SPC BENCHMARK 1™

FULL DISCLOSURE REPORT

TELECOMMUNICATIONS TECHNOLOGY ASSOCIATION

GLUESYS ANYSTOR-700EK

SPC-1™ V3.10.0

SUBMISSION IDENTIFIER: A32024

SUBMITTED FOR REVIEW: NOVEMBER 29, 2021

First Edition – November 2021

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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
Telecommunications Technology Association
47, Bundang-ro, Bundang-gu, Seongnam-city
Gyeonggi-do, 13591
Republic of Korea

November 24, 2021

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™	**310,022**
SPC-1 Price-Performance	**$99.71/SPC-1 KIOPS™**
SPC-1 Total System Price	30,910.00
SPC-1 IOPS Response Time	0.229 ms
SPC-1 Overall Response Time	0.193 ms
SPC-1 ASU Capacity	4,799 GB
SPC-1 ASU Price	$6.45/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.

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

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 A32024.

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

- The physical capacity of the data repository (12,802 GB).
- The total capacity of the Application Storage Unit (4,799 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 benchmark requirements, if any, were waived in accordance with the SPC Policies:

None.

Respectfully Yours,

Doug Johnson, Certified SPC Auditor

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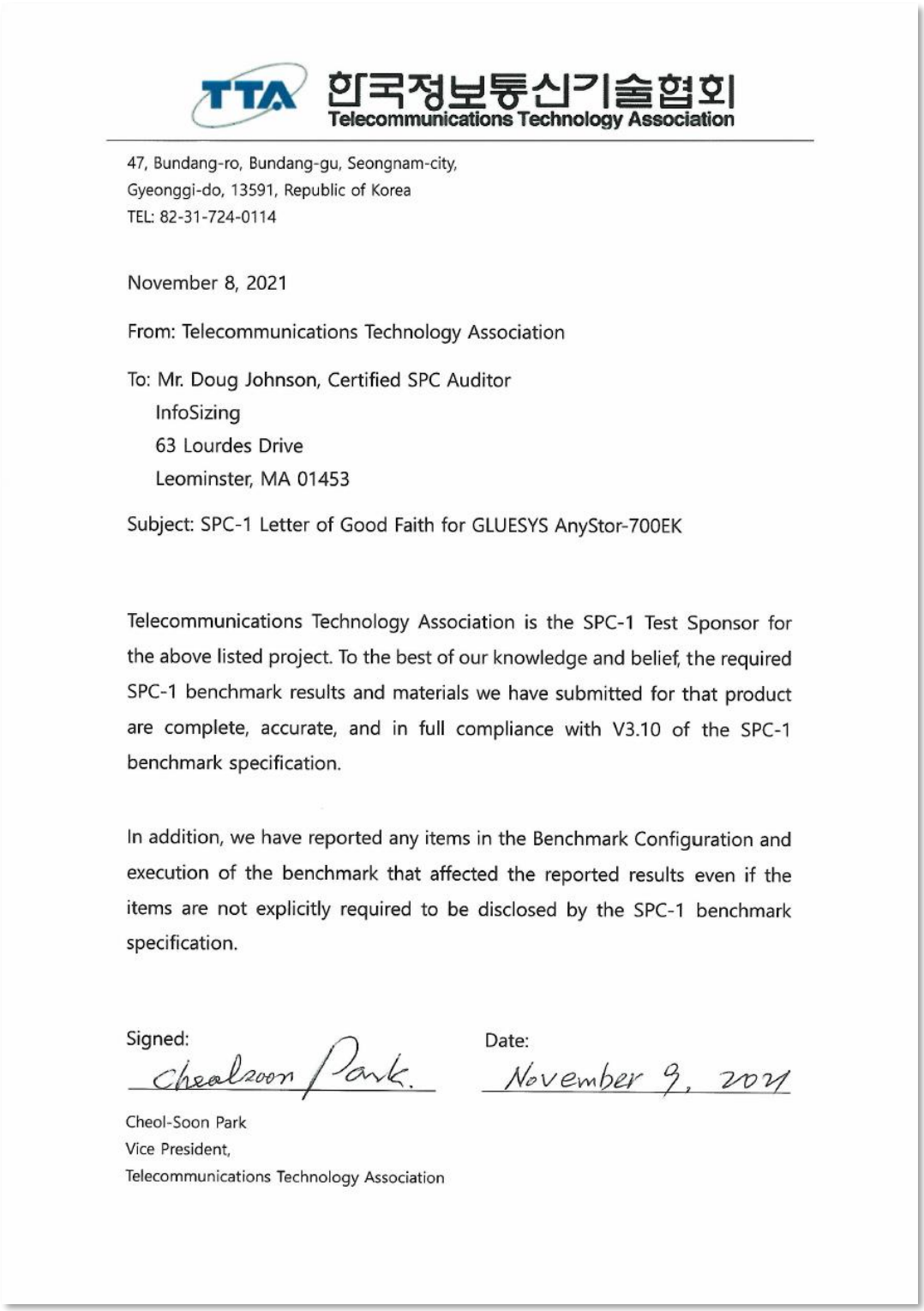
LETTER OF GOOD FAITH



TTA 한국정보통신기술협회
Telecommunications Technology Association

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

November 8, 2021

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: Cheolsoon Park. Date: November 9, 2021

Cheol-Soon Park
Vice President,
Telecommunications Technology Association

SPC Benchmark 1™

Executive Summary

Gluesys AnyStor-700EK

SPC-1 IOPS™	**310,022**	SPC-1 Price Performance	**$99.71/SPC-1 KIOPS™**
SPC-1 IOPS Response Time	**0.229 ms**	SPC-1 Total System Price	**$30,910.00**
SPC-1 Overall Response Time	0.193 ms	SPC-1 Overall Discount	46.94%
		Currency / Target Country	USD / Korea
		Availability Date	November 29, 2021

Extensions

SPC-1 Data Reduction	NA
SPC-1 Encryption	NA
SPC-1 NDU	NA
SPC-1 Synchronous Replication	NA
SPC-1 Snapshot	NA

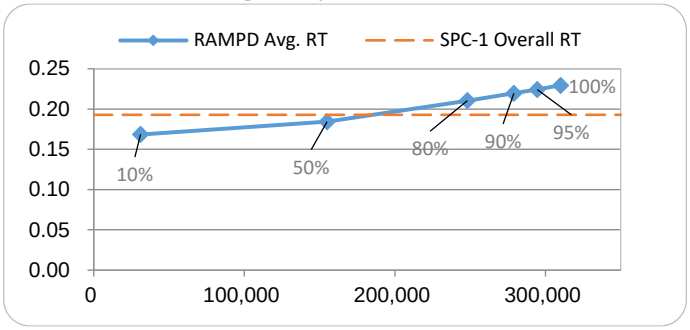
Storage Metrics

SPC-1 Data Protection Level	Protected 1
SPC-1 Physical Storage Capacity	12,802 GB
SPC-1 ASU Capacity	4,799 GB
SPC-1 ASU Price	$6.45/GB

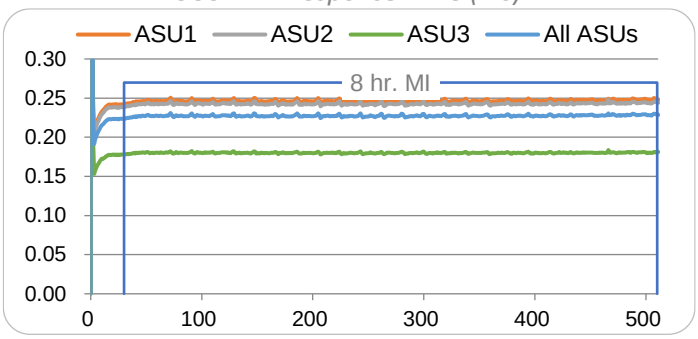
Priced Storage Configuration Summary

1	Mellanox 100 Gbps IB HCA (dual port)
1	Gluesys AnyStor-700EK
1	Controller
64	GB Total Cache
2	Total Front-End Ports (100 Gbps IB)
8	1.6 TB Intel 2.5'' NVMe SSDs
2	Total RUs

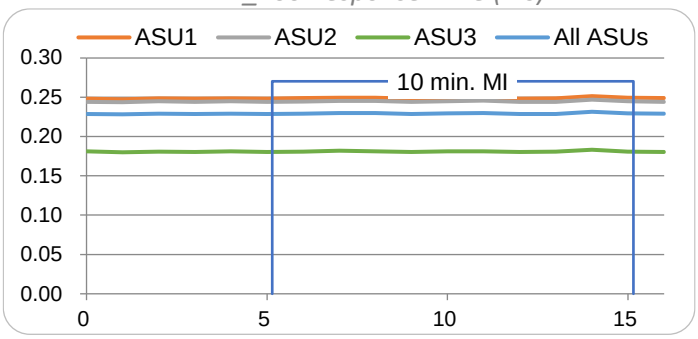
RAMPD Average Response Time (ms) vs. IOPS



SUSTAIN Response Time (ms)



RAMPD_100 Response Time (ms)



SPC Benchmark 1™ Specification Revision	v3.10.0	Submitted for Review	November 29, 2021
SPC Benchmark 1™ Workload Generator Revision	v3.0.2	Submission Details	www.storageperformance.org/r/A32024

