SPC BENCHMARK 1™
FULL DISCLOSURE REPORT

HUAWEI TECHNOLOGIES CO., LTD.
HUAWEI OCEANSTOR™ S2600

SPC-1 V1.12

Submitted for Review: March 18, 2010
Submission Identifier: A00090
Revised: December 13, 2012

First Edition – March 2010

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AUDIT CERTIFICATION

Eric He
Huawei Symantec Technologies Co., Ltd.
Tianchen Road 88#
Chengdu, Sichuan, China 611711

March 17, 2010

The SPC Benchmark 1™ results listed below for the Huawei Symantec Oceanspace S2600 were produced in compliance with the SPC Benchmark 1™ 1.12 Remote Audit requirements.

SPC Benchmark 1™ 1.12 Results	
Tested Storage Configuration (TSC) Name: Huawei Symantec Oceanspace S2600	
Metric	**Reported Result**
SPC-1 IOPS™	16,995.54
SPC-1 Price-Performance	CNY 18.25/SPC-1 IOPS™
Total ASU Capacity	2.920.000 GB
Data Protection Level	Protected *(Mirroring)*
Total TSC Price (including three-year maintenance)	CNY 310,220

The following SPC Benchmark 1™ Remote Audit requirements were reviewed and found compliant with 1.12 of the SPC Benchmark 1™ specification:

- A Letter of Good Faith, signed by a senior executive.
- The following Data Repository storage items, based on information supplied by Huawei Symantec Technologies Co., Ltd.:
  - ✓ Physical Storage Capacity and requirements.
  - ✓ Configured Storage Capacity and requirements.
  - ✓ Addressable Storage Capacity and requirements.
  - ✓ Capacity of each Logical Volume and requirements.
  - ✓ Capacity of each Application Storage Unit (ASU) and requirements.
- An appropriate diagram of the Benchmark Configuration (BC)/Tested Storage Configuration (TSC).
- Listings and commands to configure the Benchmark Configuration/Tested Storage Configuration, including customer tunable parameters that were changed from default values.

Storage Performance Council
643 Bair Island Road, Suite 103
Redwood City, CA 94062
AuditService@storageperformance.org
650.556.9384

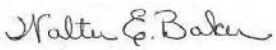
AUDIT CERTIFICATION *(CONT.)*

- SPC-1 Workload Generator commands and parameters used for the audited SPC Test Runs.
- The following Host System requirements, based on information supplied by Huawei Symantec Technologies Co., Ltd.:
  - ✓ The type of Host System including the number of processors and main memory.
  - ✓ The presence and version number of the SPC-1 Workload Generator on each Host System.
  - ✓ The TSC boundary within each Host System.
- The Test Results Files and resultant Summary Results Files received from Huawei Symantec Technologies Co., Ltd. for each of following were authentic, accurate, and compliant with all of the requirements and constraints of Clauses 4 and 5 of the SPC-1 Benchmark Specification:
  - ✓ Data Persistence Test
  - ✓ Sustainability Test Phase
  - ✓ IOPS Test Phase
  - ✓ Response Time Ramp Test Phase
  - ✓ Repeatability Test
- There were no differences between the Tested Storage Configuration (TSC) used for the benchmark and Priced Storage.
- The submitted pricing information met all of the requirements and constraints of Clause 8 of the SPC-1 Benchmark Specification.
- The Full Disclosure Report (FDR) met all of the requirements in Clause 9 of the SPC-1 Benchmark Specification.
- This successfully audited SPC measurement is not subject to an SPC Confidential Review.

Audit Notes:

There were no audit notes or exceptions.

Respectfully,



Walter E. Baker
SPC Auditor

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LETTER OF GOOD FAITH

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http://www.huaweisymantec.com/en/

Date: March 17, 2010

From: Huawei Symantec Technologies Co., Ltd.

To: Walter E. Baker, SPC Auditor
Gradient Systems, Inc.
643 Bair Island Road. Suite 103
Redwood City, CA 94063

Subject: SPC-1 Letter of Good Faith for the Huawei Symantec Oceanspace S2600

Huawei Symantec Technologies 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 benchmark results and materials we have submitted for that product are complete, accurate, and in full compliance with V1.12 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,

Su Liqing

Su Liqing
Senior Vice President R&D

EXECUTIVE SUMMARY

Test Sponsor and Contact Information

Test Sponsor and Contact Information	
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Test Sponsor Alternate Contact	Huawei Technologies Co., Ltd. – http://www.huawei.com/en/ Prairie Liu – liuyuan09@huawei.com No. 1899, Xiyuan Road Chengdu, 611731 P.R. China Phone: 0086 28 65281941 FAX: 0086 28 64696419
Auditor	Storage Performance Council – http://www.storageperformance.org Walter E. Baker – AuditService@StoragePerformance.org 643 Bair Island Road, Suite 103 Redwood City, CA 94063 Phone: (650) 556-9384 FAX: (650) 556-9385

Revision Information and Key Dates

Revision Information and Key Dates	
SPC-1 Specification revision number	V1.12
SPC-1 Workload Generator revision number	V2.1.0
Date Results were first used publicly	March 18, 2010
Date the FDR was submitted to the SPC	March 18, 2010
Date revised FDR was submitted to the SPC Updated company name, logo and product name to reflect the complete acquisition of Huawei Symantec by Huawei Technologies Co., Ltd.	December 13, 2012
Date the priced storage configuration is available for shipment to customers	currently available
Date the TSC completed audit certification	March 17, 2010

Tested Storage Product (TSP) Description

Huawei OceanStor™ S2600 *(hereinafter referred to as the S2600)* series storage products are the third-generation products for small and medium-sized enterprises. Owing to evolutionary architectural design, the S2600 features easy management and energy-saving, and provides economical storage solutions and perfect data protection.

