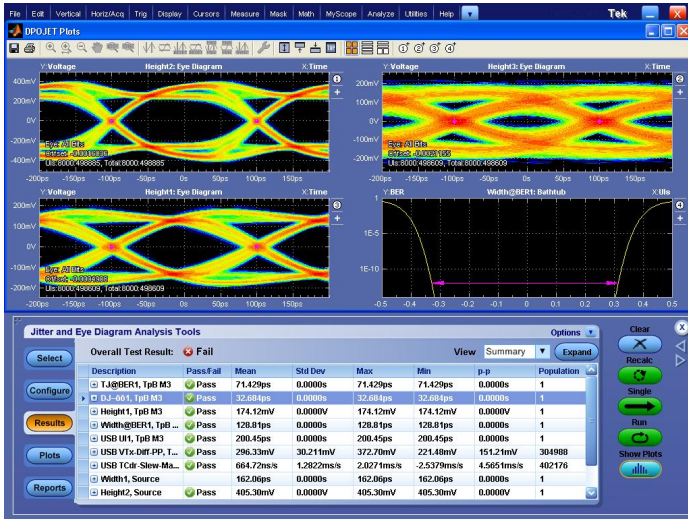


USB 3.0 Transmitter and Receiver Solutions

USB-TX • USB-RMT • USB3 • SSP



Features & benefits

Transmitter testing

- Provides a comprehensive toolset for USB 3.0 verification, characterization, debug, and compliance test
- Provides automatic processing of USB-IF SIGTEST results without manual intervention
- Transmitter verification and debug of USB 3.0 SuperSpeedPlus designs (Opt. SSP)
- Automatic DUT control and pattern validation to capture all required data patterns (LFPS, CP0, CP1, etc.)
- Automated USB 3.0 normative and informative transmitter tests – single-button execution with no user interaction required

- Quickly test under different test conditions with independent controls for de-embedding, channel embedding, and equalization
- Channel models and equalization can be customized with serial data link analysis (Opt. SLA)
- Test fixtures provide access to both USB 3.0 transmitter and receiver signals supporting transmitter and receiver tests without physical cables
- Quickly validate test status with comprehensive reporting that details test margins, pass/fail results, and plots

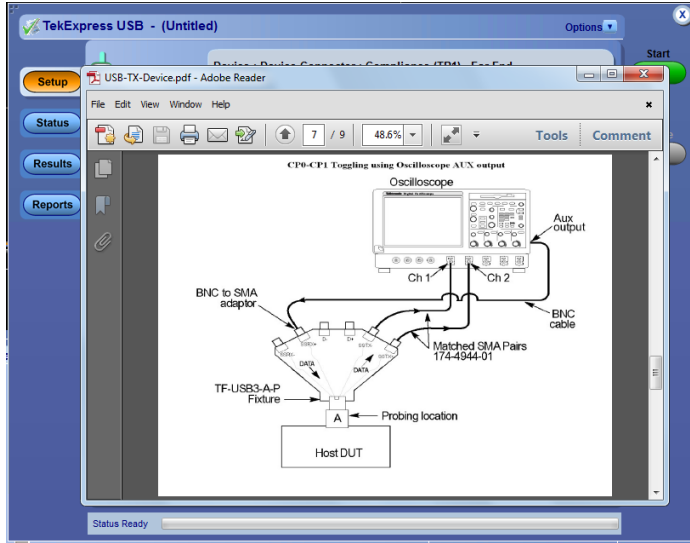
Receiver testing

- Support for a broad range of serial standards, leveraging the BERTScope® and Arbitrary Waveform Generator
- Fully automated receiver compliance and margin testing, including automated calibration and integration with Tektronix power supply reduces the test time and complexity of executing receiver tests
- Industry leading single-click loopback initiation
- Accurate and fast BERT-based jitter tolerance testing maximizes receiver test throughput
- Robust automation software includes hardware configuration help, report generation, and test database
- 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
- Automated calibration of signal impairments enables quick calibration of waveforms, and does not require you to understand detailed procedures for calibration
- Programmatic interface enables integrating additional test procedures into the TekExpress® RMT automation framework

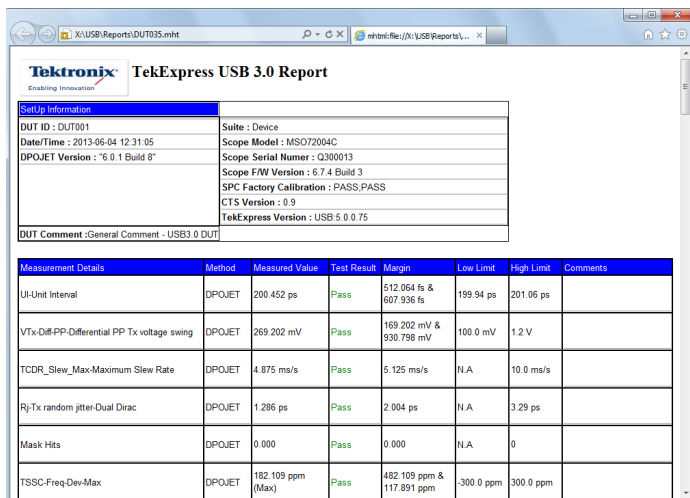
Applications

Transmitter and receiver testing

- USB 3.0 transmitter and receiver testing for:
 - USB 3.0 Host and Device silicon validation
 - System, peripheral, and hub validation and integration
 - Manufacturing test



Show Schematic.



View Report.

Complete automation for USB 3.0 testing

TekExpress USB 3.0 software provides an automated, simple, and efficient way to test USB 3.0 transmitters (USB-TX) consistent with the requirements of the SuperSpeed USB Electrical Compliance Test Specification (CTS). Receiver testing is automated on both the BERTScope (BSAUSB3) and AWG platforms (TEKEXP USB-RMT).

100% USB 3.0 test coverage

Compliance requirements per the Electrical Compliance Test Specification for USB consist of an eye diagram and jitter (Random, Deterministic,

and Total Jitter and SSC Profile) tests. However, the SuperSpeed USB base specification also includes a set of informative measurements including tests for Slew, Voltage Levels, and others. The TekExpress USB-TX software is an easy-to-use software package that automates the USB 3.0 (5 Gb/s) Normative and Informative transmitter tests. The DPOJET Option USB3 provides semi-automation of the USB 3.0 (5 Gb/s) Normative and Information Transmitter measurements and setup library. The DPOJET Option SSP provides semi-automation of the USB 3.0 (10 Gb/s) transmitter measurements. These include limits and mask files as well as new measurements now required for 10 Gb/s operation. While other manufacturers promote standard-specific compliance software, the Tektronix solution provides a comprehensive verification, characterization, debug, and compliance environment.

