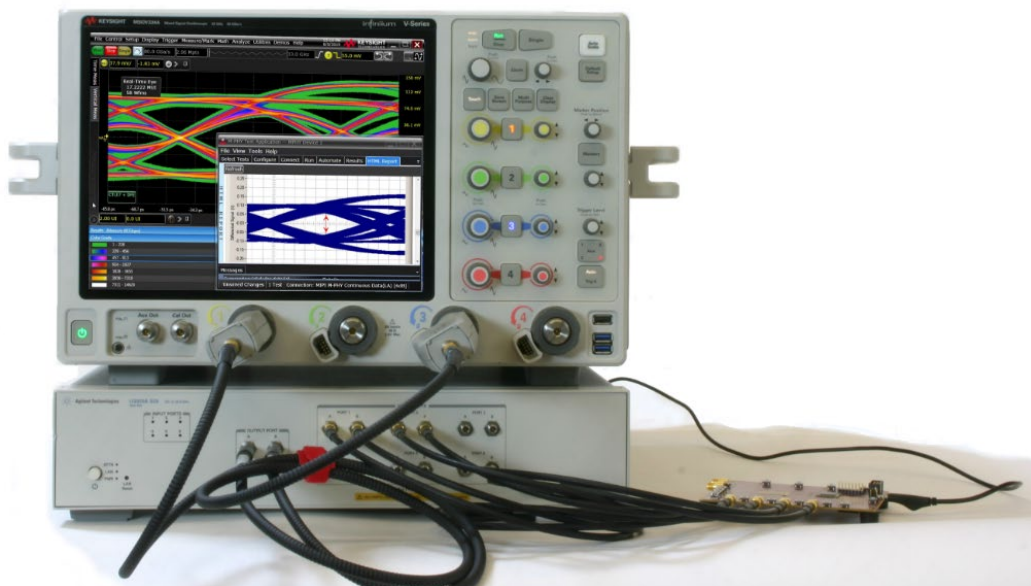


D9040MPHC

MIPI M-PHY Compliance Test Software

for Infiniium Oscilloscopes



Introduction

Keysight Technologies' MIPI® M-PHY® conformance test software for Infiniium oscilloscopes gives you a fast, easy way to validate and debug your embedded M-PHY data links. The M-PHY electrical test software allows you to automatically execute M-PHY electrical checklist tests for DigRF v4, UniPro, LLI, UFS, SSIC and M-PCIe architectures, and displays the results in a flexible report format. In addition to the measurement data, the report provides margin analysis that shows how closely your product passed or failed each test. The M-PHY conformance test software performs a wide range of tests required to meet the physical layer requirements per section 5 of the MIPI Alliance Specification for M-PHY and section 1 of the M-PHY Conformance Test Suite (CTS). The M-PHY conformance test software helps you execute the most difficult physical layer tests for transmitters (TX tests only) that can be measured with a high bandwidth real-time digital oscilloscope. Although there are not currently any requirements for physical layer compliance verification, it is highly recommended that every MIPI M-PHY link be tested against the limits of the physical layer specification to ensure that it conforms to the specification and to minimize concerns with protocol level interoperability.

Key features

The M-PHY conformance test software offers several features to simplify design validation:

- Complete MIPI Alliance Specification for M-PHY v3.0, v4.0 and v4.1, section 5 and M-PHY v3.0, v4.0 and v4.1 CTS v1.0, section 1.
- User selection of tests and configuration of data rate. – Automated scope measurement setup and programming for increased accuracy, time-savings and repeatability.
- Advanced debug modes for troubleshooting.
- Automated margin analysis and pass/fail conformance reporting.
- Fully integrated SigTest tool for Gear4 Eye diagram test.
- UFS reference clock test (informative).

With the M-PHY conformance test software, you can use the same oscilloscope you use for everyday debugging to perform automated testing and margin analysis based on not only the MIPI Alliance Specification for M-PHY v3.0 but also v4.0 and v4.1 section 5 requirements and M-PHY CTS v3.0, v4.0 and v4.1, section 1. UFS reference clock test based on JEDEC specification for UFS v3.0.

Save Time with the M-PHY Conformance Application

The M-PHY conformance test software saves you time by setting the stage for automatic execution of required electrical tests. The primary difficulties associated with performing electrical tests for M-PHY is connecting the oscilloscope to the target device, correctly configuring the oscilloscope's measurement system for ultimate accuracy, issuing the proper commands to perform the tests and then analyzing the measured results by comparing them to limits published in the specification. The M-PHY conformance test software automates this work to provide rapid, accurate and repeatable test execution. In addition, if you discover a problem with your product, debug tools in the oscilloscope are available to aid in root-cause analysis.

