

Agilent N5409A

Fully Buffered DIMM Compliance Application for Infiniium Oscilloscopes

Data Sheet

The Agilent Technologies' N5409A fully buffered DIMM compliance application tool provides you with a fast and easy way to characterize and evaluate the signal integrity of both your high-speed FB-DIMM signals and your reference clock. The tests performed by the N5409A are based on the JEDEC High-Speed Point-to-Point Link Specification.

Key features:

- Easy-to-use graphical test selection and setup
- Automatic HTML report generation
- RJ/DJ jitter analysis at 10^{-12} BER
- Supports both JEDEC and Intel eye masks
- Built-in AMB control for test setup (DIMM and AMB testing)
- User-configurable margin analysis
- Debug mode allows changes in test parameters, giving you better insight into problems

FB-DIMM provides a revolutionary approach to improving server and workstation memory capacity. Using a component called the advanced memory buffer (AMB), FB-DIMM-based servers and workstation are now able to access significantly greater amounts of memory compared to single- or dual-channel DDR2 approaches. FB-DIMM systems easily accommodate eight or more gigabytes of memory, using a single memory channel from the host memory controller (or MCH).

Because it uses an innovative high-speed serial channel that supports 10

southbound and 14 northbound lanes that can operate at up to 4.8-GBits/s, FB-DIMM technology presents a significant challenge to today's digital designer. The goal of any system is to deliver the utmost reliability and interoperability; to achieve that goal you must ensure your design has good signal integrity on both of the high-speed lanes, as well as throughout the routing of the reference clock. Interoperability starts at the physical layer, and the Agilent N5409A provides you with a very-easy-to-use compliance tool that supports DIMM SI validation.



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The fixtures you use to connect your device to the oscilloscope are key to high-performance testing. Agilent provides high-performance test fixtures for signal integrity analysis of FB-DIMM devices. If you are working with server-class motherboards, you will want the N4238A/B FB-DIMM slot parametric probe. If you're working primarily with DIMM modules, the Agilent N4236A FB-DIMM module test fixture is the right choice. If your work is principally focused on the AMB, choose the Agilent N4235A FB-DIMM AMB parametric test fixture.

The Agilent N5409A FB-DIMM compliance tool tests all the currently supported speeds of FB-DIMM technology. You can test signal integrity of the northbound and southbound lanes at DDR2 400 (3.2-Gbit/s), 533 (4.0-Gbit/s) and 800 (4.8-Gbit/s) speed. The Agilent N5409A also includes both JEDEC and Intel Sigtest masks for SI compliance testing. In addition, you can optionally de-embed the test fixture to compensate for signal attenuation due to loss.

For DIMM module and AMB developers, the Agilent N5409A FB-DIMM compliance tool offers the added benefit of built-in AMB control. Using the same Python-based control codes typically used with the Intel channel test card, your Infiniium oscilloscope controls the AMB on your device under test to force it to generate an IBIST signal necessary for testing signal quality.

The scope communicates to the AMB using its USB port, which talks through a USB-to-SMBus interface on both the N4236A and N4235A fixtures. You also can select from multiple IBIST patterns within the N5409A FB-DIMM compliance tool and define your

own custom IBIST pattern, allowing you great flexibility in stressing your DUT's SI sensitivity around different frequencies. Also, having AMB control built into the N5409A allows you to easily and automatically test large, medium and small voltage swings with one test setup. This saves you time and gives you the confidence that you are making the most accurate measurements possible, time and time again.