Receiver testing is a requirement for SuperSpeed USB certification. The increase of data rate makes it critical that the receiver properly interprets the incoming bit stream. The receiver test is a jitter tolerance test which stresses the receiver over defined sinusoidal jitter frequencies and amplitudes which are defined in the CTS. The table below outlines the required test frequencies for USB 3.0 SuperSpeed receiver testing. All other impairments (RJ, SSC, De-emphasis) remain constant while the SJ is swept across the frequencies defined in the standard.

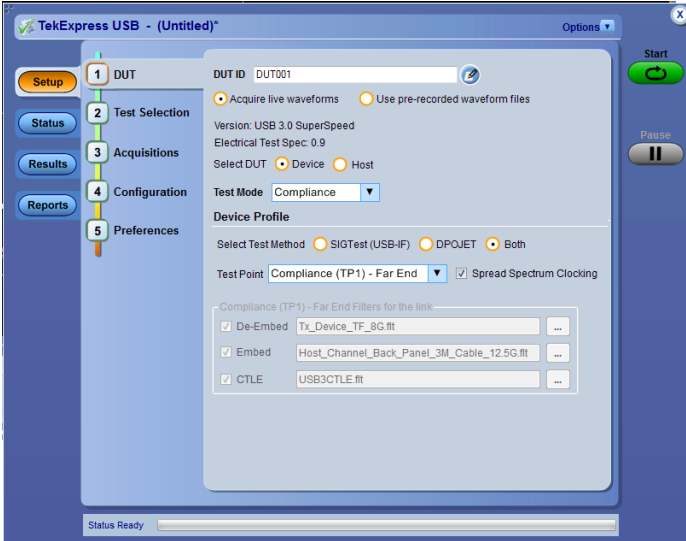
SuperSpeed USB required jitter tolerance frequency and amplitude sets

Frequency	SJ
500 kHz	400 ps
1 MHz	200 ps
2 MHz	100 ps
4.9 MHz	40 ps
10 MHz	40 ps
20 MHz	40 ps
33 MHz	40 ps
50 MHz	40 ps

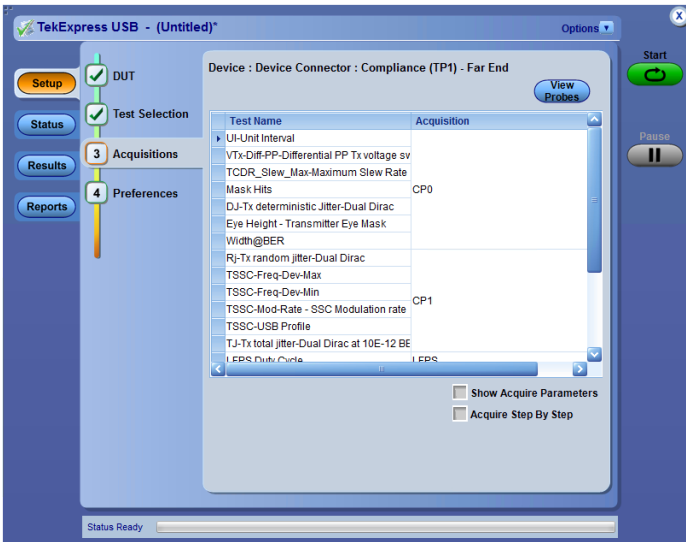
Automated solutions BSAUSB3 for the BERTScope and USB-RMT for the AWG simplify receiver testing. No longer is it a requirement that the end user be an expert in USB 3.0. The process of defining test parameters, putting the device into the proper test mode (loopback), measuring errors, showing results after each frequency is executed, and printing/storing the test results is fully automated for the user. Both solutions provide all of the required signal impairments for SuperSpeed USB including SJ, RJ, SSC, De-emphasis.

Required test procedures (MOI) can be found at:

www.tektronix.com/usb



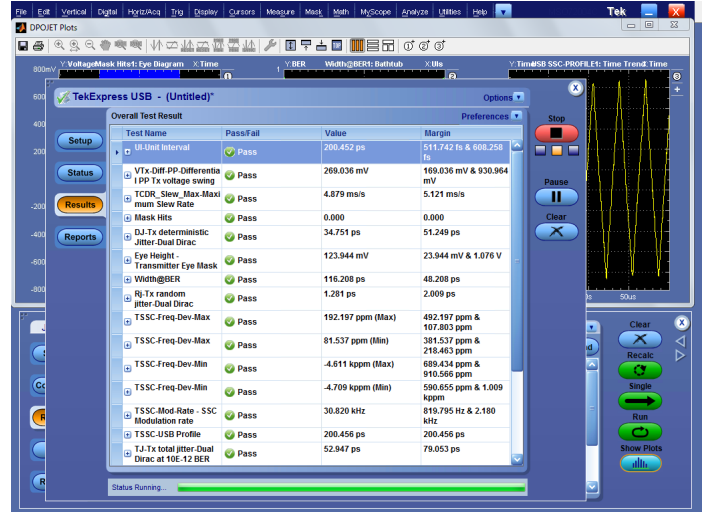
Quickly start compliance testing by selecting the DUT type. All necessary default settings will be configured automatically.



Acquisitions Panel.

Automated transmitter testing – save time and resources

There is no longer a need to be an expert on transmitter testing procedures. Remembering the exact steps to take is time consuming and often requires going back to the Test Specification. USB-TX takes the guesswork out of conducting SuperSpeed USB transmitter testing. Even if you remember how to use the test equipment, it is common for even the most experienced operators to forget steps in the procedure or to set up the correct parameters, like applying the correct filters or clock recovery technique.



Real-time test status is updated upon measurement completion.

USB-TX allows engineers to simply select the desired tests to run and work on other tasks while the tests are being executed.

USB 3.0 transmitter test

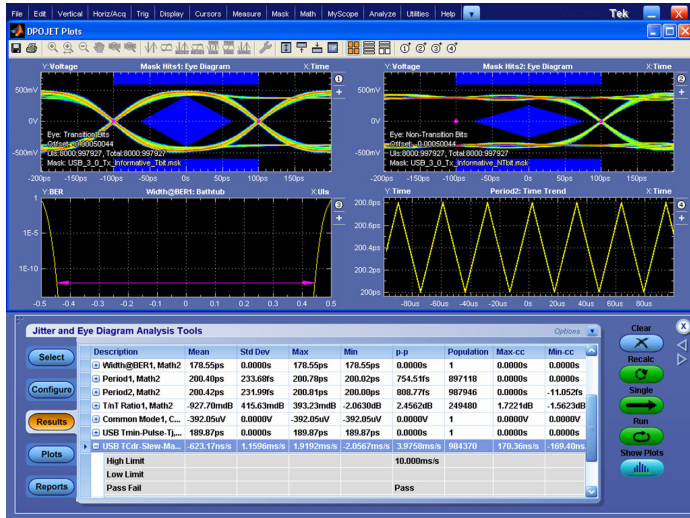
SuperSpeed USB transmitter testing with USB-TX

SuperSpeed USB transmitters must pass a signal quality test using SigTest. SigTest is a post-processing electrical test tool available from the USB-IF (www.usb.org) that measures amplitude, jitter, and mask hits. In order to simplify testing, USB-TX automatically configures the oscilloscope, acquires the waveforms, and automates SigTest measurements.

