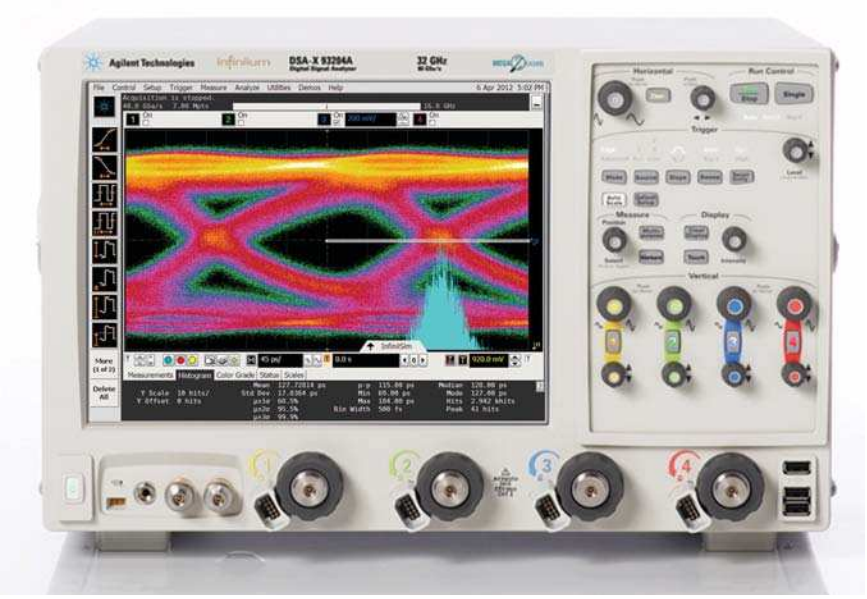
N6462A DDR4 Compliance Test Application for Infiniium Series Oscilloscopes

Data Sheet

Introduction

The Agilent Technologies N6462A DDR4 compliance test application provides a fast and easy way to test, debug and characterize your DDR4 designs. The tests performed by the N6462A software are based on the JEDEC1 JESD79-4 DDR4 SDRAM Specification. In addition, the application features Custom mode, which covers crucial measurements such as eye-diagram analysis, mask testing, ringing and other tests that are not covered in the specifications but are critical for characterizing DDR4 devices. The test application offers a user-friendly setup wizard and a comprehensive report that includes margin analysis.



DDR4 is an evolutionary upgrade to DDR3 memory systems. DDR4 technology enables higher bandwidth for data transfer than DDR3 and allows you to build devices with even smaller chip footprints that consume less power and generate less heat. DDR4 achieves these advances with enhanced fine ball-grid array (FBGA) packaging, on-die termination, self-calibration and automatic self-refresh for improved control of signal integrity.

Signal integrity is crucial for memory system interoperability. Reference clock jitter measurements help you ensure that jitter is well within the specifications, which is the key to reliable and interoperable modular memory systems. Electrical and timing characteristics of other signals are also critical, to ensure the memory system functions correctly and stays error free. The new data jitter measurements enable characterization of jitter to determine the data valid window.

The N6462A DDR4 compliance test application is compatible with Agilent Infiniium digital storage oscilloscopes.

1 The JEDEC (Joint Electronic Device Engineering Council) Solid State Technology Association is a semiconductor engineering standardizationbody of the Electronic Industries Alliance (EIA), a trade association that represents all areas of the electronic industry.

Comprehensive test coverage

With the DDR4 compliance test application, you can use the same oscilloscope you use for everyday debugging to perform automated testing and margin analysis based on the JEDEC electrical and timing specifications. The application automatically configures the oscilloscope for each test and provides informative results. It includes margin analysis indicating how close your device comes to passing or failing the test for each specification. Some of the difficulties in performing DDR3 tests are connecting to the target device, configuring the oscilloscope, performing the tests and analyzing the measured results.

The DDR4 compliance test application does most of this work for you. If you discover a problem with your device, the Custom mode feature in the test application and debug tools in the oscilloscope are available to aid in root-cause analysis.

