USB 3.2 PHY Test Solution

QPHY-USB3.2-TX-RX
USB32BUS D
WavePulser 40iX

Key Features

Fast and easy USB 3.2 "Gold Suite" PHY Compliance testing using QualiPHY test automation

Transmitter testing using a variety of generators

Receiver testing using the protocol enabled Anritsu MP1900A BERT

Connection diagrams ensure correct setup on the first try

QualiPHY report generation creates comprehensive USB-IF approved reports

Powerful and flexible PHY and PHY-logic tools provide unmatched insight into failures

Supports USB-IF approved fixtures for all connector types and third party fixtures and DUT controllers.

Since becoming the first USB-IF "Gold Suite" in 2011, Teledyne LeCroy continues to be the trusted leader in all the latest USB Type-C® technologies including USB 3.2 Tx/Rx "Gold Suite" compliance testing, the deepest USB 3.2 signal integrity (SI) toolbox, and unmatched PHY-logic and sideband debug.

"Gold Suite" Compliance Testing

QPHY-USB3.2-TX-RX provides fast, easy USB 3.2 compliance. Transmitter (Tx), LFPS, and LBPM/SCD tests are performed by variety of cost effective LFPS generators. Receiver (Rx) stressed signal calibration, BER and JTOL testing are automated using the Anritsu MP1900A USB 3.2 protocol enabled BERT. QualiPHY walks the user through the test MOI (Method of Implementation) and provides a USB-IF approved pass/fail compliance test report when complete.

The Deepest SI Toolbox

Easily switch between compliance and SI testing by using either 'SigTest' or 'Teledyne LeCroy SDAIII' analysis. Further understand system losses and equalization effects using SDAIII, and use the WavePulser 40iX to make your own channel and cable measurements on USB 3.2 system components.

Unmatched PHY-Logic and Sideband Debug

Debug PHY-logic using USB32BUS D serial decoder software and USB ProtoSync protocol analysis software. Debug USB-C® interoperability issues with USB-PD TDMP and DP-AUX DMP Trigger, Decode, Measure/Graph and Physical Layer software.

USB 3.2 TRANSMITTER TESTING

QPHY-USB3.2-TX-RX fully automates tests outlined in USB 3.2 PHY compliance test specifications. A variety of low cost Low Frequency Periodic Signaling (LFPS) test generators can be used for compliance pattern sequencing and even 3rd party AUX controllers can be used to test both USB 3.2 Tx and DisplayPort Source over USB Type-C. QPHY provides simple setup and connection diagrams to guide the user through the tests. When complete, a USB-IF approved compliance report is generated.

Test Setup

The Tx setup menu provides selection of the DUT type, selected tests, connector type, analysis method, and the generator to be used for compliance pattern sequencing. Supported generators include the Anritsu MP1900A, a low cost Teledyne LeCroy T3AFG, or a Wilder-Tech DUTC which can also be used for DisplayPort™ over USB-C Source testing for Alt Mode devices.
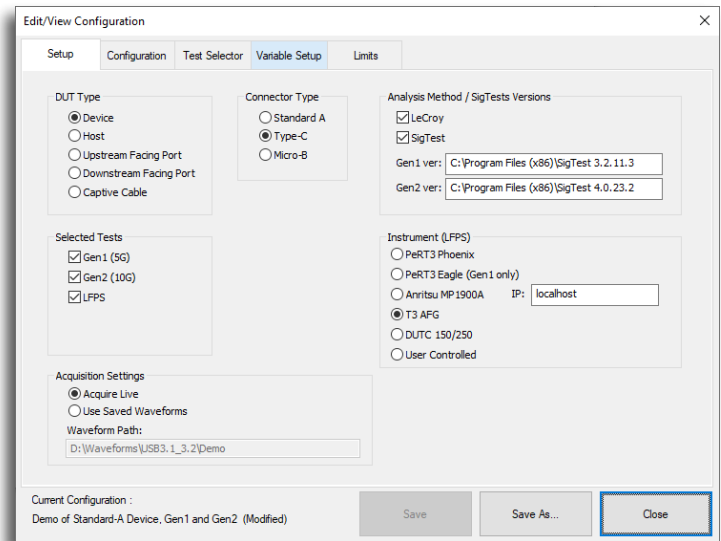
Connection Diagrams

A full library of connection diagrams support all USB connector types and LFPS generators selected from the Setup Menu.

