

D9340USBC USB4 Transmitter Compliance Test Software

Introduction

The Keysight Technologies, Inc. USB4 Transmitter compliance test software provides a fast and easy way to test, debug and characterize your USB4 products. The tests performed by the D9340USBC software are based on the USB4 Compliance Test Specification (CTS). The test software application offers a user-friendly setup wizard and a comprehensive report that includes margin analysis. In addition to the automated testing, there is also a configuration menu that allows customized setups including different cable models and jitter setups.

- Setup wizard for quick setup, configuration and test selection
- Covers 10/10.3125/20/ 20.625 Gbps rates
- Automated test setup and execution for ease of use
- Simultaneous two-lane testing as well as single or dual port
- Cable and test fixture embedding and de- embedding to provide more accurate margin estimates
- Test results report generation
- Pass/fail margin analysis
- Test framework that reports multi trial results with full array of statistics for each measurement with worst case measurement result



Comprehensive Test Coverage

The USB4 test software automatically configures the oscilloscope for each test and provides results which include margin and statistical analysis. The tests coverage includes electrical, timing and eye diagram tests as stated in the USB4 specification and the CTS. The signal is optimized for most accurate test result and measurement repeatability.

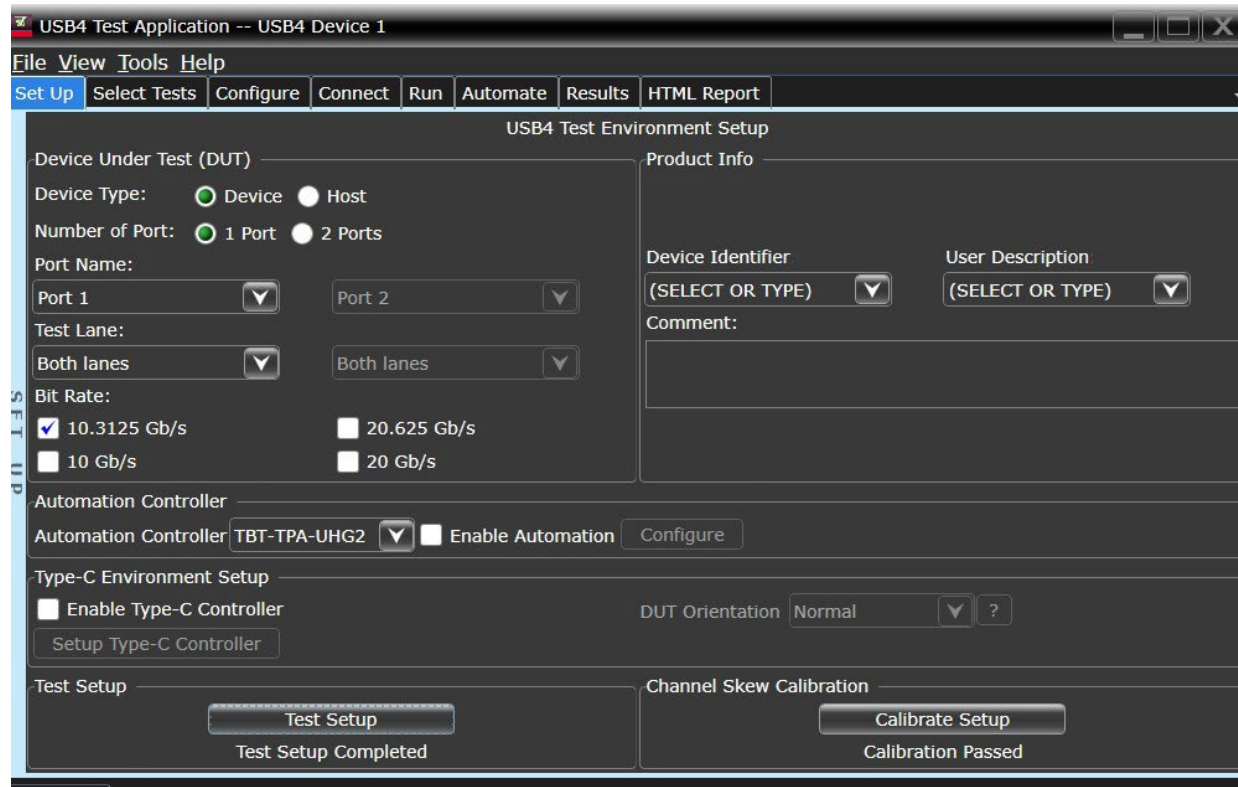


Figure 1. USB4 software application test setup screen

One of the unique requirements of USB4 testing is Preset Calibration and CTLE calibration. The USB4 test software automatically determines the optimal Preset and CTLE.

