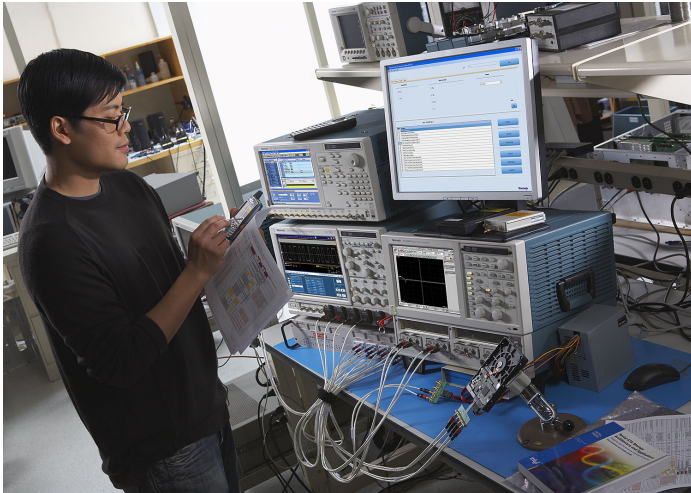


TekExpress™ SATA Automated Compliance SW

TEKEXP • TEKEXPUP Data Sheet



Features & Benefits

- 100% SATA Gen1, Gen2, and Gen3 6 Gb/s Physical Layer Test Coverage for Hosts, Devices, and Cables per UTDs 1.2 - 1.4
- Significant Reduction in Testing Time through Automation
- Performs all SATA Interoperability Program Approved Transmitter, Receiver, and Channel Measurements
- Single and Simple Windows XP User Interface for Multi-instrument Testing
- Repeatable and Accurate Results
- Automatic HTML Report and SATA-IO (MS Excel) Scorecard Generation
- Receiver Margin Testing
- Direct Synthesis and Device State Control Eliminates the Need for Multiple Sources
- Powered by NI TestStand™
- Seamlessly Integrate with High-level NI TestStand™ Automation Layer

Applications

- Device, Host, and Cable Compliance to SATA Gen1, Gen2, and Gen3 Specifications
- PHY/TSG/OOB Transmitter Compliance Measurements
- Rx/Tx Channel Compliance Measurements
- RSG Receiver Compliance Measurements
- RMT (Receiver Margin Testing)
- SI Cable Compliance Measurements
- Device and Host Validation
- Manufacturing Test

TekExpress™ Automated Compliance Test Software

TekExpress (TEKEXP) Automated Compliance Test Software is a Windows-based application that runs on any Windows XP*1 computer operating system including Tektronix Windows-based instruments. TekExpress software ordered with SATA-specific options provides a completely automated, simple, and efficient way to test SATA Gen1, Gen2, and Gen3 6 Gb/s hosts, devices, and cables per the requirements of the SATA-IW (Serial ATA Interoperability Working Group) as defined in accepted Methods of Implementation (MOI).

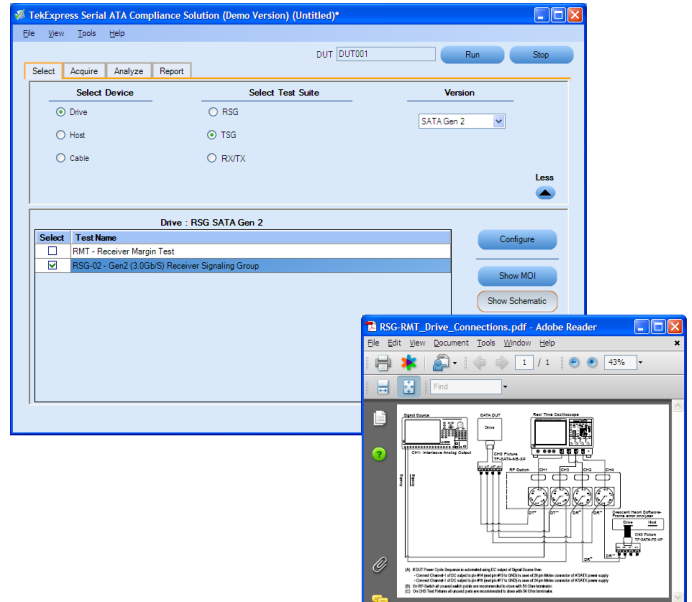
*1 See host system requirements in Ordering Information section.