USB 3.2 Tx Compliance Tests

QPHY-USB3.2-TX-RX software automates the following tests:
- Enhanced Superspeed CTS:
    - TD 1.1 - Low Frequency Periodic Signaling TX Test (Including Low Power LFPS TX ECN)
    - TD 1.3 - Transmitted Eye Test at 5 GT/s
    - TD 1.4 - Transmitted Eye Test at 10 GT/s
    - TD.1.5 - Trasmit Equalization Test at 10 GT/s
    - TD 1.6 - Transmitted SSC Profile Test at 5 GT/s
    - TD 1.7 - Transmitted SSC Profile Test at 10 GT/s
- USB 3.2 Draft CTS
    - USB 3.2 LFPS TX (SCD/LBPM)

The user selects the the tests from the Test Selector menu, presses the Start button and plugs the fixture into the DUT when prompted. Tests are executed and a USB-IF approved report is generated.


USB 3.2 Tx Setup Menu
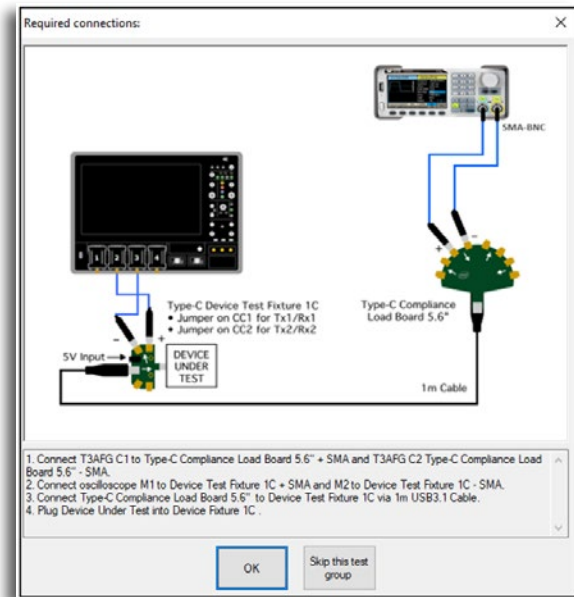
*Connection Diagram using T3AFG Generator*

Advanced Analysis and Signal Integity Debug

QPHY-USB3.2-TX-RX provides the choice to use Intel's 'SigTest' or 'Teledyne LeCroy SDAIII' Analysis for analyzing signal quality. SigTest used by the USB-IF for compliance, analyzes the oscilloscope waveforms and provides a Pass/Fail result. SDAIII allows the user to further debug SI issues using SDAIII-CompleteLinQ analysis software. For instance, analyzing the signal path from Tx pins to the equalized signal at after receiver equalization, or decompose jitter components to find root cause of SI failures. The WavePulser 40iX Interconnect Analyzer can also be used to characterize physical channels and compare them to worst case models used for USB-IF compliance testing.
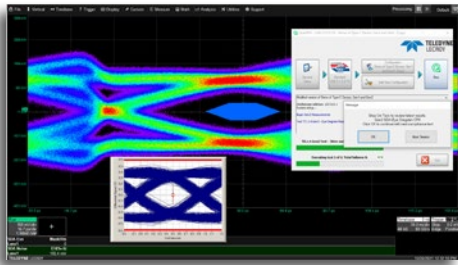
Use 'SigTest' or 'SDA-III'
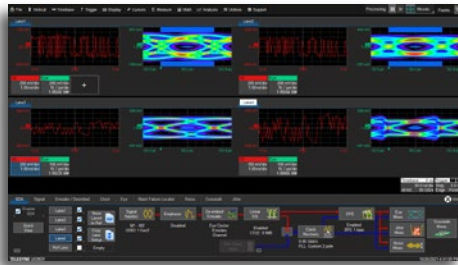
Characterize signal from Tx to Rx-EQ
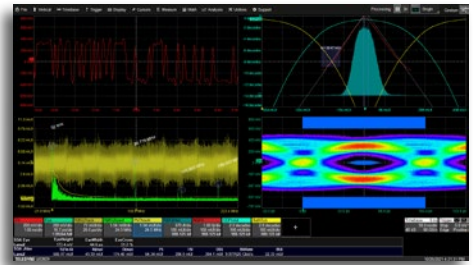
Identify Sources of System Jitter

