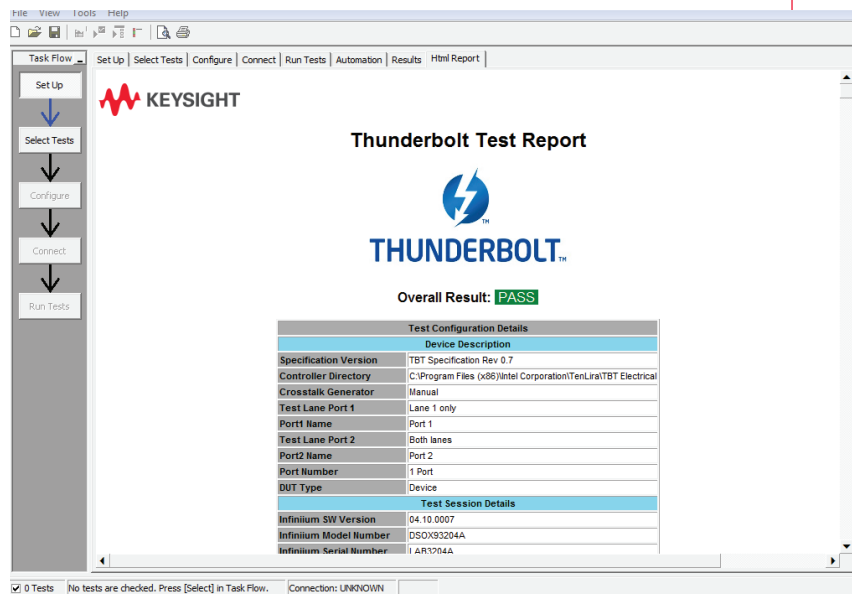


Keysight Technologies

N6463A Thunderbolt Transmitter Electrical Performance Validation and Compliance Test Software for Infiniium Oscilloscopes

Data Sheet



Verify and Debug Your Thunderbolt Designs Features and Benefits

The N6463A Thunderbolt electrical test software gives you a fast and easy way to verify and debug your Thunderbolt designs for both silicon validation as well as end products like storage devices or motherboards.

The Thunderbolt electrical test software allows you to automatically execute Thunderbolt electrical transmitter tests 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.

The N6463A Thunderbolt electrical test software covers the prescribed test methods and parameters required for Thunderbolt electrical certification testing for all current Thunderbolt specification revisions. This produces results that are consistent with those obtained during official certification at approved test labs and informational testing at plugfests.

In addition to automatic setup and execution of the transmitter tests, the N6463A Thunderbolt electrical test software also provides an automatic setup and control of the crosstalk generator source, a required condition for electrical testing during official certification tests.

The N6463A Thunderbolt electrical test software offers several features to simplify the validation of your Thunderbolt designs:

- Automated test setup and execution for ease of use
- Testing support for Thunderbolt Interconnect specification revisions 0.6, 0.7 and 0.9
- Fully-automated Device Test Mode control
- Support for simultaneous two-lane testing as well as single or dual port
- Support for SMA cable and test fixture de-embedding to provide more accurate margin estimates
- Includes required Thunderbolt UJ_RJ jitter decomposition test method
- Run tests with live or saved waveforms for easy regression testing if specification requirements change
- Support for user-defined limits and specification-specific limits for all Thunderbolt Interconnect specification revisions
- Automated test report generation and margin analysis
- Add additional custom tests, steps or automation to your application using the N5467A User-Defined Application (UDA) development tool
- Supports automated setup and control of crosstalk generator

Applications

The N6463A Thunderbolt application software provides electrical testing coverage for:

- Thunderbolt devices
 - Storage devices
 - Displays
 - Expansion bays
- Systems, hosts, motherboards
- Dongles
- Cables
- Silicon

Easy Test Definition

The N6463A Thunderbolt electrical test software extends the ease-of-use advantages of the Keysight Technologies, Inc. Infiniium 90000 X- and Q-Series oscilloscopes to testing Thunderbolt designs. The Keysight automated test engine walks you quickly through the steps required to define, set up, perform, and view the results for the tests. You can select a category of tests all at once or specify individual tests. You can save tests and configurations as project files and recall them later to quickly re-test, run additional tests and review previous test results. You can also quickly verify old test results against new specification requirements using the Saved Waveform option.

