# Tektronix®

USB3.2 Type-C Transmitter and Receiver Solutions
USBSSP-TX, USB-TX, BSAUSB31, BSXUSB31N

DPOJET Analysis plots displaying eye mask hits, bath tub curve, and SSC profile

The Tektronix USBSSP-TX and USB-TX Automated Transmitter solutions provide an easy way to validate and characterize emerging USB 3.2 Type-C host controllers, hubs and devices with Tektronix MSO/DPO/70000DX/SX series oscilloscopes. The BERTScope Automated USB 3.2 Receiver Solution is designed to provide fast and accurate BERT-based testing with high test throughput, fast margin testing and a wide range of debugging tools.
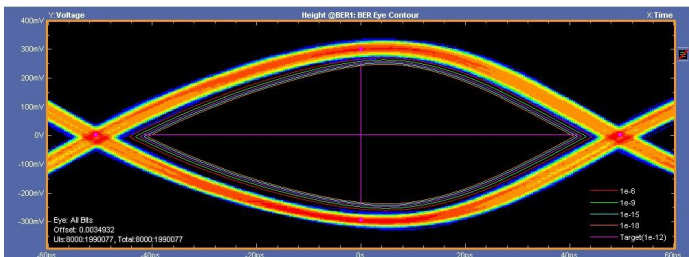
BER contour for USB 3.2 Gen 2 at 10Gbps extrapolated at 1E-12

Key features

- Transmitter testing
  - Provides a comprehensive automated and manual toolset for USB 3.2 Gen1 (5 Gbps) and Gen2 (10 Gbps) verification, characterization, debug, and compliance test
  - Supports Type-C, Standard and Micro connectors for USB 3.2 Specification
  - Provides automatic processing of USB-IF SIGTEST results without manual intervention
  - Auto selection of sources (channels) based on the probe type selected
  - Includes support for captive devices and their associated channels as per CTS
  - Uses pre-recorded mode to run measurements for offline analysis and collaboration with the globally dispersed teams.
  - DPOJET plugin for USB 3.2 Type-C, Standard and Micro connectors which supports USB 3.2 specification and CTS (Gen1 & Gen2) with setup files and MOI
  - Automatic DUT control and pattern validation to capture all required data patterns (CP0, CP1, CP9, CP10, etc.)
  - Support embedding all Channels and their respective filter files for Type-C, Standard and Micro Connectors using SDLA
  - Quickly validate test status with comprehensive reporting that details test margins, pass/fail results, and plots in PDF, MHT and CSV formats
  - Manual Lane Switching – Support for reversible Type-C connector

- Receiver testing
  - Fully automated receiver calibration, JTOL and margin testing
  - The BSX BERTScope series provides complete visualization of LTSSM (Protocol Awareness) and control the link training. If the DUT fails to handshake properly, the application provides error messages to debug further.
  - Sophisticated error analysis tools such as Pattern Sequencing and Error location analysis, built into the BSX Series help to understand underlying causes of bit errors
  - Receiver sensitivity to test beyond compliance and debug the DUT. This measurement tests how tolerant is the DUT, with the changes of amplitude keeping all the stresses enabled.
  - Comprehensive reporting that details test margins, pass/fail results, and plots in PDF, HTML, and CSV formats
  - Flexible signal impairments covering ISI, SSC and SJ, enables emulating any length channel/cable combination, any SSC profile at any frequency, and multiple tones simultaneously
  - USB Receiver Test software can be operated remotely through ASCII commands sent through TCP/IP, giving test engineers further flexibility in designing beyond compliance tests.

Applications

USB transmitter and receiver testing

- Host and Device silicon validation
- System, peripheral, and hub validation and integration
- Manufacturing test

Complete automation for USB testing

The automated solution for USB 3.2 on the BERTScope simplifies receiver testing. No longer is it a requirement that the end user be an expert in USB. The process of defining test parameters, putting the device into the proper test mode (loopback), measuring errors, showing results after each frequency is executed, and printing/storing the test results is fully automated for the user. The BERTScope solution provides all of the required signal impairments for USB 3.2, including SJ, RJ, SSC, and De-emphasis.

