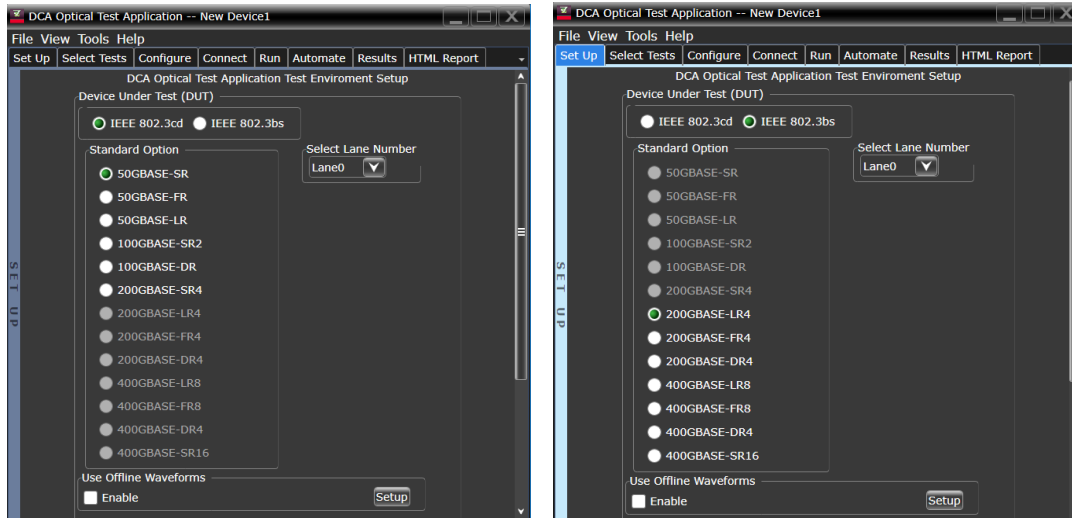
Select the Desired Software Test Suite

The N1095BSCA Optical TX Test application covers PAM4 transmitter measurements outlined in IEEE 802.3bs and IEEE 802.3cd specifications. The tests are sorted conveniently by Section.

- IEEE 802.3cd (Sections 138, 139, 140)
 - 50GBASE-SR
 - 50GBASE-FR
 - 50GBASE-LR
 - 100GBASE-SR2
 - 100GBASE-DR
 - 200GBASE-SR4
- IEEE 802.3bs (Sections 121, 122, 123, 124)
 - 200GBASE-LR4
 - 200GBASE-FR4
 - 200GBASE-DR4
 - 400GBASE-LR8
 - 400GBASE-FR8
 - 400GBASE-DR4
 - 400GBASE-SR16

Note – all “-SR” tests require N1092A Option 30A and N1077A Clock Recovery.

On the Set Up tab, select the desired test group as shown below:



The N1095BSCA test application covers most TX tests as outlined in the tables below. For a comprehensive and up-to-date list of specific tests covered by the application, download the N1095BSCA application from www.keysight.com, install it on a PC, and run the application in “Demo Mode”. No license (or hardware) is required to run the software application in “Demo Mode”.

IEEE 802.3bs 200 Gb/s and 400 Gb/s Operation

| | PAM4, 1310nm, Single-Mode | | | | | | NRZ, 850nm, MM |
|--|-----------------------------|-----------------------------|-----------------------------|------------------------------|------------------------------|-----------------------------|--------------------|
| | 200GBASE- LR4 | 200GBASE- FR4 | 200GBASE- DR4 | 400GBASE- LR8 | 400GBASE- FR8 | 400GBASE- DR4 | 400GBASE- SR16 |
| IEEE 802.3bs | | | | | | | |
| IEEE 802.3-2018 Reference | Section 122, Table 122-9 | Section 122, Table 122-9 | Section 121, Table 121-6 | Section 122, Table 122-10 | Section 122, Table 122-10 | Section 124, Table 124-6 | Section 123.7.1 |
| Nominal Baud Rate | 26.5625 GBd | 26.5625 GBd | 26.5625 GBd | 26.5625 GBd | 26.5625 GBd | 53.125 GBd | 26.5625 GBd |
| Average Optical Launch Power (TX OFF) | X | X | X | X | X | X | X |
| Signaling Rate | X | X | X | X | X | X | X |
| Average Optical Launch Power | X | X | X | X | X | X | X |
| Outer Optical Modulation Amplitude (Outer OMA) | X | X | X | X | X | X | X |
| Outer Extinction Ratio (Outer ER) | X | X | X | X | X | X | X |
| Transmitter and Dispersion Eye Closure (TDECQ) | X | X | X | X | X | X | N/A |
| Transmitter and Dispersion Eye Closure (TDEC) | N/A | N/A | N/A | N/A | N/A | N/A | X |
| Launch Power in OMA _{outer} minus TDECQ | X | X | X | X | X | X | N/A |
| Launch Power in OMA _{outer} minus TDEC | N/A | N/A | N/A | N/A | N/A | N/A | X |
| Relative Intensity Noise (RIN _{xx} OMA ¹) | X | X | X | X | X | X - Debug only | N/A |
| Difference in Launch Power between any two lanes | X | X | N/A | X | X | N/A | N/A |

