

## Testing Solid-state Drives with the OakGate OCP Datacenter NVMe SSD Compliance Suite

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### Synopsis

The OCP Datacenter NVMe SSD specification was developed by industry leaders to address large hyper-scaling applications.

Teledyne LeCroy was the first to introduce a compliance suite. The OakGate OCP Compliance Suite can be licensed with OakGate SSD Test Solutions, used by the world's most prominent solid-state storage suppliers.

The new OCP 2.0 Compliance Suite includes over 130 specific tests covering PCIe, NVMe, Security, Power, Endurance, Thermal, SMBus, Reliability, Form Factor and Labeling. The test suite is supported on both the PCIe 4.0 and PCIe 5.0 OakGate SSD Test Platforms.

OCP Datacenter NVMe SSD Test Services are also offered through Teledyne LeCroy's Austin Labs, the premier third-party test and validation center for storage devices, to help customers deliver fully tested products to market on time and within budget.

### Introduction

Hyperscale data centers host servers and storage networks supporting largescale cloud, server, and storage needs. They serve a critical role in business and industry as they remain vigilant in cloud stability, security, up-time, and performance.

Hyperscale data centers maintain and manage large, enterprise-level, SSD systems and have specific needs managing SSDs at scale. Ensuring SSD compliance and functionality is key to optimize efficiency and reduce the risk of the interruption of data flow.

The newly-ratified Open Compute Platform (OCP) Datacenter NVMe SSD Specification was developed by key OCP members to address large hyper-scaling applications and align the industry as a whole. Testing for compliance using the v1.0a and 2.0 Datacenter NVMe SSD Compliance Suite software is key to achieving these goals. This collaboration leads to improvements in workload throughput and reduced latency.



Datacenter NVMe® SSD Specification

### Challenges with Flash Storage and Data Center Workloads

There are currently a number of challenges using Flash Storage with data center application workloads including device stability, ability to handle mixed format data effectively, overprovisioning, and power inefficiencies.

In general, the SSD requirements of the hyperscale providers are not significantly different, but since there has not been much alignment between them, it has forced the SSD developers to provide separate firmware development and qualification branches which led to overall industry inefficiencies.

Additionally, Hyperscale providers have features that are needed to manage SSD's at scale. But they have not been sharing these features with the rest of the industry. Creating an industry-wide specification standardizes many key features important to customers, enabling SSD manufacturers to focus on innovation that drives performance improvements and creates greater value for cloud service providers.

## Benefits of OCP Testing

The OCP Datacenter NVMe SSD Specification was created to address Hyperscale providers specific needs. The OCP requires that Solid State Storage Drives (SSDs) adhere to the OCP's NVMe Cloud SSD Specification v1.0 or the newer Datacenter NVMe SSD specification v2.0. The goal is to ensure system makers and SSD providers collaborate with Hyperscaler's and the industry to create higher quality SSDs that they can trust and rely upon in the Datacenter.

### Key Benefits

- Industry alignment through common requirements and reducing unnecessary costs for drive suppliers and the industry
- Opportunity for device manufacturers and software providers to create new supporting infrastructure, validation test suites, performance software, failure prediction methods, and tools to manage and debug at scale
- Enable early adoption and accelerate time to market for Datacenter deployments

## Testing Solid-state Drives with OakGate OCP Datacenter NVMe SSD Compliance Test Suite

The Teledyne LeCroy OCP Datacenter NVMe SSD Compliance Test Suite meets the unique needs and feature set of Hyperscale Data Centers compliance testing and provides an unprecedented level of functionality, performance, and ease of use for testing enterprise storage devices.

The OakGate OCP Compliance Suite is a standalone application with a custom installer and is currently supported on MS Windows environments. The application is supported on OakGate SSD Test Appliances running SVF/Enduro. The OCP 2.0 suite category coverage includes over 130 tests for PCIe, NVMe, Security, Power, Endurance, Thermal, SMBus, Reliability, Form Factor, TCG, and Labeling.

The OCP Compliance Application has been separated into functional window areas and individual feature buttons that make manual test execution straight forward and easy.

