



SPC BENCHMARK 1™
FULL DISCLOSURE REPORT

INSPUR ELECTRONIC INFORMATION INDUSTRY CO. INC.
INSPUR AS5500G5

SPC-1 V3.8.0

SUBMISSION IDENTIFIER: A32015

SUBMITTED FOR REVIEW: JUNE 17, 2020

First Edition – June 2020

THE INFORMATION CONTAINED IN THIS DOCUMENT IS DISTRIBUTED ON AN AS IS BASIS WITHOUT ANY WARRANTY EITHER EXPRESS OR IMPLIED. The use of this information or the implementation of any of these techniques is the customer's responsibility and depends on the customer's ability to evaluate and integrate them into the customer's operational environment. While each item has been reviewed by Inspur Electronic Information Industry Co. Inc. for accuracy in a specific situation, there is no guarantee that the same or similar results will be obtained elsewhere. Customers attempting to adapt these techniques to their own environment do so at their own risk.

This publication was produced in the United States. Inspur Electronic Information Industry Co. Inc. may not offer the products, services, or features discussed in this document in other countries, and the information is subject to change with notice. Consult your local Inspur Electronic Information Industry Co. Inc. representative for information on products and services available in your area.

© Copyright Inspur Electronic Information Industry Co. Inc. 2020. All rights reserved.

Permission is hereby granted to publicly disclose and reproduce this document, in whole or in part, provided the copyright notice as printed above is set forth in full text on the title page of each item reproduced.

Trademarks

SPC Benchmark 1, SPC-1, SPC-1 IOPS, SPC-1 LRT and SPC-1 Price-Performance are trademarks of the Storage Performance Council.

Inspur, the Inspur logo and AS5500G5 are trademarks or registered trademarks of Inspur Electronic Information Industry Co. Inc. in the United States and other countries. All other brands, trademarks, and product names are the property of their respective owners.

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	4
Letter Of Good Faith	6
Executive Summary	7
Configuration Information	12
Benchmark Configuration and Tested Storage Configuration	12
Benchmark Configuration Creation Process	14
Benchmark Execution Results	15
Benchmark Execution Overview	15
SUSTAIN Test Phase	16
RAMPD_100 Test Phase	19
Response Time Ramp Test	22
Repeatability Test	24
Space Optimization Techniques	27
Data Persistence Test	28
Appendix A: Supporting Files	29
Appendix B: Third Party Quotation	30
Appendix C: Tuning Parameters and Options	31
Appendix D: Storage Configuration Creation	32
Appendix E: Configuration Inventory	33
Appendix F: Workload Generator	34

AUDIT CERTIFICATION



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

June 17, 2020

I verified the SPC Benchmark 1™ (SPC-1™ V3.8) test execution and performance results of the following Tested Storage Product:

AS5500G5

The results were:

SPC-1 IOPS™	3,300292
SPC-1 Price-Performance™	\$295.73/SPC-1 KIOPS™
SPC-1 IOPS™ Response Time	0.387 ms
SPC-1 Overall Response Time	0.228 ms
SPC-1 ASU Capacity	137,438 GB
SPC-1 ASU Price	\$7.11/GB
SPC-1 Total System Price	\$975,975.69

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 the Test Sponsor, 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 the Test Sponsor, and can be found at www.spcresults.org under the Submission Identifier A32015.

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

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

Inspur

AS5500G5

A32014

- The physical capacity of the data repository;
- The total capacity of the Application Storage Unit (ASU);
- 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; and
- 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

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

LETTER OF GOOD FAITH

June 17, 2020

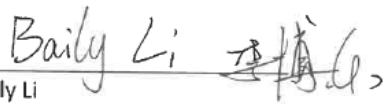
To: Doug Johnson, SPC Auditor
PerLabs, Inc. DBA InfoSizing
63 Lourdes Drive
Leominster, MA 01453-6709
USA

Subject: SPC-1 Letter of Good Faith for the AS5500G5

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 3.8 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,


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

2020.6.17
Date: June 17, 2020



SPC BENCHMARK 1™

EXECUTIVE SUMMARY

INSPUR ELECTRONIC INFORMATION INDUSTRY CO. INC. INSPUR AS5500G5

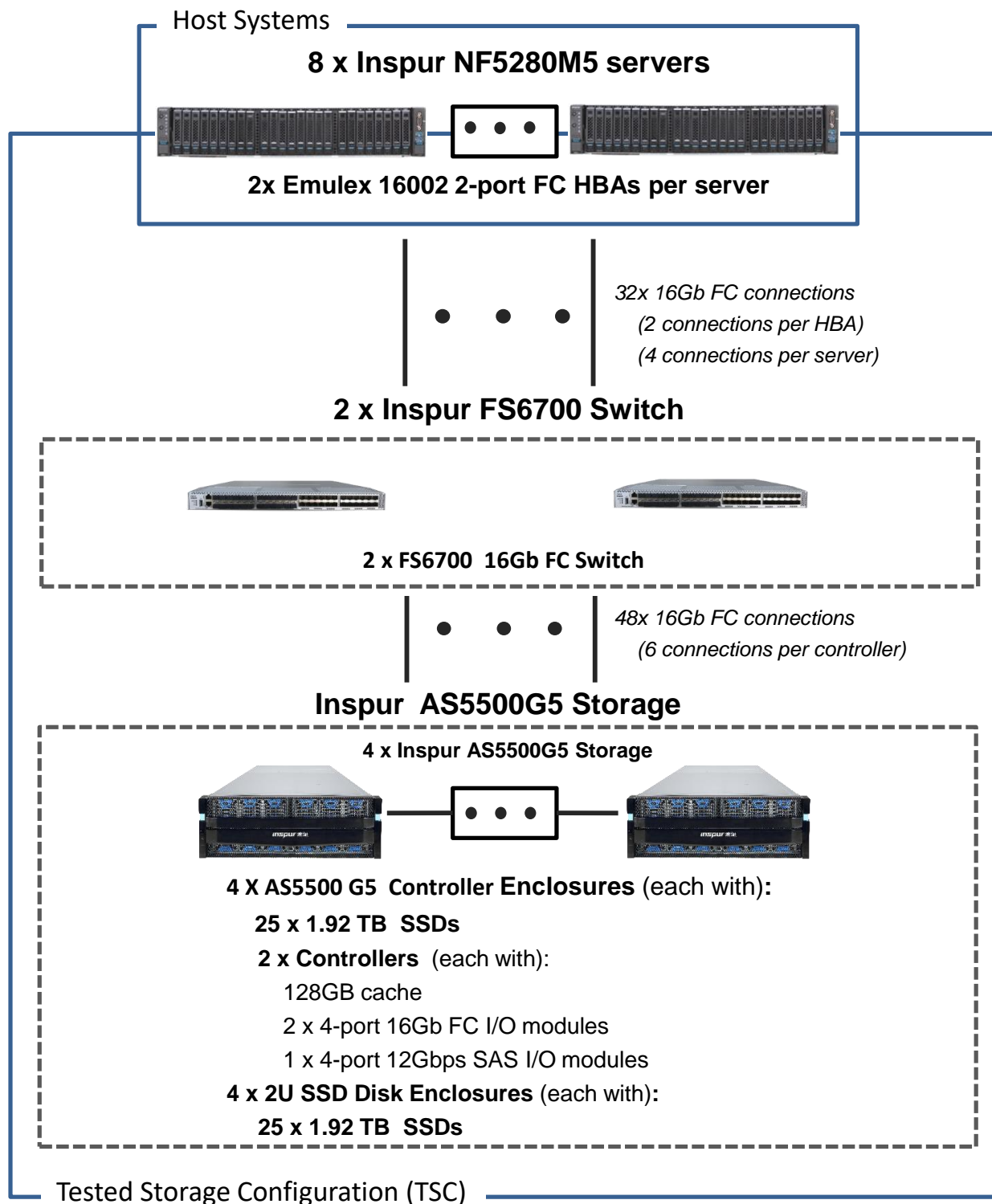
SPC-1 IOPS™	3,300,292
SPC-1 Price-Performance™	\$295.73/SPC-1 KIOPS™
SPC-1 IOPS™ Response Time	0.387 ms
SPC-1 Overall Response Time	0.228 ms
SPC-1 ASU Capacity	137,438 GB
SPC-1 Space Effectiveness Ratio	NA
SPC-1 ASU Price	\$7.11/GB
SPC-1 Total System Price	\$975,975.69
Data Protection Level	Protected 2 (RAID-10)
Physical Storage Capacity	384,000 GB
Pricing Currency / Target Country	U.S. Dollars / China

SPC-1 V3.8.0

SUBMISSION IDENTIFIER: A32015

SUBMITTED FOR REVIEW: JUNE 17, 2020

Benchmark Configuration Diagram



Tested Storage Product Description

Inspur AS5500G5 is a storage system gearing to medium-sized enterprise application environment for structured data processing applications. The system adopts the industry mainstream protocols 16Gb&32Gb FC, 1Gb/10Gb/40Gb iSCSI, 12Gb SAS and PCIe3.0, and is able to integrate with hardware platforms of IP SAN and FC SAN and intelligent management software. As an enterprise-level storage system, it reaches the highest level in products of the same level in the industry in terms of performance, functionality, reliability and ease of use, is able to meet the need on data storage, data backup and data disaster tolerance in applications like medium-sized database OLTP/OLAP and virtualization, and is widely used in governments, enterprises, financial, energy, medical and education sectors.

