

D9040DPPC DisplayPort Electrical Performance Validation and Compliance Software

Keysight Technologies, Inc. DisplayPort Electrical Performance Validation and Compliance software for Infiniium Series oscilloscopes provides you with a fast and easy way to verify and debug your DisplayPort™ interface designs for source and sink ICs, motherboard systems, computers and graphics cards and now supports the DisplayPort 1.4a specification.



Features

The DisplayPort Electrical Performance Validation and Compliance software is a full-featured package to simplify the validation process of DisplayPort designs:

- Covers RBR, HBR, HBR2 and HBR3 Main Link speeds and AUX Channel
- Supports DP, mDP and USB-C® connectors
- Full test automation with AUX Channel Controller
- Setup wizard for guided configuration and test selection
- Optional switch control for unattended automation
- Supports D9010AGGC Compliance Test Measurement Server

Comprehensive Test Coverage

Part of the difficulty of performing electrical tests for DisplayPort is connecting the oscilloscope to the target device, defining the capabilities of the device under test, configuring the instrument for measurements, executing test procedures, and then comparing the results against the specification. The DisplayPort Electrical Performance Validation and Compliance software does all of this work for you. In addition, if you discover a problem with your device, debug tools are available to aid in root cause analysis.

D9040DPPC is especially suitable for Authorized Test Centers. It allows users to execute DisplayPort electrical checklist tests as well as employ the software as a characterization tool.

Easy Test Setup

The DisplayPort Electrical Performance Validation and Compliance software extends the ease-of-use advantages of Keysight's Infiniium Series oscilloscopes to testing DisplayPort designs. The Keysight automated test engine walks you quickly through the steps required to define the device under test, to select the tests, set up the tests, perform the tests, and view the test results. You can pick high-level test parameters to suit your test process objectives, and you can then proceed to select the full test suite at once, or specify individual tests.

The user interface is oriented to minimize reconnections, which saves you time and minimizes potential for operator error. You can save tests and configurations as project files and recall them later for quick testing and review of previous test results. The intuitive graphical user interface lets you perform tests with a minimum of mouse clicks.

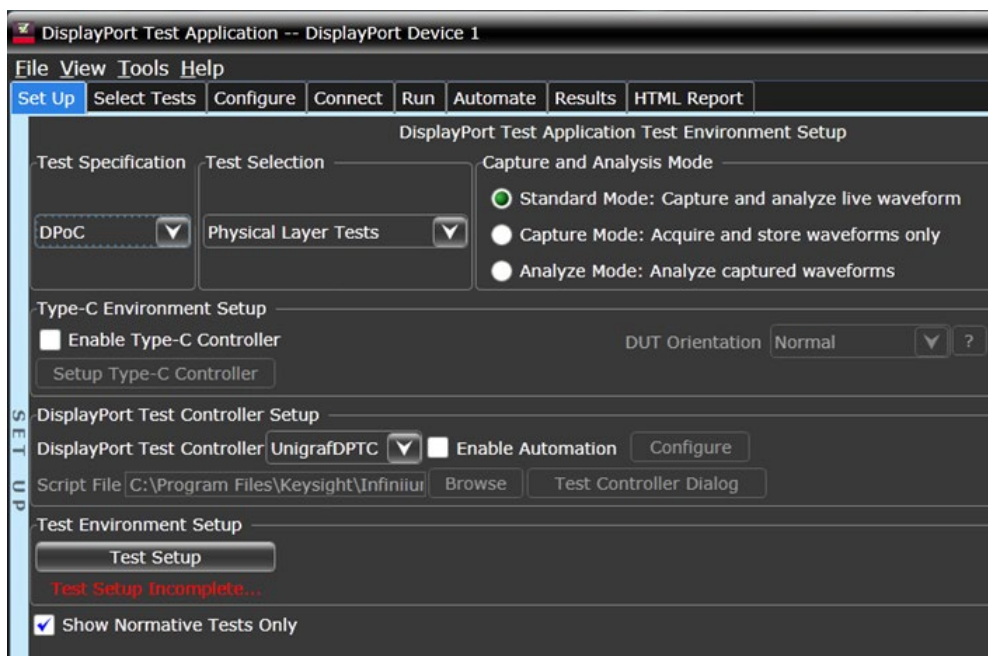


Figure 1. D9040DPPC Setup Screen

This screen enables selection of the DisplayPort Compliance test specification, for instance, DP1.4a or DPoC1.4a (DisplayPort over Type-C) and test suite categories for various DP validation tasks, including Main Link Physical Layer Tests (shown), AUX Channel and Inrush Test, and characterizations such as CTLE sweep found in Test Tools.