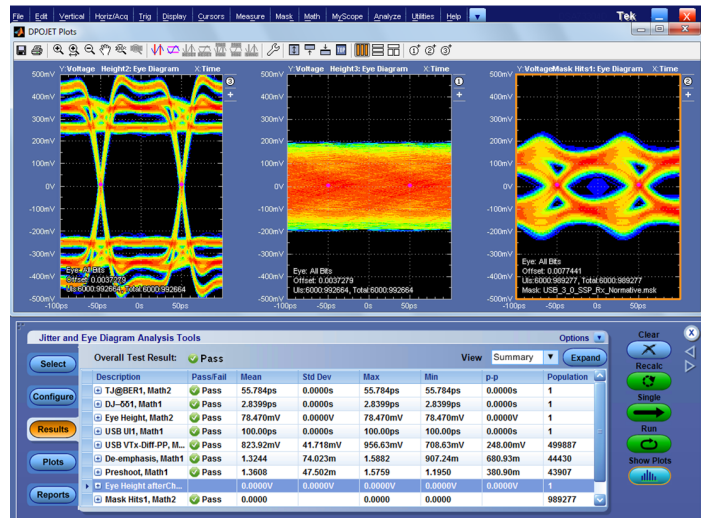
A choice is available at run time to process the measurements using SigTest or, if debug and further analysis is required, with DPOJET.

Compliance testing requires three different test patterns: CP0, CP1, and LFPS. Controlling the device under test to transmit the required test patterns is simple with USB-TX. State control is fully automated by using a supported Tektronix Arbitrary Function Generator (AFG) or Arbitrary Waveform Generator (AWG). The option is also available to control the DUT using the Auxiliary output of the oscilloscope (though this method is not guaranteed for all DUTs). In the event that the DUT is not able to generate the desired test pattern, the user has the flexibility to skip all measurements requiring that pattern without losing any test data that has been previously acquired. Once all necessary patterns have been acquired all measurements are fully automated with USB-TX.

Upon completion of the testing a comprehensive report is provided that outlines the measurements, test limits, and margin. The report also shows plots representing the eye diagram and SSC profile which are useful to determine the source of failures or results with minimal margin. In the event that measurements need to be redone, USB-TX provides an option to use prerecorded waveforms. This is useful in situations where data sharing is required and a DUT is not physically available.



Advanced analysis with USB3 for verification and debug.



Tx (left), Far End (middle), and Post Rx EQ (right) response with SSP measurement suite

USB 3.0 SuperSpeed (5 Gb/s) transmitter testing with USB3 Essentials

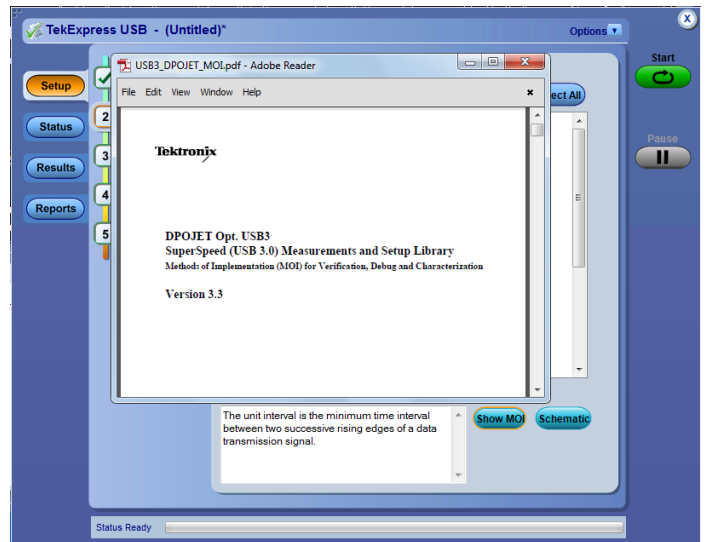
USB 3.0 Essentials DPOJET Measurements and Setup Library (Opt. USB3) for the DSO/DSA/MSO70000 Series oscilloscopes provides a semi-automated USB 3.0 transmitter solution. USB3 provides a precise verification, characterization, and debug environment built upon the general-purpose analysis capabilities of DPOJET. USB3 enables the execution of all USB 3.0 Normative and Informative transmitter tests. A comprehensive analysis environment is provided allowing the user to quickly compare the results from multiple test configurations. For example, multiple eye diagrams can be displayed at one time allowing the user to analyze the effects of different clock recovery techniques or software channel models. USB 3.0 requires the analysis of the eye diagram with and without the transition bit. With DPOJET the user can easily compare the results of both eye diagrams at the same time.

A supported configuration includes a DPO/DSA/MSO70000 oscilloscope (or other supported oscilloscope) equipped with DPOJET (Jitter and Eye Diagram Analysis Tools). The software requires a DPO/DSA/MSO70000 oscilloscope (greater than 8 GHz, 12.5 GHz required for compliance testing) with DPOJET (Opt. DJA).

USB 3.0 SuperSpeedPlus (10 Gb/s) transmitter testing with Option SSP

SuperSpeedPlus Essentials DPOJET measurements and setup library (Opt. SSP) for the DSO/DSA/MSO70000 Series oscilloscopes provides a semi-automated USB 3.0 10 Gb/s transmitter test solution. SSP, like Option USB3, is built upon the general-purpose analysis capabilities of DPOJET and enables thorough verification and debug of SuperSpeedPlus designs.

New silicon validation is easier with the integrated debug tools offered with DPOJET, SDLA Visualizer, and Option SSP. Evaluating design margin is a critical step while migrating to the 10 Gb/s data rate. For example, a shrinking channel loss budget will require more attention than before to the impact of equalization on far end signal quality. Multi-cycle acquisition and regression analysis along with DPOJET visualization tools can provide insight into design optimizations. Also with SDLA Visualizer you can easily



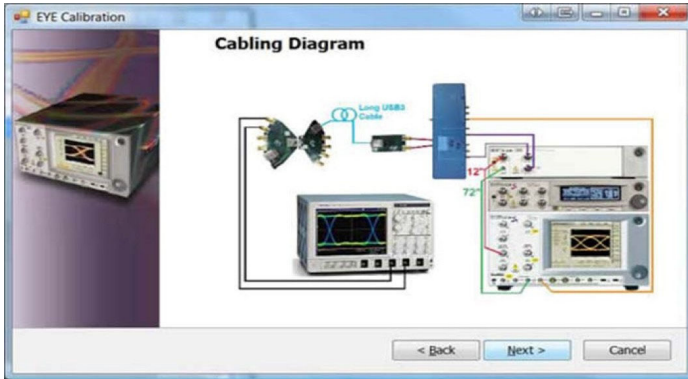
Show MOI

compare results with the reference transmitter equalization while varying CTLA/DFE parameters to find the best combination to maximize margins.