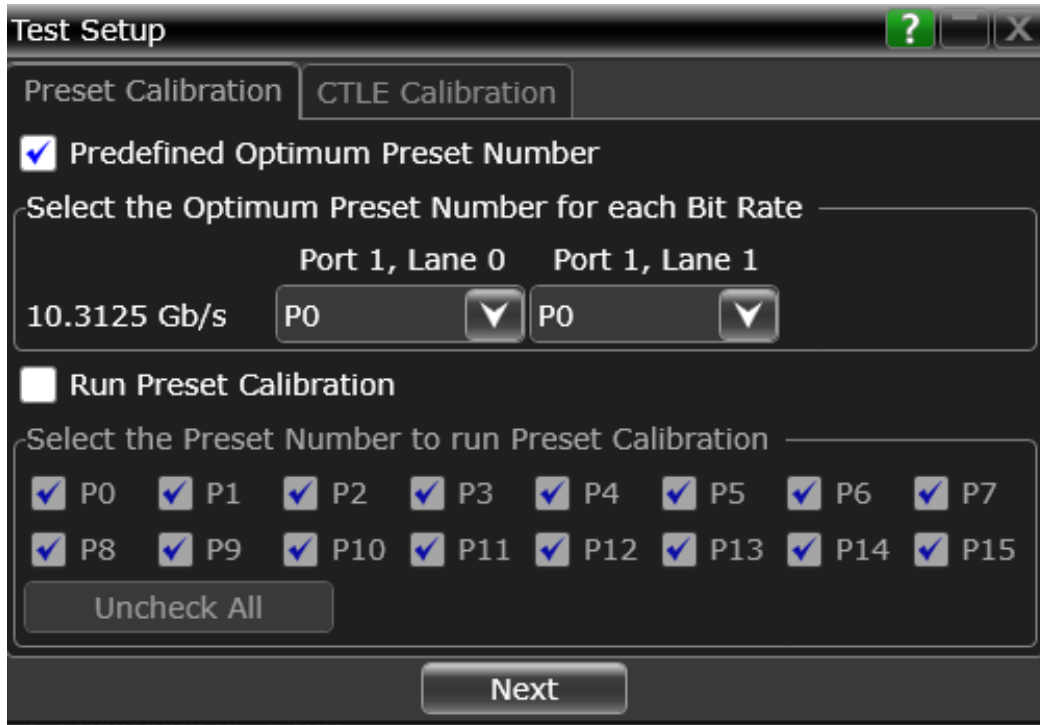


Figure 2. Preset calibration

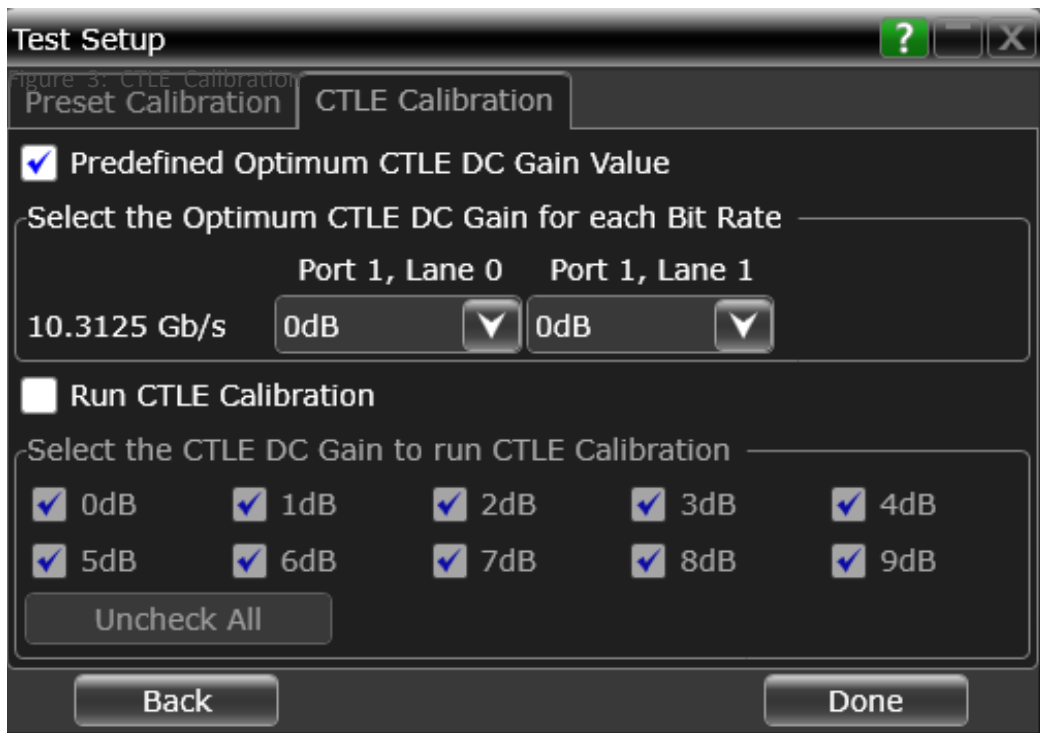


Figure 3. CTLE calibration

Easy Test Definition

The test software application enhances the usability of Keysight Infiniium oscilloscopes for testing USB4 products. The Keysight automated test framework guides you quickly through the steps required to define the setup, perform the tests and view the test results. You can select a category of tests or select an individual test. The user interface is designed to minimize unnecessary reconnections, which will help save test time and minimize potential operator error. You can save the tests and configurations as project files and recall them for quick testing and review previous results.