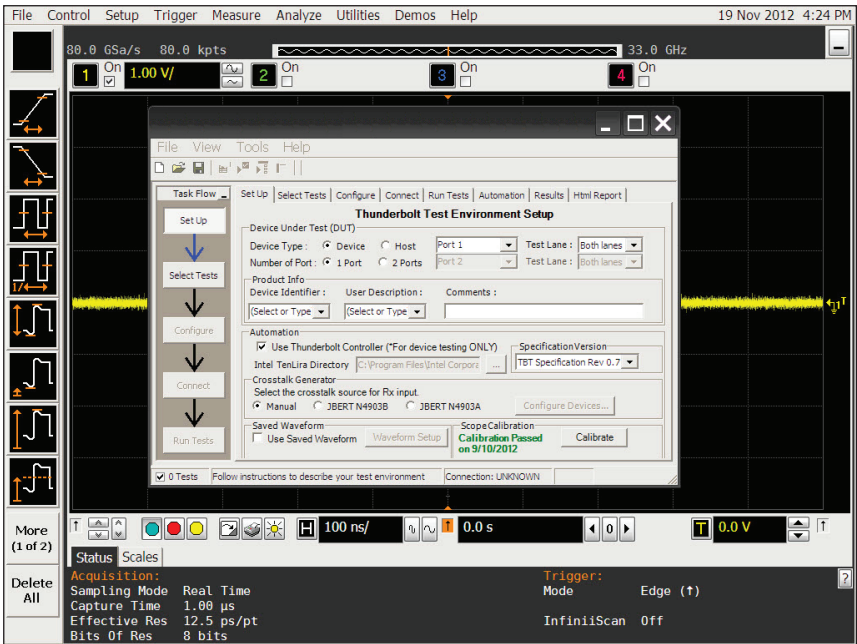


Figure 1. Setup test environment for one or two port products

Thunderbolt transmitter testing requires active inputs to the receivers of the product under test during all electrical tests. The N6463A Thunderbolt electrical test software automates setup and control of the crosstalk source.