Next, you can control the test flow. Standard Mode will capture waveforms and process them sequentially, whereas Capture Mode will save waveforms on the scope hard-drive to process later with Analyze Mode.

USB Type-C Control

The DisplayPort Electrical Performance Validation and Compliance software fully controls devices that incorporate the USB Type-C connector with the **Keysight N7018A Type-C Test Controller**. The N7018A is required to place the DUT into DisplayPort Alternate Mode and to establish a power delivery (PD) contract, which allows the product to provide or consume power at different voltage/current ratings.

The N7018A supports two DisplayPort Alternate Modes: “DP 2+2”, where two lanes are reserved for DisplayPort and the other two lanes are reserved for USB 3.2, and “DP 4 Lane”, where all four lanes are reserved for DisplayPort. Combined with a power supply from the Keysight N67xxx family, the N7018A Type-C test controller lets you configure your DUT for any power role: consumer or provider. Figure 2 below shows the USB Type-C configuration process.

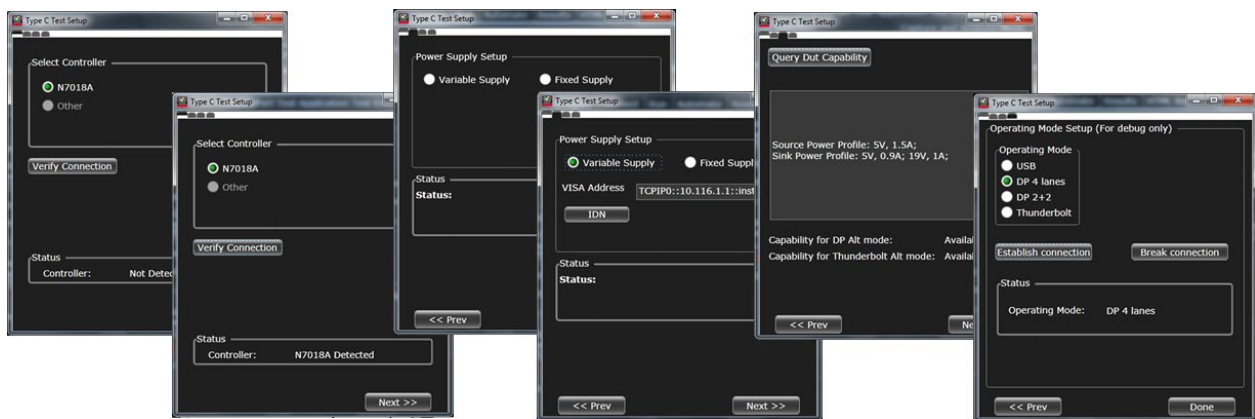


Figure 2. Enabling USB Type-C: Interactive setup connection of Type C controller, power supply connection and DUT query for supported Alternate Modes and PD contracts.

Test Automation over the Auxiliary Channel

DisplayPort Test Mode, optional but highly recommended for compliance testing, enables full control of the Main Link via transactions over the DisplayPort Auxiliary (AUX) Channel. This allows to configure the DP Source DUT for the desired number of lanes, data rate and SSC state, and to transmit the test pattern required for a particular test item.

To leverage this powerful capability, the DisplayPort Electrical Performance Validation and Compliance software fully integrates Unigra’s DisplayPort AUX channel controller DPR-100. With the help of a convenient menu shown in Figure 3, you can easily configure the DisplayPort test software to control Unigra’s DPR-100 to communicate with your DUT. More information of the DPR-100 is provided in the Ordering Information section.