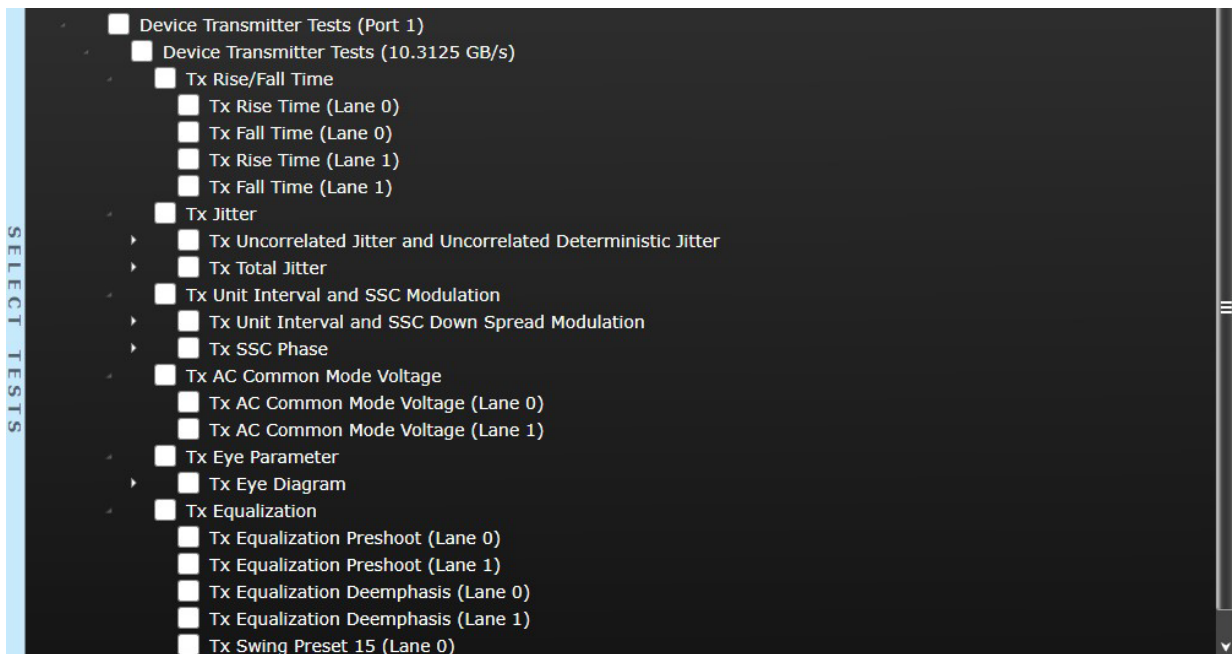


Figure 4. The Select tab list all the tests available in your setup. You can easily setup the individual test or group of tests.

Configurability and Guided Connection

The USB4 test software provides flexibility in your test setup. Once you have configured the tests, the connection page will display the connection diagram for the test you have selected.

You can also specify the number of test trials and only stop running selected tests when the stop condition is met. The software