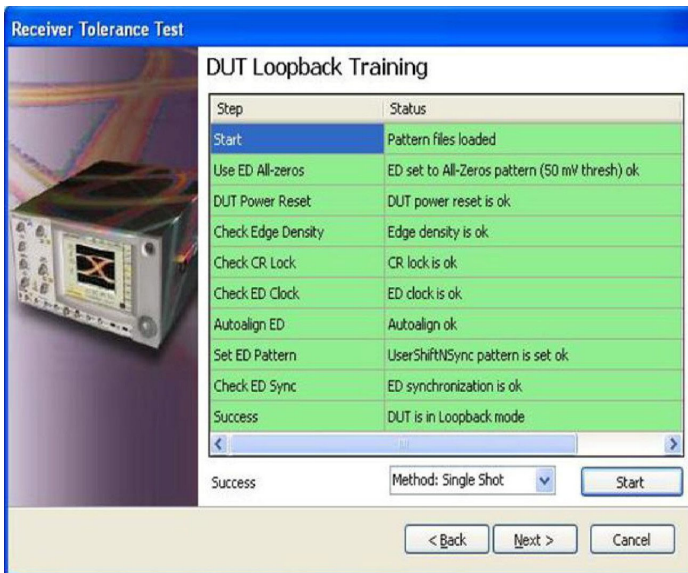
A supported configuration includes a DPO/DSA/MSO70000 Series oscilloscope (or other supported oscilloscope) equipped with DPOJET (Jitter and Eye Diagram Analysis Tools) and SDLA Visualizer (SDLA64, optional). The software requires a DPO/DSA/MSO70000 Series oscilloscope (greater or equal than 16 GHz with DPOJET (Opt. DJA)).

Automated receiver testing

USB 3.0 is prevalent in an array of markets ranging from consumer electronics to computing applications. Often multiple technologies must be tested to bring these products to market. The Tektronix USB 3.0 receiver portfolio of the BERTScope and AWG provides broad support for these standards. Regardless of the technologies at hand that must be tested with USB 3.0, Tektronix has a solution. Leading-edge technologies such as PCI Express 3.0 and SAS-3 that require complex transmitter equalization are



Test Configuration Wizard.



Automated Loopback Initiation.

supported with the BERTScope. The unique requirements such as cable emulation for HDMI and pulse width jitter for MIPI are supported with the AWG platform. Both solutions provide an automated test environment for USB 3.0 receiver compliance and margin testing.

BERTScope automated receiver testing

The BERTScope USB 3.0 Automated receiver test solution is designed to streamline the often tedious and labor-intensive receiver test workflow. No longer is expert USB 3.0 domain knowledge required to configure, calibrate, test, and document the results. Fast and accurate BERT-based testing provides high test throughput, intuitive and fast margin testing, and availability of a wide range of debugging tools when further investigation is required. The result is high test productivity starting from setup through to the documentation of results.

Test configuration wizard

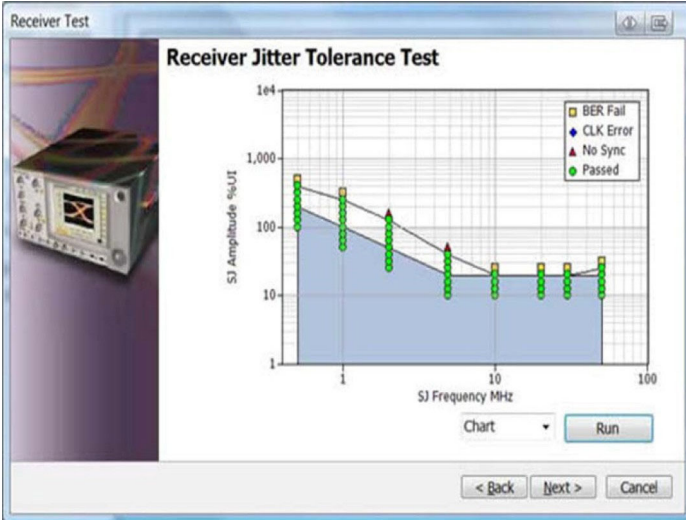
The BERTScope BSAUSB3 Test Configuration Wizard provides step-by-step guidance for receiver test equipment setup and software setup. Clearly drawn Block diagrams, cabling configurations, and descriptions simplify the test configuration step.

Automated stress calibration

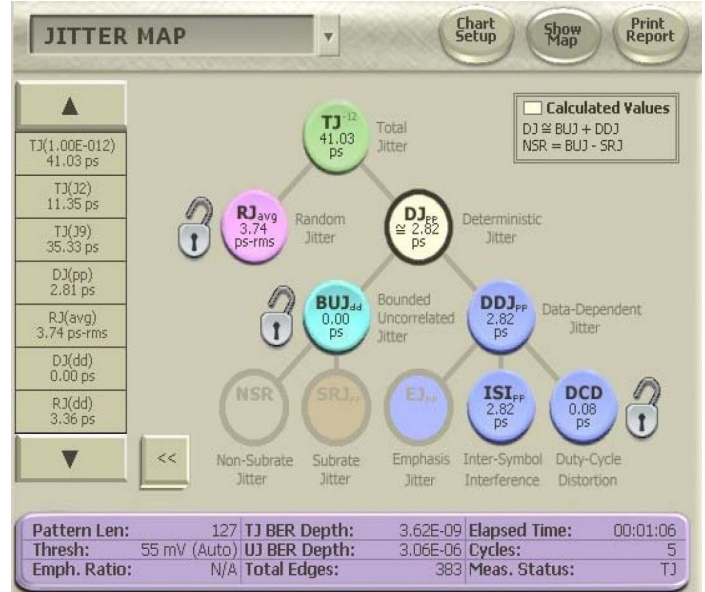
An important step in preparing for receiver testing is the calibration of the stress sources to ensure that the stress applied at the test fixture to the device under test is truly compliant with the test standard. In the past, these calibrations were often the most tedious and error-prone steps in the receiver test setup process. With the BSAUSB3 Automation Software, the calibration of the stress "recipe" is completely automated, including saving the calibration data. For test configurations that do not change, this step only needs to be performed once, and the stored calibration data is immediately available. Test engineers can now spend less time calibrating, and more time testing.