IEEE 802.3cd 50 Gb/s, 100 Gb/s, and 200 Gb/s Operation

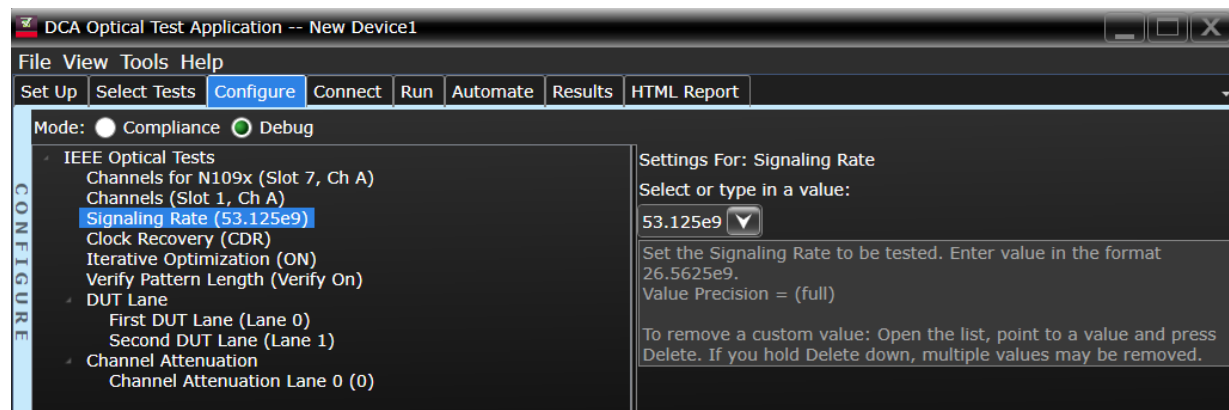
| | PAM4, 850nm, MM | PAM4, 1310nm, SM | | PAM4, 850nm, MM | PAM4, 1310nm, SM | PAM4, 850nm, MM |
|---|-----------------------------|------------------------------------|------------------------------------|-----------------------------|-----------------------------|-----------------------------|
| IEEE 802.3cd | 50GBASE- SR | 50GBASE- FR | 50GBASE- LR | 100GBASE- SR2 | 100GBASE-DR | 200GBASE- SR4 |
| IEEE 802.3cd-2018 Reference | Section 138, Table 138-8 | Section 139, Table 139- 6 | Section 139, Table 139- 6 | Section 138, Table 138-8 | Section 140, Table 140-6 | Section 138, Table 138-8 |
| Nominal Baud Rate | 26.5625 GBd | 26.5625 GBd | 26.5625 GBd | 26.5625 GBd | 53.125 GBd | 26.5625 GBd |
| Average Optical Launch Power (TX OFF) | X | X | X | X | X | X |
| Signaling Rate | X | X | X | X | X | X |
| Average Optical Launch Power | X | X | X | X | X | X |
| Outer Optical Modulation Amplitude (Outer OMA) | X | X | X | X | X | X |
| Outer Extinction Ratio (Outer ER) | X | X | X | X | X | X |
| Transmitter and Dispersion Eye Closure (TDECQ) | X | X | X | X | X | X |
| TDECQ minus 10log(Ceq) | X | X | X | X | X | X |
| Launch Power in OMAouter minus TDECQ | X | X | X | X | X | X |
| Relative Intensity Noise (RINxx OMA) ¹ | X | X | X | X | X - Debug only | X |
| Transmitter Transition Time | X | X | X | X | X | X |

Notes:

1. Compliant RIN measurements at 26 GBd require N1092X-40A, otherwise all RIN results are FYI only in Debug mode.

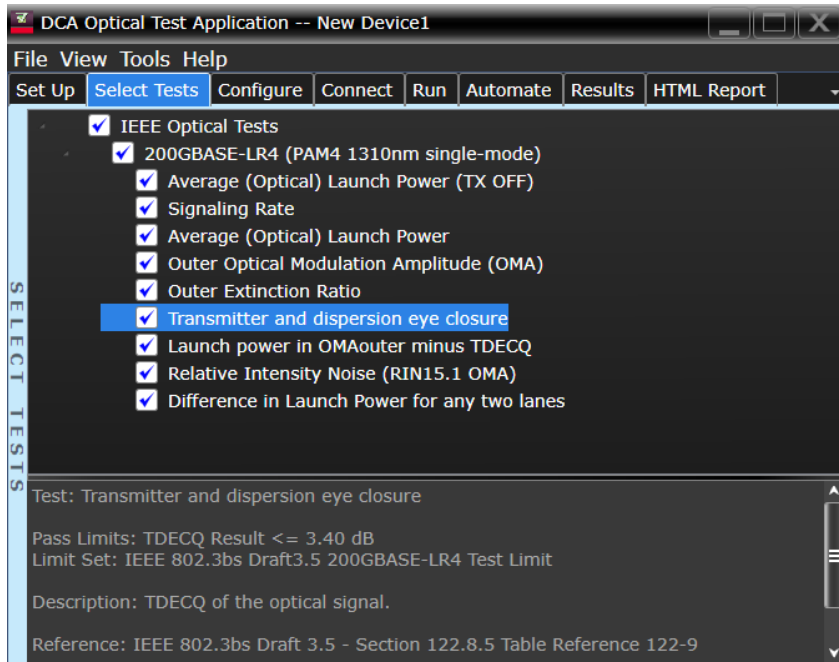
Configure Your Measurements

Customize parameters that are specific to your setup, such as signaling rate and desired TDECQ configuration. Use default values or enter your own settings including channel attenuation. Choose Compliance mode to test within limits or choose Debug mode to test to your custom limits and adjust other test parameters.



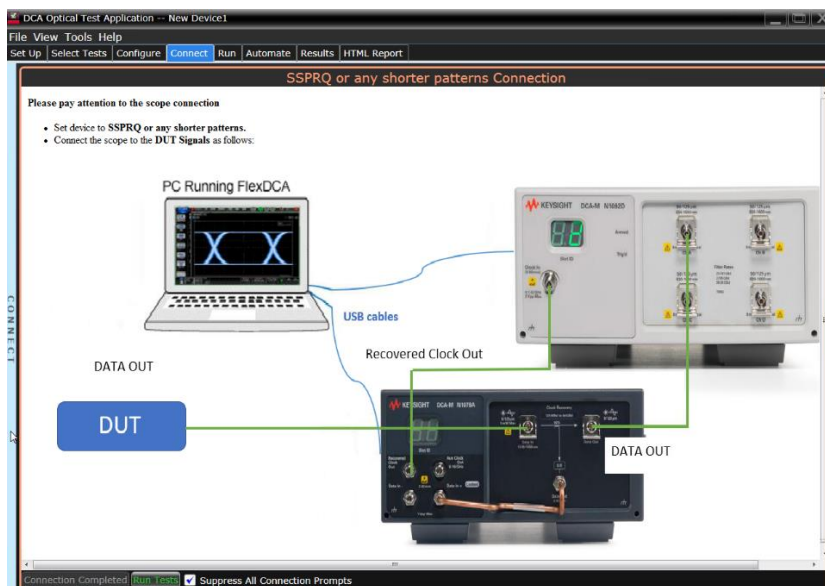
Choose Your Tests

The N1095BSCA Optical TX Test application provides comprehensive coverage of most PAM4 tests that are specific to the Section 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.



Guided Connection Diagrams for Easy Setup

Simply follow the steps to connect and configure your device under test and click Run Tests. The N1095BSCA Optical TX Test application automatically configures and controls your supported DCA-M oscilloscope.



More Features Streamline Development

Generate Reports

Your team members and your customers are interested in the performance of your device. Share a test 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.