Flexible Tx Automation Software

The QualiPHY Setup menu provides quick and easy test setup. The Variable Setup menu provides more advanced user settings for customizing tests and higher-level automation. User configurable variables include:
- Device type and data rates to test
- Connector types: USB Type-C, Standard-A, Micro-B
- Teledyne LeCroy SDAIII or SigTest analysis method (with SigTest version control)
- Generators: T3AFG 200/350/500, DUTC 150/250, Anritsu MP1900A, PeRT[3] (Eagle/Phoenix), user controlled
- Analyze live or saved waveforms
- Pause after test to review results or save setup for further analysis
- Customize CTLE and S-param embed/de-embed settings
- Test to Standard or Low Power LFPS measurement limits
- Host Program Control provides remote interface for higher-level automation

USB and DisplayPort over USB-C Compliance

QualiPHY software provides selection between all Compliance Test Specifications (CTS) with a single, easy to understand user interface and fastest test execution.
- USB 2.0: HS/FS/LS
- USB 3.2: Gen1/Gen2 (5 Gb/s and 10 Gb/s)
- USB4 & Thunderbolt 3/4
  – USB4: Gen2/Gen3 (10 Gb/s and 20 Gb/s)
  – Thunderbolt 3/4: Gen2/Gen3
    (10.3125 Gb/s and 20.625 Gb/s)
- DisplayPort 1.4/2.0 Source/Sink Testing over USB-C
Refer to individual QualiPHY datasheets for details.
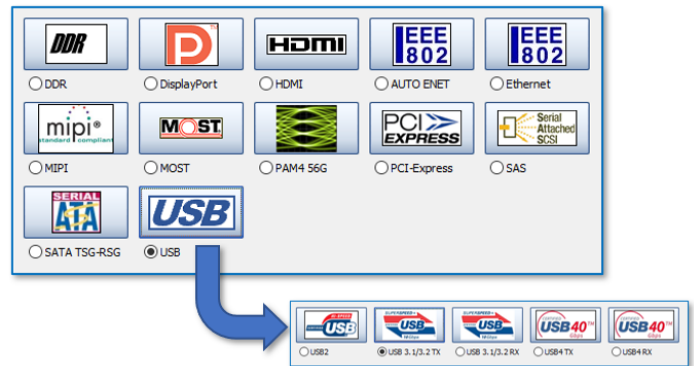
QualiPHY USB Compliance Selection

QPHY-USB3.2-TX-RX fully automates Rx stressed signal calibration and BER testing using the Anritsu MP1900A SQA BERT configured with MX183000A USB Link Training option. As with Tx testing, QualiPHY guides the user through CTS specified calibration and BER testing using connection diagrams. When complete, a USB-IF approved compliance report is generated. The MP1900A JTOL option can also be used to perform jitter margin testing.
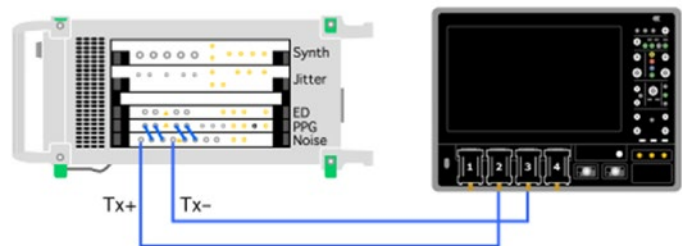
Sink Stressed Signal Calibration

Rx calibration is fully automated by adjusting the stressed signal parameters on the Anritsu MP1900A BERT and measuring them on the oscilloscope. The insertion loss (IL) of the total channel must be calibrated using the USB-IF standard calibration kits for USB Type-C, Standard-A, or Micro-B. The connection diagrams used for calibration are determined by the selected connector type.

