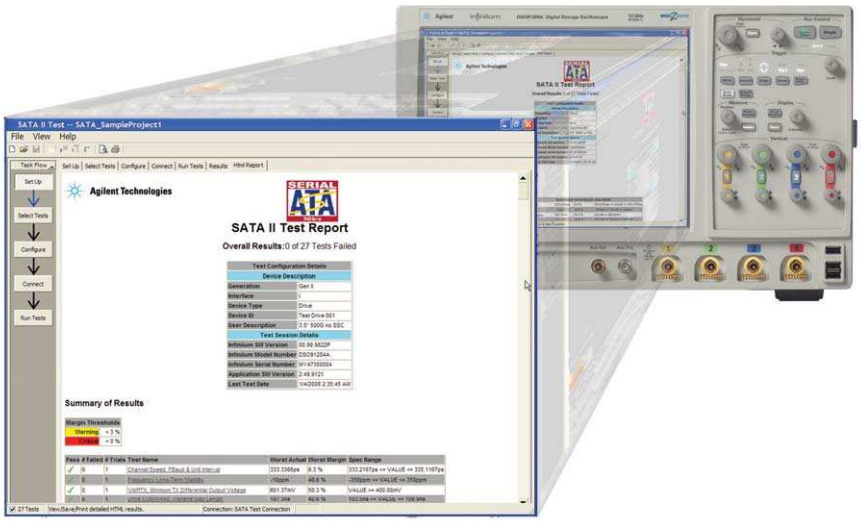
Agilent Technologies N5411A SATA Compliance Test Software for Infiniium Series Oscilloscopes

Data Sheet



Agilent Technologies' N5411A SATA compliance test software for Infiniium oscilloscopes provides you with a fast and easy way to validate and debug your SATA 1.5-Gbps (Gen 1) and 3.0-Gbps (Gen 2) silicon, host bus adapter, port multiplier, high-density disk drive or optical disk drive. The SATA electrical test software allows you to automatically execute SATA PHY, TSG and OOB tests at each of the i, m and x interface points, and displays the results in a flexible report format. In addition to the measurement data, the report provides a margin analysis that shows how closely your device passed or failed each test.

To make measurements with the N5411A SATA compliance test software, you will also need a test fixture for signal access to make measurements. The Crescent Heart Software TF-SATA-NE/ZP and TF-eSATA-NE/ZP fixtures are recommended for all host and device compliance testing. More information on the required test fixtures can be obtained from **http://www.c-h-s.com/tf-sata.shtml**.

The N5411A SATA electrical test software performs a wide range of tests required to meet the physical layer requirements per section 7.2 Electrical Specifications, Tables 27, 29 and 32 of the Serial ATA Revision 2.6 by the Serial ATA International Organization (SATA-IO). The N5411A SATA electrical test software helps you execute the most difficult physical layer tests for transmitters (TX tests only) that can be measured with a combination of a 10 GHz or higher real-time oscilloscope and a 3.0-Gbps or higher programmable pulse/pattern generator. The SATA-IO currently sponsors at least two compliance and interoperability plugfests annually for member companies to test their products' operational capability and margins with other member companies' products. It is highly recommended that every SATA product that will be used commercially be tested against the limits of the physical layer specification to ensure that it is compliant to the specification and to provide documentation of test verification to integrators of the SATA product.