PRICING DETAILS

Part No.	Description	Source	Qty	Unit Price	Ext. Price	Disc.	Disc. Price
Hardware & Software							
ASE-4024	1x Ampere Altra CPU, up to 80 Arm v8.2+64-bit CPU cores at up to 3.30 GHz with Sustained Turbo 64GB 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 O/S - Raid: 0, 1, 10, 5, 6 Support Supported Protocol - NFS, CIFS, FTP, iSCSI/iSER AnyManager - Web-Based NAS Management Tool - 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	1	40,000.00	40,000.00	50%	20,000.00
HD-SD01600T	INTEL SSDPE2KE016T8	1	8	1,250.00	10,000.00	45%	5,500.00
NC-IB Cable	MCP1600-E002 IB EDR Cable	1	2	180.00	360.00	0%	360.00
NC-IB0002 Card	MCX556A-ECAT ConnectX®-5 VPI adapter card, EDR IB (100Gb/s) and 100GbE, dual-port QSFP28, PCIe3.0 x16, tall bracket, ROHS R6	1	2	1,100.00	2,200.00	0%	2,200.00
						Hardware & Software Subtotal	**28,060.00**
Support & Maintenance							
SV-WTE724-3Y	Premium Package 3-Year Support & Maintenance	1	1	5,700.00	5,700.00	50%	2,850.00
						Support & Maintenance Subtotal	**2,850.00**
SPC-1 Total System Price							**30,910.00**
SPC-1 IOPS™							310,022
SPC-1 Price-Performance™ ($/SPC-1 KIOPS™)							**99.71**
SPC-1 ASU Capacity (GB)							4,799
SPC-1 ASU Price ($/GB)							**6.45**

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	http://tta.or.kr/eng/index.jsp hyosil.kim@tta.or.kr
SPC Auditor	InfoSizing Doug Johnson	www.sizing.com doug@sizing.com

Revision Information

Date	FDR Revision	Details
November 29, 2021	First Edition	Initial Publication

Anomalies, Exceptions, Waivers

There were no anomalies, exceptions or waivers associated with the audit of the Gluesys AnyStor-700EK.

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
1 x KTNF KRS580S1 2 x Intel® Xeon® Gold 6140 (2.30 GHz, 18-Core, 24 MB L3) 768 GB Main Memory Red Hat Enterprise Linux 8.3
Tested Storage Configuration
1 x Mellanox 100 Gbps IB HCA (dual port)
1 x Gluesys AnyStor-700EK with: 1 x Storage Controller 1 x Ampere™ Altra™ ARMv8 (2.80 GHz, 32MB) 64 GB cache 2 x 100 Gbps IB Front End Ports 8 x 1.6 TB Intel 2.5” NVMe SSD

Component Changes in Revised Full Disclosure Report

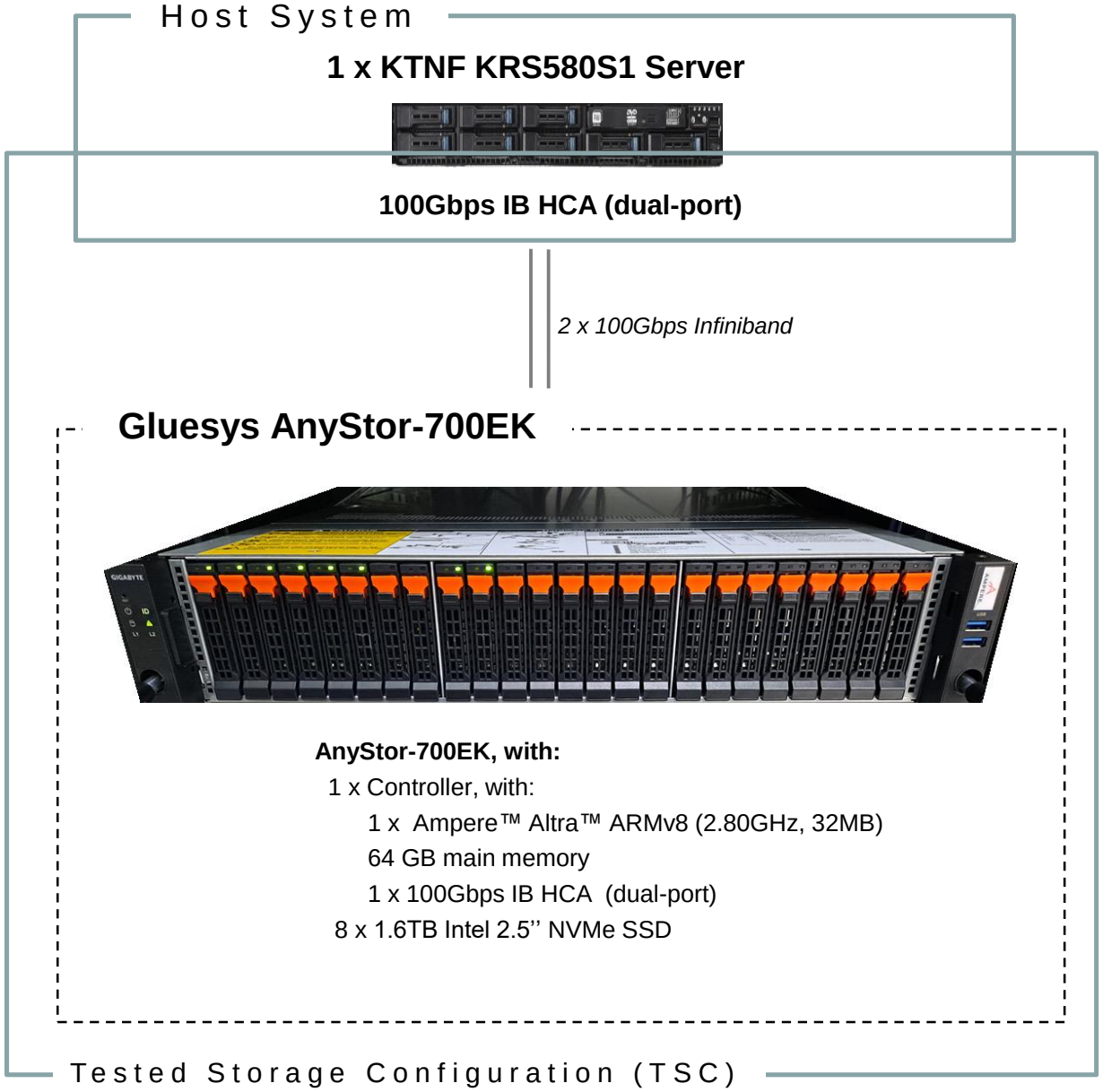
The following table outlines component changes that were made in revisions to this Full Disclosure Report.

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).



Storage Network Configuration

The Tested Storage Configuration (TSC) consisted of a single storage subsystem (Gluesys AnyStor-700EK), driven by a single KTNF KRS580S1 host system. The host had two InfiniBand (IB) connections 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	239.9	239.9	2,159.6	45.0%	No
ASU-2	9	239.9	239.9	2,159.6	45.0%	No
ASU-3	2	239.9	239.9	479.9	10.0%	No
	SPC-1 ASU Capacity			4,799		

*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
NVMe	8	1,600.3	12,802.6
	Total Physical Capacity		**12,802**
	Physical Capacity Utilization		**37.49%**

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.

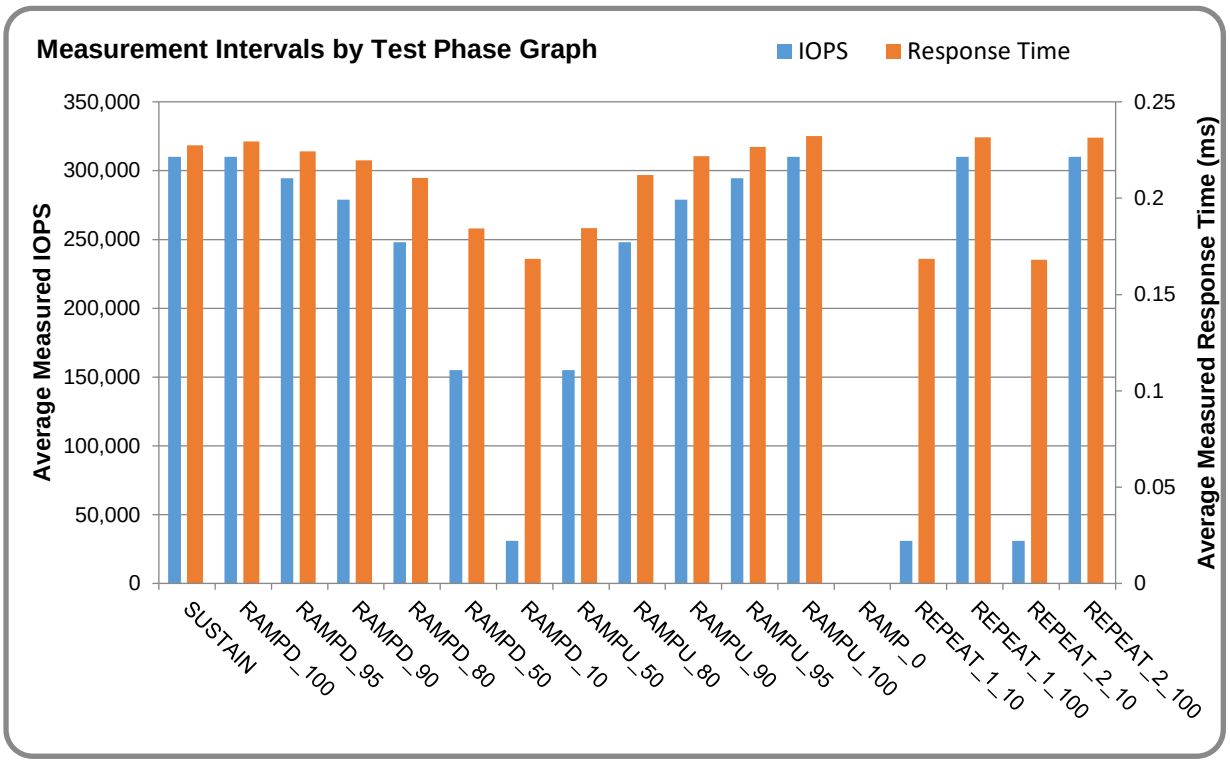
Benchmark Execution Overview

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).