TekExpress sample report in MHT format

Required test procedures (MOI) can be found at: www.tek.com/usb.
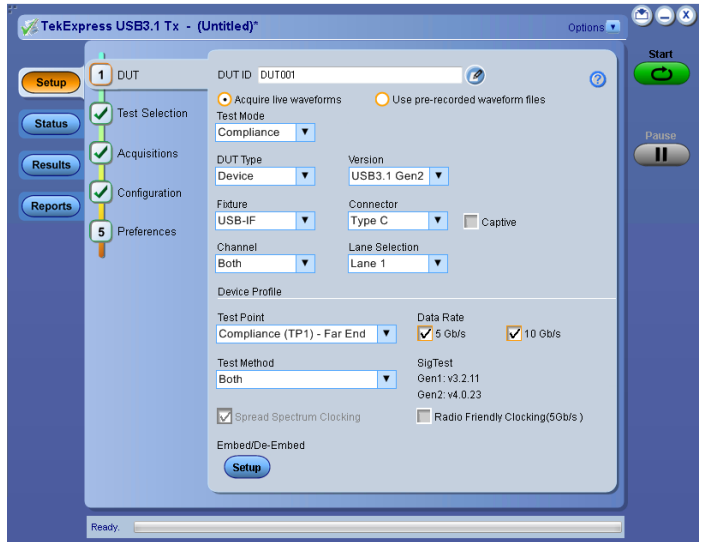
TekExpress automated framework configuration panel

Test configuration wizard

The BERTScope USB 3.2 Receiver Software Test Configuration Wizard provides step-by-step guidance for receiver test equipment setup and software setup. Clearly drawn Block diagrams, cabling configurations, and descriptions simplify the test configuration step.

Loopback initiation

The BERTScope USB 3.2 Receiver Automation Software provides a robust and hands-off system for initiating loopback of both host and device. Power on the DUT; it goes through different states of the Link Training and Status State Machine (LTSSM) training. Direct Low Frequency Periodic Signal (LFPS) generation by the BSX BERTScope's TxEQ module with inbound LFPS detection by the BERTScope receive logic, allows successful LFPS handshaking between the DUT and BERTScope. Tektronix USB Rx application uses color notation to display the state of the DUT. If there is any failure, the application will show error messages pup-up.
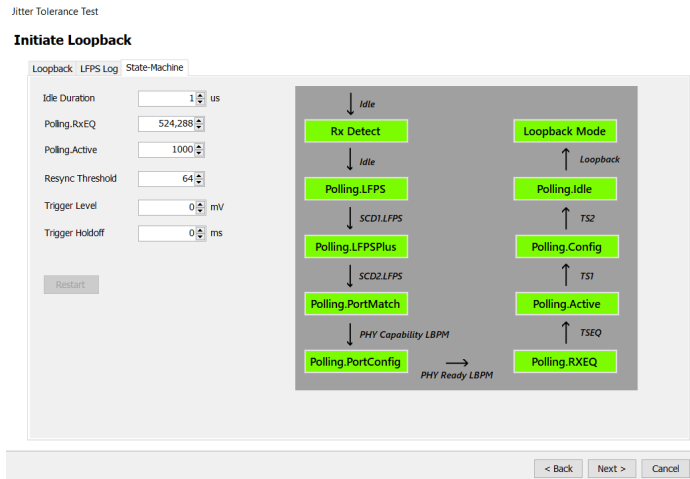
Automated loopback initiation.
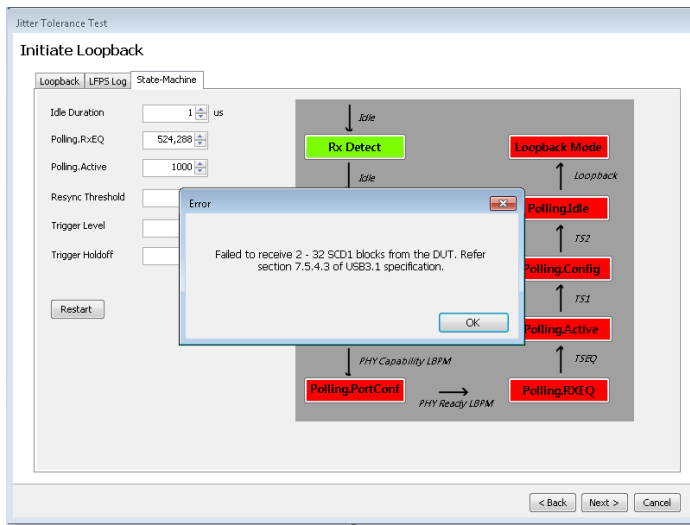
Loopback failure with error message.

Jitter tolerance testing

Jitter Tolerance (JTOL) is used when you perform receiver testing. Testing may be either in Compliance mode or Margin mode. Compliance-mode testing performs single test at each sinusoidal jitter (SJ) frequency specified in the jitter tolerance template. Margin mode testing sweeps a range of amplitudes for each SJ frequency.