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Features

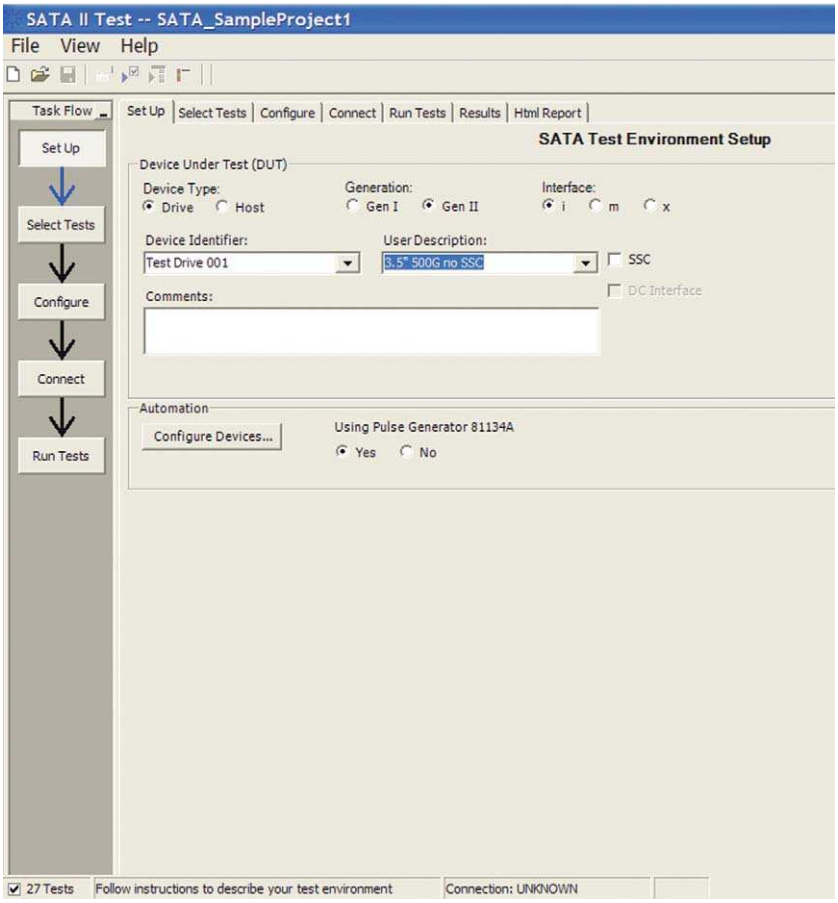
The N5411A SATA electrical test software offers several features to simplify the validation of SATA designs:

- User selection of tests and configuration of SATA i/m/x interfaces
- Vendor specific or far-end retimed loopback test modes
- Automated scope measurement setup, programming and test execution
- Spread-spectrum clock modulation depth and frequency accuracy measurements
- Complete SATA-IO LOGO validation tests for Phy General, Transmit Signal and OOB requirements per Unified Test Document 1.3
- Automated Out-of-band (OOB) burst and gap margin analysis and tests for detect/reject on COMRESET, COMINIT and COMWAKE bursts that are in/out of specified ranges

N5411A saves you time

The N5411A SATA electrical test software saves you time by setting the stage for automatic execution of SATA electrical tests. Part of the difficulty of performing electrical tests for SATA is connecting the oscilloscope to the target device, configuring the scope's measurement system for compliance testing, issuing the proper commands to perform the tests and then analyzing the measured results by comparing them to limits published in the specification. The SATA electrical test software does much of this work for you. In addition, if you discover a problem with your device, debug tools in the scope are available to aid in root-cause analysis.

The N5411A SATA electrical test software offers the required tests to verify compliance with the Physical Layer Requirements Tables 27, 29 and 32 of the Serial ATA Revision 2.6 Standard. The software automatically configures the oscilloscope for each test and provides an informative results report that includes margin analysis relative to the specified conformance limits. See Table 2 for a complete list of the measurements made by the N5411A SATA electrical test software.



Easy test definition

The N5411A SATA electrical test software extends the ease-of-use advantages of Agilent's Infiniium Series oscilloscopes to testing SATA designs. The Agilent automated test engine walks you quickly through the steps required to define set up and, perform the tests, and view the results. You can select a category of tests or specify individual tests. The user interface is oriented to minimize unnecessary reconnections, which saves time and minimizes potential for measurement error. You can save tests and configurations as project files and recall them later for additional testing and review of previous test results. Straightforward menus let you perform tests with a minimum of mouse clicks.