In addition to Test Mode, the DisplayPort Electrical Performance Validation and Compliance software also supports Link Training Mode, which instead of using test patterns, guides the DP Source DUT through the DisplayPort link training state machine to imitate the link training process in a real link.

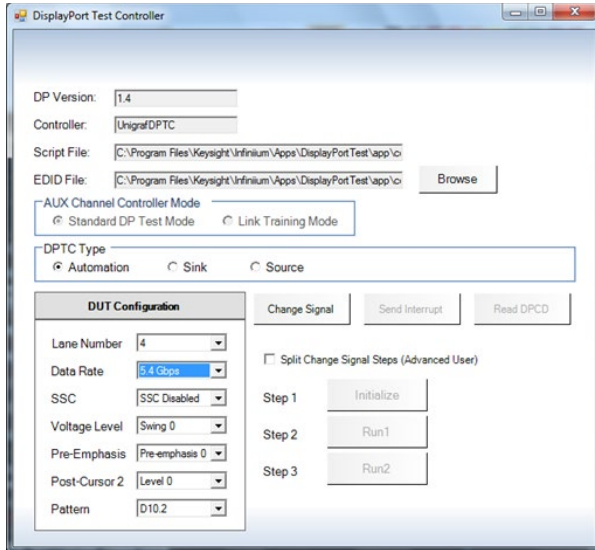


Figure 3. AUX Channel Controller GUI for verification of control DUT

Test Setup

The Test Setup section shown in Figure 4 lets the user enter which tests to run: Differential, Single-Ended or Both, and the DUT capabilities: lane configuration, bitrates, drive settings, etc. which are needed in order to create the test plan. The user will be alerted in case the configuration entered is invalid.

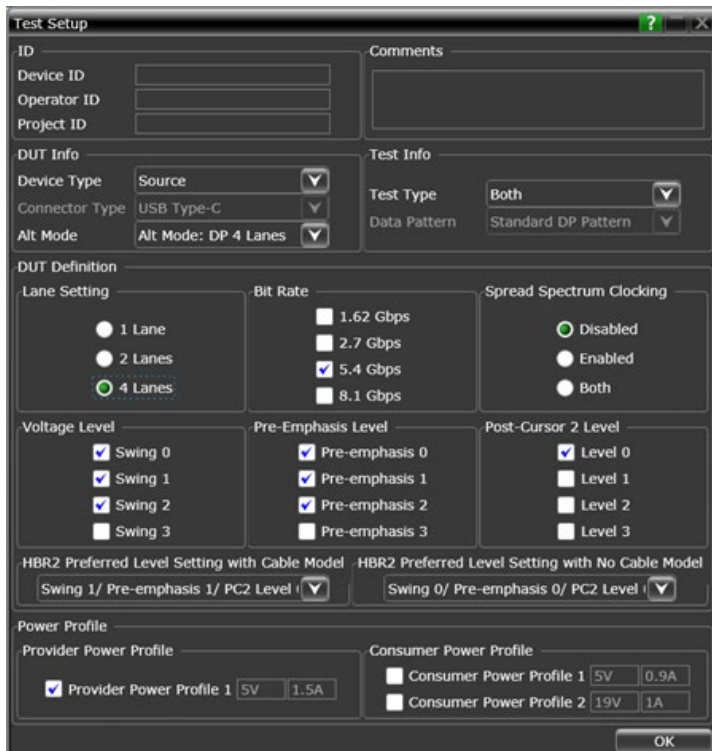


Figure 4. Test Setup screen for setting up the DUT capabilities.

The bottom section exists to enable characterization of DisplayPort alt mode devices, and in particular if the validation engineer wants to sweep the Power Delivery Objects (PDOs) that are valid for the device under test. Such a procedure allows to run any test vs each PDO supported.