Easy Test Definition

The M-PHY conformance test software extends the ease-of-use advantages of Keysight's Infiniium oscilloscopes to testing M-PHY designs. The Keysight automated test engine walks you quickly through the steps required to define and configure the tests, execute the tests and view the test results. You can select a category of tests all at once or specify individual tests. The user interface is oriented to minimize unnecessary reconnections, which saves time and ensures accuracy and repeatability of tests. You can save tests and configurations as project files and recall them later for quick re-testing or review of a previous test. Straightforward menus let you perform tests with a minimum of mouse clicks.

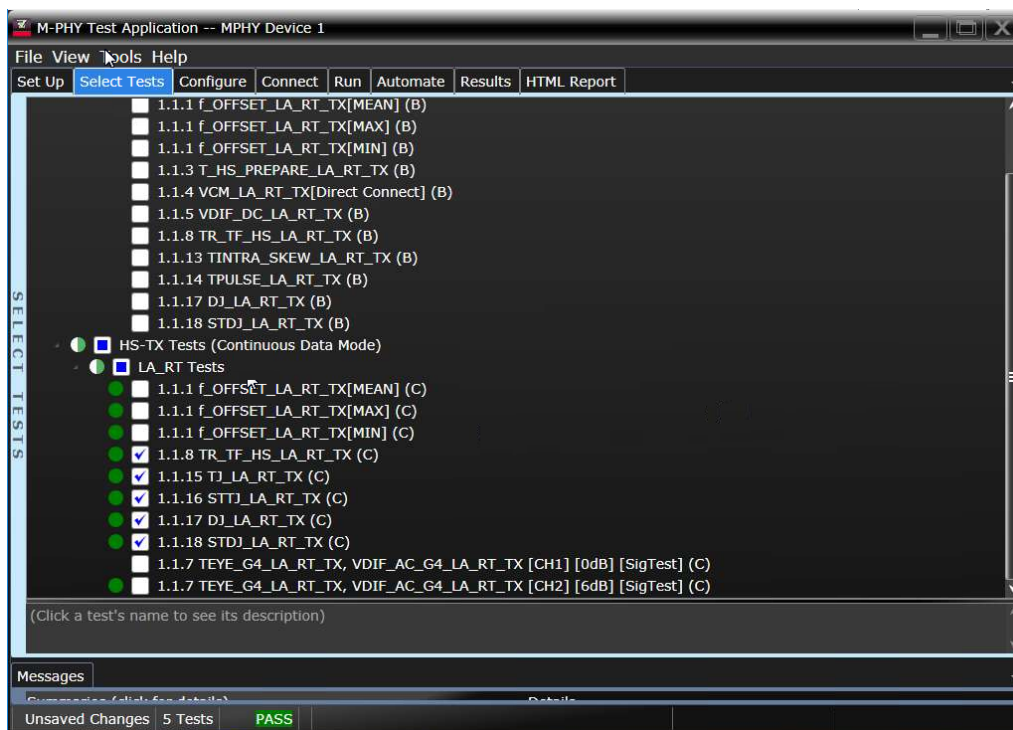


Figure 1. You can easily select individual tests or groups of test with a mouse-click and customize your output report based on the test results you want to see.

Configurability and Guided Connections

The M-PHY conformance test software provides flexibility in your test setup. The M-PHY conformance test software provides you with user-defined controls for critical test parameters such as channel probe configurations, number of measurement observations for tests and the trigger threshold. After you configure the tests to meet your needs, the M-PHY user interface will present you the connection screen that is specific to the configuration data you have selected. This includes the oscilloscope channels used for the test and the routing of any necessary probing needed to perform the tests. In some cases, a configuration change may be necessary to properly make a new set of measurements. Guided configuration diagrams will be presented when each change is needed to ensure proper configuration for the tests. The software is designed to minimize connection changes to increase the efficiency of test operation and save you time.