Summary of Results

SPC-1 Results	
Tested Storage Product (TSP) Name: Huawei OceanStor™ S2600	
Metric	**Reported Result**
SPC-1 IOPS™	16,995.54
SPC-1 Price-Performance	CNY 18.25/SPC-1 IOPS™
Total ASU Capacity	2,920.000 GB
Data Protection Level	Protected *(Mirroring)*
Total TSP Price (including three-year maintenance)	CNY 310,220

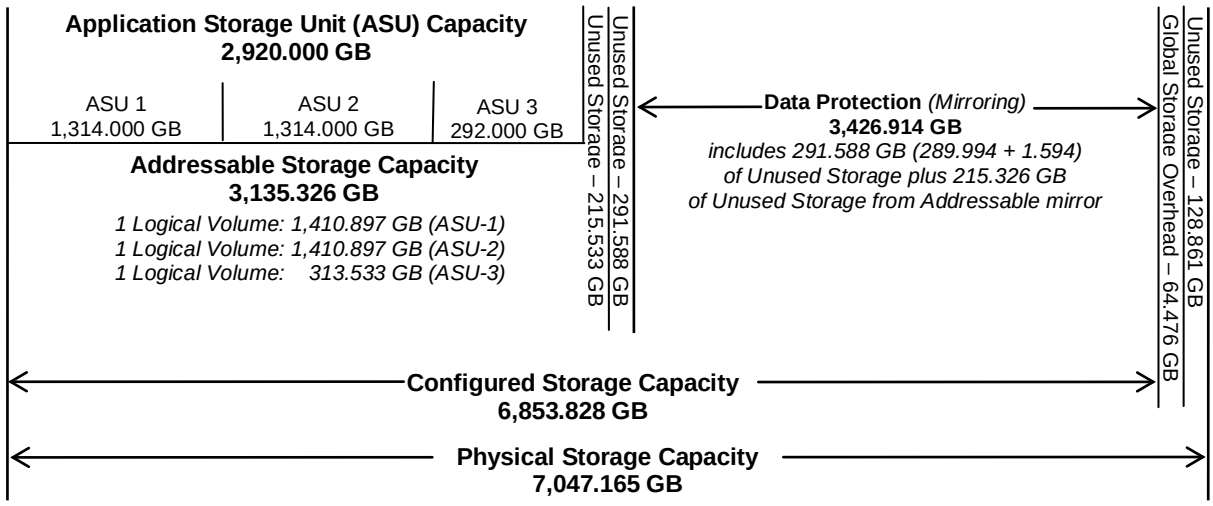
SPC-1 IOPS™ represents the maximum I/O Request Throughput at the 100% load point.

Total ASU (Application Storage Unit) **Capacity** represents the total storage capacity read and written in the course of executing the SPC-1 benchmark.

A **Data Protection Level** of **Protected** using ***Mirroring*** configures two or more identical copies of user data.

Storage Capacities, Relationships, and Utilization

The following diagram and table document the various storage capacities, used in this benchmark, and their relationships, as well as the storage utilization values required to be reported.



SPC-1 Storage Capacity Utilization	
Application Utilization	41.44%
Protected Application Utilization	82.87%
Unused Storage Ratio	16.21%

Application Utilization: Total ASU Capacity *(GB)* divided by Physical Storage Capacity *(GB)*

Protected Application Utilization: (Total ASU Capacity *(GB)* plus total Data Protection Capacity *(GB)* minus unused Data Protection Capacity *(GB)* divided by Physical Storage Capacity *(GB)*

