N1091DJPA DCA Electrical Transmitter Test Software for IEEE802.3dj

Characterize IEEE 200 Gb/s Electrical TX Designs using DCA-X Equivalent-Time Sampling Oscilloscope

Introduction

IEEE standard associations have defined specifications for 200 Gb/s and over one lane on the Physical Medium Attachment (PMA) Sublayer & Physical layer. As an example, chip-to-chip or chip-to-module interface of 200/400/800 Gb/s, and 1.6 Tb/s designs, or backplane (KR) or shielded balanced copper cabling (CR) defined by IEEE 802.3dj.

The Keysight N1091DJCA IEEE 802.3dj software is a measurement application for the DCA-X equivalent-time sampling oscilloscopes designed to save time and money by automating 106Gbaud PAM4 transmitter (TX) test measurements using a half-rate measurement setup.

KEYSIGHT

Transform Complexity into Simplicity

The N1091DJPA is half-rate validation solution (not conformance) on the DCA platform, that:

- Saves time in understanding details of IEEE802.3dj standards
- Accelerating DJ characterization from setup to results
- Supporting debug mode with flexible configurations
- Automating critical DJ analysis steps for repeatable measurements
- Producing ready-to-share HTML reports that summarize device performance

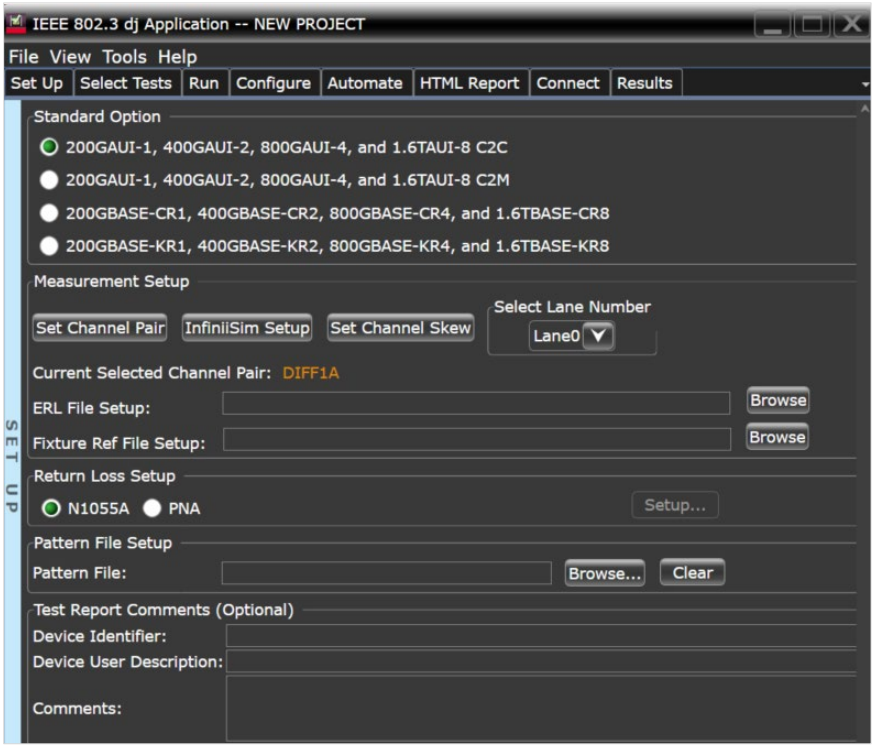


Figure 1. N1091DJPA IEEE802.3dj application

Select Industry-Leading Hardware

Configure your DCA-X for single- or multi-channel operation. The N1091DJPA application supports the N1000A DCA-X wide-bandwidth oscilloscope platform with the N1046A 1/2/4-port remote heads, optimized for half-rate PAM4 transmitter measurements.

Refer to the Ordering Guide in this document for supported hardware configurations.