Connection Setup

After entering the DUT capabilities, the user must define the connection to the oscilloscope by clicking on the Connection Setup button. Upon so doing, the screen on Figure 5 will be shown. The DisplayPort Electrical Performance and Validation software supports multiple TPAs and, if the vendor provides the s-parameters for their product, it allows to de-embed these fixtures. With the Keysight N7015A Type-C fixture, Keysight has de-embed files for the TPA itself as well as with cables that extend reach. If a proprietary fixture is desired to be used, it can be handled as “Other” and a de-embed file can be provided. The configuration options available will depend on the test type selected in the Test Setup dialog and the number of lanes supported by the DUT. If using single-ended connections, only two lanes at a time can be connected to the oscilloscope. With differential probes, all four lanes can be connected to the oscilloscope at the same time, which helps the test operator save time making reconnections.

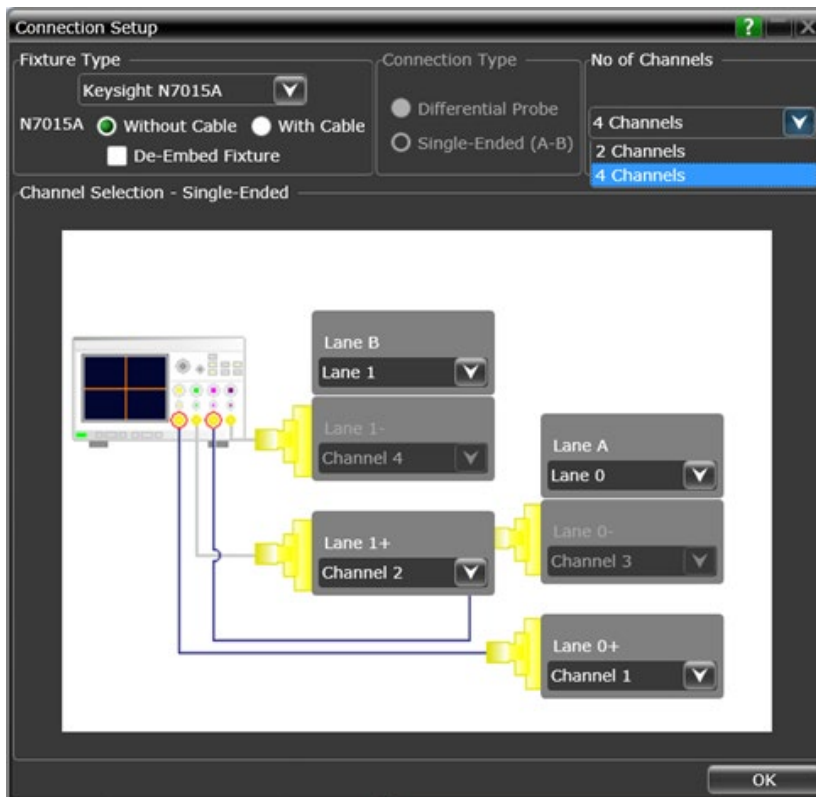


Figure 5. Connection Setup

Test Selection

After defining the test environment, you are presented with only those tests that are appropriate for the environment chosen. For instance, if spread spectrum clocking (SSC) is not enabled, then no SSC tests will appear. This is the case for the optional settings of pre-emphasis and levels as well. If your device definition is one lane only, or your defined device connection is one lane (one differential probe or two single-ended connections) then no inter-pair skew tests will appear in the test suite. This dynamic filtering simplifies your job by ensuring you attempt to test only what is possible for the DUT and the connection model you have chosen.

The DP 1.4a test suite is shown in the Test Selection screen shown in Figure 6. Test items are grouped in a way to minimize the total test time avoiding unnecessary DUT re-configuration steps.