USB 3.2 Rx Compliance Tests

The following LFPS Rx and Rx JTOL tests are automated:
- Enhanced Superspeed CTS:
  - TD 1.2 - Low Frequency Periodic Signaling RX Test (using MP1900A or T3AFG)
  - TD 1.8 - Receiver Jitter Tolerance at 5 GT/s over the USB Type-A or micro-B connector
  - TD 1.9 - Receiver Jitter Tolerance Test 5 GT/s over the USB Type-C connector
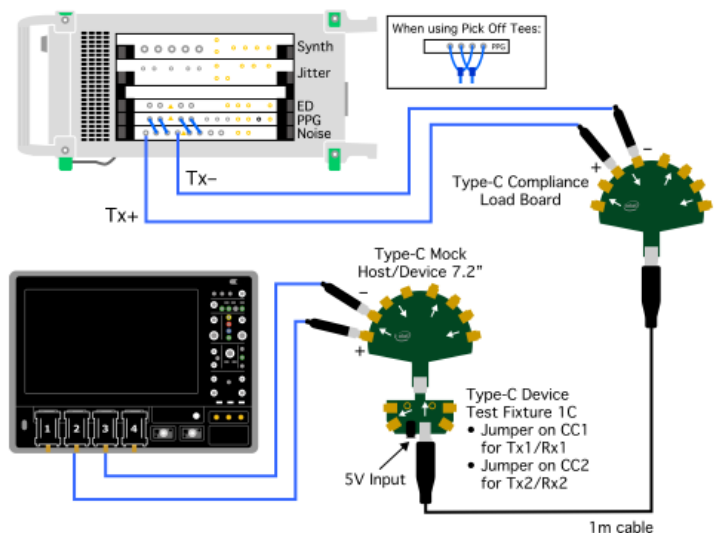 - TD.1.10 - Receiver Jitter Tollerance Test at 10 GT/s

USB 3.2 Short Channel RX Calibration

Short Channel Calibration

Short channel stressed signal parameters are as follows:
- Swing and De-emphasis
- Random Jitter (Rj)
- Sinusoidal Jitter (Sj)

Long Channel Calibration

Long Channel stressed signal calibration parameters are as follows:
- Calibrated ISI Channel (ISI)
- Final Eye Height and Width (EH/EW)

*USB 3.2 Long Channel RX Calibration*

BER Testing

After calibration is complete, BER is tested by connecting the calibrated stressed signal from the MP1900A SSG output to the the DUT's RX input; and the DUT's Tx into the MP1900A Error Detector. QualiPHY then automates loopback negotiation and BER JTOL tests using the Anritsu MX13000A Link Training software. Once all tests are executed, a USB-IF approved compliance report is generated.
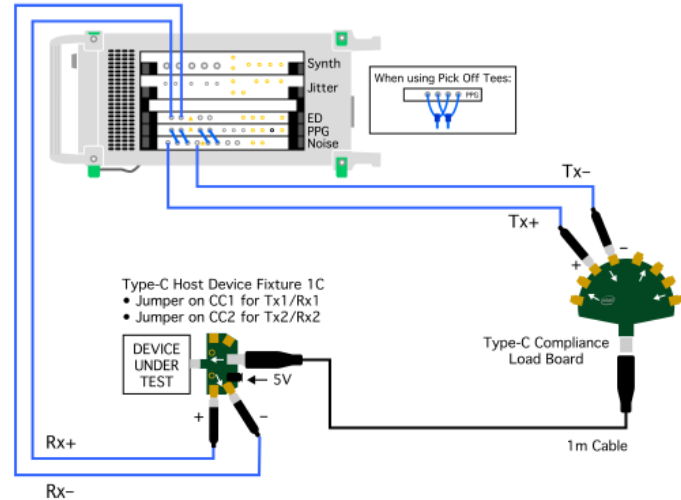
Flexible Rx Automation Software