Features

The N6462A compliance test application offers several features to simplify the validation of your designs:

- New setup wizard for quick setup, configuration and test
- Enhanced execution speed and proven test algorithm for clock test, which minimizes your compliance test time
- User-selected tests and configurations based on JEDEC JESD79-4 Specification data rate
- Unique technique to provide read-write burst signal separation on the same bus in real-time mode, allowing powerful debug and analysis
- New wizard tool to automate voltage threshold settings for nonstandard operating voltages adds flexibility in characterization work
- Ability to analyze the loading effect of adjacent RANK of the same memory channel
- Test framework provides powerful characterization through multiple trials that show a full array of statistics for each measurement and returns the worst measurement value
- Automatically perform derating table calculations for setup and hold time measurements based on slew rate

Easy test definition

The test application enhances the usability of Agilent Infiniium oscilloscopes for testing DDR4 devices. The Agilent automated test framework guides you quickly through the steps required to define the setup, perform the tests and view the test results. You can then select a category of tests or specify individual tests. The user interface is designed to minimize unnecessary reconnections, which saves time and minimizes potential operator error. You can save the tests and configurations as project files and recall them later for quick testing and review of previous results. Clear menus let you perform tests with minimum mouse clicks.

The threshold setting wizard helps you automate voltage threshold settings for non-standard operating voltages to increase flexibility to test in non-standard operating voltages.

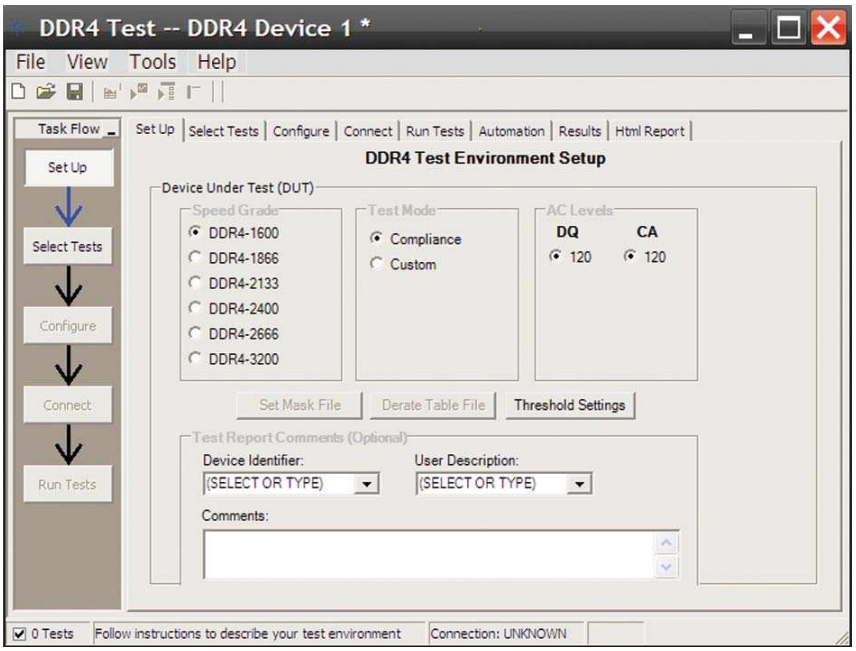


Figure 1. DDR4 application test setup screen. Select Compliance or Custom test mode and the speed grade of your device.