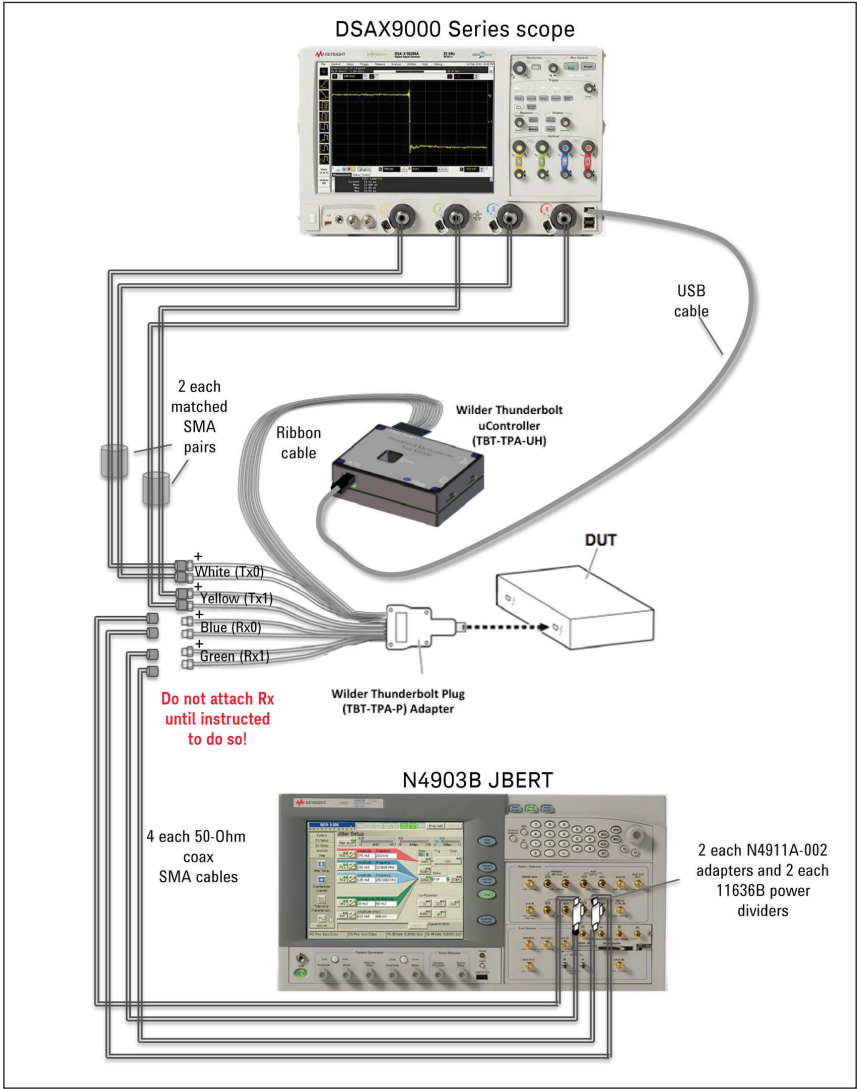


Figure 2. Automated transmitter test setup including crosstalk source

If you are testing a one-port or two-port Thunderbolt product, the Select Tests tab will provide selectable test options automatically. You can select a category of tests, all the tests, or an individual test depending on your testing requirements.

