



SPC BENCHMARK 1™

FULL DISCLOSURE REPORT

INSPUR ELECTRONIC INFORMATION INDUSTRY CO. INC.
INSPUR AS5300G5

SPC-1 v3.9.1

SUBMISSION IDENTIFIER: A32017

SUBMITTED FOR REVIEW: SEPTEMBER 3, 2020

First Edition – September 2020

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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.

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AUDIT CERTIFICATION



Hao Sun
Inspur Electronic Information Industry Co. Ltd.
NO.1036, Inspur Road, Jinan
People's Republic of China

September 2, 2020

I verified the SPC Benchmark 1™ (SPC-1™ v3.9.1) test execution and performance results of the following Tested Storage Product:

Inspur AS5300G5

The results were:

SPC-1 IOPS™	2,710,243
SPC-1 Price-Performance	\$226.99/SPC-1 KIOPS™
SPC-1 Total System Price	615,192.25
SPC-1 IOPS Response Time	0.547 ms
SPC-1 Overall Response Time	0.251 ms
SPC-1 ASU Capacity	68,719 GB
SPC-1 ASU Price	\$8.96/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 v3.0.2-1-g823a. 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 Inspur Electronic Information Industry Co. Inc., 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 Inspur Electronic Information Industry Co. Inc., and can be found at www.spcresults.org under the Submission Identifier A32017.

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

A32017

Inspur AS5300G5

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

- The physical capacity of the data repository (192,000 GB).
- The total capacity of the Application Storage Unit (68,719 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:

The SPC-1 data reduction tool sometimes exhibits a minor anomaly when grouping operations into the 1-minute buckets used when calculating and reporting statistics. As a by-product of this anomaly, minor differences (all less than 0.01%) exist between some of the values reported in the FDR and the corresponding values in the workbooks provided in the Supporting Files. In my opinion, this has no impact on the integrity of the result.

Respectfully Yours,



Doug Johnson, Certified SPC Auditor

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LETTER OF GOOD FAITH

September 2, 2020


To: Doug Johnson, SPC Auditor
PerfLabs, Inc. DBA InfoSizing
63 Lourdes Drive
Leominster, MA 01453-6709
USA

Subject: SPC-1 Letter of Good Faith for the AS5300G5

Inspur Electronic Information Industry Co. Ltd is the SPC-1 test sponsor for the above listed product. To the best of our knowledge and belief, the required SPC-1 results and materials we have submitted for that product are complete, accurate, and in full compliance with version 3.9 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.

Sincerely,


Henry Li
GM of Storage Product Department
Inspur Electronic Information Industry Co. Ltd.


Date: September 2, 2020

Inspur AS5300G5

SPC-1 IOPS™	2,710,243	SPC-1 Price Performance	\$226.99/SPC-1 KIOPS™
SPC-1 IOPS Response Time	0.547 ms	SPC-1 Total System Price	\$615,192.25
SPC-1 Overall Response Time	0.251 ms	SPC-1 Overall Discount	73.46%

Currency / Target Country: USD / China
Availability Date: August 31, 2020

Extensions

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

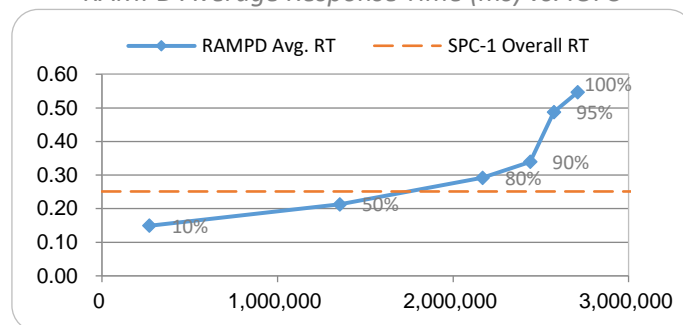
Storage Metrics

SPC-1 Data Protection Level	Protected 2
SPC-1 Physical Storage Capacity	192,000 GB
SPC-1 ASU Capacity	68,719 GB
SPC-1 ASU Price	\$8.96/GB

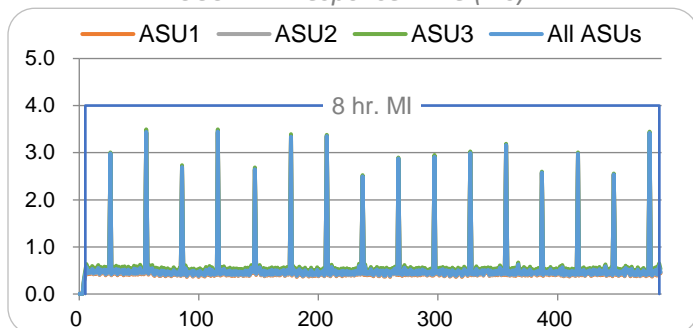
Priced Storage Configuration Summary

- 16 Emulex LPe16002 2-port FC HBAs
- 4 Inspur AS5300G5 Enclosures
- 8 Controllers (2 per Enclosure)
- 1,024 GB Total Cache
- 64 16Gb FC Ports (48 ports used)
- 200 960 GB SSDs
- 2 FS6700 16 Gb FC Switches
- 18 Total RUs

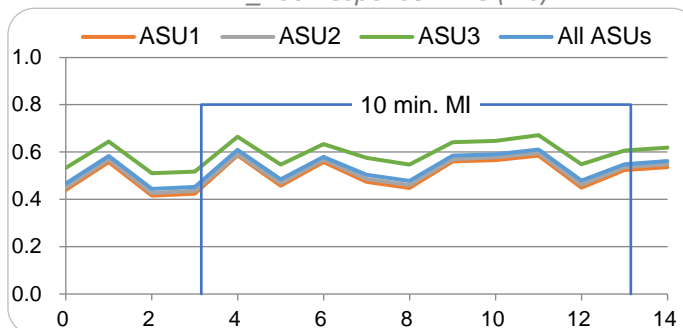
RAMPD Average Response Time (ms) vs. IOPS



SUSTAIN Response Time (ms)



RAMPD_100 Response Time (ms)



PRICING DETAILS

Part No.	Description	Source	Qty	Unit Price	Ext. Price	Disc.	Disc. Price
Hardware & Software							
UAS5300G5001	Inspur AS5300G5 Storage System Base Unit (2U,Dual Controllers,25*2.5",BBU+Flash,3Y 5x10xND Basic Svc&Warranty)	1	4	30,124.93	120,499.72	70%	36,149.92
TMO053	Inspur AS5300G5 Cache Module-256GB	1	4	1,937.68	7,750.72	68%	2,480.24
THD068	Inspur 960GB TLC SSD Enterprise Drive(2.5"), For AS5300G5 J012HG5、J025SG5、J048HG5	1	200	7,421.21	1,484,242.00	75%	371,060.50
UJ025SG50001	Inspur J025SG5 JBOD (2U, 25*2.5" disks)	1	4	9,899.72	39,598.88	70%	11,879.67
TSJ160	Inspur AS5300G5 4*16Gbps FC Ports +SFP	1	16	9,498.57	151,977.12	70%	45,593.14
THS530	Inspur AS5300G5 Basic Software(InThin,InSnapshot,InClone,InBackup, InVdiskMirror,InQos,InRAID,InPath)	1	4	2,847.86	11,391.44	90%	1,139.15
TWF003	Inspur 3M LC-LC OM4 Fibre Channel Cable	1	80	28.66	2,292.80	70%	687.84
TSJ203	Inspur 2*Port 16Gbps Fibre Channel Adapter	1	16	5,114.62	81,833.92	70%	24,550.18
500326	Inspur FS6700 SAN switch, Enable 16Gbps*48 Ports,+SFP	1	2	206,303.73	412,607.46	72%	115,530.09
Hardware & Software Subtotal							609,070.73
Support & Maintenance							
F2HII04	Installation Service - Engineering	1	4	1,027.94	4,111.76	0%	4,111.76
F2GD0030AS53G525	Upgrade TO Onsite Premier 24x7x4H Engineer Onsite Service - 36Month(s)	1	4	502.44	2,009.76	0%	2,009.76
Support & Maintenance Subtotal							6,121.52
SPC-1 Total System Price							
SPC-1 IOPS™							2,710,243
SPC-1 Price-Performance™ (\$/SPC-1 KIOPS™)							226.99
SPC-1 ASU Capacity (GB)							68,719
SPC-1 ASU Price (\$/GB)							8.96

Discount Details: The discounts are based on the total purchase price.

Warranty: Provides 7x24x4H arrival service within designated city and distance. The service includes 7x24 contact to the Inspur call center with 4-hours on-site hardware replacement or troubleshooting, and online software support with access to all new software updates or troubleshooting.

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	Inspur Electronic Information Industry Co. Inc. Hao Sun	http://en.inspur.com/ sunhaobj@inspur.com
SPC Auditor	InfoSizing Doug Johnson	www.sizing.com doug@sizing.com

Revision Information

Date	FDR Revision	Details
September 3, 2020	First Edition	Initial Publication

Exceptions and Waivers

The SPC-1 data reduction tool sometimes exhibits a minor anomaly when grouping operations into the 1-minute buckets used when calculating and reporting statistics. As a by-product of this anomaly, minor differences (all less than 0.01%) exist between some of the values reported in this FDR and the corresponding values in the workbooks provided in the Supporting Files.

