

WHITE PAPER

# How to Shorten Compliance Test Time with Software

PATHWAVE

One challenge for high-speed digital engineers is handling numerous tests. Each new generation of high-speed computing standards includes more tests and factors to consider. This white paper discusses four ways to use software to accelerate your compliance testing:

- Use the cloud for faster data processing.
- Use artificial intelligence to optimize algorithms.
- Use analytics for streamlined troubleshooting.
- Invest in an integrated hardware and software solution.

## Testing Increases as Standards Proliferate

Insatiable consumer demand for data drives new standards in the data center. The amount of data traffic continues to increase at astronomical rates worldwide. 400G will soon replace 100G, and 800G is right around the corner. While network infrastructure traffic continues to grow, high-speed digital buses must also increase in speed to keep up. To cope, engineers create new technologies, and industry standards move to the next generation.



The new standards require more tests and validation. Testing times for designs and devices continue to skyrocket. According to a survey on time-to-market barriers, product verification is one of the biggest challenges facing test engineers. Engineers need to quickly and accurately verify their designs while keeping up with their time-to-market goals. The survey finds that test engineers use a variety of tools for testing and verification (Figure 1). But are they using the right ones? Read on to find out which software tools can help shorten compliance test and verification time.

Approximately how many different software tools do you use for testing and verification?

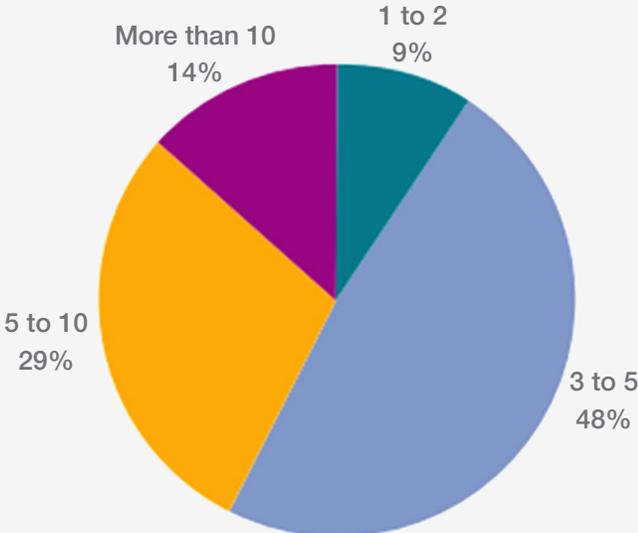


Figure 1. A question asked of design and test engineers in a survey, **Realize the Future of Testing and Validation Workflows Today.**

## Use the Cloud for Faster Data Processing

In traditional test setups, engineers perform signal acquisition and signal analysis on the same physical hardware. The acquisition and analysis processes work sequentially because of limited computing resources. Sequential processing limits hardware utilization and throughput because, before the next signal acquisition can take place, the first signal analysis must finish. Depending on the complexity of the analysis task and processor speed, the computation might take much longer than the acquisition time. Complex computations slow down overall throughput, and the acquisition hardware stays idle during the analysis.

Offloading the analysis to the cloud speeds up both the analysis (data processing) and the overall test time in a technique called measurement disaggregation. Measurement disaggregation keeps the signal acquisition on the instrument but sends the signal analysis into the cloud (Figure 2). With a test sequencer, engineers run multiple tests in parallel rather than in series, significantly speeding up overall test time. For example, an oscilloscope can continuously capture waveforms while cloud servers analyze and post-process the waveforms. With the cloud, you can also spread out post-processing into one or multiple servers.