Figure 2. N1000A DCA-X Wide-Bandwidth Oscilloscope Mainframe and N1046A 75/85/100 GHz Electrical Remote Sampling Head Module

Select the Desired Software Test Suite

The N1091DJPA IEEE 802.3dj application provides a structured set of PAM4 transmitter DJ validation measurements aligned with IEEE 802.3dj specifications. Tests are conveniently organized by clause, allowing users to select a desired test group and automatically load the corresponding measurements in the Select Tests view (factory-installed options shown).

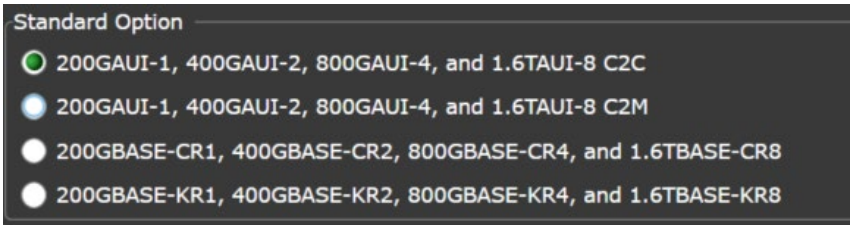


Figure 3. Standard test options of the N1091DJPA IEEE 802.3dj application

The N1091DJPA application includes a comprehensive set of transmitter DJ validation tests defined in IEEE 802.3dj. For the most up-to-date list of supported tests and options, download and run the N1091DJPA application in Demo Mode, which allows software exploration without requiring a license.

IEEE 802.3dj 200 Gb/s, 400 Gb/s, 800 Gb/s and 1.6T/s Operation

IEEE Reference	Description
176C.6.3	200GAUI-1, 400GAUI-2, 800GAUI-4 and 1.6TAUI-8 C2C transmitter electrical characteristics
176D.6.3	200GAUI-1, 400GAUI-2, 800GAUI-4 and 1.6TAUI-8 C2M Host output characteristics
176D.6.4	200GAUI-1, 400GAUI-2, 800GAUI-4 and 1.6TAUI-8 C2M Module output characteristics
179.9.4	Transmitter characteristics, 200GBASE-CR1, 400GBASE-CR2, 800GBASE-CR4 and 1.6TBASE-CR8
178.9.2	Transmitter characteristics, 200GBASE-KR1, 400GBASE-KR2, 800GBASE-KR4 and 1.6TBASE-KR8

Measurement Workflow and Reporting

N1091DJPA provides an application-driven workflow that guides users from test selection and measurement configuration through execution, results review, and automated HTML report generation for efficient PAM4 transmitter DJ validation.

Configure Your Measurements

The Configure tab enables customization of DJ validation parameters specific to the test setup, including signaling rate, clock recovery source selection and acquisition control. Users can adjust pattern length, samples per UI, interpolation and averaging settings, eye-related response filters, and coefficient test parameters to support consistent standard-aligned measurements as well as detailed debug analysis.