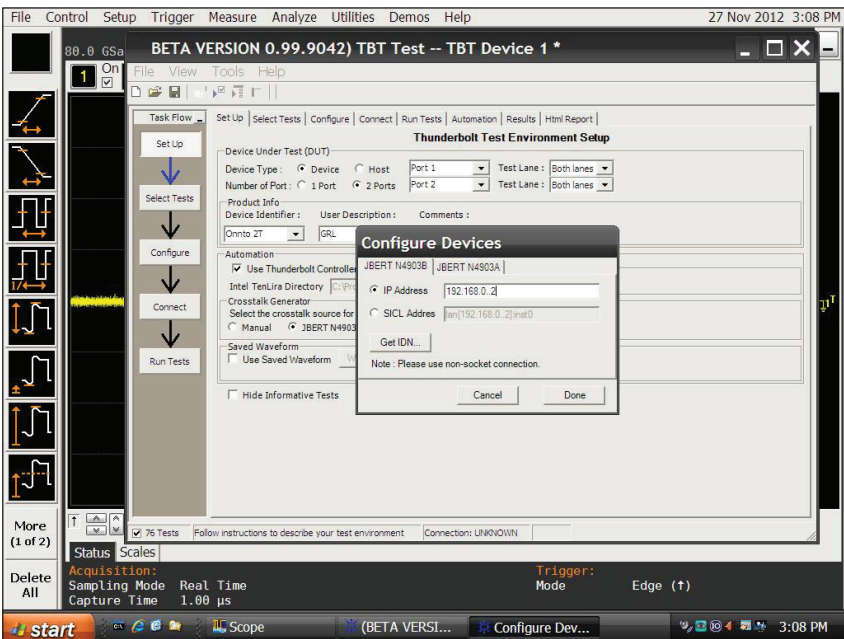


Figure 3. Configuring the crosstalk source

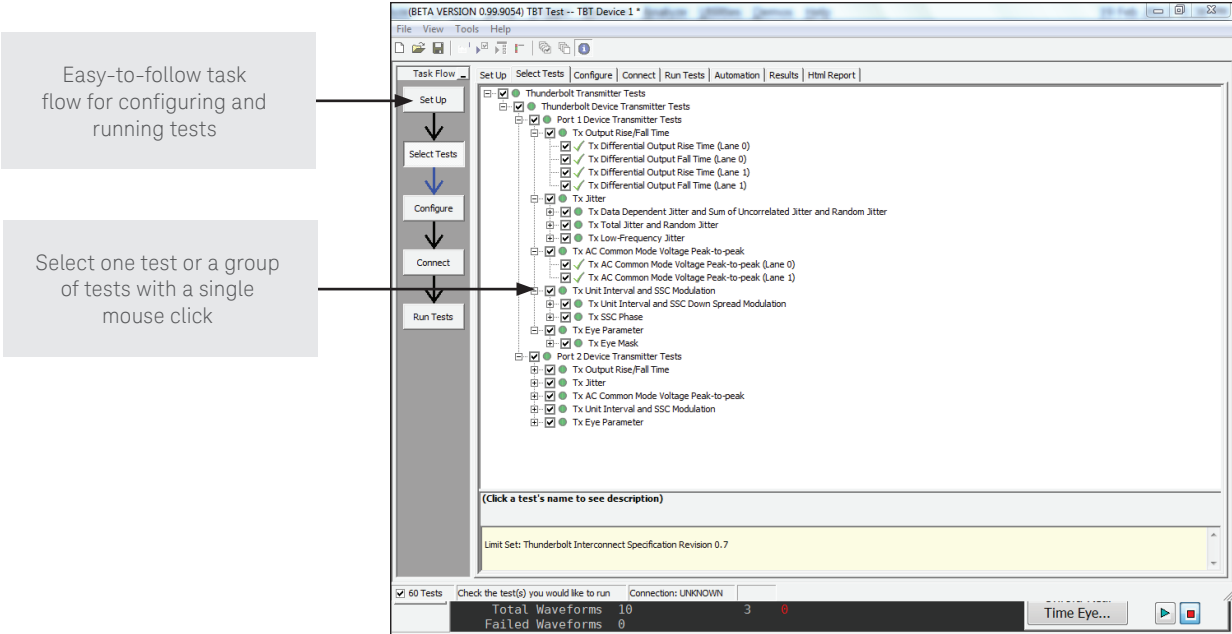


Figure 4. Thunderbolt application – select test tab

Configurability and Guided Connections

The N6463A Thunderbolt electrical test software provides flexibility in your test setup. It guides you to make connections in the proper sequence and connection changes with hookup diagrams when the tests you select require it.

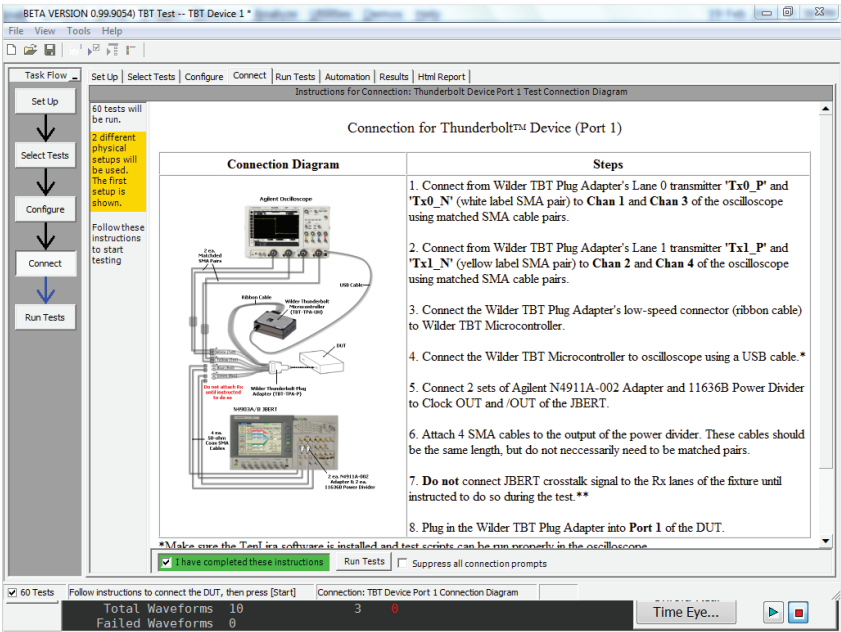


Figure 5. Thunderbolt application – connection tab

The Configure Tab provides flexibility in your test setup and oscilloscope settings used during tests. In configuring the tests, advanced users can specify changes to the test configuration to optimize test time versus coverage depending on validation requirements and testing goals.