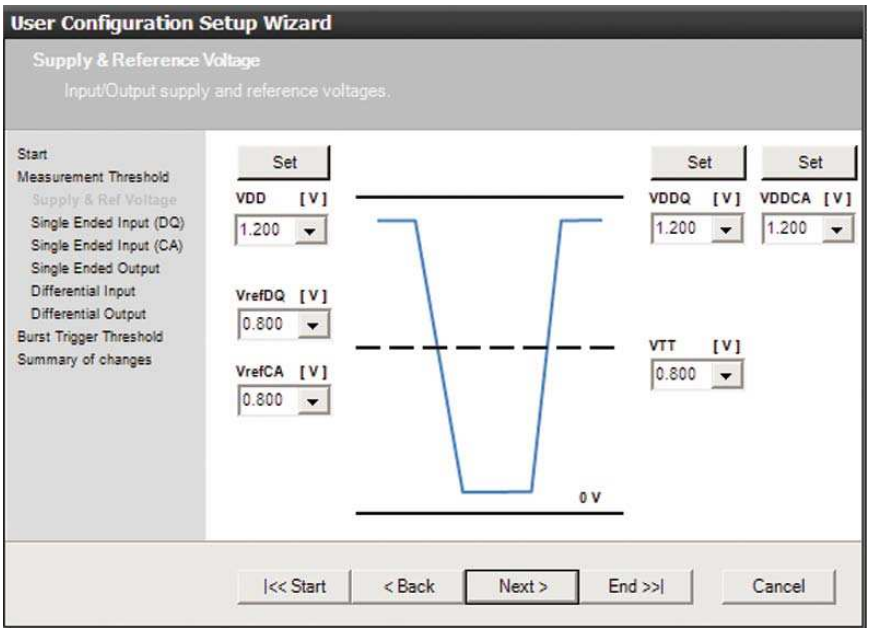


Figure 2. Automated voltage threshold setting helps you set the voltage thresholds to test in non-standard operating voltages.

Configurability and guided connection

The N6462A DDR4 compliance test application provides flexibility in your test setup. The application lets you define controls for critical test parameters such as voltage threshold values, number of waveforms used for analysis and customizable violation settings. Once you have configured the tests, the connection page will display the connection diagram for the test you have selected.

With the multiple test trial capability, you can extensively characterize the performance of your devices. You can run the selected tests until the stop condition is met. The application will then save the worst-case conditions and help you track down the anomalies in your signals.

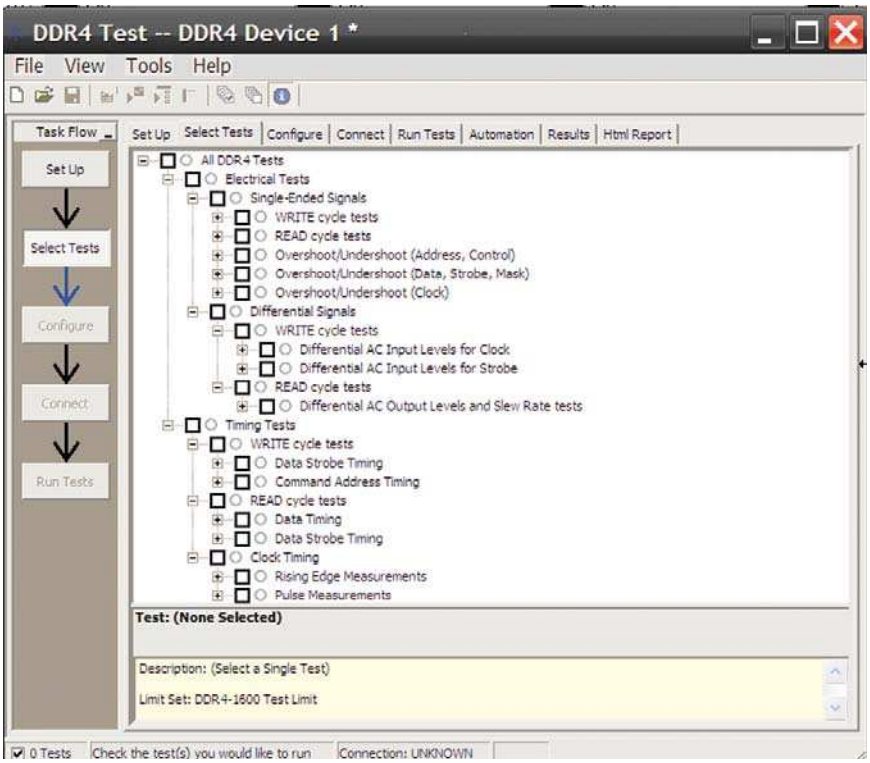


Figure 3. The Agilent automated test engine filters the test selection based on your test setup. You can easily select individual tests or groups of tests with a mouse-click.