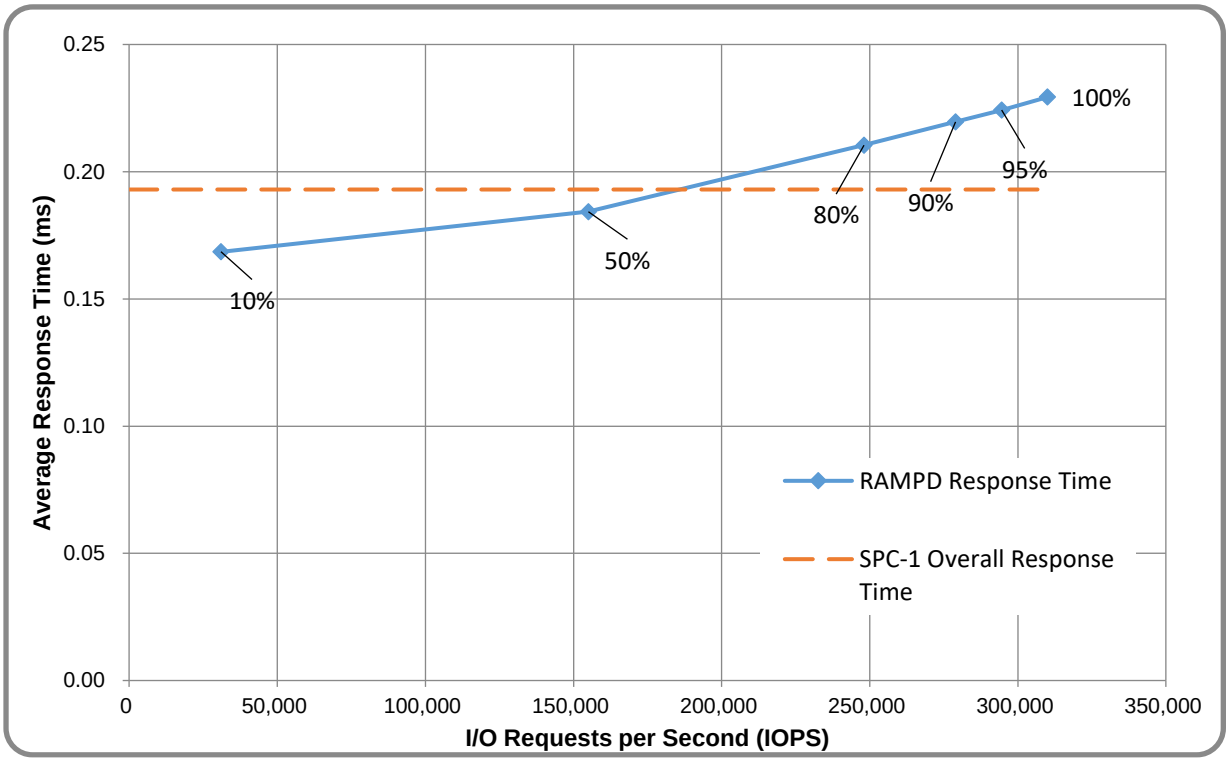
Measurement Intervals by Test Phase Graph

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	31-Oct-21 11:36:10	**Requested IOP Level**	500 MB/sec
End Time	31-Oct-21 14:09:16	**Observed IOP Level**	522 MB/sec
Duration	2:33:06	For additional details see the Supporting Files.	

SUSTAIN Test Phase

SUSTAIN – Results File

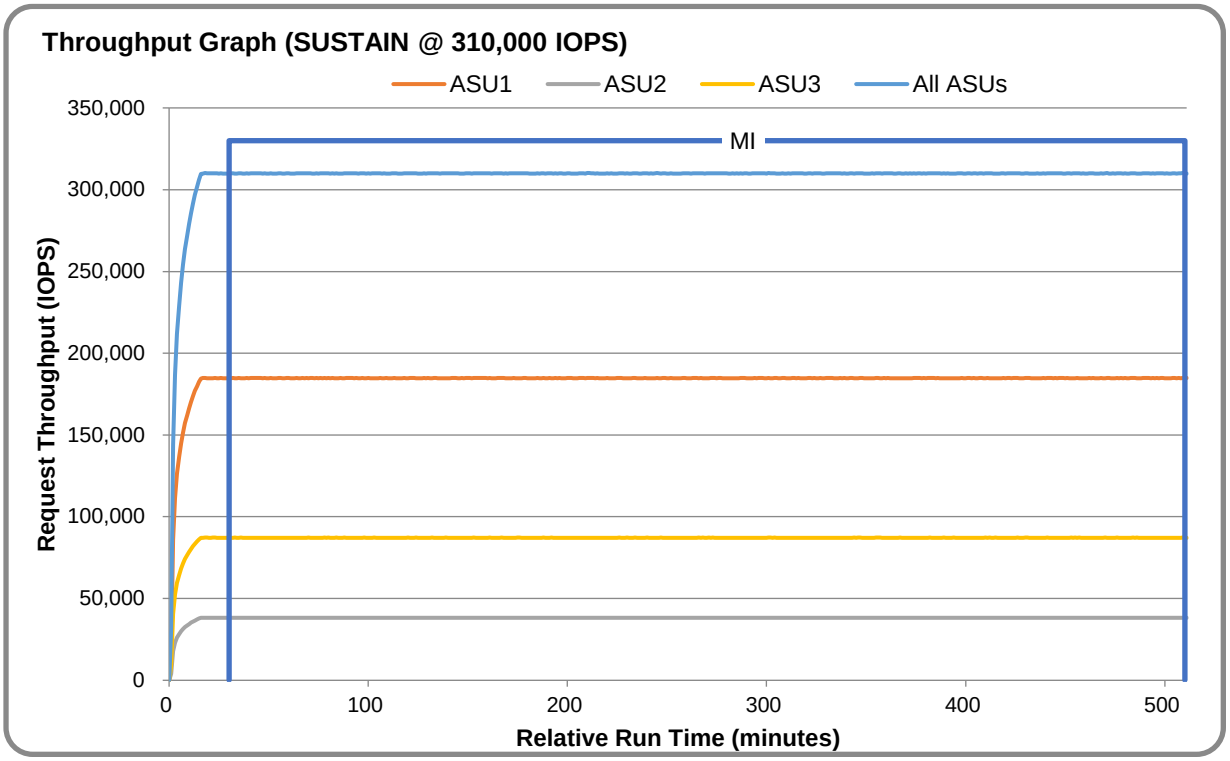
The results file generated during the execution of the SUSTAIN Test Phase is included in the Supporting Files (see Appendix A) as follows:

- **SPC1_METRICS_0_Raw_Results.xlsx**

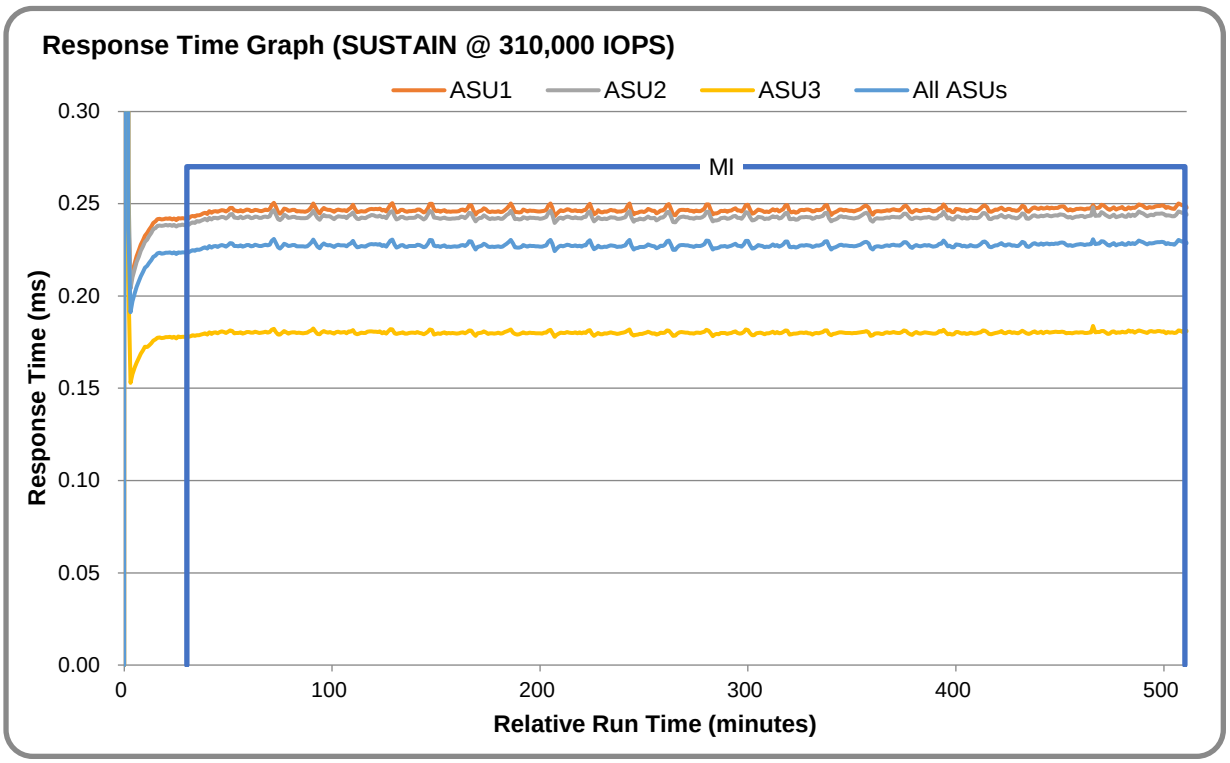
SUSTAIN – Execution Times

Interval	Start Date & Time	End Date & Time	Duration
Transition Period	31-Oct-21 14:14:09	31-Oct-21 14:44:09	0:30:00
Measurement Interval	31-Oct-21 14:44:09	31-Oct-21 22:44:10	8:00:01