The Variable Setup menu provides more advanced user settings for customizing tests and higher-level automation. User configurable variables include:

- Device type and data rates to test
- Connector types: USB Type-C, Standard A, Micro-B
- Instrument used for RX tests: MP1900A (All tests), PeRT[3] (Eagle/Phoenix - USB 3.1 Rx tests only), or T3AFG (LFPS Rx test only)
- Number of loopback max retries
- Continue or stop after max errors
- SJ frequencies to test
- JTOL test time
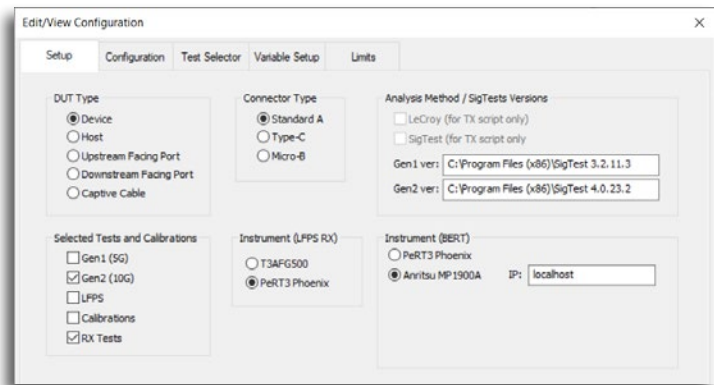
USB 3.2 Rx Setup Menu

QualiPHY

QualiPHY is designed to reduce the time, effort and specialized knowledge needed to perform compliance testing on high-speed serial buses.

- Guides the user through each test setup
- Performs each measurement in accordance with the relevant test procedure
- Compares each measured value with the applicable specification limits
- Fully documents all results
- QualiPHY helps the user perform testing the right way—every time!

Compliance Reports contain all of the tested values, the specific test limits and screen captures. Compliance Reports can be created as HTML, PDF or XML.

Beyond USB 3.2 Tx/Rx compliance testing, many USB Type-C interoperability issues arise from either PHY-logic link training or USB Type-C sideband negotiation problems between devices. DisplayPort over USB-C adds an additional layer of complexity as a USB 3.2 link can share the USB Type-C connector with two lanes of DisplayPort, all while delivering up to 240W of power across the cable. Teledyne LeCroy provides unique capabilities for Power Delivery, Alt Mode, and USB PHY-logic testing.

USB Type-C Sideband and Alt Mode debug

USB-PD TDMP (Trigger, Decode, Measure/Graph, and Physical Layer) provides triggering and decode on USB-PD packets. The USB-PD power contract is the first thing that gets negotiated when two USB Type-C devices are connected. DisplayPort 'Alt Mode' can be decoded by using DP-AUX DMP (Decode, Measurement/Graph, and Physical Layer) to debug timing issues. Both USB-PD TDMP and DP-AUX DMP also provide physical layer measurements that can be used to validate that each sideband signal meets the specification.

USB 3.2 PHY-logic decode

The USB32BUS D PHY-logic decode option provides link layer decode information annotated on the USB 3.2 physical layer waveform as well as in tabular form. This provides the ability to view protocol traffic on the oscilloscope and verify that the link is alive and operating properly.

