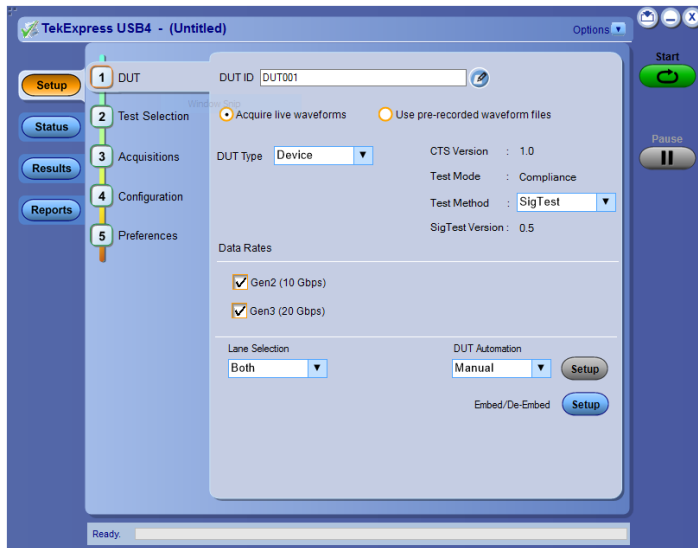


USB4™ Transmitter, Compliance, and Debug Solution

Opt. USB4 Application Datasheet

The Tektronix USB4¹ Compliance and Debug solutions provide an easy way to validate and characterize the emerging USB4™ Router-Host, USB4™ Router-Device, and USB4™ Hubs as per the USB4™ Electrical Compliance Test Specification v1.0. Tektronix DPO/MSO70000SX/DX Series Oscilloscope (bandwidth ≥ 23 GHz) supports the Tektronix USB4 Compliance and Debug solutions.

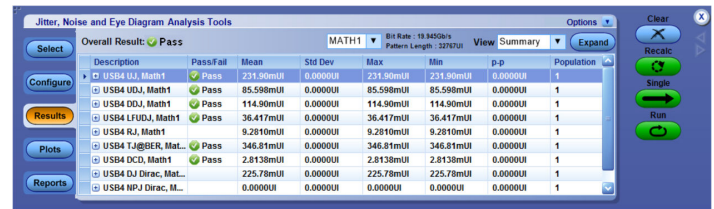


Tektronix USB4 Transmitter Compliance Solution

Key features

- Tektronix USB4 Compliance and Debug solution provide a comprehensive toolset for the USB4™ Gen2 (10 Gbps) and Gen3 (20 Gbps) verification, characterization, debug, and compliance testing.
- Tektronix USB4 solution² is compliant with the USB4™ Specification Ver1.0 and USB4™ Router Assembly Electrical Compliance Test Specification Rev 1.0.
- Tektronix DPOJET-USB4 Plug-in solution with setup files and MOI assists the root cause analysis.
- Tektronix USB4 solution supports the SigTest (USB-IF Analysis Tool).
- Tektronix USB4 solution supports the Wilder Technologies USB4 Controller and USB4 Electrical Test Tool (ETT).
- Tektronix Serial Data Link Analysis (SDLA) tool supports the De-embedding, Embedding, Equalization (CTLE+DFE), and Custom Channel Characterization.

- The TekExpress USB4 Signal Validation feature validates the compliance pattern to ensure the accuracy of the results.
- The TekExpress USB4 Pre-Recorded Mode supports the offline analysis and baseline for future specification changes.
- The TekExpress USB4 Automatic DUT Control mode captures all the compliance test patterns. So the USB4 Transmitter testing completes without user intervention.
- Tektronix USB4 Automatic DUT Control supports both USB4 Discrete and Integrated (SoC) products.
- Complete both Lane 0 and Lane 1 Transmitter test without flipping the USB Type-C® connector or USB4 High-Speed fixture.
- Quickly validate test results with comprehensive reporting that details test margins, pass/fail results, and plots in PDF, MHT, and CSV formats.