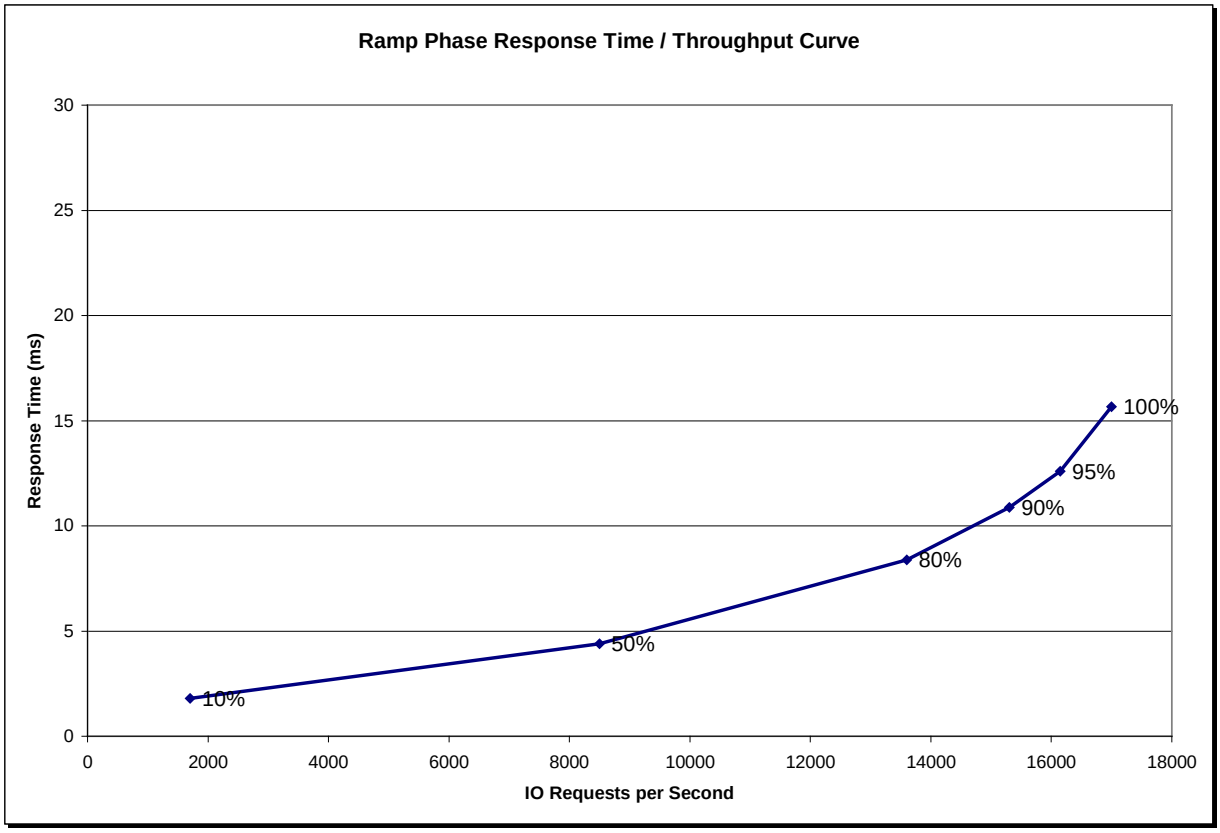
Unused Storage Ratio: Total Unused Capacity *(GB)* divided by Physical Storage Capacity *(GB)* and may not exceed 45%.

Detailed information for the various storage capacities and utilizations is available on pages 20-21 in the Full Disclosure Report.

Response Time – Throughput Curve

The Response Time-Throughput Curve illustrates the Average Response Time (milliseconds) and I/O Request Throughput at 100%, 95%, 90%, 80%, 50%, and 10% of the workload level used to generate the SPC-1 IOPS™ metric.

The Average Response Time measured at any of the above load points cannot exceed 30 milliseconds or the benchmark measurement is invalid.



Response Time – Throughput Data

	10% Load	50% Load	80% Load	90% Load	95% Load	100% Load
I/O Request Throughput	1,703.44	8,498.69	13,599.56	15,300.22	16,147.30	16,995.54
Average Response Time (ms):						
All ASUs	1.81	4.39	8.39	10.88	12.59	15.66
ASU-1	2.36	5.56	9.89	12.08	13.57	16.09
ASU-2	1.74	4.31	9.18	11.78	13.44	16.25
ASU-3	0.66	1.95	4.85	7.95	10.13	14.50
Reads	3.62	8.24	14.05	15.78	16.85	18.18
Writes	0.63	1.88	4.71	7.70	9.82	14.02

Priced Storage Configuration Pricing

Product Name	Quantity	Unit list Price in RMB	Total list Price in RMB	Discount	Unit price after discount in RMB	Total price after discount in RMB
OceanStor S2600 Base Unit * Active-Active controllers ** 8GB of memory, 4GB per controller ** 2 - quad host port modules, 1 module per controller ** 8 - 4Gb SFPs	1	343,800.00	343,800.00	80.00%	68,760.00	68,760.00
D120s Expansion Unit * 2 - 1-Meter Mini SAS Cable	3	121,800.00	365,400.00	80.00%	24,360.00	73,080.00
146 GB, 15K RPM SAS Disk Drive	48	15,000.00	720,000.00	80.00%	3,000.00	144,000.00
Dual-port Qlogic QLE2462 Fiber Channel HBA	2	11,060.00	22,120.00	0.00%	11,060.00	22,120.00
5-Meter Fiber Optic Cable	4	90.00	360.00	0.00%	90.00	360.00
Maintenance/Support: 3 years, 24*7, with 4-hour acknowledgement and 4-hour onsite	1	1,900.00	1,900.00	0.00%	1,900.00	1,900.00
Total			1,453,580.00			310,220.00

Differences between the Tested Storage Configuration (TSC) and Priced Storage Configuration

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

Priced Storage Configuration Diagram

2 - dual-port Qlogic QLE2462 FC HBAs

Huawei OceanStor™ S2600
Active-Active controllers
8 GB memory, 4 GB per controller
2 - Quad 4Gbps FC host port modules
8 - 4 Gbps SFPs

3 - D120s Expansion Units

48 - 146.8 GB 15K RPM disk drives
12 - disk drives in the controller unit
12 - disk drives in each D120s

Priced Storage Configuration Components

Priced Storage Configuration:
2 – dual-port Qlogic 2462 FC HBAs
Huawei OceanStor™ S2600 **Active-Active controllers with:** 8 GB cache total, 4 GB per controller 2 – Quad 4 Gbps FC port host modules *(1 per controller)* 8 – 4 Gbps Fibre Channel host ports *(4 per controller)* 2 – 4*3 Gbps Mini SAS expander ports *(1 per controller)* 8 – 4 Gbps SFPs
3 – D120s Expansion Units
48 – 146.8 GB 15K RPM SAS disk drives

In each of the following sections of this document, the appropriate Full Disclosure Report requirement, from the SPC-1 benchmark specification, is stated in italics followed by the information to fulfill the stated requirement.

