



**SPC BENCHMARK 1™**  
**FULL DISCLOSURE REPORT**

**INSPUR ELECTRONIC INFORMATION INDUSTRY CO. LTD.**  
**INSPUR AS5600G2**

**SPC-1 V3.8.0**

**SUBMISSION IDENTIFIER: A32014**

**SUBMITTED FOR REVIEW: MARCH 20, 2020**

## **First Edition – March 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](http://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

March 23, 2020

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

### **AS5600G2**

The results were:

<b>SPC-1 IOPS™</b>	<b>7,520,358</b>
<b>SPC-1 Price-Performance™</b>	<b>\$386.50/SPC-1 KIOPS™</b>
SPC-1 IOPS™ Response Time	0.472 <u>ms</u>
SPC-1 Overall Response Time	0.251 <u>ms</u>
SPC-1 ASU Capacity	274,877 GB
SPC-1 ASU Price	\$10.58/GB
SPC-1 Total System Price	\$2,906,551.87

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](http://www.spcresults.org) under the Submission Identifier A32014.

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

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Inspur

AS5600G2

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

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## LETTER OF GOOD FAITH

March 23, 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 AS5600G2

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,



Bin Sun  
GM of Storage Product Department  
Inspur Electronic Information Industry Co. Ltd.



Date: March 23, 2020



## SPC BENCHMARK 1™

### EXECUTIVE SUMMARY

# INSPUR ELECTRONIC INFORMATION INDUSTRY CO. LTD. INSPUR AS5600G2

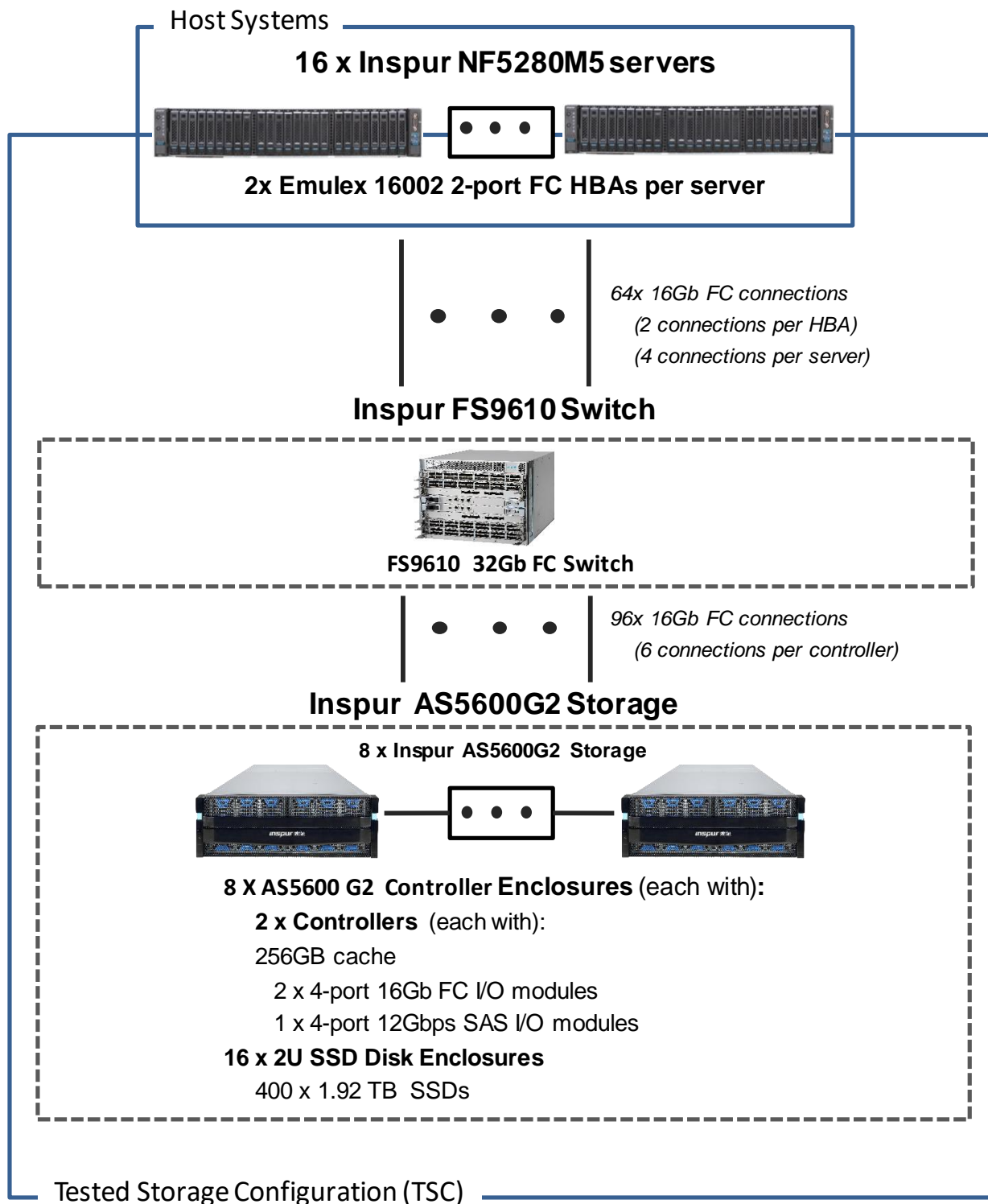
<b>SPC-1 IOPS™</b>	<b>7,520,358</b>
<b>SPC-1 Price-Performance™</b>	<b>\$386.50/SPC-1 KIOPS™</b>
SPC-1 IOPS™ Response Time	0.472 ms
SPC-1 Overall Response Time	0.251 ms
SPC-1 ASU Capacity	274,877 GB
SPC-1 Space Effectiveness Ratio	NA
SPC-1 ASU Price	\$10.58/GB
SPC-1 Total System Price	\$2,906,551.87
Data Protection Level	Protected 2 (RAID-10)
Physical Storage Capacity	768,000 GB
Pricing Currency / Target Country	U.S. Dollars / China

### SPC-1 V3.8.0

**SUBMISSION IDENTIFIER: A32014**

**SUBMITTED FOR REVIEW: MARCH 20, 2020**

### Benchmark Configuration Diagram





## Tested Storage Product Description

Inspur AS5600G2 mid-end converged active storage system (hereinafter referred to as G2 mid-range active storage) is a storage system targeted at medium and large enterprises for structured and unstructured data applications. With its storage operating system built specifically for cloud computing and big data environments, rich software features, and leading industry hardware platforms, it meets the needs of data storage, disaster recovery, dual-active and backup in applications such as large and medium-sized databases OLTP/OLAP, virtualization and file sharing. Inspur G2 mid-range active storage system has reached the highest level in products of the same grade in the industry in terms of performance, function, reliability and ease of use. It is widely used in government, finance, communications, energy, media, medical, education, SMB and other sectors.

## Priced Storage Configuration Components

<b>32 x 16Gb Emulex 16002 2-Port FC HBAs</b>
<b>8 x AS5600G2, each with:</b> <ul style="list-style-type: none"><li><b>2 x Storage Controllers, each with:</b><ul style="list-style-type: none"><li><b>256 GB cache (4,096 GB total)</b></li><li><b>2 x 4-port 16 Gb FC I/O modules</b></li><li><b>1 x4-port 12 Gbps SAS I/O module</b></li></ul></li></ul>
<b>16 x 2U SSD Disk Enclosures</b> <ul style="list-style-type: none"><li><b>400 x 1.92 TB SSDs</b></li></ul>
<b>1 x Inspur FS9610 32Gb FC Switch (192 active ports)</b>