Priced Storage Configuration Components

16 x Emulex 16002 2-port FC HBAs
4 x Inspur AS5500G5 , each with: 2 x Storage Controllers, each with: 128 GB cache (1,024 GB total) 2 x 4-port 16 Gb FC I/O modules 1 x 4-port 12 Gb SAS I/O module
4 x 2U SSD Disk Enclosures, each with: 25 x 1.92 TB SSDs
 2 x FS6700 16Gb FC Switch

Storage Configuration Pricing

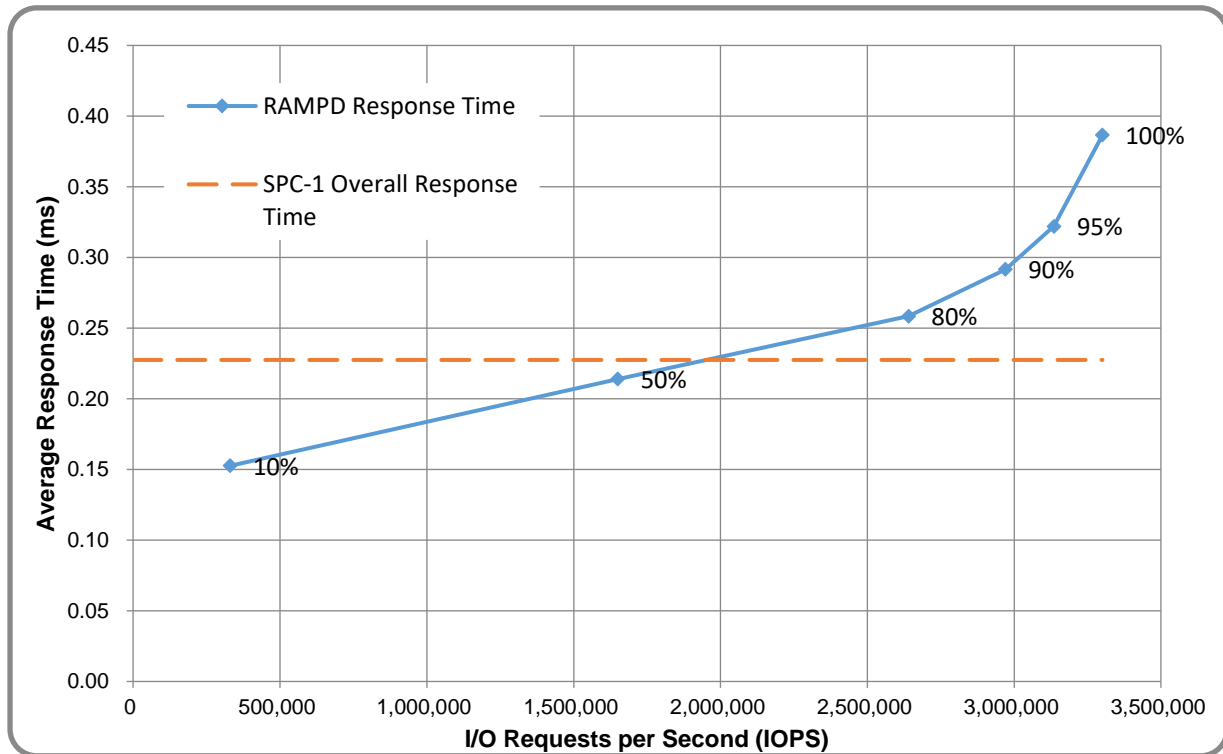
Part No.	Description	Source	Qty	Unit Price	Ext. Price	Disc.	Disc. Price
Hardware & Software							
UAS5500G5000	Inspur AS5500G5 Storage System Base Unit (2U,Dual Controllers,25*2.5",BBU+Flash,3Y 5x10xND Basic Svc&Warranty)	1	4	60,180.95	240,723.80	70%	72,217.14
TMO071	Inspur AS5500G5 Cache Module-256GB	1	4	38,689.12	154,756.48	68%	49,522.08
THD088	Inspur 1.92TB TLC SSD Enterprise Drive(2.5"), For AS5500G5的J012HG5、J025SG5、J048HG5	1	200	12,965.62	2,593,124.00	75%	648,281.00
UJ025SG50001	Inspur J025SG5 JBoD (2U, 25*2.5" disks)	1	4	9,899.72	39,598.88	70%	11,879.67
TSJ160	Inspur AS5500G5 4*16Gbps FC Ports +SFP	1	16	9,498.57	151,977.12	70%	45,593.14
THS550	Inspur AS5500G5 Basic Software(InThin,InSnapshot,InClone,InBackup,InVdiskMirror,InQos,InRAID,InPath)	1	4	3,979.66	15,918.64	90%	1,591.87
TWF003	Inspur 3MLC-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							969,853.01
Support & Maintenance							
F2HII04	Installation Service - Engineering	1	4	1,027.94	4,111.76	0%	4,111.76
F2GD0030AS55G525	UPgrade TO Onsite Premier 24x7x4H Engineer Onsite Service -36Month(s)	1	4	502.73	2,010.92	0%	2,010.92
Support & Maintenance Subtotal							6,122.68
SPC-1 Total System Price							975,975.69
SPC-1 IOPS™							3,300,292
SPC-1 Price-Performance™ (\$/SPC-1 KIOPS™)							295.73
SPC-1 ASU Capacity (GB)							137,438
SPC-1 ASU Price (\$/GB)							7.11

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

Warranty: Provide 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.

Availability Date: May 30, 2020.

Response Time and Throughput Graph



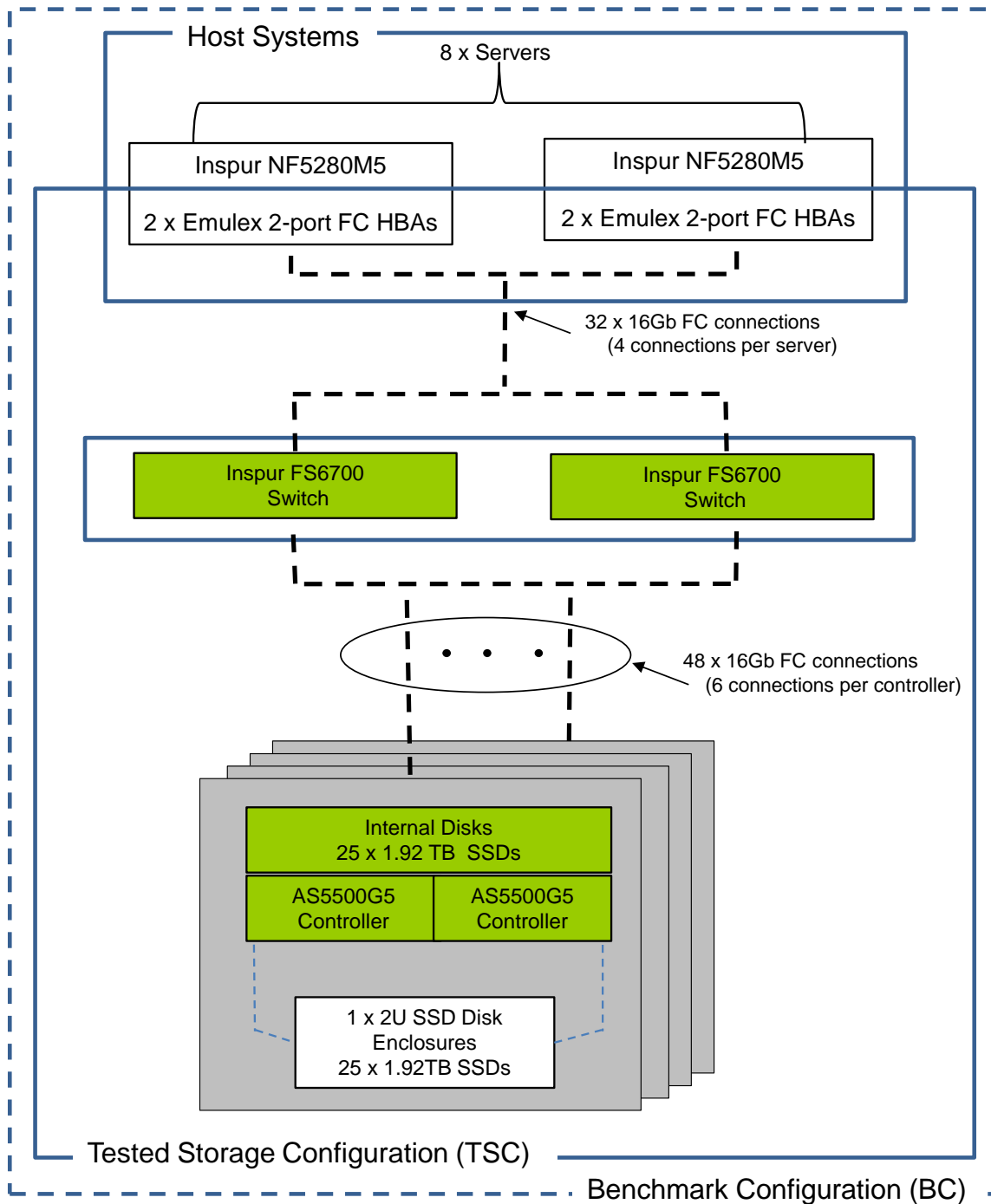
Contact Information	
Test Sponsor Primary Contact	Inspur Electronic Information Industry Co. Inc. – {www.someCompany.com} Hao Sun – sunhaobj@inspur.com
SPC Auditor	InfoSizing – www.sizing.com Doug Johnson – doug@sizing.com