CONFIGURATION INFORMATION

Tested Storage Product Description

Inspur AS5300G5 is a mid-end hybrid flash storage system for medium/large-sized enterprises and provides both SAN and NAS. With the storage operating system especially developed for cloud computing and big data, rich software features, and industry-leading hardware platform, AS5300G5 satisfies the data storage and disaster recovery requirement of various applications, such as medium/large-sized OLTP/OLAP databases, virtualization and file sharing.

Host System and Tested Storage Configuration Components

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

Host Systems
8 x Inspur NF5280M5, each with: 2 x Intel® Xeon® 6132 CPU (2.6 GHz, 14-Core, 20 MB L3) 128 GB Main Memory Red Hat Enterprise Linux 7.4
Tested Storage Configuration
16 x Emulex LPe16002 2-port FC HBAs
4 x Inspur AS5300G5 Enclosures, each with: 2 x Storage Controller 128 GB cache (1,024 GB total) 2 x 4-port 16 Gbps FC I/O modules (48 ports used) 1 x 4-port 12 Gb SAS I/O module 200 x 960 GB SSDs (25 per enclosure)
2 x INSPUR FS6700 16 Gb FC Switches

Component Changes in Revised Full Disclosure Report

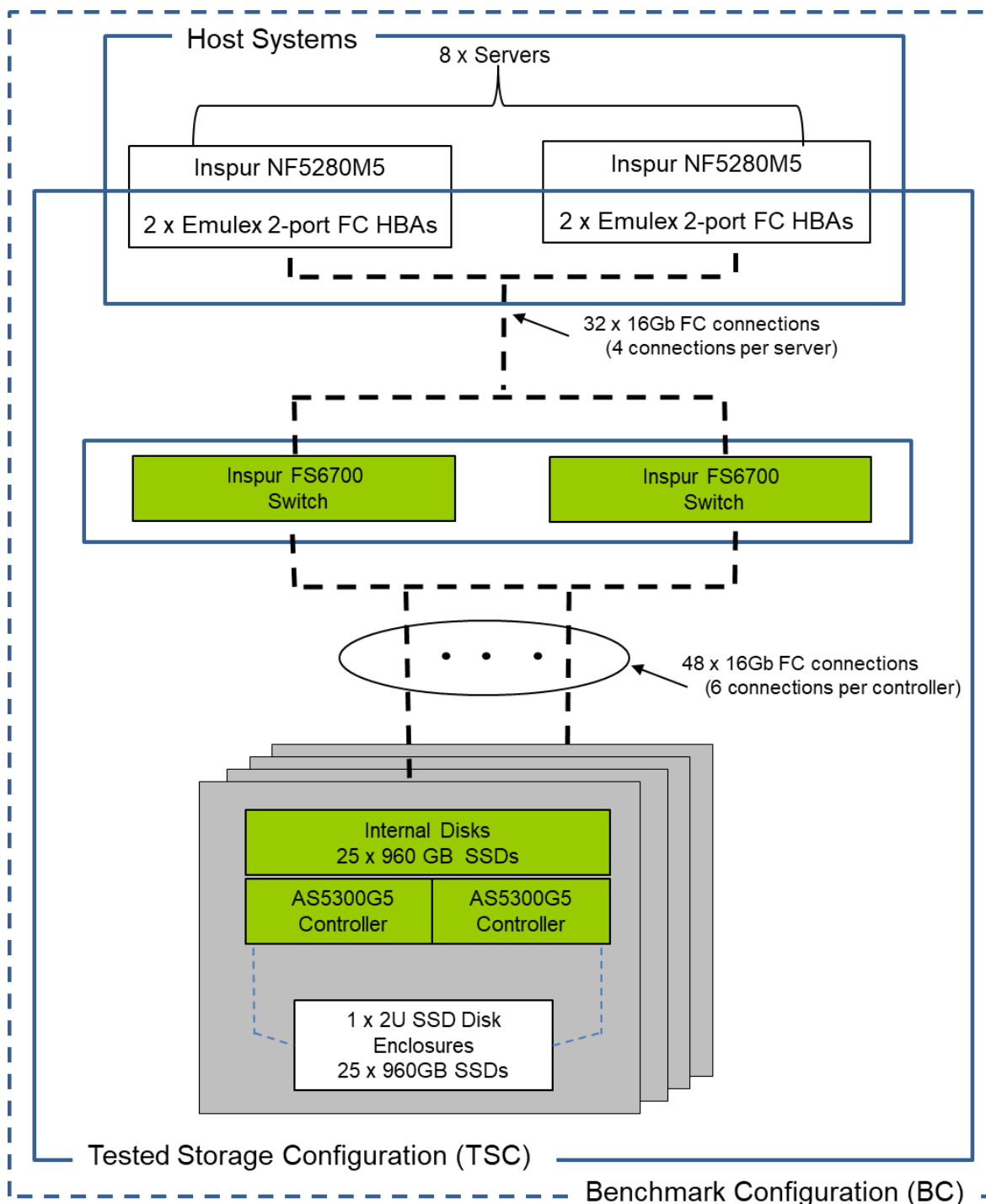
The following table outlines component changes that were made in revisions to this Full Disclosure Report.

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 TSC utilized an external storage subsystem consisting of eight Inspur AS5300G5 controllers driven by eight host systems (Inspur NF5280M5). Each NF5280M5 host system utilized two dual-port Fibre Channel HBAs to establish four connections to the FS6700 switches. Each HBA had one connection to each of the two switches. The AS5300G5 controllers were grouped in sets of two, forming four Inspur AS5300G5 Controller Enclosures. Each AS5300G5 controller had six connections to the FS6700 switches (three connections per switch). All Fibre Channel paths operated at 16 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	18	1,717.9	1,717.9	30,923.7	45.0%	No
ASU-2	18	1,717.9	1,717.9	30,923.7	45.0%	No
ASU-3	4	1,717.9	1,717.9	6,871.9	10.0%	No
SPC-1 ASU Capacity				68,719	*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
SSD	200	960.0	192,000.0
Total Physical Capacity			192,000
Physical Capacity Utilization			35.79%

Data Protection

The data protection level used for all LVs was **Protected 2 (RAID-10)**, which was accomplished by configuring 80 LUNs over four storage pools comprising 16 RAID-10 arrays.

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.

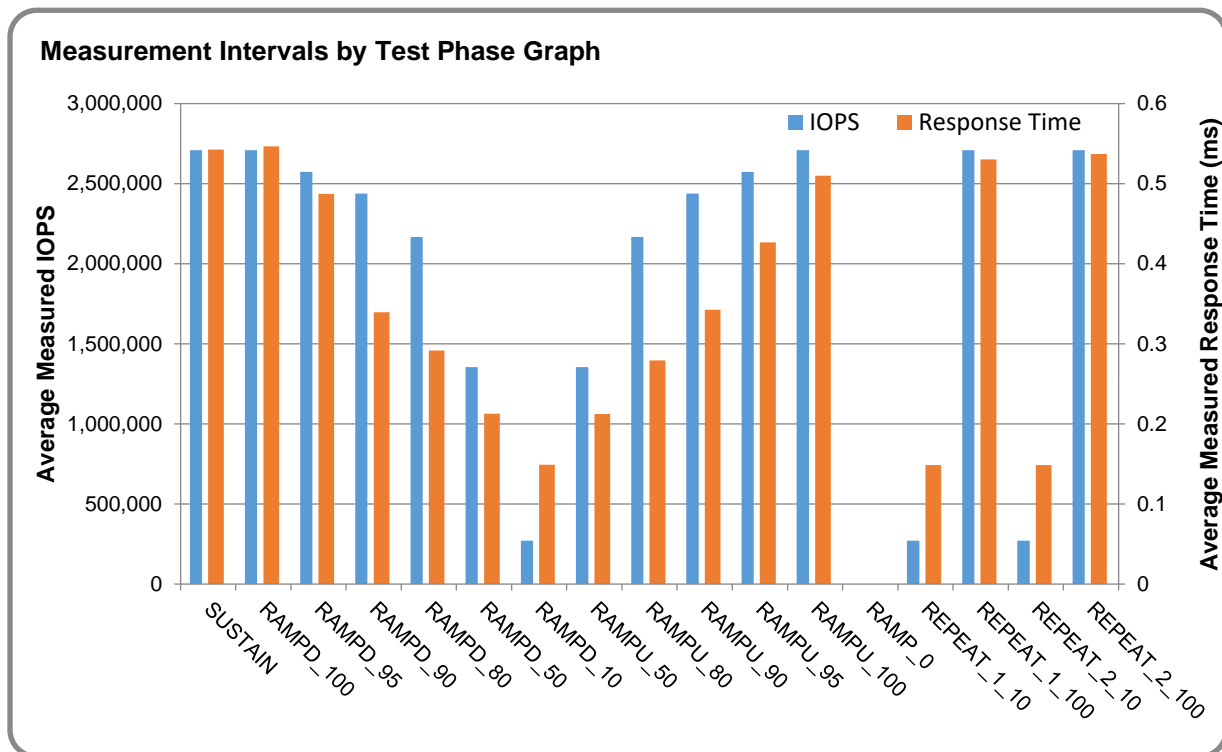
Benchmark Execution Overview

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).