Tektronix USB4 debug solution

Applications

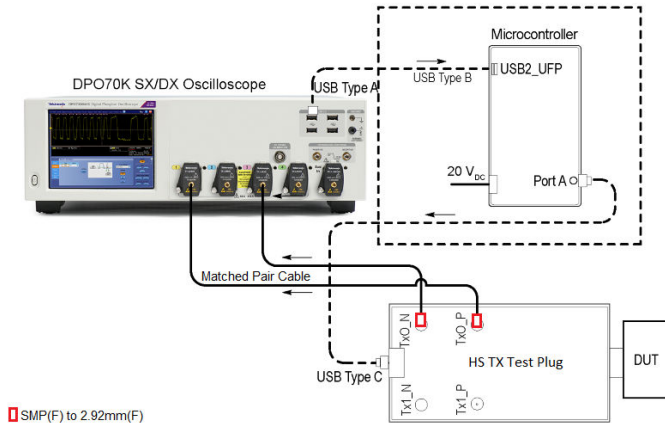
USB transmitter testing

- USB4 Silicon Testing: Host, Device, and Hub
- USB4 Peripheral Testing: Host, Device, and Hub
- Manufacturing testing

¹ USB Type-C®, and USB4™ are trademarks of the Universal Serial Bus Implementers Forum (USB-IF)

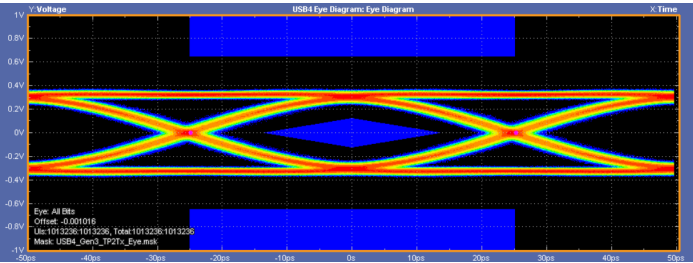
² USB-IF approved the Tektronix oscilloscopes (SX and DX series) for the USB4 testing. Approval for the automation software is pending.

USB4 Transmitter TP2 and TP3 Connection Diagram

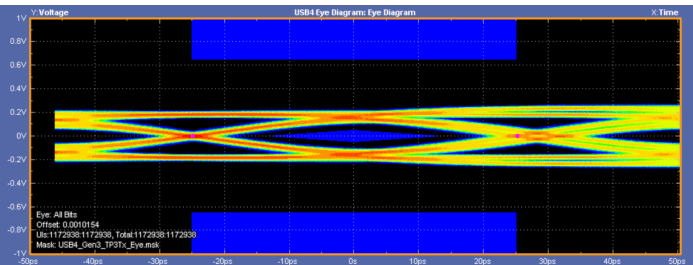


Tektronix USB4 Transmitter connection diagram

Required test procedures (MOI) can be found at: www.tek.com/usb



USB4 Gen3 (20 Gbps) TP2 Eye diagram



USB4 Gen3 (20 Gbps) TP3 Eye diagram with Equalization (CTLE and DFE)

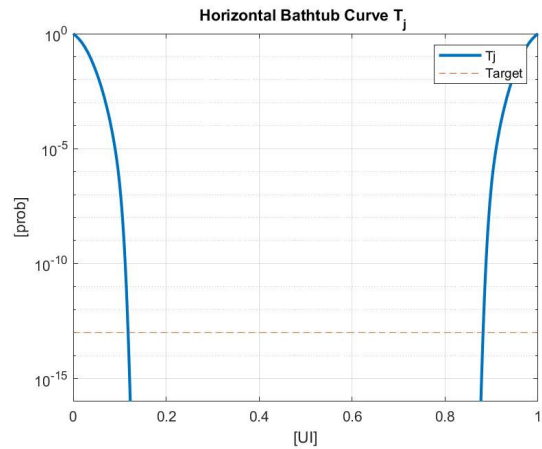
Tektronix® TekExpress USB4 Transmitter Test Report