Tests* supported by the Agilent N5409A FB-DIMM compliance test tool:

- _____
RJ/DJ at 10^{-12} BER
- _____
Common mode voltage swing (AC/DC)
- _____
Differential peak-to-peak voltage swing
- _____
Rise time/fall time voltage swing
- _____
Tx transition mask with 3.5 dB and 6.0 dB de-emphasis
- _____
Rx transition mask with 3.5 dB and 6.0 dB de-emphasis
- _____
Tx de-emphasis mask with 3.5 dB and 6.0 dB de-emphasis
- _____
Rx de-emphasis mask with 3.5 dB and 6.0 dB de-emphasis
- _____
Reference clock phase jitter

* Most tests supported for large, regular, and small voltage swing amplitude



Figure 1. Agilent Infiniium oscilloscope connected to the N4238B FB-DIMM slot parametric probe

Setting up your FB-DIMM measurements

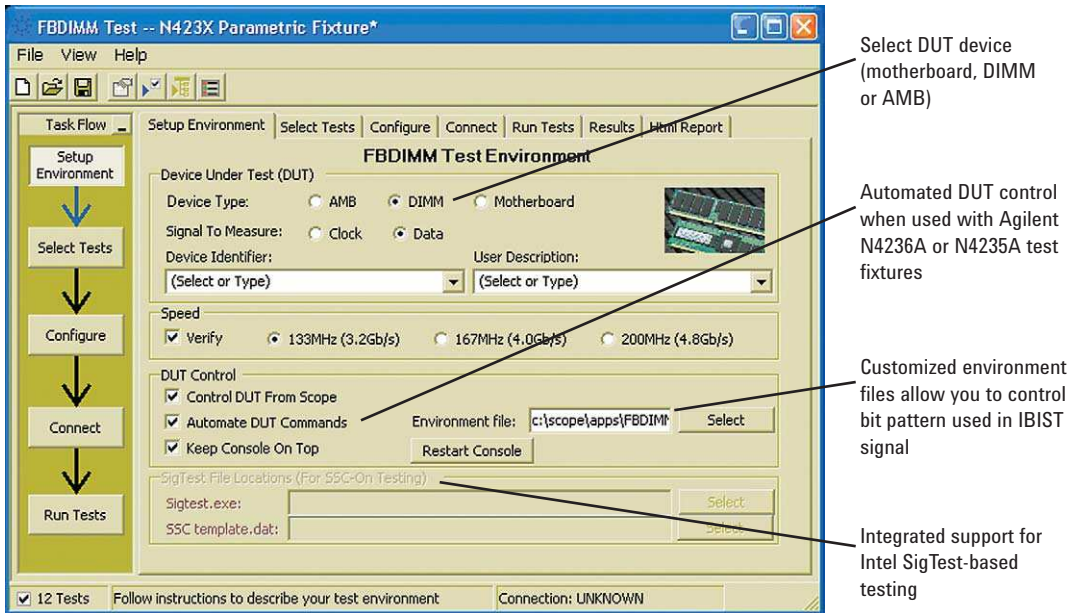


Figure 2. The Agilent N5409A saves you time and ensures accurate, repeatable results with a powerful control panel setup dialog that allows you to customize the tool for your own test needs.

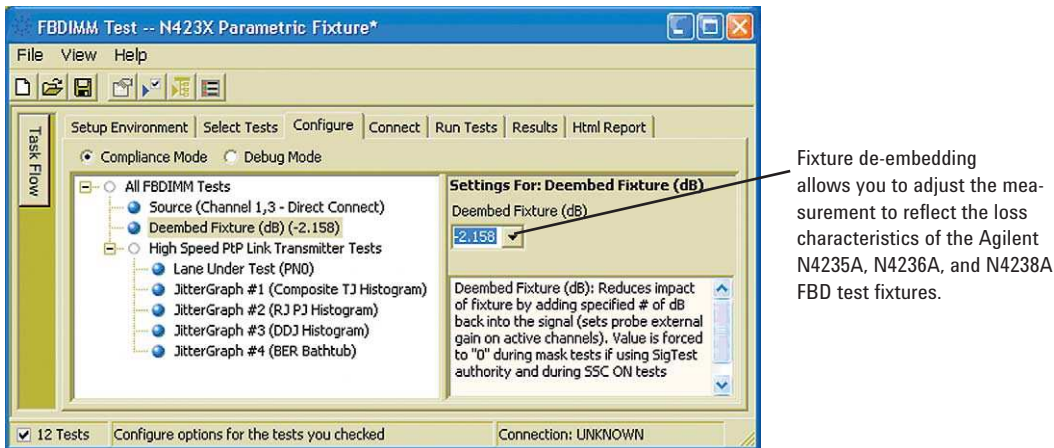


Figure 3. By selecting the Configure tab you can select the type of probing connection to your target as well as de-embed loss effects of the Agilent test fixtures.