## Storage Configuration Pricing

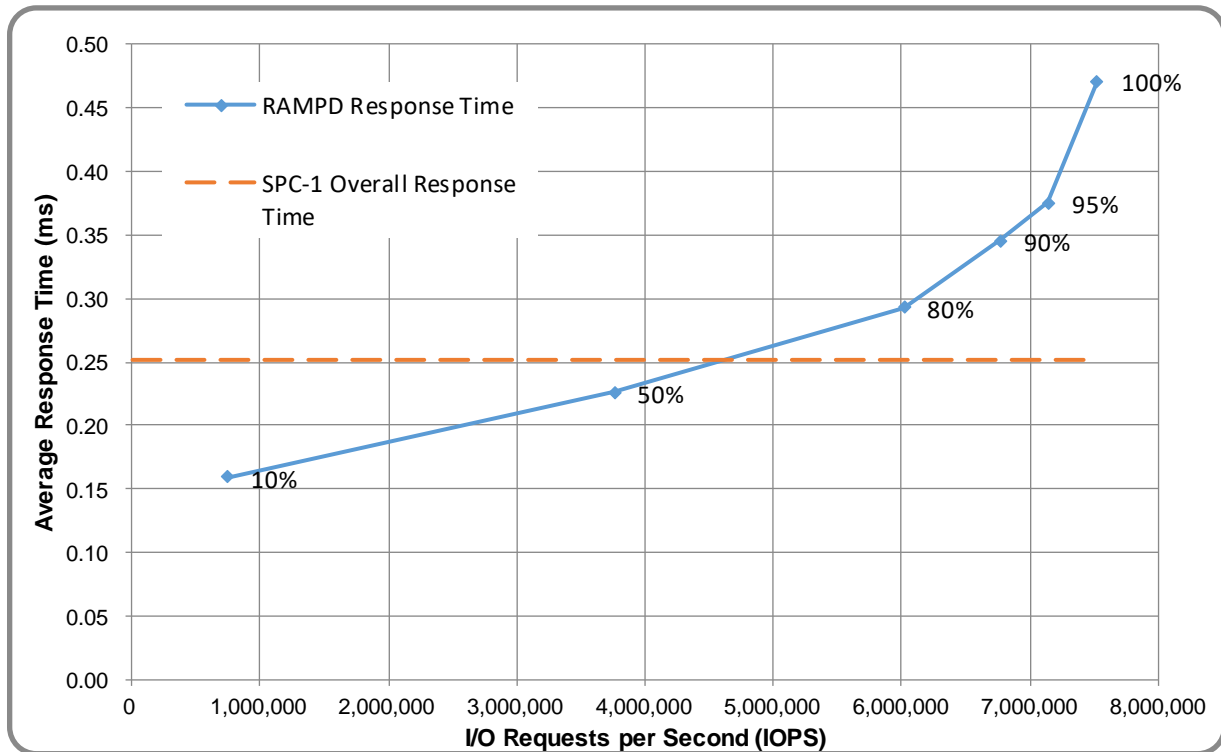
Part No.	Description	Source	Qty	Unit Price	Ext. Price	Disc.	Disc. Price
<b>Hardware &amp; Software</b>							
UAS5600G2000	Inspur AS5600G2 Storage System Base Unit (4U,Dual Controllers,BBU+Flash,3Y 5x10xND Basic Svc&Warranty)	1	8	71,275.08	570,200.64	68%	182,464.21
TMO071	Inspur AS5600G2 Cache Module-512GB	1	8	77,378.23	619,025.84	68%	198,088.27
THD088	Inspur 1.92TB TLC SSD Enterprise Drive(2.5"), For AS5600G2、AS5800G2、J012HG2、J025SG2、J048HG2	1	400	14,885.39	5,954,156.00	68%	1,905,329.92
UJ025SG20001	Inspur J025SG2 JBOD (2U, 25*2.5" disks)	1	16	9,899.72	158,395.52	60%	63,358.21
TSJ160	Inspur AS5600G2 4*16Gbps FC Ports +SFP	1	32	9,498.57	303,954.24	60%	121,581.70
THS478	Inspur AS5600G2 Basic Software(InThin,InSnapshot,InClone,InBackup,InVdiskMirror,InQos,InRAID,InPath)	1	8	14,856.74	118,853.92	90%	11,885.40
THS5000	AS5000 Series RACK	1	2	11,934.10	23,868.20	60%	9,547.28
TWF003	Inspur 3M LC-LC OM4 Fibre Channel Cable	1	160	28.66	4,585.60	60%	1,834.24
TSJ203	Inspur 2*Port 16Gbps Fibre Channel Adapter	1	32	5,114.62	163,667.84	60%	65,467.14
600125	Inspur FS9610 SAN switch, Enable 32Gbps*192 Ports,+SFP	1	1	1,107,306.60	1,107,306.60	70%	332,191.98
<b>Hardware &amp; Software Subtotal</b>							<b>2,891,748.35</b>
<b>Support &amp; Maintenance</b>							
F2HII06	Installation Service - Engineering	1	8	1,347.43	10,779.44	0%	10,779.44
F2GD0030AS56G225	Upgrade to Onsite Premier 24x7x4H Engineer Onsite Service - 36Month(s)	1	8	503.01	4,024.08	0%	4,024.08
<b>Support &amp; Maintenance Subtotal</b>							<b>14,803.52</b>
<b>SPC-1 Total System Price</b>							<b>2,906,551.87</b>
<b>SPC-1 IOPS™</b>							<b>7,520,358</b>
<b>SPC-1 Price-Performance™ (\$/SPC-1 KIOPS™)</b>							<b>386.50</b>
<b>SPC-1 ASU Capacity (GB)</b>							<b>274,877</b>
<b>SPC-1 ASU Price (\$/GB)</b>							<b>10.58</b>

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

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

**Availability Date:** March 29, 2020.

### Response Time and Throughput Graph



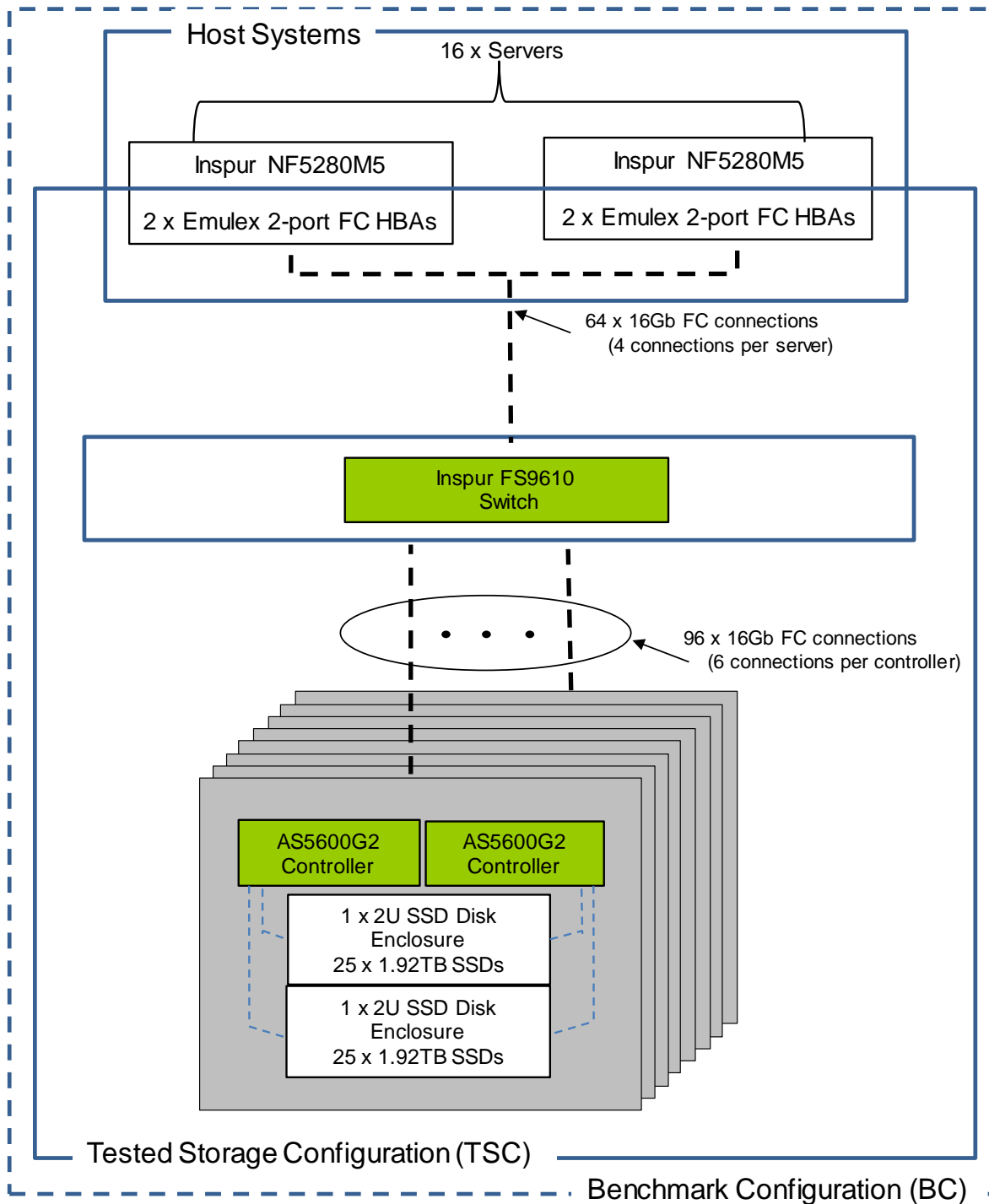
Contact Information	
<b>Test Sponsor Primary Contact</b>	<a href="http://en.inspur.com/">Inspur Electronic Information Industry Co. Ltd.</a> – Hao Sun – sunhaobj@inspur.com
<b>SPC Auditor</b>	InfoSizing – <a href="http://www.sizing.com">www.sizing.com</a> – Doug Johnson – doug@sizing.com

Revision Information	
<b>SPC Benchmark 1™ Revision</b>	V3.8.0
<b>SPC-1 Workload Generator Revision</b>	v3.0.2-1-g823a
<b>Publication Revision History</b>	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 16 Inspur AS5600G2 controllers driven by 16 host systems (Inspur NF5280M5). Each NF5280M5 host system utilized two dual-port Fibre Channel HBAs to establish 4 connections to the FS9610 switch. The AS5600G2 controllers were grouped in sets of two, forming eight Inspur AS5600G2 Controller Enclosures. Each AS5600G2 controller had six connections to the FS9610 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
16 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
32 x 16Gb Emulex 16002 2-Port FC HBAs
8 x AS5600G2, each with: 2 x Storage Controllers, each with: 256 GB cache (4,096 GB total) 2 x 4-port 16 Gb FC I/O modules 1 x 4-port 12 Gbps SAS I/O module 16 x 2U SSD Disk Enclosures 400 x 1.92 TB SSDs
1 x Inspur FS9610 32 Gb FC Switch (192 active ports)

**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	6,871.9	6,871.9	123,695.0	45.0%	No
ASU-2	18	6,871.9	6,871.9	123,695.0	45.0%	No
ASU-3	4	6,871.9	6,871.9	27,487.7	10.0%	No
<b>SPC-1 ASU Capacity</b>				<b>274,877</b>	*See <a href="#">Space Optimization Techniques</a>	

### 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 1.92TB	400	1,920.0	768,000.0
<b>Total Physical Capacity</b>			<b>768,000</b>
<b>Physical Capacity Utilization</b>			<b>35.79%</b>

### Data Protection

The data protection level used for all LVs was **Protected 2 (RAID-10)**, which was accomplished by configuring 160 LUNs over eight pools comprising 32 RAID-10

arrays. Utilizing the redundancies built into the FS9610 switch, all storage was accessible via multiple independent pathways.