Setup Information			
DUT ID	DUT001	Scope Model	DPO770025X
Date / Time	5/30/2021 3:22:58 PM	Scope Serial Number	B300069
Acquisition Mode	Live	Scope Firmware Version	1.0.12.0 Build 26
DUT Control	Manual	SPC Factory's/W Calibration	PASS:PASS
DUT Type	Device	TekExpress USB4 TX	10.0.91.28 (BETA)
Test Method	DPOJET	TekExpress Framework	5.5.0.91
Total Acquisition Time	00:06:04.52	DPOJET version	10.3.0.22
Total Analysis Time	00:01:58.59	SDLA version	3.0.11.10
Over All Test Result	Pass	CTS Version	v1.0
DUT COMMENT: General Comment - USB4 Transmitter DUT			

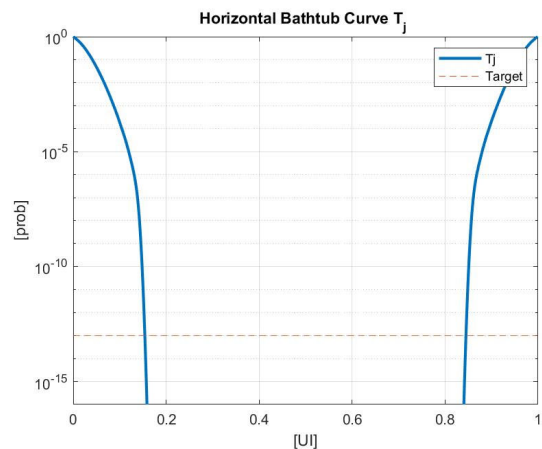
Minimum Unit Interval							
Measurement Details	Data Rates	Lane	Measured Value	Test Result	Margin	Low Limit	High Limit
MinimumUnitInterval Min	10G	Lane 0	100.015 ps	Pass	LL: 44.854 fs, HL: NA	99.97 ps	NA
MinimumUnitInterval Max	10G	Lane 0	100.017 ps	Pass	LL: NA, HL: 13.419 fs	NA	100.03 ps
MinimumUnitInterval Min	10G	Lane 1	100.015 ps	Pass	LL: 44.81 fs, HL: NA	99.97 ps	NA
MinimumUnitInterval Max	10G	Lane 1	100.017 ps	Pass	LL: NA, HL: 13.217 fs	NA	100.03 ps

SSC Down Spread Range							
Measurement Details	Data Rates	Lane	Measured Value	Test Result	Margin	Low Limit	High Limit
SSCDownSpreadRange Min	10G	Lane 0	0.453 %	Pass	LL: 0.053 %, HL: NA	0.4 %	NA
SSCDownSpreadRange Max	10G	Lane 0	0.457 %	Pass	LL: NA, HL: 0.043 %	NA	0.5 %
SSCDownSpreadRange Min	10G	Lane 1	0.453 %	Pass	LL: 0.053 %, HL: NA	0.4 %	NA
SSCDownSpreadRange Max	10G	Lane 1	0.457 %	Pass	LL: NA, HL: 0.043 %	NA	0.5 %