Comprehensive results analysis

In addition to providing you with measurement results, the N6462A DDR4 compliance test application reports how close you are to the specified limit. You can specify the level at which warnings are to be issued. You are provided with a full array of statistics for each measurement, and you can save worst case conditions to extensively test the performance of your device.

Figure 4. The Repetitive Run feature allows you to run the selected tests until the stop condition is met. It allows you to extensively test the performance of your device.

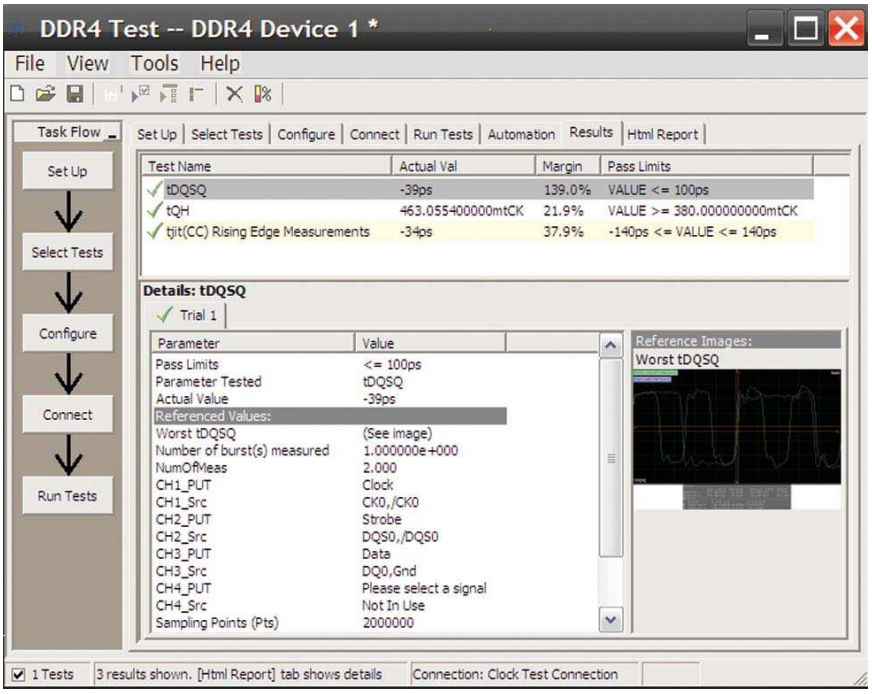
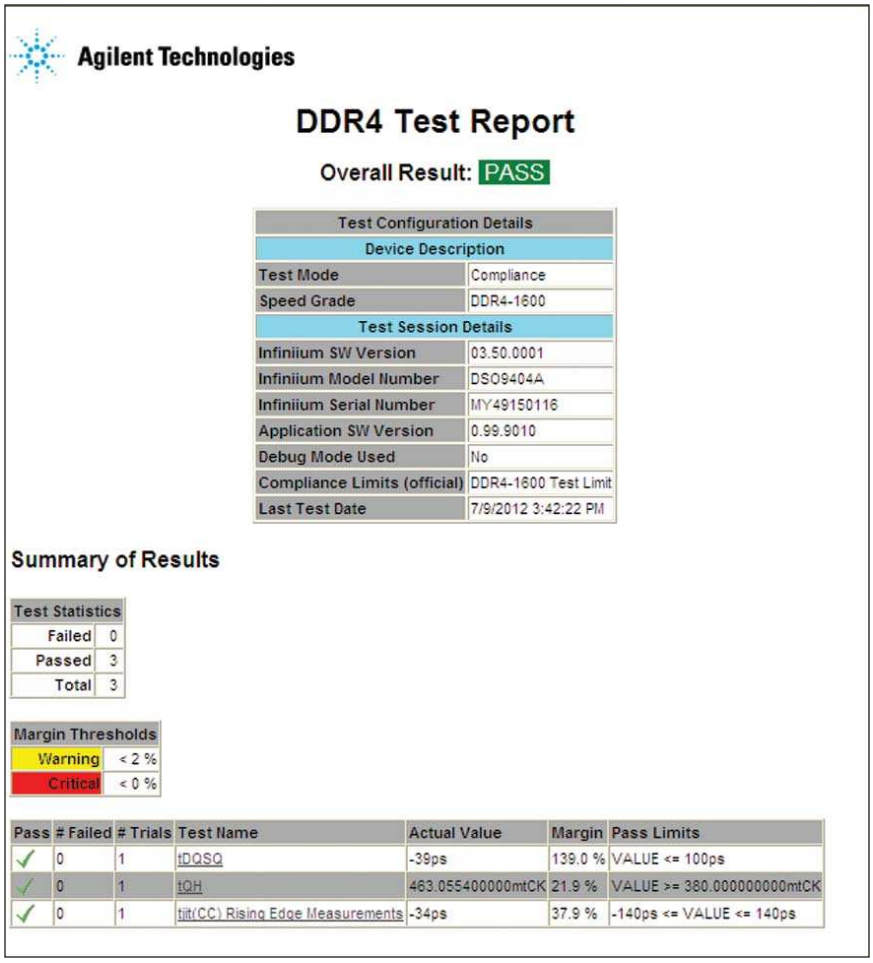