100% SATA Gen1, Gen2, and Gen3 6 Gb/s Physical Layer Test Coverage

Compliance requirements for SATA hosts and devices include Transmitter Signaling Group (TSG), Physical Layer (PHY), Out-of-Bound (OOB), Receiver Signaling Group (RSG), and channel measurements (Rx/Tx). SATA cable testing requires Signal Integrity (SI) cable tests. The TekExpress SATA software is an easy-to-use software package that automates 100% of the required SATA physical layer using the Tektronix multi-instrument test bench. The SATA test bench includes a real-time oscilloscope (DPO/DSA70000B), a high-performance signal generator (AWG7122B), a sampling oscilloscope (DSA8200), a frame error analyzer, and an RF switch. While other manufacturers automate portions of the transmitter and receiver test requirements, the Tektronix high-speed serial test bench with TekExpress SATA software is the only solution that provides 100% physical layer test coverage for SATA, which is the most comprehensive compliance certification program in the electronics industry. The Tektronix SATA test bench is used at bi-annual workshops sponsored by SATA-IO for 'Gold Suite' testing. Required test procedures (MOI) can be found at <http://www.serialata.org/developers/interoperability.asp>. Now, using TekExpress SATA automated compliance test software, you can perform 100% of the physical layer tests performed in the 'Gold Suite' at SATA-IO plug fests in your own lab.

100% Automated – Save Time and Resources

There's no longer a need to be an expert on all the required instrument user interfaces. Remembering how to use the instrumentation is often time consuming and typically requires a senior engineer who monitors the SATA-IO test spec development. Even if you remember how to use all the instruments, it's common for even the most experienced operator to forget steps in the procedure, like calibration, or setting up parameters correctly, like clock recovery, only to have to restart the test. The TekExpress software takes the human element out of the equation and yields accurate and repeatable measurements every time. No need to spend hours in the lab testing a single device or configuring a single test instrument. Simply press the **Run** button in the TekExpress software and turn your attention to other activities.



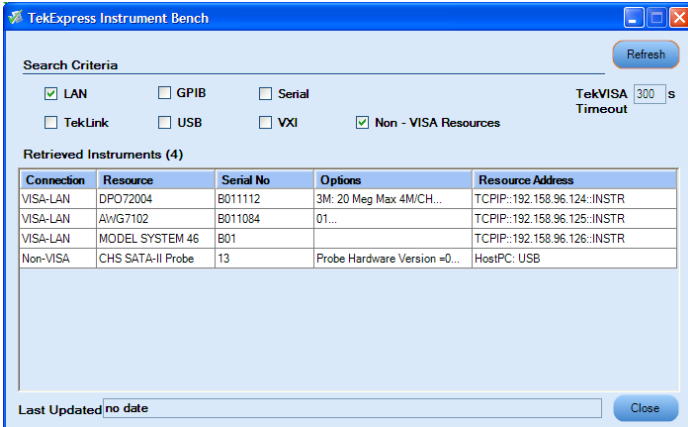
Show Schematic

Simple Setup, Test Execution, and Reporting

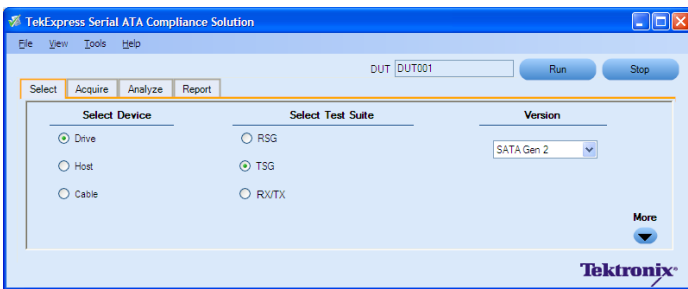
Setup and test execution is simple with the TekExpress software. The real-time oscilloscope, sampling oscilloscope, signal generator, and frame error analyzer are all controlled through the TekExpress automation framework. The TekExpress software provides a graphical user interface (GUI) and provides an intuitive workflow through setup and testing.

Setting up the Bench

When setting up a test, nothing can be simpler than hooking up the test system by looking at a schematic. View the schematic of the selected test with a push of a button.