Loopback initiation

Before the receiver test can start, the device under test must be put in the proper test mode, called Loopback, where the device is re-transmitting the exact same data that was received. Entering Loopback mode is challenging because of the variety of loopback negotiation sequences across the range of USB 3.0 devices, and compatibility with test equipment characteristics. The BERTScope BSAUSB3 automation software, operating with the Tektronix Instrument Switch (BSASWITCH), provides a robust, hands-off system for initiating loopback for both Host and Device-style targets. In addition, recovery from loss of synchronization is handled through the use of word-alignment patterns, often avoiding the need to retrain loopback and interrupt the test process.



Receiver jitter tolerance margin test.



BERTScope jitter decomposition.

Jitter tolerance testing

Jitter Tolerance testing is the essence of the USB 3.0 receiver test, and a single-click operation is part of the BSAUSB3 software solution. With real-time stress adjustment, quick synchronization, and BER testing capability, the BERTScope provides the ideal platform for fast jitter compliance testing. Test results are stored using the built-in database for later recall and report generation.

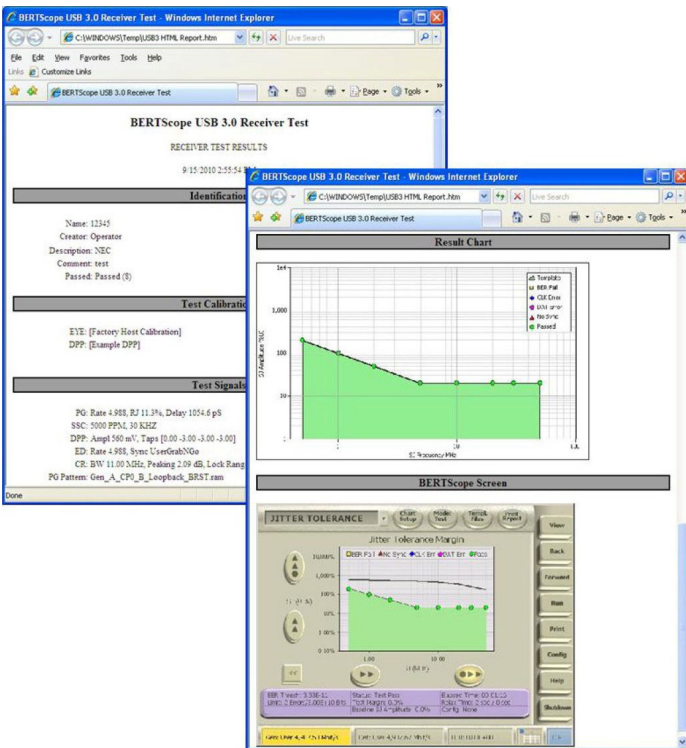
Beyond testing compliance, the automation software also provides a single-click solution for finding the ultimate tolerance limits of the device under test, termed "search for margin".

Remote control protocol

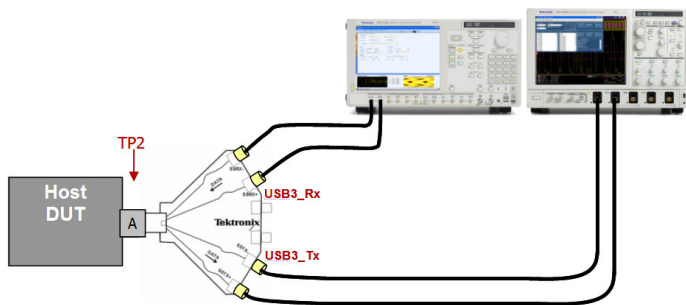
Test software can be operated remotely through ASCII commands sent through TCP/IP, giving test engineers further flexibility in designing "beyond compliance" tests.

Debugging tools

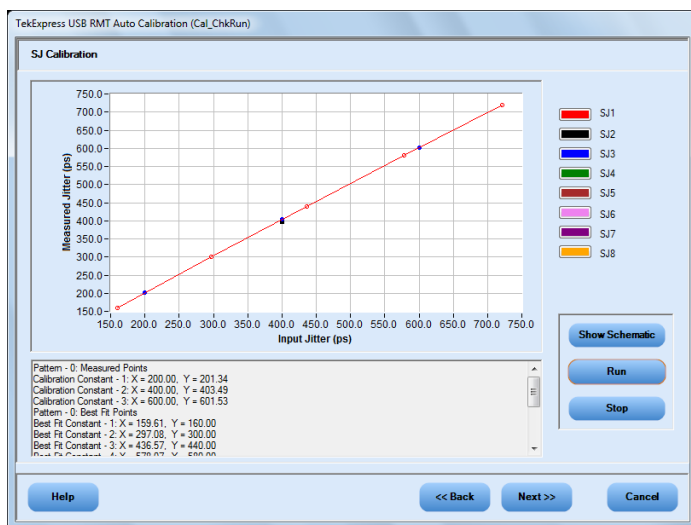
When a device fails to meet the test requirements, the operator has the power of the full range of BERTScope debugging tools. From intuitive and fast manual stress adjustment to exclusive error analysis capability and jitter decomposition, the BERTScope can help identify subtle issues that other instruments might miss.



Receiver test report.



AWG SuperSpeed USB Host setup for transmitter and receiver testing.



Automated Calibration

AWG automated receiver testing

Configuring test equipment for receiver testing can often be time consuming and cumbersome. The AWG is the only receiver test solution for USB 3.0 that provides a common test configuration for transmitter and receiver testing. Where other configurations rely on switches, physical USB cables, and reference channels, the AWG7000 and DPO/DSAMSO70000 Series instruments provide a simplified test configuration.

Automated calibration in RMT

Automated calibration of signal impairments provides calibration routines that are USB3 standard specific, enables quickly calibration of waveforms and does not require you to understand detailed procedures for calibration. The objective of calibration is to compensate the patterns for specific jitter parameters. The typical parameters are de-emphasis, random and sinusoidal jitter, and stressed eye. The procedure will be to sequence through all the patterns and each pattern will be calibrated independently. These values are used for the jitter-controlled generation of patterns which will be injected into DUT during loopback.

The Final Tj check using Calibrated Rj, Sj (50 MHz) and De-emphasis are within a range of 85 ps to 100 ps.

The calibration results can be viewed at any time as values as well as graphical plots. Using quadratic fit (also known as curve-fit) for all the target values gives the characteristic curve. The curve fit will be useful

for estimation if any of the target values shows nonlinear nature. The respective calibrated values are derived from the characteristic curve.