Figure 5. The DDR4 test application documents your test parameters, pass or fail status, test specification range, measured values and the pass/fail margin.

Thorough performance reporting

N6462A DDR4 compliance test application generates thorough HTML reports that capture the performance, status and margins of your device. It also captures screen shots of critical measurements for your reference and documentation. This report is suitable for printing and sharing with your vendors, customers or colleagues.



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DDR4 Test Report

Overall Result: PASS

Test Configuration Details	
Device Description	
Test Mode	Compliance
Speed Grade	DDR4-1600
Test Session Details	
Infiniium SW Version	03.50.0001
Infiniium Model Number	DSO9404A
Infiniium Serial Number	MY49150116
Application SW Version	0.99.9010
Debug Mode Used	No
Compliance Limits (official)	DDR4-1600 Test Limit
Last Test Date	7/9/2012 3:42:22 PM

Summary of Results

Test Statistics	
Failed	0
Passed	3
Total	3

Margin Thresholds	
Warning	< 2 %
Critical	< 0 %

Pass	# Failed	# Trials	Test Name	Actual Value	Margin	Pass Limits
✓	0	1	tDQSQ	-39ps	139.0 %	VALUE <= 100ps
✓	0	1	tQH	463.055400000mtCK	21.9 %	VALUE >= 380.000000000mtCK
✓	0	1	tjit(CC) Rising Edge Measurements	-34ps	37.9 %	-140ps <= VALUE <= 140ps

Figure 6. The DDR4 test application generates a summary report where you can see your device's test results quickly and clearly. Details are available for each test including the test limits, test description and test results, including saved waveforms. In addition, the pass/fail margin is indicated to give you further insight.

Extensibility

You may add additional custom tests or steps to your application using the N5467A User Defined Application (UDA) development tool (www.agilent.com/find/uda). Use UDA to develop functional "Add-ins" that you can plug into your application.

Add-ins may be designed as:

- Complete custom tests (with configuration variables and connection prompts)
- Any custom steps such as pre or post processing scripts, external instrument control and your own device control