Revision Information	
SPC Benchmark 1™ Revision	V3.8.0
SPC-1 Workload Generator Revision	v3.0.2-1-g823a
Publication Revision History	Initial Publication

CONFIGURATION INFORMATION

Benchmark Configuration and Tested Storage Configuration

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) involved an external storage subsystem consisting of 8 Inspur AS5500G5 controllers driven by 8 host systems (Inspur NF5280M5). Each NF5280M5 host system utilized two dual-port Fibre Channel HBAs to establish 4 connections to the FS6700 switches. Each HBA had one connection to each of the two switches. The AS5500G5 controllers were grouped in sets of two, forming four Inspur AS5500G5 Controller Enclosures. Each AS5500G5 controller had six connections to the FS6700 switches (3 connections per switch). All Fibre Channel paths operated at 16 Gbps.

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 16002 2-port FC HBAs
4 x Inspur AS5500G5 , each with: 2 x Storage Controllers, each with: 128 GB cache (1,024 GB total) 2 x 4-port 16 Gb FC I/O modules 1 x 4-port 12 Gb SAS I/O module
4 x 2U SSD Disk Enclosures, each with: 25 x 1.92 TB SSDs
2 x FS6700 16Gb FC Switch

Differences Between Tested and Priced Storage Configurations

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

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

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	3,435.9	3,435.9	61,847.5	45.0%	No
ASU-2	18	3,435.9	3,435.9	61,847.5	45.0%	No
ASU-3	4	3,435.9	3,435.9	13,743.8	10.0%	No
SPC-1 ASU Capacity				137,438	*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	1,920.0	384,000.0
Total Physical Capacity			384,000
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 pools comprising 16 RAID-10 arrays.

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).

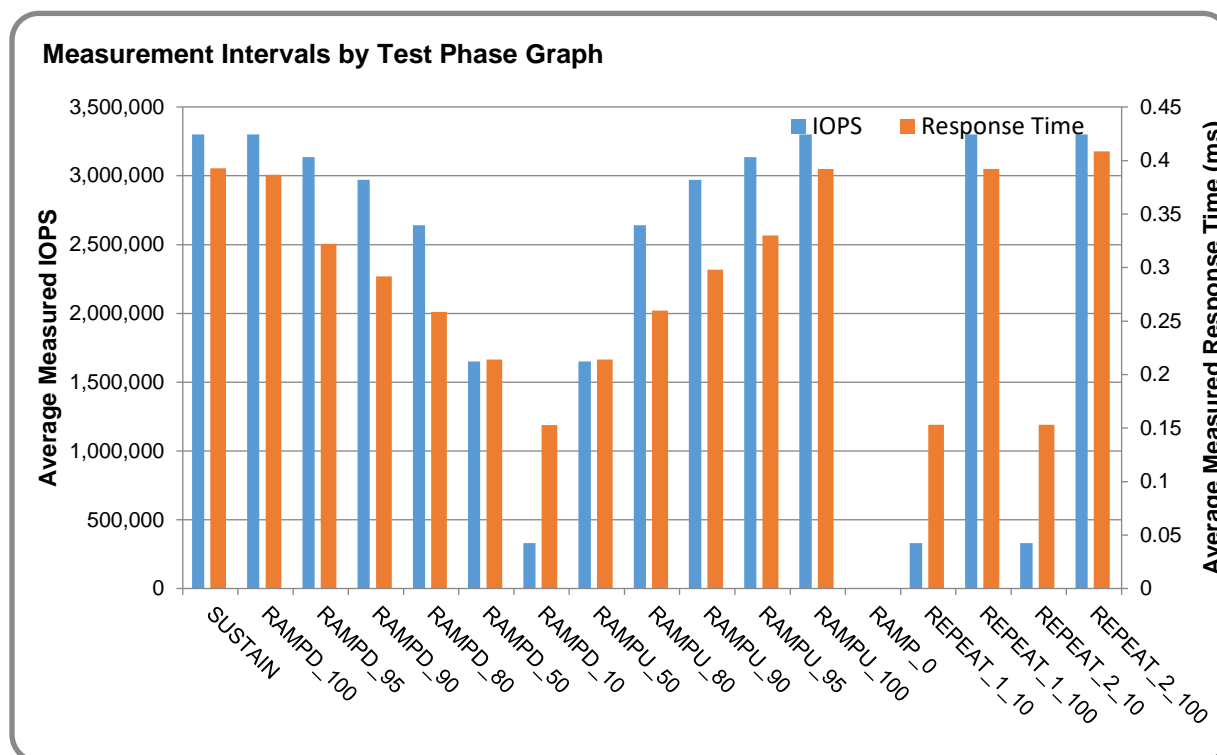
Primary Metrics Test Phases

The benchmark execution consists of the Primary Metrics Test Phases, including the Test Phases SUSTAIN, RAMPD_100 to RAMPD_10, RAMPU_50 to RAMPU_100, RAMP_0, REPEAT_1 and REPEAT_2.

Each Test Phase starts with a transition period followed by a Measurement Interval (MI).

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.



Exception and Waiver

None.

SUSTAIN Test Phase

SUSTAIN – Results File

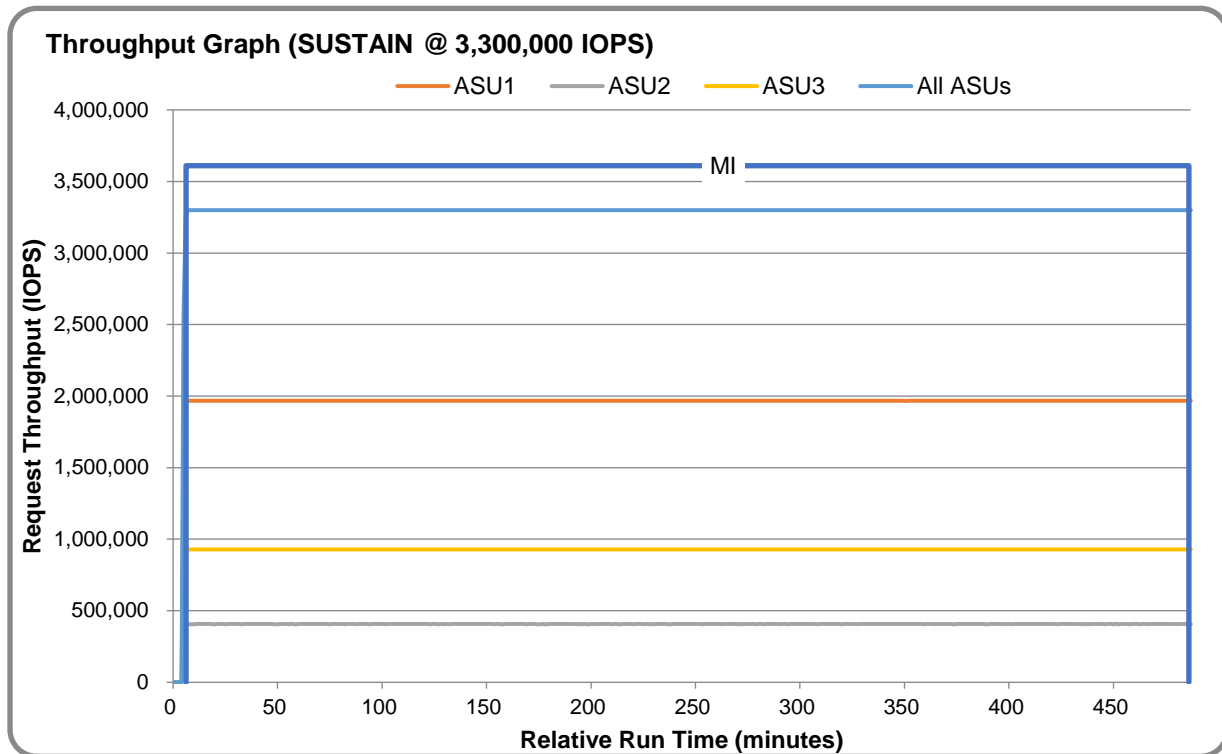
The results file generated during the execution of the SUSTAIN Test Phase is included in the Supporting Files (see Appendix A) as follows:

- SPC1_METRICS_0_Raw_Results.xlsx

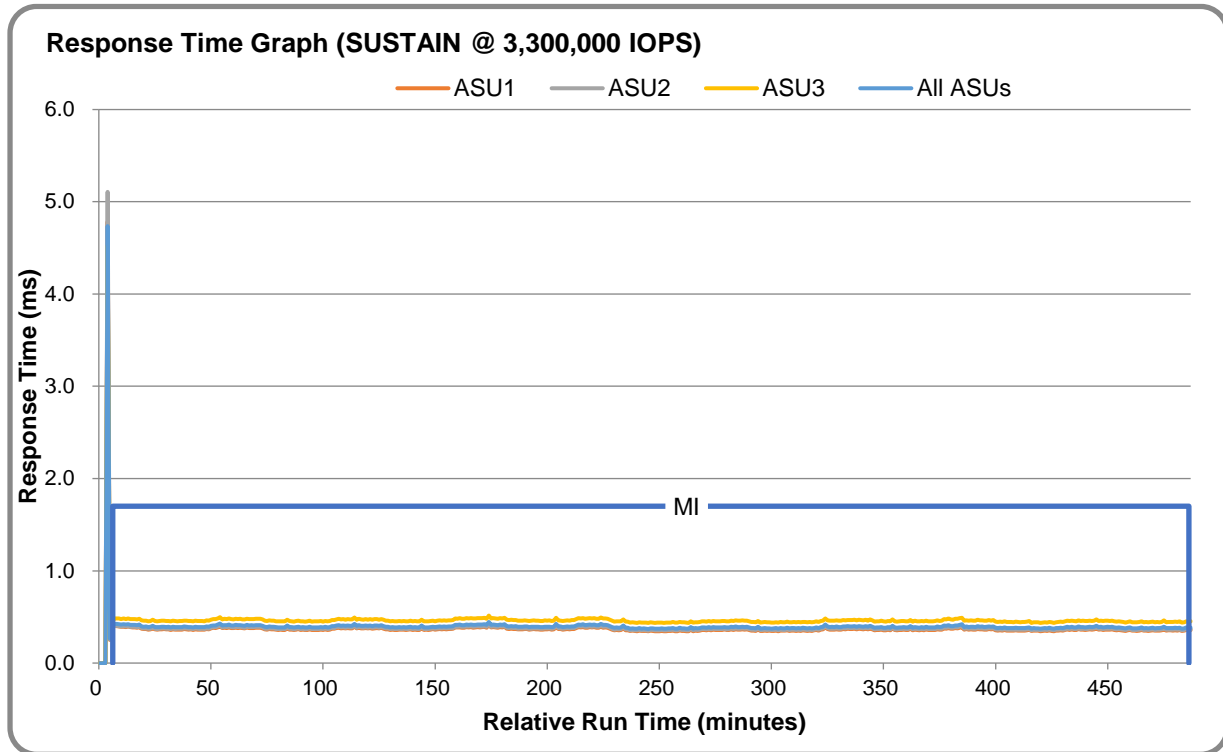
SUSTAIN – Execution Times

Interval	Start Date & Time	End Date & Time	Duration
Transition Period	10-Jun-20 04:45:00	10-Jun-20 04:48:00	0:03:00
Measurement Interval	10-Jun-20 04:48:00	10-Jun-20 12:48:01	8:00:01

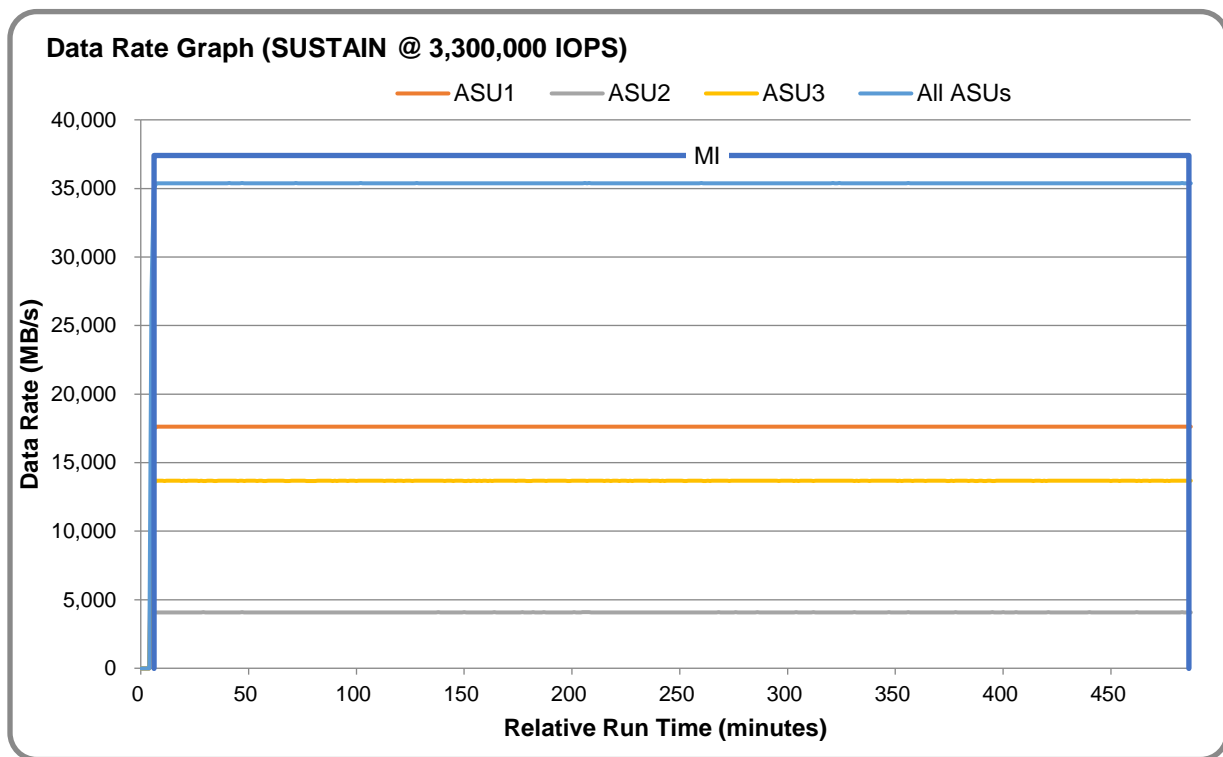
SUSTAIN – Throughput Graph



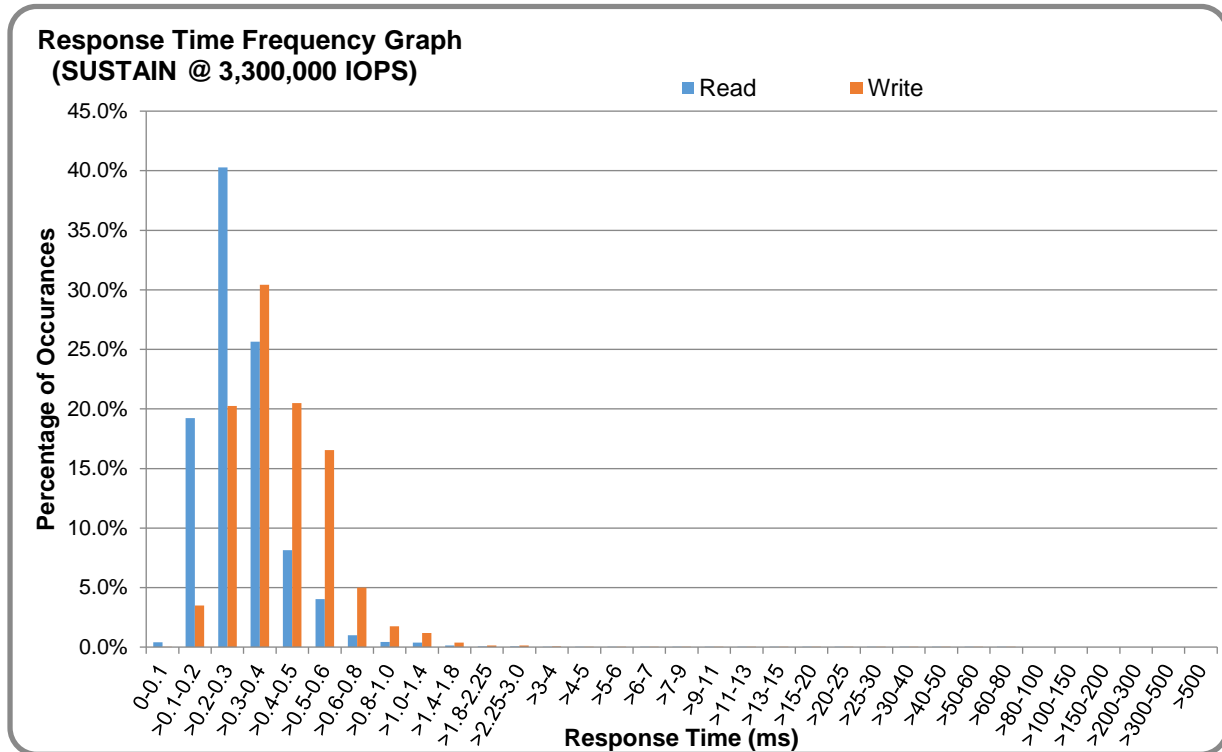
SUSTAIN – Response Time Graph



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	0.0005	0.0003	0.0004	0.0001
Difference	0.006%	0.002%	0.005%	0.000%	0.004%	0.003%	0.006%	0.001%