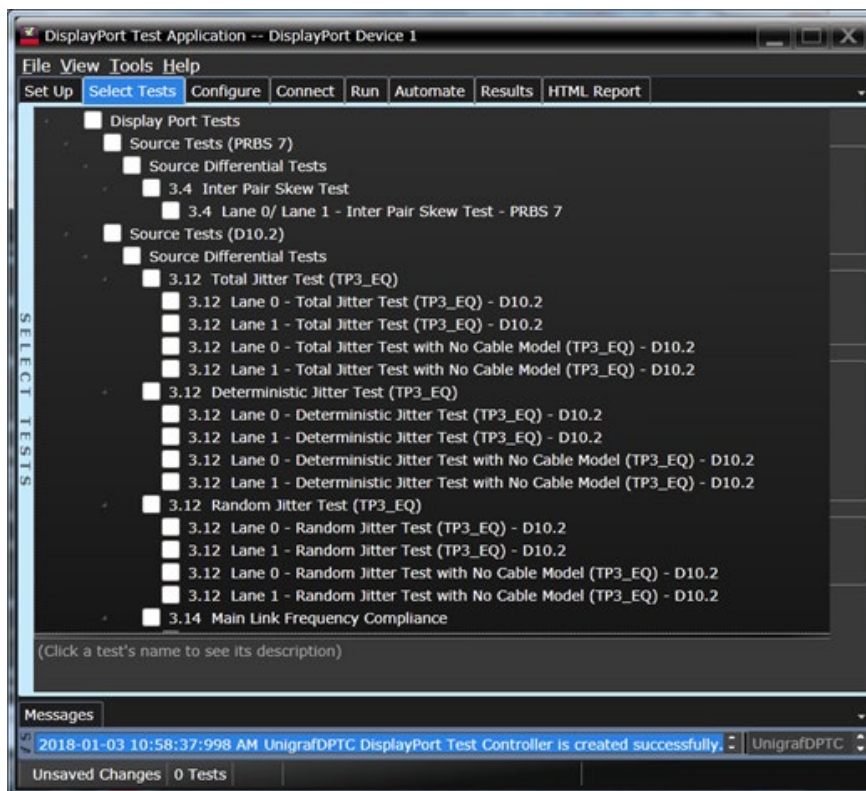


Figure 6. Full DP1.4a test suite

Configurability and Guided Connection

The DisplayPort Electrical Performance Validation and Compliance software provides flexibility in your test setup. It guides you to make connection changes with connection diagrams when the tests you select require it. For test parameters such as bandwidth, you can select appropriate values. For more critical parameters, such as mask scaling option or number of edges for analysis, default values are tied to the compliance standard; these values can only be altered in the debug screen. In Figure 7 you can see the selection for equalization. The application has default values it uses, however, different use models require exploration and resetting the various measurement parameters.

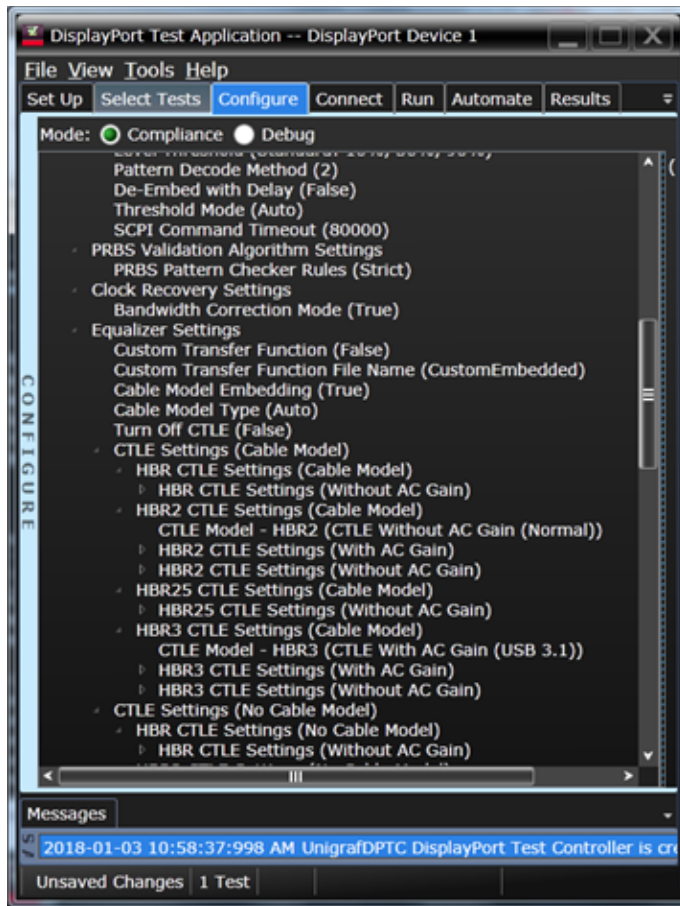


Figure 7. The Configure Tab enables many possibilities for parameters for each test that you can change or optimize your testing or for characterization or troubleshooting.