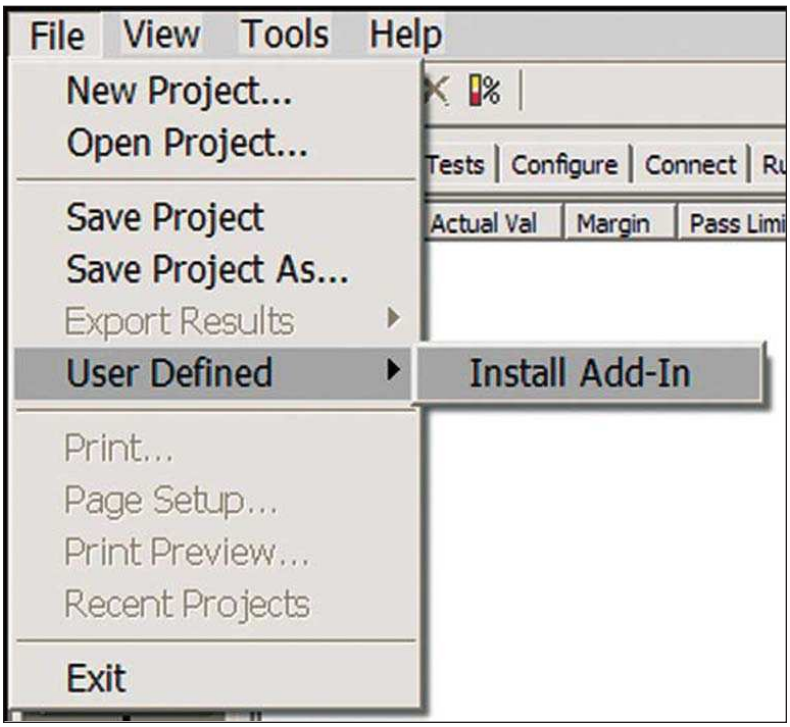

Figure 7. Importing a UDA Add-in into your test application.

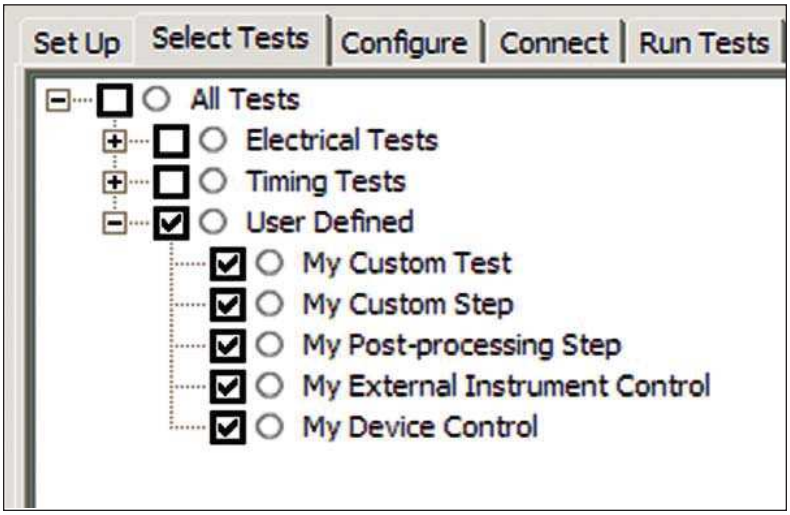

Figure 8. UDA Add-in tests and utilities in your test application.

Automation

You can completely automate execution of your application's tests and Add-ins from a separate PC using the included N5452A Remote Interface feature (download free toolkit from: www.agilent.com/find/scope-apps-sw). You can even create and execute automation scripts right inside the application using a convenient built-in client. The commands required for each task may be created using a command wizard or from "remote hints" accessible throughout the user interface. Using automation, you can accelerate complex testing scenarios and even automate manual tasks such as:

- Opening projects, executing tests and saving results
- Executing tests repeatedly while changing configurations
- Sending commands to external instruments
- Executing tests out of order

Combine the power of built-in automation and extensibility to transform your application into a complete test suite executive:

- Interact with your device controller to place it into desired states or test modes before test execution
- Configure additional instruments used in your test suite such as a pattern generator and probe switch matrix
- Export data generated by your tests and post-process it using your favorite environment, such as MATLAB, Python, LabVIEW, C, C++, Visual Basic, etc.
- Sequence or repeat the tests and "Add-in" custom steps execution in any order for complete test coverage of the test plan

