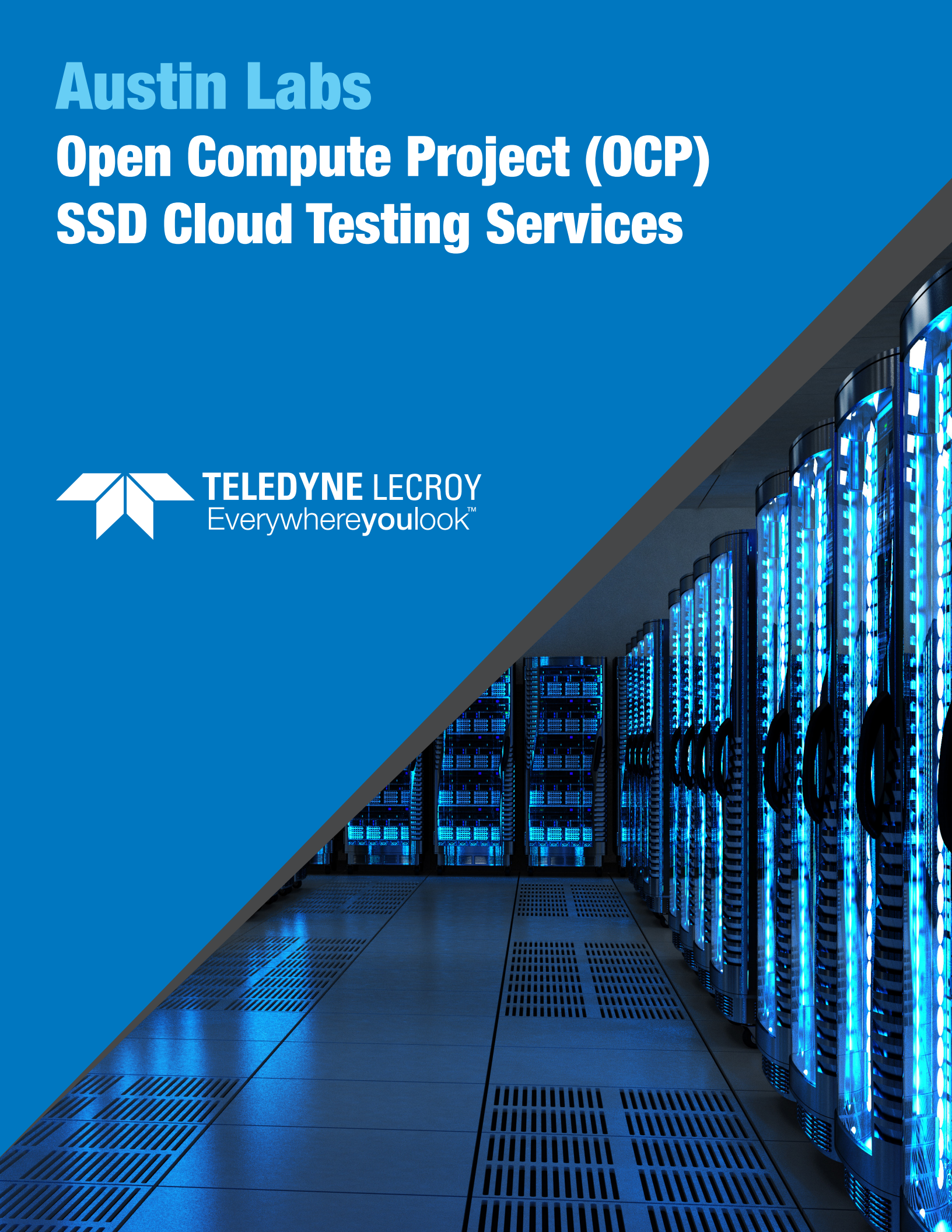
Austin Labs

Open Compute Project (OCP) SSD Cloud Testing Services

TELEDYNE LECROY
Everywhereyoulook™



Testing Services for OCP Cloud SSD

The Austin Labs Advantage

- Qualified testing staff with extensive industry experience
- Intense focus on working with our customers to provide the best services
- Unmatched combination of testing, training, and test tools
- Completely confidential testing results
- Word class testing facility equipped with test equipment
- Complete analysis and debug of all issues discovered including protocol traces
- Certification testing and validation across both hardware and software
- Ability to provide reports for marketing and engineering purposes

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Open Compute Platform (OCP) Cloud SSD Specification

The newly-ratified Open Compute Platform (OCP) Cloud SSD specification was developed by Facebook and Microsoft to address large hyper-scaling applications and align the industry as a whole. These alignments should lead to improved throughput and latency.