## 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).

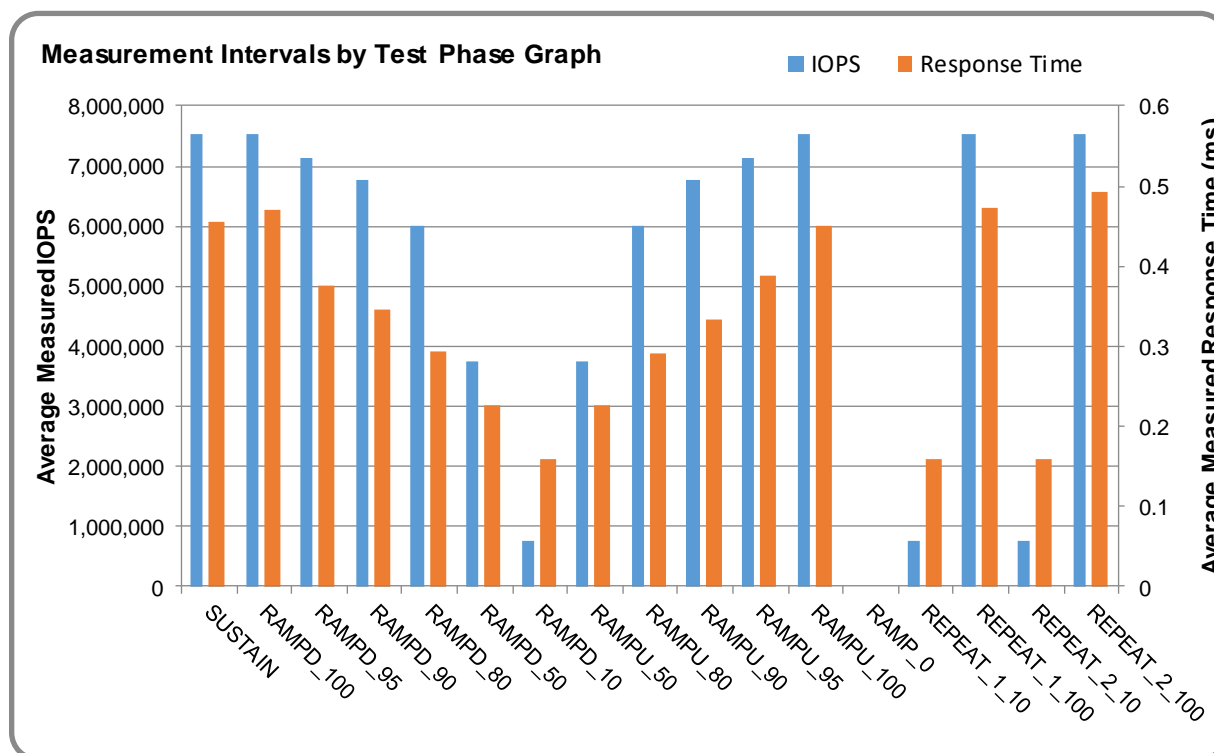
#### Primary Metrics Test Phases

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

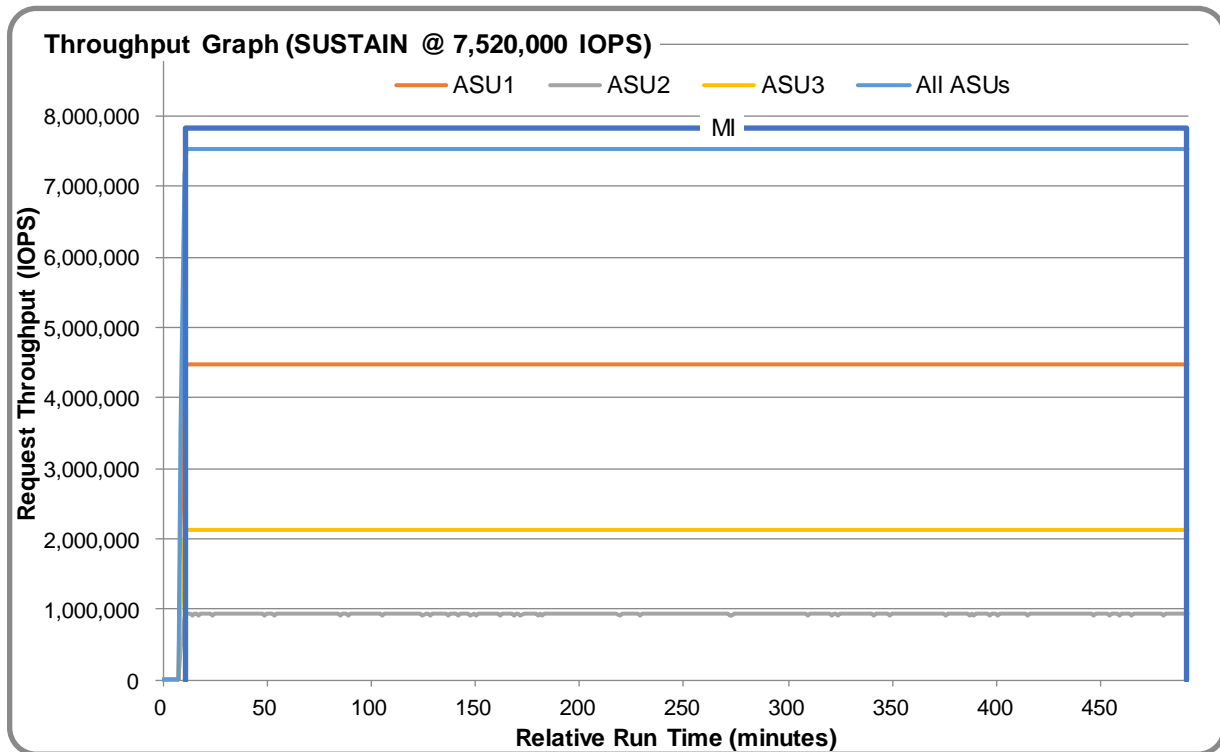
The results file generated during the execution of the SUSTAIN Test Phase is included in the Supporting Files (see Appendix A) as follows:

- SPC1\_METRICS\_0\_Raw\_Results.xlsx

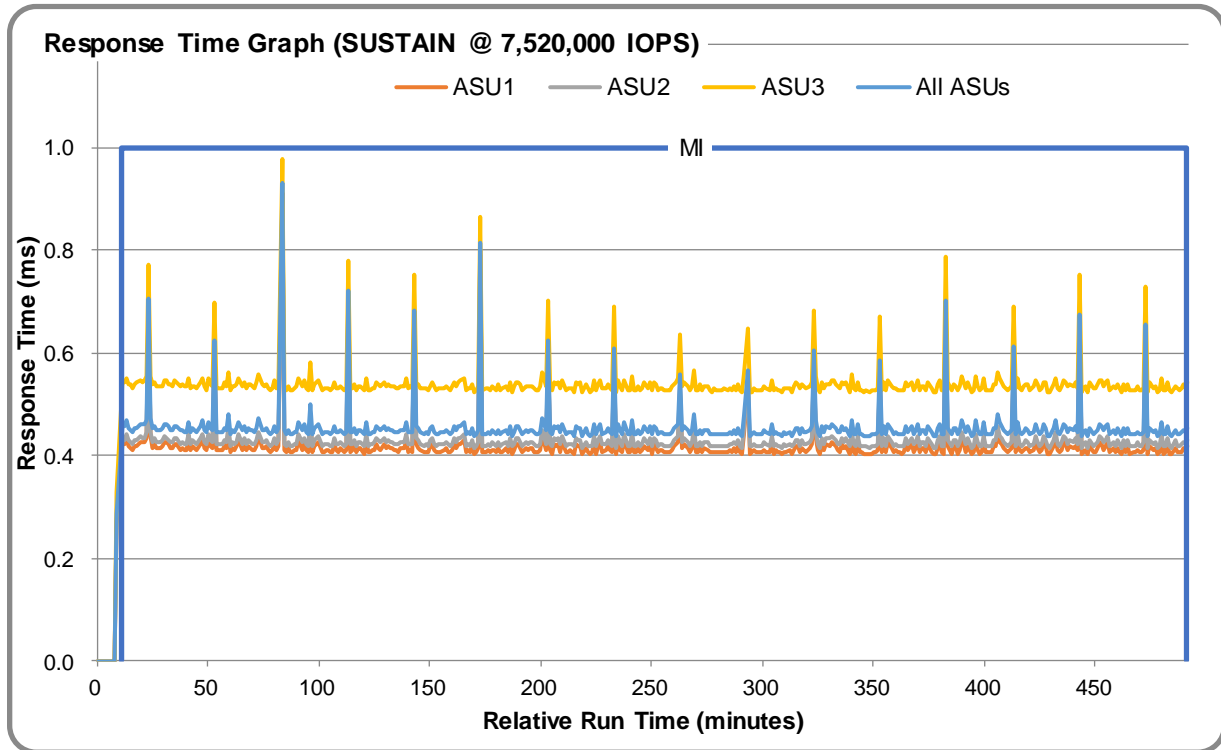
### SUSTAIN – Execution Times

Interval	Start Date & Time	End Date & Time	Duration
Transition Period	17-Mar-20 12:23:10	17-Mar-20 12:26:10	0:03:00
Measurement Interval	17-Mar-20 12:26:10	17-Mar-20 20:26:11	8:00:01