The screenshot shows the 'HTML Report' window in the DCA Optical Test Application. The report is titled 'Test Report' and shows an 'Overall Result: PASS'. The report is organized into several sections:

- Test Configuration Details**
 - Application**
 - Name: N1095BSCA DCA Optical Test
 - Version: 0.99.9033.0
 - Device Description**
 - Spec Option: IEEE 802.3bs
 - Measurement Option: 200GBASE-LR4
 - OfflineEnable: No
 - Test Session Details**
 - FlexDCA SW Version: P.06.40.381
 - DCA Model Numbers: Frame: N1010A, Slot1: Not Present, Slot2: Not Present, Slot3: Not Present, Slot4: Not Present
 - DCA Serial Numbers: Frame: WINDOWS-DISM873, Slot1: XXXXXXXXXXXX, Slot2: XXXXXXXXXXXX, Slot3: XXXXXXXXXXXX, Slot4: XXXXXXXXXXXX
 - Debug Mode Used: No
 - Compliance Limits: IEEE 802.3bs DraR3.5 200GBASE-LR4 Test Limit (official)
 - Last Test Date: 2019-07-03 16:42:51 UTC -07:00

Control Your Device or Other Equipment

The Automation tab enables you to enter commands to control external devices or equipment, and to further sequence your tests or to control timing.

The screenshot shows the 'Automate' tab in the DCA Optical Test Application. The 'Automate' tab is active, and a 'Create Automation Commands' dialog box is open. The dialog box allows users to create automation commands by selecting a menu or application tab and a desired action.

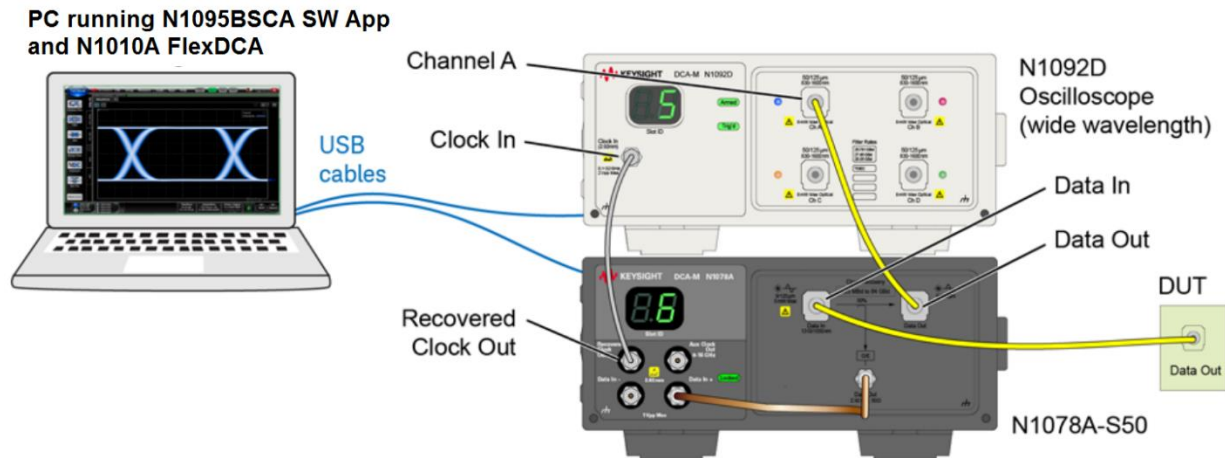
The 'Create Automation Commands' dialog box has the following options:

- Create: Single Command Entire Script
- Choose menu or application tab and select desired action:
- File Menu: Open Project from Default Location, Save Project to Default Location, Open Project from Another Location, Save Project to Another Location, Start New Project

Simple Setup

Install the N1095BSCA and N1010A FlexDCA software applications on your PC and control the DCA-M oscilloscope hardware via a USB connection.

This lets you use your PC for more processing power and other applications, or you can have all measurement capability consolidated into a compact solution.