Thorough Performance Reporting

The DisplayPort Electrical Performance Validation and Compliance software generates thorough reports that not only capture the performance and status of the device under test, but also the screen shots of your most significant measurements for your perusal and evaluation. The first page of the report lists equipment and configuration details required in standard quality assurance programs. It also provides a hot-linked results table that will quickly get you to the measurement report section of interest.

Compliance Test Measurement Server

The DisplayPort Electrical Performance Validation and Compliance software is compatible with the [D9010AGGC Compliance Test Software Measurement Server](#), which provides the capability to offload measurements to one or multiple virtual machines or measurement servers, enabling concurrent data acquisition and computation of test results, drastically reducing the overall test time. Please contact us in case you would like more information about this powerful feature.

Extensibility

You may add additional custom tests or steps to your application using the User Defined Application (UDA) development tool (www.keysight.com/find/uda). Use UDA to develop functional “Add-Ins” that you can plug into your application.

Add-ins may be designed as:

- Complete custom tests (with configuration variables and connection prompts)
- Any custom steps such as pre or post processing scripts, external instrument control and your own device control.

Automation

You can completely automate execution of your application’s tests and Add-Ins from a separate PC using the included Remote Interface feature (download free toolkit from www.keysight.com/find/scope-apps-sw). You can even create and execute automation scripts right inside the application using a convenient built-in client.

The commands required for each task may be created using a command wizard or from “remote hints” accessible throughout the user interface.

Using automation, you can accelerate complex testing scenarios and even automate manual tasks such as:

- Opening projects, executing tests and saving results
- Executing tests repeatedly while changing configurations
- Sending commands to external instruments
- Executing tests out of order

Combine the power of built-in automation and extensibility to transform your application into a complete test suite executive:

- Interact with your device controller to place it into desired states or test modes before test execution
- Configure additional instruments used in your test suite such as a pattern generator and probe switch matrix.
- Export data generated by your tests and post-process it using your favorite environment, such as MATLAB, Python, LabVIEW, C, C++, Visual Basic etc.
- Sequence or repeat the tests and “Add-In” custom steps execution in any order for complete test coverage of the test plan.

Switch matrix

The Keysight switch matrix software option for the compliance application, used together with switch matrix hardware, enables fully automated testing for multi-lane digital bus interfaces. The benefits of this automated switching solution include:

- Eliminate reconnections, which saves time and reduces errors through automating test setup for each lane of a multi-lane bus.
- Maintain accuracy with the use of unique PrecisionProbe or InfiniiSim features to compensate for switch path losses and skew.
- Customize testing by using remote programming interface and the user-defined application tool for device control, instrument control and test customization.

More information of the switching solution and configuration, visit www.keysight.com/find/switching and the Keysight application note with the publication number 5991-2375EN.

DisplayPort Test Point Adapters

DisplayPort has added other connector form factors in addition to the original standard connector. These include the Mini-DP connector (mDP) and the USB Type-C connector. The DisplayPort Electrical Performance Validation and Compliance software allows you to choose the test point adapter you want and if the file is available from the vendor, it allows you to de-embed it as well.