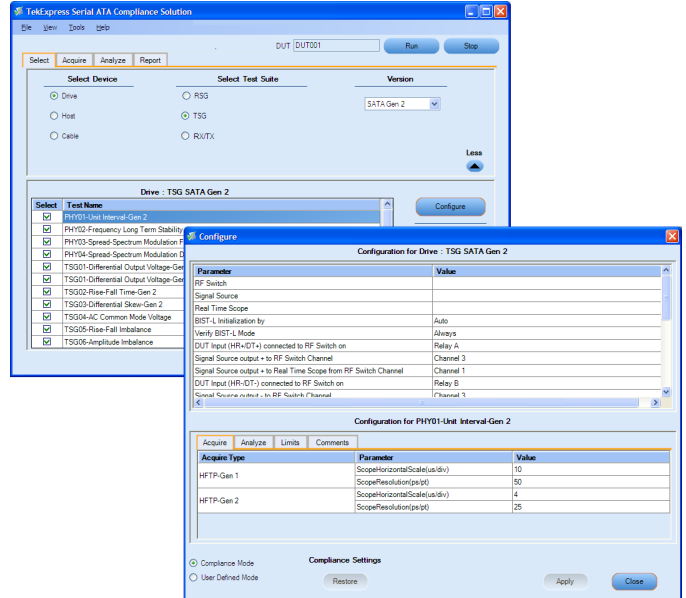
Instrument Bench Discovery



Basic Operation

Instrument Bench Discovery

TekExpress software automatically (or on demand) scans and detects supported instruments connected in your test bench (both Visa supported and non-Visa supported instruments), whether they are connected through LAN, GPIB, or USB. A quick check of the Instrument Bench menu confirms all instruments are networked correctly.



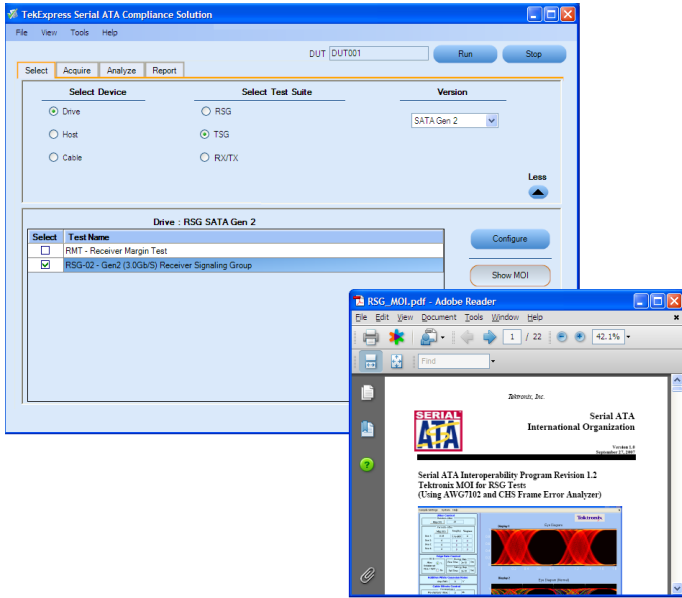
Expert Operation

One-button Testing

Once the test bench is set up and the DUT is properly connected, simply press the Run button to perform the selected test suite.

Basic and Expert User Interface

TekExpress software provides two levels of operation through its graphical user interface (GUI), advanced and basic. This allows the expert user to make and save changes on a test configuration and then hide these controls for repetitive testing by less experienced users. This provides flexibility in test configuration and at the same time insures configuration settings are not inadvertently changed.



Show MOI

Online Help and Show MOI

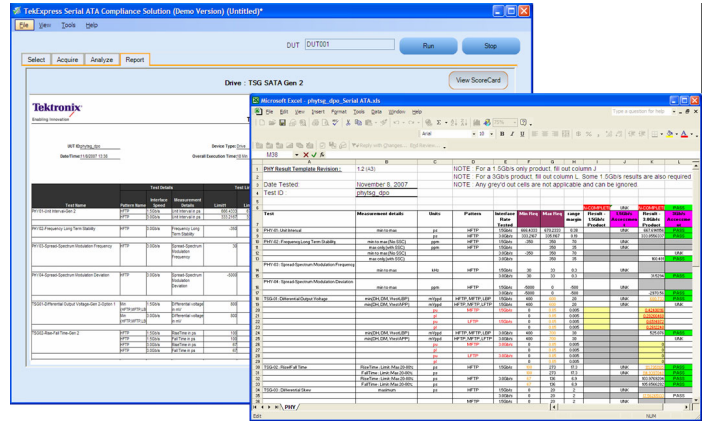
Online Help is available through the Help menu and direct access to the approved SATA MOI (Method of Implementation) through the **Show MOI** button. The SATA-IO approved MOIs document step-by-step how the test is being performed by the TekExpress software. This allows users to understand the theory behind the measurements and better understand test results.