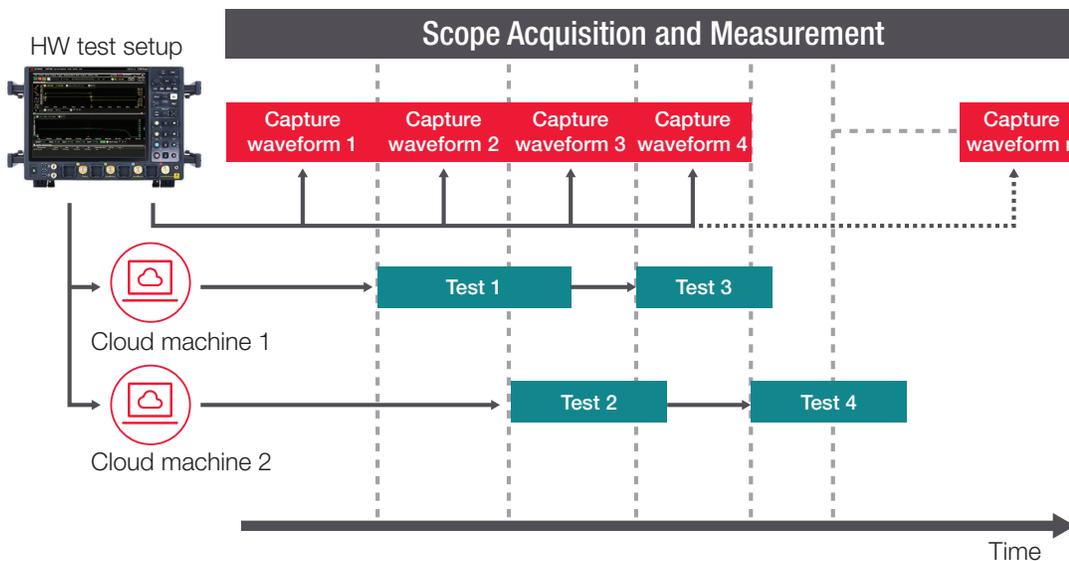


Figure 2. Measurement disaggregation separates the signal acquisition and the signal analysis, significantly speeding up overall test time.

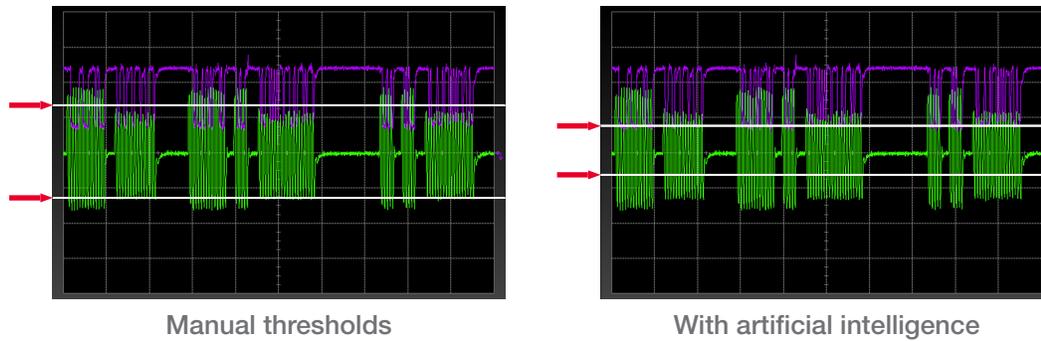
Take a closer look at how to speed up a PCIe® 5.0 16G base transmitter test with measurement disaggregation in the cloud. PCIe 5.0 designs are far more complex than the previous standard. Engineers need to run tests at the physical, data link, and transaction layers. By using PCIe electrical performance validation and compliance software with measurement disaggregation in the cloud, engineers can automatically execute PCIe transmitter tests and display the results in a flexible report format. Without cloud software, a set of 24 tests for five devices-under-test (DUTs) would take about 42 minutes. With measurement disaggregation in the cloud, that same set of tests takes about 11 minutes. The PCIe 5.0 transmitter test uses one cloud PC. Adding multiple PCs for post-processing in the cloud can further shorten the test time.

## Use Artificial Intelligence to Optimize Algorithms

Artificial intelligence with machine learning involves training computers to perform tasks based on examples rather than relying on human programming. A common technique called deep learning passes data through webs of mathematical matrices known as artificial neural networks. As a network processes training data, connections between the parts of the network adjust, building up an ability to interpret future data. Deep learning is the technology behind driverless cars and voice-controlled devices. Software that uses deep learning algorithms can classify, store, and analyze information much faster than humans alone can.

Consider an example in which artificial intelligence software accelerates double data rate (DDR) device tests. The JEDEC specifications for DDR include a long list of measurements to ensure compliance. Measurements include electrical, timing, and eye diagram tests. As you construct your test setup, you need to define critical parameters such as voltage threshold values, the number of waveforms used for analysis, and violation settings. As waveforms can take various shapes, engineers need to manually adjust the threshold values to properly identify bursts in the signal data.

Artificial intelligence software more accurately and quickly finds the threshold values (Figure 3). The software uses a clustering algorithm and neural network modeling to quickly find threshold values for the waveforms. The software accelerates the entire setup for the DDR4 test because it no longer takes any time to manually set the thresholds, as the software does it automatically.



**Figure 3. Artificial intelligence software accelerates defining of waveform burst thresholds required to set up DDR4 tests.**

## Use Analytics for Streamlined Troubleshooting

Data analytics can play a valuable role in the test and measurement world by accelerating design simulation, analysis, validation, compliance testing, and manufacturing. Effective data analytics tools ultimately save engineering teams money and enable them to get to market faster. The following is an example of how data analytics helps accelerate compliance test troubleshooting (Figure 4).