USB Type-C Device JTOL Test.
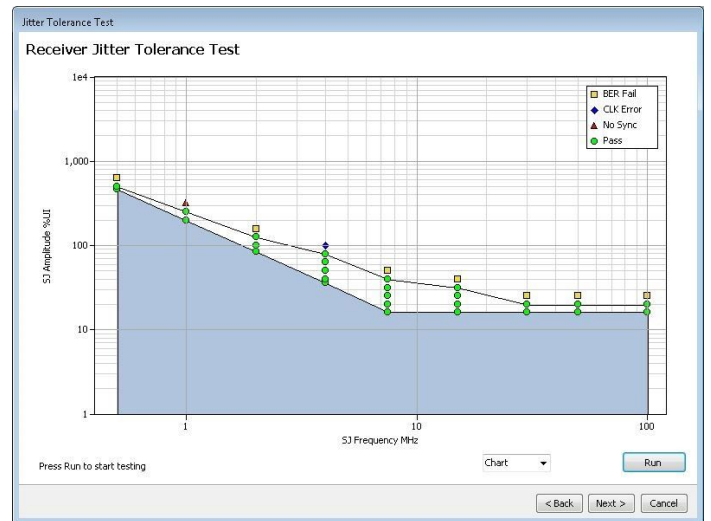
Receiver Margin Test.

Key differences between USB-TX and USBSSP-TX

Feature	USB-TX	USBSSP-TX
Automatic measurement selections based on device type, test type, test points, and selected probes	X	X
Automatic selection of receiver CTLE filter	CTLE only	CTLE/DFE
Automatic selection of Tx channel modeling for software channel emulation	X	X
Complete coverage of USB 3.2 Normative and Informative tests (see next table)	Gen1 (5 Gb/s)	Gen1 (5 Gb/s) and Gen2 (10 Gb/s)
Automatically save test reports and waveforms	X	X
Re-analyze prerecorded waveforms	X	X
Single test report for all measurements	Gen1 (5 Gb/s)	Gen1 (5 Gb/s) and Gen2 (10 Gb/s)
Automated LFPS measurements (setup files only)	X	X
Automated DUT toggle	X	X
Automated SIGTEST measurements	X	X

Ordering information

Automated TekExpress USB 3.2 (5 Gb/s and 10 Gb/s) transmitter measurements

DPO/MSO70000 [1]	Tektronix DPO (Digital Phosphor Oscilloscope) or MSO (Mixed Signal Oscilloscope) Oscilloscopes – 16 GHz and above with DPOJET and SDLA64 installed
DPO/MSO70000 Opt. USBSSP-TX [2]	USB 3.2 5 and 10 Gb/s Transmitter Normative and Informative Tests for TekExpress Automated Compliance Test Software
USBSSP-UP	Upgrade USB-TX (Supports 5G only) software to USBSSP-TX software package (Supports 5G & 10G)
DPOFL-USBSSP-TX [2]	Floating license upgrade for USB 3.2 5 Gb/s and 10 Gb/s Transmitter Normative and Informative Tests for TekExpress Automated Compliance Test Software
DPO-UP USBSSP-TX [2]	Upgrade for USB 3.2 5 Gb/s and 10 Gb/s Transmitter Normative and Informative Tests for TekExpress Automated Compliance Test Software
DPOFL-USBSSP-UP	Upgrade from Floating USB TX to Floating USB SSP TX

Recommended test fixtures, cables, and tools

Item	Vendor	Quantity
USB3ET Type A and Micro B Gen1 test fixtures	USB-IF	1
USB31AET Type A & Micro B Gen2 test fixture kit	USB-IF	1
USB31CET Type C Gen1 and Gen2 test fixture	USB-IF	1
PMCABLE1M Phase Matched SMA cable set	Tektronix	2
AFG3051C, AFG3052C, AFG3101C and above, AWG5000C, AWG7000C or AWG70000 (DUT State Control)	Tektronix	1
015-0572-00 BNC to SMA adapter	Tektronix	2
PWS4000 Tektronix Power Supply (optional for automatic power cycling)	Tektronix	1

Automated TekExpress USB 3.2 (5 Gb/s) transmitter measurements

DPO/MSO70000 [1]	Tektronix DPO (Digital Phosphor Oscilloscope) or MSO (Mixed Signal Oscilloscope) Oscilloscopes – 12.5 GHz and above with DPOJET and SDLA64 installed
DPO/MSO70000 Opt. USB-TX [3]	USB 3.2 5 Gb/s Transmitter Normative and Informative Tests for TekExpress Automated Compliance Test Software
DPOFL-USB-TX [3]	Floating license upgrade for USB 3.2 5 Gb/s Transmitter Normative and Informative Tests for TekExpress Automated Compliance Test Software
	Includes: Latest TekExpress product software DVD kit and upgrade SW key. Online documentation and printable manual in PDF format are supplied
DPO-UP USB-TX [3]	Upgrade for USB 3.2 5 Gb/s Transmitter Normative and Informative Tests for TekExpress Automated Compliance Test Software
	Includes: Latest TekExpress product software DVD kit and upgrade software key. Online documentation and printable manual in PDF format are supplied
USB-TX-UP	Upgrade USB TX solution from dongle based license to software node locked license.