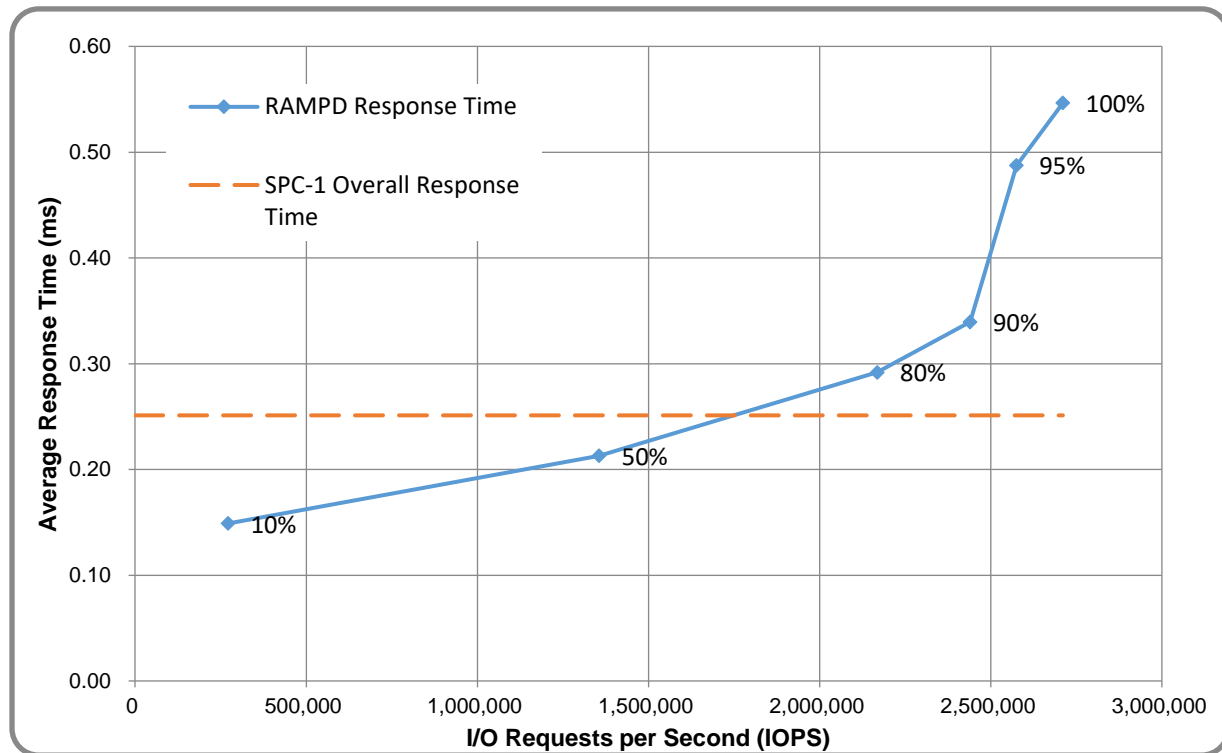
Measurement Intervals by Test Phase Graph

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-Aug-20 07:27:19	Requested IOP Level	10,000 MB/sec
End Time	08-Aug-20 09:19:15	Observed IOP Level	10,232 MB/sec
Duration	1:51:56	For additional details see the Supporting Files.	

SUSTAIN Test Phase

SUSTAIN – Results File

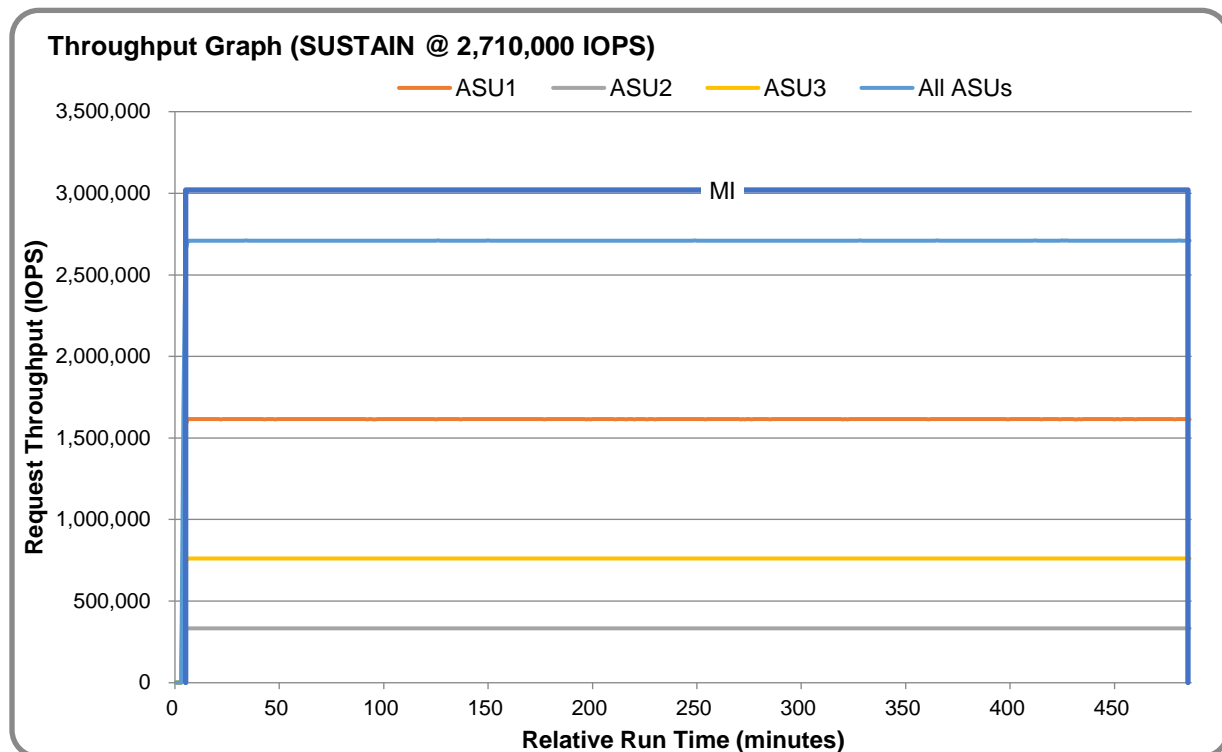
The results file generated during the execution of the SUSTAIN Test Phase is included in the Supporting Files (see Appendix A) as follows:

- SPC1_METRICS_0_Raw_Results.xlsx

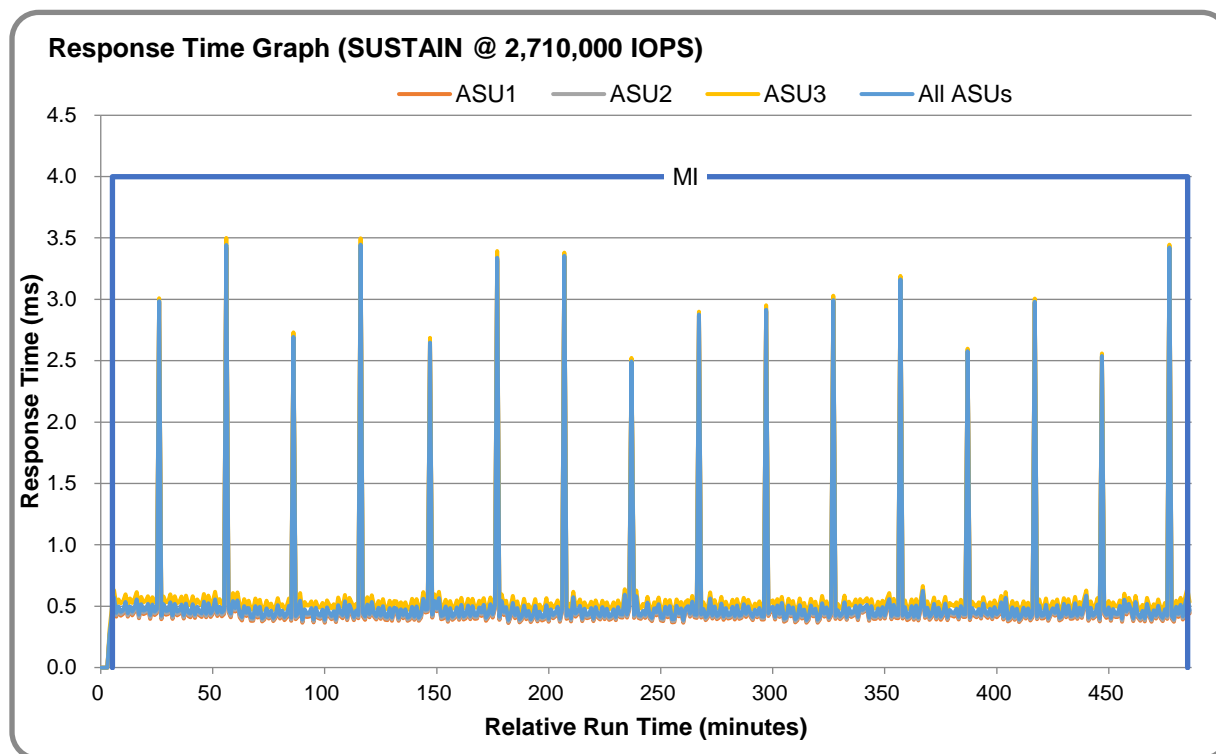
SUSTAIN – Execution Times

Interval	Start Date & Time	End Date & Time	Duration
Transition Period	08-Aug-20 09:27:56	08-Aug-20 09:30:56	0:03:00
Measurement Interval	08-Aug-20 09:30:56	08-Aug-20 17:30:57	8:00:01