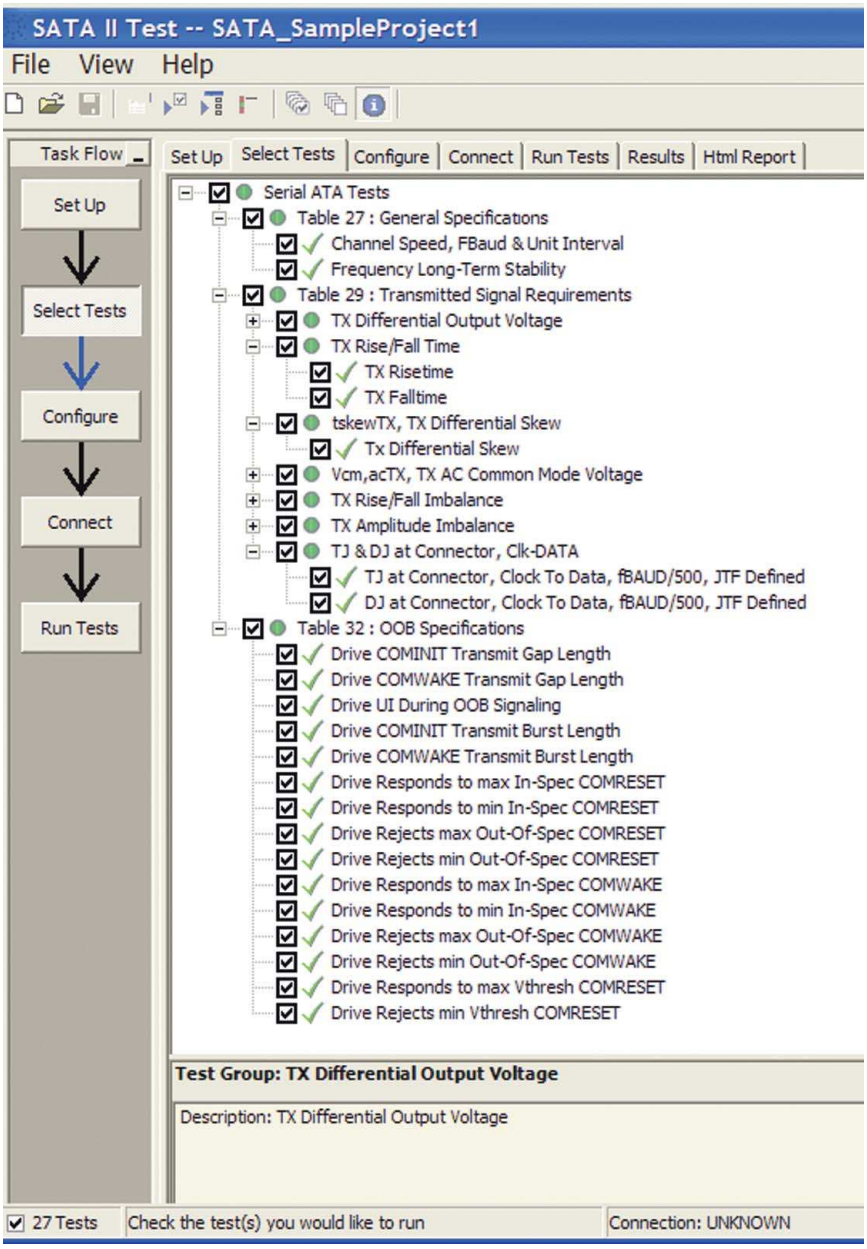


Figure 1. The Agilent automated test engine guides you quickly through selecting and configuring tests, setting up the connection, running the tests, and viewing the results. You can easily select individual tests or groups of tests with a mouse-click and customize your output report based on the test results you want to see.

Configurability and guided connections
The N5411A SATA electrical test software provides flexibility in your test setup. When the tests you select require it, the software guides you to make connection changes with diagrams. The SATA electrical test software provides you with user defined controls for critical test parameters, such as test pattern source selection and number of unit intervals (UI) desired for the test group.

After configuring the tests according to your needs, the N5411A user interface will then present you the connection screen that is specific to the configuration data you have selected. This includes the oscilloscope channels used for the test and the routing of any necessary SMA cabling, power dividers, DC blocking capacitors and test fixtures needed to perform the tests.