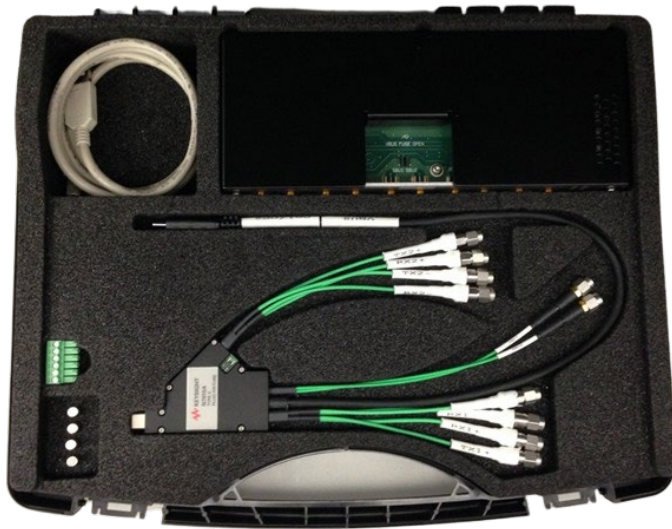


Figure 8. N7015A USB Type-C Test point adapter

Data Analytics

The KS6810A data analytics web service software provides an interface that allows the user to export the test result directly to the data repository server via a URL. The user can retrieve the aggregated measurement to be viewed using the visualization tool included in the KS6810A software. The visualization tool provides graphical plots in histogram or line mode that describes the measurement in different test conditions or properties.

Ordering Information

Software

Model number	Description	Note
D9040DPPC	DisplayPort Transmitter Compliance Test Software	Required
D9020ASIA	Advanced Signal Integrity Software (EQ, InfiniiSim Advanced)	Required
D9020JITA	Jitter, Vertical and Phase Noise Analysis Software	Required
D9010DMBA	Precision Cable Calibration	Optional
D9020SCNA	InfiniiScan Event Identification Software	Optional
KS6810A	Data Analytics software (1 license)	Optional

DisplayPort Compliance Test with D9010AGGC Compliance Test Measurement Server

Model number	Description	Quantity
D9040DPPC	DisplayPort Transmitter Compliance Test Software. To be installed and licensed on the Infiniium Manager PC. Recommended hardware: 8G RAM, 100G storage.	1
D9020ASIA	Advanced Signal Integrity Software (EQ, InfiniiSim Advanced) To be installed on the oscilloscope.	1
D9020JITA	Jitter, Vertical and Phase Noise Analysis Software. To be installed on the oscilloscope.	1
D9010AGGC	Measurement server license. To be installed on each measurement server: PC or virtual machine. The quantity depends on the desired speed improvement.	N
KS8108A	Resource Arbiter Server To be installed and licensed on any host of the network.	1

Recommended oscilloscope

Data rate	Recommended bandwidth	Oscilloscope
Up to HBR2 (5.4 Gbs)	13 GHz minimum	Infiniium V, Z and UXR series
Up to HBR3 (8.1 Gbs)	16 GHz recommended	Infiniium V, Z and UXR series

AUX Channel Controller

To purchase AUX channel controller for automated control of a DisplayPort TX device under test using the Keysight DisplayPort Electrical Performance Validation and Compliance software, order:

Model number	Description	Quantity
Unigraf DPR-100	AUX channel controller. Requires hardware and software license from Unigraf Oy. www.unigraf.fi	1

Test Point Access Adapters

Model number	Description	
N7015A	USB Type-C Test Point Adapter	Keysight TPA with BW of 20GHz and de-embeddable to 30GHz
BIT-1000-0000-0	Type-C Alt mode plug TPA	Bitifeye Corporation, recommended integrator for Keysight solutions.
BIT-1050-0040-0	Standard DisplayPort Plug and AUX TPA	

Unattended Testing with Probes or Switch Matrix

For one connection testing with full automation in DisplayPort either each lane is connected to a differential probe amplifier and SMA probe head, or, a switch matrix under control of the DisplayPort Electrical Performance Validation and Compliance software is used. For accuracy, direct connection to oscilloscope as always preferred, however, Keysight enables test automation through these two methods to support validation productivity.