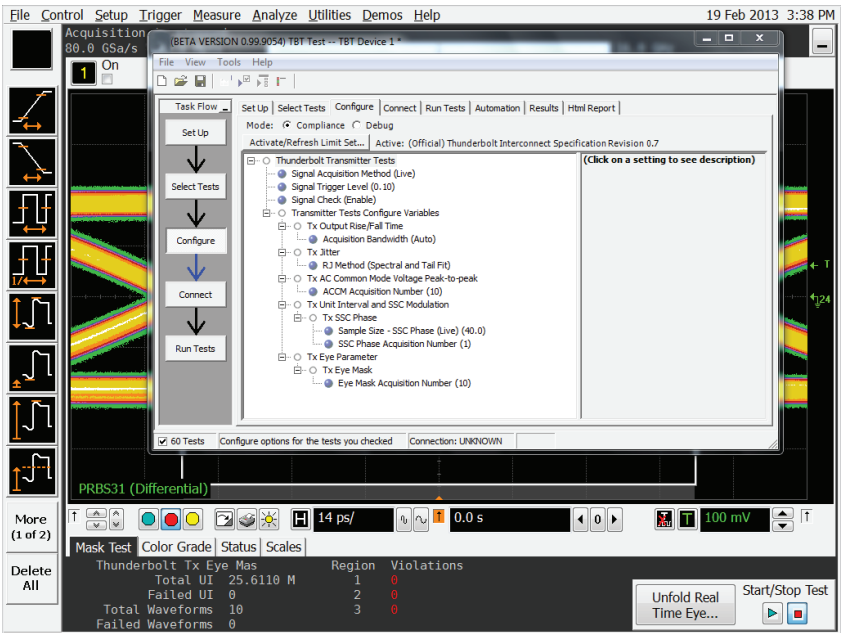


Figure 6. Thunderbolt application – configure tab

Reports with Margin Analysis

In addition to providing you with measurement results, The N6463A Thunderbolt electrical test software automates and provides a report format that shows you not only where your product passes or fails but also how close you are to the limits specified for a particular test parameter relative to the specification revision you are testing. You can select the margin test report parameter, which means you can specify the level at which warnings are issued to alert you to electrical tests where your product is operating close to the official test limit defined by the Thunderbolt Interconnect specification.