Pass/Fail Report and SATA Scorecard

The Report tab provides an HTML view of test results along with Pass/Fail status. Once testing is complete, a SATA-IO compliant scorecard (MS Excel format) is generated. This is the scorecard that is submitted to SATA-IO for official compliance certification by test houses and at SATA compliance workshops. If your scorecard has a 100% passing score, your device can then be considered physical-layer conformant.

TSG/PHY/OOB Automation

For transmitter testing (TSG/PHY/OOB) TekExpress (Opt. SATA-TSG) performs all the tests required by the specification. SATA transmitter compliance measurements involve a multitude of complex measurements, including a unique vertical amplitude measurement.



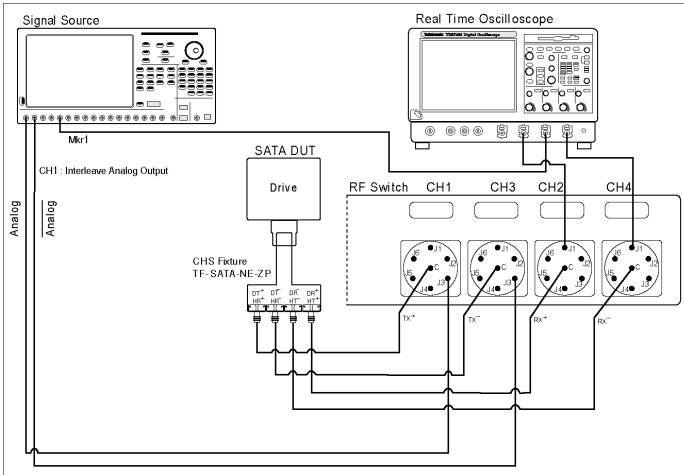
View Scorecard

Direct Synthesis and Device State Control in a Single Instrument

The AWG7122B Arbitrary Waveform Generator with Opt. 01 (64 M waveform length) and Opt. 06 (24 GS/s interleaving) is a key component of the TekExpress Serial ATA Compliance Solution. It provides state control for the device or host under test as well as direct synthesis of the waveform patterns (impaired and unimpaired) needed for testing.

In SATA, state control is required to initiate a BIST-L (Build-In Self Test – Loopback) sequence to the device under test from its receiver port. This is used for all measurement test suites: transmitter, receiver, and channel. Other solutions attempt to initiate the BIST-L with an off-the-shelf host system or a digital generator and then try to apply the appropriate pattern for testing. This often requires the user to disconnect the BIST-L source from the device and then reconnect to a second source causing many devices to fall out of BIST-L mode. This leads to frequent rework and wasted time.

For signal impairment, alternative solutions require a multitude of sources to create the proper signal impairment (jitter and amplitude loss) for receiver testing. These include a pattern generator, a noise source, and a sinusoidal jitter source. This configuration is difficult to setup and even more difficult to duplicate reliably at different sites. With the AWG7122B, the signal impairment is synthesized digitally with a single setup file so it can be reproduced reliably. Further, it can also transition seamlessly from BIST-L initiation to a digitally impaired signal, a unique capability of a high-speed arbitrary waveform generator.



Receiver Margin Testing

While the SATA RSG (Receive Signaling Group) test is a Pass/Fail test on whether the receiver can tolerate a laboratory grade impaired framed composite test signal, designers will want to know ‘how much margin do I have?’ TekExpress SATA software provides both a Pass/Fail RSG test and receiver margin testing (RMT). When the RMT test is selected, jitter is synthesized at different frequencies and amplitudes increasingly until errors are detected on the frame error analyzer. A jitter tolerance curve is then created that shows where the device fails. This information is useful in validating the design of the receiver.

Powered by NI TestStand™

The TekExpress automated compliance software uses NI (National Instruments) TestStand to manage and execute its test sequences. A Windows user interface is provided in the TekExpress software for simple and complete operation of compliance measurements. However, if your validation and debug needs go beyond the features offered by the TekExpress software, a full version of NI TestStand can be used to develop higher-level automation sequences to control the TekExpress software.

NI TestStand is the de facto industry standard test management environment for automating test and validation systems. NI TestStand is used to develop, manage, and execute test sequences, to integrate test

modules written in any test programming language through an open and flexible architecture. Customers who own NI TestStand and purchase the TekExpress software will be able to write scripts using NI TestStand that call the TekExpress software with a limited command set. The limited command set allows the NI TestStand user to recall and save TekExpress software setups, start execution, query current execution status, and receive measurement results.