RAMPD_100 Test Phase

RAMPD 100 – Results File

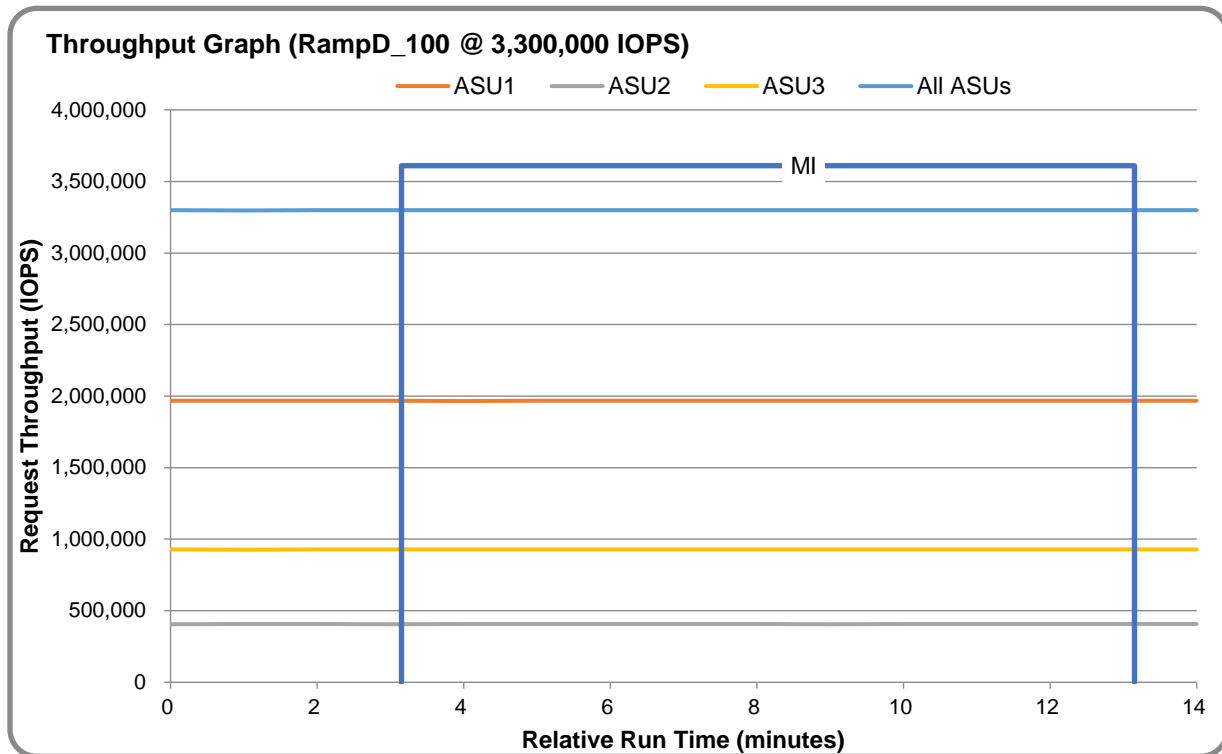
The results file generated during the execution of the RAMPD_100 Test Phase is included in the Supporting Files (see Appendix A) as follows:

- SPC1_METRICS_0_Raw_Results.xlsx

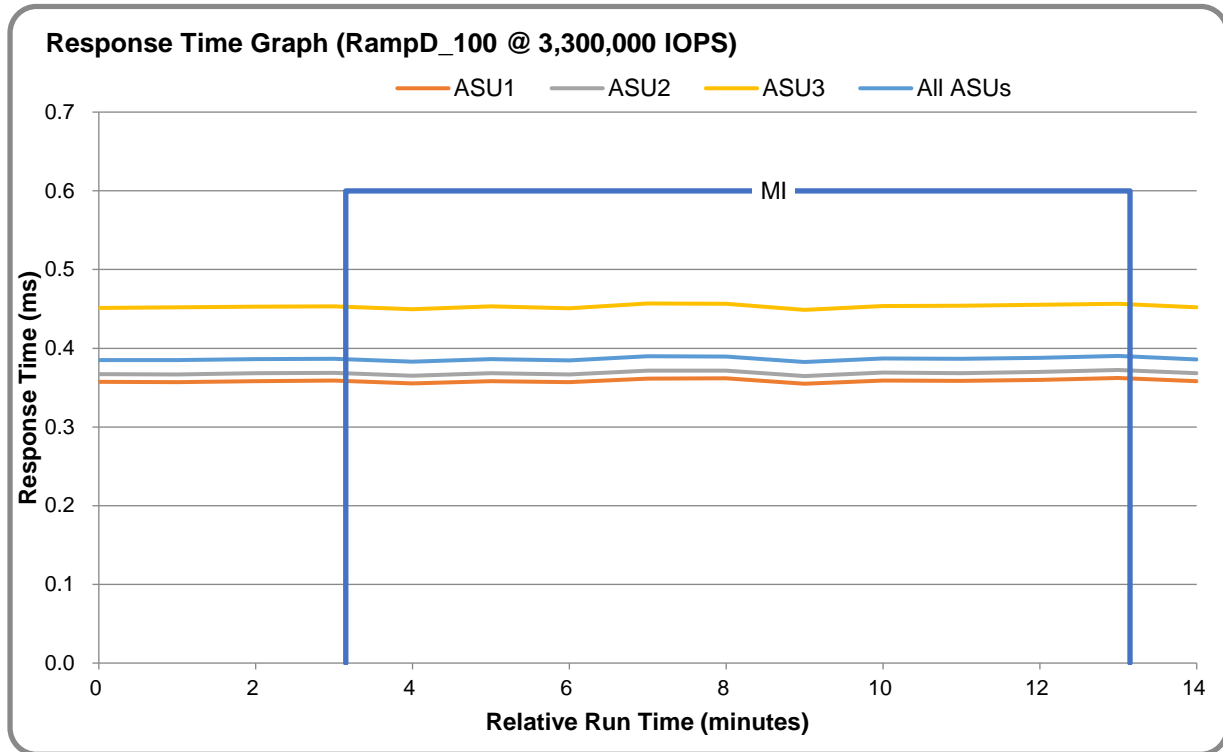
RAMPD 100 – Execution Times

Interval	Start Date & Time	End Date & Time	Duration
Transition Period	10-Jun-20 12:49:00	10-Jun-20 12:52:00	0:03:00
Measurement Interval	10-Jun-20 12:52:00	10-Jun-20 13:02:01	0:10:01