CONFIGURATION INFORMATION

Benchmark Configuration (BC)/Tested Storage Configuration (TSC) Diagram

Clause 9.4.3.4.1

A one page Benchmark Configuration (BC)/Tested Storage Configuration (TSC) diagram shall be included in the FDR…

The Benchmark Configuration (BC)/Tested Storage Configuration (TSC) is illustrated on page 17 *(*Benchmark Configuration/Tested Storage Configuration Diagram*).*

Storage Network Configuration

Clause 9.4.3.4.1

…

5. *If the TSC contains network storage, the diagram will include the network configuration. If a single diagram is not sufficient to illustrate both the Benchmark Configuration and network configuration in sufficient detail, the Benchmark Configuration diagram will include a high-level network illustration as shown in Figure 9-8. In that case, a separate, detailed network configuration diagram will also be included as described in Clause 9.4.3.4.2.*

Clause 9.4.3.4.2

If a storage network was configured as a part of the Tested Storage Configuration and the Benchmark Configuration diagram described in Clause 9.4.3.4.1 contains a high-level illustration of the network configuration, the Executive Summary will contain a one page topology diagram of the storage network as illustrated in Figure 9-9.

The TSC did not utilize network storage.

Host System and Tested Storage Configuration (TSC) Table of Components

Clause 9.4.3.4.3

The FDR will contain a table that lists the major components of each Host System and the Tested Storage Configuration (TSC). Table 9-10 specifies the content, format, and appearance of the table.

The Host System and TSC table of components may be found on page 18 *(Host System(s) and Tested Storage Configuration Components).*

Benchmark Configuration/Tested Storage Configuration Diagram

HS1: **HP ProLiant DL580G5 Server**

2 - dual-port Qlogic QLE2462 FC HBAs

SC-1/SC-2:
Huawei OceanStor™ S2600
Active-Active controllers
8 GB memory, 4 GB per controller
2 - Quad 4Gbps FC host port modules
8 - 4 Gbps SFPs

3 - D120s Expansion Units

48 - 146.8 GB 15K RPM disk drives
12 - disk drives in the controller unit
12 - disk drives in each D120s

Host System(s) and Tested Storage Configuration Components

Host System:	Tested Storage Configuration (TSC):
HS-1: HP ProLiant DL580G5 Server	2 – dual-port Qlogic 2462 FC HBAs
4 – Intel Xeon E7330 2.4GHz Quad Processors with 6 MB L2 cache	**SC-1/SC-2:** **Huawei OceanStor™ S2600** **Active-Active controllers with:** 8 GB cache total, 4 GB per controller 2 – Quad 4 Gbps FC host port modules *(1 per controller)* 8 – 4 Gbps Fibre Channel host ports *(4 per controller)* 2 – 4*3 Gbps Mini SAS expander ports *(1 per controller)* 8 – 4 Gbps SFPs
16 GB main memory	
Windows Server 2003 Enterprise Edition 32-bit with SP2	
UltraPath for Windows, version 01.01.14T01	
PCIe:	
WG	3 – D120s Expansion Units
	48 – 146.8 GB 15K RPM SAS disk drives

Customer Tunable Parameters and Options

Clause 9.4.3.5.1

All Benchmark Configuration (BC) components with customer tunable parameter and options that have been altered from their default values must be listed in the FDR. The FDR entry for each of those components must include both the name of the component and the altered value of the parameter or option. If the parameter name is not self-explanatory to a knowledgeable practitioner, a brief description of the parameter's use must also be included in the FDR entry.

"Appendix B: Customer Tunable Parameters and Options" on page 62 contains the customer tunable parameters and options that have been altered from their default values for this benchmark.

Tested Storage Configuration (TSC) Description

Clause 9.4.3.5.2

The FDR must include sufficient information to recreate the logical representation of the TSC. In addition to customer tunable parameters and options (Clause 4.2.4.5.3), that information must include, at a minimum:

- *A diagram and/or description of the following:*
  - *All physical components that comprise the TSC. Those components are also illustrated in the BC Configuration Diagram in Clause 9.2.4.4.1 and/or the Storage Network Configuration Diagram in Clause 9.2.4.4.2.*
  - *The logical representation of the TSC, configured from the above components that will be presented to the Workload Generator.*
- *Listings of scripts used to create the logical representation of the TSC.*
- *If scripts were not used, a description of the process used with sufficient detail to recreate the logical representation of the TSC.*

"Appendix C: Tested Storage Configuration (TSC) Creation" on page 63 contains the detailed information that describes how to create and configure the logical TSC.

SPC-1 Workload Generator Storage Configuration

Clause 9.4.3.5.3

The FDR must include all SPC-1 Workload Generator storage configuration commands and parameters.

The SPC-1 Workload Generator storage configuration commands and parameters for this measurement appear in "Appendix D: SPC-1 Workload Generator Storage Commands and Parameters" on page 66.

SPC-1 DATA REPOSITORY

This portion of the Full Disclosure Report presents the detailed information that fully documents the various SPC-1 storage capacities and mappings used in the Tested Storage Configuration. "SPC-1 Data Repository Definitions" on page 58 contains definitions of terms specific to the SPC-1 Data Repository.

Storage Capacities and Relationships

Clause 9.4.3.6.1

Two tables and an illustration documenting the storage capacities and relationships of the SPC-1 Storage Hierarchy (Clause 2.1) shall be included in the FDR.