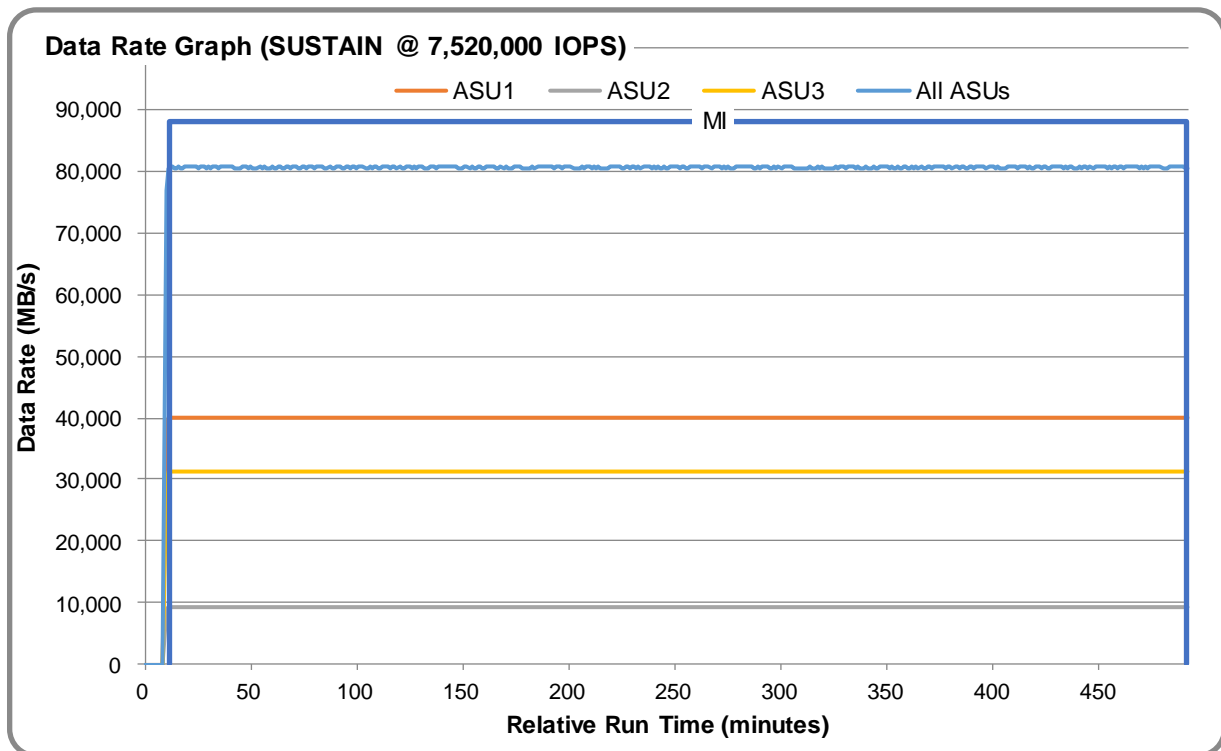
### SUSTAIN – Throughput Graph



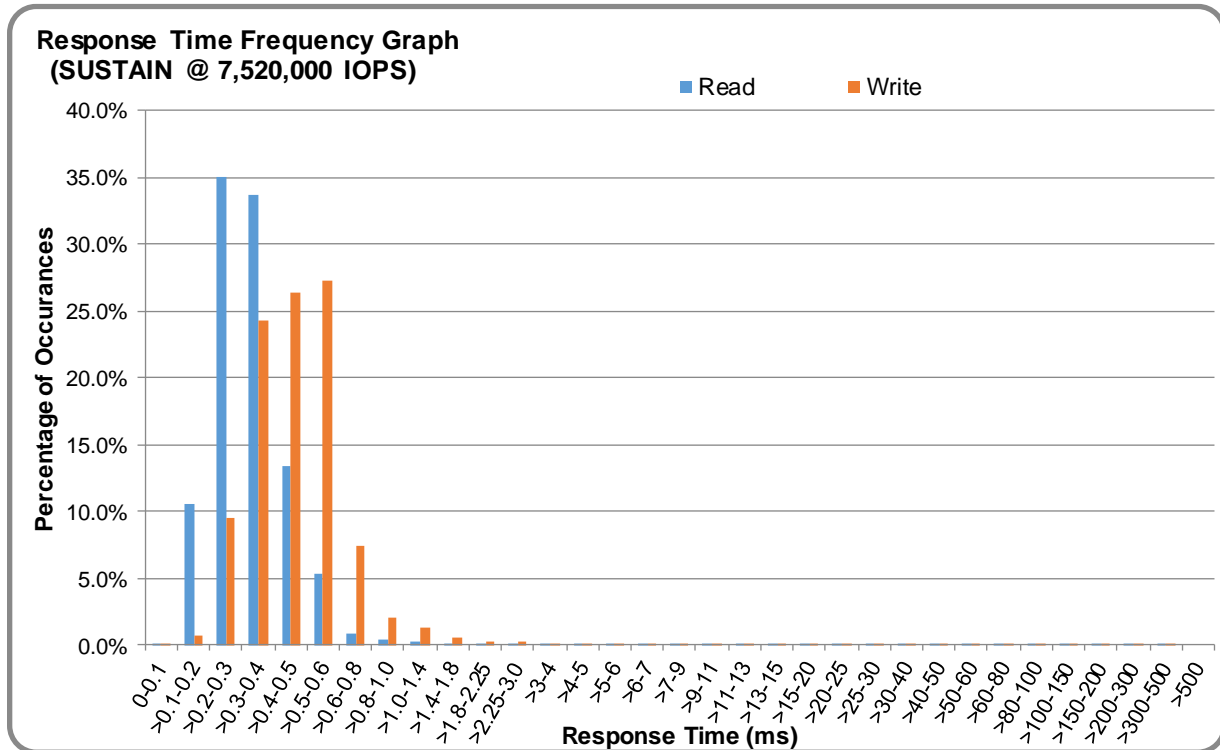
### SUSTAIN – Response Time Graph



### 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
<b>Defined</b>	0.0350	0.2810	0.0700	0.2100	0.0180	0.0700	0.0350	0.2810
<b>Measured</b>	0.0350	0.2810	0.0700	0.2100	0.0180	0.0700	0.0350	0.2810
<b>Variation</b>	0.0003	0.0001	0.0002	0.0001	0.0003	0.0002	0.0002	0.0001
<b>Difference</b>	0.005%	0.002%	0.005%	0.001%	0.007%	0.004%	0.006%	0.002%

## RAMPD\_100 Test Phase

### RAMPD 100 – Results File

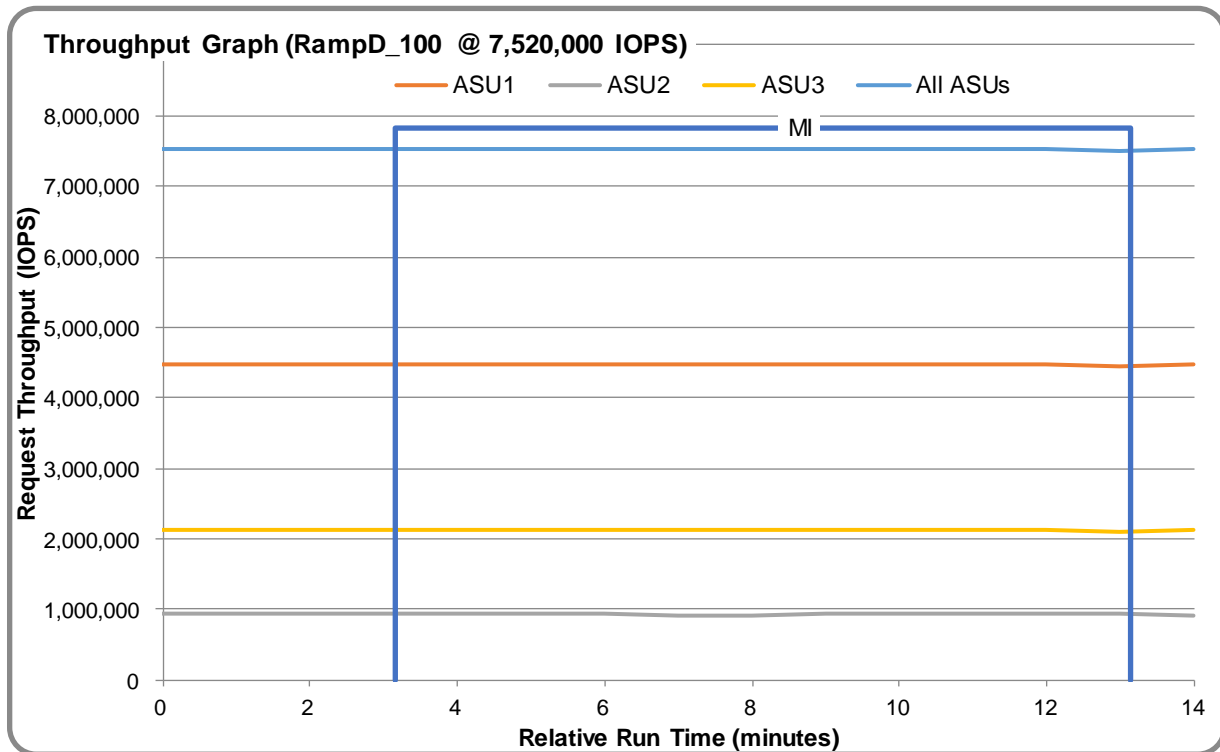
The results file generated during the execution of the RAMPD\_100 Test Phase is included in the Supporting Files (see Appendix A) as follows:

- SPC1\_METRICS\_0\_Raw\_Results.xlsx

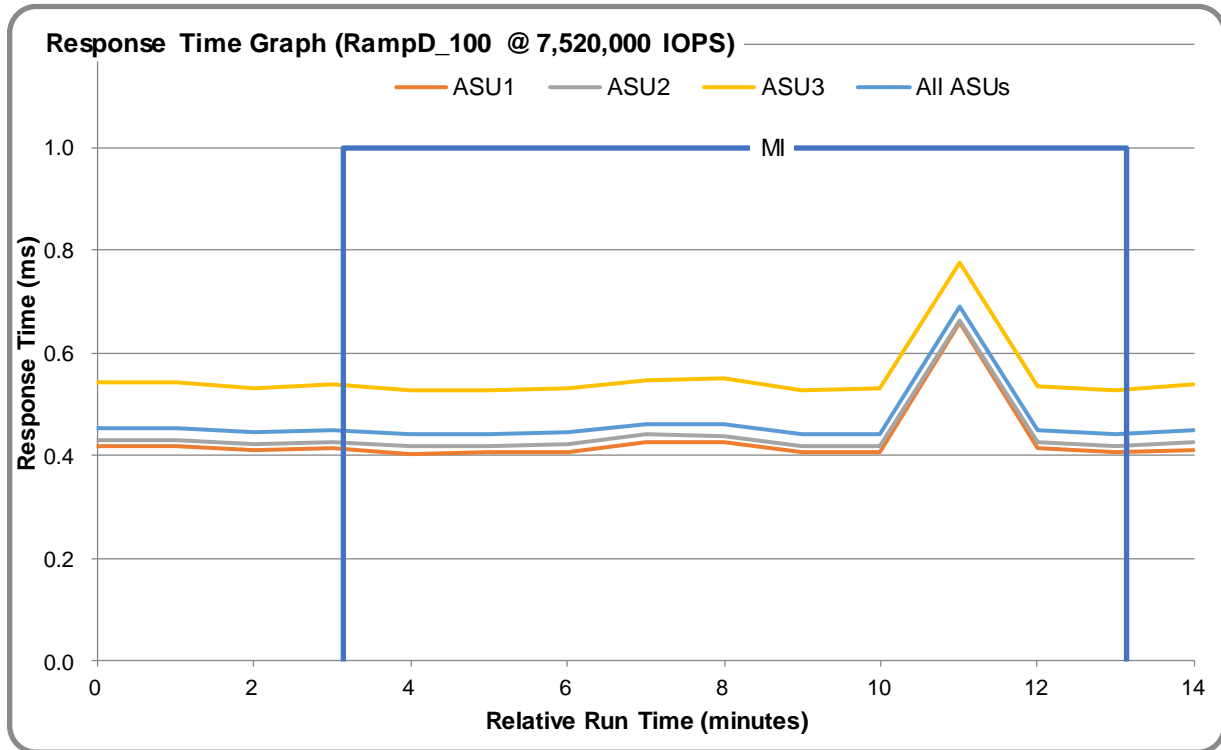
### RAMPD 100 – Execution Times

Interval	Start Date & Time	End Date & Time	Duration
Transition Period	17-Mar-20 20:27:10	17-Mar-20 20:30:11	0:03:01
Measurement Interval	17-Mar-20 20:30:11	17-Mar-20 20:40:11	0:10:00