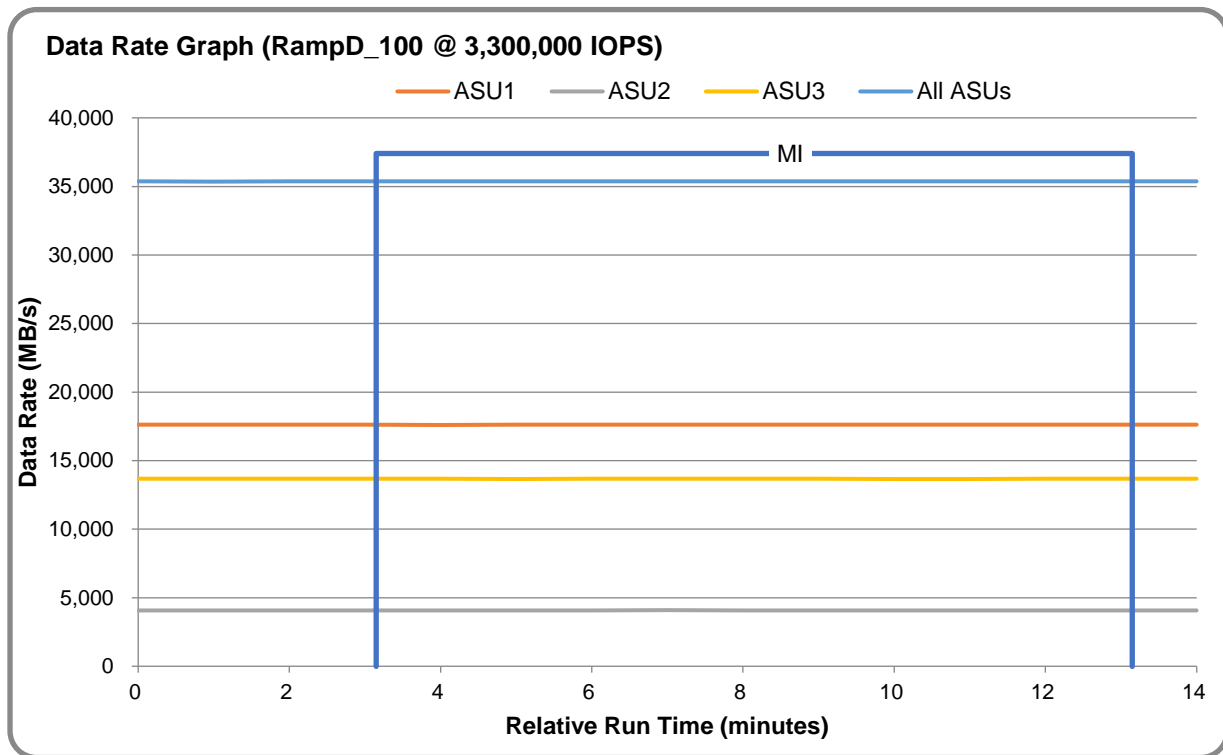
RAMPD 100 – Throughput Graph



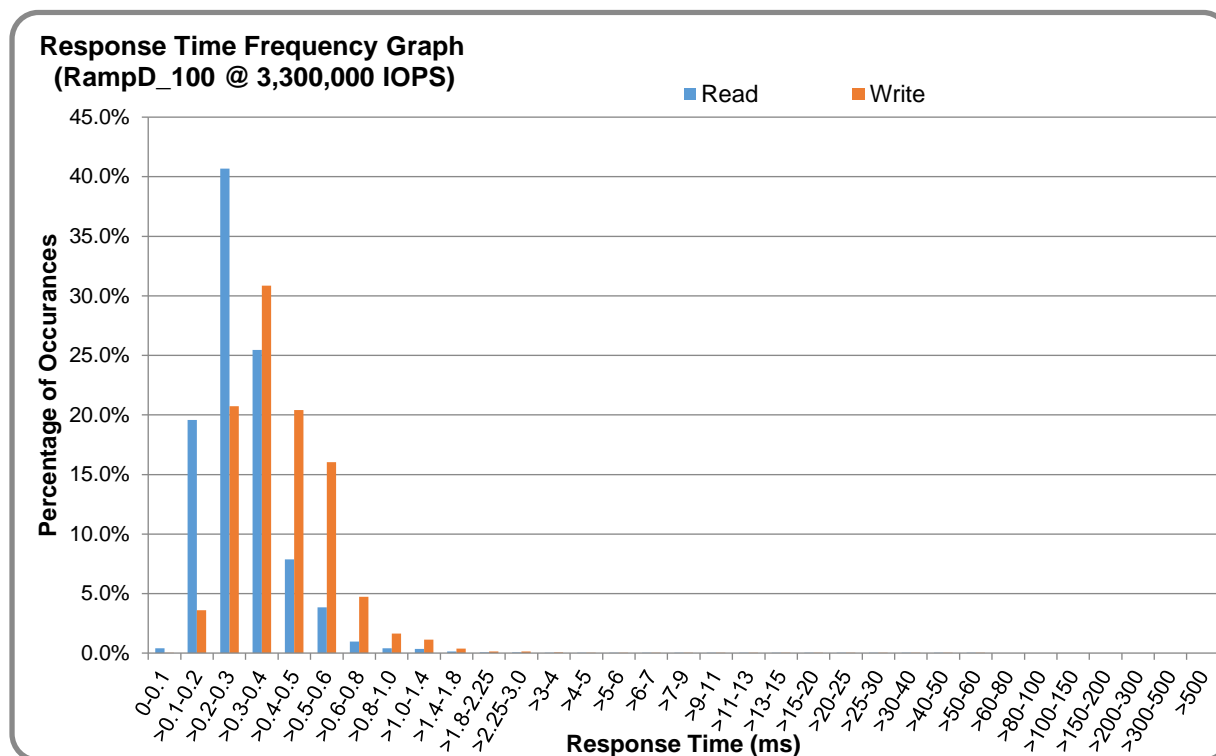
RAMPD 100 – Response Time Graph



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	0.0004	0.0001	0.0002	0.0002	0.0005	0.0002	0.0005	0.0001
Difference	0.038%	0.003%	0.005%	0.001%	0.010%	0.006%	0.018%	0.001%

RAMPD 100 – I/O Request Summary

I/O Requests Completed in the Measurement Interval	1,980,178,786
I/O Requests Completed with Response Time <= 30 ms	1,980,172,106
I/O Requests Completed with Response Time > 30 ms	6,680

Response Time Ramp Test

Response Time Ramp Test – Results File

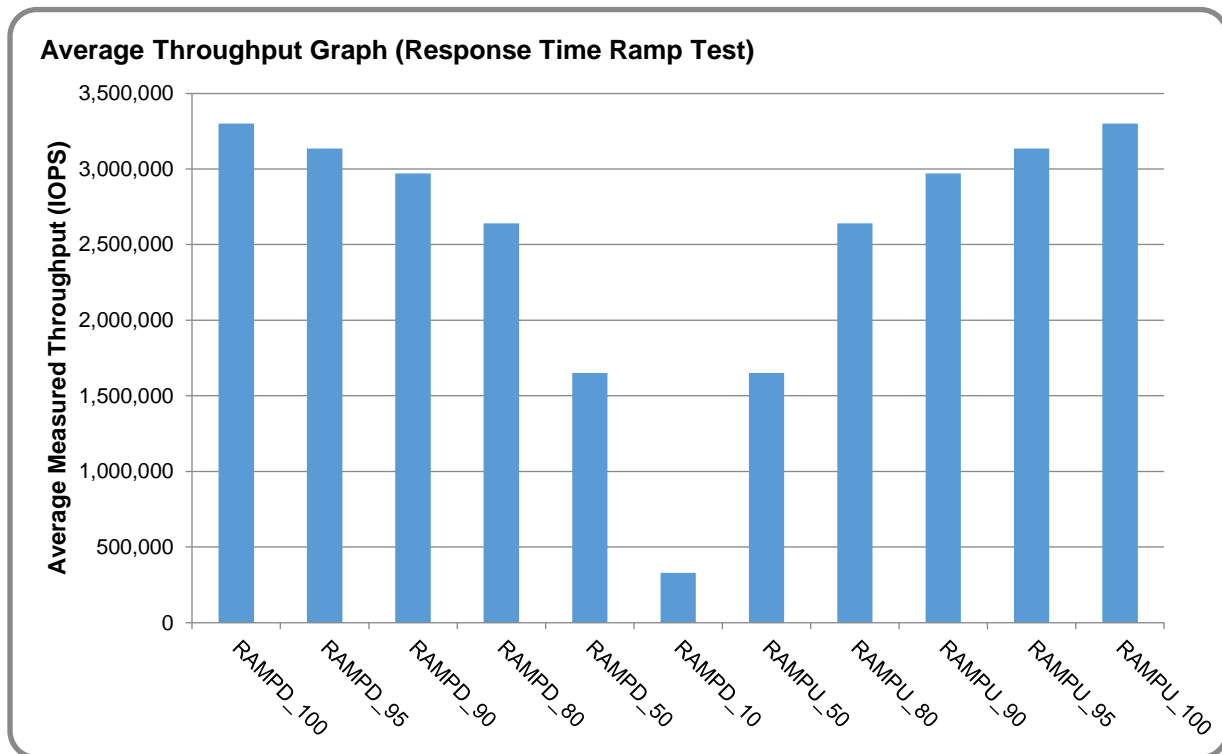
The results file generated during the execution of the Response Time Ramp Test is included in the Supporting Files (see Appendix A) as follows:

- **SPC1_METRICS_0_Raw_Results.xlsx**

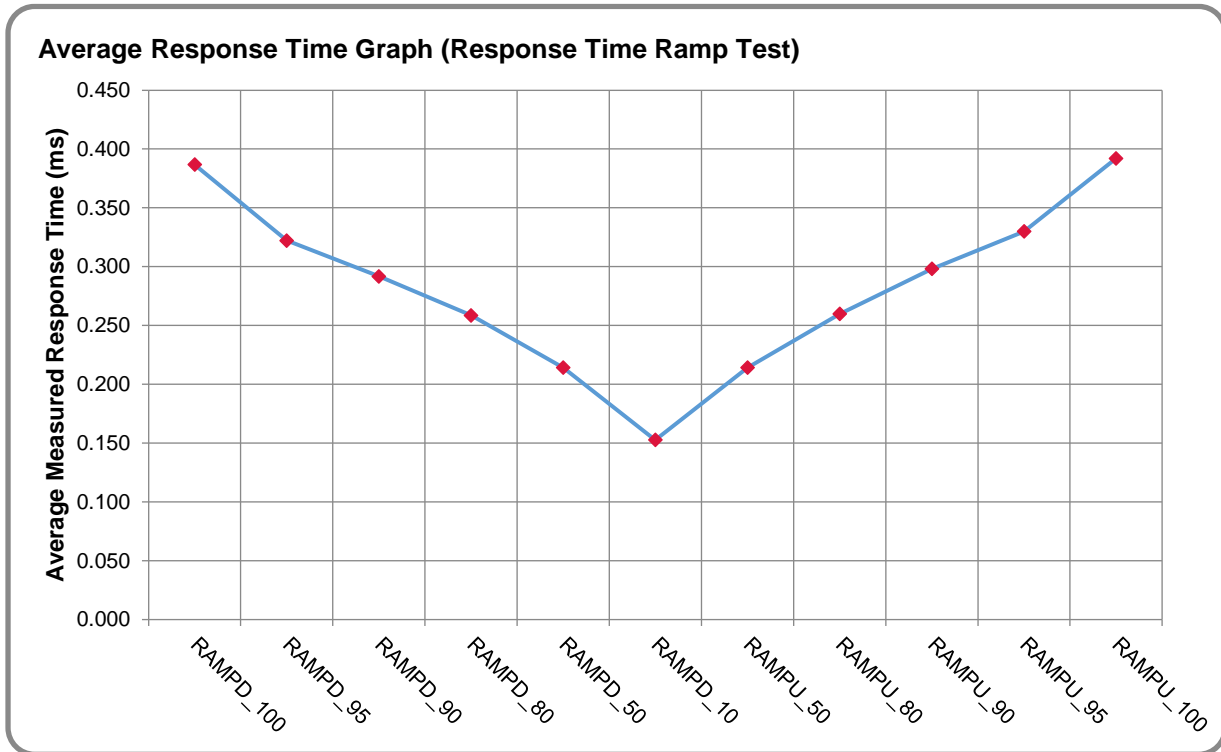
Response Time Ramp Test – Phases

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).