USB 3.2 Protocol Analysis

ProtoSync software provides 'linked analysis' between the oscilloscope's decoder and USB Protocol Software Suite to further debug link up issues. Viewing protocol traffic on the osciloscope provides seamless transition from PHY, to PHY-logic, to Link Layers of the USB 3.2 protocol stack, enabling debug of protocol issues that may be PHY related.
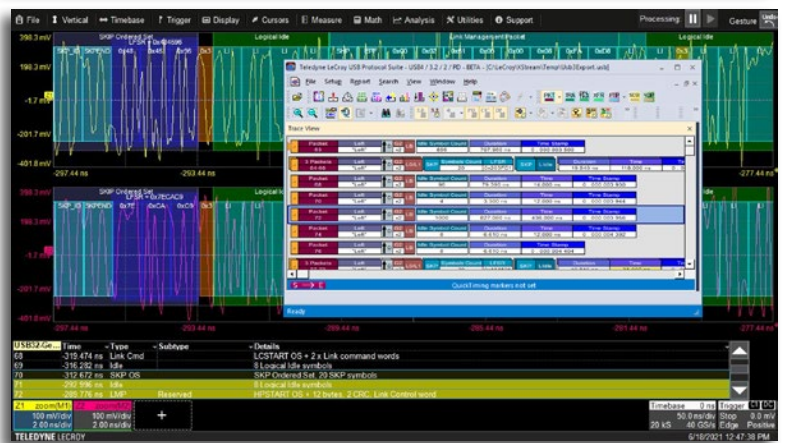
Teledyne LeCroy High Performance Oscilloscopes

The Teledyne LeCroy family of oscilloscopes has several models that support USB 3.2 compliance testing.

- LabMaster 10 Zi-A (20 GHz - 65 GHz bandwidth models) for simultaneous multi-lane acquisition
- SDA 8 Zi-B (8 GHz - 30 GHz bandwidth models) for single lane acquisition

Anritsu MP1900A Signal Quality Analyzer-R

The MP1900A is a BER test solution for R&D and compliance testing of high-speed devices. The MP1900A provides highly accurate stressed signal generation from 2.4 Gb/s to 32.1 Gb/s with the lowest intrinsic jitter available and supports high-reproducibility jitter and noise tolerance tests.

Teledyne LeCroy WavePulser 40iX High-speed Interconnect Analyzer

The WavePulser 40iX is the ideal single measurement tool for high-speed hardware designers and test engineers. The combination of S-parameters (frequency domain) and Impedance Profiles (time domain) in a single acquisition with a deep toolbox provides unmatched characterization insight of high-speed interconnects.

USB 3.2 PHY Test Fixtures and Generators

QPHY-USB3.2-TX-RX supports USB-IF approved as well as a variety of 3rd party test fixtures and generators:

Product:	Contact:
USB-IF official USB 3.2 Type-C Tx/Rx fixture Kit	*wilder-tech.com*
USB-IF official USB 3.2 Type-A/Micro-B Tx/Rx Fixture Kit	*usb.org/estore*
USB Type-C TPA Fixtures (Tx only) with DUTC Type-C and DP AUX Controllers	*wilder-tech.com*
USB Type-C TPA Fixtures (Tx only)	*en.luxshare-ict.com*
Teledyne LeCroy T3AFG LFPS Generators	*teledynelecroy.com*

USB 3.2, USB4™, and Sideband Protocol Analyzers

The introduction of USB 3.2 and USB4 along with the Type-C connector ushers in a new era of unprecedented performance for consumer electronics that can now utilize this universal interface for power, data and display. Positioned as the primary high-performance interconnect for the next decade, developers are ramping up their USB 3.2 / USB4 expertise. From engineering validation to compliance test, trust the experts at Teledyne LeCroy to help ensure product compatibility for next generation USB systems.

teledynelecroy.com/protocolanalyzer/usb

LabMaster 10Zi-A or WaveMaster 8Zi-B Oscilloscope (required for USB 3.2 Tx and Rx testing)

	LabMaster 10 Zi-A	SDA 8 Zi-B
LabMaster 10 Zi-A MCM	MCM Zi-A	–
Supported by QPHY-USB3.2-TX-RX	LM 10-20Zi-A to LM 10-65Zi-A	SDA 813Zi-B to SDA 830Zi-B
USB 3.2 Gen1 (5 Gb/s) Minimum BW	13 GHz at 40 GS/s	
USB 3.2 Gen2 (10 Gb/s) Minimum BW	16 GHz at 80 GS/s	

See oscilloscope datasheets for more information

Anritsu MP1900A BERT Configuration (required for USB 3.2 Rx testing)