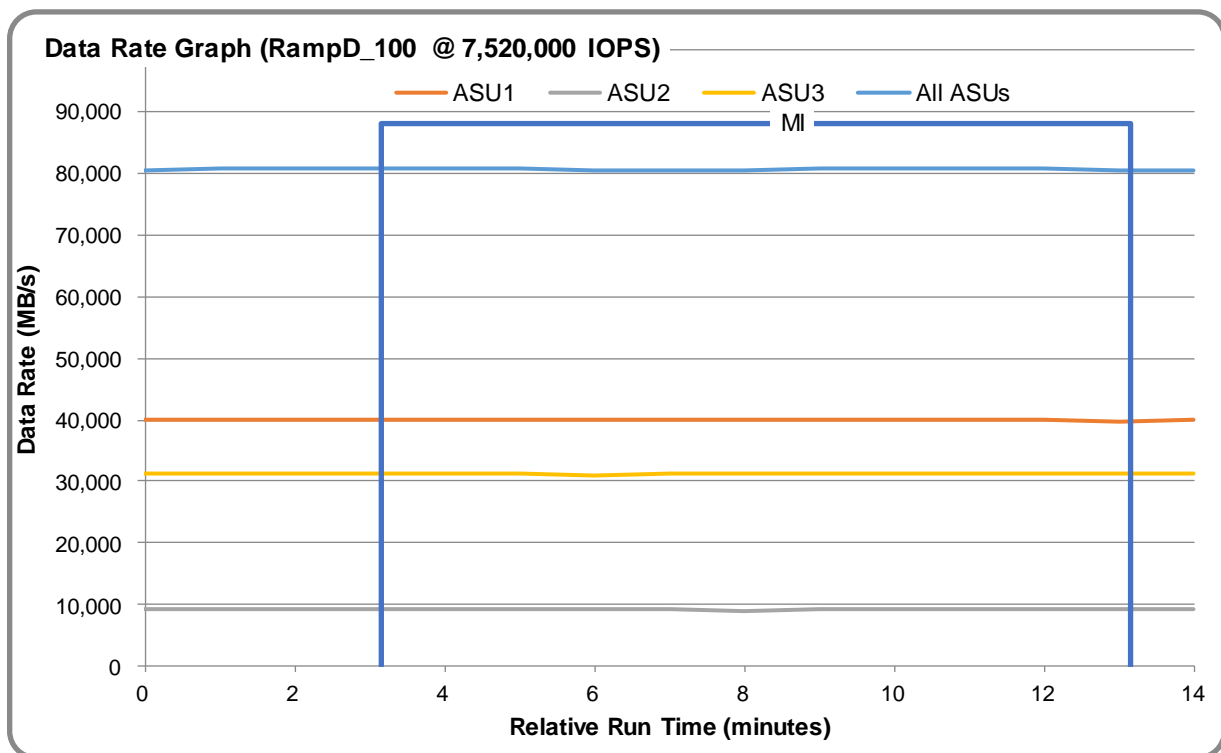
### RAMPD 100 – Throughput Graph



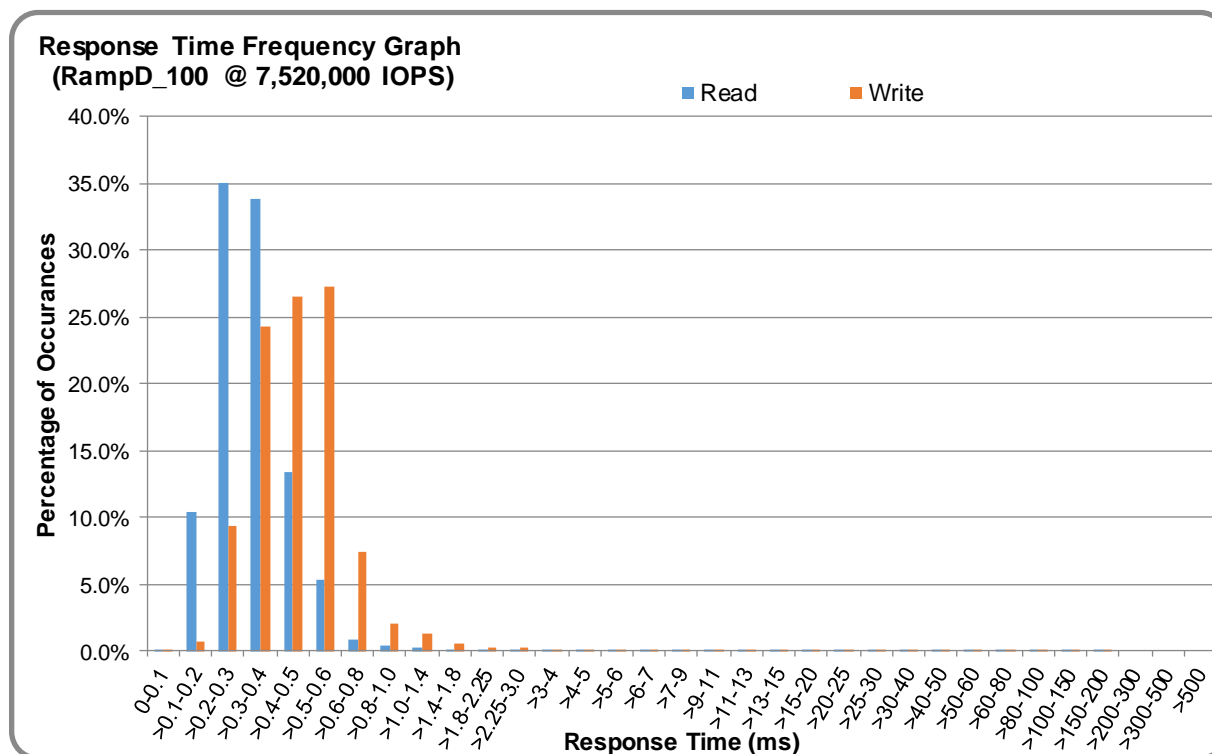
### RAMPD 100 – Response Time Graph



### 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
<b>Defined</b>	0.0350	0.2810	0.0700	0.2100	0.0180	0.0700	0.0350	0.2810
<b>Measured</b>	0.0350	0.2810	0.0700	0.2100	0.0180	0.0700	0.0350	0.2810
<b>Variation</b>	0.0002	0.0001	0.0001	0.0001	0.0004	0.0002	0.0002	0.0000
<b>Difference</b>	0.006%	0.000%	0.001%	0.002%	0.001%	0.008%	0.004%	0.001%

### RAMPD 100 – I/O Request Summary

<b>I/O Requests Completed in the Measurement Interval</b>	4,512,199,342
<b>I/O Requests Completed with Response Time &lt;= 30 ms</b>	4,510,565,175
<b>I/O Requests Completed with Response Time &gt; 30 ms</b>	1,634,167

## Response Time Ramp Test

### Response Time Ramp Test – Results File

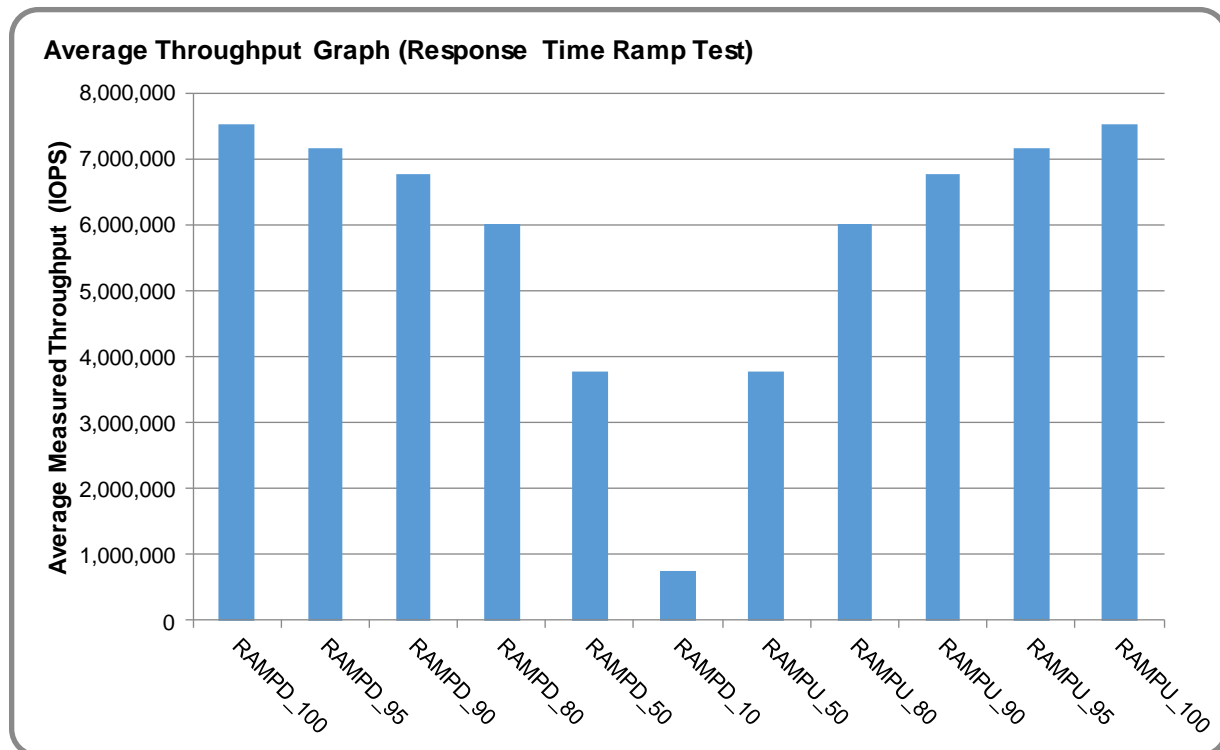
The results file generated during the execution of the Response Time Ramp Test is included in the Supporting Files (see Appendix A) as follows:

- **SPC1\_METRICS\_0\_Raw\_Results.xlsx**

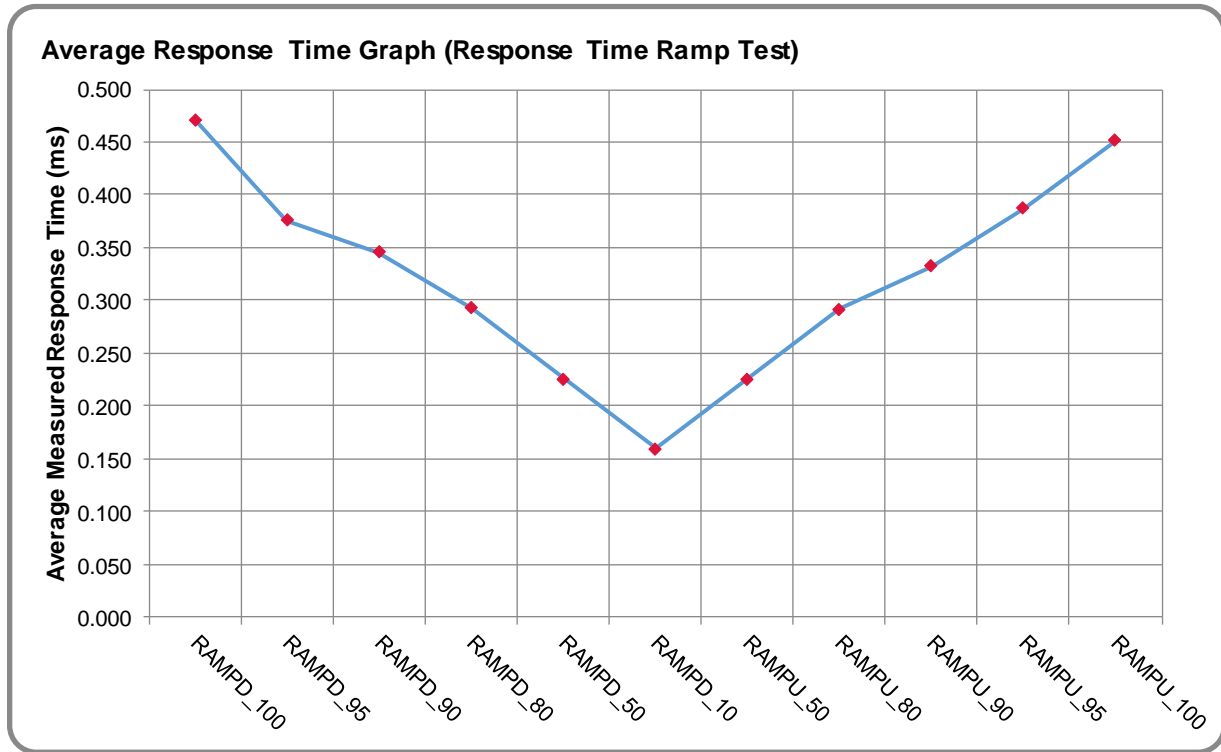
### Response Time Ramp Test – Phases

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).