Loopback negotiation

Before the receiver test can start, the device under test must be put into the proper test mode, called loopback. In this mode, the DUT is sending the exact same data pattern on its transmit pair as it received. Loopback negotiation is one of the most difficult and time-consuming aspects of performing receiver testing. The flexibility of the AWG is unparalleled in the ability to put devices into loopback. The power is in the real-time sequencing of the AWG that enables the user to create infinite waveform loops, jumps, and conditional branches.

This process is fully automated with the USB-RMT, following the sequence described in the SuperSpeed USB Compliance Test Specification. For devices that require a custom loopback method, a custom sequence file can be created and used with USB-RMT. However, for certification the intent is to require that the device is capable of going into loopback following the sequence described in the CTS.

Error detection

Once the device is in loopback, an error detection mechanism is required in order to validate that the data pattern being retransmitted from the DUT is what was sent from the AWG. Error detection for USB 3.0 requires the use of an error detector that works with asynchronous reference clocks. For USB 3.0, the Tx and Rx are on separate reference clocks, which requires the use of SKP ordered sets to compensate for the frequency delta caused by the separate reference clocks and SSC. A transmitter is required to send SKP ordered sets every 354 symbols, however, the SKP ordered sets may not be inserted in a packet. The result is that the number of transmitted SKP ordered sets by the AWG may not match the number of SKP ordered sets sent by the DUT. In this event, the error detector must be able to ignore SKP ordered sets while executing the test.

Real-time oscilloscope error detection

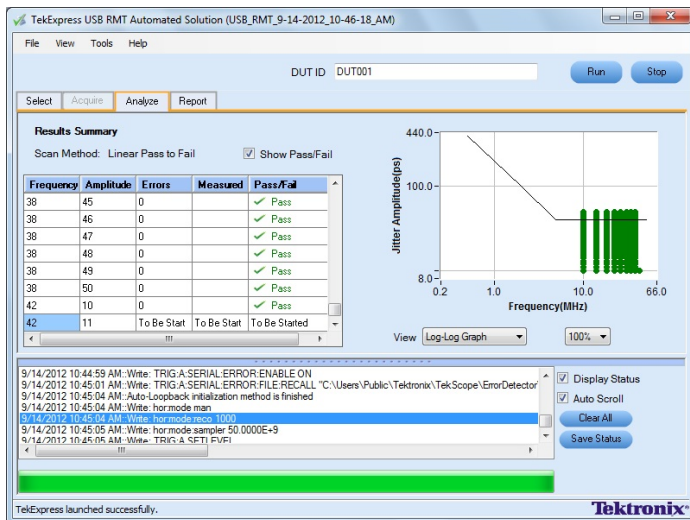
Error detection for USB 3.0 is supported in the DPO/DSAMSO70000 Series of real-time oscilloscopes. USB-RMT automates the interfaces of the error detector, so no configuration is required. For times when debugging is required the error detector includes a user-friendly control interface that enables the setup and configuration of the error detector.

The process of visually validating that a device is in loopback is simplified with the real-time scope. For example, in many cases a device may not be in loopback, but may simply be in the Compliance mode, and this is easily detected on the real-time scope. While turning the signal generator off the loopback signal should go to an idle state, otherwise the device is in a compliance mode.

Error detection with the real-time scope supports symbol errors, which goes beyond simple character and disparity error detection. While operating in Symbol Error mode, the error detector is looking at 10-bit blocks of data that have been transmitted from the AWG and comparing those 10 bits to what is received by the error detector. At the same time, a count is maintained which displays how many of those errors were character errors versus disparity errors.



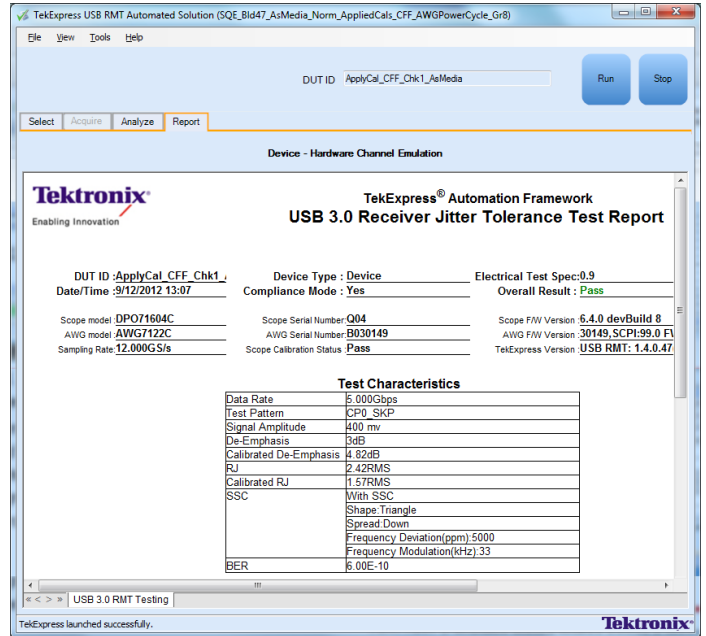
Testing CP0 compliance pattern with Tektronix Scope Error Detector



Real-time Test Status across jitter and frequency ranges

In some cases, the disparity of the SKP ordered set can be reversed when the signal is retransmitted. The error detector is smart enough to ignore SKP ordered sets regardless of the disparity.

The last mode of operation is Bit Error mode. Bit Error mode compares each bit that is transmitted from the signal generator to the data being



Test Report

transmitted to the error detector. While in Bit Error mode, the error detector is flexible enough to still ignore SKP ordered sets in order to properly count the number of receiver errors.

Test status

Once the test has been properly configured, USB-RMT will automatically set up and configure the test equipment. As the test points are completed, USB-RMT will update the results dynamically. The results of the tests are shown in a tabular format and a graphical display. The graphical display supports both logarithmic and linear scales. Passing results are denoted by a green circle and failing results are denoted by a red 'X'.

Test report

Upon completion of the test, a comprehensive report will be generated in .MHT format. The results of the test will also be stored in an Excel .XLS file that can be used for further data analysis. Included in the test report are the configuration settings for the test equipment, the static parameters for the test (i.e. RJ, Amplitude, SSC Profile, De-emphasis level), a graphical display of the test results, and a tabular display of the test results.