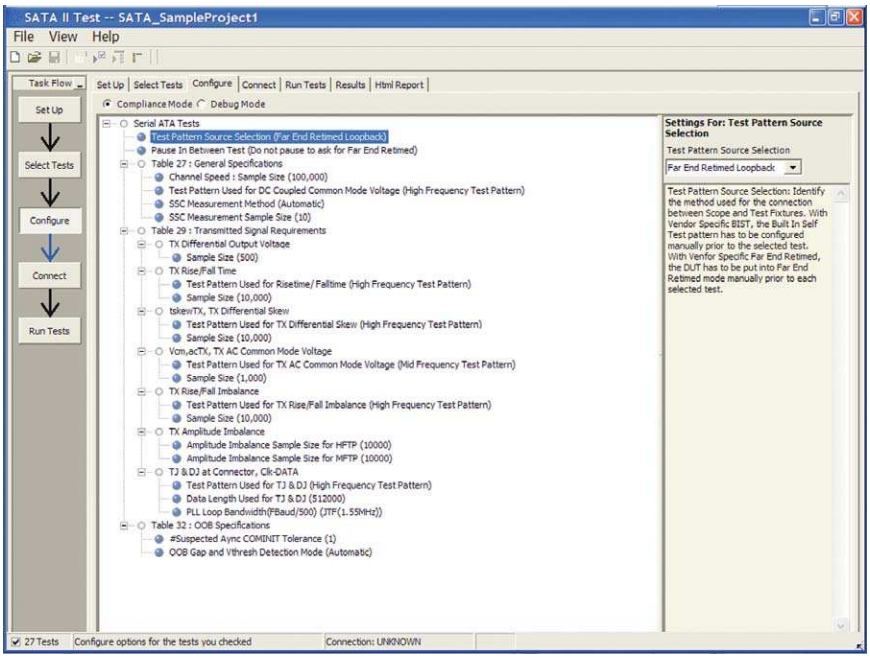


Figure 2. In configuring the tests, you define the test mode and define which pattern will be used for each test.

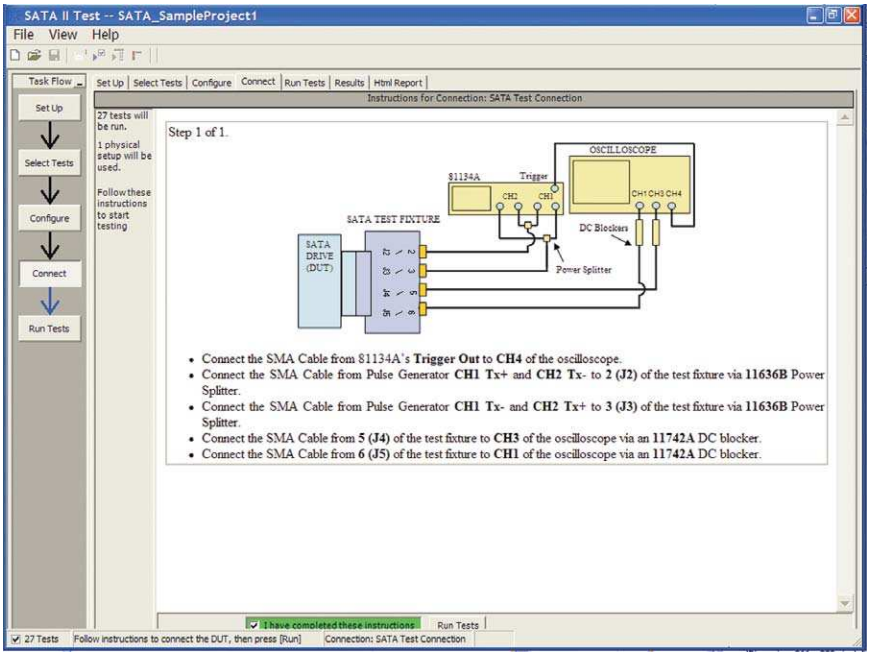


Figure 3. When you make multiple tests where the connections must be changed, the software prompts you with connection diagrams.