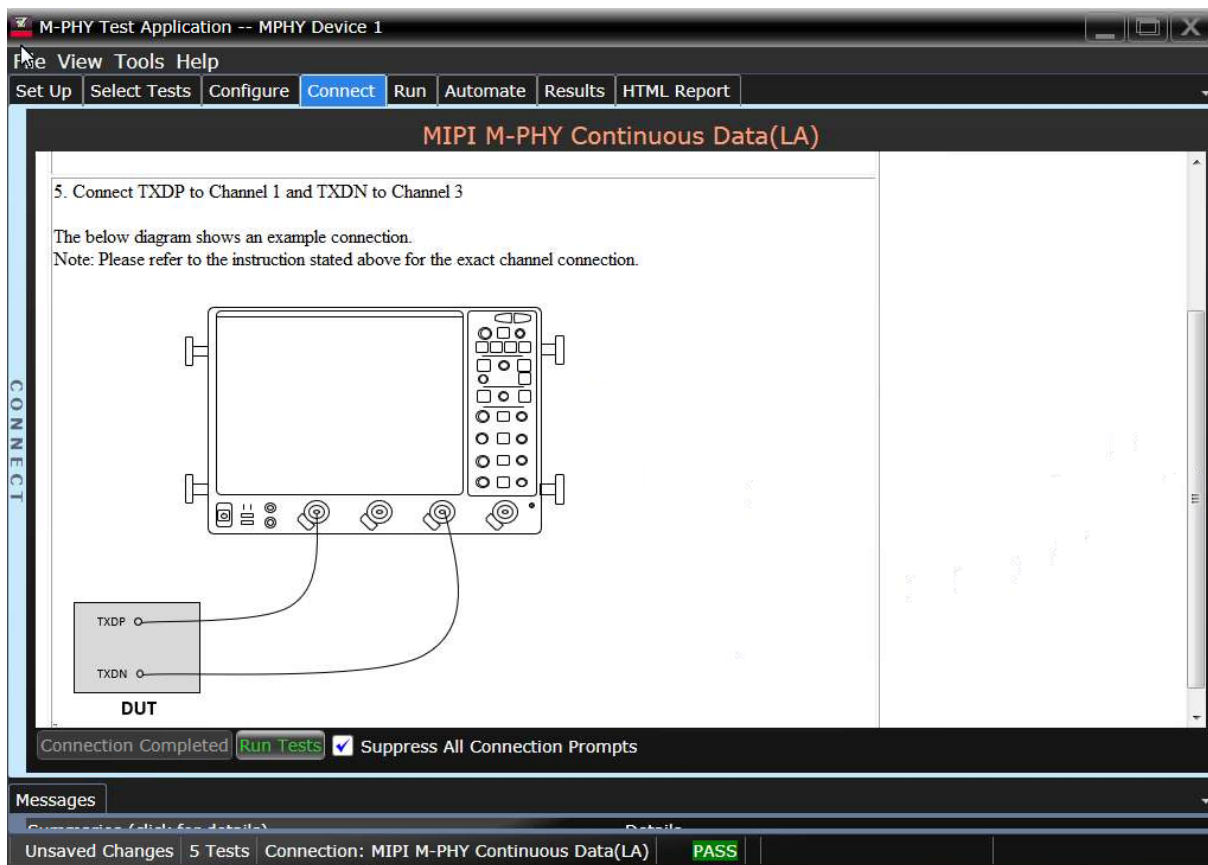


Figure 2. Guided configuration diagrams provide you with channel and probe configurations needed to properly connect to your product and accurately perform tests.

Result Reports with Margin Analysis

In addition to providing you with measurement results, the M-PHY test software provides a report format that shows you not only where your product passes or fails, but also reports how close you are to the limits specified for a particular test. You select the margin test report parameter, which means you can specify the level at which warnings are issued to alert you to the electrical tests where your product is operating close to the official test limit defined by the specification for a given test.