application will save the worst-case test result to help you track down the anomalies in your signals.

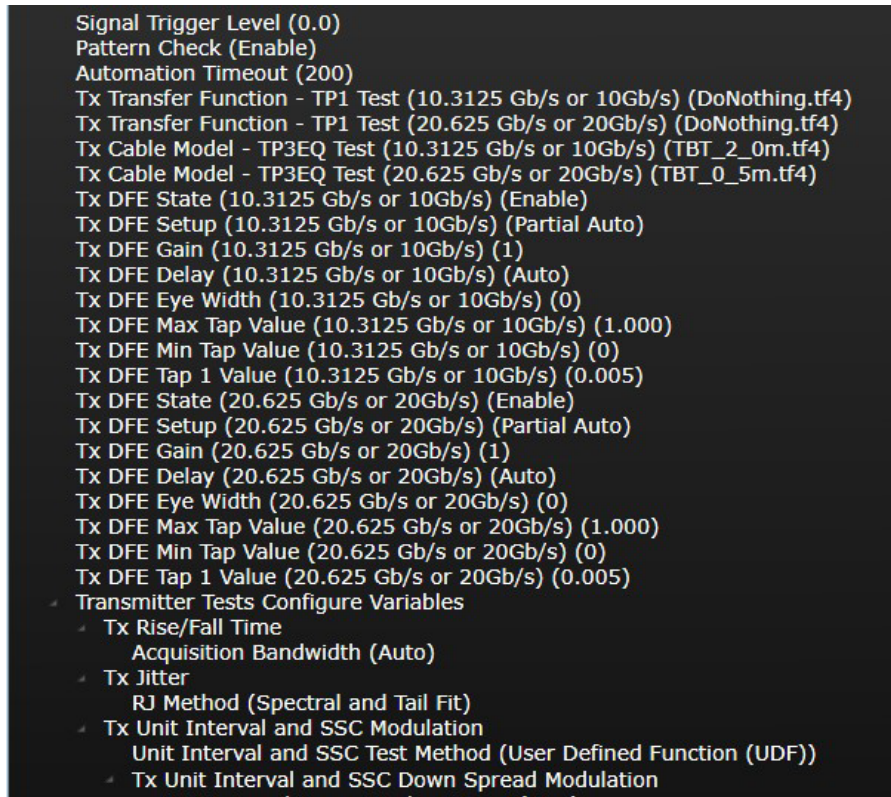


Figure 5. Configuration menu allows for flexible and customized test conditions

Comprehensive Result Analysis

In addition to providing you with measurement results, the test software application reports how close your test results are to the specified test limit. You can specify the level at which warnings are to be issued. You are provided a full array of statistics for each measurement.