Reports with margin analysis

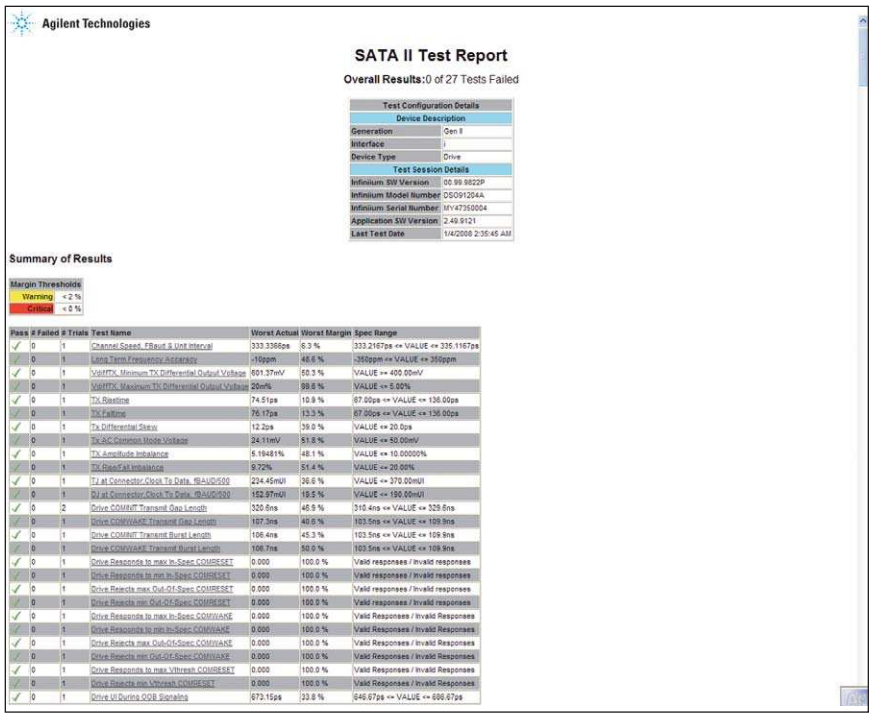
In addition to providing you with measurement results, the N5411A SATA electrical test software provides a report format that shows you not only where your product passes or fails, but also reports how close you are to the limits specified for a particular test parameter. You can specify the level at which warnings are issued to alert you to the electrical tests where your product is operating close to the official test limit defined by the specification for a given test parameter.

Thorough performance reporting

The N5411A SATA compliance and validation software generates thorough reports that clearly identify passing and failing conformance tests, provide computed margin analysis relative to the official test limits and provide relevant screen captures for complex measurements to supplement your test documentation.

Measurement requirements

To use the N5411A SATA electrical performance validation and compliance software you will need an Agilent 80000 or 90000A Series oscilloscope with at least 10-GHz of analog, real-time bandwidth. You will also need the N5400A EZJIT Plus Jitter Analysis Software Option (Option 004 on new scopes) and the E2688A Serial Data Analysis/ Mask Testing with Clock Recovery Software Option (Option 003 on new scopes). In order to use the vendor specific test mode of the N5411A SATA electrical test software your SATA chipset will need to be able to source the required compliance test patterns as defined in the SATA Standard, Revision 2.6 (HFTP, MFTP, LBP and LFTP). If you are using far-end retimed loopback mode, then the Agilent 81134A 3.35-Gbps Pulse/Pattern Generator can be automatically programmed by the N5411A to provide the necessary test stimulus signals to be retimed by your chipset. The 81134A is also used for OOB signal testing.