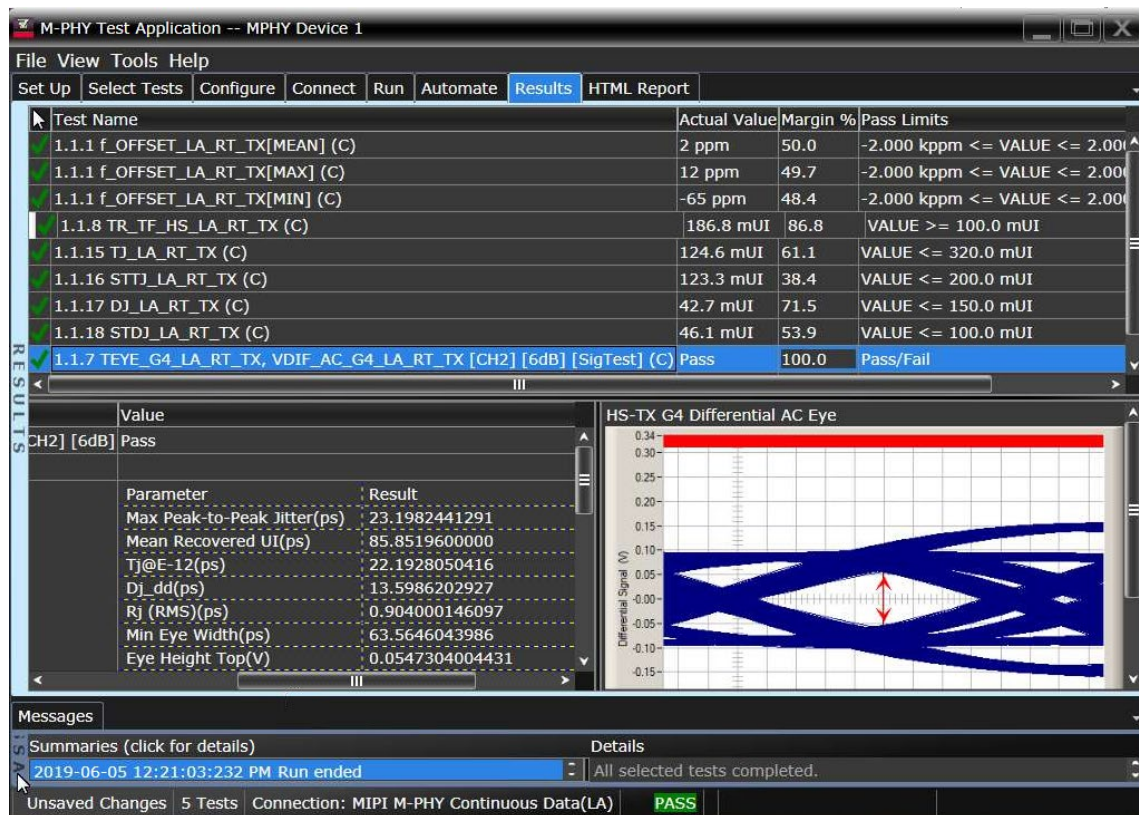


Figure 3. Results reports highlight test margins versus specified limits and a summary of measurements that pass/fail or violate the margin warnings you have set.

Extensibility

You may add additional custom tests or steps to your application using the N5467B/ N5467C 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 N5452A 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

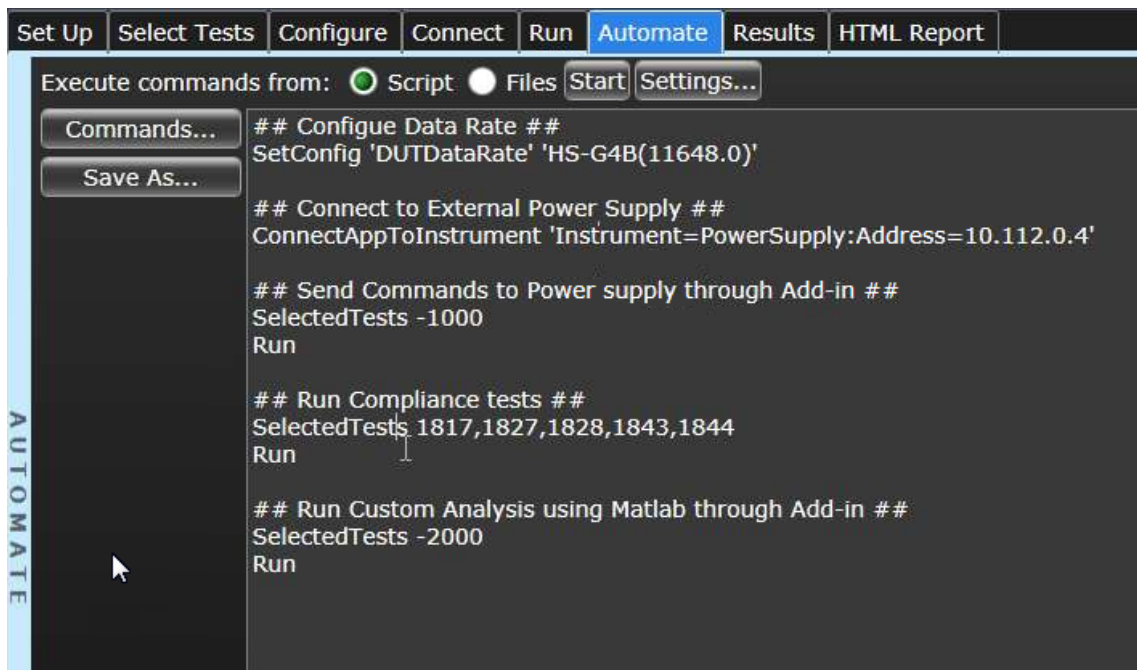


Figure 4. Remote programming script in the Automation tab.