Selecting tests to run

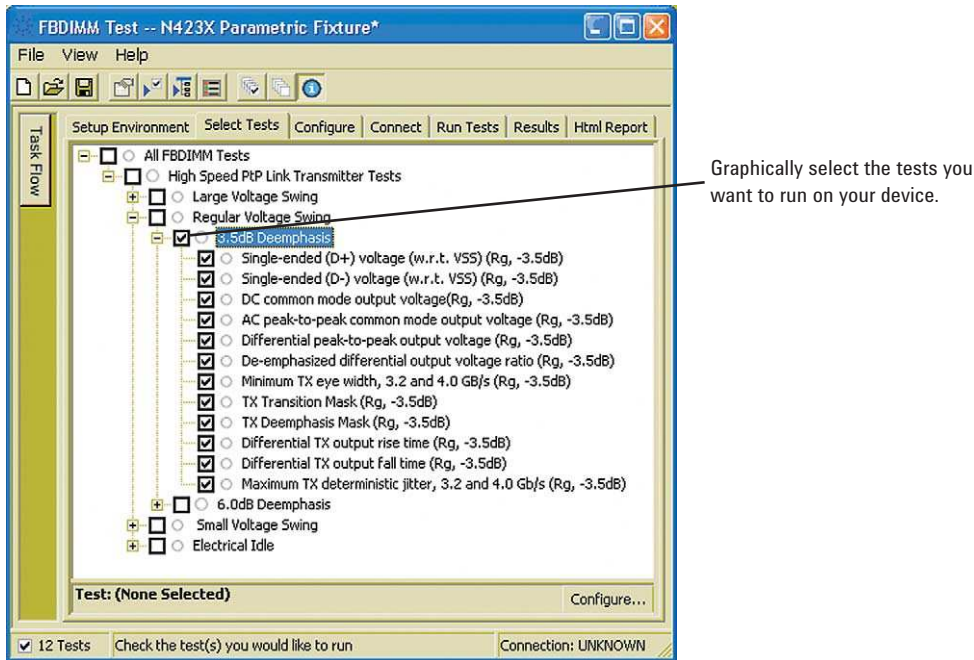


Figure 4. You can graphically select the tests you want to run using the “select tests” dialog box of the N5409A.