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SATA II Test Report

Overall Results: 0 of 27 Tests Failed

Test Configuration Details	
Device Description	
Generation	Gen II
Interface	I
Device Type	Drive
Test Session Details	
Infiniium SW Version	00.99.9822P
Infiniium Model Number	DSO91204A
Infiniium Serial Number	MY47350004
Application SW Version	2.49.9121
Last Test Date	1/4/2008 2:35:45 AM

Summary of Results

Margin Thresholds	
Warning	< 2 %
Critical	< 0 %

Pass	# Failed	# Trials	Test Name	Worst Actual	Worst Margin	Spec Range
✓	0	1	Channel Speed, FBaud, 6 Unit Interval	333.3366ps	6.3 %	333.2167ps <= VALUE <= 335.1167ps
✓	0	1	Long Term Frequency Accuracy	-10ppm	48.6 %	-350ppm <= VALUE <= 350ppm
✓	0	1	VdiffTX, Minimum TX Differential Output Voltage	601.37mV	50.3 %	VALUE >= 400.00mV
✓	0	1	VdiffTX, Maximum TX Differential Output Voltage	20mV	99.6 %	VALUE <= 5.00%
✓	0	1	TX Risetime	74.51ps	10.9 %	67.00ps <= VALUE <= 136.00ps
✓	0	1	TX Falltime	76.17ps	13.3 %	67.00ps <= VALUE <= 136.00ps
✓	0	1	Tx Differential Skew	12.2ps	39.0 %	VALUE <= 20.0ps
✓	0	1	TX AC Common Mode Voltage	24.11mV	51.8 %	VALUE <= 50.00mV
✓	0	1	TX Amplitude Imbalance	5.19481%	48.1 %	VALUE <= 10.00000%
✓	0	1	TX Rise/Fall Imbalance	9.72%	51.4 %	VALUE <= 20.00%
✓	0	1	TJ at Connector Clock To Data, fBAUD/500	234.45mUI	39.6 %	VALUE <= 370.00mUI
✓	0	1	DJ at Connector Clock To Data, fBAUD/500	152.97mUI	19.5 %	VALUE <= 190.00mUI
✓	0	2	Drive COMINIT Transmit Gap Length	320.6ns	46.9 %	310.4ns <= VALUE <= 329.6ns
✓	0	1	Drive COMWAKE Transmit Gap Length	107.3ns	40.6 %	103.5ns <= VALUE <= 109.9ns
✓	0	1	Drive COMINIT Transmit Burst Length	106.4ns	45.3 %	103.5ns <= VALUE <= 109.9ns
✓	0	1	Drive COMWAKE Transmit Burst Length	106.7ns	50.0 %	103.5ns <= VALUE <= 109.9ns
✓	0	1	Drive Responds to max In-Spec COMRESET	0.000	100.0 %	Valid responses / Invalid responses
✓	0	1	Drive Responds to min In-Spec COMRESET	0.000	100.0 %	Valid responses / Invalid responses
✓	0	1	Drive Rejects max Out-Of-Spec COMRESET	0.000	100.0 %	Valid responses / Invalid responses
✓	0	1	Drive Rejects min Out-Of-Spec COMRESET	0.000	100.0 %	Valid responses / Invalid responses
✓	0	1	Drive Responds to max In-Spec COMWAKE	0.000	100.0 %	Valid Responses / Invalid Responses
✓	0	1	Drive Responds to min In-Spec COMWAKE	0.000	100.0 %	Valid Responses / Invalid Responses
✓	0	1	Drive Rejects max Out-Of-Spec COMWAKE	0.000	100.0 %	Valid Responses / Invalid Responses
✓	0	1	Drive Rejects min Out-Of-Spec COMWAKE	0.000	100.0 %	Valid Responses / Invalid Responses
✓	0	1	Drive Responds to max Vthresh COMRESET	0.000	100.0 %	Valid Responses / Invalid Responses
✓	0	1	Drive Rejects min Vthresh COMRESET	0.000	100.0 %	Valid Responses / Invalid Responses
✓	0	1	Drive UI During OOB Signaling	673.15ps	33.8 %	646.67ps <= VALUE <= 699.67ps

Figure 4. Automated and consolidated HTML report quickly documents the results of all completed tests, including screen images from the oscilloscope taken after each measurements is completed.