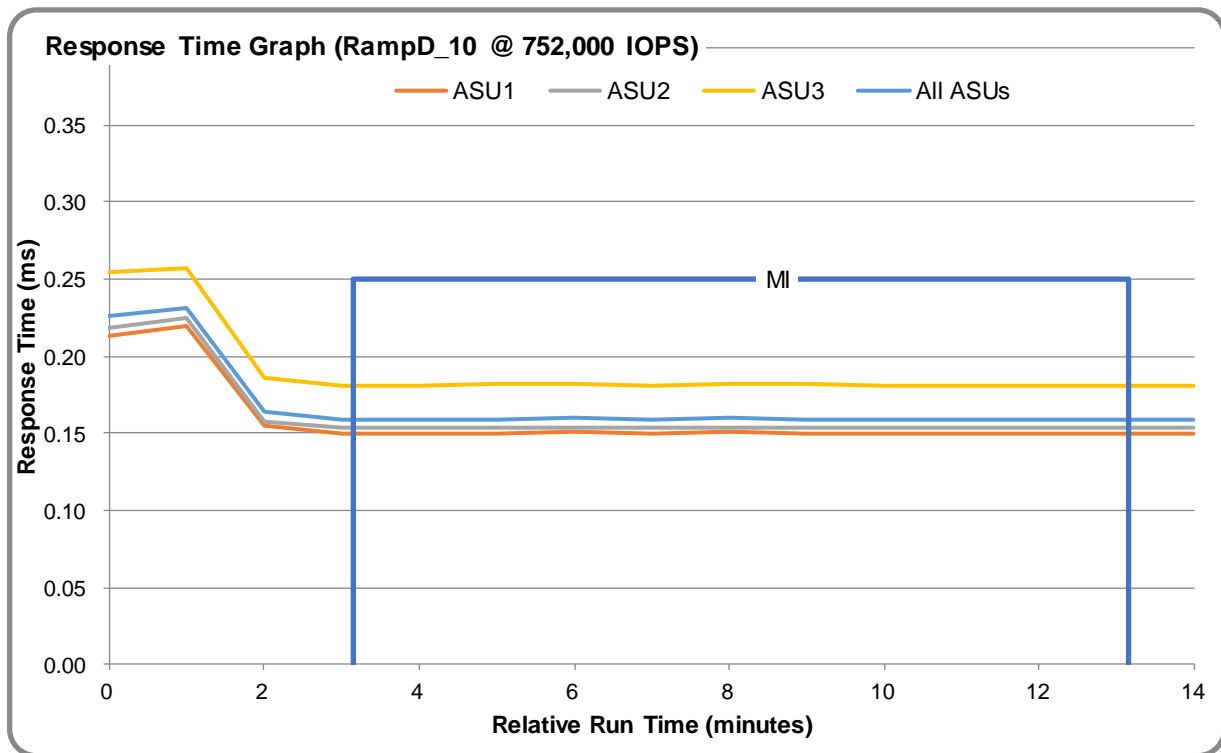
### Response Time Ramp Test – Average Throughput Graph



**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:

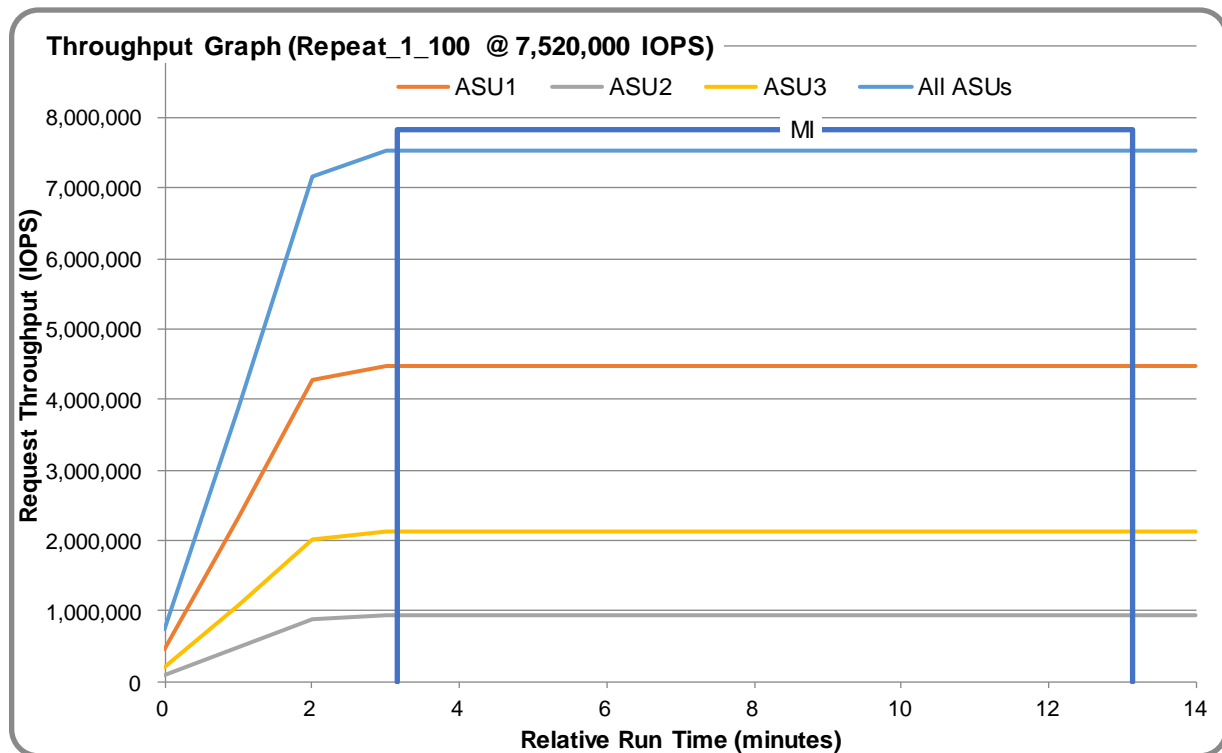
- **SPC1\_METRICS\_0\_Raw\_Results.xlsx**

### Repeatability Test Results

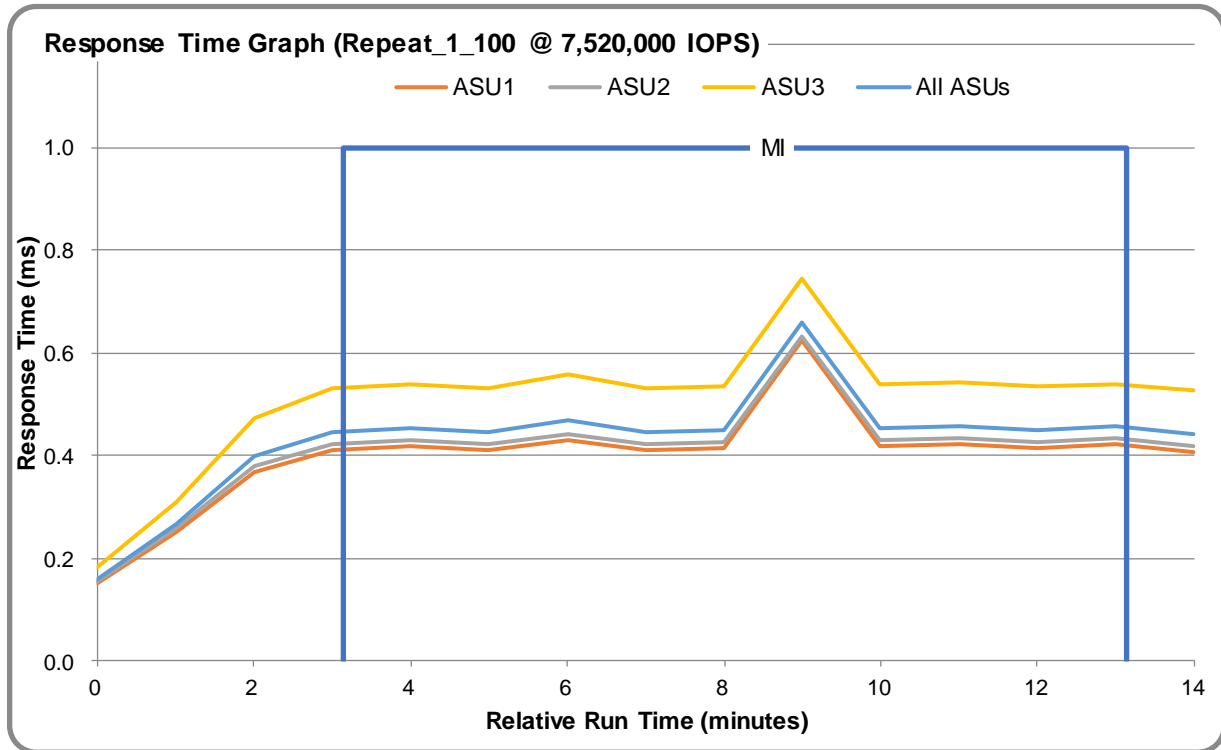
The throughput measurements for the Response Time Ramp Test (RAMPD) and the Repeatability Test Phases (REPEAT\_1 and REPEAT\_2) are listed in the table below.