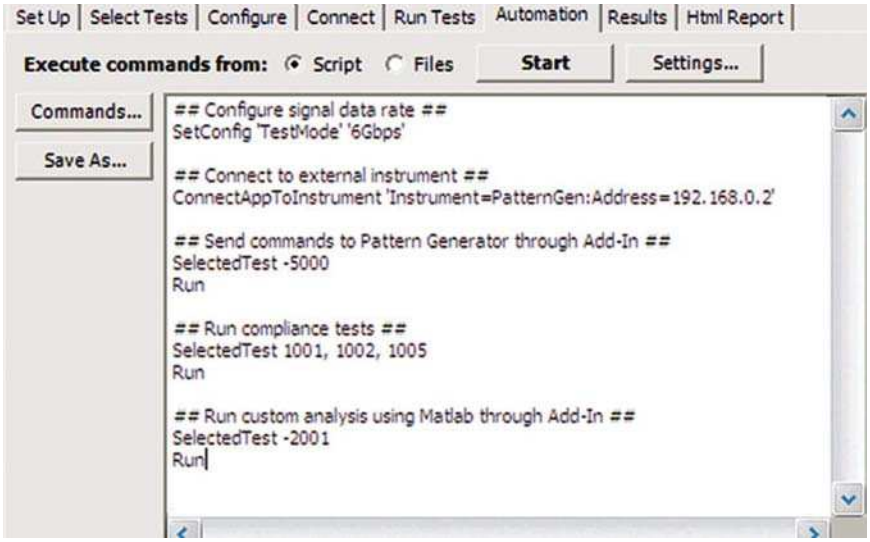

Figure 9. Remote Programming script in the Automation tab.

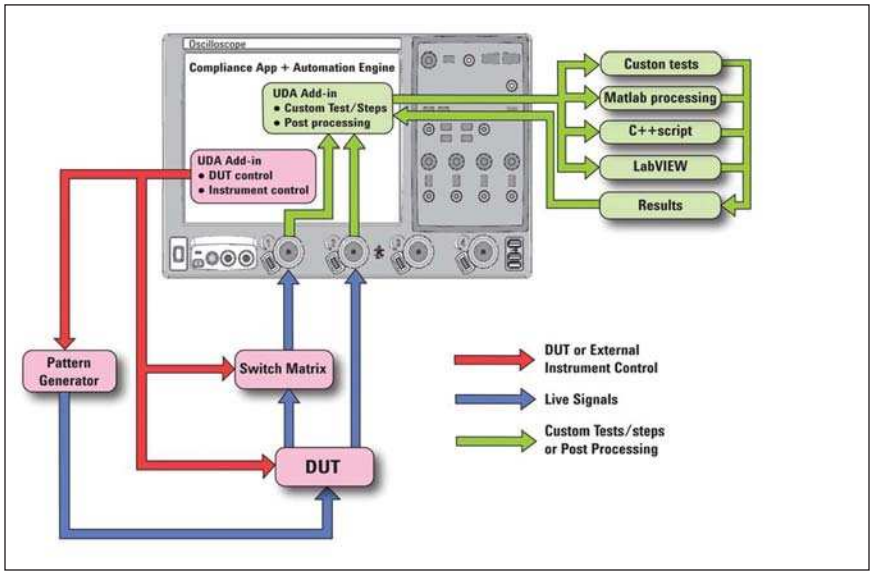

Figure 10. Combine the power of built-in automation and extensibility to transform your application into a complete test suite executive.

Requirements and Compatibility

Test performed

The Agilent N6462A DDR4 compliance test application covers clock, electrical and timing parameters of the JEDEC JESD79-4 DDR4 SDRAM Specifications. The application helps you test all DDR4 devices for compliance while using an Agilent 9000 or 90000 Series Infiniium oscilloscope. In addition, the test application's Custom mode feature provides popular test methodologies that are not covered in any specification. These tests help users who want to perform extensive validation beyond the test specification. It also sets up the scope to isolate the read and write signals so you can immediately jump in to debug the signals.

System device requirements

In order to speed your test time, you must use the appropriate RAM test reliability software with the memory system to generate random activity on the memory bus. Memtest is commonly used RAM reliability test software that can run on DOS,Windows® and Linux systems.

Oscilloscope compatibility

The N6462A compliance test application is compatible with Agilent 9000, 90000A, 90000 X- or 90000 Q-Series oscilloscopes with operation software revision 3.50 or higher. For oscilloscopes with earlier software revisions, free upgrade software is available at http://www.agilent.com/find/scope-apps-sw.