Testing beyond compliance

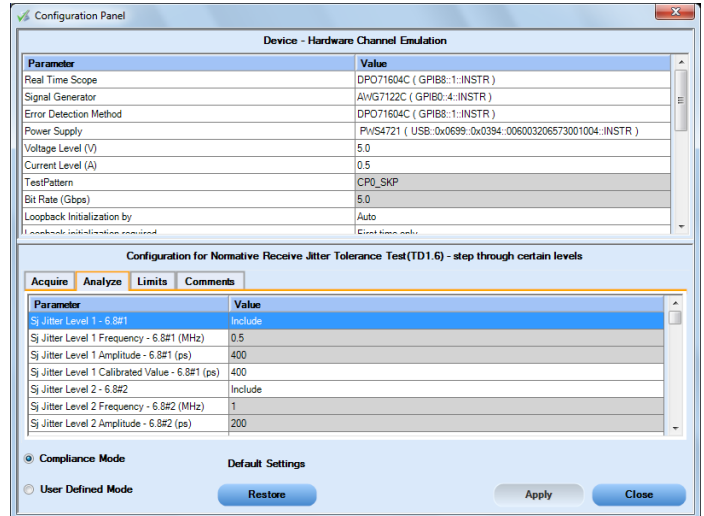
Margin testing

While the CTS requires a Jitter Tolerance Test and specific frequencies and amplitudes, it is often necessary to understand at what point the receiver stops interpreting the incoming data correctly, which determines the margin of the device under test. Margin testing is often a long tedious process. USB-RMT automates margin testing across a range of SJ frequencies so the user is not required to interface with the software while the test is being executed.

The user also has the flexibility to change the SJ amplitude of the compliance test points. For example, a compliance test can be ran with 20% margin by easily changing the amplitude of jitter at each frequency and saving that setup. The setup can be recalled at a later point in time and the test can be run under tighter conditions.

Complex SSC profiles

One source of system failures or PHY non-compliance is SSC. With USB-RMT, the user can quickly modify the SSC deviation and/or frequency modulation in order to determine if the SSC is the cause of bit errors.



Jitter Tolerance Test.

USB 3.0 transmitter testing with TekExpress™ USB-TX software

TekExpress Software (with Opt. USB-TX) provides automation of the Tektronix USB 3.0 transmitter measurements MOI. A supported configuration includes a DPO/DSA/MSO70000 Series oscilloscope (or other supported oscilloscope) equipped with DPOJET (Jitter and Eye Diagram Analysis Tools). USB-TX also includes a license for USB3 Essentials DPOJET measurements and setup library. Option SSP adds support for USB 3.0 SuperSpeedPlus 10 Gb/s transmitter measurements.

The following table outlines the key differences between the USB3 and the USB-TX software solutions.

Table 1 – Key differences between USB3 Essentials and USB-TX

Feature	USB3 Essentials	USB-TX
Automatic measurement selections based on device type, test type, test points, and selected probes		X
Automatic selection of receiver CTLE filter	X	X
Automatic selection of Tx Channel Modeling for Software Channel Emulation	X	X
Complete coverage of USB 3.0 Normative and Informative Tests (see Table 2)	X	X
Single-button execution for all selected measurements	X	X
Comprehensive debug environment allows isolation of spec violations	X	
Detailed or Summary Reports	Detailed Only	Detailed and Summary
Automatically save test reports and waveforms		X
Re-analyze prerecorded waveforms	X	X
USB-specific user interface		X
Automated Tj measurement based on Dj (CP0) and Rj (CP1)		X
Single test report for all measurements		X
Automated LFPS Measurements (Setup files only)		X
Automated DUT Toggle		X
Automated SIGTEST Measurements		X
Quickly add general-purpose measurements or plots to the test sequence	X	

Table 2 – Supported USB 3.0 transmitter measurements

Spec reference	Parameter	Symbol(s)
Table 6-17	Unit Interval including SSC	UI
Table 6-15	Tj – Dual Dirac at 10 ⁻¹² BER	tTX–TJ-DD
Table 6-19	Tx Deterministic Jitter – Dual Dirac	tTX–DJ-DD
	Tx Random Jitter – Dual Dirac	tTX–RJ-DD
Table 6-16	SSC Modulation Rate	tSSC-MOD-RATE
	SSC Deviation	tSSC-FREQ-DEVIATION
Table 6-17	Differential p-p Tx Voltage Swing	VTX-DIFF-PP
	Low-power Differential p-p Tx Voltage Swing	VTX-DIFF-PP-LOW
	De-emphasized Output Voltage Ratio* ² (5 GT/s)	Tx de-emphasis
	Maximum Slew Rate (5 GT/s)	tCDR_SLEW_MAX
	SSC df/dt (10 GT/s)	SSCdf/dt
	Table 6-18	Tx Min Pulse* ²
Deterministic Min Pulse* ²		tMIN-PULSE-DJ
Transmitter Eye – Dual Dirac at 10 ⁻¹² BER		tTX-EYE
Transmitter DC Common Mode Voltage* ²		VTX-DC-CM
Tx AC Common Mode Voltage Active* ²		VTX-CM-ACPP_ACTIVE
Table 6-28	LFPS UI Duration	tPeriod
	LFPS Common Mode Voltage	VCM-AC-LFPS
	LFPS Differential Voltage	VCM-DFF-PP-LFPS
	LFPS Rise Time	tRise
	LFPS Fall Time	tFall
	LFPS Duty Cycle	Duty Cycle
	LFPS tPeriod	tPeriod
	LFPS tPeriod-SSP (10 GT/s)	tPeriod-SSP
Table 6-29	LFPS tBurst	tBurst
	LFPS tRepeat	tRepeat
Table 6-31	LFPS tRepeat-0 (10 GT/s)	tRepeat-0
	LFPS tRepeat-1 (10 GT/s)	tRepeat-1
Table 6-32	LFPS Pulse Width Modulation (10 GT/s)	tPWM
	tLFPS-0 (10 GT/s)	tLFPS-0
	tLFPS-1 (10 GT/s)	tLFPS-1

*² Denotes informative tests, all other tests are normative.

Required Equipment for USB 3.0 Testing

For a complete list of required equipment please visit

http://www.tek.com/Masurement/applications/serial_data/usb.html

Ordering information

USB3 Essentials

Model	Description
DPO/DSA/ MSO70000	DPO (Digital Phosphor Oscilloscope), DSA (Digital Serial Analyzer), or MSO (Mixed Signal Oscilloscope) Oscilloscopes – 8 GHz and above with DPOJET installed
DPO/DSA/ MSO70000 Opt. USB3*3	USB 3.0 Essentials for USB 3.0 Transmitter Testing
DPO-UP Opt. USB3*3	Upgrade for USB 3.0 Essentials for USB 3.0 Transmitter Testing
DPOFL-USB3*3	Floating license upgrade for USB 3.0 Essentials for USB 3.0 Transmitter Testing