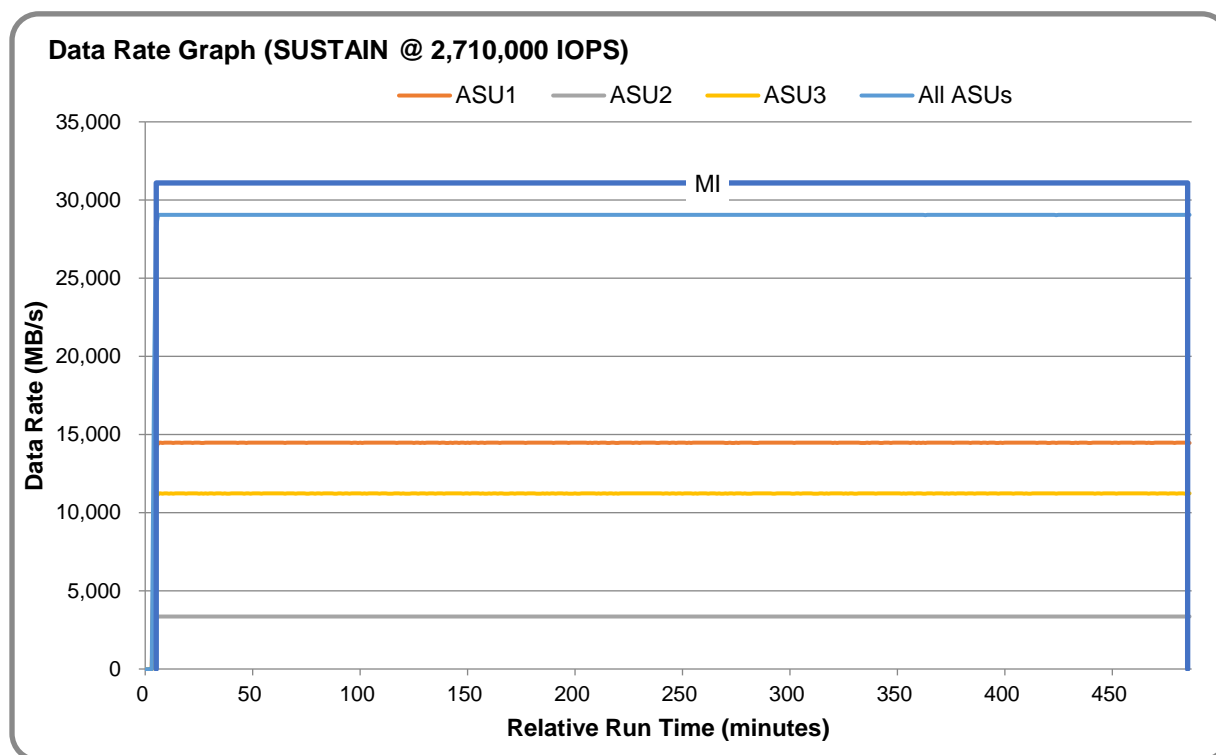
SUSTAIN – Throughput Graph



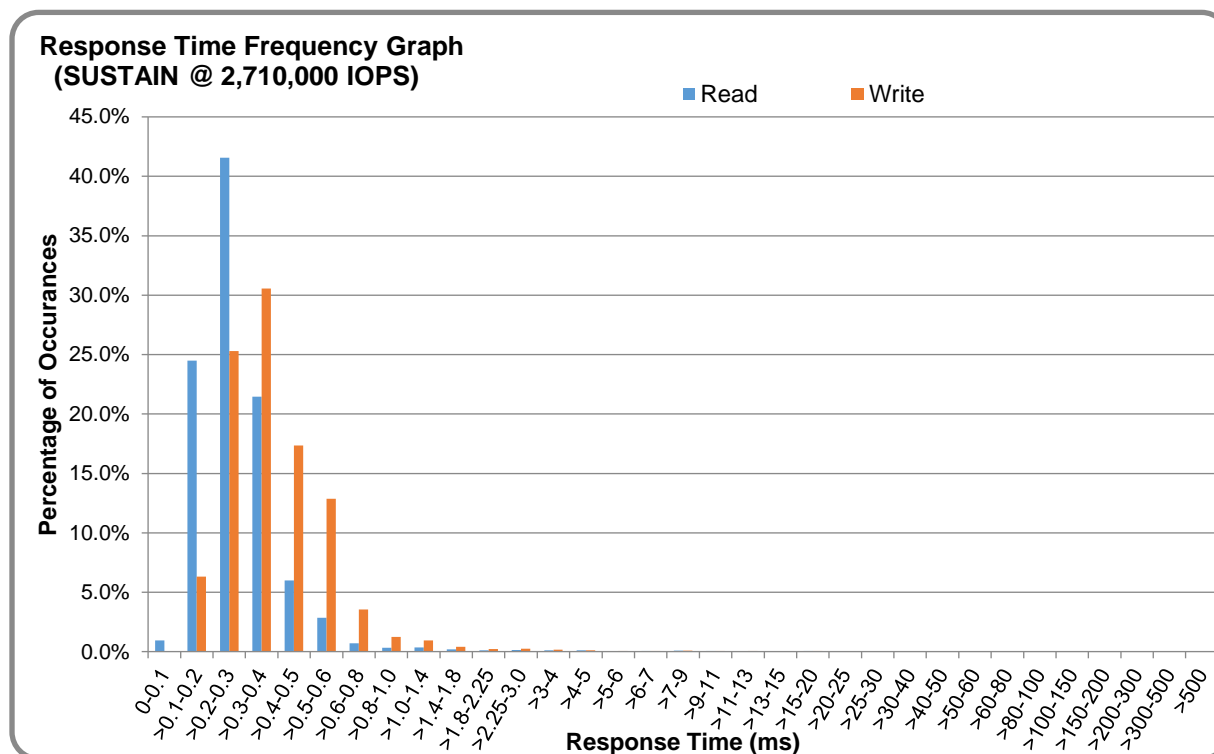
SUSTAIN – Response Time Graph



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	0.0004	0.0001	0.0003	0.0001	0.0006	0.0003	0.0004	0.0001
Difference	0.004%	0.002%	0.003%	0.000%	0.011%	0.005%	0.004%	0.002%

RAMPD_100 Test Phase

RAMPD 100 – Results File

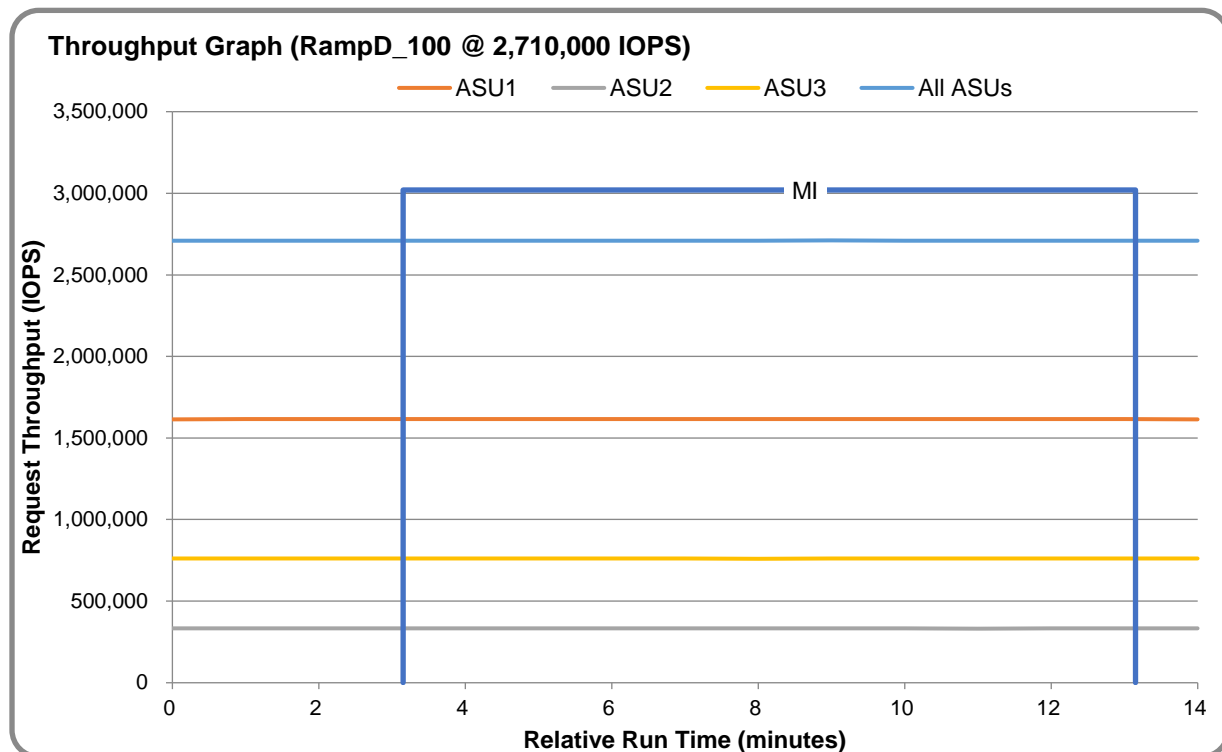
The results file generated during the execution of the RAMPD_100 Test Phase is included in the Supporting Files (see Appendix A) as follows:

- SPC1_METRICS_0_Raw_Results.xlsx

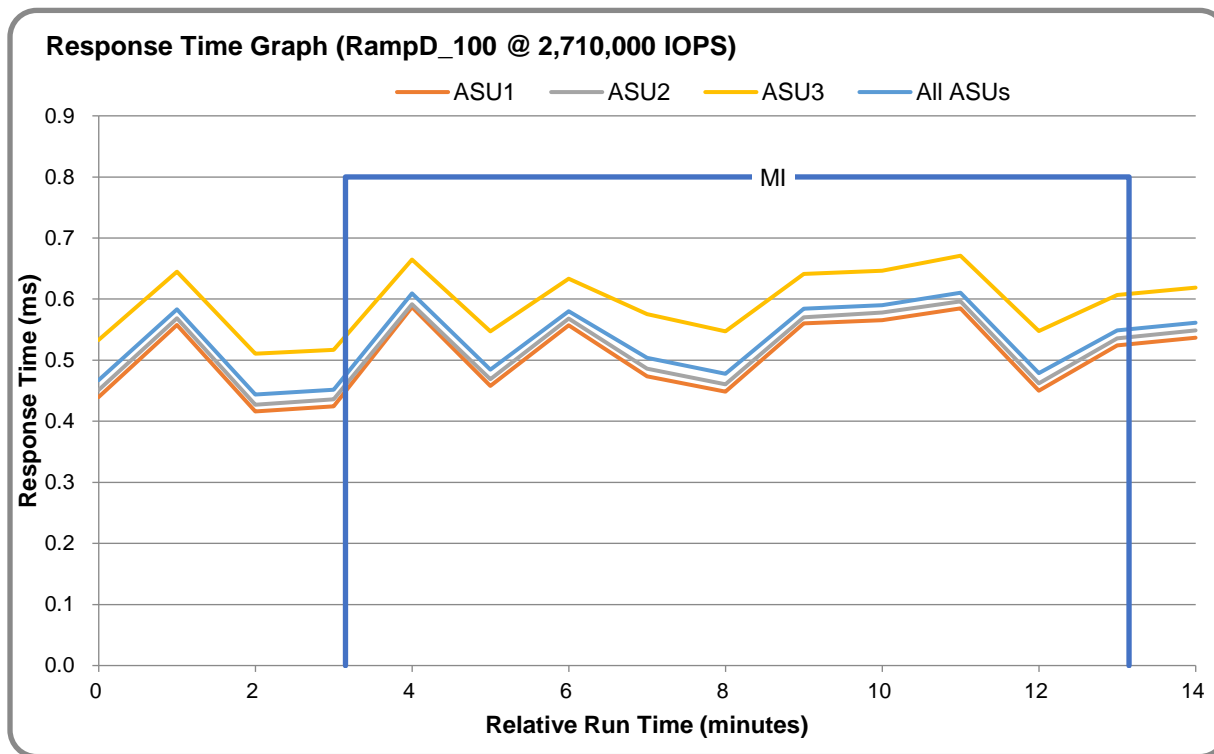
RAMPD 100 – Execution Times

Interval	Start Date & Time	End Date & Time	Duration
Transition Period	08-Aug-20 17:31:56	08-Aug-20 17:34:57	0:03:01
Measurement Interval	08-Aug-20 17:34:57	08-Aug-20 17:44:57	0:10:00

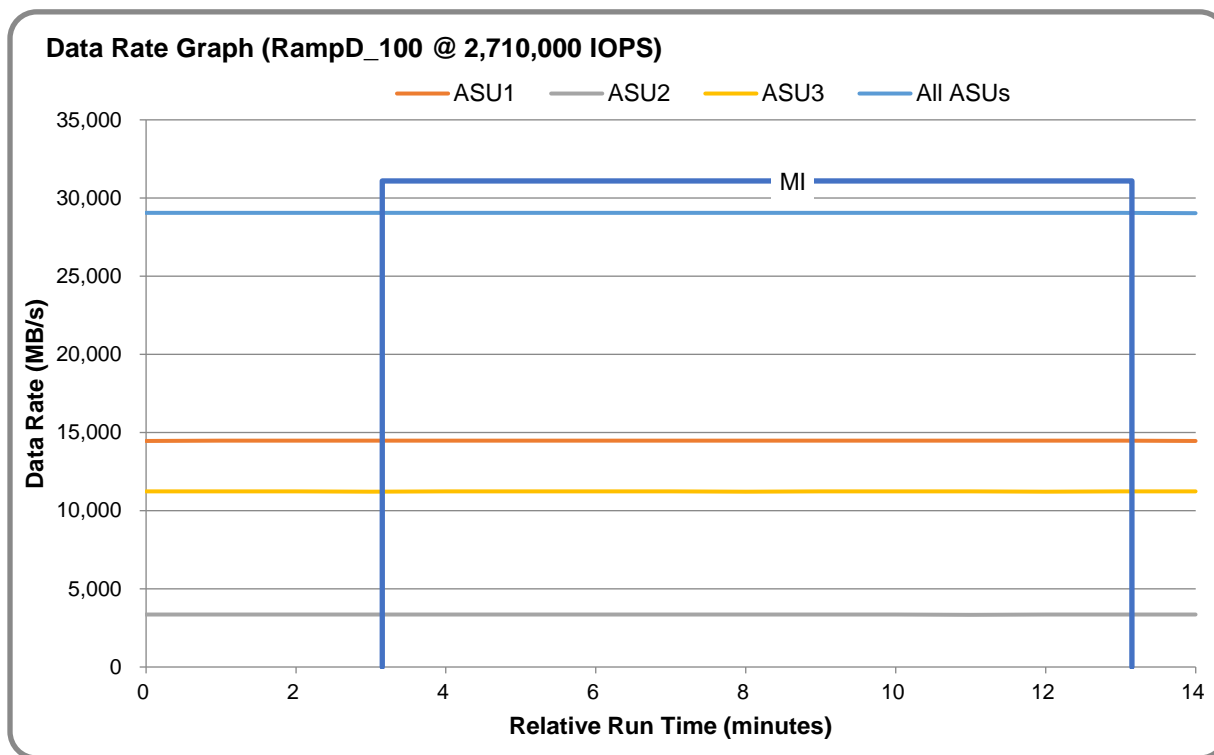
RAMPD 100 – Throughput Graph



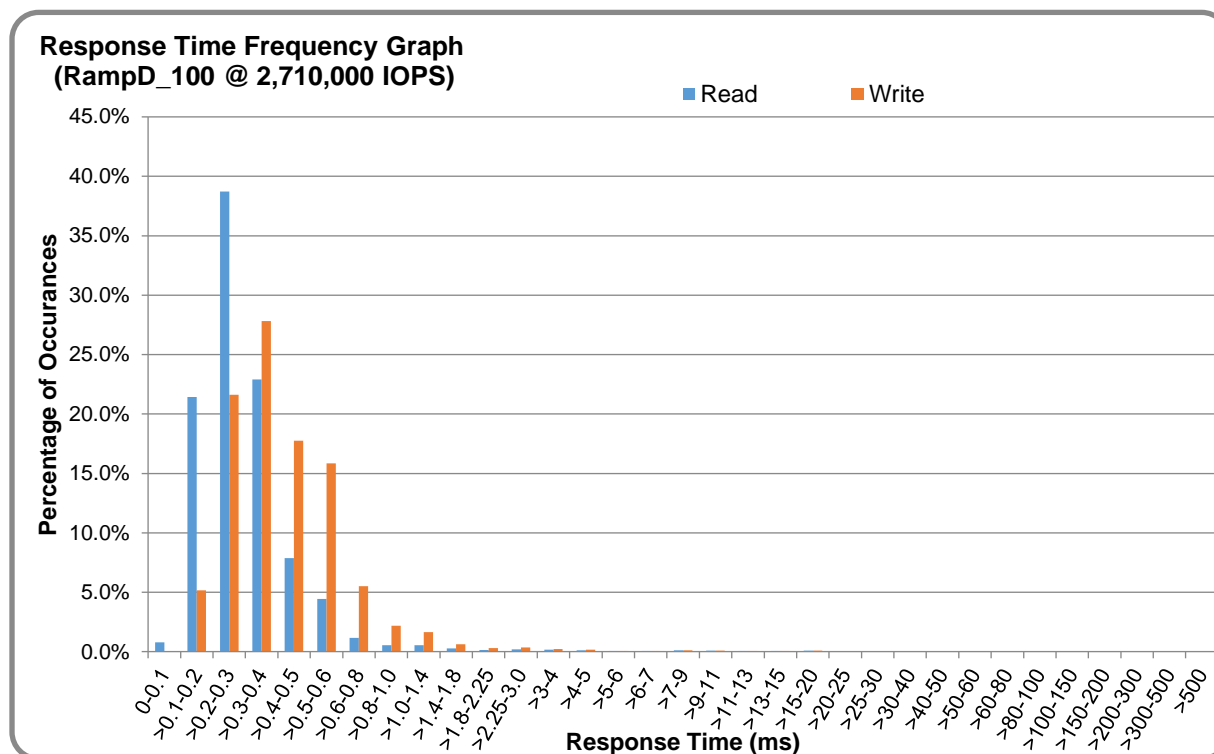
RAMPD 100 – Response Time Graph



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	0.0003	0.0001	0.0003	0.0002	0.0007	0.0003	0.0005	0.0001
Difference	0.019%	0.003%	0.009%	0.007%	0.009%	0.005%	0.000%	0.002%