SPC-1 Storage Capacities

SPC-1 Storage Capacities		
Storage Hierarchy Component	**Units**	**Capacity**
Total ASU Capacity	Gigabytes (GB)	2,920.000
Addressable Storage Capacity	Gigabytes (GB)	3,135.326
Configured Storage Capacity	Gigabytes (GB)	6,853.828
Physical Storage Capacity	Gigabytes (GB)	7,047.165
Data Protection *(Mirroring)*	Gigabytes (GB)	3,426.914
Required Storage	Gigabytes (GB)	0.000
Global Storage Overhead	Gigabytes (GB)	64.476
Total Unused Storage	Gigabytes (GB)	1,142.689

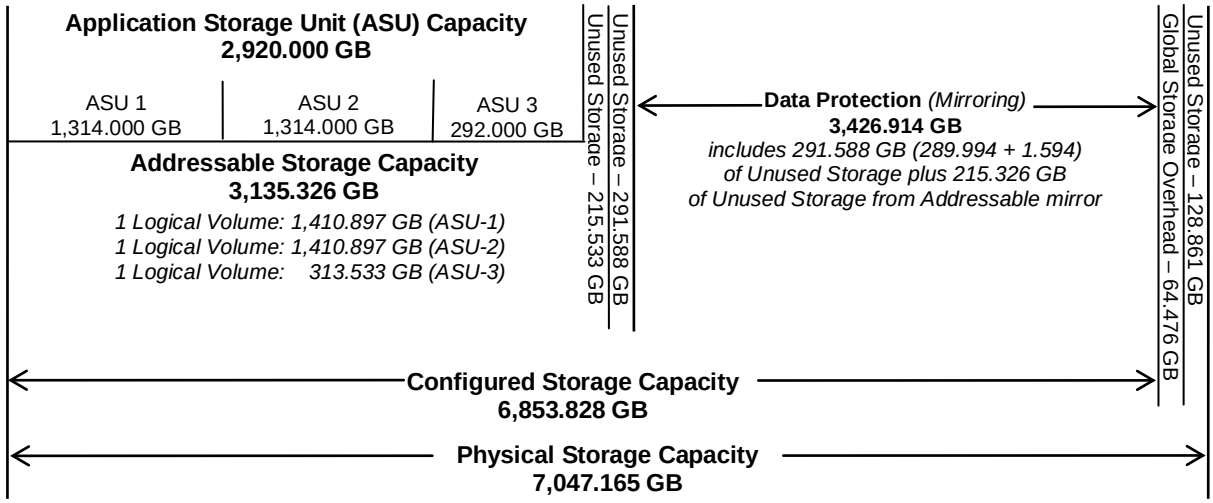
SPC-1 Storage Hierarchy Ratios

	Addressable Storage Capacity	Configured Storage Capacity	Physical Storage Capacity
Total ASU Capacity	93.13%	42.60%	41.44%
Required for Data Protection *(Mirrored)*		50.00%	48.63%
Addressable Storage Capacity		45.75%	44.49%
Required Storage		0.00%	0.00%
Configured Storage Capacity			97.26%
Global Storage Overhead			0.91%
Unused Storage:			
Addressable	6.87%		
Configured		8.51%	
Physical			1.83%

The Physical Storage Capacity consisted of 7,047.165 GB distributed over 48 disk drives each with a formatted capacity of 146.816 GB. There was 128.861 GB (1.83%) of Unused Storage within the Physical Storage Capacity. Global Storage Overhead consisted of 64.476 GB (0.91%) of Physical Storage Capacity. There was 583.176 GB (8.51%) of Unused Storage within the Configured Storage Capacity. The Total ASU Capacity utilized 93.13% of the Addressable Storage Capacity resulting in 215.326 GB (6.87%) of Unused Storage within the Addressable Storage Capacity. The Data Protection *(mirroring)* capacity was 3,426.914 GB of which 3,136.920 GB was utilized. The total Unused Storage was 1,142.689 GB.

SPC-1 Storage Capacities and Relationships Illustration

The various storage capacities configured in the benchmark result are illustrated below (not to scale).



Logical Volume Capacity and ASU Mapping

Clause 9.4.3.6.3

A table illustrating the capacity of each ASU and the mapping of Logical Volumes to ASUs shall be provided in the FDR. … Logical Volumes shall be sequenced in the table from top to bottom per its position in the contiguous address space of each ASU. The capacity of each Logical Volume shall be stated. … In conjunction with this table, the Test Sponsor shall provide a complete description of the type of data protection (see Clause 2.4.5) used on each Logical Volume.

Logical Volume Capacity and Mapping		
ASU-1 (1,314.000 GB)	**ASU-2 (1,314.000 GB)**	**ASU-3 (292.000 GB)**
1 Logical Volume 1,410.897 GB per Logical Volume (1,314.000 GB used per Logical Volume)	1 Logical Volume 1,410.897 GB per Logical Volume (1,314.000 GB used per Logical Volume)	1 Logical Volume 313.533 GB per Logical Volume (292.000 used per Logical Volume)

The Data Protection Level used for all Logical Volumes was "Mirrored" as described on page 11. See "ASU Configuration" in the **IOPS Test Results File** for more detailed configuration information.

Storage Capacity Utilization

Clause 9.4.3.6.2

The FDR will include a table illustrating the storage capacity utilization values defined for Application Utilization (Clause 2.8.1), Protected Application Utilization (Clause 2.8.2), and Unused Storage Ratio (Clause 2.8.3).