For device validation, it’s often desirable to make multiple runs of a single device using different operating conditions such as temperature and power supply voltages. This is sometimes referred to as ‘four corners testing,’ (testing to low-high temperature and low-high supply voltages). For four corners testing, NI TestStand supports drivers for a wide range of temperature chambers and power supplies. NI TestStand can be used to control the temperature chamber and then call the TekExpress software for a compliance test using the limited command set. For adjusting power supply voltages, the power supply control sequence file within the TekExpress software can be modified using a standard NI TestStand sequence file. Thus, if your company already uses TestStand for automation, your test engineers can incorporate commands to run the TekExpress compliance software directly into their test sequences.

Characteristics

SATA Gen1, Gen2, and Gen3 6 Gb/s PHY/TSG/OOB Transmitter Testing with TekExpress Software

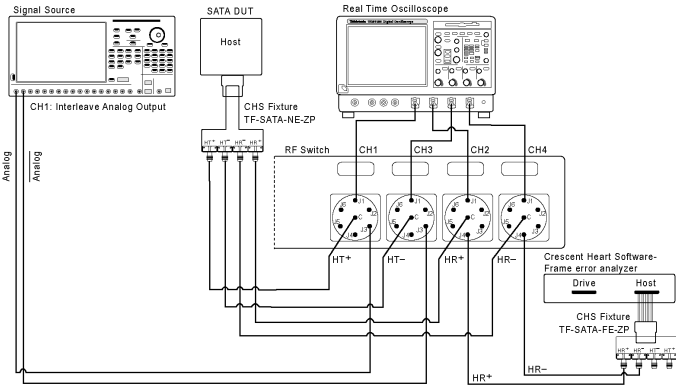
TekExpress (with Opt. SATA-TSG) provides 100% automation of the SATA-IO approved PHY/TSG/OOB Method of Implementation (MOI). The software requires a DPO/DSA70000B Series oscilloscope (or other supported oscilloscope) equipped with DPOJET (Advanced Jitter Analysis), an AWG7122B Arbitrary Waveform Generator, and an RF Switch. TekExpress SATA software (run on the DPO/DSA70000B Windows XP OS or an external host Windows XP OS computer) sequences through the entire test suite. The AWG7122B is used as the device state controller to put the device or host into BIST-L (Built-in Self Test - Loopback). The AWG then sends the proper patterns (LFTP, MFTP, LBP, and HFTP) for the PHY/TSG categories. The out-of-bound (OOB) measurements include testing the OOB signal thresholds, timing, as well as gap length and detection windows of COMINIT/RESET, COMWAKE, and COMINIT OOB signals. Typical test times for PHY/TSG/OOB can be more than a day of hands-on testing for a single device. The TekExpress SATA software brings this time down to less than one hour. TekExpress SATA Opt. TSG also supports ‘semi-automated’ PHY/TSG/OOB testing if the device under test supports the proper signaling without the use of an AWG.

PHY/TSG/OOB Transmitter Test Suite

PHY/TSG/OOB Transmitter	Description
PHY-01	Unit Interval
PHY-02	Frequency Long-term Stability
PHY-03	Spread-spectrum Modulation Frequency
PHY-04	Spread-spectrum Modulation Deviation
TSG-01	Differential Output Voltage
TSG-02	Rise/Fall Time
TSG-03	Differential Skew
TSG-04	AC Common Mode Voltage
TSG-05	Rise/Fall Imbalance
TSG-06	Amplitude Imbalance
TSG-07	TJ at Connector, Clock to Data, Fbaud/10
TSG-08	DJ at Connector, Clock to Data, Fbaud/10
TSG-09	TJ at Connector, Clock to Data, Fbaud/500 (Gen1)
TSG-10	DJ at Connector, Clock to Data, Fbaud/500 (Gen1)
TSG-11	TJ at Connector, Clock to Data, Fbaud/500 (Gen2)
TSG-12	DJ at Connector, Clock to Data, Fbaud/500 (Gen2)
OOB-01	OOB Signal Detection Threshold
OOB-02	UI During OOB Signaling
OOB-03	COMINIT/RESET and COMWAKE Transmit Burst Length
OOB-04	COMINIT/RESET Transmit Gap Length
OOB-05	COMWAKE Transmit Gap Length
OOB-06	COMWAKE Gap Detection Windows
OOB-07	COMINIT Gap Detection Windows