Accessories and compatibility

Recommended test accessories
To complete your test setup, Agilent provides a wide range of cables, adapters, terminations, etc. Please note that the required equipment is listed in the Ordering Information summary. This list is provided for your convenience to accommodate necessary mating switches or additional debug capability.

Model Number	Description
11667B	Power splitter, DC to 26.5 GHz, 3.5-mm (f) connectors
11636B	Power divider, DC to 26.5 GHz, 3.5-mm (f) connectors
1250-1158	SMA (f-f) adapter, DC to 18 GHz
1250-1159	SMA (m-m) adapter, DC to 18 GHz
1250-1694	SMA (m) to SMA (f) adapter
15442A	Cable kit, four 90-cm (36-in) SMA (m-m) cables
15443A	Matched cable pair, two 90-cm (36-in) SMA (m-m) cables, propagation delay within 25 ps
1810-0118	SMA (m) 50 ohm termination
5062-6681	Cable assembly 6 in. SMA (need qty. 4)
11742A	DC Blocking Capacitor, 0.045 to 26.5 GHz, 3.5-mm (m-f) connectors
Crescent Heart Test Fixture	TF-SATA-NE/ZP or TF-eSATA-NE/ZP (**http://www.c-h-s.com/tf-sata.shtml**)
8493C	Coaxial fixed attenuator (need either 2 8493C-010 or 2 8493C-020)

Table 1. Recommended test accessories

Oscilloscope compatibility
The N5411A SATA electrical performance validation and compliance software is compatible with Agilent 80000 Series oscilloscopes with operating software revision 5.50, or higher and Agilent 90000A Series oscilloscopes operating software revision 1.30, or higher. For oscilloscopes with earlier software revisions, free upgrade software is available at **www.agilent.com/find/90000a**.

Data rate	Recommended new purchase	Suitable oscilloscopes	Bandwidth of recommended oscilloscope
1.5 Gbps ONLY	DSO/DSA90804A	DSO80804B	8 GHz
1.5 Gbps or 3.0 Gbps	DSO/DSA91204A	DSO81004B	10 GHz
	DSO/DSA91204A	DSO81204B	12 GHz
	DSO/DSA91304A	DSO81304B	13 GHz

Note:
While 10 GHz is recommended by the SATA II: Electrical Specification for testing, the DSO80804B Infiniium 8-GHz oscilloscope can be used, but will NOT provide full compliance to the specification.

Tests performed

The N5411A SATA electrical performance validation and compliance software performs the following tests as per section 7.2 Electrical Specifications, Tables 27, 29 and 32 of the Serial ATA Revision 2.6 by the Serial ATA International Organization (SATA-IO).

Test Parameter	Test Interfaces					
Table 27: General Specifications, page 173	**Gen1i**	**Gen1m**	**Gen1x**	**Gen2i**	**Gen2m**	**Gen2x**
Channel Speed	x	x	x	x	x	x
Tui, Unit Interval	x	x	x	x	x	x
Ftol, TX Frequency Long Term Stability	x	x	x	x	x	x
Fssc, Spread-Spectrum Modulation Frequency	x	x	x	x	x	x
SSCtol, Spread-Spectrum Modulation Deviation	x	x	x	x	x	x
Vcm, dc, dc Coupled Common Mode Voltage	x	x				
Table 29: Transmitted Signal Requirements, pages 175-176	**Gen1i**	**Gen1m**	**Gen1x**	**Gen2i**	**Gen2m**	**Gen2x**
VdiffTX, TX Differential Output Voltage	x	x	x	x	x	x
T20-80TX, TX Rise/Fall Time	x	x	x	x	x	x
tskewTX, TX Differential Skew	x	x	x	x	x	x
R/Fbal, TX Rise/Fall Imbalance				x	x	
Ampbal, TX Amplitude Imbalance				x	x	
Vcm, ac, TX AC Common Mode Voltage				x	x	
TJ at Connector, Clk-Data, fBAUD/1667			x			x
DJ at Connector, Clk-Data, fBAUD/1667			x			x
TJ at Connector, Clk-Data, fBAUD/500 (JTF defined)	x	x		x	x	
DJ at Connector, Clk-Data, fBAUD/500 (JTF defined)	x	x		x	x	
Table 32: OOB Specifications, page 180	**Gen1i**	**Gen1m**	**Gen1x**	**Gen2i**	**Gen2m**	**Gen2x**
Vthresh, OOB Signal Detection Threshold	x	x	x	x	x	x
UIOOB, UI During OOB Signaling	x	x	x	x	x	x
COMINIT/COMRESET and COMWAKE Transmit Burst Length	x	x	x	x	x	x
COMINIT/COMRESET Transmit Gap Length	x	x	x	x	x	x
COMWAKE Transmit Gap Length	x	x	x	x	x	x
COMWAKE Gap Detection Windows	x	x	x	x	x	x
COMINIT/COMRESET Gap Detection Windows	x	x	x	x	x	x

