SPC Benchmark 1™

Full Disclosure Report

Telecommunications Technology Association

Gluesys AnyStor-700EK

SPC-1™ v3.10.0

Submission Identifier: A32028

Submitted For Review: December 19, 2023

First Edition – December 2023

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Benchmark Specification and Glossary

The official SPC Benchmark 1™ (SPC-1™) specification is available on the website of the Storage Performance Council (SPC) at www.spcresults.org.

The SPC-1™ specification contains a glossary of the SPC-1™ terms used in this publication.

Table of Contents

AUDIT CERTIFICATION

InfoSizing
The Right Metric For Sizing IT

Storage
Performance
Council
Certified Auditor

Hyo-Sil Kim
47, Bundang-ro, Bundang-gu, Seongnam-city
Gyeonggi-do, 13591, Republic of Korea

November 21, 2023

I verified the SPC Benchmark 1™ (SPC-1™ v3.10.0) test execution and performance results of the following Tested Storage Product:

Gluesys AnyStor-700EK

The results were:

SPC-1 IOPS™	**800,010**
SPC-1 Price-Performance	**$48.78/SPC-1 KIOPS™**
SPC-1 Total System Price	39,020.00
SPC-1 IOPS Response Time	0.117 ms
SPC-1 Overall Response Time	0.095 ms
SPC-1 ASU Capacity	22,441 GB
SPC-1 ASU Price	$1.74/GB

In my opinion, these performance results were produced in compliance with the SPC requirements for the benchmark.

The testing was executed using the SPC-1 Toolkit Version v3.0.2. The audit process was conducted in accordance with the SPC Policies and met the requirements for the benchmark.

A Letter of Good Faith was issued by Telecommunications Technology Association, stating the accuracy and completeness of the documentation and testing data provided in support of the audit of this result.

A Full Disclosure Report for this result was prepared by InfoSizing, reviewed and approved by Telecommunications Technology Association, and can be found at www.spcresults.org under the Submission Identifier A32028.

Page **1** of **2**

63 Lourdes Dr. | Leominster, MA 01453 | 978-343-6562 | www.sizing.com

The independent audit process conducted by InfoSizing included the verifications of the following items:

- The physical capacity of the data repository (61,440 GB).
- The total capacity of the Application Storage Unit (22,441 GB).
- The accuracy of the Benchmark Configuration diagram.
- The tuning parameters used to configure the Benchmark Configuration.
- The Workload Generator commands used to execute the testing.
- The validity and integrity of the test result files.
- The compliance of the results from each performance test.
- The compliance of the results from each persistence test.
- The compliance of the submitted pricing model.
- The differences between the tested and the priced configuration, if any.

The Full Disclosure Report for this result was prepared in accordance with the disclosure requirements set forth in the specification for the benchmark.

The following anomaly occurred during testing:

> The system clock of on of the host systems was set one month ahead of the other host system. This had no impact on the validity of the test.

Respectfully Yours,

Doug Johnson, Certified SPC Auditor

LETTER OF GOOD FAITH

TTA 한국정보통신기술협회
Telecommunications Technology Association

47, Bundang-ro, Bundang-gu, Seongnam-city,
Gyeonggi-do, 13591, Republic of Korea
TEL: 82-31-724-0114

November 16, 2023

From: Telecommunications Technology Association

To: Mr. Doug Johnson, Certified SPC Auditor
    InfoSizing
    63 Lourdes Drive
    Leominster, MA 01453

Subject: SPC-1 Letter of Good Faith for GLUESYS Anystor-700EK

Telecommunications Technology Association is the SPC-1 Test Sponsor for the above listed project. To the best of our knowledge and belief, the required SPC-1 benchmark results and materials we have submitted for that product are complete, accurate, and in full compliance with V3.10 of the SPC-1 benchmark specification.

In addition, we have reported any items in the Benchmark Configuration and execution of the benchmark that affected the reported results even if the items are not explicitly required to be disclosed by the SPC-1 benchmark specification.

Signed: Date:

C. S. Park.   _November 16, 2023_

Cheol-Soon Park
Vice President,
Telecommunications Technology Association

Gluesys AnyStor-700EK

SPC-1 IOPS™	**800,010**	SPC-1 Price Performance	**$48.78/SPC-1 KIOPS™**
SPC-1 IOPS Response Time	**0.117 ms**	SPC-1 Total System Price	**$39,020.00**
SPC-1 Overall Response Time	0.095 ms	SPC-1 Overall Discount	40.90%
		Currency / Target Country	USD / Republic of Korea
		Availability Date	December 19, 2023

Extensions		*Storage Metrics*	
☆ SPC-1 Data Reduction	NA	SPC-1 Data Protection Level	Protected 1
☆ SPC-1 Encryption	NA	SPC-1 Physical Storage Capacity	61,440 GB
☆ SPC-1 NDU	NA	SPC-1 ASU Capacity	22,441 GB
☆ SPC-1 Synchronous Replication	NA	SPC-1 ASU Price	$1.74/GB
☆ SPC-1 Snapshot	NA		

Priced Storage Configuration Summary

2	Mellanox 100 Gbps IB HCA (dual port)
1	Gluesys AnyStor-700EK
1	Controller
96	GB Total Cache
2	Total Front-End Ports
8	Total Storage Devices (NVMe SSD)
2	Total RUs

RAMPD Average Response Time (ms) vs. IOPS
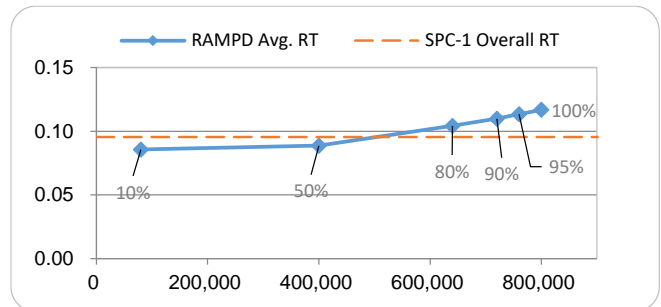
SUSTAIN Response Time (ms)

RAMPD_100 Response Time (ms)

SPC Benchmark 1™ Specification Revision	v3.10.0	Submitted for Review	December 19, 2023
SPC Benchmark 1™ Workload Generator Revision	v3.0.2	Submission Details	www.storageperformance.org/r/A32028
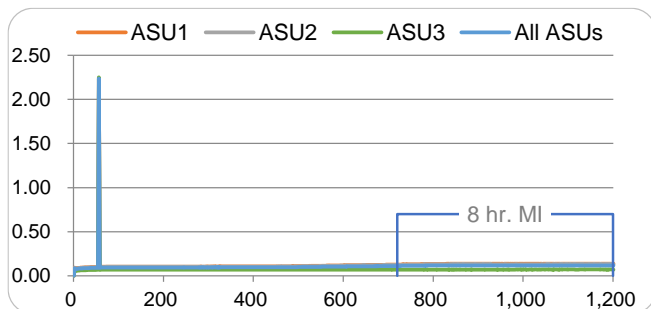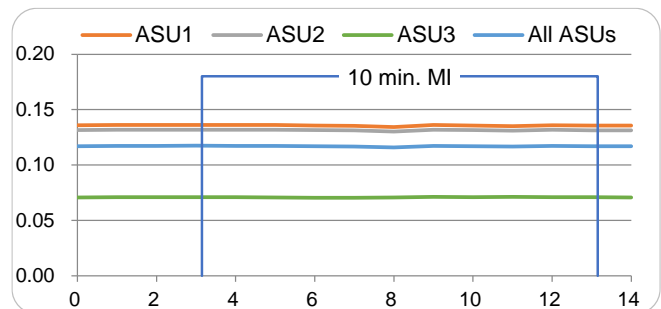
PRICING DETAILS

Part No.	Description	Source	Qty	Unit Price	Ext. Price	Disc.	Disc. Price
Hardware & Software							
AS700EK	Dual Socket P (LGA 3647) 2nd Gen Intel® Xeon® Scalable Processors and Intel® Xeon® Scalable Processors, Dual UPI up to 10.4GT/s, Support CPU TDP 70-205W Intel(R) Xeon(R) Silver 4310 CPU @ 2.10GHz" 96GB Memory(Max. 2TB) NAS O/S(960GB M.2 NVMe Disk) 10/100/1000 Gigabit Ethernet 2Port (UTP) Hot-Swappable 24 NVMe Disk Bay AnyStor Enterprise 전용 O/S - Raid 지원 : 0, 1, 10, 5, 6 Support 지원프로토콜 - NFS, CIFS, FTP, iSCSI/iSER AnyManager - 웹 기반의 NAS 관리도구 - Cluster Management - Volume Managent & Monitoring - Auto / Manual recovery - Parallel & distributed recovery - Data Replication Management - Online Scale-Out Support - POSIX FS API Support - Monitoring Tool on WEB (WMS) - Data Distributed I/O - Data Replication & NetworkRAID	2	1	42,000.00	42,000.00	50%	21,000.00
DATA Disk	DAPUSTOR DPRD3108T0T507T6000 R5100 7.68TB	2	8	1,000.00	8,000.00	0%	8,000.00
I/B Cable	MCP1600-E002 IB EDR Cable	2	4	180.00	720.00	0%	720.00
I/B Card	MCX556A-ECAT ConnectX®-5 VPI adapter card, EDR IB (100Gb/s) and 100GbE, dual-port QSFP28, PCIe3.0 x16, tall bracket, ROHS R6	2	3	1,100.00	3,300.00	0%	3,300.00
				Hardware & Software Subtotal			**33,020.00**
Support & Maintenance							
	Premium Package 3-Year Support & Maintenance	2	1	12,000.00	12,000.00	50%	6,000.00
				Support & Maintenance Subtotal			**6,000.00**
	SPC-1 Total System Price						**39,020.00**
	SPC-1 IOPS™						800,010
	SPC-1 Price-Performance™ ($/SPC-1 KIOPS™)						**48.78**
	SPC-1 ASU Capacity (GB)						22,441
	SPC-1 ASU Price ($/GB)						**1.74**

Discount Details: The discounts shown are based on the storage capacity purchased and are generally available.

Warranty: The 3-year maintenance and support included in the above pricing meets or exceeds a 24x7 coverage with a 4-hour response time.

Differences Between Tested and Priced Storage Configurations

There were no differences between the TSC and the Priced Storage Configuration.

PUBLICATION DETAILS

This section provides contact information for the test sponsor and auditor, a revision history of this document, and a description of any exceptions or waivers associated with this publication.

Contact Information

Role	Name	Details
Test Sponsor Primary Contact	Telecommunications Technology Association Hyo-Sil Kim	www.tta.or.kr hyosil.kim@tta.or.kr
SPC Auditor	InfoSizing Doug Johnson	www.sizing.com doug@sizing.com

Revision Information

Date	FDR Revision	Details
December 19, 2023	First Edition	Initial Publication

Anomalies, Exceptions, Waivers

The system clock on one of the host systems was set one month ahead of the other host system. This had no impact on the validity of the test.

CONFIGURATION INFORMATION

Tested Storage Product Description

Gluesys AnyStor-700EK (AS700EK) is an all-flash storage system that is designed and optimized to deliver outstanding response speed and performance for a wide range of enterprise environments. Due to its flexibility, AS700EK has the storage gateway capability depending on the backbone infrastructure of the business, as well as the storage expansion and data tiering in heterogeneous storage devices. Furthermore, as the AS700EK block storage is derived from its previous scale-out NAS products, it supports NVMeoF protocol for InfiniBand and Ethernet, and also with iSCSI, iSER and file-based protocols.