The tests below are defined in the NVMe Cloud SSD Specification as defined by the Open Compute Platform organization.

OCP Cloud Compliance Overview

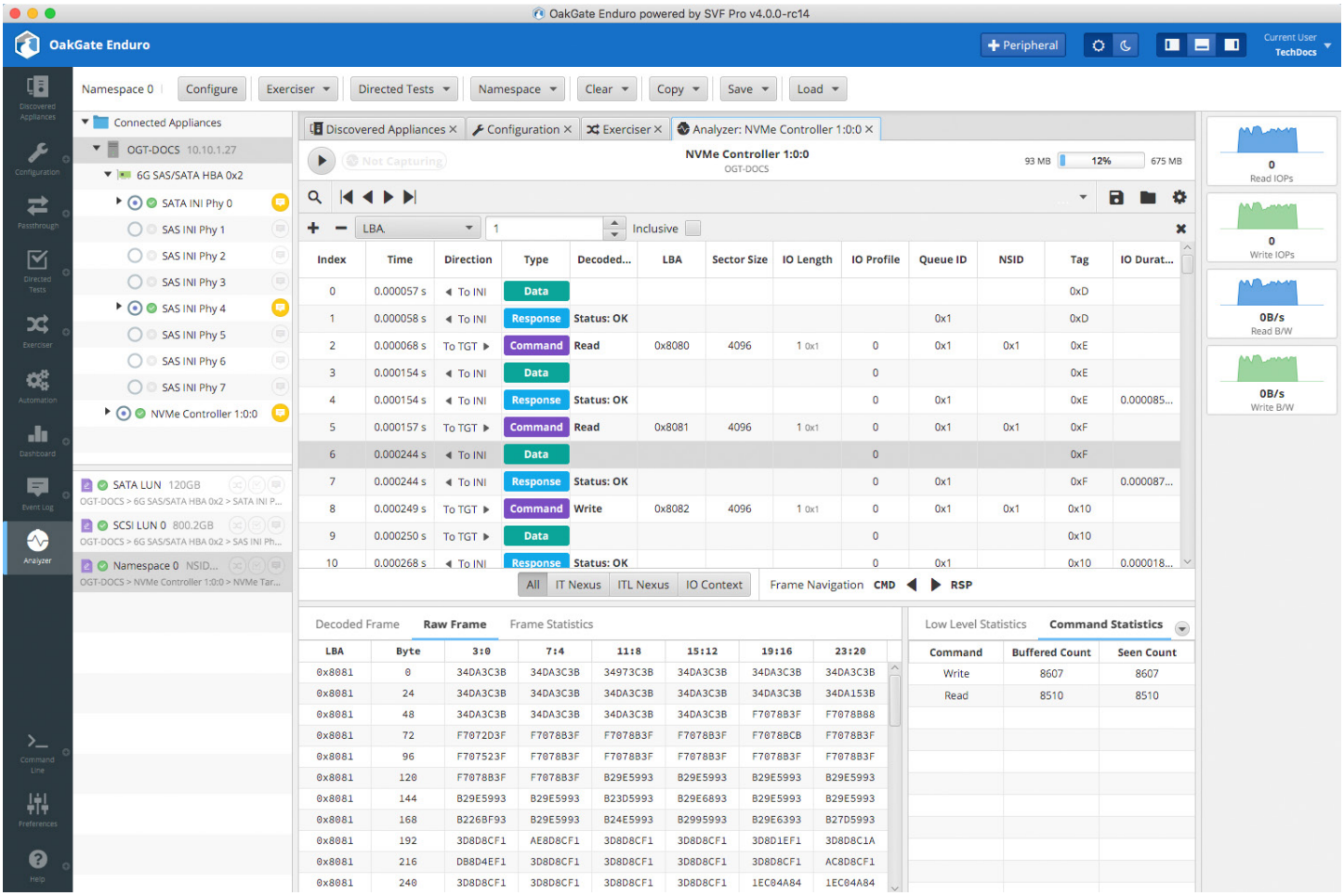
Sec. 1: NVM Express Requirements	
1.1:	NVMe Reset Supported
1.2:	NVMe Controller Configuration and Behavior
1.3:	NVMe Admin Command Set
1.4:	NVMe I/O Command Set
1.5:	Optional NVMe Feature Support
1.6:	Command Timeout
1.7:	Log Page Requirements
1.8:	De-allocation Requirements
1.9:	Sector Size and Namespace Support
1.10:	Set/Get Features Requirements
Sec. 2: PCIe Requirements	
2.1:	Boot Requirements
2.2:	PCIe Error Logging
2.3:	Low Power Modes
2.4:	PCIe Eye Capture
Sec. 3: Reliability	
3.1:	Uber
3.2:	Power On/Off Requirements
3.3:	End to End Data Protection
3.4:	Behavior on Firmware Crash, Panic or Assert
3.5:	Annual Failure Rate (AFR)
3.6:	Background Data Refresh
3.7:	Wear-leveling
Sec. 4: Endurance	
4.1:	Endurance Data
4.2:	Retention Conditions
4.3:	Shelf Life
4.4:	End-of-Life (EOL)