Signal Quality Analyzer	MP1900A
21G/32G bit/s PPG	MU195020A
1ch data output, 10Tap Emphasis	Opt. 010, 011
21G/32G bit/s ED	MU195040A
1ch ED, 1ch CTLE, Clock Recovery	Opt. 010, 011, 022
Noise Generator	MU195050A*
12.5 GHz 4 port Synthesizer	MU181000B
Jitter Modulation Source	MU181500B
Jitter Tolerance Test	MX183000A-PL001
USB Link Training	MX183000A-PL022
MicroCircuits 63 dB Programmable Attenuator TD1.2 (LFPS Rx testing)	RC4DAT-6G-60

* Not required when using Pick Off Tee J1510A (2 pcs)

See MP1900A Datasheet for more information

Product Description	Product Code
Required USB 3.2 PHY Compliance Test Software Options	
QualiPHY Enabled USB3.2 TX-RX Software Option	QPHY-USB3.2-TX-RX
USB 3.2 Decode Software for LabMaster 10 Zi-A or SDA 8 Zi-B (Required for USB 3.2 SCD/LBPM tests and recommended for PHY-logic debug)	LM10ZI-USB32BUS D, WM8ZI-USB32BUS D
Required USB 3.2 Oscilloscope Options	
Serial Data Analysis Bundle - Multi-Lane SDA LinQ Framework, Incl. Eye, Jitter, Noise, Crosstalk Meas. w/EyeDrlI & VirtualProbe (Includes LINKQ and -VIRTUALPROBE required options)	LM10Zi-SDAIII-COMPLETELINQ or SDA10Zi-COMPLETELINQ WM8Zi-SDAIII-COMPLETELINQ or SDA8Zi-COMPLETELINQ
Recommended Options (for other USB Type-C Compliance testing and PHY-logic debug)	
QualiPHY Enabled USB4 Transmitter and Receiver Compliance Software option	QPHY-USB4-TX-RX
QualiPHY Enabled USB 1.0/1.1/2.0 Compliance Software Option	QPHY-USB
QualiPHY Enabled DisplayPort 2.0 Source Compliance Software Option (Includes QPHY-DP14-SOURCE)	QPHY-DP20-SOURCE
QualiPHY Enabled DisplayPort 2.0 Sink Compliance Software Option	QPHY-DP20-SINK
USB-PD Decode, Measure/Graph, and Physical Layer Option for LabMaster 10 Zi-A	LM10ZI-USBPD DMP
USB-PD Trigger, Decode, Measure/Graph, and Physical Layer Option for SDA 8 Zi-B	WM8ZI-USBPD TDMP
DisplayPort AUX Decode, Measure/Graph, and Physical Layer Option for LabMaster 10 Zi-A or SDA 8 Zi-B	LM10ZI-DPAUX DMP WM8ZI-DPAUX DMP

See Individual software option datasheets for more information

Recommended Probing Options (for PHY-logic debug)	
8 GHz - 20 GHz Differential Probes for SDA 8 Zi-B (1 ea. per lane tested)	DH08/13/16/20-PL with DH-SI or DH-SI-HS tip
25 GHz - 30 GHz Differential Probes for LabMaster 10 Zi-A (1 ea. per lane tested)	DH25/30-2.92MM with DH-SI or DH-SI-HS tip

See DH Series Probes datasheet for more information

WavePulser 40iX High-speed Interconnect Analyzer (required for Cable De-embed and Sink Channel Calibration)	
High-speed Interconnect Analyzer, 4-port, S-parameters DC-40 GHz, <1 mm Spatial Resolution, Internal Calibration, 4 phase matched cables	WavePulser-40iX

See WavePulser 40iX datasheet for options and accessories

Customer Service

Teledyne LeCroy oscilloscopes and probes are designed, built, and tested to ensure high reliability. In the unlikely event you experience difficulties, our digital oscilloscopes are fully warranted for three years and our probes are warranted for one year. This warranty includes:

- No charge for return shipping • Long-term 7-year support • Upgrade to latest software at no charge

TELEDYNE LECROY
Everywhere**you**look™

1-800-5-LeCroy
teledynelecroy.com

Local sales offices are located throughout the world. Visit our website to find the most convenient location.

usb32-testsolution-ds-02dec22