Thorough Performance Reporting

The USB4 test software generates HTML reports that captures the performance, status and margins of your device under test. It also captures screenshots of critical measurements of your reference and documentation. This report is suitable for printing and sharing with your test vendors, customers and suppliers.

| Pass | # Failed | # Trials | Test Name | Actual Value | Margin | Pass Limits |
|------|----------|----------|--|--------------|--------------|-----------------------------------|
| | | 1 | 3.3.1a Tx Preset Calibration (Port 1, Lane 0) | P1 | | Pass/Fail |
| | | 1 | 3.3.1b Tx CTLE Calibration (Port 1, Lane 0) | 5dB | | Pass/Fail |
| | 0 | 1 | 3.5.9a Tx Rise Time (Port 1, Lane 0) | 22.545 ps | 125.5 % | VALUE >= 10.000 ps |
| | 0 | 1 | 3.5.9b Tx Fall Time (Port 1, Lane 0) | 22.505 ps | 125.1 % | VALUE >= 10.000 ps |
| | 0 | 1 | 3.5.11 Tx Uncorrelated Jitter (Port 1, Lane 0) | 167.5 mUI | 46.0 % | VALUE <= 310.0 mUI |
| | 0 | 1 | 3.5.12 Tx Uncorrelated Deterministic Jitter (Port 1, Lane 0) | 57.4 mUI | 66.2 % | VALUE <= 170.0 mUI |
| | 0 | 1 | 3.5.14 Tx Duty Cycle Distortion (Port 1, Lane 0) | 2.9 mUI | 90.3 % | VALUE <= 30.0 mUI |
| | 0 | 1 | 3.5.13 Tx Low Frequency Uncorrelated Deterministic Jitter (Port 1, Lane 0) | 21.7 mUI | 69.0 % | VALUE <= 70.0 mUI |
| | 0 | 1 | 3.5.17 Tx Uncorrelated Jitter TP3EQ (Port 1, Lane 0) | 185.6 mUI | 40.1 % | VALUE <= 310.0 mUI |
| | 0 | 1 | 3.5.18 Tx Uncorrelated Deterministic Jitter TP3EQ (Port 1, Lane 0) | 39.3 mUI | 76.9 % | VALUE <= 170.0 mUI |
| | 0 | 1 | 3.5.10 Tx Total Jitter (Port 1, Lane 0) | 327.7 mUI | 28.8 % | VALUE <= 460.0 mUI |
| | 0 | 1 | 3.5.16 Tx Total Jitter TP3EQ (Port 1, Lane 0) | 458.5 mUI | 23.6 % | VALUE <= 600.0 mUI |
| | 0 | 1 | 3.5.3a Tx Unit Interval Mean, Min (Port 1, Lane 0) | 50.1242 ps | 46.4 % | 50.1102 ps <= VALUE <= 50.1404 ps |
| | 0 | 1 | 3.5.3b Tx Unit Interval Mean, Max (Port 1, Lane 0) | 50.1243 ps | 46.7 % | 50.1102 ps <= VALUE <= 50.1404 ps |
| | 0 | 1 | 3.5.2a Tx Unit Interval, Min (Port 1, Lane 0) | 50.0095 ps | 3.8 % | 50.0000 ps <= VALUE <= 50.2513 ps |
| | 0 | 1 | 3.5.2b Tx Unit Interval, Max (Port 1, Lane 0) | 50.2394 ps | 4.7 % | 50.0000 ps <= VALUE <= 50.2513 ps |
| | 0 | 1 | 3.5.5 Tx SSC Down Spread Rate (Port 1, Lane 0) | 30.790 kHz | 26.3 % | 30.000 kHz <= VALUE <= 33.000 kHz |
| | 0 | 1 | 3.5.4 Tx SSC Down Spread Range (Port 1, Lane 0) | 457.5 m% | 42.5 % | 400.0 m% <= VALUE <= 500.0 m% |
| | 0 | 1 | 3.5.8 Tx SSC Slew Rate (Port 1, Lane 0) | 426.8 ppm/us | 57.3 % | VALUE <= 1.0000 kppm/us |
| | 0 | 1 | 3.5.6 Tx SSC Phase Deviation (Port 1, Lane 0) | 20.402 ns | 8.2 % | 2.500 ns <= VALUE <= 22.000 ns |
| | 0 | 1 | 3.5.14 Tx AC Common Mode Voltage (Port 1, Lane 0) | 51.15 mV | 48.9 % | VALUE <= 100.00 mV |
| | 0 | 1 | 3.5.15 Tx Eye Diagram (Port 1, Lane 0) | Pass | 100.0 % | Pass/Fail |
| | 0 | 1 | 3.5.19 Tx Eye Diagram TP3EQ (Port 1, Lane 0) | Pass | 100.0 % | Pass/Fail |
| | 0 | 1 | 3.5.1a Tx Equalization Preshoot (Port 1, Lane 0) | Pass | 100.0 % | Pass/Fail |
| | 0 | 1 | 3.5.1b Tx Equalization Deemphasis (Port 1, Lane 0) | Pass | 100.0 % | Pass/Fail |
| | 0 | 1 | 3.5.1c Tx Swing Preset 15 (Port 1, Lane 0) | 3.3736 dB | 43.7 % | 2.5000 dB <= VALUE <= 4.5000 dB |