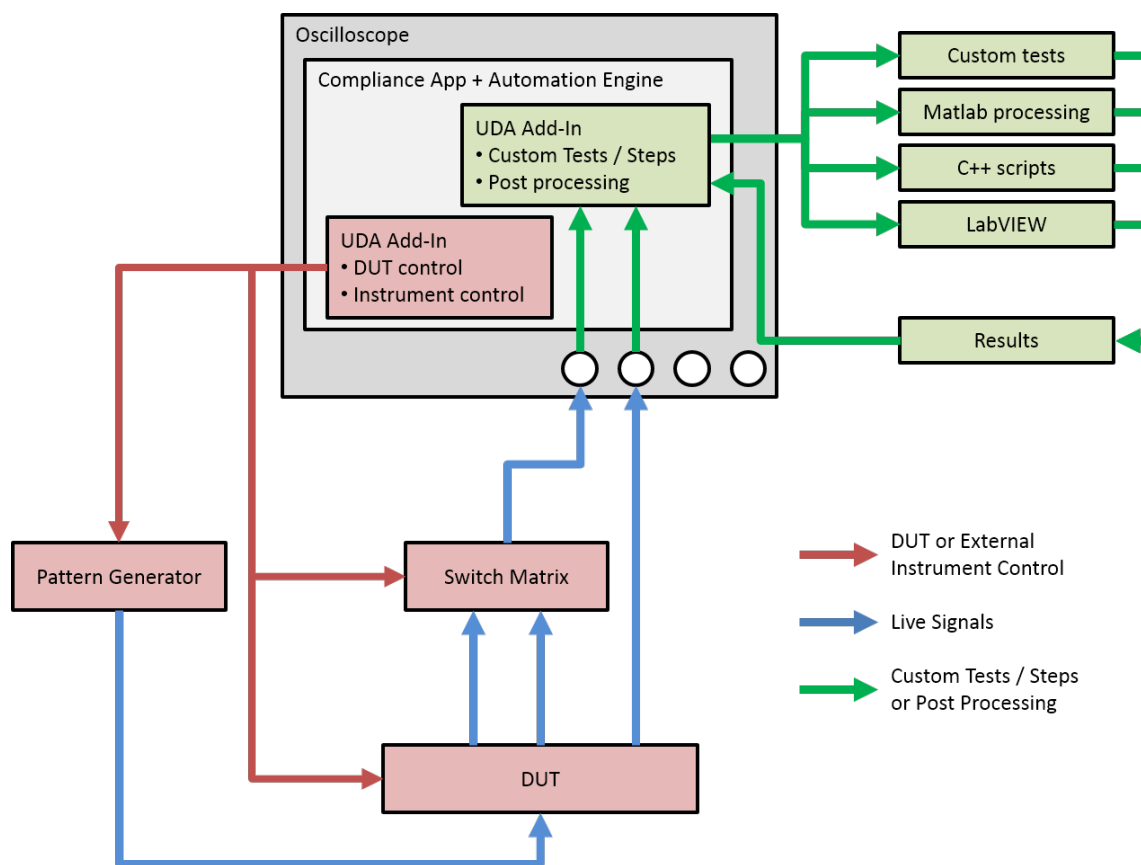


Figure 5. Combine the power of built-in automation and extensibility to transform your application into a complete test suite executive.

Test Coverage

HS-TX characteristics

Test 1.1.1 UIHS and fOFFSET_TX
Test 1.1.2 PSDCM_TX (informative)
Test 1.1.3 THS_PREPARE
Test 1.1.4 VCM_TX
Test 1.1.5 VDIF_DC_TX
Test 1.1.6 TEYE_TX, VDIF_AC_TX (Gear1 and Gear2)
Test 1.1.7 TEYE_HS_G3/G4_TX, VDIF_AC_HS_G3/G4_TX
Test 1.1.8 TR_HS_TX and TF_HS_TX (informative)
Test 1.1.9 TL2L_SKEW_HS_TX (if supports 2 or more lanes)
Test 1.1.10 SRDIF_TX[MIN/MAX] (for Gear1 only)
Test 1.1.11 SR_DIF Monotonicity (for Gear1 only)
Test 1.1.12 Δ SR_DIF_TX (for Gear1 only)
Test 1.1.13 TINTRA_SKEW_TX
Test 1.1.14 TPULSE (informative)
Test 1.1.15 TJTX (informative)
Test 1.1.16 STTJTX (informative)
Test 1.1.17 DJTX (informative)
Test 1.1.18 STDJTX (informative)