Life is great if your design passes all compliance tests on the first try, but each new standard requires more complex tests with varying challenges. Sometimes a device fails a compliance test because of signal integrity or functional issues with the design. When the design does not behave as expected, designers need to quickly understand the data to find the root cause of any issues. Root cause analysis means taking problem reports and performing fault isolation, debug, and analysis. It is frequently a slow, manual process with multiple data sources and disparate software applications. But with data analytics software, identifying the root cause is quicker because easy-to-interpret graphs and charts display the data. Getting consensus on the best way to approach the issue is faster because teams can more easily share and view the data.

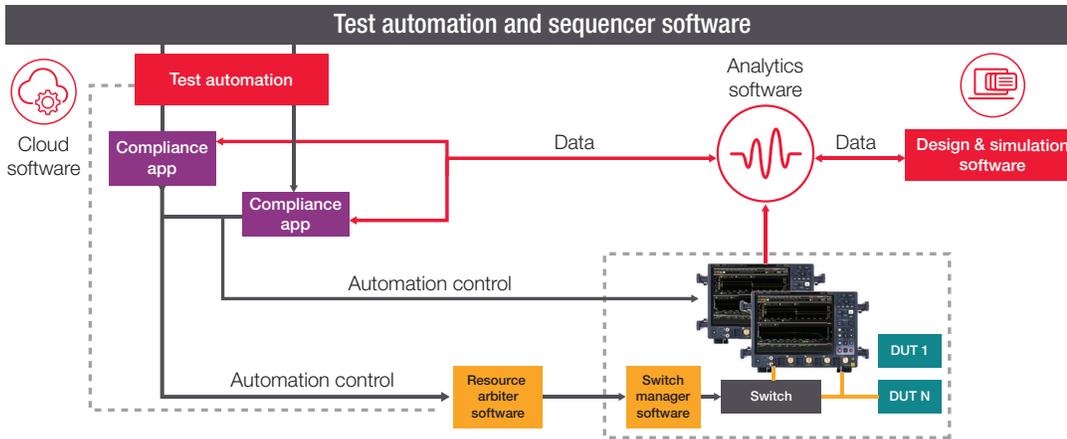


**Figure 4. Data analytics software with visualization and report tools allows for faster troubleshooting if devices fail compliance tests.**

Common data visualizations include histograms, waveform plots, and Pareto plots. Data overlays enable benchmarking against user-defined baselines. The best analytics capabilities are those that allow the user to review test properties that are the possible cause of compliance test failure. Analytics tools can also display a margin analysis report that shows how closely your device passed or failed each test. You can use this data to optimize your design and more quickly pass future compliance tests.

## **Invest in an Integrated Hardware and Software Solution**

Part of the difficulty in performing electrical compliance tests is connecting all the required instruments without introducing errors or noise into the system. Typical issues include connectivity to the DUT, such as repeatability using defined fixtures and qualified cabling and harnesses. Tracking of setup procedures and software releases for specific tests can also be an issue. Investing in an integrated hardware and software solution upfront saves setup time later on. Once the engineer properly connects the instrument to the DUT, the software automation tools can automatically capture the data and run the appropriate tests. An integrated solution enables reliable, repeatable results and analysis (Figure 5).



**Figure 5. An integrated hardware and software solution ensures consistent measurements, saving setup and troubleshooting time later on.**

For example, to pass signal quality testing at a PCI-SIG®-sponsored compliance workshop, your product must successfully pass “Gold Suite” testing based on the PCI-SIG SigTest application. The SigTest application tests your device against the minimum signal quality performance requirements for PCIe. But if you also develop receivers and transmitters for boards and system motherboards, you need a complete hardware and software solution to execute the SigTest and additional oscilloscope tests. While SigTest analysis provides a good overview of PCIe electrical signal quality, it addresses only a small subset of the specified electrical compliance measurements.

An integrated hardware and software solution for PCIe allows you to perform SigTests and much more. It allows you to explore measurement values, decipher eye mask violations, and understand excessive jitter. You can also execute complex two-port motherboard tests and single-port add-in card tests. Using a software solution for PCIe testing ensures that your results are consistent with SigTests without customized setup from you. You can also test other test fixtures and low-power, half-swing devices. An integrated solution allows you to use the same oscilloscope you use for everyday debugging to perform automated testing and margin analysis based on the PCI-SIG-specified tests.

## More Information

For more information on how Keysight provides hardware and software to shorten compliance test time, check out the following:

[Cloud software for faster data processing of PCIe transmitter tests](#)

[Artificial intelligence software for optimizing the setup of DDR4 compliance tests](#)

[Analytics software for streamlining troubleshooting of compliance test failures](#)

[Free 30-day trials of compliance test software](#)

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