Required Equipment for PHY/TSG/OOB Testing

PHY/TSG/OOB Test Equipment	Description	Quantity
TekExpress Automated Compliance Test Software	TEKEXP with Opt. SATA-TSG or Opt. SATA-DHB (device or host SW bundle)	1
Real-time Oscilloscope	Any of the following three instruments: DSA72004, DSA71604, DSA71254. DPOJET software is required and is included standard on DSA models	1
High-speed Signal Source for BIST Activation and OOB Stimulus	AWG7122B with Opt. 1, Opt. 6, and Opt. 8	1
RF Switch	Model # S46-6666A (optional and can be purchased separately from Keithley Instruments)	1
SATA Test Fixture for DUT Connectivity	TF-1R31 (Gen1 - Gen3 receptacle fixture) TF-1P21 (Gen1 - Gen2 plug fixture) TF-SATA-NE-ZP (supports Gen1 and Gen2)	1
Phase Matched SMA Cables	174-4944-01	5 pair
Attenuators	015-1001-01	2
LAN Cables	Required to share folders and control instruments over LAN	2
GPIB 488.2 Connections	USB-GPIB or GPIB cable from controller PC to RF switch	1



SATA RSG/RMT Receiver Testing with TekExpress Software

TekExpress Software (with Opt. SATA-RSG) provides automation of the SATA-IO approved Receiver Signaling Group / Receiver Margin Test (RSG/RMT) MOI. A supported configuration includes a DPO/DSA7000B Series oscilloscope (or other supported oscilloscope) equipped with DPOJET (Advanced Jitter Analysis), an AWG7122B Arbitrary Waveform Generator, and a Frame Error Analyzer. The TekExpress SATA software first initiates a BIST-L sequence to the device under test to put the device into loopback. After loopback is achieved and the loopback transmitter is transmitting good data to the frame error analyzer, the AWG sends jitter at the frequency tones and amplitudes defined in the specification to the receiver. If the frame error detector detects errors on the loopback channel, then the device fails the RSG test. Prior to the test, the oscilloscope is used to calibrate the impaired signal (jitter and amplitude) to be used in the test.

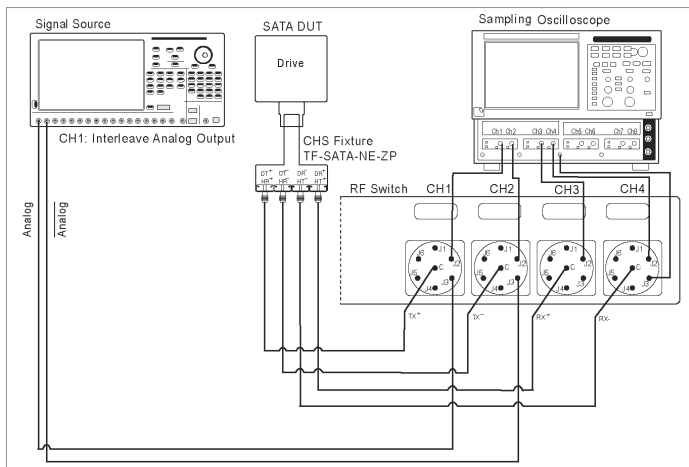
RSG/RMT Receiver Test Suite

RSG/RMT Receiver	Description
RSG-01	Gen1 (1.5 Gb/s) Receiver Jitter Test
RSG-02	Gen1 (3.0 Gb/s) Receiver Jitter Test

Required Equipment for RSG/RMT Testing

RSG/RMT Test Equipment	Description	Quantity
TekExpress Automated Compliance Test Software	TEKEXP with Opt. SATA-RSG or Opt. SATA-DHB (device or host SW bundle)	1
Real-time Oscilloscope*2	Any of the following three instruments: DSA72004, DSA71604, DSA71254. DPOJET software is required and is included standard on DSA models	1
High-speed Signal Source	AWG7122B with Opt. 1, Opt. 6, and Opt. 8	1
RF Switch	Model # S46-6666A (optional and can be purchased separately from Keithley Instruments)	1
SATA Test Fixture for DUT Connectivity	TF-1R31 (Gen1 - Gen3 receptacle fixture) TF-1P21 (Gen1 - Gen2 plug fixture) TF-SATA-NE-ZP (supports Gen1 and Gen2) TF-SATA-FE-ZP (supports Gen1 and Gen2)	1 of each
Frame Error Analyzer	SATA-II Frame Error Analyzer	1
Phase Matched SMA Cables	174-4944-01	6 pair
Attenuators	015-1001-01	2
LAN Cables	Required to share folders and control instruments over LAN	2
GPIO 488.2 Connections	USB-GPIO or GPIO cable from controller PC to RF switch	1

*2 If the real-time oscilloscope is to be used as the host system (controller in charge), see system requirements in Ordering Information section.