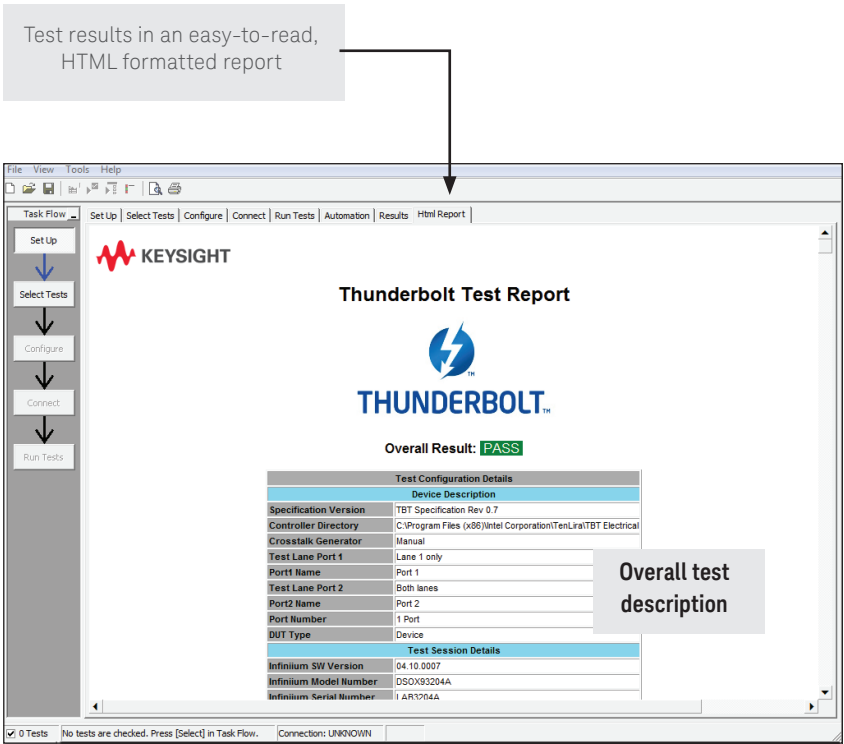


Figure 7. Thunderbolt application – results HTML report

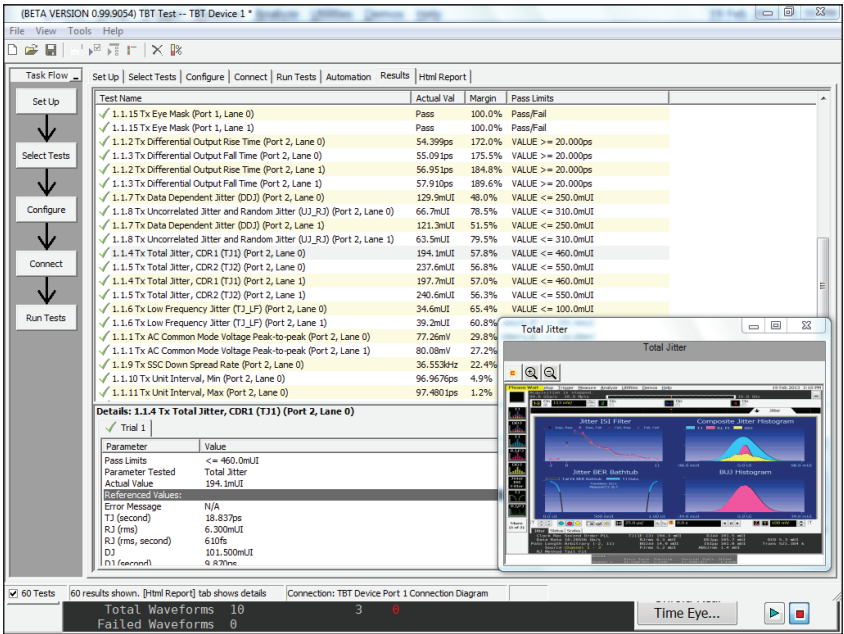


Figure 8. Thunderbolt application – summary of test results

Thunderbolt Specification Measurements

Supported Transmitter Compliance Test Requirements

Test ID	Test name
1.1	TBT transmitter test
1.1.1	AC common mode
1.1.2	Rise time
1.1.3	Fall time
1.1.4	Total jitter CDR1
1.1.5	Total jitter CDR2
1.1.6	Low-frequency jitter
1.1.7	DDJ
1.1.8	UJ/RJ
1.1.9	SSC modulation frequency
1.1.10	Unit interval (min)
1.1.11	Unit interval (max)
1.1.12	SSC down-spread deviation
1.1.13	SSC phase deviation
1.1.14	SSC phase slew rate
1.1.15	Eye mask

Extensibility

You may add additional custom tests or steps to your application using the N5467A User Defined Application (UDA) development tool (www.keysight.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

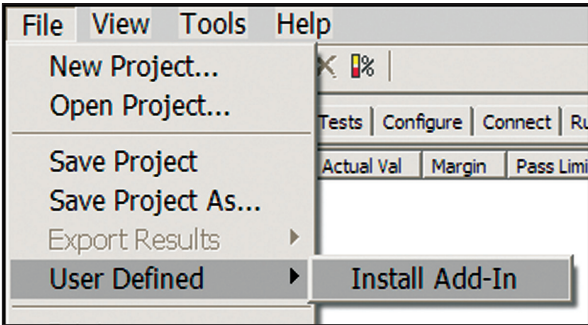


Figure 12. Importing a UDA Add-In into your test application.