RAMPD 100 – I/O Request Summary

I/O Requests Completed in the Measurement Interval	1,626,128,728
I/O Requests Completed with Response Time <= 30 ms	1,624,583,469
I/O Requests Completed with Response Time > 30 ms	1,545,259

Response Time Ramp Test

Response Time Ramp Test – Results File

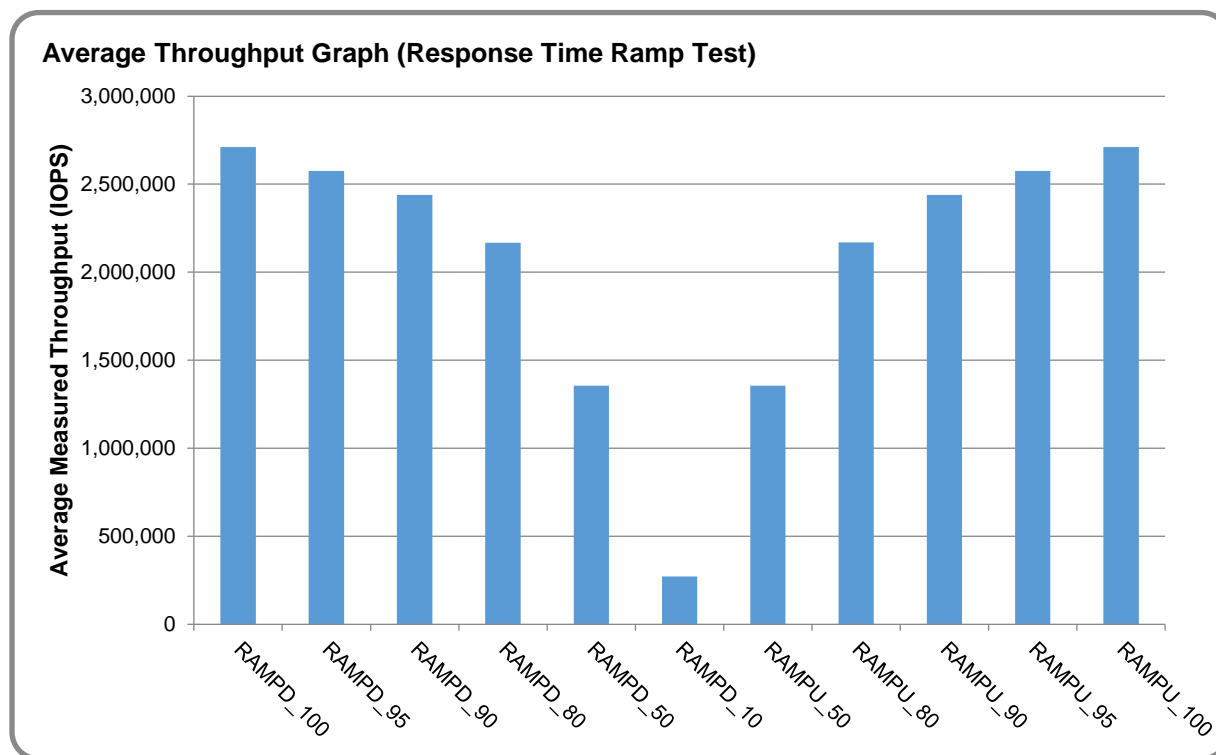
The results file generated during the execution of the Response Time Ramp Test is included in the Supporting Files (see Appendix A) as follows:

- **SPC1_METRICS_0_Raw_Results.xlsx**

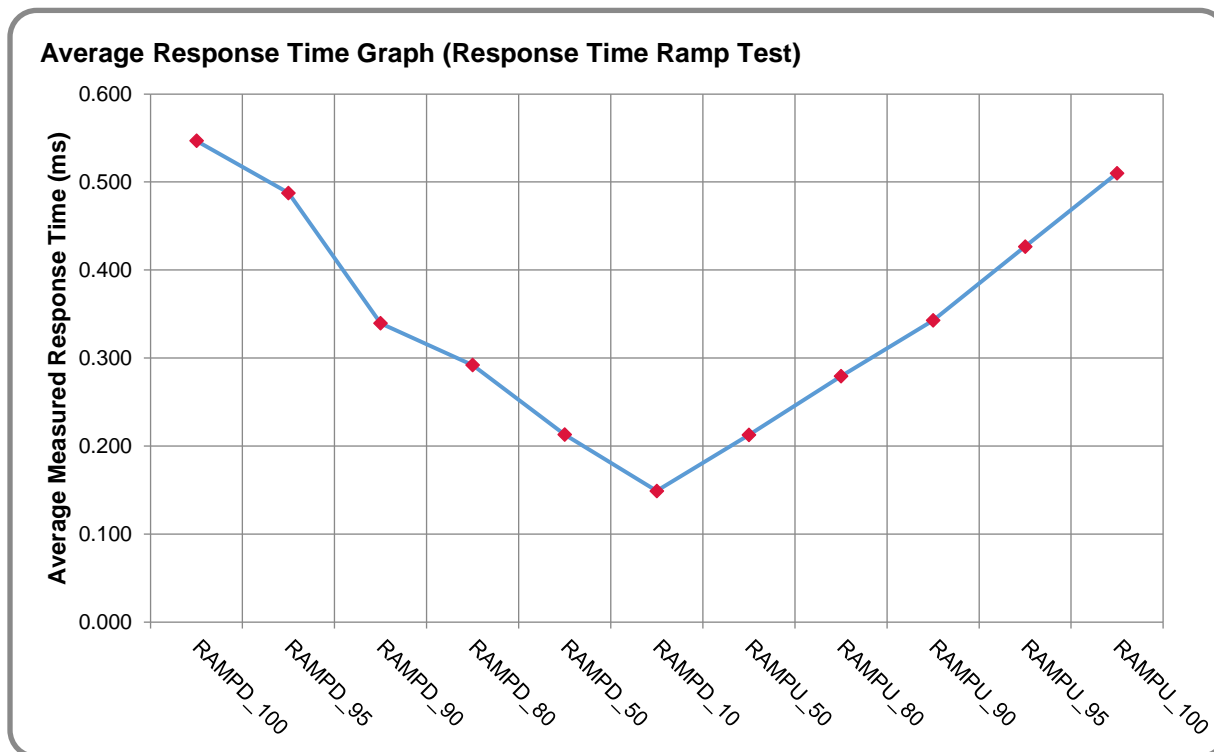
Response Time Ramp Test – Phases

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).

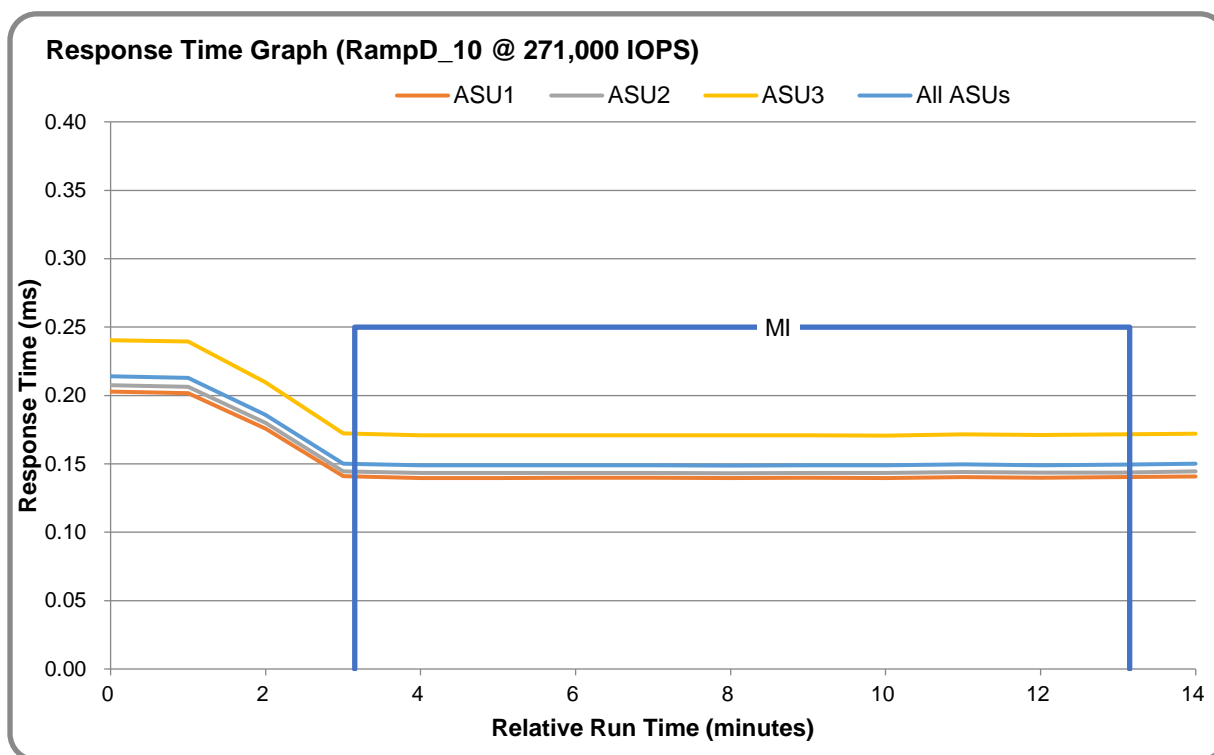
Response Time Ramp Test – Average Throughput Graph