Host System and Tested Storage Configuration Components

The following table lists the components of the Host System(s) and the TSC.

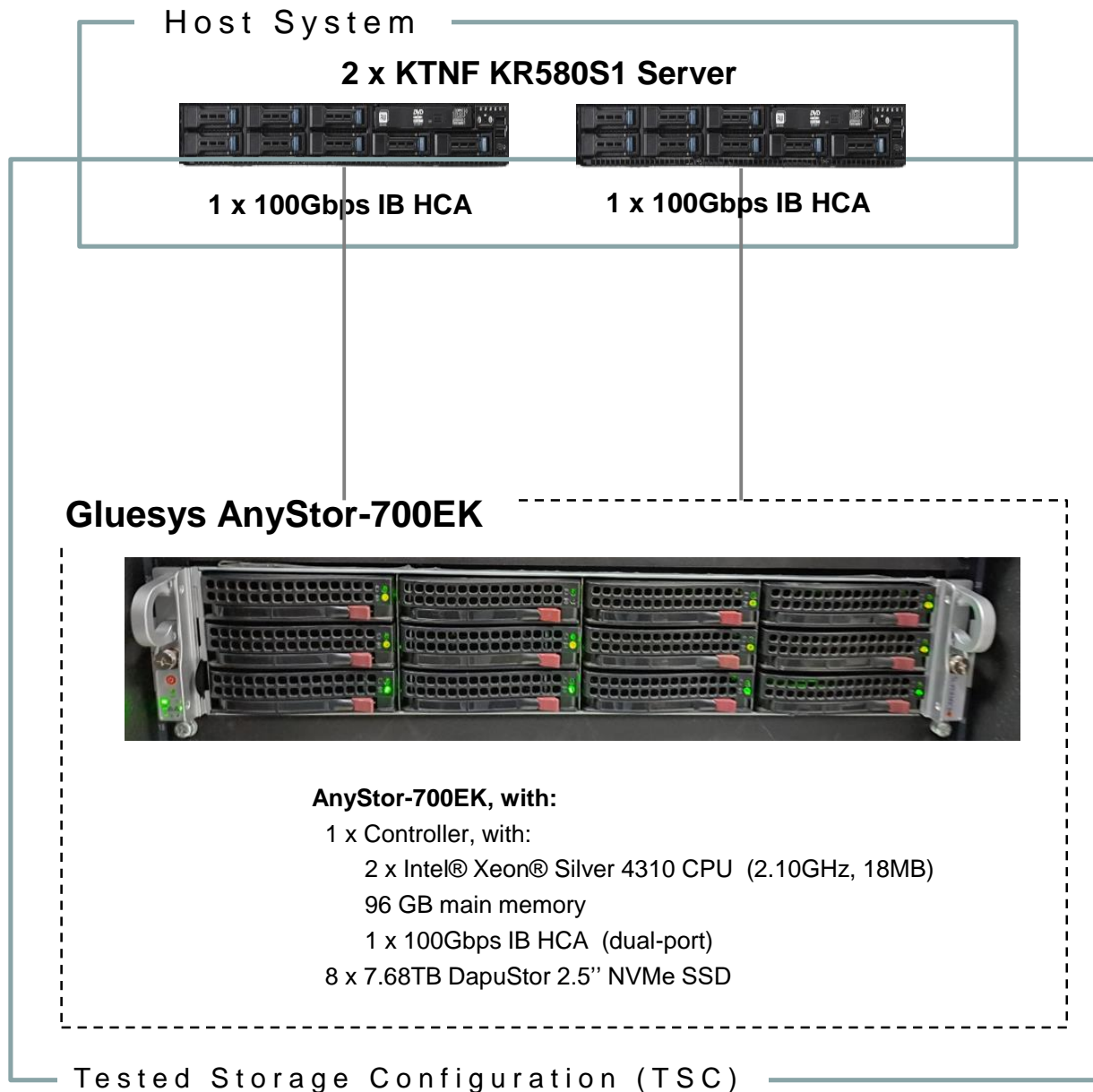| Host Systems |
|---|
| 2 x KTNF KR580S1, each with :
    2 x Intel® Xeon® Gold 6140 CPU @2.30 GHz Processors
    192 GB Main Memory
    CentOS Stream 8 |
| **Tested Storage Configuration** |
| 2 x Mellanox 100 Gbps IB HCA (dual port) |
| **1 x Gluesys AnyStor-700EK with:**
    1 x Storage Controller
        2 x Intel® Xeon® Silver 4310 CPU (2.10 GHz, 18 MB)
        96 GB Total cache
        1 x 100 Gbps IB HCA (dual port)
    8 x 7.68 TB DapuStor 2.5" NVMe SSD |

Component Changes in Revised Full Disclosure Report

The following table outlines component changes that were made in revisions to this Full Disclosure Report.

Original Component	Revised Component	Description of Change
n/a	n/a	Initial submission

Configuration Diagrams

BC/TSC Configuration Diagram

The following diagram illustrates the Benchmark Configuration (BC), including the Tested Storage Configuration (TSC) and the Host System(s).

Host System

2 x KTNF KR580S1 Server

1 x 100Gbps IB HCA   **1 x 100Gbps IB HCA**

Gluesys AnyStor-700EK

AnyStor-700EK, with:

1 x Controller, with:

2 x Intel® Xeon® Silver 4310 CPU (2.10GHz, 18MB)

96 GB main memory

1 x 100Gbps IB HCA (dual-port)

8 x 7.68TB DapuStor 2.5'' NVMe SSD

Tested Storage Configuration (TSC)

Storage Network Configuration

The Tested Storage Configuration (TSC) consisted of a single storage subsystem (Gluesys AnyStor-700EK), driven by two KTNF KR580S1 host systems. Each host system had one InfiniBand (IB) connection to the storage subsystem. The connections operated at 100 Gbps.

Benchmark Configuration Creation Process

Customer Tuning Parameters and Options

All the customer tuning parameters and options that have been altered from their default values for this benchmark are included in Appendix C and in the Supporting Files (see Appendix A).

Tested Storage Configuration Creation

A detailed description of how the logical representation of the TSC was created is included in Appendix D and in the Supporting Files (see Appendix A).

Tested Storage Configuration Inventory

An inventory of the components in the TSC, as seen by the Benchmark Configuration, is included in Appendix E and in the Supporting Files (see Appendix A).

Workload Generator Storage Configuration

The SPC-1 Workload Generator storage configuration commands and parameters used to invoke the execution of the tests are included in Appendix F and in the Supporting Files (see Appendix A).

Logical Volume Capacity and Application Storage Unit Mapping

The following table details the capacity of the Application Storage Units (ASUs) and how they are mapped to logical volumes (LVs). All capacities are reported in GB.

	LV per ASU	LV Capacity	Used per LV	Total per ASU	% ASU Capacity	Optimized*
ASU-1	9	1,122.0	1,122.0	10,098.5	45.0%	No
ASU-2	9	1,122.0	1,122.0	10,098.5	45.0%	No
ASU-3	1	2,244.1	2,244.1	2,244.1	10.0%	No
SPC-1 ASU Capacity				22,441	*See Space Optimization Techniques	

Physical Storage Capacity and Utilization

The following table details the Physical Capacity of the storage devices and the Physical Capacity Utilization (percentage of Total Physical Capacity used) in support of hosting the ASUs. All capacities are reported in GB.

Devices	Count	Physical Capacity	Total Capacity
DapuStor 2.5" NVMe SSD	8	7,680.0	61,440.0
Total Physical Capacity			**61,440**
Physical Capacity Utilization			**36.53%**

Data Protection

The data protection level used for all LVs was **Protected 1 (RAID 1+0)**.

Space Optimization Information

Description of Utilized Techniques

The TSC did not use any space optimization techniques.

Physical Free Space Metrics

The following table lists the Physical Free Space as measured at each of the required points during test execution. If space optimization techniques were not used, "NA" is reported.

Physical Free Space Measurement	Free Space (GB)
After Logical Volume Creation	NA
After ASU Pre-Fill	NA
After Repeatability Test Phase	NA

Space Optimization Metrics

The following table lists the required space optimization metrics. If space optimization techniques were not used, "NA" is reported.

Metric	Value
SPC-1 Space Optimization Ratio	NA
SPC-1 Space Effectiveness Ratio	NA

BENCHMARK EXECUTION RESULTS

This portion of the Full Disclosure Report documents the results of the various SPC-1 Tests, Test Phases, and Test Runs.

Benchmark Execution Overview

Workload Generator Input Parameters

The SPC-1 Workload Generator commands and input parameters for the Test Phases are presented in the Supporting Files (see Appendix A).
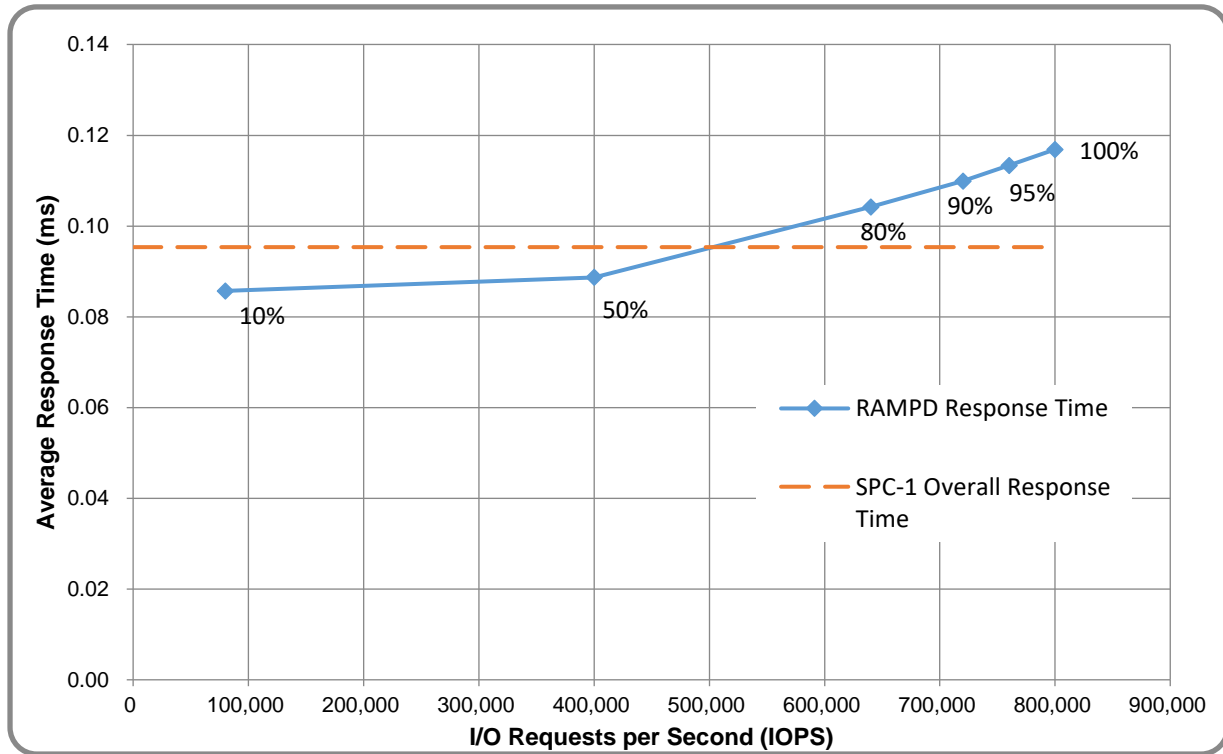
Measurement Intervals by Test Phase Graph