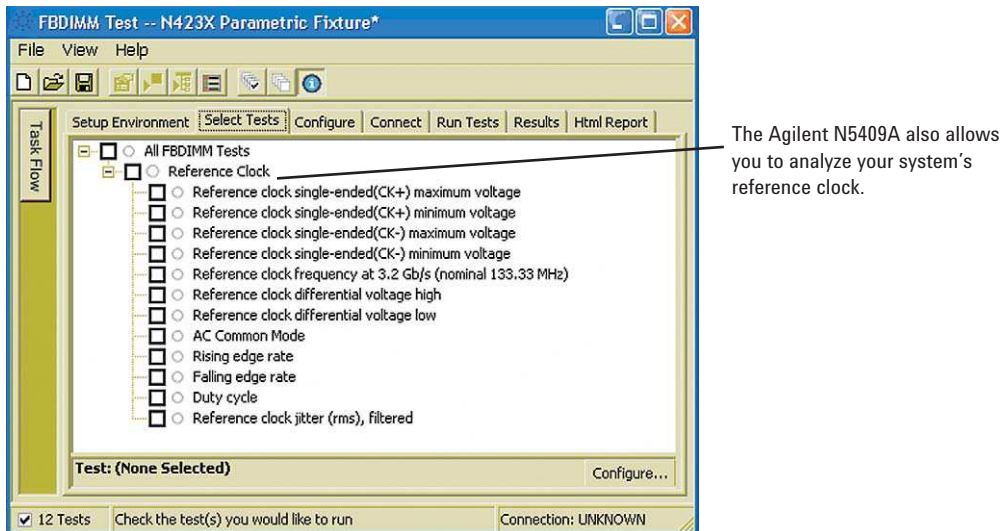


Figure 5. The Agilent N5409A allows you to analyze your system's reference clock, including phase jitter. Excessive jitter on the reference clock has been proven to cause interoperability problems. Jitter on the REF_CLK signal will transfer to the high-speed signals generated by the AMB. With the Agilent N5409A FB-DIMM compliance application, you can ensure that your reference clock conforms to the JEDEC standard for allowable phase jitter.

Viewing your results

The screenshot shows the 'Results' tab of the Agilent N5409A test software. The main window displays a table of test results with columns for Test Name, Spec Range, Actual Val, and Margin. A 'Task Flow' sidebar is on the left. Below the table, there is a 'Details' section for 'Maximum TX deterministic jitter, 3.2 and 4.0 Gb/s (Rg, -3.5dB)' and a 'Reference Images' section showing a 'Deterministic Jitter' plot.

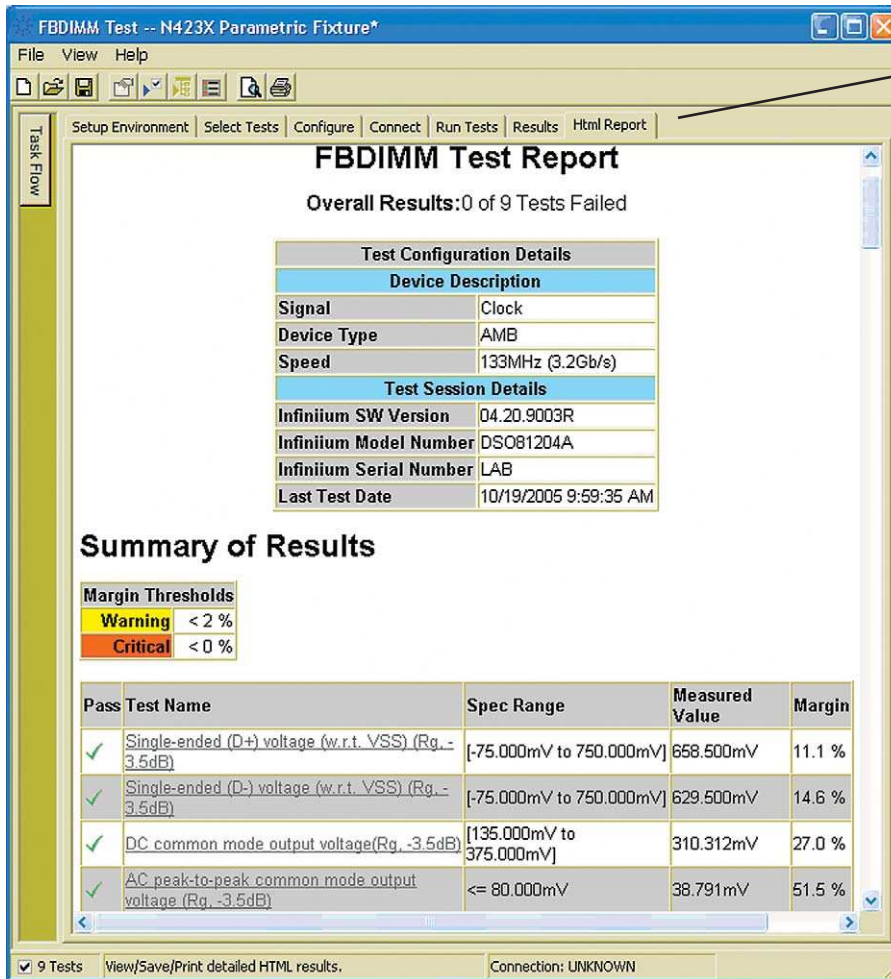
Test Name	Spec Range	Actual Val	Margin
✓ Single-ended (D+) voltage (w.r.t. VSS) ...	[-75.000mV to 750.00...	658.500mV	11.1%
✓ Single-ended (D-) voltage (w.r.t. VSS) (...)	[-75.000mV to 750.00...	629.500mV	14.6%
✓ DC common mode output voltage(Rg, -...	[135.000mV to 375.0...	310.312mV	27.0%
✓ AC peak-to-peak common mode output ...	<= 80.000mV	38.791mV	51.5%
✓ Differential peak-to-peak output voltag...	[800.000mV to 1,300...	919.000mV	23.8%
✓ Minimum TX eye width, 3.2 and 4.0 Gb/...	>= 0.70UI	0.90UI	28.6%
✓ TX Transition Mask (Rg, -3.5dB)	No Mask Failures	0	
✓ TX Deemphasis Mask (Rg, -3.5dB)	No Mask Failures	0	
✓ Maximum TX deterministic jitter, 3.2 an...	DJ at 10E-12 BER less...	0.058UI	71.0%