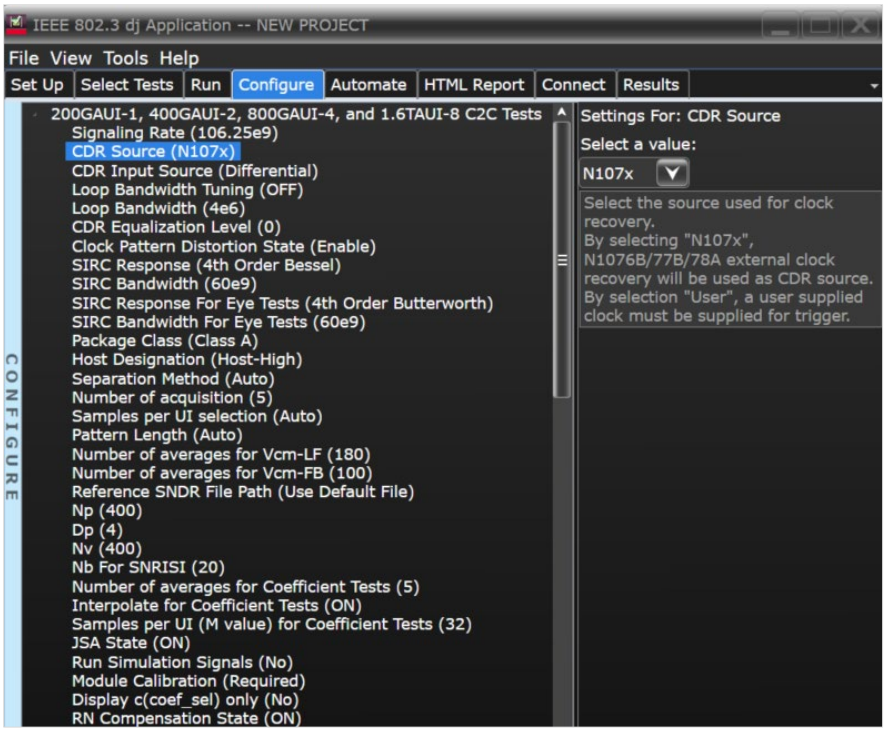


Figure 4. Configuration page of N1091DJPA IEEE802.3dj TX test application

Choose Your Tests

The N1091DJPA IEEE 802.3dj application provides organized access to PAM4 transmitter DJ validation measurements, grouped by IEEE 802.3dj clauses and test categories. Users can select all tests, a group of tests, or individual measurements to run, with full test names displayed consistently in the test list, results, and HTML reports. Each test includes a brief description and a reference to the corresponding IEEE 802.3dj specification to aid test selection and analysis.

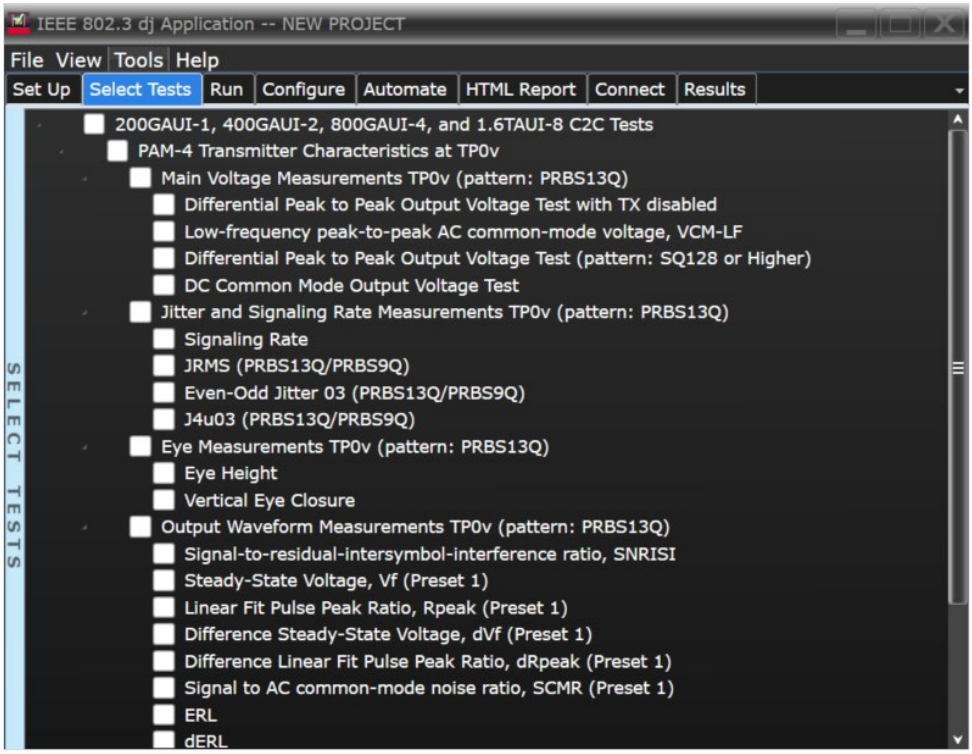


Figure 5. Clause-based test groups selected in the N1091DJPA IEEE 802.3dj application

Guided Connection Diagram for Easy Setup

The Connection tab provides clear guidance for connecting the device under test, illustrating both full-rate and half-rate signal paths to the DCA-X. The half-rate path requires an additional Keysight Clock Data Recovery (CDR) solution, after which the N1091DJPA application automatically configures and controls the supported DCA-X hardware for DJ validation measurements.