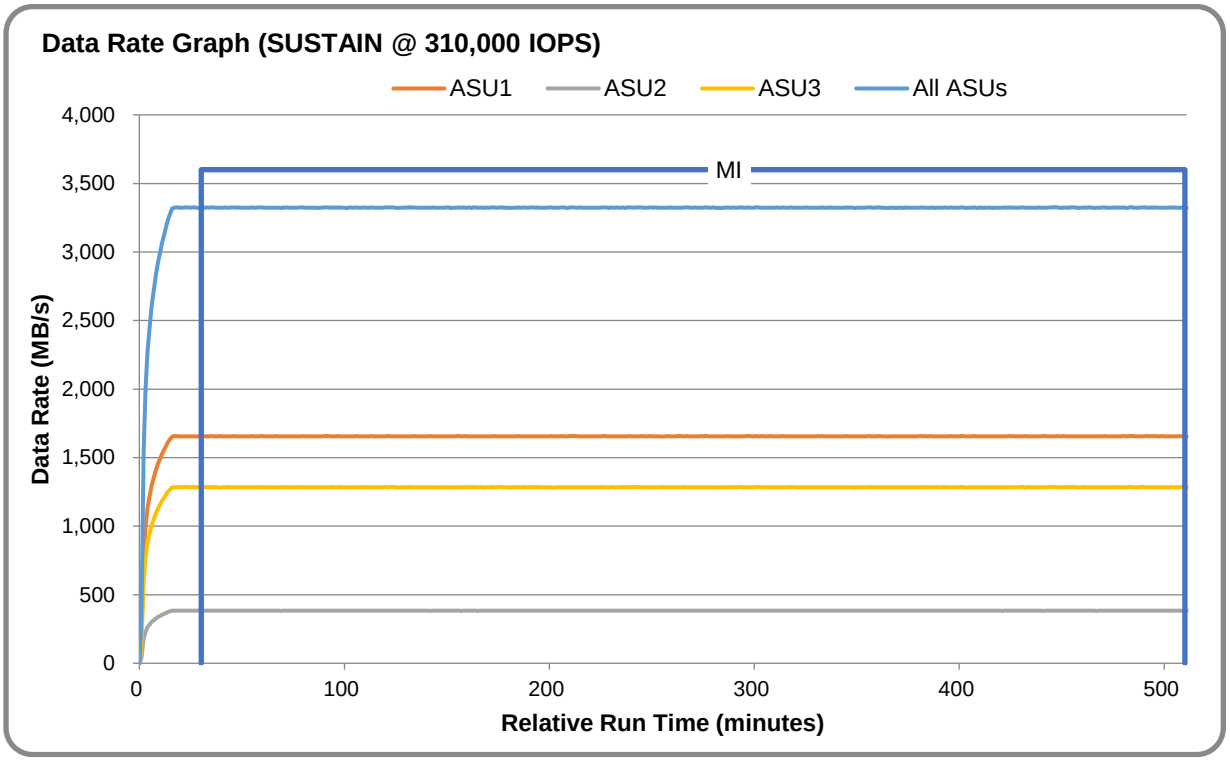
SUSTAIN – Throughput Graph



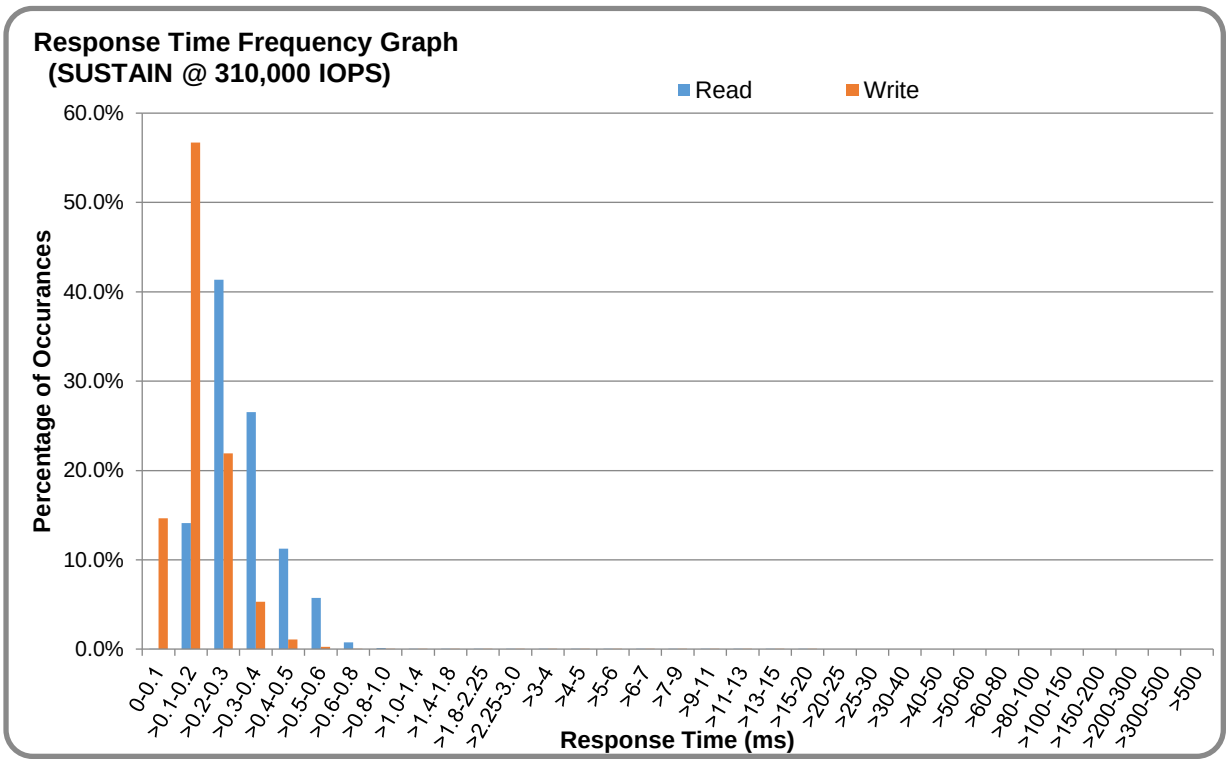
SUSTAIN – Response Time Graph



SUSTAIN – Data Rate Graph



SUSTAIN – Response Time Frequency Graph



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	0.0011	0.0004	0.0008	0.0004	0.0017	0.0008	0.0012	0.0004
Difference	0.014%	0.002%	0.001%	0.002%	0.004%	0.001%	0.001%	0.002%

RAMPD_100 Test Phase

RAMPD_100 – Results File

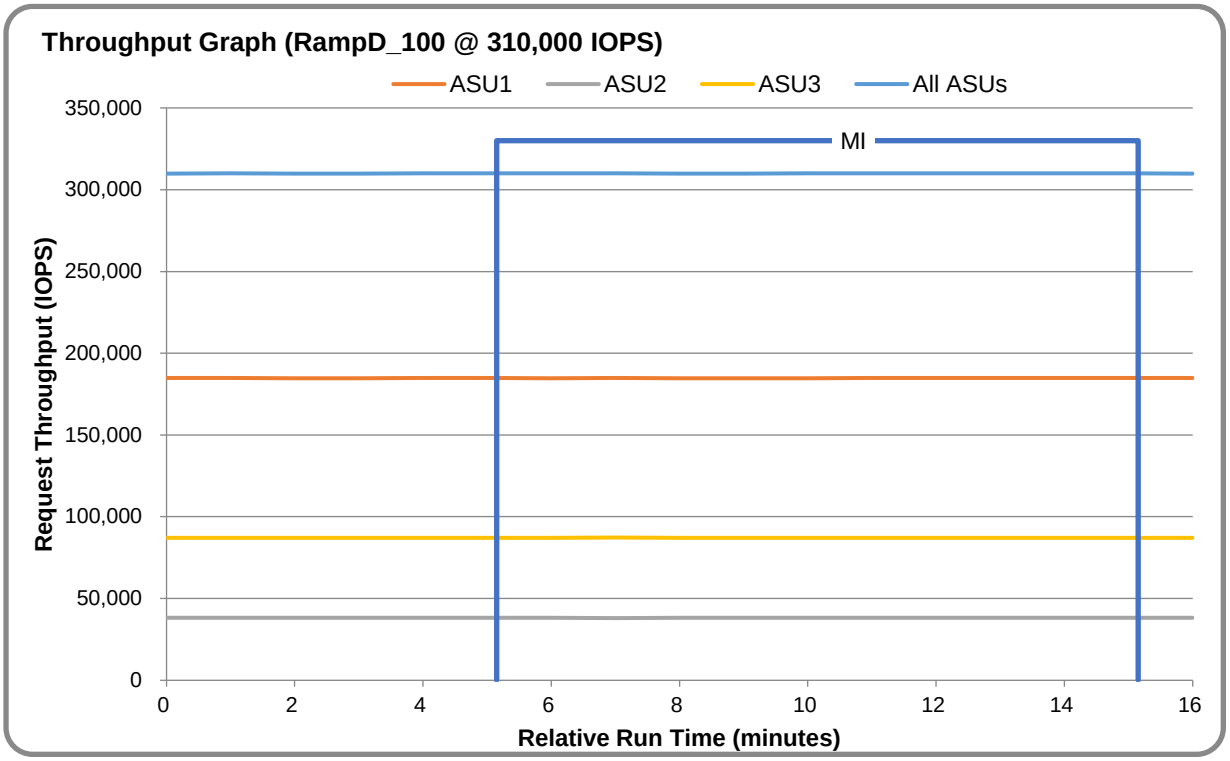
The results file generated during the execution of the RAMPD_100 Test Phase is included in the Supporting Files (see Appendix A) as follows:

- **SPC1_METRICS_0_Raw_Results.xlsx**

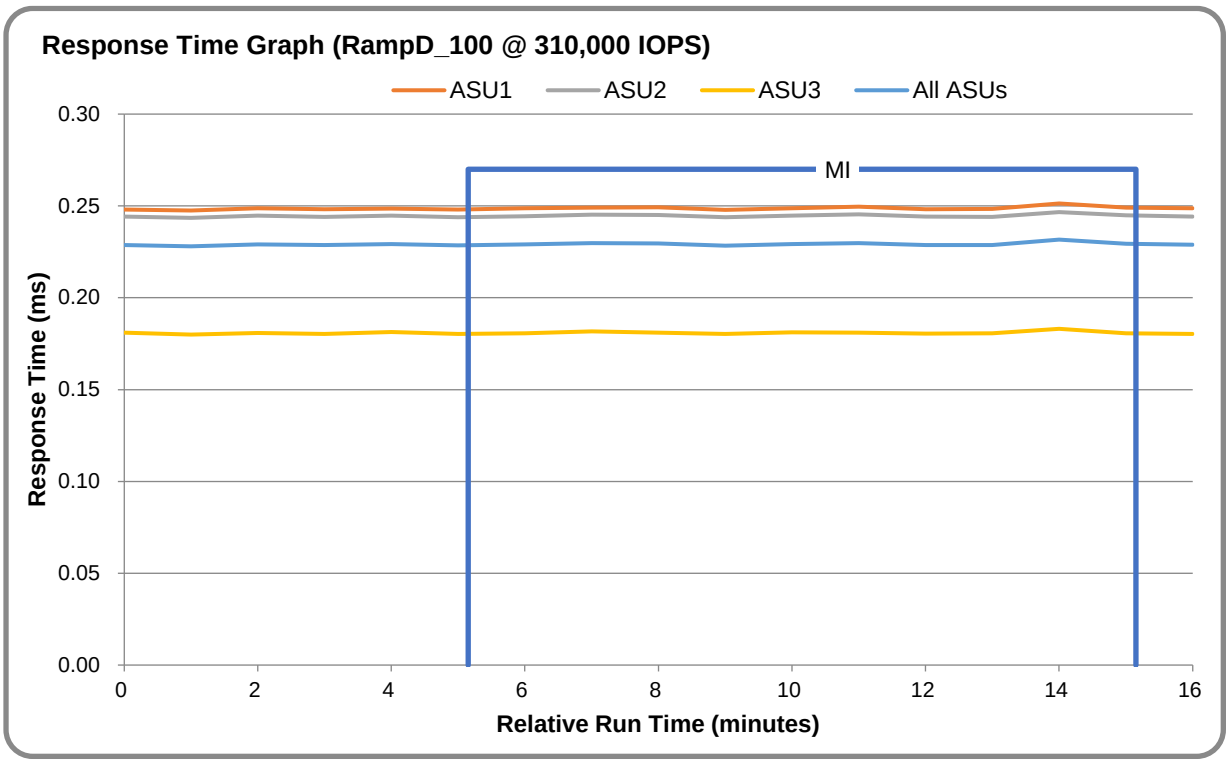
RAMPD_100 – Execution Times

Interval	Start Date & Time	End Date & Time	Duration
Transition Period	31-Oct-21 22:45:09	31-Oct-21 22:50:09	0:05:00
Measurement Interval	31-Oct-21 22:50:09	31-Oct-21 23:00:10	0:10:01

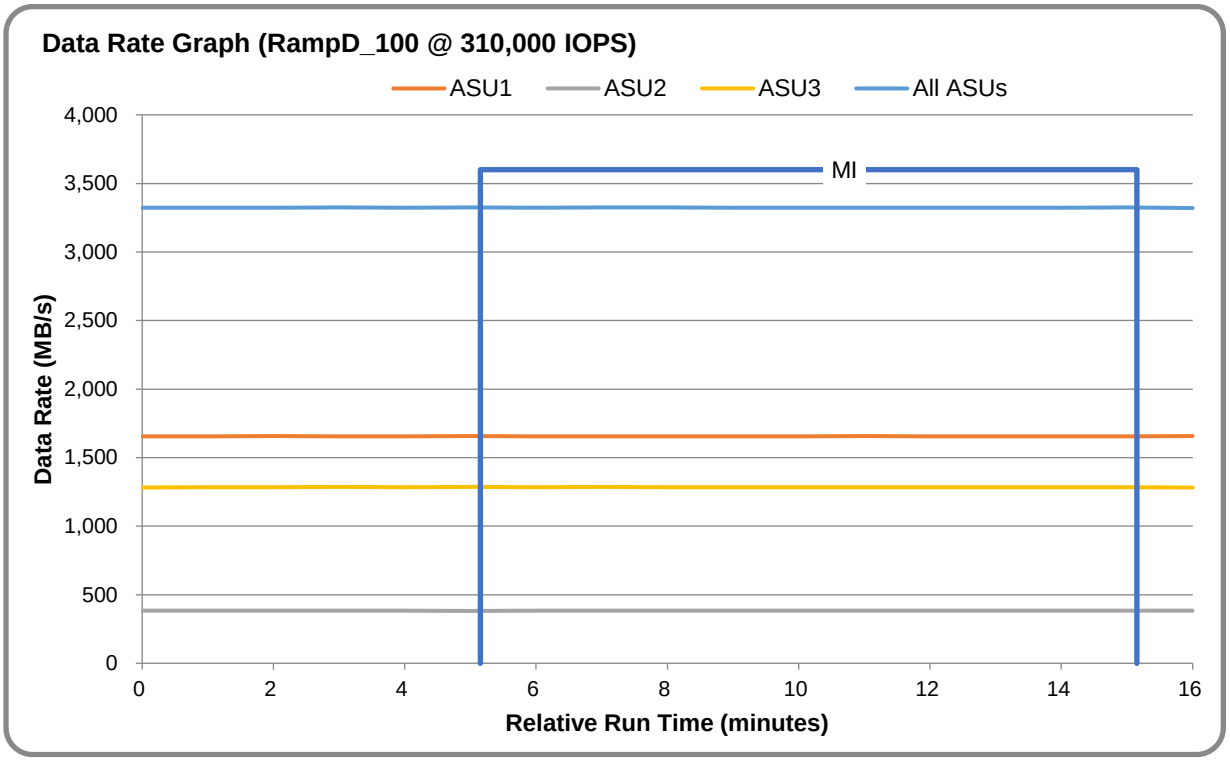
RAMPD_100 – Throughput Graph



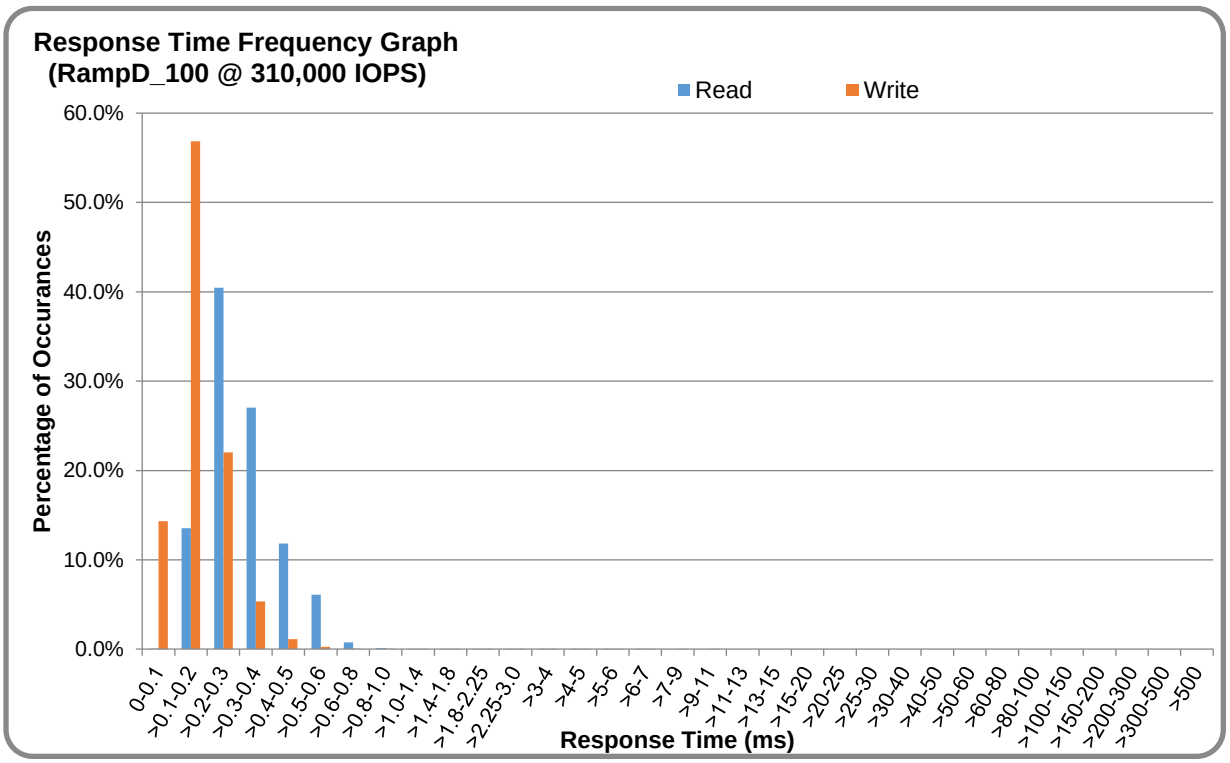
RAMPD_100 – Response Time Graph



RAMPD_100 – Data Rate Graph



RAMPD_100 – Response Time Frequency Graph



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	0.0009	0.0004	0.0008	0.0004	0.0021	0.0010	0.0009	0.0003
Difference	0.003%	0.013%	0.001%	0.010%	0.031%	0.046%	0.033%	0.012%