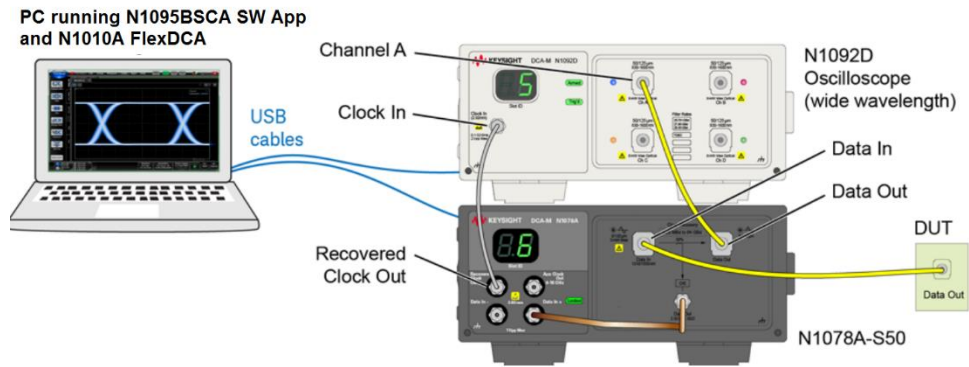
OSCILLOSCOPE COMPATIBILITY

For IEEE 802.3bs/cd Optical TX testing, you may choose a hardware combination that addresses your test needs for today, and into the future:

1. **N1092X with external clock recovery (“Two-Box” solution)
(covers both Multimode and Single-mode applications)**
 - a. N1092A/B/C/D/E DCA-M Sampling Oscilloscope (pick ONE)
 - i. Option 30A – required for SR/SR2/SR4 (Multimode) testing
 - ii. Option 40A – recommended for single-mode only applications.
 - b. Clock Recovery (pick ONE)
 - i. N1077A Optical/Electrical Clock Recovery for Single-Mode and Multimode testing to 32 GBd
 - Required for SR/SR2/SR4 (Multimode) testing
 - ii. N1078A Optical/Electrical Clock Recovery for Single-Mode only testing to 32 GBd or 64 GBd
 - Required for testing at 53 GBd.
2. **N1092A/B with integrated clock recovery (“One-Box” solution)
(covers 26/53 GBd Single-mode applications)**
 - a. N1092A/B DCA-M with integrated CDR (Required options LOJ, PLK, IRC, 40A, CDR)

Solution 1: Keysight N1092X DCA-M Optical Reference RX + N1077A/N1078A Clock Recovery

1. Covers both single-mode and multimode applications (with N1077A CR)
2. Flexible configuration (external clock recovery)
3. Scalable

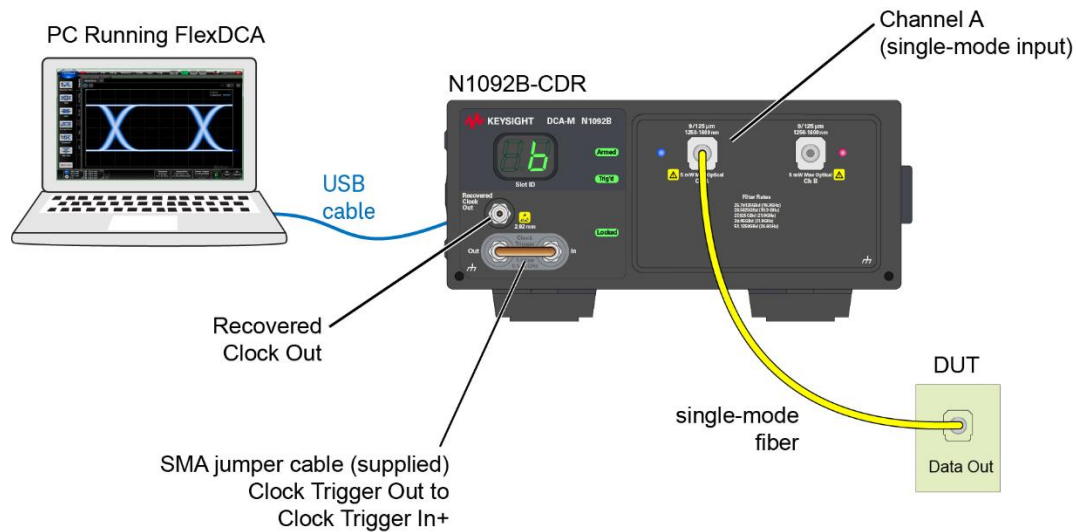


Equipment Configuration:

| | Software Model No. (For User-Supplied PC) | Software Options (Install On PC, Or Use Fixed SW Licenses for the DCA-M) | |
|---|--|--|-----------------------|
| Optical TX test using digital communications analyzer (DCA-M) | N1010A FlexDCA | FlexDCA FW Rev 6.4 or later equipped with N1010100A R&D Package (or equivalent licenses as shown below): 1. PAM4 measurements require: N1010100A, N1010200A, or legacy option 9FP/9TP (Pick ONE) 2. NRZ-TDEC measurements require: N1010100A, N1010200A, or legacy option 500/TFP (Pick ONE) 3. RIN measurements require: N1010100A or legacy option 200 (Pick ONE) | |
| | N1095BSCA | Optical TX Test SW for IEEE 802.3bs/cd | |
| | Keysight IO libraries | Rev 16.3 or later, automatically installed with FlexDCA installation | |
| | DCA-M Model No. (Pick One) | DCA-M Options | # Of Optical Channels |
| | N1092A | Required: LOJ, PLK, IRC, and either 30A (SM+MM) or 40A (SM only); Optional: FS1 | 1 |
| | N1092B | Required: LOJ, PLK, IRC, and either 30A (SM+MM) or 40A (SM only); Optional: FS1 | 2 |
| | N1092C | Required: LOJ, PLK, IRC, and either 30A (SM+MM) or 40A (SM only); Optional: FS1 | 1 |
| | N1094D | Required: LOJ, PLK, IRC, and either 30A (SM+MM) or 40A (SM only); Optional: FS1 | 4 |
| | N1094E | Required: LOJ, PLK, IRC, and either 30A (SM+MM) or 40A (SM only); Optional: FS1 | 2 |
| | Clock Recovery Model No. (Pick ONE) | Clock Recovery Options (Pick ONE) | |
| N1077A | 232 (for Single-Mode or Multimode applications). Required for SR/SR2/SR4 applications. | | |
| N1078A | 232/264 (for Single-Mode only; not applicable for Multimode applications) | | |
| Accessories | | | |
| N1027A-78A or N1078A-CR1 | Clock Recovery Phase Matching Kit for N1078A Optical (Recommended but optional) | | |

Solution 2: Keysight N1092A/B DCA-M Optical Reference RX with integrated Clock Recovery (Option CDR)

1. Covers all single-mode applications
2. Lowest cost
3. Scalable



| Optical TX test using digital communications analyzer (DCA-M) | Software Model No. (For User-Supplied PC) | Software Options (Install On PC, Or Use Fixed SW Licenses for the DCA-M) | |
|---|--|---|-----------------------|
| | N1010A FlexDCA | FlexDCA FW Rev 6.4 or later equipped with N1010100A R&D Package (or equivalent licenses as shown below): 1. PAM4 measurements require: N1010100A, N1010200A, or legacy option 9FP/9TP (Pick ONE) 2. RIN measurements require: N1010100A or legacy option 200 (Pick ONE) | |
| | N1095BSCA | Optical TX Test SW for IEEE 802.3bs/cd | |
| | Keysight IO libraries | Rev 16.3 or later, automatically installed with FlexDCA installation | |
| | DCA-M Model No. (Pick One) | DCA-M Options | # Of Optical Channels |
| | N1092A | Required: LOJ, PLK, IRC, 40A, CDR; Optional: FS1 | 1 |
| N1092B | Required: LOJ, PLK, IRC, 40A, CDR; Optional: FS1 | 2 | |

Ordering Information

The N1095BSCA Optical TX Test SW for IEEE 802.3bs/cd may be licensed using any of four different methods. Choose a license type and term that best suits your requirements:

License Types:

1. **Node-locked:** Allows you to use the license on one specified instrument or computer.
2. **Transportable:** Allows you to move the license from one instrument or computer to another using Keysight's online tool.
3. **USB portable:** Allows you to move the license from one instrument or computer to another with a certified USB dongle.
4. **Floating:** Allows you to access the license on networked instruments or computers from a server, one at a time.

License Terms:

Each of the license types are offered as perpetual (licenses can be used indefinitely) or time-based (licenses can be used through the term of the license: 6, 12, 24, or 36 months).

For more information, visit: KeysightCare Software Support Subscriptions, 5992-3419EN.

Required Software Options

The N1095BSCA software requires that the N1010100A R&D Package (or equivalent licenses, see table below) be licensed on the platform.

1. N1010100A R&D Package for FlexDCA (recommended)
- or
2. Equivalent combination of licenses outlined in the table below:

| Measurement Type | Subscription License | | Legacy License | | | |
|------------------|----------------------|-----------|----------------|-----|-----|-----|
| | N1010100A | N1010200A | 9FP/9TP | TF9 | 500 | 200 |
| PAM4 | ✓ | ✓ | ✓ | | | |
| NRZ-TDEC | ✓ | ✓ | | ✓ | ✓ | |
| RIN | ✓ | | | | | ✓ |

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