Sec. 5: Thermal	
5.1:	Data Center Altitude
5.2:	Thermal Throttling
5.3:	Temperature Reporting
5.4:	Thermal Shutdown
Sec. 6: Form Factor Requirements	
6.1:	Generic Form Factor Requirements
6.2:	Power Consumption Measurement Methodology
6.3:	Power Levels
6.4:	M.2 Form Factor Requirements
6.5:	E1.S Form Factor Requirements
6.6:	E1.L Form Factor Requirements
Sec. 7: SMBus Support	
7.1:	SMBus Requirements
7.2:	SMBus Data Format
Sec. 8: Security	
8.1:	Basic Security Requirements
8.2:	Secure Boot
8.3:	Data Encryption and Eradication
Sec. 9: Configuration Specifics	
9.1:	Facebook
9.2:	Microsoft
Sec. 10: Performance Requirements	
10.1:	Facebook
10.2:	Microsoft

About Austin Labs

Teledyne LeCroy's Austin Labs is the premier third-party test and validation center for servers, storage, and network devices. With decades of testing experience, the lab provides customized services to help our customers deliver fully tested products to market on time and within budget. Experience the best test equipment available including Oscilloscopes, Protocol Analyzers, Jammers, Exercisers, BERT's, and protocol compliance test suites.