Click the Results tab for a quick overview of your test results.

Margin analysis helps you to focus on areas that are outside of allowed specification limits.

Figure 6. The Agilent N5409A provides you with a simple-to-read test summary of the test performed. You also can specify how close to the limit of the tested specification you can get before the tool reports a warning.

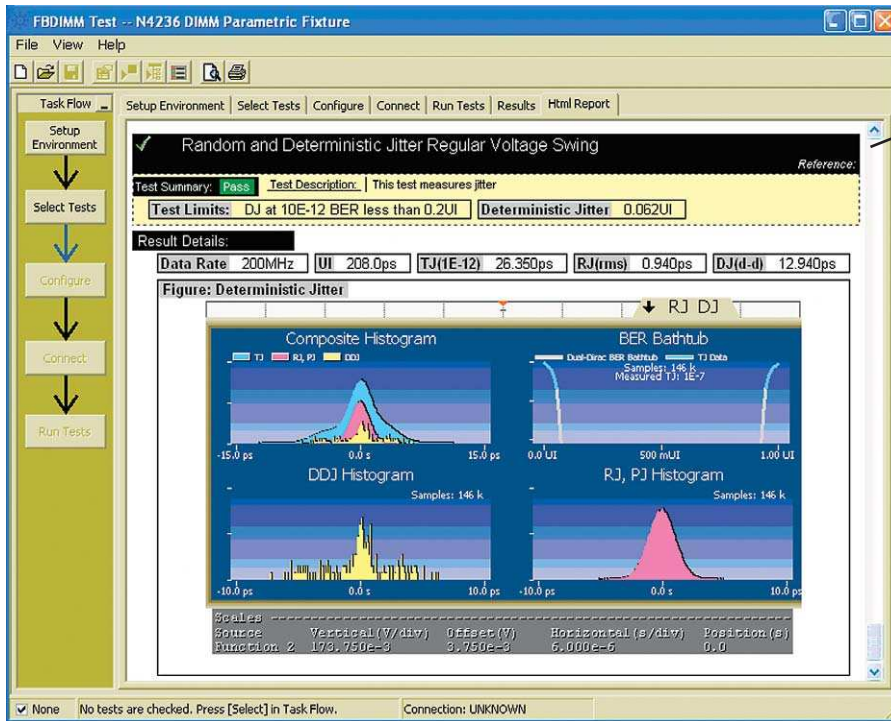
Viewing your results



Click the HTML Report tab for a detailed report that includes screen shots of analyzed waveforms.

Figure 7. The Agilent N5409A FB-DIMM compliance tool saves you time and energy with its HTML report generator that quickly summarizes your test results in great detail, including both test summary information as well as detailed test-by-test results that include the scope waveforms that were analyzed.