The following graph presents the average IOPS and the average Response Times measured over the MI of each Test Phase.
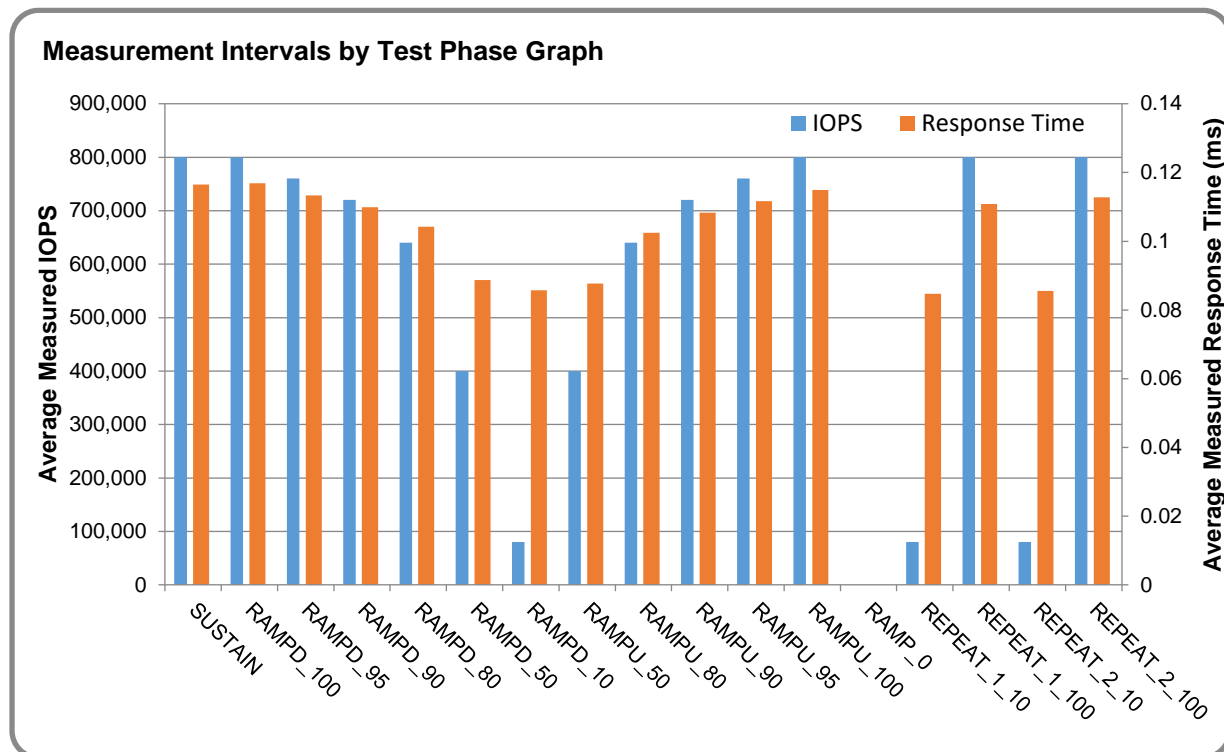
Response Time vs. Throughput Graph

The following graph presents the average Response Times versus the average IOPS for RAMPD_100 to RAMPD_10.

ASU Pre-Fill

The following table provides a summary of the Pre-Fill performed on the ASU prior to testing.

ASU Pre-Fill Summary			
Start Time	08-Nov-23 17:22:00	Requested IOP Level	1,000 MB/sec
End Time	08-Nov-23 23:19:45	Observed IOP Level	1,045 MB/sec
Duration	5:57:45	For additional details see the Supporting Files.	

SUSTAIN Test Phase

SUSTAIN – Results File

The results file generated during the execution of the SUSTAIN Test Phase is included in the Supporting Files (see Appendix A) as follows:

- **SPC1_METRICS_0_Raw_Results.xlsx**

SUSTAIN – Execution Times

| Interval	Start Date & Time	End Date & Time	Duration
Transition Period	08-Nov-23 23:25:10	09-Nov-23 11:25:06	11:59:55
Measurement Interval	09-Nov-23 11:25:06	09-Nov-23 19:25:07	8:00:01

SUSTAIN – Throughput Graph
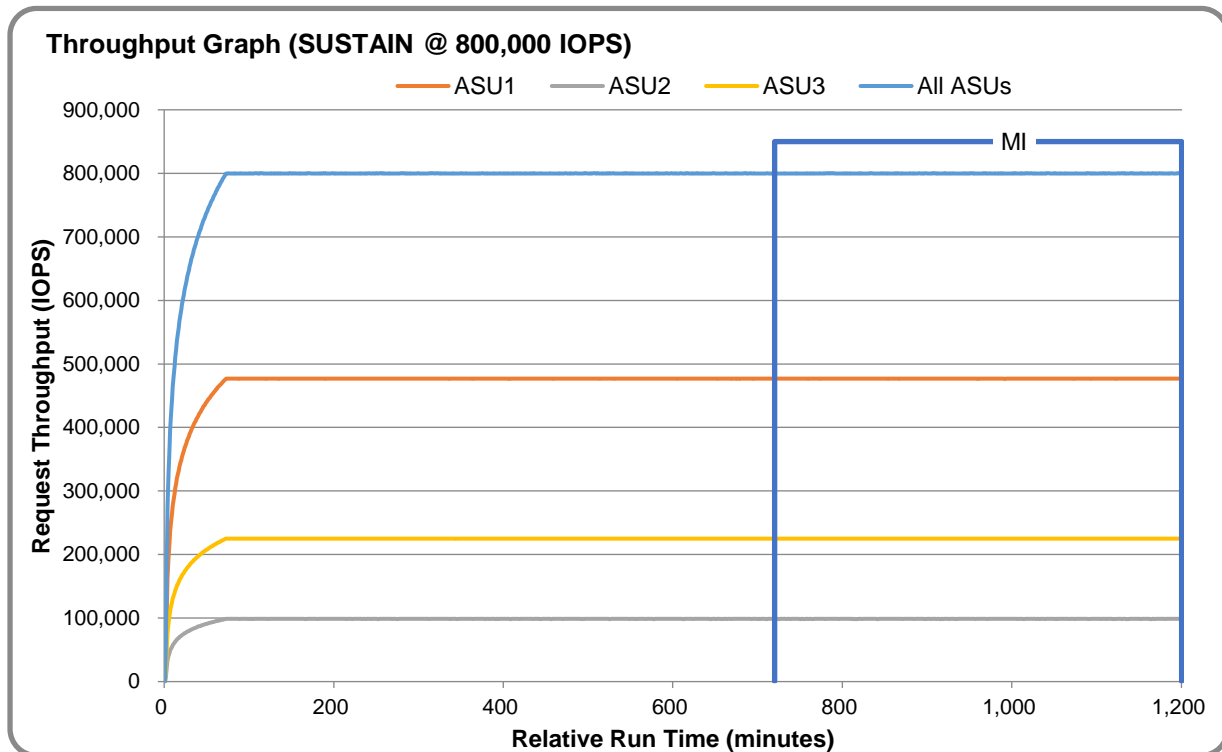
SUSTAIN – Response Time Graph

Response Time Graph (SUSTAIN @ 800,000 IOPS)
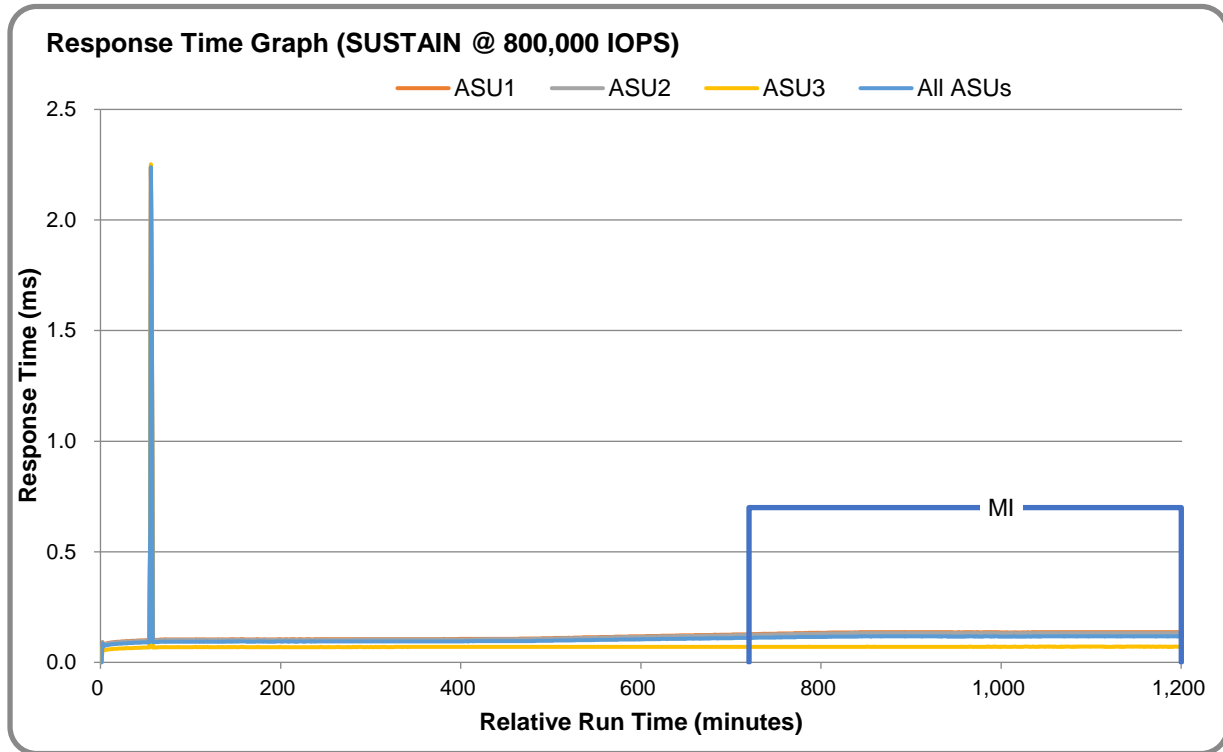
SUSTAIN – Data Rate Graph

Data Rate Graph (SUSTAIN @ 800,000 IOPS)