One connection solution	Description	Vendor and details
Four channel Differential Connection	Amplifiers: 1169A, N280xA or N700xA Probe heads: N5480B, N5444A	Keysight probe solutions supported by the D9040DPPC
Switch Matrix	BIT-2100B: BIT-4000-2114-1 modules, quantity = 2 (4:1 switches) Mainframe BIT-4000-2100-1	Bitifeye Corporation, recommended integrator for Keysight solutions. Switch Matrix supported by the D9040DPPC

Recommended Type-C Accessories

For testing USB Type-C™ devices, the following solution elements are recommended for the purposes identified:

Model number	Description	Quantity	Purpose
N7018A	Type-C Test Controller	1	Control Power Delivery contracts, alternate mode and orientation
N7015A	Type-C Plug Test point adapter	1	Access of all Type-C signals
N6701C	Power Supply Chassis	1	Power Supply/Active Load for arbitrary Power Delivery settings
N6786A	Power Supply & Active Load	1 minimum / 2 optional	Power Supply/Active Load for arbitrary Power Delivery settings
N9398C	DC Blocking Capacitors	2 minimum / 4 recommended	The RX lanes of Type-C devices do not have blocking capacitors. When testing DP, at least one of these lanes is tested
5061-5311	3.5mm f-f adapter	4 minimum / 8 recommended	Connect matched cables to break out coaxial connector of N7015A
N2823A	1 m matched cable set	2 minimum	Connect scope to N7015A break outs
N5448B	0.25 m matched cable set	2 minimum	Connect scope to N7015A break outs

Flexible Software Licensing and KeysightCare Software Support Subscriptions

Keysight offers a variety of flexible licensing options to fit your needs and budget. Choose your license term, license type, and KeysightCare software support subscription.

License Terms

Perpetual – Perpetual licenses can be used indefinitely.

Subscription – Subscription licenses can be used through the term of the license only (6, 12, 24, or 36 months).

License Types

Node-locked – License can be used on one specified instrument/computer.

Transportable – License can be used on one instrument/computer at a time but may be transferred to another using Keysight Software Manager (internet connection required).

USB Portable – License can be used on one instrument/computer at a time but may be transferred to another using a certified USB dongle (available for additional purchase with Keysight part number E8900-D10).

Floating (single site) – Networked instruments/computers can access a license from a server one at a time. Multiple licenses can be purchased for concurrent usage.

KeysightCare Software Support Subscriptions

Perpetual licenses are sold with a 12 (default), 24, 36, or 60-month software support subscription. Support subscriptions can be renewed for a fee after that.

Subscription licenses include software support through the term of the license.

KeysightCare Software Support Subscription provides peace of mind amid evolving technologies.

Ensure your software is always current with the latest enhancements and measurement standards.

Gain additional insight into your problems with live access to our team of technical experts.

Stay on schedule with fast turnaround times and priority escalations when you need support.

Selecting your license:

Step 1. Choose your software product (eg. S1234567A).

Step 2. Choose your license term: perpetual or subscription.

Step 3. Choose your license type: node-locked, transportable, USB portable, or floating.

Step 4. Depending on the license term, choose your support subscription duration.

Subscription based Compliance Test Software Suites

A new ownership model of multiple Compliance Test Software Applications is now available.

With this new subscription based model, the DisplayPort software suites bundle the Compliance Test Software Applications under a model number. Using a subscription based ownership, you can enjoy all the test software features covered under DisplayPort across multiple generations and variants.

Software support and continuity

Under the subscription plan, software support is made available with no extra support cost. Ensuring your software always stays up to date with the latest enhancements and measurement standards while having access to our team of technical experts when you need support.

On top of that all upgrades are made available to you as the DisplayPort standards progresses with no additional costs.

Subscription based Compliance Test Software Suites

Each suite comes with a 12, 24, or 36-month software suite subscription.

Model Number	Options Available
SW00DSPP Display Port Validation License	<ul style="list-style-type: none">• Display Port TX Application (D9040DPPC)• Display Port UHBR (2.0) TX Application (D9042DPPC)
SW02DSPP Display Port Full Validation License	<ul style="list-style-type: none">• Display Port TX Application (D9040DPPC)• Display Port UHBR (2.0) TX Application (D9042DPPC)• DisplayPort eDP TX Test (D9040EDPV)

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