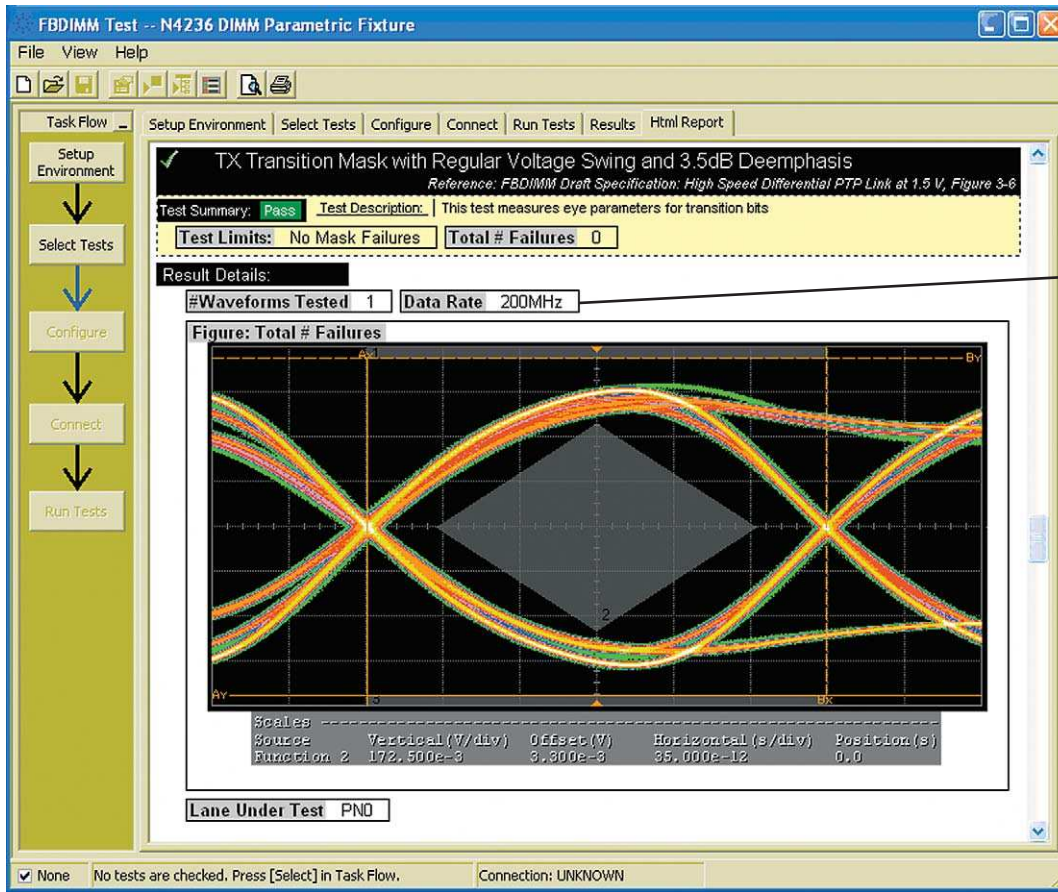
Viewing your results



HTML Report includes graphs such as jitter eye diagrams and detailed jitter graphs.

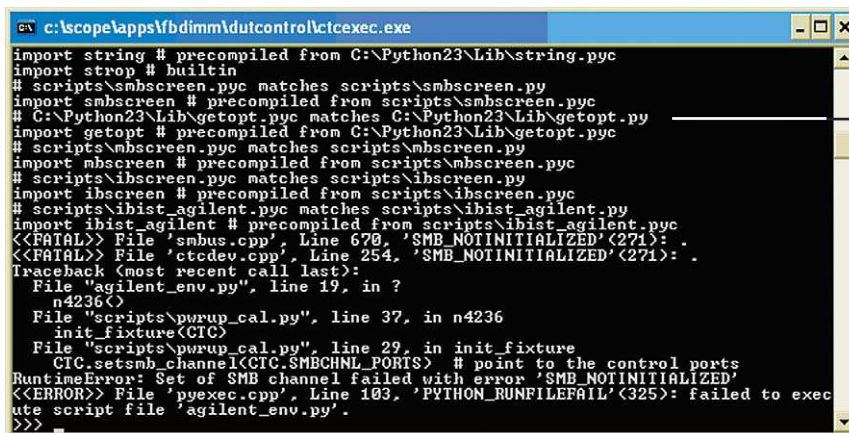
Figure 8. The Agilent N5409A FB-DIMM compliance application provides you with a breakdown of RJ/DJ values for jitter at 10⁻¹² BER.