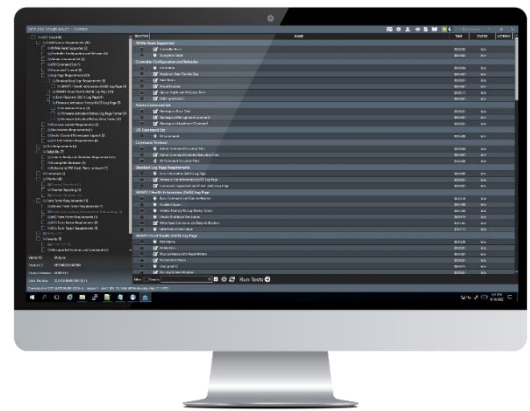


Figure 1: OCP Datacenter NVMe SSD Compliance Test Suite

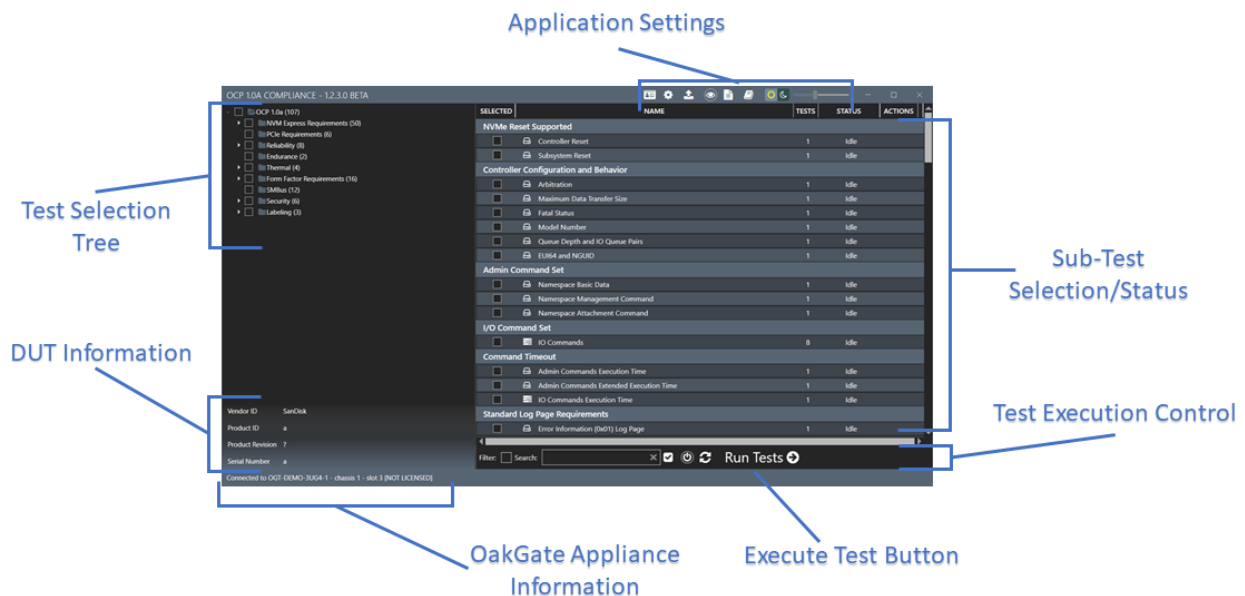


Figure 2: OCP Datacenter NVMe SSD Compliance Test Suite Sections

Future improvements with this software will include providing automated test framework, so that unattended test execution will be possible. The purpose description of the windows sections and button icons are listed above in Figure 2.

The OakGate OCP compliance tests are categorized for ease of use. See Figure 3 for the various test categories for both the OCP 1.0a and 2.0 specifications. The OCP 1.0a test list shown in Figure 4 highlights the individual tests under each category. Tests can be run by selecting the category or the individual tests.

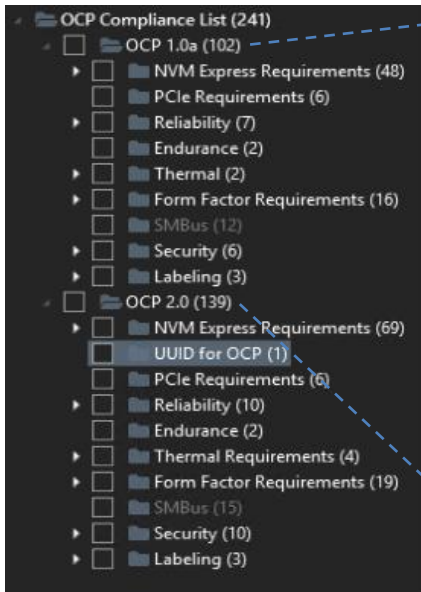


Figure 3: OCP Compliance Test Categories

The compliance tests can be easily selected and executed by selecting Run Tests. The tests will run and results will be displayed in the test results log – see Figure 5.