SUSTAIN – Response Time Frequency Graph
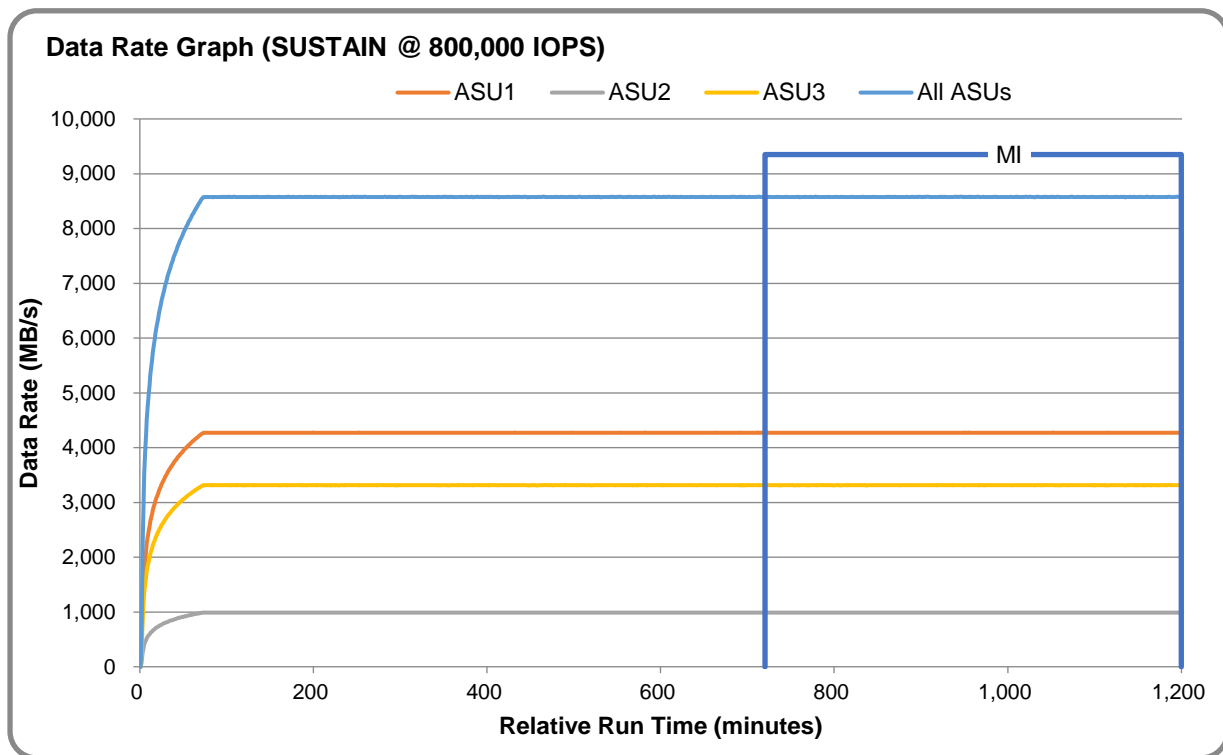
Response Time Frequency Graph (SUSTAIN @ 800,000 IOPS)
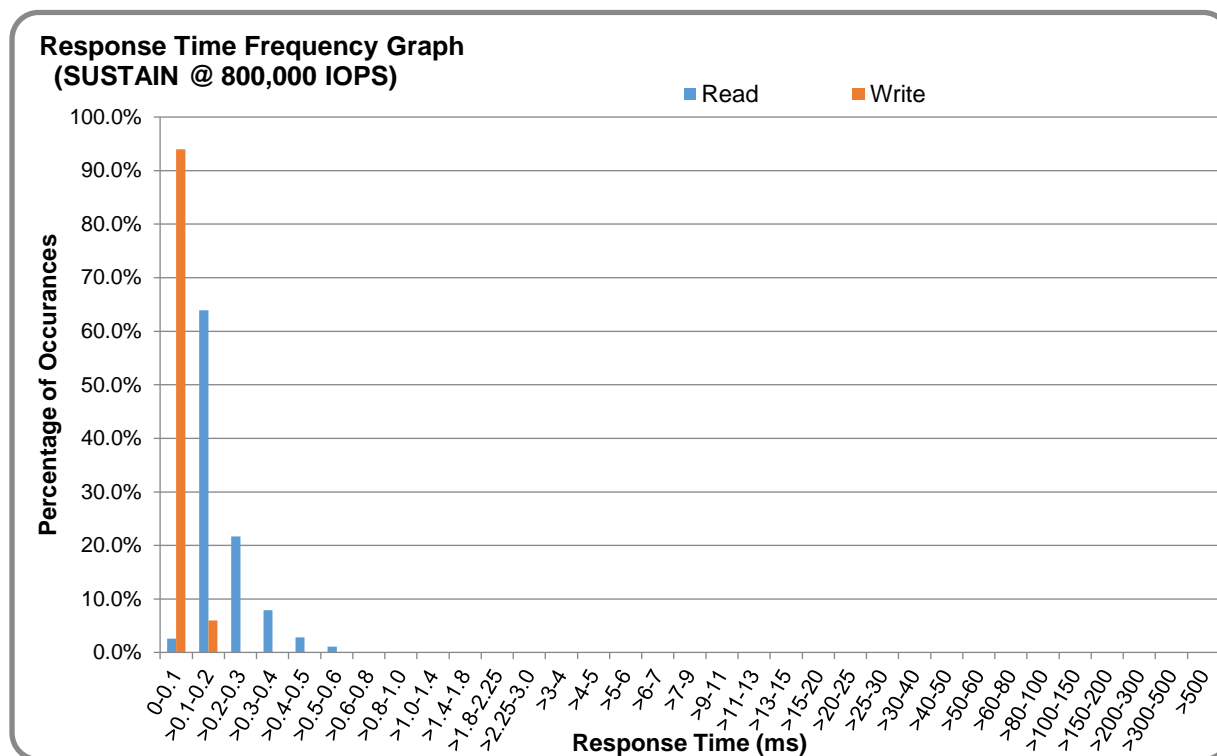
SUSTAIN – Intensity Multiplier

The following table lists the targeted intensity multiplier (Defined), the measured intensity multiplier (Measured) for each I/O stream, its coefficient of variation (Variation), and the percentage of difference (Difference) between Defined and Measured.

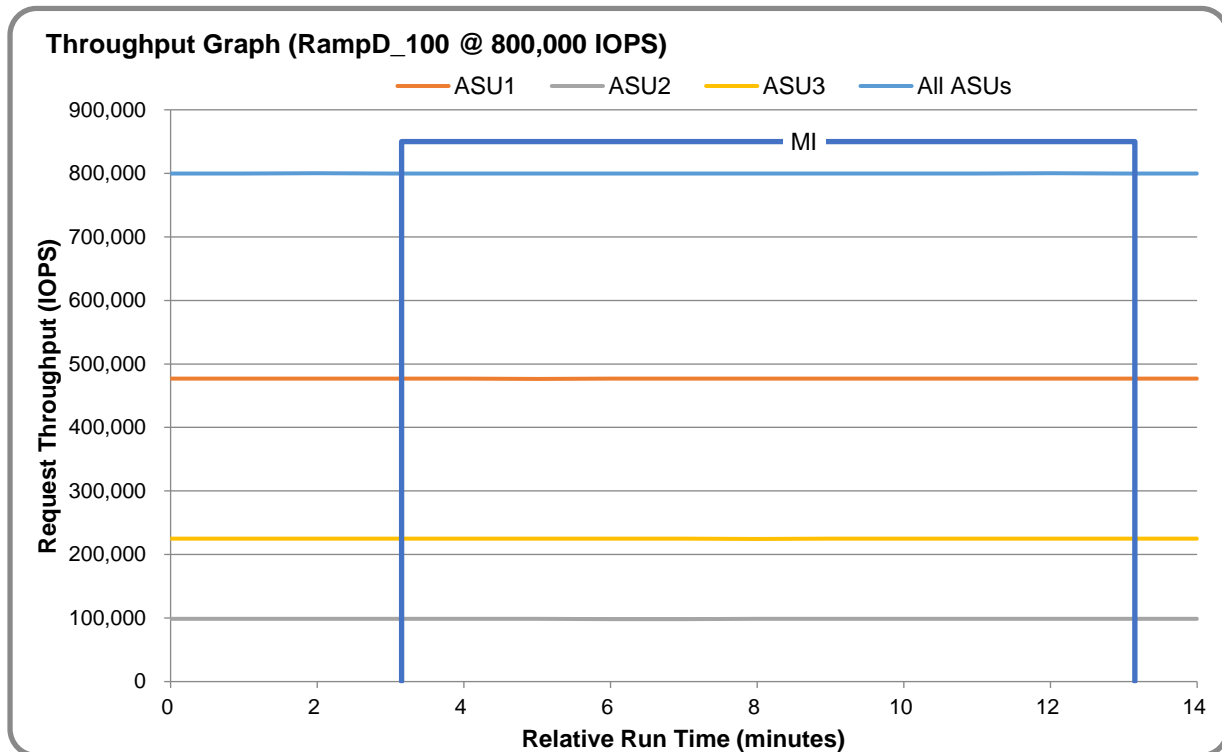|	ASU1-1	ASU1-2	ASU1-3	ASU1-4	ASU2-1	ASU2-2	ASU2-3	ASU3-1
Defined	0.0350	0.2810	0.0700	0.2100	0.0180	0.0700	0.0350	0.2810
Measured	0.0350	0.2810	0.0700	0.2100	0.0180	0.0700	0.0350	0.2810
Variation	0.0008	0.0002	0.0005	0.0003	0.0010	0.0005	0.0008	0.0002
Difference	0.003%	0.001%	0.003%	0.000%	0.004%	0.008%	0.002%	0.002%

RAMPD_100 Test Phase

RAMPD_100 – Results File

The results file generated during the execution of the RAMPD_100 Test Phase is included in the Supporting Files (see Appendix A) as follows:

- **SPC1_METRICS_0_Raw_Results.xlsx**

RAMPD_100 – Execution Times

Interval	Start Date & Time	End Date & Time	Duration
Transition Period	09-Nov-23 19:26:06	09-Nov-23 19:29:06	0:03:00
Measurement Interval	09-Nov-23 19:29:06	09-Nov-23 19:39:07	0:10:01

RAMPD_100 – Throughput Graph

RAMPD_100 – Response Time Graph

Response Time Graph (RampD_100 @ 800,000 IOPS)
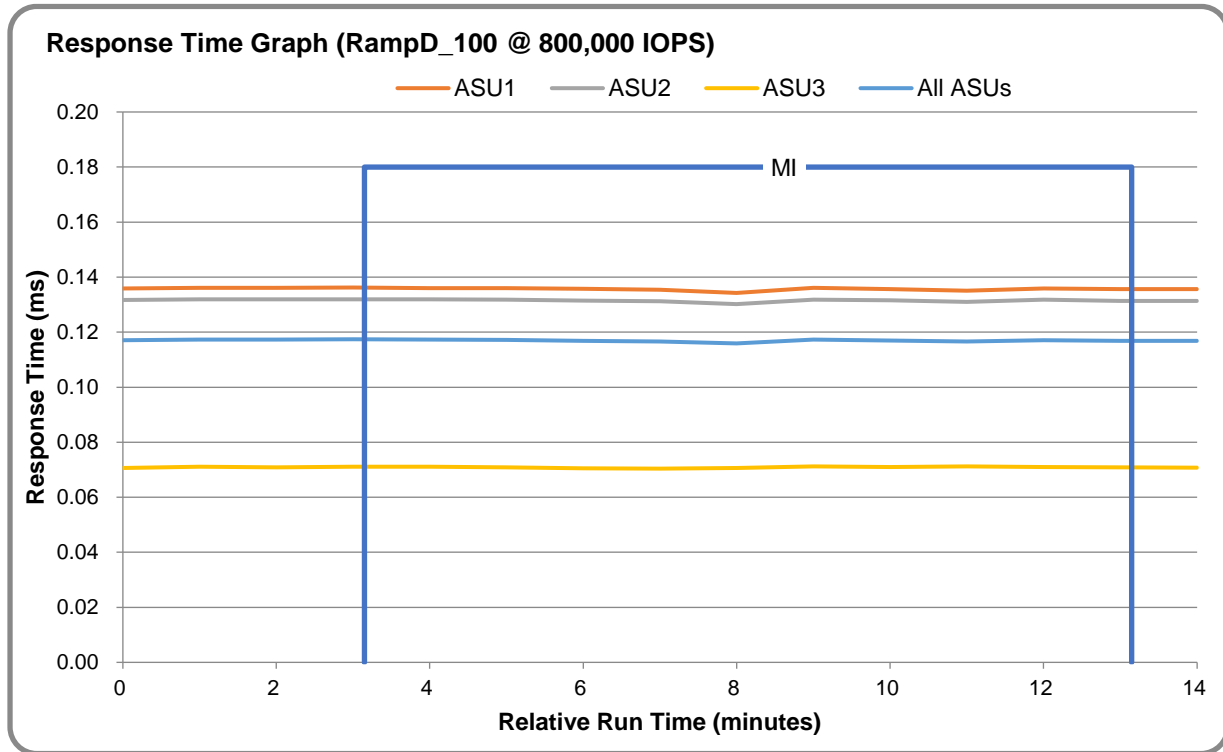
RAMPD_100 – Data Rate Graph