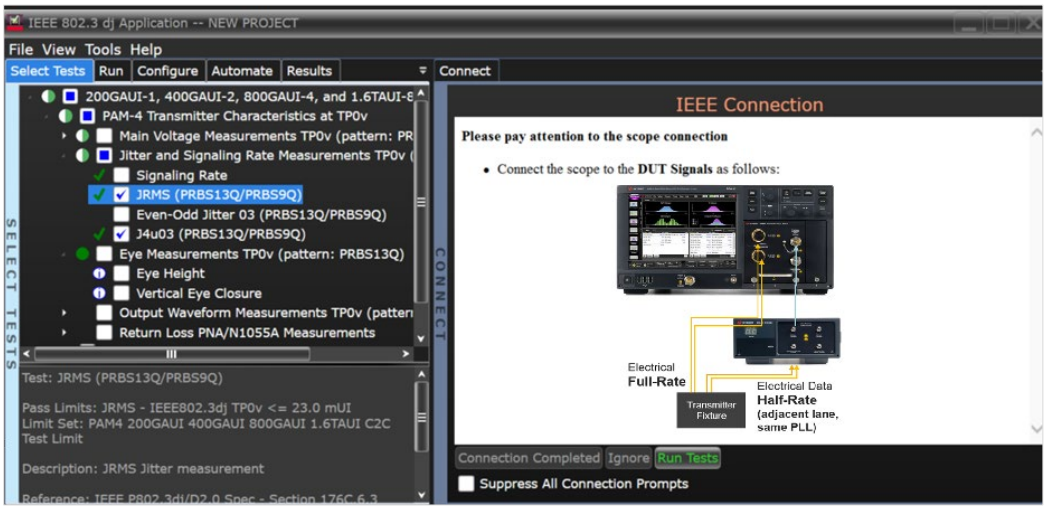


Figure 6. Connection diagram in the N1091DJPA IEEE 802.3dj application, including full-rate and half-rate paths (CDR required for half-rate)

View Result and Generate Reports

The Results tab displays measured values, limits, and pass/fail status for each selected test, along with detailed measurement information and waveform views. The HTML Report tab generates a consolidated report that captures test configuration details, overall results summary, and test measurement data with graphical views, enabling easy review and sharing of results.