Viewing your results



The Agilent N5409A supports signal speeds up to 4.8 Gbit/s for eye diagram and jitter analysis.

Figure 9. The Agilent N5409A provides you with clear and concise HTML based reports and includes screen captures from the oscilloscope to document your test results.



The N5409A supports Python script monitor capability so you can monitor SMBus control commands sent to your AMB.

Figure 10. A monitor window allows you to observe commands sent to your AMB or DIMM for test setup.

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

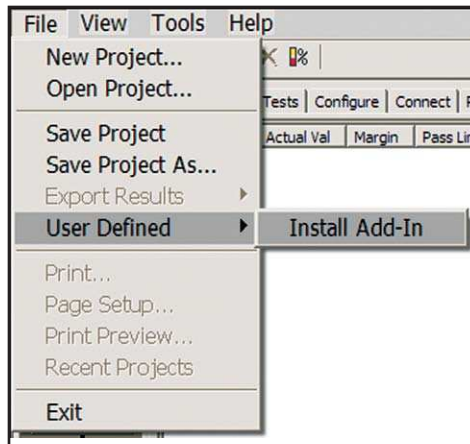


Figure 11. Importing a UDA Add-In into your test application.

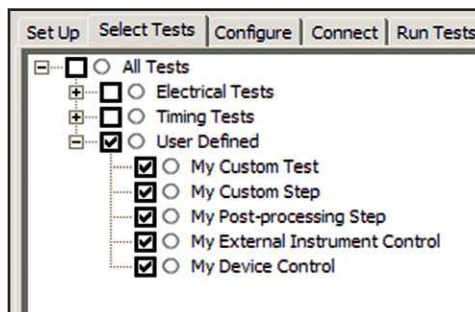


Figure 12. UDA Add-In tests and utilities in your test application.

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.

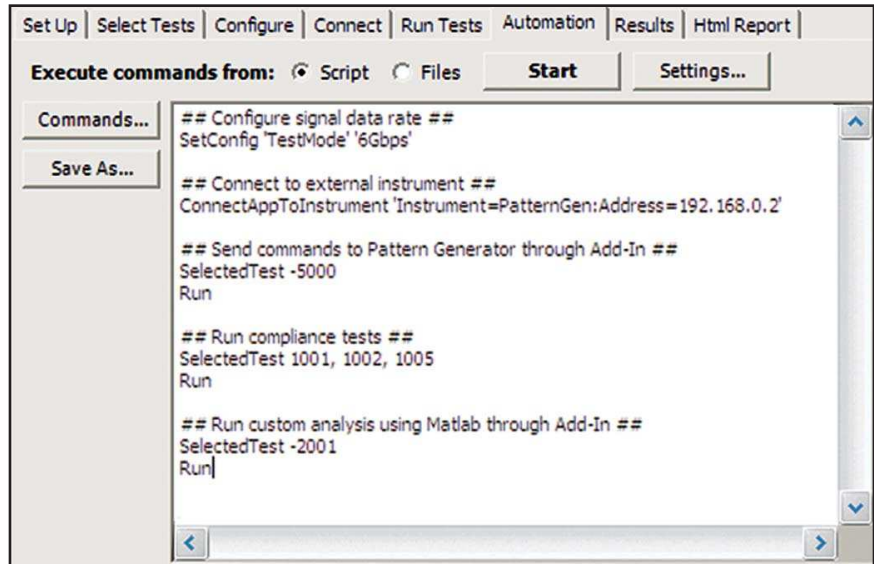


Figure 13. Remote Programming script in the Automation tab.