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:

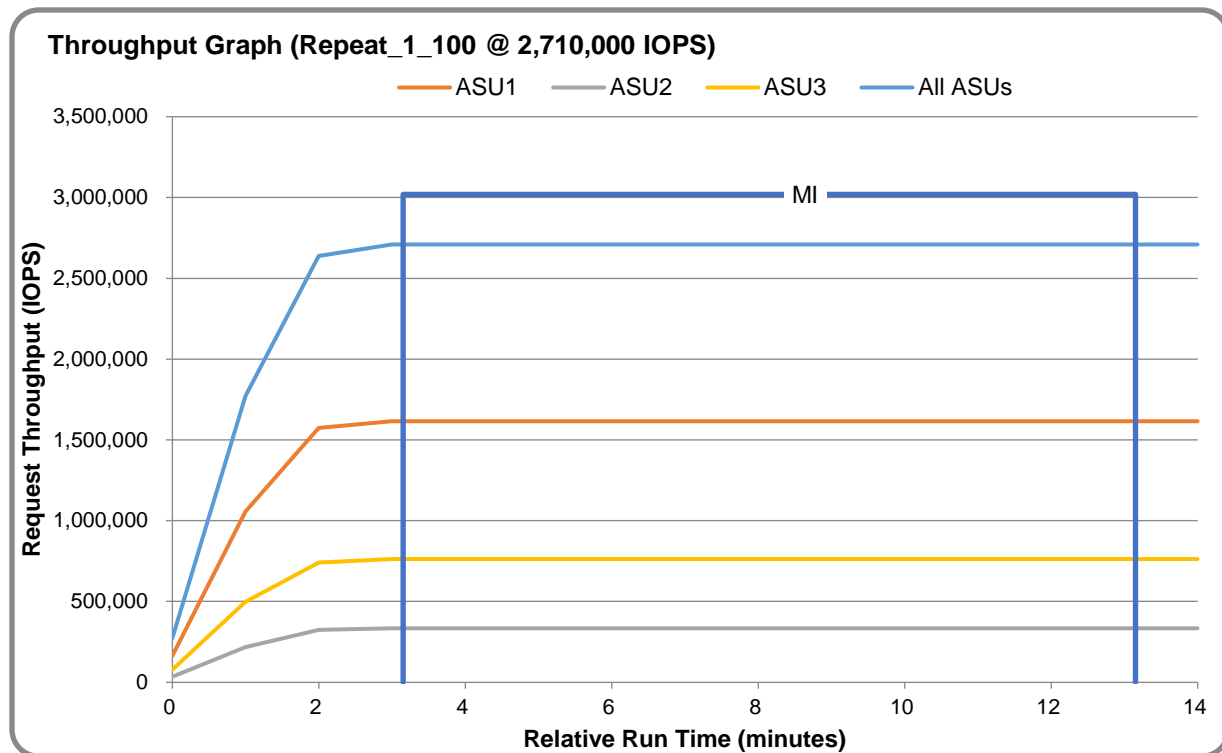
- **SPC1_METRICS_0_Raw_Results.xlsx**

Repeatability Test Results

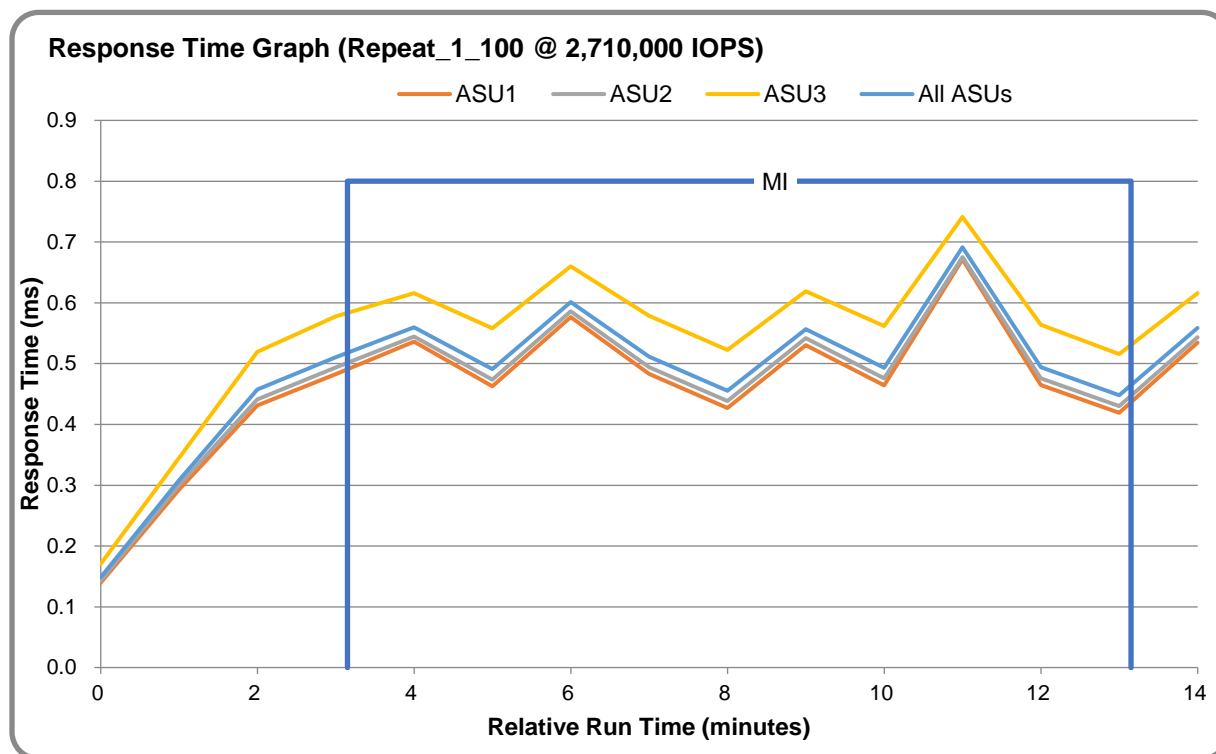
The throughput measurements for the Response Time Ramp Test (RAMPD) and the Repeatability Test Phases (REPEAT_1 and REPEAT_2) are listed in the table below.

Test Phase	100% IOPS	10% IOPS
RAMPD	2,710,243.7	271,032.9
REPEAT_1	2,710,105.1	271,031.3
REPEAT_2	2,710,142.6	271,028.4