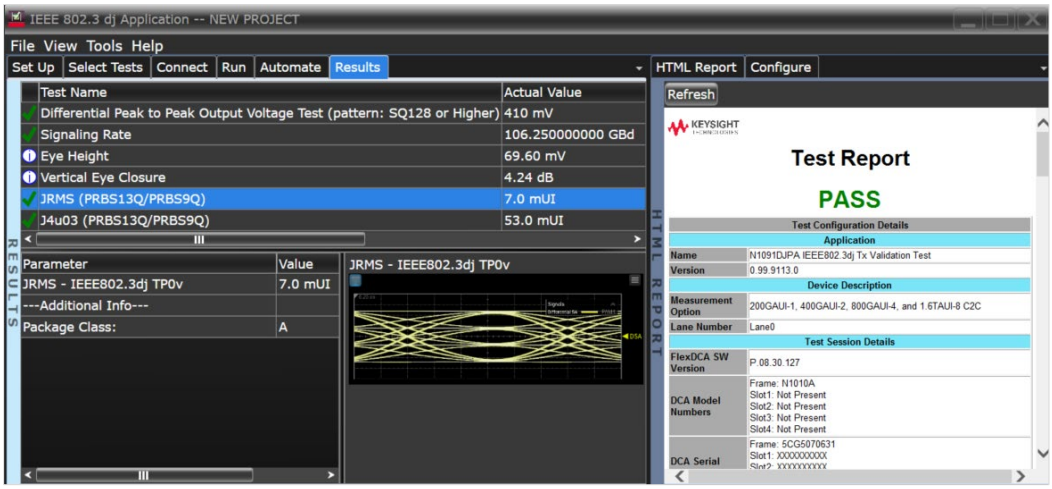


Figure 7. Measurement results and HTML report in the N1091DJPA IEEE 802.3dj application

Configure Your Solution in Three Ways

The N1091DJPA application offers flexible hardware and software deployment options to match different lab environments and workflows. The application can be configured in the following ways:

1. N1000A DCA-X runs the N1091DJPA application locally and controls remote PNA via LAN
2. PC runs the N1091DJPA application and controls remote N1000A DCA-X, PNA via LAN
3. PC runs both the N1091DJPA and N1010A FlexDCA software applications and controls remote N1000A DCA-X and PNA via LAN.

Figure 8. PC runs both DCA time-equivalent oscilloscope and PNA via LAN

This flexible architecture allows users to leverage a PC for additional processing power and multitasking, or to consolidate all measurement capability within the DCA-X platform for a compact, integrated solution.

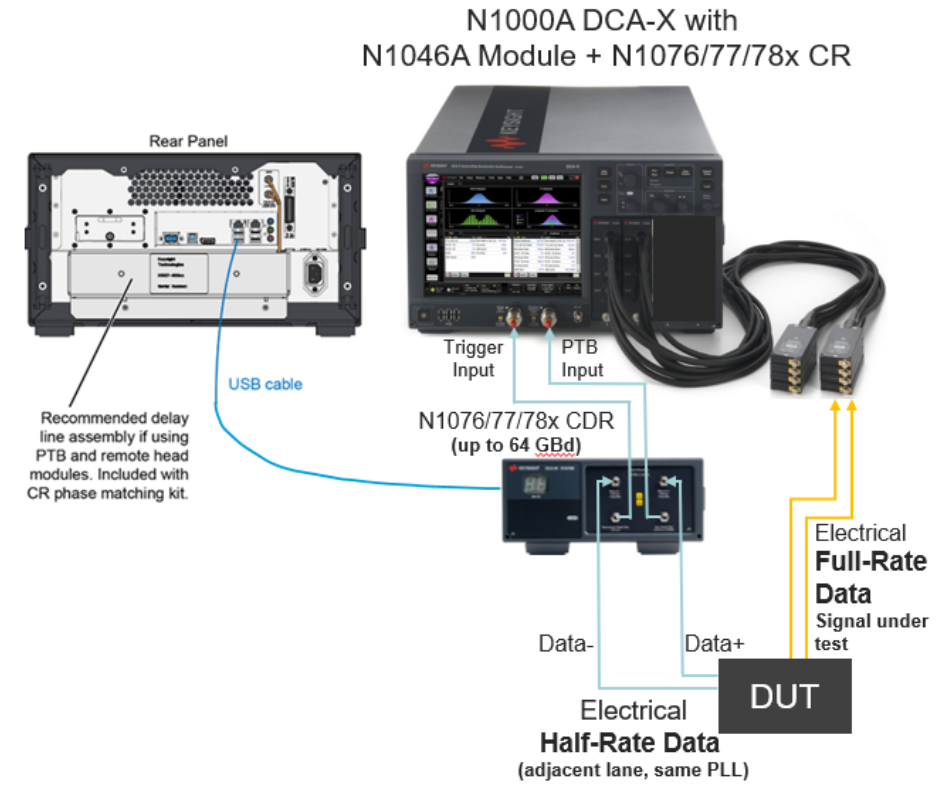
Oscilloscope Compatibility

Keysight provides flexible DCA-based electrical test solutions to support current and emerging high-speed PAM4 interfaces.