Clause 2,8.1

Application Utilization is defined as Total ASU Capacity divided by Physical Storage Capacity.

Clause 2,8.2

Protected Application Utilization is defined as (Total ASU Capacity plus total Data Protection Capacity minus unused Data Protection Capacity) divided by Physical Storage Capacity.

Clause 2,8.3

Unused Storage Ratio is defined as Total Unused Capacity divided by Physical Storage Capacity and may not exceed 45%.

SPC-1 Storage Capacity Utilization	
Application Utilization	41.44%
Protected Application Utilization	82.87%
Unused Storage Ratio	16.21%

SPC-1 BENCHMARK EXECUTION RESULTS

This portion of the Full Disclosure Report documents the results of the various SPC-1 Tests, Test Phases, and Test Runs. "SPC-1 Test Execution Definitions" on page 59 contains definitions of terms specific to the SPC-1 Tests, Test Phases, and Test Runs.

Clause 5.4.3

The Tests must be executed in the following sequence: Primary Metrics, Repeatability, and Data Persistence. That required sequence must be uninterrupted from the start of Primary Metrics to the completion of Persistence Test Run 1. Uninterrupted means the Benchmark Configuration shall not be power cycled, restarted, disturbed, altered, or adjusted during the above measurement sequence. If the required sequence is interrupted other than for the Host System/TSC power cycle between the two Persistence Test Runs, the measurement is invalid.

SPC-1 Tests, Test Phases, and Test Runs

The SPC-1 benchmark consists of the following Tests, Test Phases, and Test Runs:

- **Primary Metrics Test**
  - Sustainability Test Phase and Test Run
  - IOPS Test Phase and Test Run
  - Response Time Ramp Test Phase
    - 95% of IOPS Test Run
    - 90% of IOPS Test Run
    - 80% of IOPS Test Run
    - 50% of IOPS Test Run
    - 10% of IOPS Test Run (LRT)
- **Repeatability Test**
  - Repeatability Test Phase 1
    - 10% of IOPS Test Run (LRT)
    - IOPS Test Run
  - Repeatability Test Phase 2
    - 10% of IOPS Test Run (LRT)
    - IOPS Test Run
- **Data Persistence Test**
  - Data Persistence Test Run 1
  - Data Persistence Test Run 2

Each Test is an atomic unit that must be executed from start to finish before any other Test, Test Phase, or Test Run may be executed.

The results from each Test, Test Phase, and Test Run are listed below along with a more detailed explanation of each component.

Primary Metrics Test – Sustainability Test Phase

Clause 5.4.4.1.1

The Sustainability Test Phase has exactly one Test Run and shall demonstrate the maximum sustainable I/O Request Throughput within at least a continuous three (3) hour Measurement Interval. This Test Phase also serves to insure that the TSC has reached Steady State prior to reporting the final maximum I/O Request Throughput result (SPC-1 IOPS™).

Clause 5.4.4.1.2

The computed I/O Request Throughput of the Sustainability Test must be within 5% of the reported SPC-1 IOPS™ result.

Clause 5.4.4.1.4

The Average Response Time, as defined in Clause 5.1.1, will be computed and reported for the Sustainability Test Run and cannot exceed 30 milliseconds. If the Average Response time exceeds that 30-milliseconds constraint, the measurement is invalid.

Clause 9.4.3.7.1

For the Sustainability Test Phase the FDR shall contain:

1. *A Data Rate Distribution graph and data table.*
2. *I/O Request Throughput Distribution graph and data table.*
3. *A Response Time Frequency Distribution graph and table.*
4. *An Average Response Time Distribution graph and table.*
5. *The human readable Test Run Results File produced by the Workload Generator (may be included in an appendix).*
6. *A listing or screen image of all input parameters supplied to the Workload Generator (may be included in an appendix).*
7. *The Measured Intensity Multiplier for each I/O stream.*
8. *The variability of the Measured Intensity Multiplier, as defined in Clause 5.3.13.3.*

SPC-1 Workload Generator Input Parameters

The SPC-1 Workload Generator input parameters for the Sustainability, IOPS, Response Time Ramp, Repeatability, and Persistence Test Runs are documented in "Appendix E: SPC-1 Workload Generator Input Parameters" on Page 67.

Sustainability Test Results File

A link to the test results file generated from the Sustainability Test Run is listed below.