Figure 4: OCP 1.0a Individual Compliance Tests

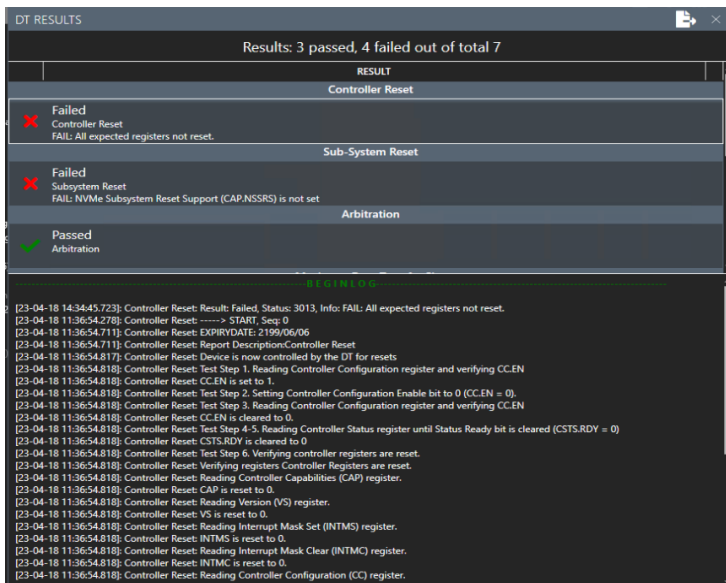


Figure 5: OCP Compliance Test Results Log

Users can also select the port or the port with power controller, and view the port log information.

Additionally, users can view the

- OakGate Appliance Information
- DUT Information
- OCP license
- Test Configuration

## OakGate OCP Datacenter NVMe SSD Compliance Test Suite – Software Features

Software Features			
NVMe Tests	PCIe® Requirements	Endurance Tests	SMBus
• NVMe Resets	• PCIe Maximum Payload Size Requirements	• Endurance Data	• Data Verification
• NVMe Controller Configuration & Behavior	• PCIe TLP completion timeout Requirements	• End of Life	• FW Update Verification
• NVMe Admin Command Set	• PCIe Resets Requirements	<b>Thermal Requirements</b>	• Secure Boot Failure
• Sanitize Command	• Boot Requirements	• Thermal Throttling	• Data TTR Verification
• I/O Command Set	• PCIe Error Logging	• Thermal Reporting	• Invalid Transaction
• Command Timeout	• Low Power Modes	• Thermal Shutdown	<b>Security</b>
• Log Page Requirements	<b>Reliability</b>	<b>Form Factor Requirements</b>	• Unsupported Features and Commands
• Firmware Update Requirements	• Time to Ready and Shutdown	• Generic Form Factor Requirements	<b>Secure Boot</b>
• Deallocation Requirements	• Incomplete Shutdown	• Power Management	• Unsecure Drive Verification
• Sector Size and Namespace Support	• Behavior on FW Crash Panic or Assert	• M.2 Form Factor Requirements	• Rollback Prevention
• Set/Get Features Requirements	<b>Power Loss Protection</b>	• E1.S Form Factor Requirements	• Secure Drive Verification
<b>UUID for OCP</b>	• Data Integrity	• E1.L Form Factor Requirements	<b>TCG</b>
	• IO Latency and Performance	• U.2-U.3 Form Factor Requirements	• Basic Security TCG
	• Drive Behavior in case of PLP Failure		<b>Labeling</b>
			• Label Requirements

### Summary

Teledyne LeCroy provides the Industry's most comprehensive OCP Datacenter NVMe SSD compliance tools and support. The OCP feature requirements were developed with input from a number of our current customers and OCP members and are compliant with the OCP 1.0a and 2.0 Datacenter NVMe SSD Specifications.

Teledyne LeCroy's OCP Compliance Suite can be licensed with OakGate SSD Test Solutions and includes the following features.

- 100+ Tests for OCP 1.0a
- 130+ Tests for OCP 2.0
- Standalone Application
- Custom Installer
- **Test category coverage:** PCIe, NVMe, Security, Power, Endurance, Thermal, SMBus, Reliability, Form Factor, TCG, and Labeling
- Based on OCP Datacenter NVMe SSD Specifications
- Supported on PCIe Gen4 and Gen5 OakGate SSD Test Systems
- Support for Test Case Adaptation Parameter Requirements
- Term or perpetual license options available

Additionally, our **customized, proprietary driver talks directly to the SSD hardware** providing highest level of performance and low latency, providing a consistent and repeatable test performance.

For more information and/or demonstration of SVF/Enduro and other OakGate products, visit <https://www.teledynelecroy.com/oakgate> or contact us by email at [sales@oakgatetech.com](mailto:sales@oakgatetech.com).