Data Rate Graph (RampD_100 @ 800,000 IOPS)

RAMPD_100 – Response Time Frequency Graph
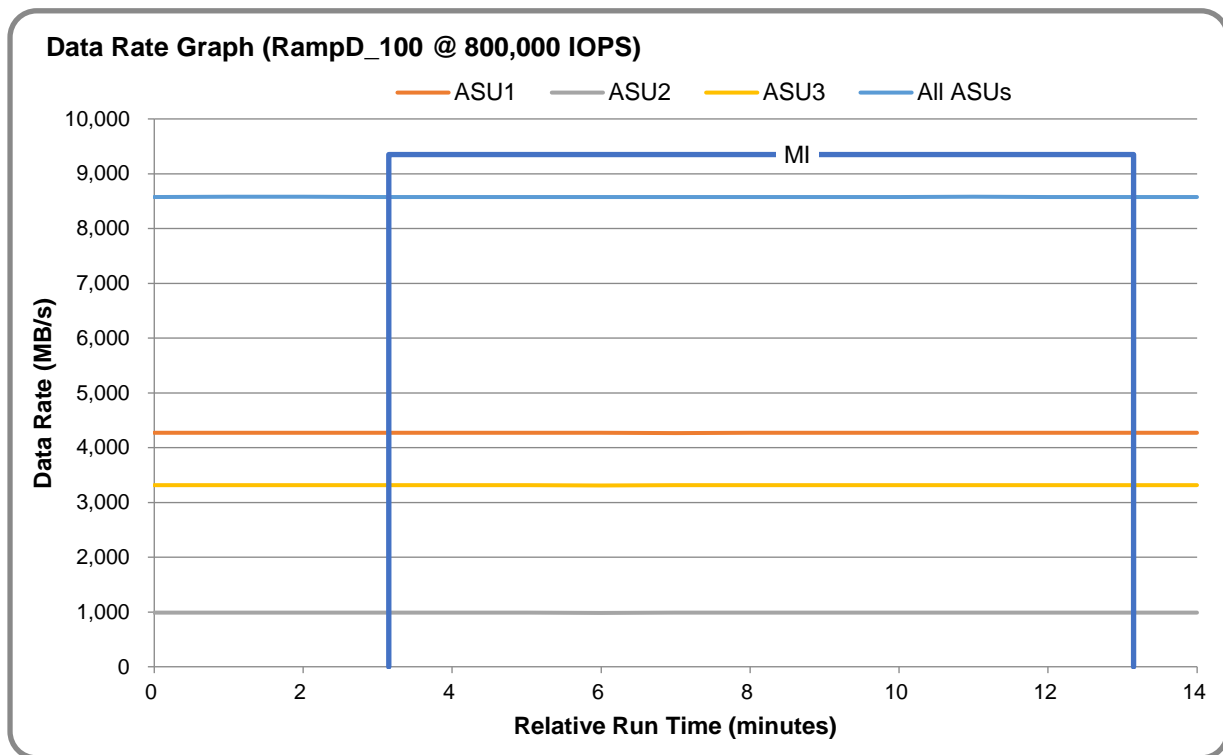
Response Time Frequency Graph (RampD_100 @ 800,000 IOPS)
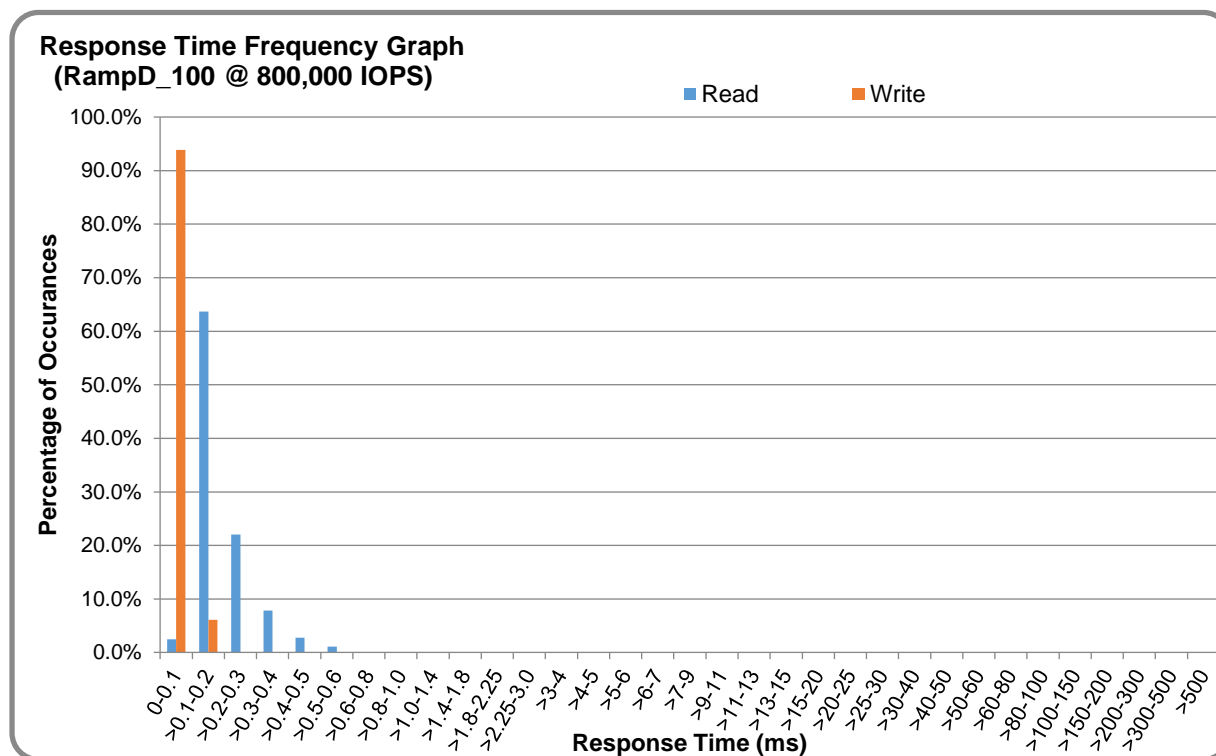
RAMPD_100 – Intensity Multiplier

The following table lists the targeted intensity multiplier (Defined), the measured intensity multiplier (Measured) for each I/O stream, its coefficient of variation (Variation), and the percentage of difference (Difference) between Defined and Measured.

	ASU1-1	ASU1-2	ASU1-3	ASU1-4	ASU2-1	ASU2-2	ASU2-3	ASU3-1
Defined	0.0350	0.2810	0.0700	0.2100	0.0180	0.0700	0.0350	0.2810
Measured	0.0350	0.2810	0.0700	0.2100	0.0180	0.0700	0.0350	0.2810
Variation	0.0008	0.0002	0.0003	0.0004	0.0013	0.0005	0.0007	0.0003
Difference	0.012%	0.008%	0.003%	0.006%	0.023%	0.018%	0.027%	0.004%

RAMPD_100 – I/O Request Summary

I/O Requests Completed in the Measurement Interval	480,001,597
I/O Requests Completed with Response Time <= 30 ms	480,001,597
I/O Requests Completed with Response Time > 30 ms	0

Response Time Ramp Test

Response Time Ramp Test – Results File

The results file generated during the execution of the Response Time Ramp Test is included in the Supporting Files (see Appendix A) as follows:

- **SPC1_METRICS_0_Raw_Results.xlsx**

Response Time Ramp Test – Phases

The Response Time Ramp Test is comprised of 11 Test Phases, including six Ramp-Down Phases (executed at 100%, 95%, 90%, 80%, 50%, and 10% of the Business Scaling Unit) and five Ramp-Up Phases (executed at 50%, 80%, 90%, 95%, and 100% of the Business Scaling Unit).

Response Time Ramp Test – Average Throughput Graph

Response Time Ramp Test – Average Response Time Graph

Average Response Time Graph (Response Time Ramp Test)