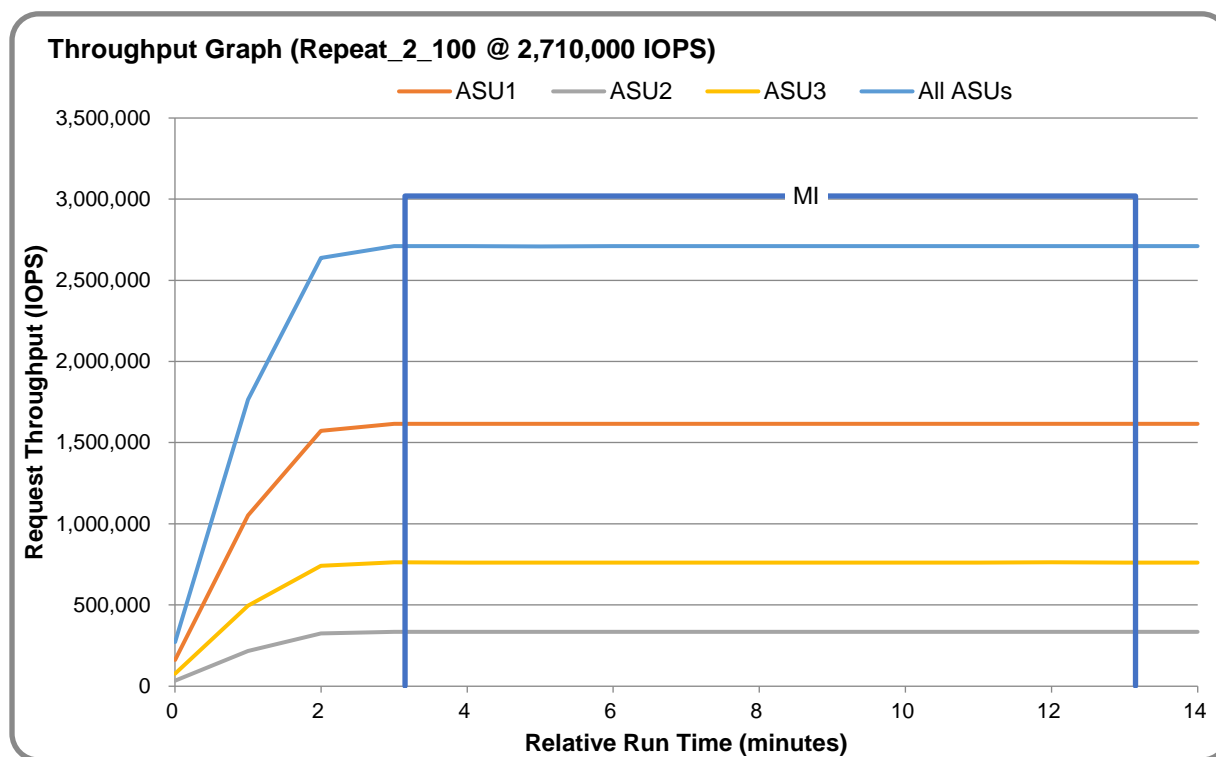
REPEAT 1 100 – Throughput Graph



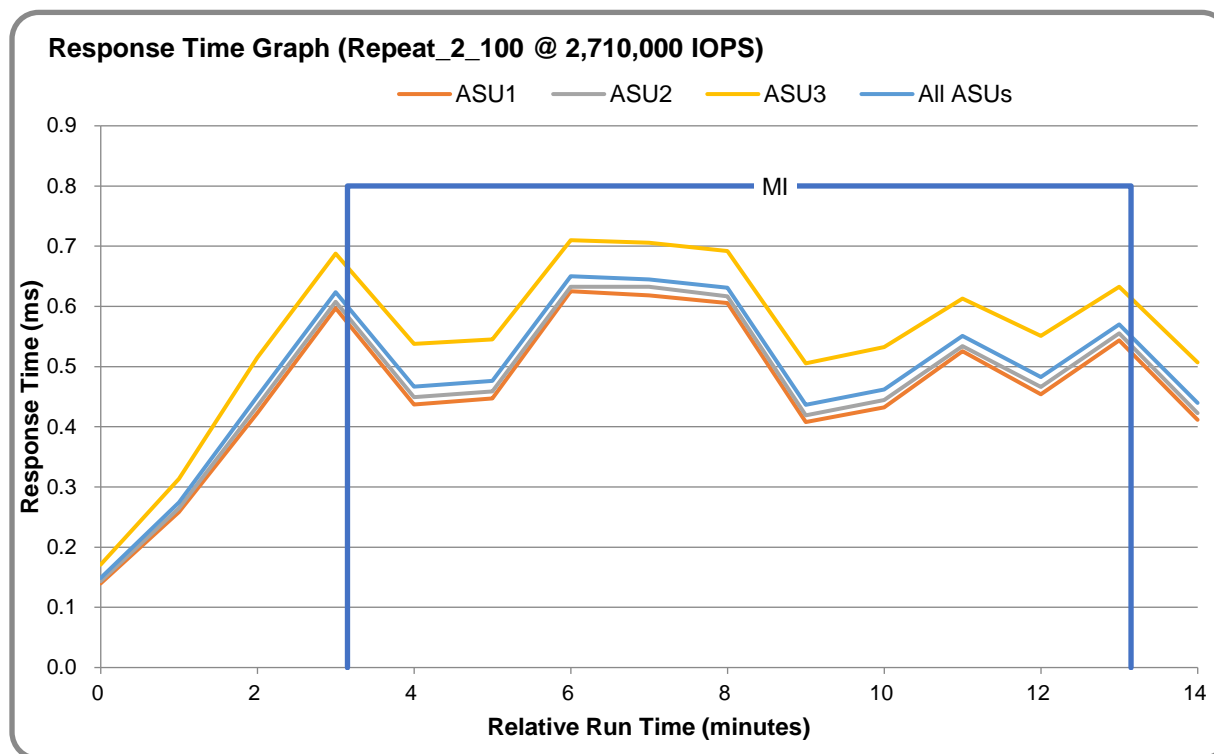
REPEAT 1 100 – Response Time Graph



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	0.0004	0.0001	0.0002	0.0001	0.0006	0.0002	0.0004	0.0001
Difference	0.018%	0.002%	0.001%	0.005%	0.007%	0.013%	0.011%	0.008%

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	0.0003	0.0001	0.0003	0.0002	0.0009	0.0003	0.0003	0.0001
Difference	0.008%	0.005%	0.024%	0.005%	0.019%	0.013%	0.010%	0.000%

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	575,342,776
Total Number of Logical Blocks Verified	284,518,946
Total Number of Logical Blocks Overwritten	290,823,830
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 TSC uses a BBU power-down protection mechanism. Each controller has two batteries and an SSD as the system disk. When an unexpected power-down occurs, the controller continues to be powered by the battery and refreshes the cache data to the SSD for permanent storage. When the power supply is restored, the data in the system disk SSD is automatically restored.

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_nr_requests.sh	Set queue depth, max AIO and scheduler	/C_Tuning
/D_Creation	Storage configuration creation	root
init_as5300G5.sh	Create Pools, RAIDs, LUNs, and Hosts	/D_Creation
lv_scan.sh	Scan and activate logical volumes	/D_Creation
lvm.sh	Create logical volumes	/D_Creation
vg.sh	Create volume groups	/D_Creation
/E_Inventory	Configuration inventory	root
profile.sh	Captures profile of storage environment	/E_Inventory
profile_end_as5300g5.txt	Storage configuration after restart	/E_Inventory
profile_start_as5300g5.txt	Storage configuration before INIT	/E_Inventory
volume_list.sh	Captures logical volume environment	/E_Inventory
volume_listing_end.txt	List of logical volumes after restart	/E_Inventory
volume_listing_start.txt	List of logical volumes before INIT	/E_Inventory
/F_Generator	Workload generator	root
full_test_before_persist.sh	Executes all test phases before PERSIST1	/F_generator
HOST8.HST	Host configuration file	/F_generator
SPC1.asu	Define LUNs hosting the ASUs	/F_generator
test_persist1.sh	Executes PERSIST1	/F_generator
test_persist2.sh	Executes PERSIST2	/F_generator

APPENDIX B: THIRD PARTY QUOTATION

All components are available directly through the Test Sponsor (Inspur Electronic Information Industry Co. Inc.).

APPENDIX C: TUNING PARAMETERS AND OPTIONS

Change the Scheduler on each Host System. Execute the set_nr_requests.sh script on each Host System to complete the following settings:

- Change the maximum number of AIO operations to 1048576.
- Change the nr_requests from 128 to 1024 on each Host System for each device.
- Change the I/O scheduler from cfq to noop on each Host System.

APPENDIX D: STORAGE CONFIGURATION CREATION

Step 1: Create Storage Pools, RAIDs, LUNs, Hosts, Mapping and deploy LUNs.

Execute the `init_as5300g5.sh` script on a remote server which can login on AS5300G5 storage system to complete the following:

1. Create 4 storage pools: Pool0,Pool1,Pool2,Pool3
2. Create 16 RAID10
3. Create 80 LUNs(20 LUN per Pool, 850 GB per LUN)
4. Create 8 Hosts in storage cluster
5. Add the FC port's WWPN to the 8 hosts (4 WWPNs per Host)
6. Map LUNs to the 8 Hosts

Step 2: Create Volumes on the Master Host System

Execute the `vg.sh` script on the Master Host System to create 2 VGs ,and the excute the `lvm.sh` script to create 40 logical volumes as follows:

In addition, the script will make each logical volume available (activate).

1. Create Physical Volumes

Create 80 physical volumes using the `pvccreate` command.

2. Create Volumes Groups

Create 2 volume groups (`spc1vg1` `spc1vg2`) using the `vgcreate` command as follows:

Create `spc1vg1` using 40 of 80 physical volumes,and create `spc1vg2` using 40 of 80 physical volumes

3. Create Logical Volumes

- Create 9 logical volumes ,every volume capacity is 1600 GB, on `spc1vg1` for ASU-1.
- Create 9 logical volumes ,every volume capacity is 1600 GB, on `spc1vg2` for ASU-1
- Create 9 logical volumes ,every volume capacity is 1600 GB, on `spc1vg1` for ASU-2.
- Create 9 logical volumes ,every volume capacity is 1600 GB, on `spc1vg2` for ASU-2.
- Create 2 logical volumes ,every volume capacity is 1600 GB, on `spc1vg1` for ASU-3.
- Create 2 logical volumes ,every volume capacity is 1600 GB, on `spc1vg2` for ASU-3.

Step 3: Change the Scheduler on each Host System.

1. Execute the `set_nr_requests.sh` script on each Host System to complete the following settings:

- Change the maximum number of AIO operations to 1048576
- Change the from 128 to 1024 on each Host System for each device.
- Change the I/O scheduler from `cfq` to `noop` on each Host System.

APPENDIX E: CONFIGURATION INVENTORY

An inventory of the configuration was collected by running the following scripts.

- profile.sh
- volume_list.sh

The following log files were generated by running the above scripts.

- profile_start_as5300g5.txt
- profile_end_as5300g5.txt
- volume_listing_start.txt
- volume_listing_end.txt

These files are all available in the Supporting Files (see Appendix A).

APPENDIX F: WORKLOAD GENERATOR

The ASUs accessed by the SPC-1 workload generator were defined using the script SPC1.ASU.

The hosts used to drive the SPC-1 workload were defined using the script HOST8.HST. The scripts used to execute the benchmark sequence were:

- full_run_before_persist.sh
- test_persist1.sh
- test_persist2.sh

These files are all available in the Supporting Files (see Appendix A).