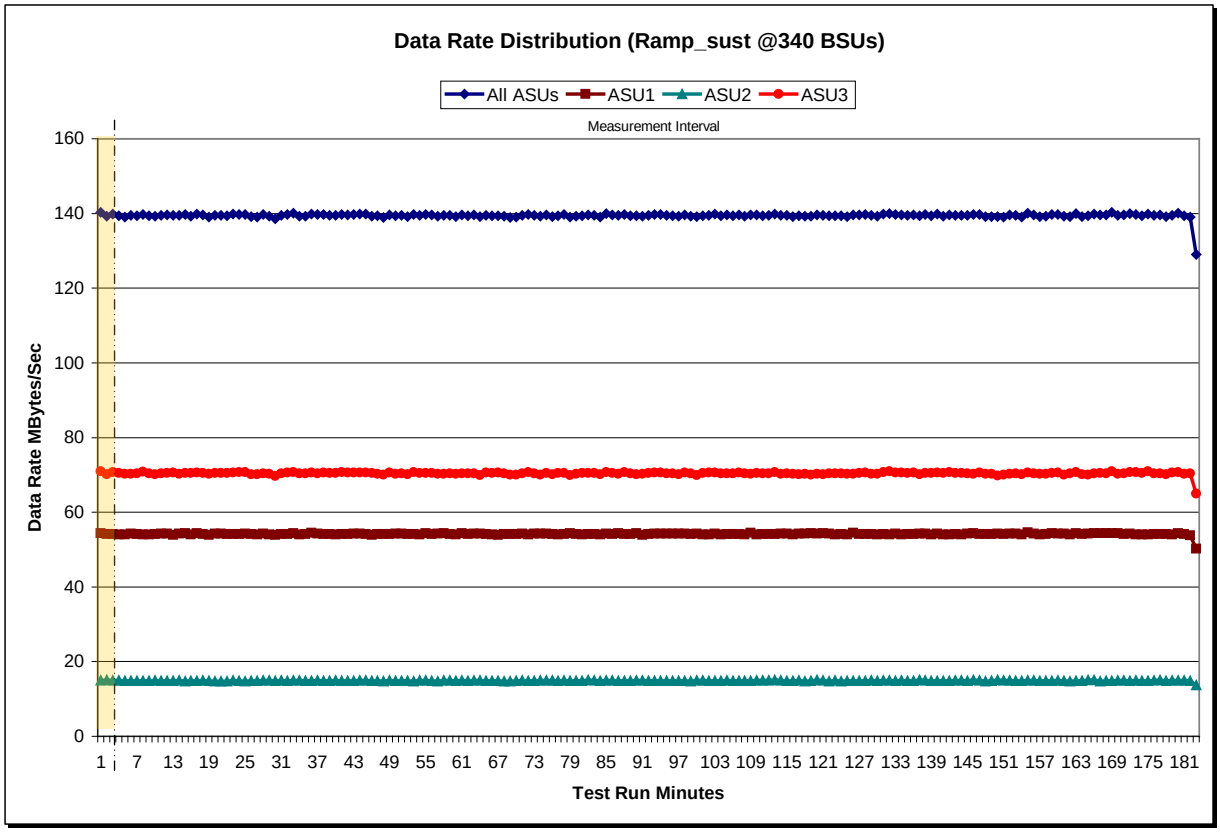
Sustainability Test Results File

Sustainability – Data Rate Distribution Data *(MB/second)*

	Start	Stop	Interval	Duration
Ramp-Up/Start-Up	22:41:58	22:44:58	0-2	0:03:00
Measurement Interval	22:44:58	1:44:58	3-182	3:00:00