Test Phase	100% IOPS	10% IOPS
RAMPD	7,520,358.9	752,061.5
REPEAT_1	7,520,562.0	752,072.4
REPEAT_2	7,520,352.5	752,046.0

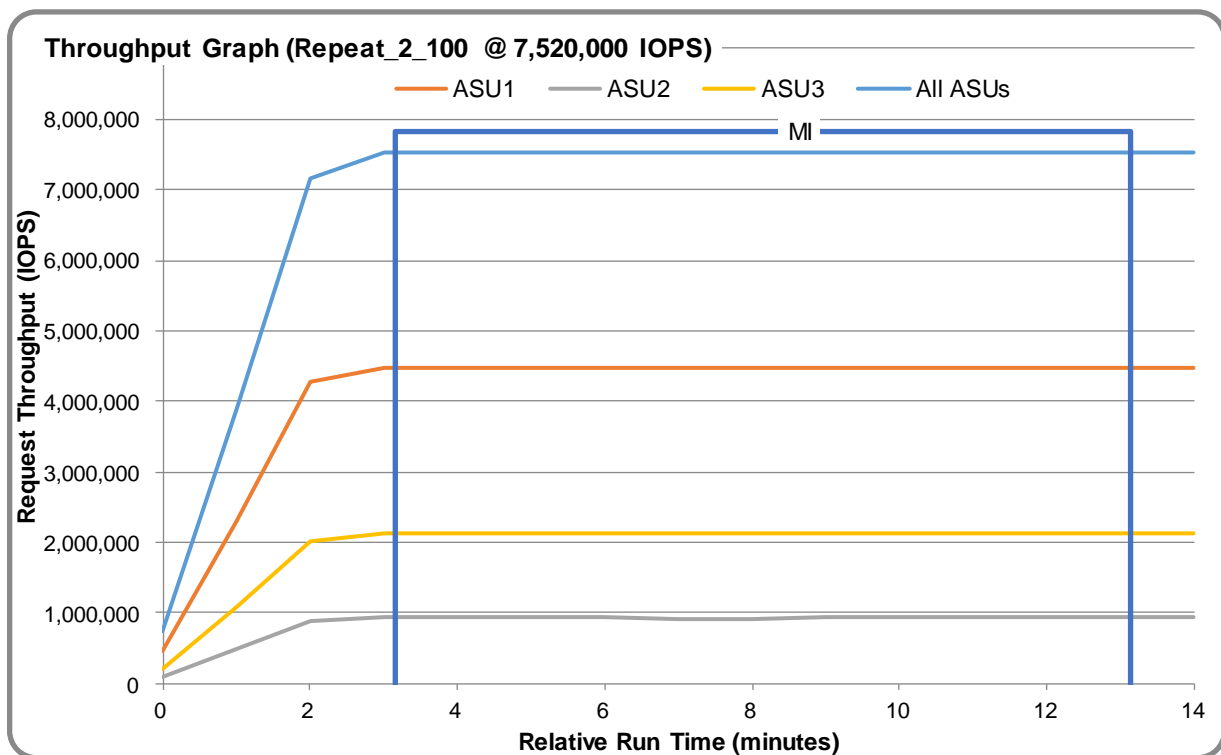
### REPEAT 1 100 - Throughput Graph



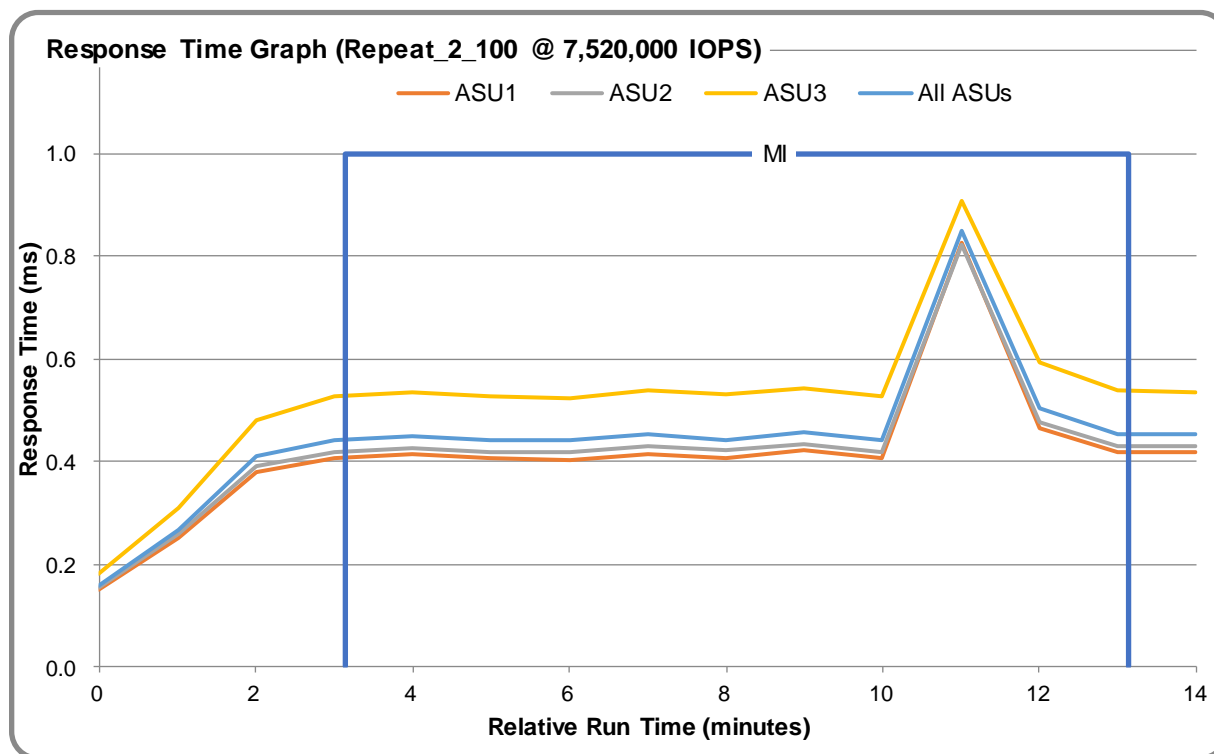
### REPEAT 1 100 – Response Time Graph



### 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
<b>Defined</b>	0.0350	0.2810	0.0700	0.2100	0.0180	0.0700	0.0350	0.2810
<b>Measured</b>	0.0350	0.2810	0.0700	0.2100	0.0180	0.0700	0.0350	0.2810
<b>Variation</b>	0.0003	0.0001	0.0002	0.0001	0.0004	0.0001	0.0002	0.0001
<b>Difference</b>	0.007%	0.002%	0.008%	0.002%	0.009%	0.008%	0.002%	0.003%

#### REPEAT\_2\_100 Test Phase

	ASU1-1	ASU1-2	ASU1-3	ASU1-4	ASU2-1	ASU2-2	ASU2-3	ASU3-1
<b>Defined</b>	0.0350	0.2810	0.0700	0.2100	0.0180	0.0700	0.0350	0.2810
<b>Measured</b>	0.0350	0.2810	0.0700	0.2100	0.0180	0.0700	0.0350	0.2810
<b>Variation</b>	0.0003	0.0001	0.0002	0.0001	0.0004	0.0002	0.0003	0.0001
<b>Difference</b>	0.005%	0.003%	0.004%	0.001%	0.020%	0.005%	0.012%	0.003%

## 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

<b>Data Persistence Test Phase: Persist1</b>	
<b>Total Number of Logical Blocks Written</b>	1,544,669,672
<b>Total Number of Logical Blocks Verified</b>	762,727,052
<b>Total Number of Logical Blocks Overwritten</b>	781,942,620
<b>Total Number of Logical Blocks that Failed Verification</b>	0
<b>Time Duration for Writing Test Logical Blocks (sec.)</b>	601
<b>Size in bytes of each Logical Block</b>	8,192
<b>Number of Failed I/O Requests in the process of the Test</b>	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.

<b>File Name</b>	<b>Description</b>	<b>Location</b>
<b>/SPC1_RESULTS</b>	<b>Data reduction worksheets</b>	<b>root</b>
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
<b>/C_Tuning</b>	<b>Tuning parameters and options</b>	<b>root</b>
set_nr_requests.sh	Set queue depth, max AIO and scheduler	/C_Tuning
<b>/D_Creation</b>	<b>Storage configuration creation</b>	<b>root</b>
init_as5600G2.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
<b>/E_Inventory</b>	<b>Configuration inventory</b>	<b>root</b>
profile.sh	Captures profile of storage environment	/E_Inventory
profile_end_as5600g2.txt	Storage configuration after restart	/E_Inventory
profile_start_as5600g2.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
<b>/F_Generator</b>	<b>Workload generator</b>	<b>root</b>
full_test_before_persist.sh	Executes all test phases before PERSIST1	/F_generator
HOST16.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. Ltd.).

## **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 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_as5600g2.sh` script on a remote server which can login on AS5600G2 storage system to complete the following:

1. Create 8 storage pools: Pool0, Pool1, Pool2, Pool3, Pool4, Pool5, Pool6, Pool7
2. Create 32 RAID10
3. Create 160 LUNs(20 LUN per Pool, 1700 GB per LUN)
4. Create 16 Hosts in storage cluster
5. Add the FC port's WWPN to the 16 hosts (4 WWPNs per Host)
6. Map LUNs to the 16 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 160 physical volumes using the `pvcreeate` command.

2. Create Volumes Groups

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

Create `spc1vg1` using 80 of 160 physical volumes, and create `spc1vg2` using 80 of 160 physical volumes

3. Create Logical Volumes

- Create 9 logical volumes, every volume capacity is 6400 GB, on `spc1vg1` for ASU-1.
- Create 9 logical volumes, every volume capacity is 6400 GB, on `spc1vg2` for ASU-1
- Create 9 logical volumes, every volume capacity is 6400 GB, on `spc1vg1` for ASU-2.
- Create 9 logical volumes, every volume capacity is 6400 GB, on `spc1vg2` for ASU-2.
- Create 2 logical volumes, every volume capacity is 6400 GB, on `spc1vg1` for ASU-3.
- Create 2 logical volumes, every volume capacity is 6400 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\_as5600g2.txt
- profile\_end\_as5600g2.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 HOST16.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).