Response Time Ramp Test – RAMPD_10 Response Time Graph

Response Time Graph (RampD_10 @ 80,000 IOPS)
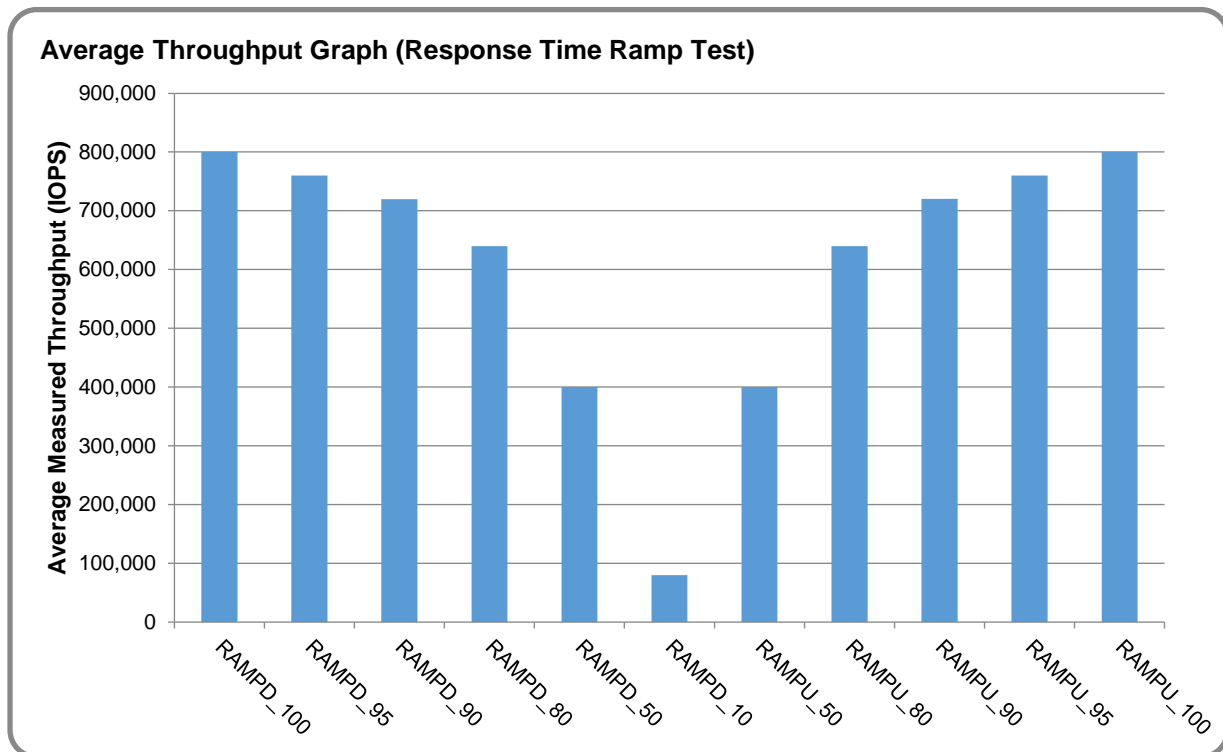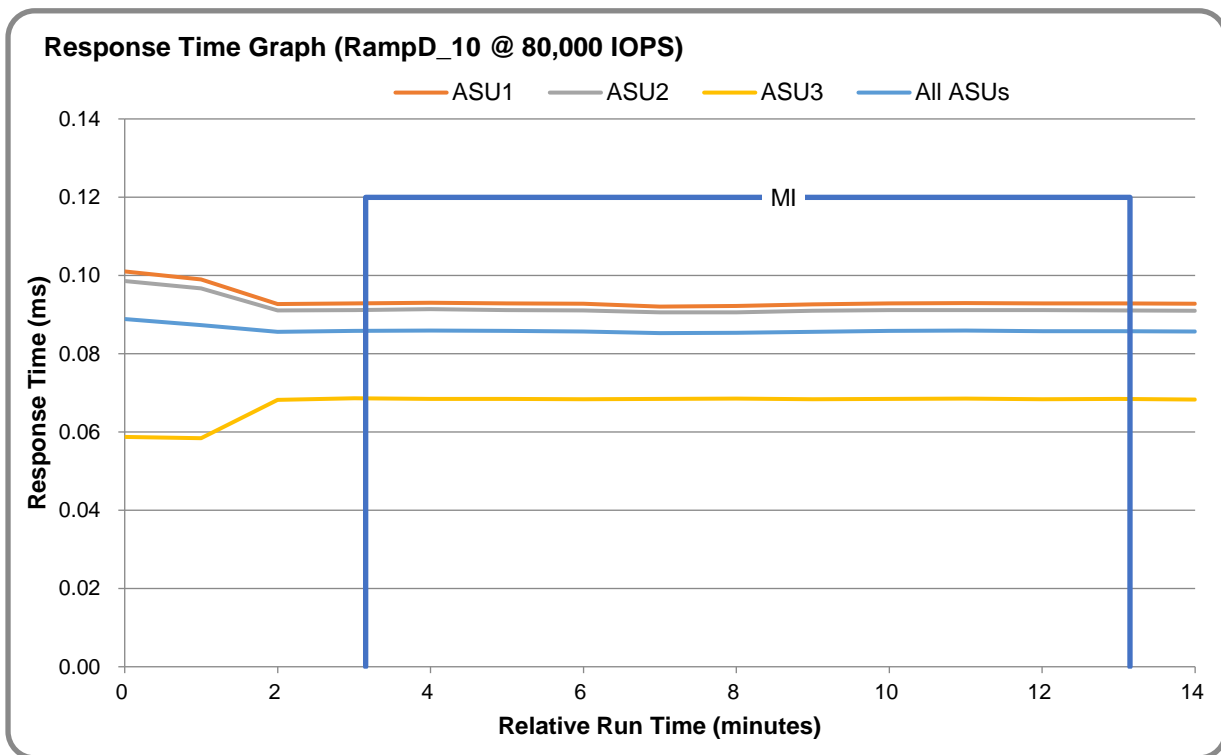
Repeatability Test

Repeatability Test Results File

The results file generated during the execution of the Repeatability Test is included in the Supporting Files (see Appendix A) as follows:
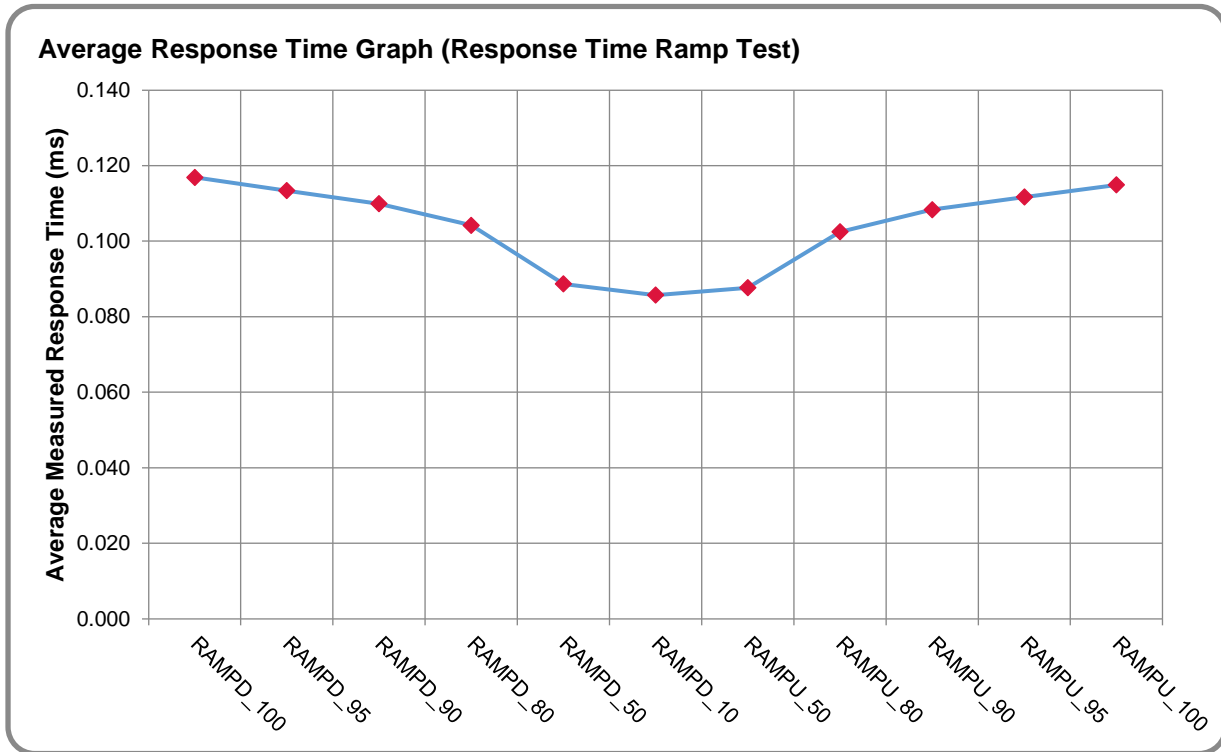
- **SPC1_METRICS_0_Raw_Results.xlsx**

Repeatability Test Results

The throughput measurements for the Response Time Ramp Test (RAMPD) and the Repeatability Test Phases (REPEAT_1 and REPEAT_2) are listed in the table below.

Test Phase	100% IOPS	10% IOPS
RAMPD	800,010.1	80,027.8
REPEAT_1	800,015.2	80,007.9
REPEAT_2	800,013.1	80,009.8

REPEAT_1_100 – Throughput Graph
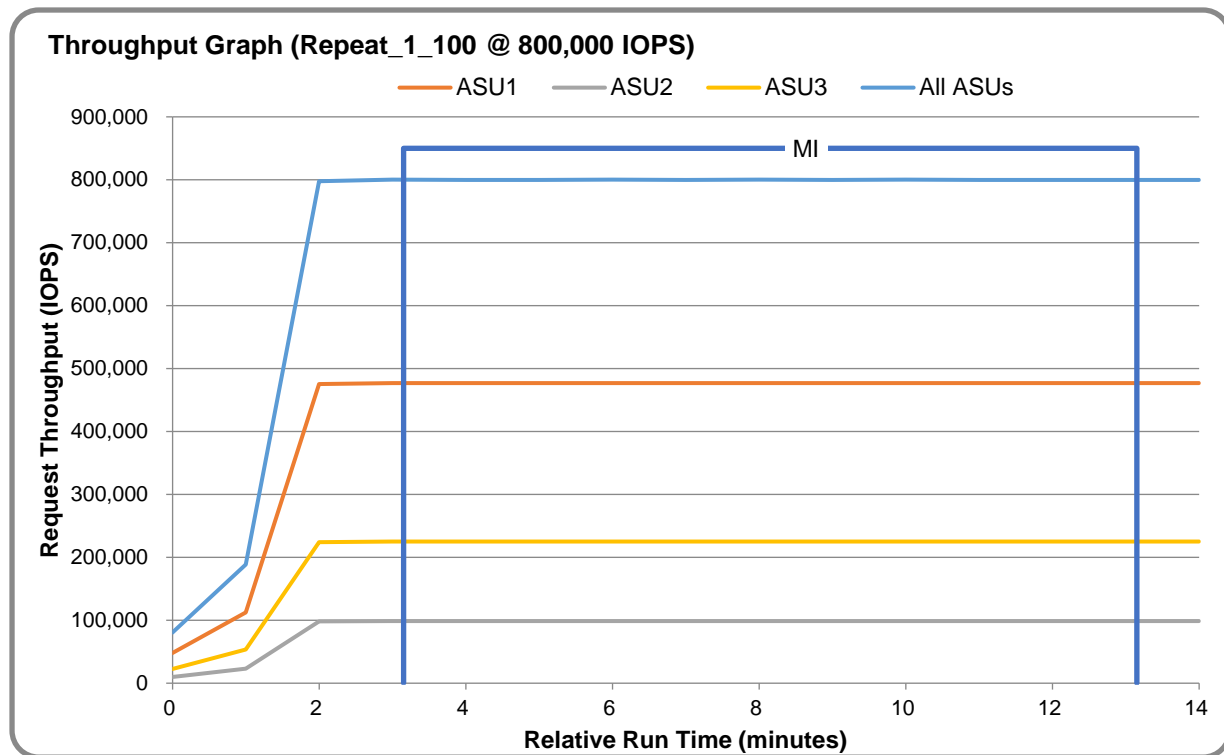
REPEAT_1_100 – Response Time Graph

Response Time Graph (Repeat_1_100 @ 800,000 IOPS)