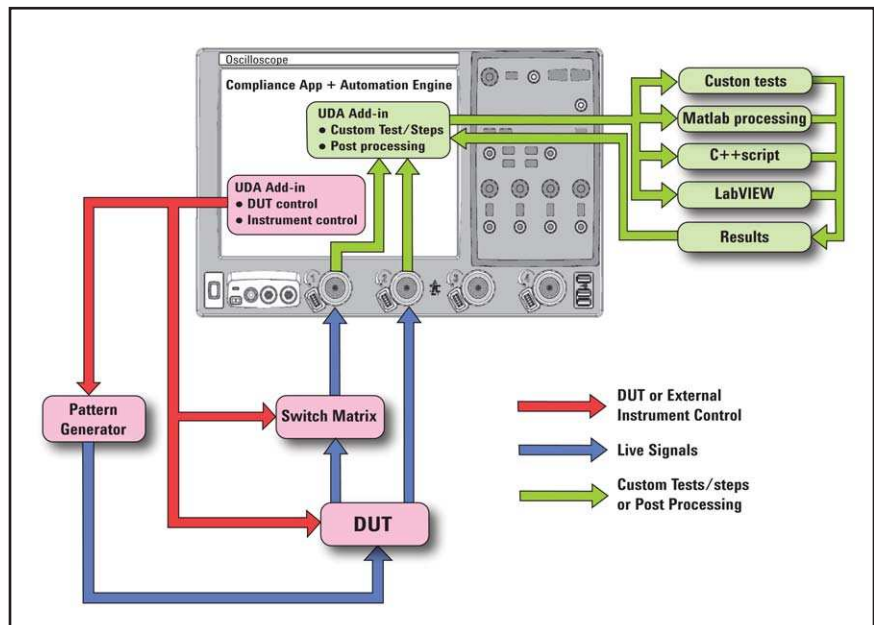


Figure 14. Combine the power of built-in automation and extensibility to transform your application into a complete test suite executive.

Oscilloscope compatibility

One of the unique and powerful capabilities provided to you by the Agilent N5409A is its ability to control your AMB in either the N4235A AMB test fixture or your DIMM module using the N4236A DIMM module test fixture. The Agilent N5409A includes the ability to communicate over the SMBus to the AMB via your scope's USB interface. The same commands used to control the Intel channel test card (CTC) are also used by the N4236A and N4235A test fixtures. This feature allows you to leverage your experience

with the CTC directly, as you are able to observe and monitor the commands sent to the AMB on your test device.

The Agilent N5409A FB-DIMM compliance application is compatible with Agilent DSO 80000 Series oscilloscopes with operating software revision A.04.21 or higher on a 90000 Series oscilloscope. For oscilloscopes with earlier software revisions, free upgrade software is available at http://www.agilent.com/find/infiniium_software

Ordering information

To purchase the Agilent N5409A FB-DIMM compliance application to coincide with your order for an Infiniium Series oscilloscope, please add the following model numbers to your order. The Agilent N5409A tool also requires that you have current licenses for the E2688A serial data analysis package as well as the N5400A EZ-Jit Plus jitter package.

Model number	Description
N5409A	Fully buffered DIMM compliance application
E2688A	Serial data analysis software
N5400A	Ez-Jit Plus jitter analysis software

The following FB-DIMM test fixtures are also available:

Model number	Description
N4235A	AMB parametric test fixture for FB-DIMM
N4236A	Parametric test fixture for FB-DIMM
N4238A	Slot parametric probe for FB-DIMM with pass-through test capability
N4238B	Slot parametric probe for FB-DIMM

Related Literature

Publication Title	Publication Type	Publication Number
<i>Infiniium 90000 Series Oscilloscopes InfiniiMax II Series Probes</i>	Data sheet	5989-7819EN
<i>E2688A High-Speed Serial Data Analysis with Clock Recovery Software</i>	Data sheet	5989-0108EN
<i>EZJIT Plus and EZJIT Jitter Analysis</i>	Data sheet	5989-0109EN

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