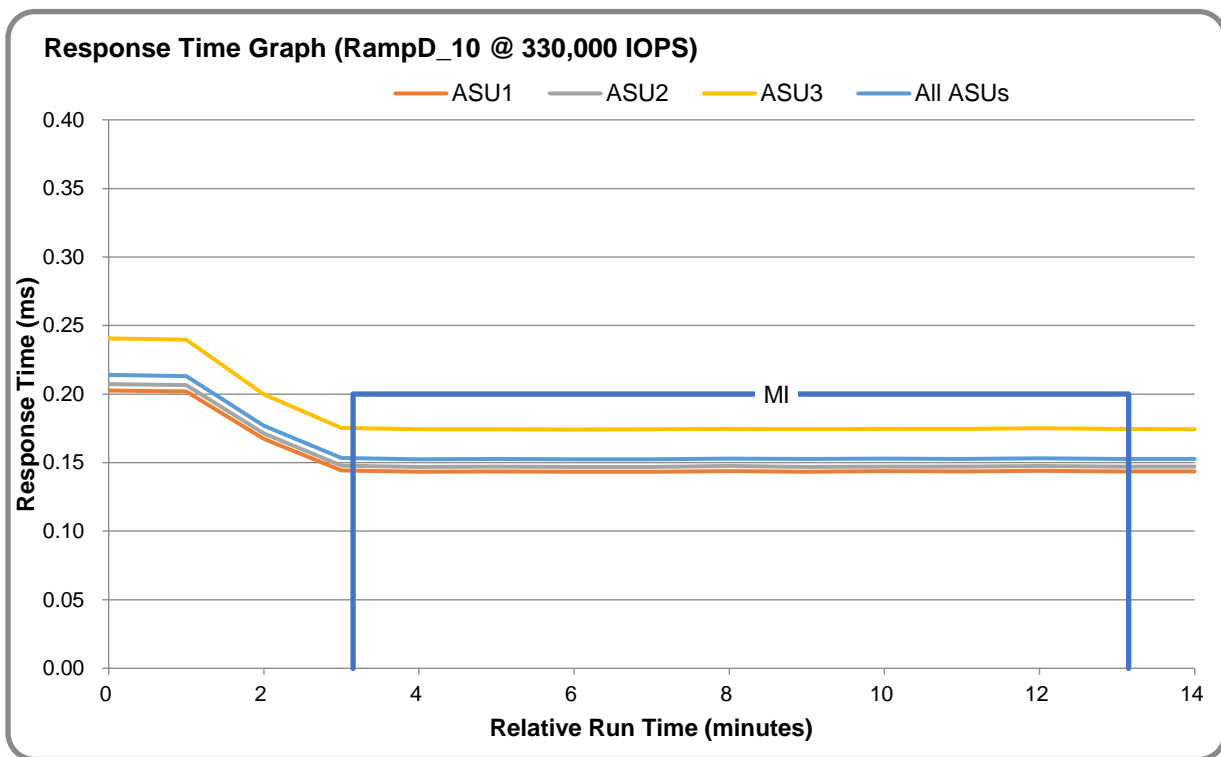
Response Time Ramp Test – Average Throughput Graph



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:

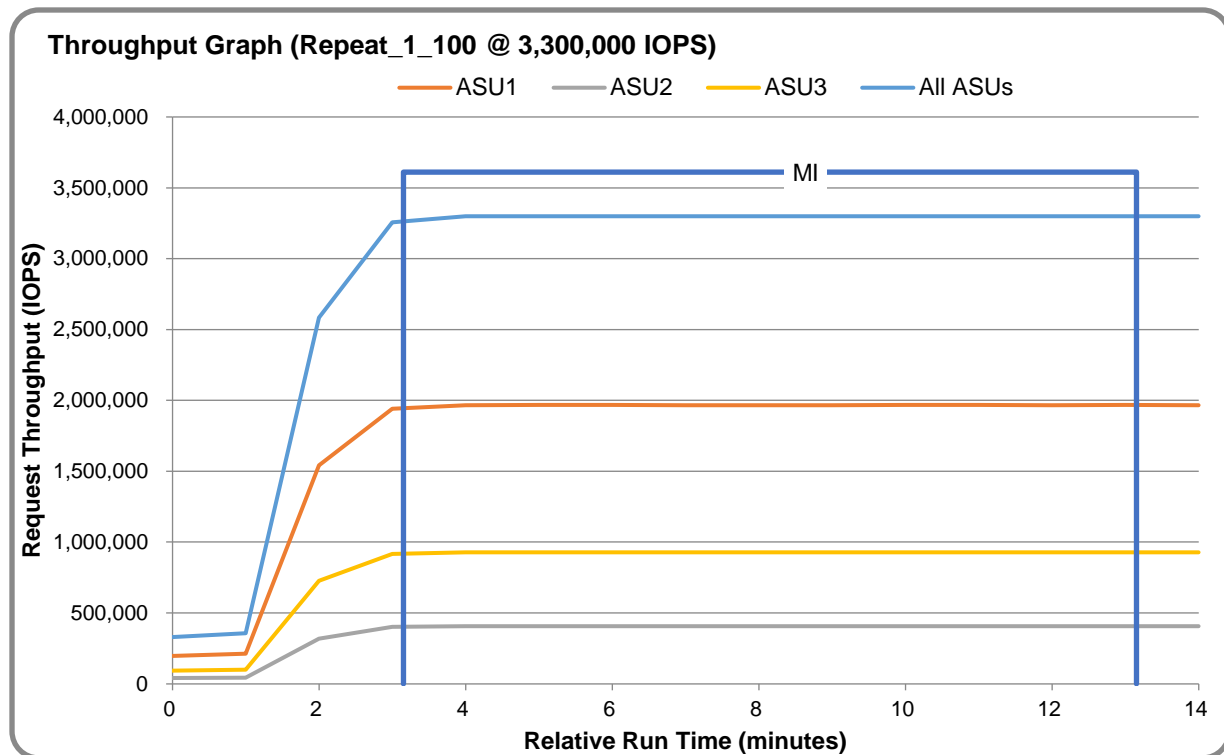
- **SPC1_METRICS_0_Raw_Results.xlsx**

Repeatability Test Results

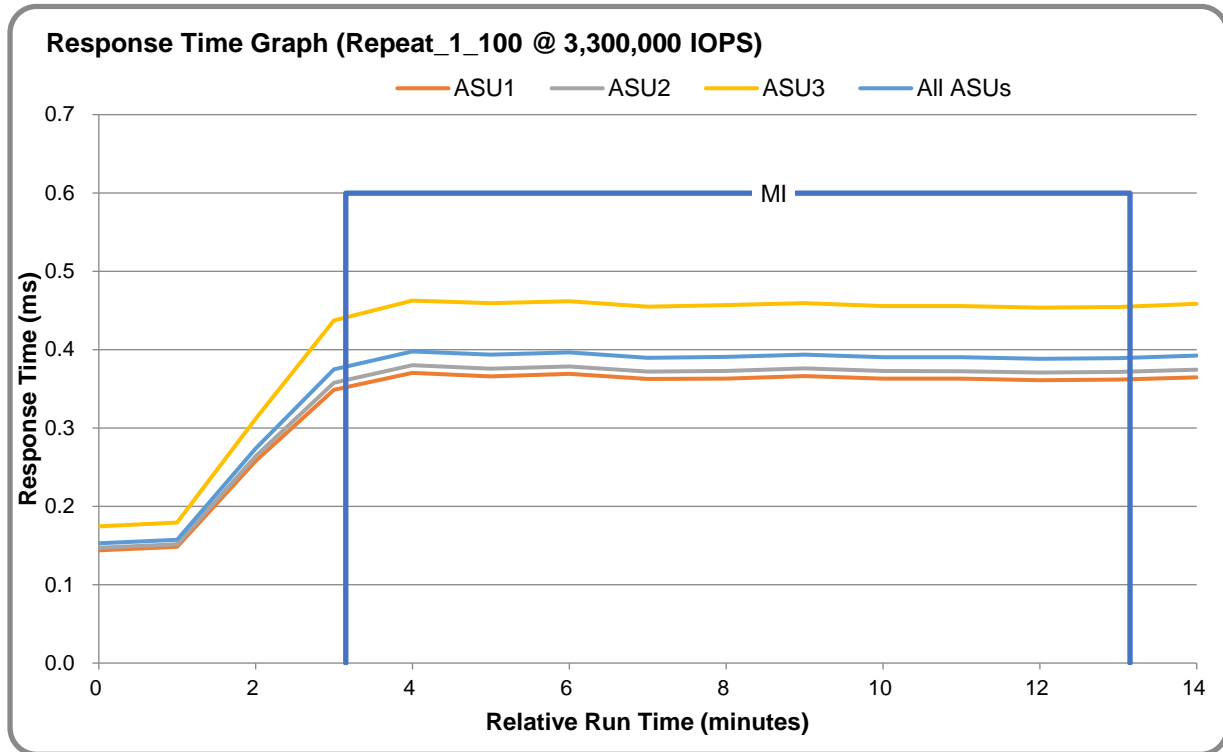
The throughput measurements for the Response Time Ramp Test (RAMPD) and the Repeatability Test Phases (REPEAT_1 and REPEAT_2) are listed in the table below.