Note:

1. Recommended 8 GHz bandwidth or greater for full characterization.
2. Option 005 noise reduction is recommended for 8-GHz or higher bandwidth oscilloscopes.
3. The JEDEC JESD79- 4 specifications does not specify the rise time and fall time for DDR4 signals. The required oscilloscope bandwidth is also not mentioned. It is advisable for you to determine the oscilloscope bandwidth requirement based on the fastest rise time and fall time of the DDR4 signals.

Ordering information

To purchase the N6462A DDR4 compliance test application for your new and existing Infiniium 9000, 90000A, 90000X- or 90000Q-Series oscilloscope, order the following:

Oscilloscope requirements

9000/90000/90000X/90000Q	Infiniiium Series scope with software 3.50 or higher
N6462A or	DDR4 compliance test application (Option 058 on new 9000/90000 Series oscilloscope)
N5435A-056 E2688A	DDR4 compliance test application server based license High-speed serial data analysis and clock recovery software (Option 003 on new 9000 or 90000 Series oscilloscopes or Option N5435A-003 for application server license)
N5400A	Option N5435A-003 for application server license)
N5414B	Recommended and optional InfiniiScan event identification software Option 009 on new 9000 or 90000 Series oscilloscopes or Option N5435A-004 for application server license)
116xA/N280xA[1, 2]	InfiniiMax I/II probe amplifier (minimum quantity 3 required)

1 Ensure that the probe amplifier meets the bandwidth requirement for your signal measurements. Refer to the "Probe accessories" section below to configure the probe head to go with your probe amplifier.

2 For multiple RANK testing, a quantity of 4 probes are required for additional probing of Chip Select (CS) pin.

Probe accessories

InfiniiMax probe amplifiers	
1169A	12-GHz differential probe amplifier
1168A	10-GHz differential probe amplifier
N2803A	30 GHz InfiniiMax III probe amplifier
N2802A	25 GHz InfiniiMax III probe amplifier
N2801A	20 GHz InfiniiMax III probe amplifier
N2800A	16 GHz InfiniiMax III probe amplifier

InfiniiMax probe heads	
N5381A	InfiniiMax II 12-GHz differential solder-in probe head and accessories
N5382A	InfiniiMax II 12-GHz differential browser
E2677A	InfiniiMax 12-GHz differential solder-in probe head and accessories
E2675A	InfiniiMax 6-GHz differential browser probe head and accessories
N5425A	InfiniiMax 12-GHz ZIF probe head
N5426A	ZIF tips (x10)
N5451A	Long Wire tips (x10)
N5439A	ZIF probe head
N5445A	Browser (hand held) probe head
N5441A	Solder-in probe head
N5440A	450 Ω ZIF tip replacement (set of 5)
N5447A	250 Ω ZIF tip replacement (set of 5)

For more information about Agilent's InfiniiMax III probing system, check out the InfiniiMax III data sheet with the Agilent literature number, 5990-5653EN.

Product Web site

For the most up-to-date and complete application and product information, please visit our product Web site at www.agilent.com/find/n6462a.

Related literature

Publication type	Publication type	Publication number
Agilent Infiniium DSO/DSA 90000A Series Oscilloscopes and InfiniiMax Probes	Data Sheet	5989-7819EN
Agilent Infiniium 90000X Series Oscilloscopes	Data Sheet	5990-5271EN
InfiniiScan+ Event Identification Software for Infiniium 90000 (N5414B) and 9000 (N5415B) Series Oscilloscopes	Data Sheet	5990-5093EN
Agilent Technologies E2688A, N5384A High Speed Serial Data Analysis and Clock Recovery Software for Infiniium Oscilloscopes Agilent Technologies	Data Sheet	5989-0108EN
EZJIT and EZJIT PlusJitter Analysis Software for Infiniium Series Oscilloscopes	Data Sheet	5989-0109EN

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Revised: January 6, 2012

Product specifications and descriptions in this document subject to change without notice.

Published in USA, July 30, 2012
5991-0853EN

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