RAMPD_100 – I/O Request Summary

I/O Requests Completed in the Measurement Interval	186,015,688
I/O Requests Completed with Response Time <= 30 ms	186,015,688
I/O Requests Completed with Response Time > 30 ms	0

Response Time Ramp Test

Response Time Ramp Test – Results File

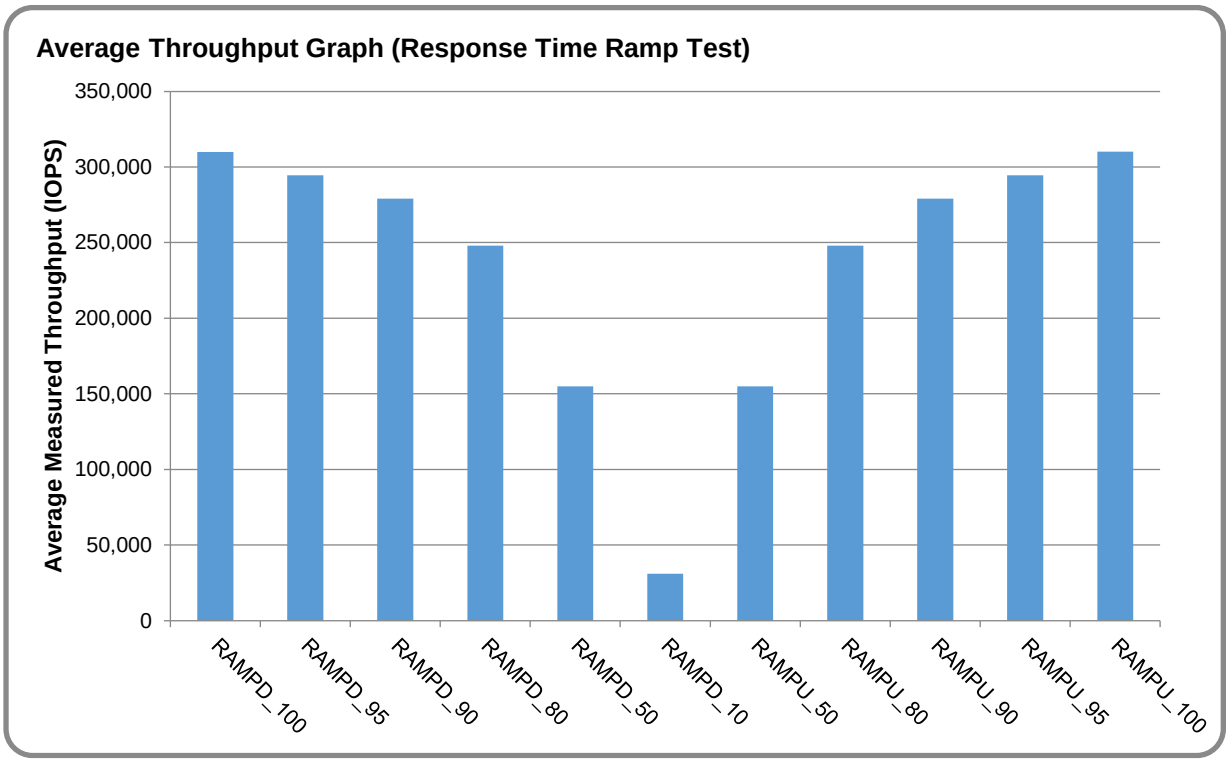
The results file generated during the execution of the Response Time Ramp Test is included in the Supporting Files (see Appendix A) as follows:

- **SPC1_METRICS_0_Raw_Results.xlsx**

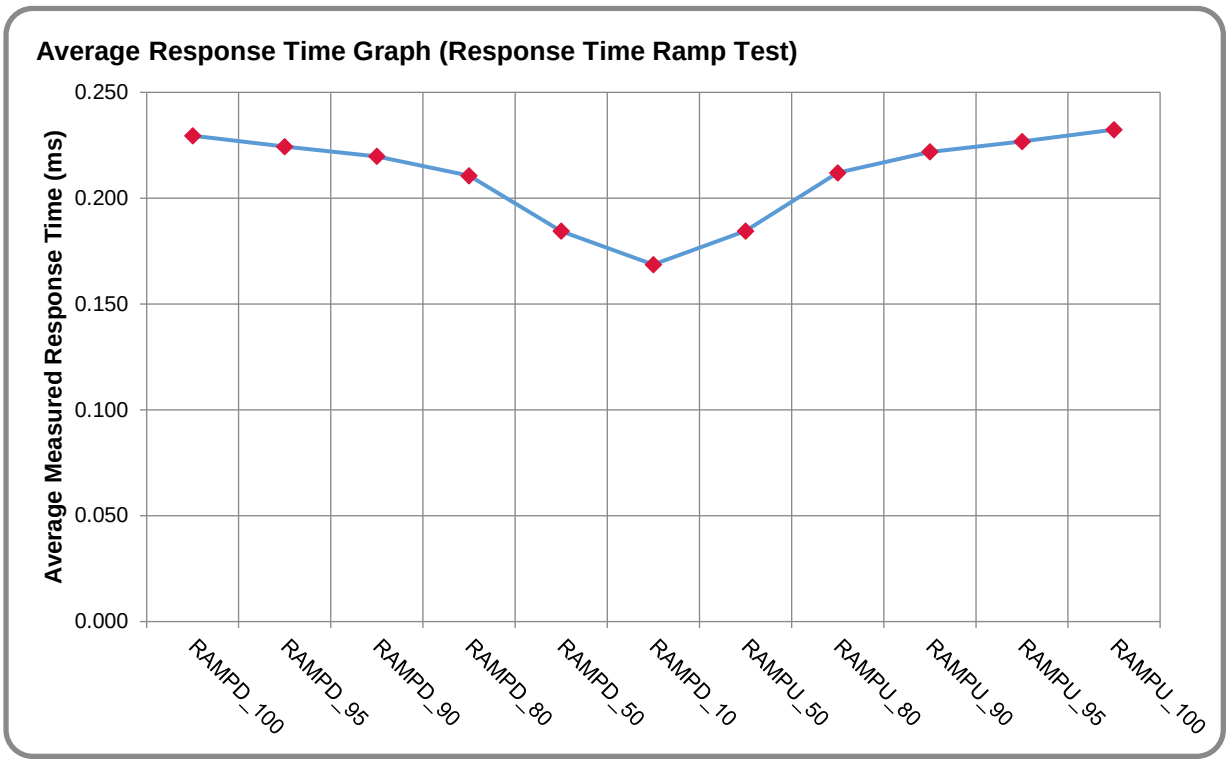
Response Time Ramp Test – Phases

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).

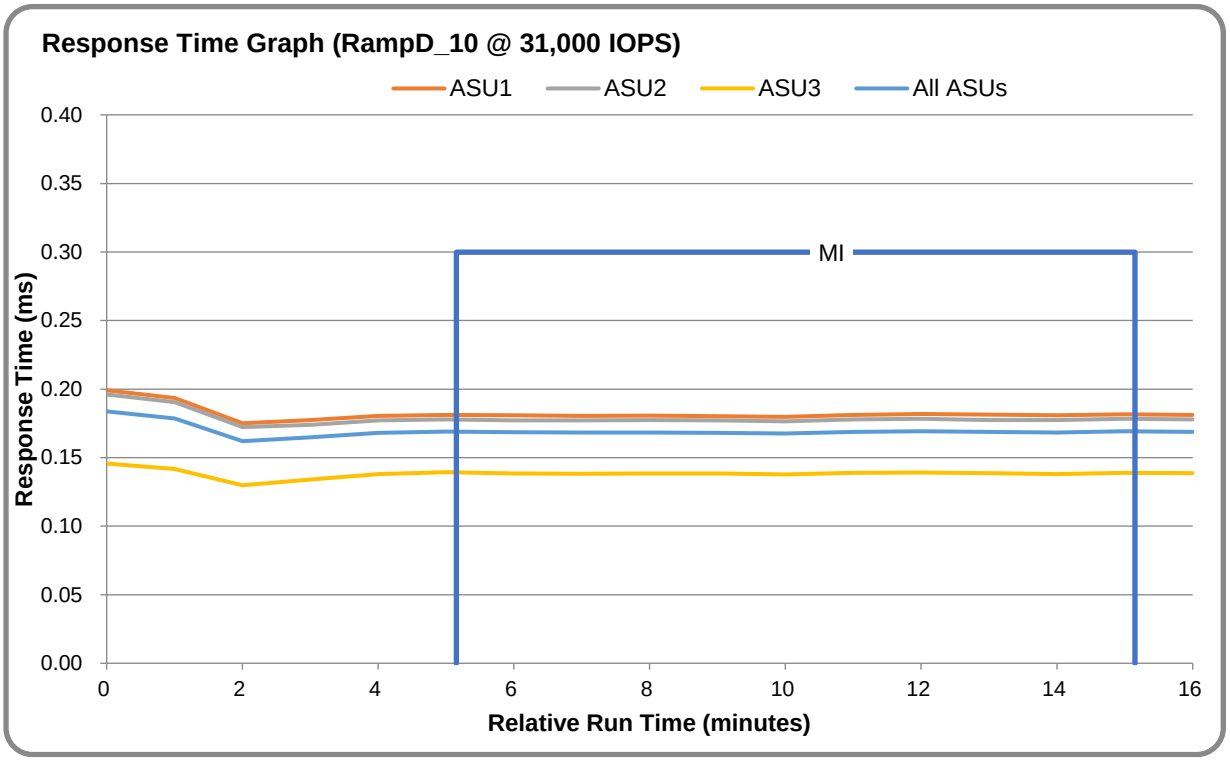
Response Time Ramp Test – Average Throughput Graph