For IEEE 802.3dj DJ validation, the N1091DJPA application supports the following hardware configurations:

1. N1000A DCA-X with DCA module and external clock recovery – recommended
2. N1000A DCA-X with N1060A and external clock recovery

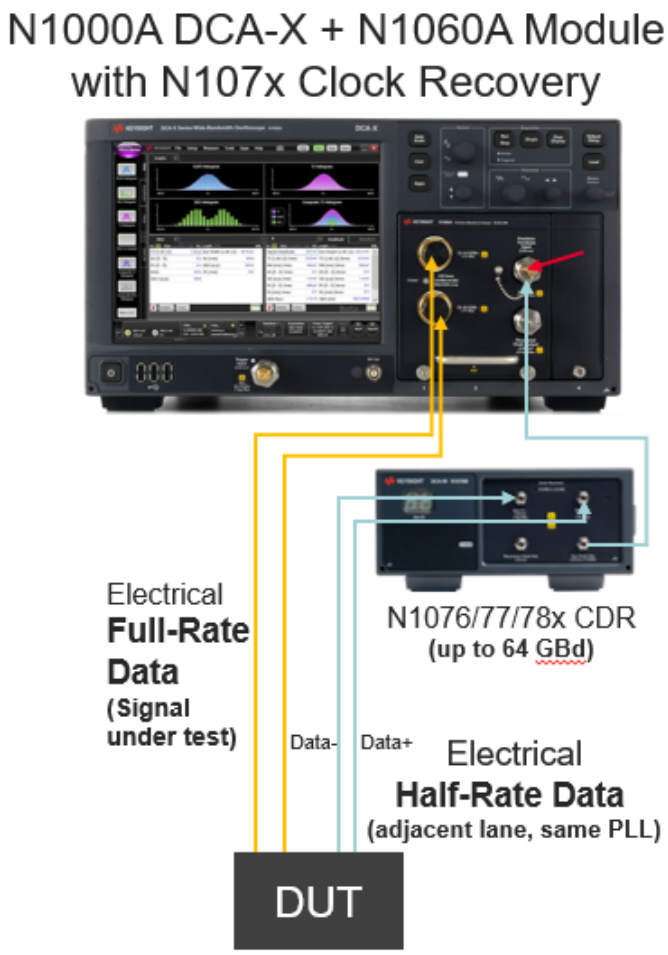
Solution 1: Keysight N1000A DCA-X Mainframe with DCA Module + External Clock Recovery (Recommended)



Mainframe Model No.	Mainframe Hardware Options	Mainframe Software Options (Fixed or Transportable Licenses)
N1000A DCA-X	Required: PLK/LOJ/PTB (N1000A)	Required: N1010100A[1]
Plug-in Module Model Number	**Plug-in Module Options**	**Max # of Modules/Diff Channels[2]**
N1046A	72F, 74F, 82F, 84F, 12F, 14F (any 2 or 4 channel config)	4/8
Clock Recovery Model No. (Pick One)	**Clock Recovery Options**	
N1076B	264, EVA	
N1077B	264, EVA	
N1078A	264, EVA	
Software		
N1091DJPA	DCA Electrical Transmitter Test Software for IEEE802.3dj	
N1010A	FlexDCA FW Rev 8.30.140 or later (included with N1000A mainframe)	
Keysight IO libraries	Rev 18.3 or later, automatically installed with FlexDCA installation	
Accessories [3,4]		
N1027A-76B	Clock Recovery Phase Matching Kit for use with N1046A remote head and N1076B, N1077B and N1078A CR	
Mode (Return Loss)	**Description**	
N1055A TDR/TDT	50 GHz 4 Port TDR/TDT Remote Sampling Head for the N1000A DCA-X (option 54F or 54M) equipped with N1010300A SW licenses[5]	
Network Analyzer	4-port PNA's equal or greater than 67 GHz (e.g. N5247B)	