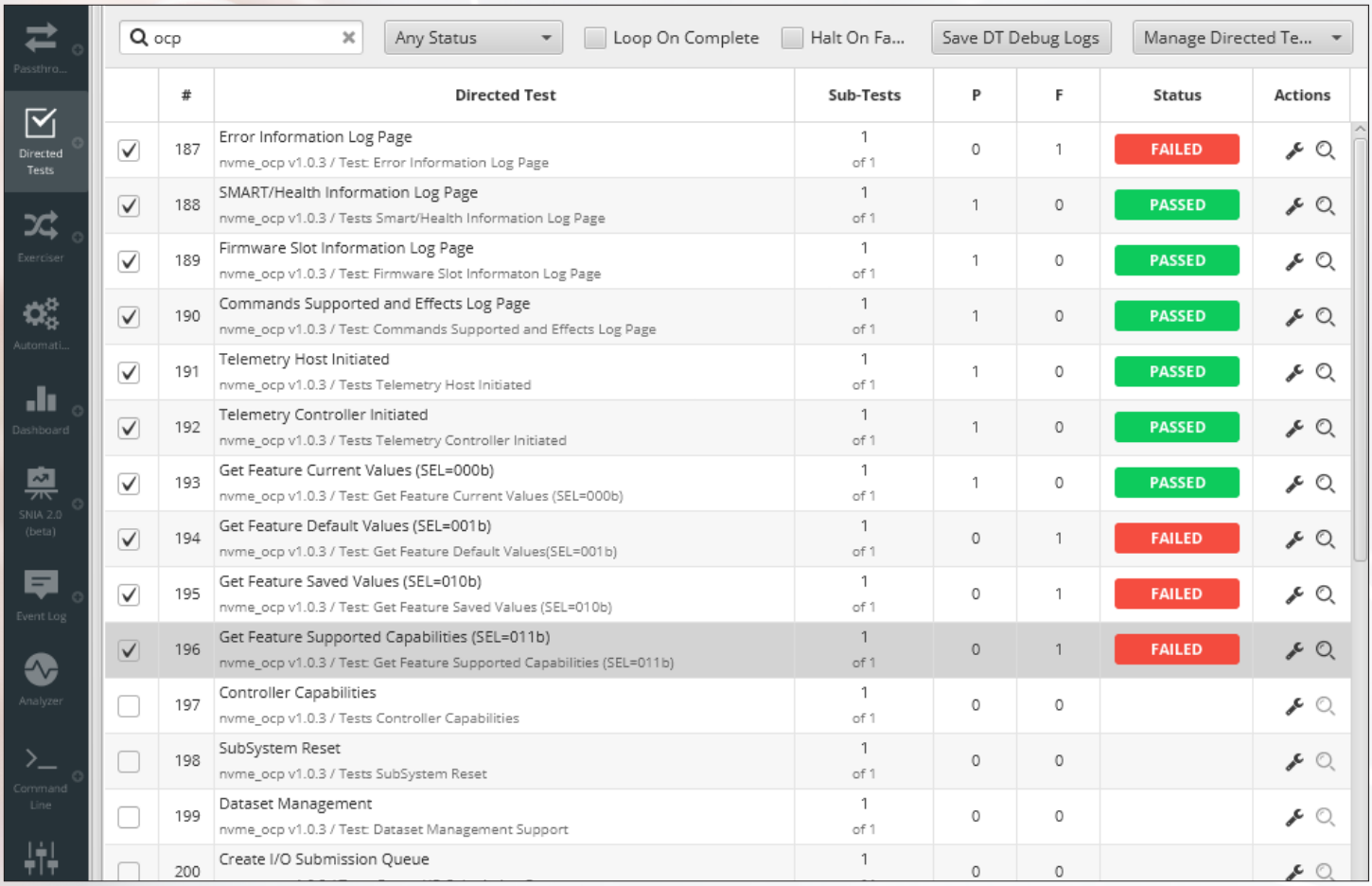
Teledyne LeCroy's Austin Labs provides NVMe Drive Qualification testing with specific support for the NVMe Cloud SSD Specification. Additional testing for NVMe includes, but not limited to Data Integrity, Performance Analysis, Interoperability, Error Injection/Recover, Pre-compliance, NVMe-MI, ZNS, Log Page Validation, Feature Validation, Spec Gap testing, Command Validation, Power States, Thermals, Open Compute and Spec Compliance. The testing included in this proposal is to outline the test cases that will be attempted as part of the Cloud SSD testing plan. Austin Labs provides full debug and analysis to help you root cause your issues.



Storage Validation tools allow Austin Labs to generate high-performance, randomized traffic profiles with ease and test scenarios that would be extremely difficult to create manually or with any other test tool.

Tools and Methodology

This project includes running the tests and providing the results of the tests noted above along with required testing equipment. Once a purchase order is received, Austin Labs will establish a date when test equipment can be made available to start the project.