Response Time Ramp Test – Average Response Time Graph



Response Time Ramp Test – RAMPD_10 Response Time Graph



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:

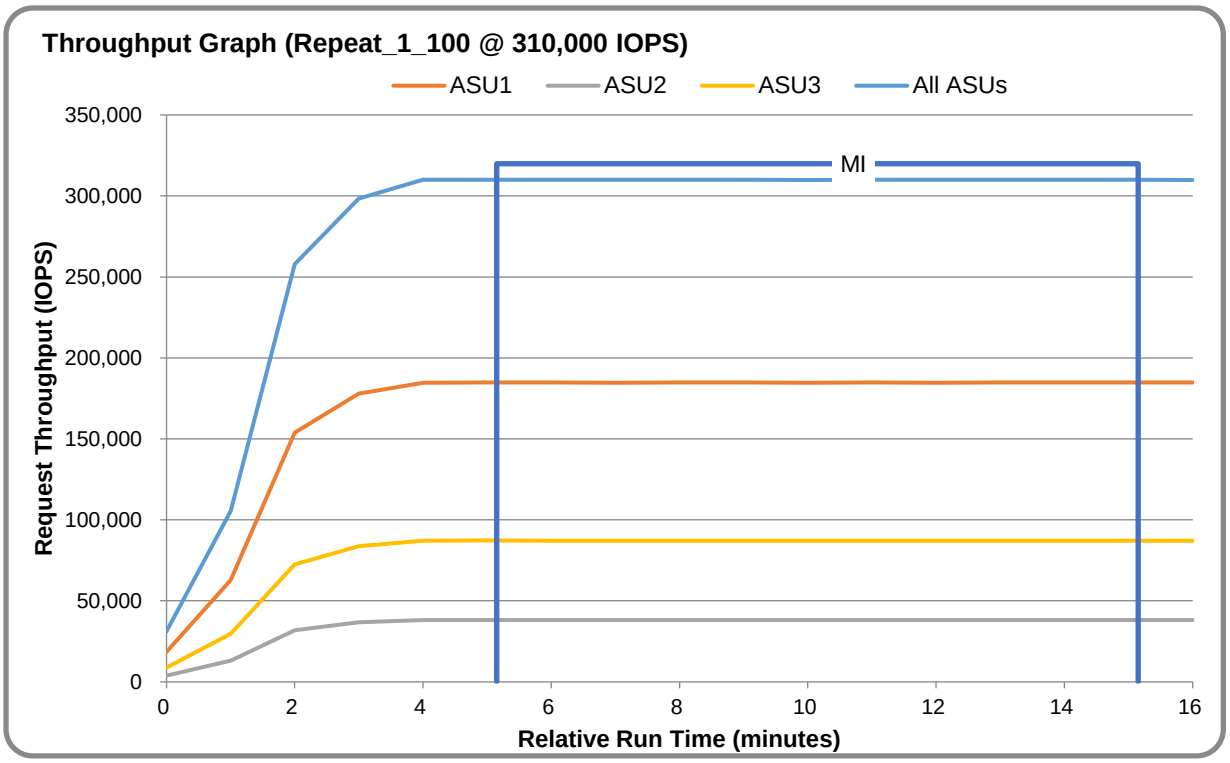
- **SPC1_METRICS_0_Raw_Results.xlsx**

Repeatability Test Results

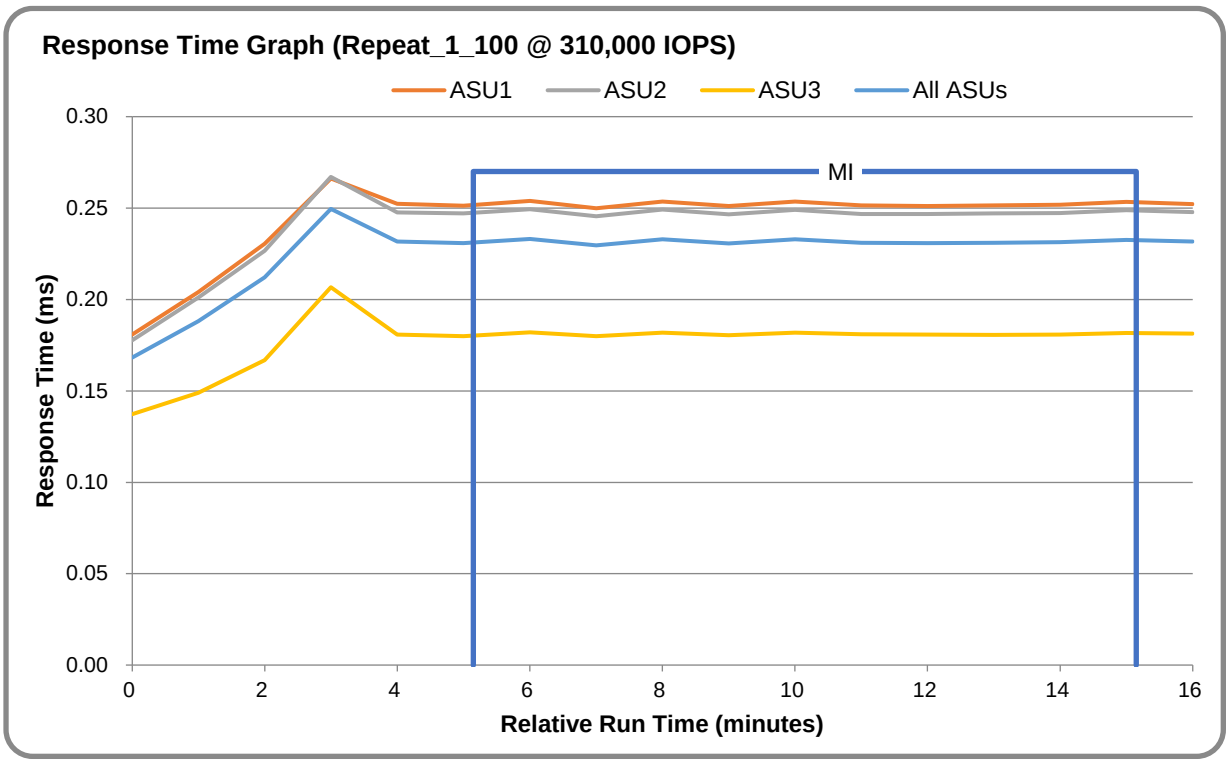
The throughput measurements for the Response Time Ramp Test (RAMPD) and the Repeatability Test Phases (REPEAT_1 and REPEAT_2) are listed in the table below.

Test Phase	100% IOPS	10% IOPS
RAMPD	310,022.3	31,009.2
REPEAT_1	310,021.0	31,012.0
REPEAT_2	310,011.4	31,002.1