PWM-TX characteristics

Test 1.2.1 TPWM_TX
Test 1.2.2 kPWM_TX
Test 1.2.3 TPWM_PREPARE
Test 1.2.4 VCM_TX
Test 1.2.5 VDIF_DC
Test 1.2.6 TEYE_TX (OBSOLETE)
Test 1.2.7 VDIF_AC_TX
Test 1.2.8 TR_PWM_TX and TF_PWM_TX
Test 1.2.9 TL2L_SKEW_PWM_TX
Test 1.2.10 TOLPWM_G1_LR_TX
Test 1.2.11 TPWM_MINOR_G0_TX

UFS reference clock (Informative) ¹

Reference clock output high voltage (VOH)(informative)
Reference clock output low voltage (VOL)(informative)
Reference clock output rise time (TORISE)
Reference clock output fall time (TOFALL)
Reference clock frequency error (FERROR)
Reference clock duty cycle (TDC)
Reference clock phase noise (N)
Reference clock noise floor density (NDENSITY)

1. UFS reference clock test is available only with D9040MPHC license

Recommended Oscilloscopes

The M-PHY compliance software is compatible with Keysight Infiniium Series oscilloscopes with operating software revision 6.40 or higher. For oscilloscopes with earlier revisions, free upgrade software is available here: www.keysight.com/find/scope-apps-sw.

Symbol Rate	Minimum bandwidth	Minimum channels	Compatible oscilloscopes
Gear1 (up to 1.46Gbps)	6GHz	4 Analog channels	90000, V-Series, Z-Series and UXR-Series
Gear2 (up to 2.92Gbps)	12GHz		90000, V-Series, Z-Series and UXR-Series
Gear3 (up to 5.83Gbps)	20GHz		V-Series, Z-Series and UXR-Series
Gear4 (up to 11.66Gbps)	25GHz		V-Series, Z-Series and UXR-Series

Ordering Information

Model number	Description	Note
D9040MPHC	MIPI M-PHY Tx Compliance Software	Mandatory
D9020JITA	EZJIT Complete – Jitter and Vertical Noise Analysis Software for V/Z/UXR-Series	Optional
D9020ASIA	Advanced Signal Integrity Software (EQ, InfiniiSim Adv, Crosstalk)	Optional

Other Hardware, Probes and Accessories

Model number	Description	Quantity
MX0023A	InfiniiMax 25GHz RC probe amp	2
E2669B	Differential probe connectivity kit (contains needed probe header)	1
15443A	Matched cable pair (2 x SMA(m) to SMA(m) cable included)	1
N7010A	30GHz Active Termination Adapter for Continuous mode test	2

Related Literature

Type	Description / URL
Brochure	Infiniium V-Series (8 GHz to 33 GHz real time oscilloscope)
Data Sheet	Infiniium UXR Series (13 GHz to 110 GHz real time oscilloscope)
Brochure	30 Things Only Infiniium Oscilloscopes Can Do

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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 a software support subscription 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:

Step1. Choose your software product (eg. S1234567A).

Step2. Choose your license term: perpetual or subscription.

Step3. Choose your license type: node-locked, transportable, USB portable, or floating.

Step4. 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 MIPI 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 MIPI 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 MIPI 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.

Suite license	Technology generation and variants coverage (current)
SW00MIPI MIPI Validation License	<ul style="list-style-type: none">• C-PHY TX Validation (D9010CPHC)• D-PHY TX Validation (D9020DPHC)• M-PHY TX Validation (D9040MPHC)
SW02MIPI MIPI Full TX Test Suite	<ul style="list-style-type: none">• C-PHY TX Validation (D9010CPHC)• D-PHY TX Validation (D9020DPHC)• M-PHY TX Validation (D9040MPHC)• C-PHY and D-PHY Protocol Validation (D9010MCDP)• M-PHY Protocol Validation (D9010MPMP)• LowSpeed Protocol Validation (D9010MPLP)

Learn more at: www.keysight.com

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