Figure 6. The USB4 test software generates a summary report for quick results viewing. The report includes details such as test limits, test description and test results.

Recommended Oscilloscope

The D9340USBC USB4 Transmitter Compliance Test Software is compatible with various series oscilloscopes. Please refer to the release notes for the recommended oscilloscope software version.

| Data Rate | Recommended Bandwidth | Minimum Channels | Description |
|-----------|--|------------------|---|
| 20 Gb/s | 33 GHz. Higher bandwidth is required if debugging close to silicon | 4 | Infiniium XR8, UXR series oscilloscopes |

Recommended Hardware Requirement

1-PC Mode to connect and run USB4 SigTest analysis with an oscilloscope:

- Processor: Multicore CPU with at least 12 logical cores, Performance-core Frequency 4.80 GHz
- Memory: 64 GB RAM or higher
- Operating System: Windows 11 or later

Note: For 1-PC Mode setup, install the D9340USBC license on the PC. Refer to Methods of Implementation (MOI) for detailed setup instructions.

VNA Configuration Requirements

| Description | Test Equipment | Quantity |
|------------------|---|----------|
| Network analyzer | <p>Keysight Vector Network Analyzer:</p> <ul style="list-style-type: none">- 20 GHz is recommended as USB4 requires measurements up to 20 GHz.- Minimum 4-port VNA to support USB4 SigTest tool requirement.• E5080B-4K0: 4-port test set, 9 kHz to 20 GHz or• P5024A-400 Streamline USB Series VNA or• M9804A-400 PXI multiport VNA or• N522xB 4-port PNA <p>Note 1: Ensure that VNA firmware revision is at least version A.15.60.xx or above (Windows 10)</p> <p>Note 2: All 2-Port VNA and legacy E5071C will not be supported. Please refer to Return Loss Test MOI for manual setup.</p> | 1 ea. |
| ECal module | 4-Port Electronic Calibration (ECal) module - N4433D-010/ODC 4-Ports | 1 ea. |

Ordering Information

| Model Number | Description | Note |
|--------------|--|----------|
| D9340USBC | USB4 Transmitter Compliance Test Software | Required |
| D9320ASIA | Advanced Signal Integrity Software (Crosstalk) | Required |
| D9320JITA | Jitter, Vertical and Phase Noise Analysis Software | Required |

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| Suite License | Technology Generation and Variants Coverage (Current) |
|---|--|
| SW30USBH USB High Speed Validation License | USB4v2 Tx Compliance Software (D9350USBC) USB4 Tx Compliance Software (D9340USBC) USB 3.2 Tx Compliance Software (D9320USBC) |

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