SATA Gen1, Gen2, and Gen3 6 Gb/s Rx/Tx Channel Testing with TekExpress Software

TekExpress Software (with Opt. SATA-RXTX) provides 100% automation of the SATA-IO approved Receive/Transmit Channel measurements (Rx/Tx) MOI. A supported configuration includes a DSA8200 sampling Digital Serial Analyzer equipped with 80SICON (IConnect® Signal Integrity TDR and S-parameter software), an AWG7122B Arbitrary Waveform Generator, and an RF Switch. After an automatic calibration is performed, the user can obtain the results for a Rx/Tx group of tests with a single click. The TekExpress SATA Software controls AWG7122B to put the device under test (DUT) into the required mode of operation, and controls DSA8200 oscilloscope to perform TDR measurements. The data is then passed to IConnect software that accurately measures a true impedance profile and S-parameter response from the device under test. Test results are conveniently reported by TekExpress.

Rx/Tx Channel Measurements Test Suite

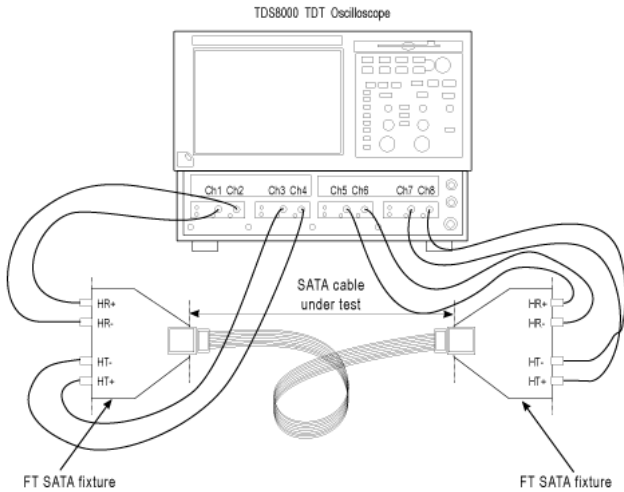
Rx/Tx Channel Measurements	Description
RX-01	Pair Differential Impedance
RX-02	Single-ended Impedance (Informative)
RX-03	Gen2 (3 Gb/s) Differential Mode Return Loss
RX-04	Gen2 (3 Gb/s) Common Mode Return Loss
RX-05	Gen2 (3 Gb/s) Impedance Balance
RX-06	Gen1 (1.5 Gb/s) Differential Mode Return Loss
TX-01	Pair Differential Impedance
TX-02	Single-ended Impedance (Informative)
TX-03	Gen2 (3 Gb/s) Differential Mode Return Loss
TX-04	Gen2 (3 Gb/s) Common Mode Return Loss
TX-05	Gen2 (3 Gb/s) Impedance Balance
TX-06	Gen1 (1.5 Gb/s) Differential Mode Return Loss

Required Equipment for Rx/Tx Testing

Rx/Tx Test Equipment	Description	Quantity
TekExpress Automated Compliance Test Software	TEKEXP with Opt. SATA-RXTX or Opt. SATA-DHB (device or host SW bundle)	1
Sampling Oscilloscope	DSA8200	1
TDR Module for Sampling Oscilloscope	80E04, or 80E08, or 80E10 TDR sampling module for DSA8200	2
S-parameter Analysis Software	80SICON software option for DSA8200	1
High-speed Signal Source	AWG7122B with Opt. 1, Opt. 6, and Opt. 8	1
RF Switch	Model # S46-6666A (optional and can be purchased separately from Keithley Instruments)	1
SATA Test Fixture for DUT Connectivity	TF-1R31 (Gen1 - Gen3 receptacle fixture) TF-1P21 (Gen1 - Gen2 plug fixture) TF-SATA-NE-ZP (supports Gen1 and Gen2)	1
Phase Matched SMA Cables	174-4944-01	5 pair
Attenuators	015-1001-01	2

Complete Device/Host Test System

TekExpress Software (ordered with Opt. SATA-DHB) provides complete automation of tests required for devices and hosts. It combines RSG/RMT, PHY/TSG/OOB, and Rx/Tx tests using a DPO/DSA7000B Series oscilloscope, DSA8200 Series sampling Digital Serial Analyzer, and an AWG7122B Arbitrary Waveform Generator, RF Switch, and Frame Error Analyzer.