	#	Directed Test	Sub-Tests	P	F	Status	Actions
☑	187	Error Information Log Page nvme_ocp v1.0.3 / Test: Error Information Log Page	1 of 1	0	1	FAILED	
☑	188	SMART/Health Information Log Page nvme_ocp v1.0.3 / Tests Smart/Health Information Log Page	1 of 1	1	0	PASSED	
☑	189	Firmware Slot Information Log Page nvme_ocp v1.0.3 / Test: Firmware Slot Informaton Log Page	1 of 1	1	0	PASSED	
☑	190	Commands Supported and Effects Log Page nvme_ocp v1.0.3 / Test: Commands Supported and Effects Log Page	1 of 1	1	0	PASSED	
☑	191	Telemetry Host Initiated nvme_ocp v1.0.3 / Tests Telemetry Host Initiated	1 of 1	1	0	PASSED	
☑	192	Telemetry Controller Initiated nvme_ocp v1.0.3 / Tests Telemetry Controller Initiated	1 of 1	1	0	PASSED	
☑	193	Get Feature Current Values (SEL=000b) nvme_ocp v1.0.3 / Test: Get Feature Current Values (SEL=000b)	1 of 1	1	0	PASSED	
☑	194	Get Feature Default Values (SEL=001b) nvme_ocp v1.0.3 / Test: Get Feature Default Values(SEL=001b)	1 of 1	0	1	FAILED	
☑	195	Get Feature Saved Values (SEL=010b) nvme_ocp v1.0.3 / Test: Get Feature Saved Values (SEL=010b)	1 of 1	0	1	FAILED	
☑	196	Get Feature Supported Capabilities (SEL=011b) nvme_ocp v1.0.3 / Test: Get Feature Supported Capabilities (SEL=011b)	1 of 1	0	1	FAILED	
☐	197	Controller Capabilities nvme_ocp v1.0.3 / Tests Controller Capabilities	1 of 1	0	0		
☐	198	SubSystem Reset nvme_ocp v1.0.3 / Tests SubSystem Reset	1 of 1	0	0		
☐	199	Dataset Management nvme_ocp v1.0.3 / Test: Dataset Management Support	1 of 1	0	0		
☐	200	Create I/O Submission Queue	1	0	0		

Automated Test Results

Example Test Results Logging

The following outlines the timeline and key events from beginning to end of the testing cycle and who participates in each event.

1. Austin Labs - provide dedicated contact/engineer for testing project
2. Austin Labs – provide testing HW required for Gen4 electrical and protocol testing
3. Customer – provide device under test
4. Customer – provide any product training needed
5. Austin Labs – Run Tests and provide results to Customer
6. Austin Labs – provide support for debug and analysis including trace collection and delivery

Why third-party validation?

Our engineers helped develop some of the industry's key technologies and continue to have a vigorous passion for improving products and sharing their knowledge. This experience and enthusiasm translates into the highest quality testing and training services possible. We specialize in:

- ✓ Data Integrity
- ✓ Signal Integrity
- ✓ Stress and Performance Benchmarking
- ✓ Compliance and Interoperability
- ✓ Protocol Analysis and Compliance
- ✓ Error Injection and Recovery
- ✓ Hardware and Software Feature Validation
- ✓ Market and Product Analysis
- ✓ Interoperability
- ✓ Virtualization
- ✓ Automation

Cost Savings
Third-party validation provides a defined solution with known expenses

Resource Constraints
Doing more with less means having to find new ways to test

Hardware Needs
Independent labs provide access to a wide range of equipment

Time
Delivery schedules are always shortened – beat the market with a partner

Perspective
It is beneficial to have someone external to the project test with a new view

Want to become a Protocol Expert?

Austin Labs also offers a full line of advanced protocol training classes. Each of the classes is instructor-led and guides the students through the protocol specifications while using hands on labs with trace analysis to help students discover how the protocol is implemented. Classes are available on-site with a live instruction or through a virtual classroom environment.

Current class offerings include:

- PCIe
- NVMe
- NVMe over RoCE
- NVMe over Fibre Channel
- NVMe over TCP
- Fibre Channel
- iSCI
- SAS
- FCoE

ATTITUDE

- We will find serious flaws and bugs
- We will help you understand how to isolate and fix these problems
- We are your partner

APPROACH

- Our focus is on the entire product from documentation to critical issues
- We specialize in data corruption, data loss, disruptions
- We are protocol experts and have the tools to test protocol compliance
- We are attentive to issues that get overlooked

QUALITY

- We use Teledyne LeCroy test and analysis tools along with industry tools
- We supplement internal testing and provide an external validation
- Our customers always come back for more

Why are we different?

Teledyne LeCroy Austin Labs
800 Paloma Dr., Suite 130
Round Rock, TX 78665

Please visit teledynelecroy.com/events/
for a listing of scheduled learning events.

Additional topics are also available upon request.
Please contact your local Teledyne LeCroy
representative for details.

teledynelecroy.com/services/austinlabs-testing.aspx
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