SSP Essentials

Model	Description
DPO/DSA/ MSO70000	Tektronix DPO (Digital Phosphor Oscilloscope), DSA (Digital Serial Analyzer), or MSO (Mixed Signal Oscilloscope) Oscilloscopes – 16 GHz and above with DPOJET and SDLA installed
DPO/DSA/ MSO70000 Opt. SSP*4	USB 3.0 SuperSpeedPlus Essentials for USB 3.0 Transmitter Testing
DPO-UP Opt. SSP*4	Upgrade for USB 3.0 SuperSpeedPlus Essentials for USB 3.0 Transmitter Testing
DPOFL-SSP*4	Floating license upgrade for USB 3.0 SuperSpeedPlus Essentials for USB 3.0 Transmitter Testing

Automated TekExpress™ USB 3.0 transmitter measurements*3

Model	Description
DPO/DSA/ MSO70000	Tektronix DPO (Digital Phosphor Oscilloscope), DSA (Digital Serial Analyzer), or MSO (Mixed Signal Oscilloscope) Oscilloscopes – 8 GHz and above with DPOJET installed
DPO/DSA/ MSO70000 Opt. USB-TX*3	USB 3.0 Transmitter Normative and Informative Tests for TekExpress Automated Compliance Test Software
DPO-UP Opt. USB-TX*3	Upgrade for USB 3.0 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
DPOFL-USB-TX*3	Floating license upgrade for USB 3.0 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

Automated BERTScope USB 3.0 receiver margin and compliance test

Model	Description
BSAUSB3 Receiver Test Bundle	Includes: BSAUSBSOFT – USB 3.0 Automation Software, BSASWITCH – BERTScope Intelligent Switch with driver Requires: BSA85C or higher BERTScope*5, DPP125C Digital Pre-emphasis Processor, CR125A Clock Recovery

Automated TekExpress™ USB 3.0 receiver margin and compliance test

Model	Description
DPO/DSA/ MSO70000 Opt. ERRDT	Frame and Bit Error Rate Detector for high-speed serial standards
DPO/DSA/ MSO70000	Automated TekExpress USB 3.0 Receiver Margin and Compliance Test Software. Order this option (TEKEXP) and Opt. USB-RMT if TekExpress (TEKEXP) is not already owned. The software installs on the controller PC. A USB key dongle with software key enables the selected set
TEKEXP Opt. USB-RMT	Automated TekExpress USB 3.0 Receiver Margin and Compliance Test Software Order this option, if TekExpress (TEKEXP) is already owned. The USB key dongle will be upgraded with Opt. USB-RMT
TEKEXPUP Opt. USB-RMT	Includes: Latest TekExpress product software DVD kit (P/N 020-2913-xx) and upgrade SW key. Online documentation and printable manual in PDF format are supplied

*3 Requires DPOJET Jitter and Eye Analysis Tools (Opt. DJA) and ≥8 GHz oscilloscope (12.5 GHz required for compliance testing).

*4 Requires DPOJET Jitter and Eye Analysis Tools (Opt. DJA) and ≥16 GHz oscilloscope and SSP Essentials (SSP).

*5 Note: when ordering BSA125C or higher with option STR, Symbol Filtering (opt. SF) needs to be ordered separately.

*6 Standard copper wire is required to make use of the power supply for DUT Power Cycle.

Prerequisite Host System Software Requirements for USB-TX

- DPO/DSA/MSO70000 Series oscilloscope with Windows 7 OS or later

Prerequisite Host System Software Requirements for USB-RMT and BSAUSB3

- Microsoft XP OS with SP2 or later
- Microsoft Excel 2002 or above
- Microsoft Access (BSA USB3 only)
- PWS4000*6 Tektronix Power Supply with Output Current ≥1.2 A

USB 3.0 Test Fixtures*7

Fixture	Description
TF-USB3-AB-KIT	USB 3.0 A/B Fixture/Cable Kit Includes: USB 3.0 Type A to Type B Short Cable, USB 3.0 Calibration Board, USB 3.0 Type A Plug Fixture (TF-USB3-A-P), USB 3.0 Type A Receptacle Fixture (TF-USB3-A-R), USB 3.0 Type B Receptacle Fixture (TF-USB3-B-R)
TF-USB3-A-P	USB 3.0 Type A Plug Fixture Includes: USB 3.0 Type A Plug Fixture
TF-USB3-A-R	USB 3.0 Type A Receptacle Includes: USB 3.0 Type A Receptacle Fixture and USB 3.0 Type A to Type B Short Cable
TF-USB3-B-R	USB 3.0 Type B Receptacle Includes: USB 3.0 Type B Receptacle Fixture and USB 3.0 Type A to Type B Short Cable
174-5772-xx	USB 3.0 Type A to Type B Short Cable Includes: USB 3.0 Type A to Type B Short Cable

*7 Tektronix test fixtures are low-loss fixtures designed to minimize the impact of fixturing on measurements and for using software emulation of a hardware channel with the AWG7000 Series. Fixtures used for certification can be ordered from the USB-IF directly (www.usb.org).

Contact Tektronix:

- ASEAN / Australasia** (65) 6356 3900
- Austria** 00800 2255 4835*
- Balkans, Israel, South Africa and other ISE Countries** +41 52 675 3777
- Belgium** 00800 2255 4835*
- Brazil** +55 (11) 3759 7627
- Canada** 1 800 833 9200
- Central East Europe and the Baltics** +41 52 675 3777
- Central Europe & Greece** +41 52 675 3777
- Denmark** +45 80 88 1401
- Finland** +41 52 675 3777
- France** 00800 2255 4835*
- Germany** 00800 2255 4835*
- Hong Kong** 400 820 5835
- India** 000 800 650 1835
- Italy** 00800 2255 4835*
- Japan** 81 (3) 6714 3010
- Luxembourg** +41 52 675 3777
- Mexico, Central/South America & Caribbean** 52 (55) 56 04 50 90
- Middle East, Asia, and North Africa** +41 52 675 3777
- The Netherlands** 00800 2255 4835*
- Norway** 800 16098
- People's Republic of China** 400 820 5835
- Poland** +41 52 675 3777
- Portugal** 80 08 12370
- Republic of Korea** 001 800 8255 2835
- Russia & CIS** +7 (495) 6647564
- South Africa** +41 52 675 3777
- Spain** 00800 2255 4835*
- Sweden** 00800 2255 4835*
- Switzerland** 00800 2255 4835*
- Taiwan** 886 (2) 2722 9622
- United Kingdom & Ireland** 00800 2255 4835*
- USA** 1 800 833 9200

* European toll-free number. If not accessible, call: +41 52 675 3777

Updated 10 February 2011

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.tektronix.com



Copyright © Tektronix, Inc. All rights reserved. Tektronix products are covered by U.S. and foreign patents, issued and pending. Information in this publication supersedes that in all previously published material. Specification and price change privileges reserved. TEKTRONIX and TEK are registered trademarks of Tektronix, Inc. All other trade names referenced are the service marks, trademarks, or registered trademarks of their respective companies.

27 Jun 2013

55W-23929-9