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[1]   Requires Noise Analysis Tools (Opt. DJAN and DJA) for BER Contour support.

[2]   Requires DPOJET Jitter and Eye Analysis Tools (Opt. DJA) and ≥16 GHz oscilloscope and SDLA Visualizer (SDLA64).

[3]   Requires oscilloscope with bandwidth ≥12.5 GHz and DPOJET Jitter and Eye Analysis Tools (Opt. DJA).

Recommended test fixtures, cables, and tools

Item	Vendor	Quantity
USB3ET Type A & Micro B Gen1 test fixture kit	USB-IF	1
USB31CET Type C test fixture kit	USB-IF	1
PMCABLE1M Phase Matched SMA cable set	Tektronix	2
AFG3051C, AFG3052C, AFG3101C and above, AWG5000C, AWG7000C or AWG70000 (DUT State Control)	Tektronix	1
015-0572-00 BNC to SMA adapter	Tektronix	2

Automated BERTScope USB 3.2 receiver margin and compliance test (5 & 10 Gb/s)

BSAUSB31 Receiver Test Bundle [4]   **Includes:** BSAUSBSOFT – USB 3.2 Automation Software, BSASWITCH – BERTScope Intelligent Switch with driver

Requires: BSX125 or higher BERTScope with STR, TXEQ [5], CR125A or higher Clock Recovery

BSXUSB31N Receiver Test Bundle   **Includes:** USB 3.2 Receiver test automation software for BSX series BERTScope configured without external switch

Requires: BSX125 or higher BERTScope, C125A or higher Clock Recovery

BSXUSB31NUP   **Includes:** Upgrade BSAUSB31 software to BSXUSB31N for use with BSX-series BERTScope configured without the external switch

Recommended test fixtures, cables, and tools

Item	Vendor	Quantity
USB31AET Type A and Micro B test fixture kit for Gen 2	USB-IF	1
USB3ET Std-A/Std-B test fixture kit for Gen 1 testing	USB-IF	1
USB31CET Type-C test fixture kit for Gen 1 and Gen 2	USB-IF	1
USB3-AB-KIT Std-A/Std-B test fixture kit (for short-channel testing, order from Tektronix)	Tektronix	1
PMCABLE1M Phase Matched SMA cable set	Tektronix	2
AFG3252C (used for Rx LFPS testing)	Tektronix	1
USB3.2 Gen1/Gen2 automation software	Tektronix	1
BSX125 or higher with STR, TXEQ	Tektronix	1
CR125A or higher	Tektronix	1

Automated BERTScope USB 3.2 receiver margin and compliance test (5 Gb/s)

BSAUSB3 Receiver Test Bundle [4]   **Includes**: BSAUSBSOFT – USB 3.2 Automation Software, BSASWITCH – BERTScope Intelligent Switch with driver

Requires: BSA85C or higher BERTScope [5], DPP125C Digital Pre-emphasis Processor, CR125A Clock Recovery

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[4] Notice to EU customers: This product is not updated to comply with the RoHS 2 Directive 2011/65/EU and will not be shipped to the EU. Customers may be able to purchase products from inventory that were placed on the EU market prior to July 22, 2017 until supplies are depleted. Tektronix is committed to helping you with your solution needs. Please contact your local sales representative for further assistance or to determine if alternative product(s) are available. Tektronix will continue service to the end of worldwide support life.

[5] Note: Symbol Filtering (Opt.SF) must be ordered separately when ordering BSX125 or higher with option STR.

Prerequisite host system software requirements

For USBSSP-TX and USB-TX	DPO/MSO70000 Series oscilloscope with Microsoft Windows 7 and Windows 10
For BSAUSB31 and BSXUSB31N	Microsoft Win7 OS
	Microsoft Access (BSAUSB3 only)
	Tektronix PWS4000 [6] Power Supply with output current ≥1.2 A

Required equipment for USB 3.2 testing

For complete list of required equipments, go to http://www.tek.com/usb.

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6   Standard copper wire is required to make use of the power supply DUT power cycle.

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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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