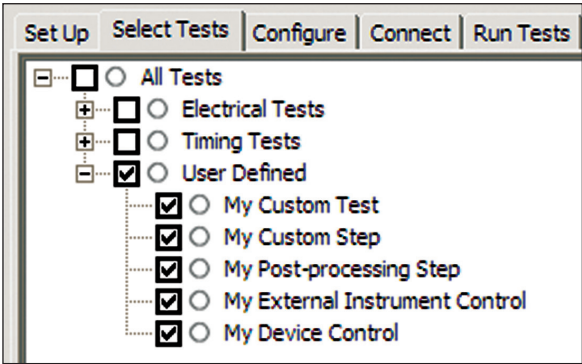


Figure 13. UDA Add-In tests and utilities in your test application.

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.keysight.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.

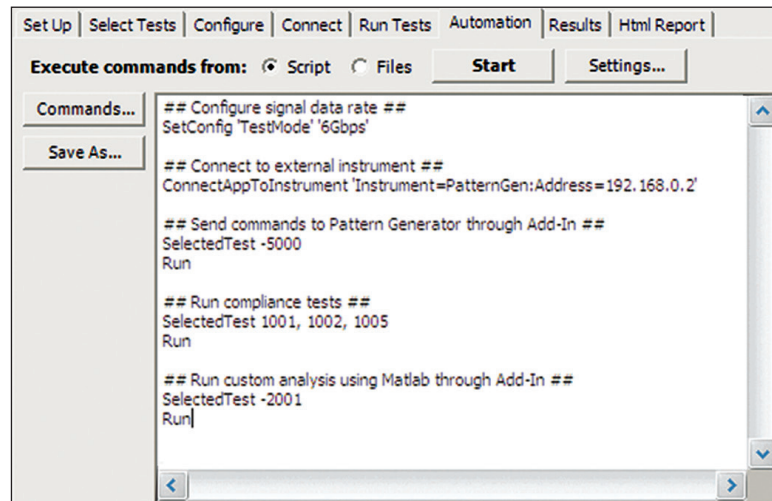


Figure 14. Remote Programming script in the Automation tab.

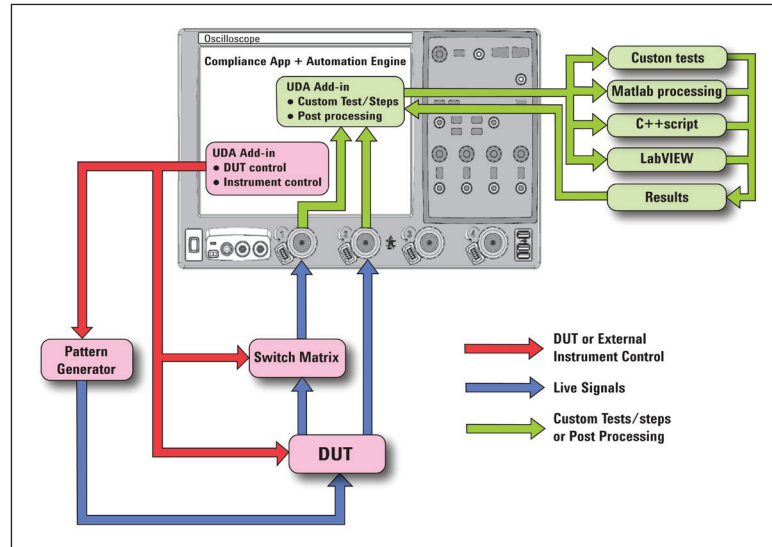


Figure 15. Combine the power of built-in automation and extensibility to transform your application into a complete test suite executive.

Oscilloscope Compatibility

The N6463A Thunderbolt electrical test software is compatible with 90000 X- and Q-Series oscilloscopes with operation software revision 4.10 or higher. Oscilloscope bandwidth must be a minimum of 16 GHz. 20 GHz or higher is recommended.