Test Phase	100% IOPS	10% IOPS
RAMPD	3,300,292.6	330,008.5
REPEAT_1	3,300,191.3	330,021.8
REPEAT_2	3,300,205.4	330,020.5

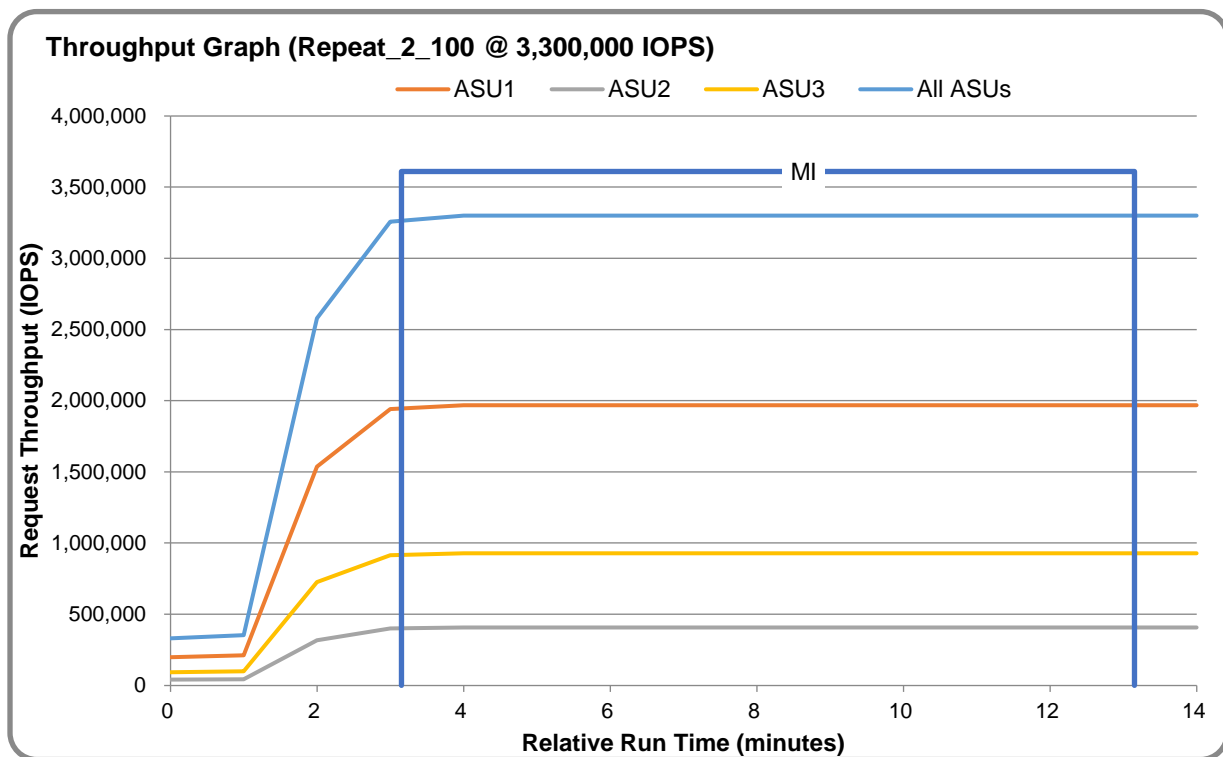
REPEAT 1 100 - Throughput Graph



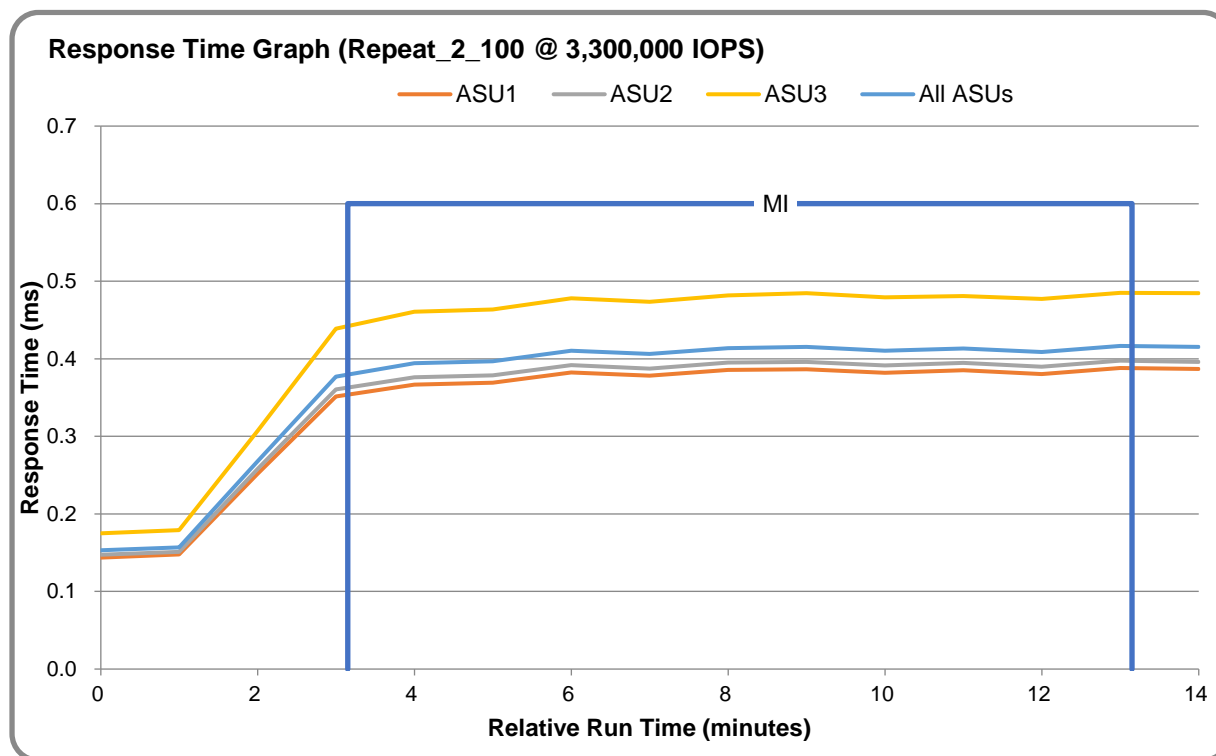
REPEAT 1 100 – Response Time Graph



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	0.0005	0.0001	0.0003	0.0002	0.0007	0.0002	0.0004	0.0001
Difference	0.003%	0.000%	0.009%	0.006%	0.009%	0.011%	0.004%	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	0.0004	0.0002	0.0002	0.0002	0.0009	0.0001	0.0003	0.0001
Difference	0.016%	0.004%	0.002%	0.000%	0.008%	0.018%	0.020%	0.006%

Space Optimization Techniques

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

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	682,232,646
Total Number of Logical Blocks Verified	339,981,063
Total Number of Logical Blocks Overwritten	342,251,583
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_as5500g5.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
profle_end_as5500g5.txt	Storage configuration after restart	/E_Inventory
profle_start_as5500g5.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_as5500g5.sh` script on a remote server which can login on AS5500G5 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, 1700 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 execute 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 `pvcreate` 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 3200 GB, on `spc1vg1` for ASU-1.
- Create 9 logical volumes, every volume capacity is 3200 GB, on `spc1vg2` for ASU-1
- Create 9 logical volumes, every volume capacity is 3200 GB, on `spc1vg1` for ASU-2.
- Create 9 logical volumes, every volume capacity is 3200 GB, on `spc1vg2` for ASU-2.
- Create 2 logical volumes, every volume capacity is 3200 GB, on `spc1vg1` for ASU-3.
- Create 2 logical volumes, every volume capacity is 3200 GB, on `spc1vg2` for ASU-3.

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_as5500g5.txt
- profile_end_as5500g5.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).