SATA SI Testing with TekExpress Software

TekExpress Software (ordered with Opt. SATA-SI) provides 100% automation of the SATA-IO approved Cable Signal Integrity measurements (SI) MOI when used with a DSA8200 sampling Digital Serial Analyzer equipped with 80SICON (IConnect® Signal Integrity TDR and S-parameter software). After an automatic calibration is performed, TekExpress Software controls the instrument to acquire all data for the SI group of tests. DSA8200 consequently excites differential ports of the cable under test to acquire time domain TDR data. TekExpress then passes the measured data to IConnect to compute accurate impedance profile and frequency domain S-parameters. Time and frequency domain data is then quickly analyzed and the test results are reported to the user.

SI Cable Test Suite

SI Cable	Description
SI-01	Mated Connector Impedance
SI-02	Cable Absolute Differential Impedance
SI-03	Cable Pair Matching
SI-04	Common Mode Impedance
SI-05	Differential Rise Time
SI-06	Intra-pair Skew
SI-07	Insertion Loss
SI-08	Differential to Differential Crosstalk: NEXT
SI-09	Inter-symbol Interference

Required Equipment for Cable Testing

Cable Test Equipment	Description	Quantity
TekExpress Automated Compliance Test Software	TEKEXP with Opt. SATA-SI	1
Sampling Oscilloscope	DSA8200	1
TDR Module for Sampling Oscilloscope	80E04, 80E08, or 80E10 TDR sampling module for DSA8200	4
S-parameter Analysis Software	80SICON software option for DSA8200	1
SATA Test Fixture for DUT Connectivity	TF-1R31 (Gen1 - Gen3 receptacle fixture) TF-1P21 (Gen1 - Gen2 plug fixture) TF-SATA-NE-ZP (supports Gen1 and Gen2) TF-SATA-FE-ZP (supports Gen1 and Gen2)	1
Phase Matched SMA Cables	174-4944-01	4 pair

Ordering Information

TEKEXP

TekExpress Automated Compliance Test Software. For a new system, order one or more of the options listed below. The software installs on the controller PC. A USB key dongle with software key enables the selected option set.

Includes: Latest TekExpress product software DVD kit (P/N 020-2913-xx), USB key dongle (P/N 119-6963-xx), online documentation and printable manual in PDF format are supplied.

TEKEXPUP

TekExpress Automated Compliance Test Software Upgrade. To upgrade an existing system, order one or more of the options listed below. The above USB key dongle is upgraded with upgraded option set through a software key.

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. Option DHB not available as an upgrade option.

Prerequisite Host System Software Requirements

- Microsoft XP OS with SP2 or later
- Microsoft Excel 2002 or above
- Microsoft Explorer 6.0 SP1 or later
- Microsoft Photo Editor 3.0 or equivalent for viewing image files
- Adobe Reader 6.0 or equivalent software for viewing portable document format (PDF) files

Options

Note: At least one option required when ordering TEKEXP or TEKEXPUP.

Option	Description
Opt. SATA-TSG	SATA PHY/TSG/OOB Transmitter Tests for TekExpress
Opt. SATA-RSG	SATA RSG/RMT Receiver Tests for TekExpress
Opt. SATA-RXTX	SATA Rx/Tx Channel Tests for TekExpress
Opt. SATA-DHB	SATA TekExpress SATA SW Bundle (TSG, RSG, Rx/Tx for hosts or devices)
Opt. SATA-SI	SATA SI Cable Tests for TekExpress
Opt. SATA-IN4	On-site Installation and System Setup

Recommended Test Instruments

Test Instruments	Description
DPO/DSA70000B	Real-time Oscilloscopes for TSG/PHY/OOB and RSG/RMT testing
AWG7122B Signal Source	For all device and host test suites including TSG/PHY/OOB, RSG/RMT, and Rx/Tx testing
DSA8200 Series Sampling Oscilloscope	For Rx/Tx or SI Cable testing

Recommended Accessories

Accessories	Descriptions
SATA-II	SATA Frame Error Analyzer
3rd Party Accessories	
S46-6666A	RF Switch (purchase from Keithley Instruments) – www.keithley.com/products
TF-1R31	Gen1 – Gen3 receptacle fixture
TF-1P21	Gen1 – Gen2 plug fixture
TF-SATA-NE-ZP	Near End SATA Test Fixture (purchase from Crescent Heart Software) - www.c-h-s.com
TF-SATA-FE-ZP	Far End SATA Test Fixture (purchase from Crescent Heart Software) – www.c-h-s.com
NI TestStand Software	For additional automation and test sequence customization - www.ni.com



Product(s) are manufactured in ISO registered facilities.



Product(s) complies with IEEE Standard 488.1-1987, RS-232-C, and with Tektronix Standard Codes and Formats.

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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.tektronix.com



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