ASU1 — ASU2 — ASU3 — All ASUs
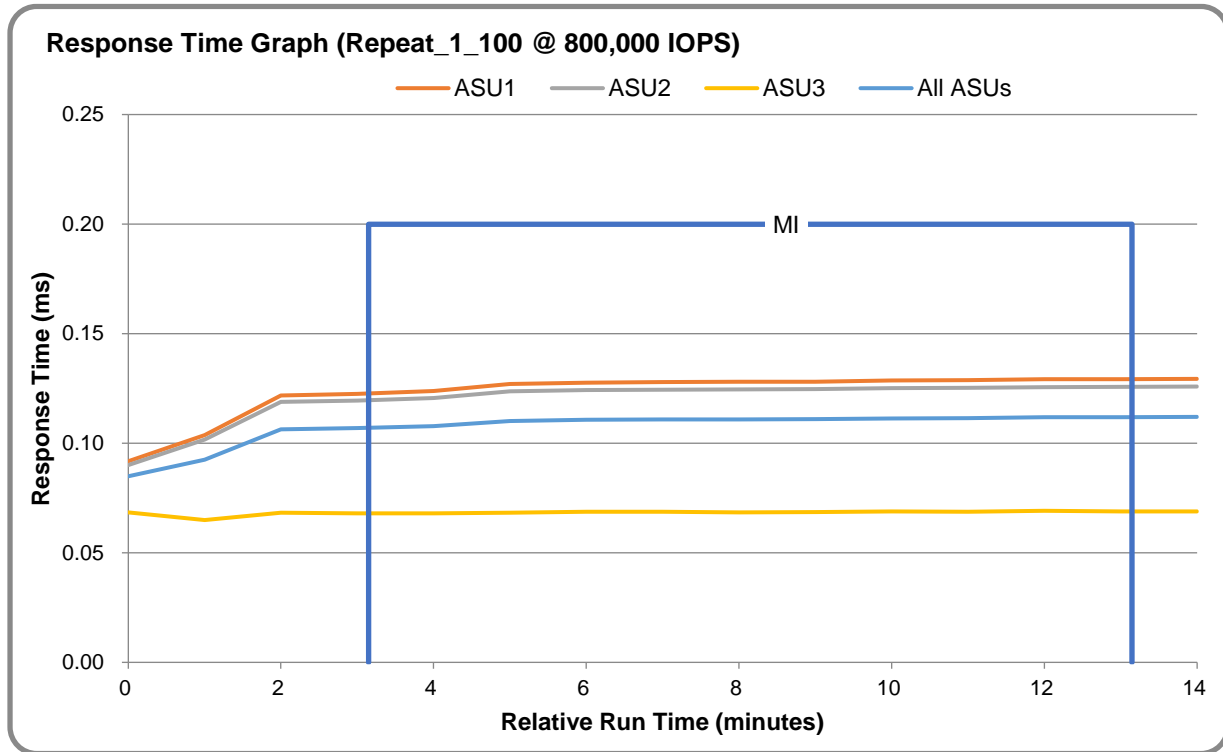
REPEAT_2_100 – Throughput Graph

Throughput Graph (Repeat_2_100 @ 800,000 IOPS)

ASU1 — ASU2 — ASU3 — All ASUs
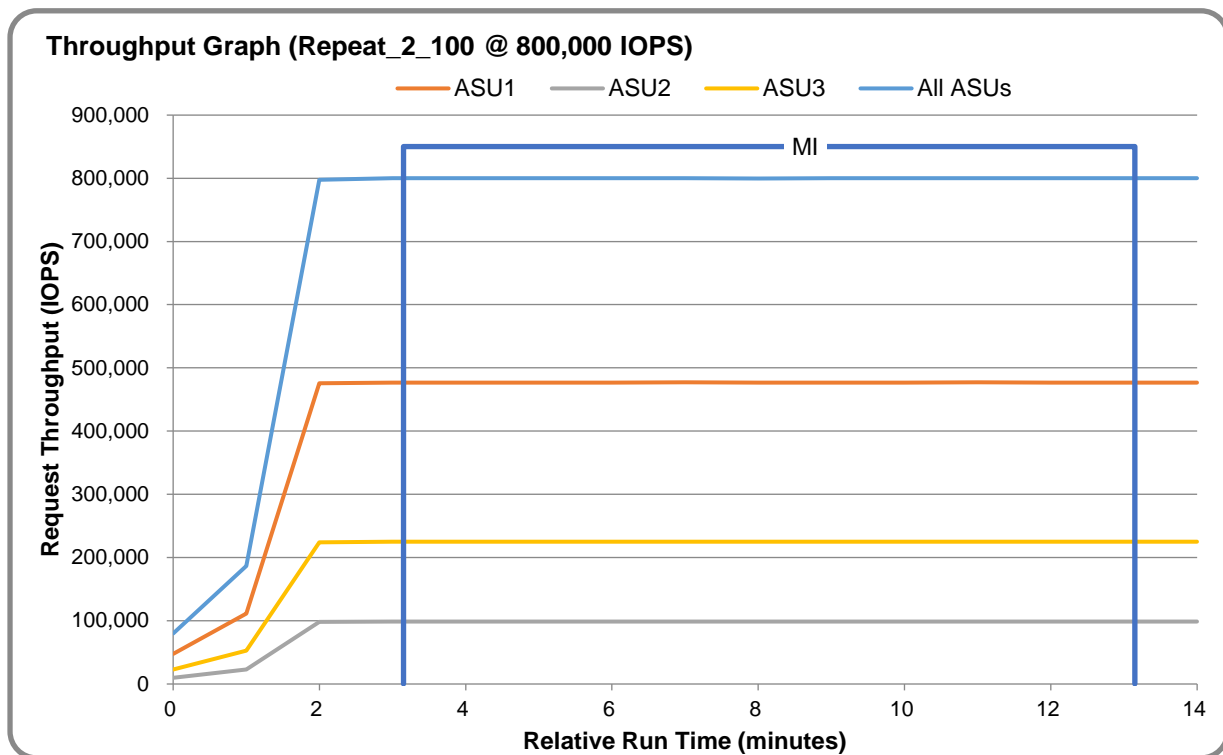
REPEAT_2_100 – Response Time Graph
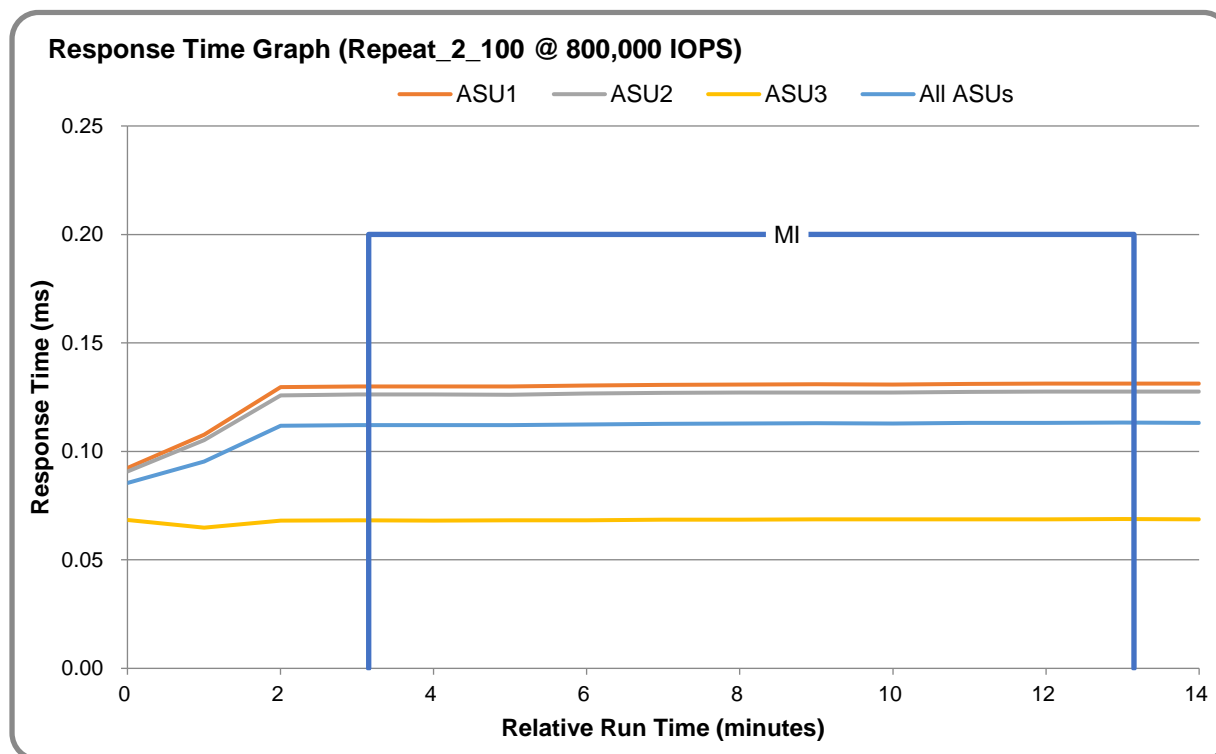
Repeatability Test – Intensity Multiplier

The following tables lists the targeted intensity multiplier (Defined), the measured intensity multiplier (Measured) for each I/O stream, its coefficient of variation (Variation), and the percent of difference (Difference) between Defined and Measured.

REPEAT_1_100 Test Phase

	ASU1-1	ASU1-2	ASU1-3	ASU1-4	ASU2-1	ASU2-2	ASU2-3	ASU3-1
Defined	0.0350	0.2810	0.0700	0.2100	0.0180	0.0700	0.0350	0.2810
Measured	0.0350	0.2810	0.0700	0.2100	0.0180	0.0700	0.0350	0.2810
Variation	0.0009	0.0002	0.0004	0.0003	0.0012	0.0003	0.0008	0.0003
Difference	0.011%	0.003%	0.030%	0.007%	0.038%	0.006%	0.051%	0.014%

REPEAT_2_100 Test Phase

	ASU1-1	ASU1-2	ASU1-3	ASU1-4	ASU2-1	ASU2-2	ASU2-3	ASU3-1
Defined	0.0350	0.2810	0.0700	0.2100	0.0180	0.0700	0.0350	0.2810
Measured	0.0350	0.2810	0.0700	0.2100	0.0180	0.0700	0.0350	0.2810
Variation	0.0007	0.0002	0.0005	0.0003	0.0010	0.0005	0.0007	0.0002
Difference	0.015%	0.002%	0.015%	0.006%	0.008%	0.004%	0.008%	0.001%

Data Persistence Test

Data Persistence Test Results File

The results files generated during the execution of the Data Persistence Test is included in the Supporting Files (see Appendix A) as follows:

- **SPC1_PERSIST_1_0_Raw_Results.xlsx**
- **SPC1_PERSIST_2_0_Raw_Results.xlsx**

Data Persistence Test Execution

The Data Persistence Test was executed using the following sequence of steps:

- The PERSIST_1_0 Test Phase was executed to completion.
- The Benchmark Configuration was taken through an orderly shutdown process and powered off.
- The Benchmark Configuration was powered on and taken through an orderly startup process.
- The PERSIST_2_0 Test Phase was executed to completion.

Data Persistence Test Results

Data Persistence Test Phase: Persist1	
Total Number of Logical Blocks Written	164,390,901
Total Number of Logical Blocks Verified	84,725,257
Total Number of Logical Blocks Overwritten	79,665,644
Total Number of Logical Blocks that Failed Verification	0
Time Duration for Writing Test Logical Blocks (sec.)	601
Size in bytes of each Logical Block	8,192
Number of Failed I/O Requests in the process of the Test	0

Committed Data Persistence Implementation

The persistence of committed data is implemented at the disk level. Data loss is prevented by using RAID1 arrays. At the controller level, the cache is set to write-through mode.

APPENDIX A: SUPPORTING FILES

The following table details the content of the Supporting Files provided as part of this Full Disclosure Report.