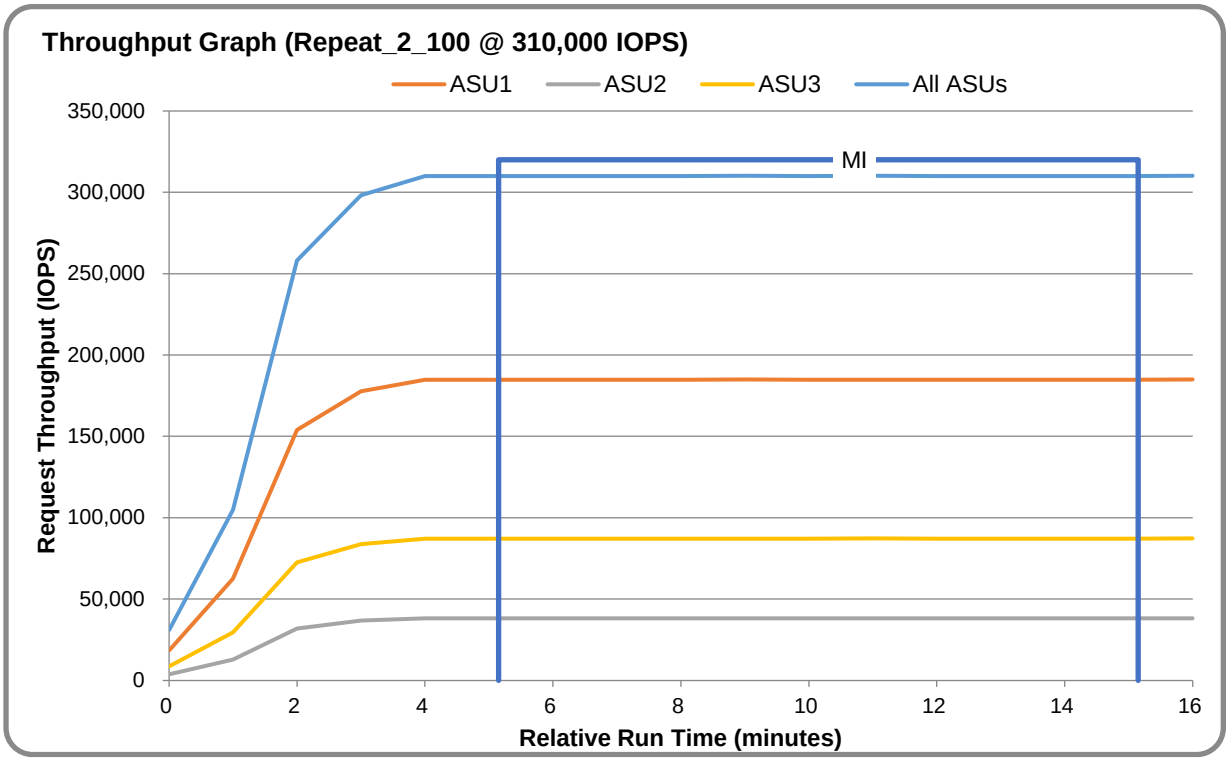
REPEAT_1_100 – Throughput Graph



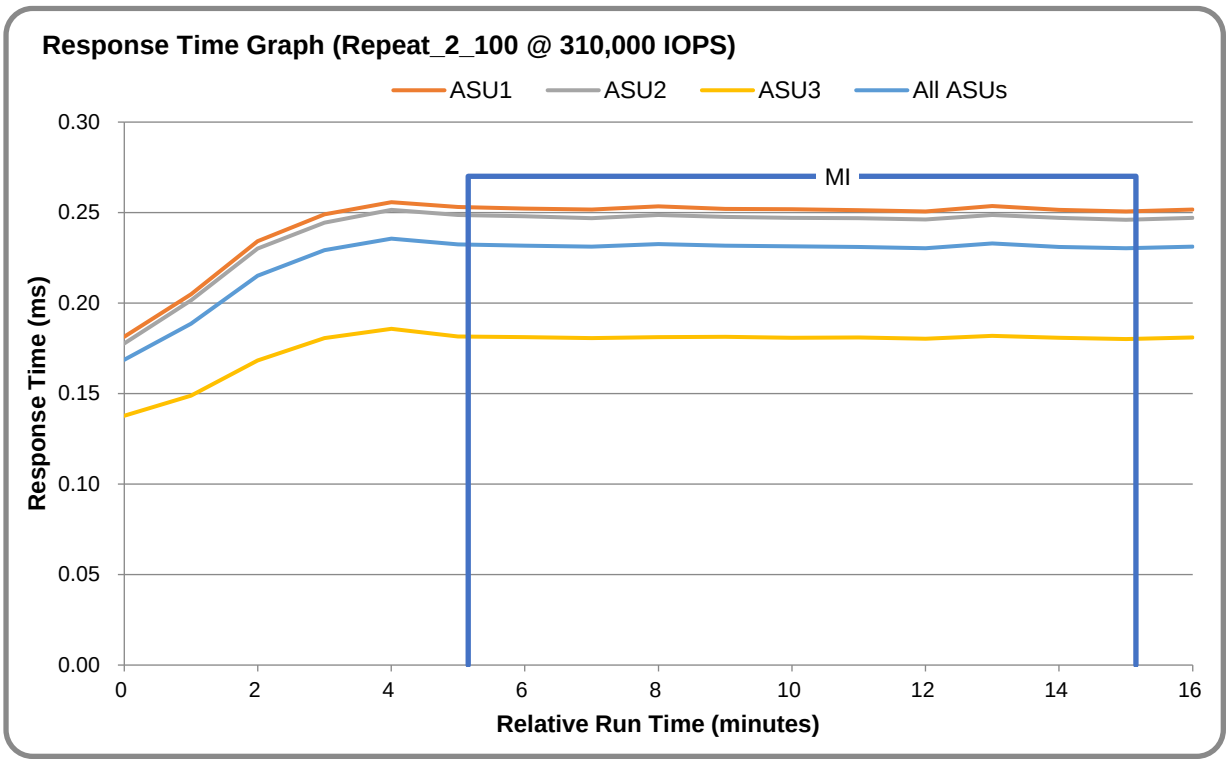
REPEAT_1_100 – Response Time Graph



REPEAT_2_100 – Throughput Graph



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	0.0010	0.0003	0.0005	0.0006	0.0021	0.0009	0.0014	0.0003
Difference	0.048%	0.005%	0.009%	0.014%	0.001%	0.006%	0.062%	0.004%

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	0.0012	0.0002	0.0010	0.0002	0.0010	0.0005	0.0012	0.0003
Difference	0.012%	0.011%	0.007%	0.014%	0.032%	0.018%	0.073%	0.011%

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	63,708,869
Total Number of Logical Blocks Verified	33,584,616
Total Number of Logical Blocks Overwritten	30,124,253
Total Number of Logical Blocks that Failed Verification	0
Time Duration for Writing Test Logical Blocks (sec.)	600
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 tuning parameters	/C_Tuning
/D_Creation	**Storage configuration creation**	**root**
connect_nvme.sh	Connects NVMe; creates LVs	/D_Creation
mkraid.sh	Overprovision NVMe; create RAID volumes	/D_Creation
nvme-binding.sh	Creates NVMe/TCP targets	/D_Creation
/E_Inventory	**Configuration inventory**	**root**
get_tsc_config.sh	Collect configuration inventory	/E_Inventory
inventory_start.out	Storage inventory before INIT	/E_Inventory
inventory_end.out	Storage inventory restart	/E_Inventory
/F_Generator	**Workload generator**	**root**
1host.HST	Host configuration file	/F_generator
SPC1.asu	Define the LUNs hosting the ASUs	/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

gluesys

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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	2021년 11월 23일
유효기간	2022년 3월 3일
납품 가능일	발주일로부터 4주 이내

담당자	김유상 과장
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대표이사	박성순

견적 금액 : **$30,910.00 (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	1x Ampere Altra CPU, up to 80 Arm v8.2+ 64-bit CPU cores at up to 3.30 GHz with Sustained Turbo 64GB 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	**40,000.00**	**20,000.00**	**20,000.00**
2	Support & Maintenance	Premium Package 3-Year Support & Maintenance	1	**5,700.00**	**2,850.00**	**2,850.00**
3	DATA Disk	INTEL SSDPE2KE016T8	8	**10,000.00**	**5,500.00**	**5,500.00**
4	I/B Cable	MCP1600-E002 IB EDR Cable	2	**180.00**	**360.00**	**360.00**
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	2	**1,100.00**	**2,200.00**	**2,200.00**
				공급가		**30,910.00**
				부가가치세		
				총합계		**30,910.00**

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 operating system parameters on the host system. This script is included below as well as in the Supporting Files (see Appendix A).

set_host_kernel_parameters.sh

```
#!/bin/sh

# OS configuration setup (SPC-1 Users' Guide)
cat /proc/sys/fs/epoll/max_user_watches >> /proc/sys/fs/aio-max-nr
source ulimit -n 1000
source ulimit -s unlimited

echo 3 > /proc/sys/vm/drop_caches

# systemctl stop irqbalance
# systemctl disable irqbalance

# CPU Governor setup
for i in `seq 0 35`
do
        echo performance > /sys/devices/system/cpu/cpu$i/cpufreq/scaling_governor
done

# Queue setup
devs=$(ls /sys/block/nvme*n1/device/model | awk -F '/' '{print $4}')

for dev in $devs;
do
        #devices configuration setup
        echo 128 > /sys/block/$dev/queue/nr_requests #128 is the max size
        echo 'none' > /sys/block/$dev/queue/scheduler
        echo 2 > /sys/block/$dev/queue/nomerges
        echo 0 > /sys/block/$dev/queue/add_random
        echo 1 > /sys/block/$dev/queue/rq_affinity

        cat /sys/block/$dev/queue/nr_requests
        cat /sys/block/$dev/queue/scheduler
        cat /sys/block/$dev/queue/nomerges
        cat /sys/block/$dev/queue/add_random
        cat /sys/block/$dev/queue/rq_affinity
done
```

APPENDIX D: STORAGE CONFIGURATION CREATION

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
nvme_over_provision () {
   for num in $(seq 0 7)
   do
      echo OverProvision 30% /dev/nvme${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${num} -nsze 0x8bc00000  -ncap 0x8bc00000 -flbas 0 -dps 0 -nmic 0
      nvme attach-ns /dev/nvme${num} -namespace-id=1 -controllers=0
      nvme reset /dev/nvme${num}
   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
}

# Main Start
nvme_over_provision
mkraid
```

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

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

nvme-binding.sh

```
#!/bin/bash

# Load nvmet kernel driver Function
load_nvmet () {
   modprobe nvme
   modprobe nvme-tcp
   modprobe nvmet
}

# Bind nvmet target Function
bind_md_nvmet () {

   mkdir -p /sys/kernel/config/nvmet/ports/1
   echo "ipv4" > /sys/kernel/config/nvmet/ports/1/addr_adrfam
   echo "tcp" > /sys/kernel/config/nvmet/ports/1/addr_trtype
   echo 12.12.12.11 > /sys/kernel/config/nvmet/ports/1/addr_traddr
   echo 4220 > /sys/kernel/config/nvmet/ports/1/addr_trsvcid

   for vol in `seq 124 127`
   do
      echo add /dev/md${vol} to nvmetcp
      mkdir -p /sys/kernel/config/nvmet/subsystems/spc-${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
}

# Main Start
load_nvmet
bind_md_nvmet
```

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

The **connect_nvme.sh** script on the host system discovers and connects NVMe/TCP targets, and create 20 Logical Volumes for ASUs.

connect_nvme.sh

```
#!/bin/sh

# nvme discover & connect & volume info update
nvme_connect () {
	for subnqn in `nvme discover -t tcp -a 12.12.12.11 -s 4220 | \
				grep subnqn | cut -d":" -f2 | cut -d "-" -f2 | sort -h`
	do
	nvme connect -t tcp -n spc-${subnqn} -a 12.12.12.11 -s 4220
	done
	sleep 1 && nvme list
	vgscan && vgchange -ay
}

# Test Volume Create Function
make_vol () {
	pvcreate /dev/nvme0n1 /dev/nvme1n1 /dev/nvme2n1 /dev/nvme3n1
	vgcreate LD /dev/nvme0n1 /dev/nvme1n1 /dev/nvme2n1 /dev/nvme3n1

	for vol in `seq 0 19`
	do
	lvcreate -l57212 -i4 -I512 -nvol${vol} LD
	done
}

# Main Start
nvme_connect
#make_vol
```

APPENDIX E: CONFIGURATION INVENTORY

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

- inventory_start.out
- inventory_end.out

These files are included in the Support Files (see Appendix A).

APPENDIX F: WORKLOAD GENERATOR

The ASUs accessed by the SPC-1 workload generator are defined in SPC1.asu. 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 Support Files (see Appendix A).