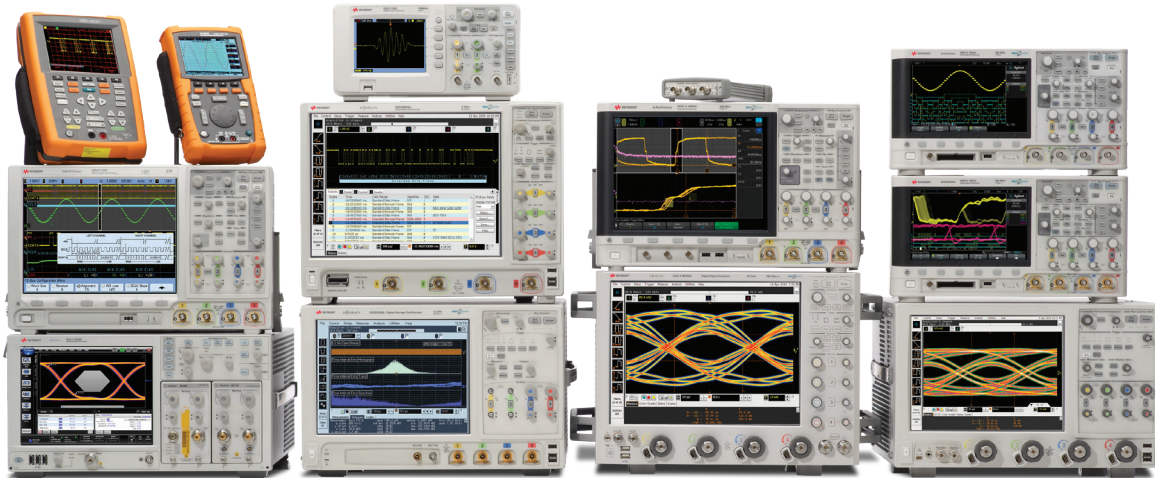
Data rate	Recommended oscilloscope	Bandwidth of recommended oscilloscope
10.3125 Gb/s	DSO/DSAX91604A	16 GHz or higher
	DSO/DSAX92004Q	20 GHz or higher

Ordering Information

You can order the N6463A as an option to your oscilloscope hardware purchase or as a separate software product. The N6463A Thunderbolt electrical test software supports testing for Thunderbolt devices and hosts.

Publication title	Publication number
<i>Infiniium 90000 X-Series Oscilloscopes – Data Sheet</i>	5990-5271EN
<i>Infiniium 90000 Q-Series Oscilloscopes – Data Sheet</i>	5990-9712EN
<i>Infiniium Oscilloscope Probes and Accessories – Data Sheet</i>	5968-7141EN
<i>E2688A, N5384A High-Speed Serial Data Analysis and Clock Recovery Software for Infiniium Oscilloscopes – Data Sheet</i>	5989-0108EN
<i>PrecisionProbe for Bandwidths up to 33 GHz – Data Sheet</i>	5990-7940EN
<i>N5465A InfiniiSim Waveform Transformation Toolset for the Infiniium Series Oscilloscopes – Data Sheet</i>	5990-4059EN
<i>Keysight Oscilloscope Probes and Accessories – Selection Guide</i>	5989-6162EN
<i>U7232B/U7232C DisplayPort Electrical Performance Validation and Compliance Software for Infiniium Series Oscilloscopes – Data Sheet</i>	5990-7697EN
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<i>N5393C PCI Express® 3.0 (Gen3) Software for Infiniium Oscilloscopes – Data Sheet</i>	5989-1240EN

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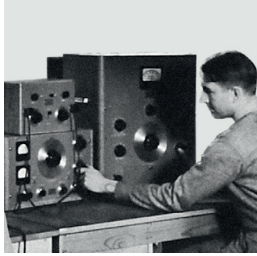
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Published in USA, March 2, 2018
5991-2132EN
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