File Name	Description	Location
/SPC1_RESULTS	**Data reduction worksheets**	**root**
SPC1_INIT_0_Raw_Results.xlsx	Raw results for INIT Test Phase	/SPC1_RESULTS
SPC1_METRICS_0_Quick_Look.xlsx	Quick Look Test Run Overview	/SPC1_RESULTS
SPC1_METRICS_0_Raw_Results.xlsx	Raw results for Primary Metrics Test	/SPC1_RESULTS
SPC1_METRICS_0_Summary_Results.xlsx	Primary Metrics Summary	/SPC1_RESULTS
SPC1_PERSIST_1_0_Raw_Results.xlsx	Raw results for PERSIST1 Test Phase	/SPC1_RESULTS
SPC1_PERSIST_2_0_Raw_Results.xlsx	Raw results for PERSIST2 Test Phase	/SPC1_RESULTS
SPC1_Run_Set_Overview.xlsx	Run Set Overview Worksheet	/SPC1_RESULTS
SPC1_VERIFY_0_Raw_Results.xlsx	Raw results for first VERIFY Test Phase	/SPC1_RESULTS
SPC1_VERIFY_1_Raw_Results.xlsx	Raw results for second VERIFY Test Phase	/SPC1_RESULTS
/C_Tuning	**Tuning parameters and options**	**root**
set_host_kernel_parameters.sh	Set host turning parameters	/C_Tuning
/D_Creation	**Storage configuration creation**	**root**
mkraid.sh	Overprovision NVMe; create RAID volumes	/D_Creation
nvmeof.sh	Create NVMe/TCP targets	/D_Creation
mount.sh	Connect NVMe/TCP targets; create LVs	/D_Creation
/E_Inventory	**Configuration inventory**	**root**
get_tsc_config.sh	Collect configuration inventory	/E_Inventory
inventory_end.out	Initial configuration inventory	/E_Inventory
inventory_start.out	Final configuration inventory	/E_Inventory
/F_Generator	**Workload generator**	**root**
2hosts.HST	Host configuration file	/F_generator
SPC1.asu	Define the LUNs hosting the ASUs	/F_generator
SPC1_METRICS	METRICS test param file	/F_generator
spc1_run.sh	Execute test phases up through PERSIST1	/F_generator
spc1_run_persist2.sh	Execute PERSIST2	/F_generator

APPENDIX B: THIRD PARTY QUOTATION

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見 積 書

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수신	귀중
참조	hyosil.kim@tta.or.kr
연 락 처	010-5110-1847
견적일	2023년 11월 17일
유효기간	2024년 2월 25일
납품 가능일	발주일로부터 4주 이내

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대표이사	박 성 순

견적 금액 : **$39,020.00 (VAT not included)**
건   명 :

귀사의 무궁한 발전을 기원하오며, 아래와 같이 견적합니다.   단위. 달러(V.A.T 별도)

번호	모델	상세내역	수량	소비자단가	공급단가	공급금액
		AnyStor-700EK				
1	AS700EK	Dual Socket P (LGA 3647) 2nd Gen Intel® Xeon® Scalable Processors and Intel® Xeon® Scalable Processors, Dual UPI up to 10.4GT/s, Support CPU TDP 70-205W Intel(R) Xeon(R) Silver 4310 CPU @ 2.10GHz 96GB Memory(Max. 2TB) NAS O/S(960GB M.2 NVMe Disk) 10/100/1000 Gigabit Ethernet 2Port (UTP) Hot-Swappable 24 NVMe Disk Bay AnyStor Enterprise 전용 O/S - Raid 지원 : 0, 1, 10, 5, 6 Support 지원프로토콜 - NFS, CIFS, FTP, iSCSI/iSER AnyManager - 웹 기반의 NAS 관리도구 - Cluster Management - Volume Managent & Monitoring - Auto / Manual recovery - Parallel & distributed recovery - Data Replication Management - Online Scale-Out Support - POSIX FS API Support - Monitoring Tool on WEB (WMS) - Data Distributed I/O - Data Replication & NetworkRAID	1	42,000.00	21,000.00	21,000.00
2	Support & Maintenance	Premium Package 3-Year Support & Maintenance	1	12,000.00	6,000.00	6,000.00
3	DATA Disk	DAPUSTOR DPRD3108T0150T16000 R5100 7.68TB	8	1,000.00	8,000.00	8,000.00
4	I/B Cable	MCP1600-E002 IB EDR Cable	4	180.00	720.00	720.00
5	I/B Card	MCX556A-ECAT ConnectX®-5 VPI adapter card, EDR IB (100Gb/s) and 100GbE, dual-port QSFP28, PCIe3.0 x16, tall bracket, ROHS R6	3	1,100.00	3,300.00	3,300.00
				공급가		39,020.00
				부가가치세		
				총합계		39,020.00

비고
1. 무상유지보수 기간은 납품 설치 후 H/W 3년(36개월) 입니다.
2. 결제조건 별도 협의.
3. 위 견적은   건에 한하여 적용 됩니다.

APPENDIX C: TUNING PARAMETERS AND OPTIONS

The script set_host_kernel_parameters.sh was used to configure the operation system parameters on the host system. This script is included in the Support Files (see Appendix A).

APPENDIX D: STORAGE CONFIGURATION CREATION

Step 1 – Create RAID volumes

The **mkraid.sh** script performs over-provisioning on each NVMe device and creates software RAID volumes (RAID 10).

```
        mkraid.sh
#!/bin/sh
# NVMe NameSpace Overprovisioning Function

ns_size=11000000000
nvme_over_provision () {
        for num in $(seq 0 7)
        do
                echo OverProvision 22% /dev/nvme${num}n1
                nvme detach-ns /dev/nvme${num} -namespace-id=1 -controllers=0
                nvme delete-ns /dev/nvme${num} -namespace-id=1
                nvme create-ns /dev/nvme${num} -nsze $ns_size -ncap $ns_size -flbas 0 -dps 0 -
nmic 0
                nvme attach-ns /dev/nvme${num} -namespace-id=1 -controllers=0
                nvme reset /dev/nvme${num}

                echo Format 512 sector /dev/nvme${num}n1
                nvme format -l0 -f /dev/nvme${num}n1
                echo Format Secure Erase /dev/nvme${num}n1
                nvme format -s0 -f /dev/nvme${num}n1
        done
}

# Linux RAID 1 Create Function
mkraid () {
        yes | mdadm --create --verbose /dev/md0 --level=1 --raid-devices 2 \
                /dev/nvme0n1 /dev/nvme1n1
        yes | mdadm --create --verbose /dev/md1 --level=1 --raid-devices 2 \
                /dev/nvme2n1 /dev/nvme3n1
        yes | mdadm --create --verbose /dev/md2 --level=1 --raid-devices 2 \
                /dev/nvme4n1 /dev/nvme5n1
        yes | mdadm --create --verbose /dev/md3 --level=1 --raid-devices 2 \
                /dev/nvme6n1 /dev/nvme7n1

}

clean () {
        vgremove spc
        mdadm --stop /dev/md0
        mdadm --stop /dev/md1
        mdadm --stop /dev/md2
        mdadm --stop /dev/md3
}
```

```
        # Main Start

        #clean
        #nvme_over_provision
        mkraid
```

Step 2 – Set-Up NVMeoF/TCP Target on the Storage Subsystem

The **nvmeof.sh** script creates NVMe/TCP targets (using nvmet kernel driver).

```
        nvmeof.sh
        #!/bin/bash
        # Load nvmet kernel driver Function

        ip_addr1="10.10.10.10"
        ip_addr2="10.10.11.10"

        mode=rdma

        load_nvmet () {
                modprobe nvmet
                modprobe nvmet_${mode}
                #modprobe nvmet_${mode} offload_mem_start=0x1680000000
        offload_mem_size=2048 offload_buffer_size=512
        }

        # Bind nvmet target Function
        bind_md_nvmet1 () {
                mkdir -p /sys/kernel/config/nvmet/ports/1
                echo "ipv4" > /sys/kernel/config/nvmet/ports/1/addr_adrfam
                echo $mode > /sys/kernel/config/nvmet/ports/1/addr_trtype
                echo $ip_addr1 > /sys/kernel/config/nvmet/ports/1/addr_traddr
                echo 4420 > /sys/kernel/config/nvmet/ports/1/addr_trsvcid
                for vol in `seq 0 3`
                do
                        echo add /dev/md${vol} to nvme-${mode} target
                        mkdir -p /sys/kernel/config/nvmet/subsystems/spc-${vol}
                        echo 1 > /sys/kernel/config/nvmet/subsystems/spc-
        ${vol}/attr_allow_any_host
                        mkdir -p /sys/kernel/config/nvmet/subsystems/spc-${vol}/namespaces/1
                        echo -n /dev/md${vol} > \
                                /sys/kernel/config/nvmet/subsystems/spc-
        ${vol}/namespaces/1/device_path
                        echo 1 > /sys/kernel/config/nvmet/subsystems/spc-
        ${vol}/namespaces/1/enable
                        ln -s /sys/kernel/config/nvmet/subsystems/spc-${vol} \
                                /sys/kernel/config/nvmet/ports/1/subsystems
```

```
            done
    }

    bind_md_nvmet2 () {
            mkdir -p /sys/kernel/config/nvmet/ports/2
            echo "ipv4" > /sys/kernel/config/nvmet/ports/2/addr_adrfam
            echo $mode > /sys/kernel/config/nvmet/ports/2/addr_trtype
            echo $ip_addr2 > /sys/kernel/config/nvmet/ports/2/addr_traddr
            echo 4420 > /sys/kernel/config/nvmet/ports/2/addr_trsvcid
            for vol in `seq 0 3`
            do
                    ln -s /sys/kernel/config/nvmet/subsystems/spc-${vol} \
                            /sys/kernel/config/nvmet/ports/2/subsystems
            done
    }

    # Main Start
    load_nvmet
    bind_md_nvmet1
    bind_md_nvmet2
```

Step 3 – Connect to NVMe/TCP Target on the Host system.

The **mount.sh** script on the host system discovers and connects NVMe/TCP targets, and create 19
Logical Volumes for ASUs.

```
    mount.sh
    #!/bin/sh

    mode=rdma
    disks="/dev/nvme1n1 /dev/nvme2n1 /dev/nvme3n1 /dev/nvme4n1"
    stripe="-i 4"
    lvsize=1045
    vg_name=spc

    function pvg_create ()
    {
            pvcreate -ff $disks
            vgcreate $vg_name $disks
    }

    function lv_create ()
    {
        for id in `seq 1 18`
        do
            lvcreate $stripe -n $id -L ${lvsize}G $vg_name
        done
```

```
        lvcreate $stripe -n $(($id + 1)) -L $((lvsize*2))G $vg_name
        lvs
}

function nvm_connect ()
{
        modprobe nvme_rdma
        cat /proc/sys/fs/epoll/max_user_watches >> /proc/sys/fs/aio-max-nr

        for sqn in $( nvme discover -t $mode -a 10.10.11.10 -s 4420 | grep subnqn | cut -
d: -f2-)
        do
            #nvme connect -t $mode -a 10.10.11.10 -s 4420 -n $sqn -i 32
            nvme connect -t $mode -a 10.10.11.10 -s 4420 -n $sqn
        done
        nvme list
        vgscan
        vgchange -ay $vg_name
}

nvm_connect
#pvg_create
#lv_create
```

APPENDIX E: CONFIGURATION INVENTORY

The script get_tsc_config.sh was used to collect an inventory of the TSD during the execution of spc1_run.sh and spc1_run_persist2.sh. The following log files were generated.

- inventory_start.out

- inventory_end.out

The files are included in the Supporting Files (see Appendix_A).

APPENDIX F: WORKLOAD GENERATOR

The ASUs accessed by the SPC-1 workload generator are defined in SPC1.asu. The workload generator parameters used during the Metrics Test are included in the file SPC1_METRICS. The test phases up through PERSIST1 are executed by spc1_run.sh. PERSIST2 is executed by spc1_run_persist2.sh.

These files are included in the Supporting Files (see Appendix_A).