1. A renewable FlexDCA support subscription is required with a minimum software version of 2025.1201. For F-JSA, a renewable FlexDCA support subscription with a minimum version of 2023.0215 is required.
2. The application supports modules installed in slots 1, 2, 3, or 4. Measurements are performed on one lane (differential pair) at a time, with lane selection configurable within the application.
3. A pair of 100-MHz low-pass hardware filters is required for the low-frequency peak-to-peak AC common-mode voltage (VCM-LF) measurement. These filters are not supplied by Keysight Technologies and must be sourced from a third-party vendor
4. For detailed guidance on clock-to-data delay matching, refer to the Keysight N107X-Series Clock Recovery DCA-M User Guide
5. F-ESP is required to enable extended S-parameter support up to 70 GHz. A renewable FlexDCA support subscription is required, with a minimum software version of 2024.0615

Solution 2: Keysight N1000A DCA-X Mainframe with N1060A and External Clock Recovery



Mainframe Model No.	Mainframe Hardware Options	Mainframe Software Options (Fixed or Transportable Licenses)
N1000A DCA-X	Required: PLK/LOJ (N1000A) Optional: PTB (not used with N1060A)	Required: N1010100A[1]
Plug-in Module Model No.	**Plug-in Module Options**	**Max # of Modules/Diff Channels**
N1060A	Required: PTB, JSA, EVA, 264, 085	1/1
Clock Recovery Model No. (Pick One)	**Clock Recovery Options**	
N1076B	264, EVA	
N1077B	264, EVA	
N1078A	264, EVA	
Software		
N1091DJPA	DCA Electrical Transmitter Test Software for IEEE802.3dj	
N1010A	FlexDCA FW Rev 8.30.140 or later (included with N1000A mainframe)	
Keysight IO libraries	Rev 18.3 or later, automatically installed with FlexDCA installation	
Accessories [2,3]		
N1027A-76B	Clock Recovery Phase Matching Kit for use with N1076B, N1077B and N1078A CR (Half-rate line)	
Mode (Return Loss)	**Description**	
N1055A TDR/TDT	50 GHz 4 Port TDR/TDT Remote Sampling Head for the N1000A DCA-X (option 54F or 54M) equipped with N1010300A SW licenses[4]	
Network analyzer	4-port PNA's equal or greater than 67 GHz (e.g. N5247B)	

1. A renewable FlexDCA support subscription is required with a minimum software version of 2025.1201. For F-JSA, a renewable FlexDCA support subscription with a minimum version of 2023.0215 is required.
2. A pair of 100-MHz low-pass hardware filters is required for the low-frequency peak-to-peak AC common-mode voltage (VCM-LF) measurement. These filters are not supplied by Keysight Technologies and must be sourced from a third-party vendor
3. For detailed guidance on clock-to-data delay matching, refer to the Keysight N107X-Series Clock Recovery DCA-M User Guide
4. F-ESP is required to enable extended S-parameter support up to 70 GHz. A renewable FlexDCA support subscription is required, with a minimum software version of 2024.0615

Ordering Information

The N1091DJPA DCA Electrical Transmitter Test Software for IEEE802.3dj 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. Three types of floating license are available:
    a. **Single Site:** 1-mile radius from the server
    b. **Single Region[1]:** Americas; Europe; Asia;
    c. **Worldwide:** export restriction identified in END User License Agreement (EULA)

License Terms:

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

KeysightCare Software Support Subscription:

- Perpetual licenses are sold with a 12 (default), 24, 36, or 60-month KeysightCare software support subscription
- Software subscription licenses include KeysightCare Software Support through the term of the license

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

Required Software Options

The N1091DJPA software requires the N1010100A R&D Package license on the platform.

Optional N1010300A Signal Integrity Package enables F-ESP (Extended S-Parameter) support for N1055A return-loss testing.

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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