Tektronix USB4 Transmitter Compliance Report in MHT format



USB4 Gen3 (20Gbps) TP2 TJ Bathtub



USB4 Gen3 (20Gbps) TP3 TJ Bathtub

Specifications

High-Speed electrical tests supported in Tektronix USB4 solution

Test	Speed		Pattern	Test Point	
	Gen2 (10 Gbps)	Gen3 (20 Gbps)		TP2	TP3
Transmitter Preset Calibration	✓	✓	PRBS15	✓	
Transmitter Equalization	✓	✓	SQ128	✓	
Minimum Unit Interval	✓	✓	PRBS31	✓	
SSC Down Spread Range	✓	✓		✓	
SSC Down Spread Rate	✓	✓		✓	
SSC Phase Deviation	✓	✓		✓	
SSC Slew Rate	✓	✓		✓	
Rise/Fall Time	✓	✓		SQ128	✓
Total Jitter (TJ)	✓	✓	PRBS15	✓	✓
Uncorrelated Jitter (UJ)	✓	✓		✓	✓
Uncorrelated Deterministic Jitter (UDJ)	✓	✓		✓	✓
Data Dependent Jitter (DDJ)	✓	✓		✓	✓
Low-Frequency UDJ (LF UDJ)	✓	✓		✓	
DCD (Even-Odd Jitter)	✓	✓		✓	
Eye Diagram	✓	✓		PRBS31	✓
AC Common Mode	✓	✓	PRBS31	✓	
Electrical Idle Voltage	✓	✓	Idle	✓	

Ordering information

TekExpress USB 4 Transmitter Compliance and Debug Solution

DPO/MSO7000SX/DX ³	Tektronix DPO (Digital Phosphor Oscilloscope) or MSO (Mixed Signal Oscilloscope) Oscilloscopes – 23 GHz and above with DPOJET (DJA) and SDLA64 installed
DPO/MSO7000SX/DX Opt. USB4 ⁴	TekExpress USB4 Tx Compliance and DPOJET: USB4 Tx/Rx Measurement Plugin Solution (Requires Opt. CIO, DJA, SDLA64)
DPO-UP USB4 ⁴	TekExpress USB4 Tx Compliance and DPOJET: USB4 Tx/Rx Measurement Plugin Solution (Requires Opt. CIO, DJA, SDLA)
DPOFL-USB4 ⁴	TekExpress USB4 Tx Compliance and DPOJET: USB4 Tx/Rx Measurement Plugin Solution (Requires Opt. CIO, DJA, SDLA64); Floating
DPOFT-USB4 ⁴	TekExpress USB4 Tx Compliance and DPOJET: USB4 Tx/Rx Measurement Plugin Solution (Requires Opt. CIO, DJA, SDLA64); Floating Trial

Recommended USB4 Controller, High-Speed test fixture, and accessories

Item	Vendor	Quantity
USB4 Controller and High-Speed Test Fixtures: USB4-TPA-UC-K	Wilder Technologies	1
SMP(F) to 2.92mm(F) Adapter: SM8852	Fairview Microwave	Min 4
[Optional] SMP Terminators: ST2643	Fairview Microwave	4
PMCABLE1M Phase Matched SMA cable set	Tektronix	2

Oscilloscope and software prerequisite requirements

Operating System	DPO/MSO7000SX/DX with Microsoft Windows 10 OS
DUT Control Tool	The USB4 Electrical Test Tool (ETT) v 0.9.9 (or above) should be available on the oscilloscope. The USB4 ETT is available on the USB-IF Test Tools site www.usb.org/document-library/usb4ett .
Controller Driver and Software	Wilder Technologies USB4 Controller Driver and Software should be available on the oscilloscope. Contact Wilder Technologies for software support.
Matlab Runtime	Install the Matlab Runtime v R2019b(9.7) on the oscilloscope to run the USB4 SigTest tool. You can download the installable from www.mathworks.com/products/compiler/matlab-runtime.html .
SigTest Tool	Copy the SigTest executable on the oscilloscope. You can download the installable from www.usb.org/document-library/usb4-sigtest .

³ Required items: Opt DJA and Opt SDLA64. Optional items: Opt 10XL and DPO7AFP.

⁴ Requires Opt. CIO, DJA, and SDLA64, and ≥ 23 GHz oscilloscope.

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For Further Information. Tektronix maintains a comprehensive, constantly expanding collection of application notes, technical briefs and other resources to help engineers working on the cutting edge of technology. Please visit www.tek.com.

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