Table 2. SATA electrical tests performed by the N5411A software

Ordering information

To purchase the N5411A SATA electrical performance validation and compliance software with a new or existing Infiniium Series oscilloscope, order the model numbers shown:

Table 27 and 29 Measurements Only with Vendor Specific Pattern Generation Capability

Model number	Description
DSA91204A	DSA91204A Ultra-high performance Infiniium series oscilloscope
N5400A	EZJIT Plus Jitter Analysis Software Option (Option 004 on new oscilloscopes)
E2688A	Serial Data Analysis/Mask Testing with Clock Recovery Software Option (Option 003 on new oscilloscopes)
N5411A	Serial ATA Electrical Performance Validation and Compliance Software for Infiniium oscilloscopes
Crescent Heart Test Fixture	TF-SATA-NE/ZP or TF-eSATA-NE/ZP (**http://www.c-h-s.com/tf-sata.shtml**)
15443A	Matched cable pair, two 90-cm (36-in) SMA (m-m) cables, propagation delay within 25 ps (or equivalent)
11742A	DC Blocking Capacitor, 0.045 to 26.5 GHz, 3.5-mm (m-f) connectors (Need Qty. 2)
8493C	Coaxial fixed attenuator (need Qty. (2) 8493C-010 or Qty. (2) 8493C-020)

Table 27, 29 and 32 Measurements with Vendor Specific Pattern Generation Capability or Far-End Retimed Loopback Mode

Model Number	Description
DSA91204A	DSA91204A Ultra-high performance Infiniium series oscilloscope
N5400A	EZJIT Plus Jitter Analysis Software Option (Option 004 on new oscilloscopes)
E2688A	Serial Data Analysis/Mask Testing with Clock Recovery Software Option (Option 003 on new oscilloscopes)
N5411A	Serial ATA Electrical Performance Validation and Compliance Software for Infiniium oscilloscopes
Crescent Heart Test Fixture	TF-SATA-NE/ZP or TF-eSATA-NE/ZP (**http://www.c-h-s.com/tf-sata.shtml**)
81134A	3.35 Gbps Pulse/Pattern Generator
11636B	Power divider, DC to 26.5 GHz, 3.5-mm (f) connectors (Need Qty. 2)
11742A	DC Blocking Capacitor, 0.045 to 26.5 GHz, 3.5-mm (m-f) connectors (Need Qty. 2)
15442A	Cable kit, four 90-cm (35-in) SMA (m-m) cables (or equivalent SMA cables 24-in or 36-in; Need Qty. 4)
5062-6681	Cable assembly 6 in. SMA (m-m) cables (or equivalent; Need Qty. 4
8493C	Coaxial fixed attenuator (need Qty. (2) 8493C-010 or Qty. (2) 8493C-020)

Related Literature

Publication Title	Publication Type	Publication Number
Infiniium DSO/DSA 90000A Series	Data Sheet	5989-7819EN
N5400A EZJIT Plus and EZJIT Jitter Analysis Software for Infiniium Series Oscilloscopes	Data Sheet	5989-0109EN

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