Interval	All ASUs	ASU1	ASU2	ASU3	Interval	All ASUs	ASU1	ASU2	ASU3	Interval	All ASUs	ASU1	ASU2	ASU3
0	140.30	54.34	14.95	71.01	63	139.15	54.25	14.96	69.94	126	139.57	54.13	14.91	70.53
1	139.31	54.09	15.07	70.15	64	139.51	54.15	14.81	70.56	127	139.69	54.17	14.91	70.61
2	139.80	54.13	14.96	70.71	65	139.43	54.02	14.86	70.55	128	139.48	54.19	15.01	70.29
3	139.39	53.99	14.93	70.46	66	139.35	53.88	14.87	70.59	129	139.26	54.05	14.90	70.31
4	139.07	53.98	14.84	70.24	67	139.29	54.16	14.76	70.37	130	139.87	54.18	14.95	70.74
5	139.46	54.28	14.91	70.27	68	138.95	54.16	14.73	70.05	131	140.01	54.06	14.99	70.96
6	139.41	54.16	14.88	70.37	69	139.01	54.10	14.84	70.07	132	139.78	54.30	14.91	70.58
7	139.74	54.06	14.88	70.79	70	139.55	54.20	14.93	70.42	133	139.60	54.00	14.99	70.61
8	139.34	54.06	14.92	70.37	71	139.67	54.04	14.88	70.75	134	139.50	54.12	14.92	70.46
9	139.28	54.14	14.94	70.20	72	139.54	54.28	14.89	70.38	135	139.64	54.18	14.85	70.61
10	139.51	54.20	14.91	70.40	73	139.32	54.26	15.01	70.04	136	139.43	54.25	15.06	70.13
11	139.66	54.28	14.87	70.52	74	139.61	54.23	14.93	70.45	137	139.70	54.31	14.94	70.46
12	139.44	53.96	14.87	70.61	75	139.20	54.15	14.93	70.12	138	139.35	54.04	14.81	70.49
13	139.45	54.20	14.99	70.26	76	139.35	54.04	14.83	70.48	139	139.81	54.29	14.89	70.63
14	139.67	54.39	14.80	70.48	77	139.72	54.16	15.02	70.55	140	139.29	54.04	14.81	70.44
15	139.32	54.00	14.89	70.44	78	139.09	54.32	14.88	69.89	141	139.65	54.04	14.89	70.72
16	139.86	54.34	14.89	70.63	79	139.23	54.15	14.81	70.27	142	139.53	54.16	14.93	70.45
17	139.59	54.15	14.96	70.48	80	139.33	53.98	14.86	70.49	143	139.53	54.06	14.96	70.51
18	139.06	53.94	14.91	70.22	81	139.64	54.14	15.06	70.45	144	139.53	54.29	14.86	70.37
19	139.51	54.27	14.78	70.46	82	139.48	54.09	14.94	70.44	145	139.75	54.41	15.07	70.27
20	139.55	54.29	14.78	70.49	83	139.02	54.04	14.81	70.16	146	139.71	54.14	14.97	70.60
21	139.33	54.15	14.71	70.47	84	139.97	54.26	14.95	70.76	147	139.15	54.13	14.74	70.28
22	139.79	54.16	15.03	70.60	85	139.61	54.15	15.00	70.46	148	139.21	54.08	14.88	70.25
23	139.72	54.11	14.88	70.72	86	139.45	54.34	14.84	70.26	149	139.19	54.30	15.06	69.83
24	139.72	54.20	14.75	70.77	87	139.72	54.17	14.87	70.67	150	139.03	54.12	14.92	69.98
25	139.16	54.18	14.89	70.10	88	139.43	54.14	14.87	70.42	151	139.57	54.30	14.96	70.31
26	138.98	54.03	14.84	70.10	89	139.43	54.32	14.94	70.17	152	139.51	54.23	14.90	70.39
27	139.70	54.30	14.99	70.42	90	139.22	53.96	14.96	70.30	153	139.09	54.06	14.83	70.20
28	139.22	54.03	14.94	70.25	91	139.47	54.12	14.81	70.54	154	140.05	54.56	14.93	70.56
29	138.57	53.94	14.88	69.75	92	139.75	54.22	14.92	70.61	155	139.59	54.30	14.93	70.35
30	139.53	54.18	14.94	70.41	93	139.67	54.21	14.90	70.56	156	139.17	54.07	14.86	70.23
31	139.68	54.18	14.90	70.60	94	139.50	54.28	14.85	70.38	157	139.26	54.12	14.88	70.26
32	140.09	54.34	14.98	70.77	95	139.37	54.20	14.84	70.33	158	139.67	54.33	14.90	70.44
33	139.30	53.99	14.92	70.38	96	139.28	54.30	14.84	70.14	159	139.76	54.21	14.96	70.58
34	139.32	54.15	14.81	70.36	97	139.67	54.25	14.83	70.59	160	139.27	54.26	14.91	70.09
35	139.87	54.45	14.85	70.58	98	139.27	54.12	14.80	70.36	161	139.18	54.04	14.73	70.41
36	139.68	54.31	14.96	70.41	99	139.14	54.23	14.99	69.91	162	139.94	54.33	14.85	70.76
37	139.70	54.17	14.90	70.63	100	139.43	53.98	14.98	70.47	163	139.16	54.13	14.85	70.18
38	139.44	54.14	14.81	70.50	101	139.48	54.00	14.91	70.56	164	139.33	54.24	15.08	70.02
39	139.53	54.05	14.97	70.51	102	139.85	54.27	14.91	70.66	165	139.88	54.42	15.03	70.42
40	139.72	54.11	14.92	70.69	103	139.37	54.05	14.90	70.42	166	139.63	54.32	14.79	70.52
41	139.67	54.19	14.85	70.63	104	139.56	54.14	15.01	70.41	167	139.58	54.37	14.87	70.35
42	139.78	54.29	14.87	70.61	105	139.33	54.13	14.83	70.38	168	140.33	54.41	14.91	71.01
43	139.84	54.24	14.96	70.63	106	139.62	54.13	14.89	70.60	169	139.51	54.33	14.93	70.25
44	139.86	54.19	15.01	70.65	107	139.28	54.04	14.84	70.39	170	139.56	54.13	15.00	70.42
45	139.30	53.96	14.83	70.51	108	139.60	54.53	14.84	70.24	171	139.93	54.28	14.89	70.77
46	139.34	54.17	14.90	70.26	109	139.58	54.07	14.98	70.53	172	139.68	54.01	14.98	70.68
47	138.97	54.12	14.78	70.08	110	139.40	54.10	14.97	70.33	173	139.35	54.04	14.86	70.46
48	139.67	54.10	14.97	70.60	111	139.53	54.18	14.97	70.38	174	139.84	54.03	14.91	70.90
49	139.42	54.27	14.87	70.29	112	139.84	54.09	15.03	70.72	175	139.45	54.14	14.93	70.38
50	139.46	54.22	14.82	70.42	113	139.52	54.21	15.01	70.30	176	139.63	54.10	15.10	70.43
51	139.16	54.11	14.85	70.20	114	139.51	54.26	14.92	70.33	177	139.17	54.10	14.89	70.18
52	139.70	54.16	14.76	70.77	115	139.16	54.02	14.87	70.26	178	139.54	53.99	14.94	70.62
53	139.44	54.01	14.93	70.50	116	139.42	54.30	14.98	70.15	179	140.06	54.38	14.99	70.69
54	139.77	54.35	14.95	70.48	117	139.25	54.23	14.77	70.26	180	139.41	54.17	14.93	70.31
55	139.57	54.17	14.89	70.50	118	139.27	54.32	14.88	70.07	181	139.06	53.85	14.87	70.34
56	139.31	54.28	14.80	70.23	119	139.63	54.27	15.08	70.27	182	128.98	50.26	13.72	65.00
57	139.48	54.32	14.93	70.23	120	139.45	54.32	14.93	70.21					
58	139.47	54.11	15.01	70.36	121	139.34	54.21	14.80	70.33					
59	139.16	54.00	14.85	70.31	122	139.38	54.01	14.96	70.40					
60	139.61	54.34	14.93	70.34	123	139.37	54.18	14.75	70.43					
61	139.38	54.14	14.91	70.33	124	139.11	54.05	14.83	70.23					
62	139.60	54.30	14.95	70.34	125	139.62	54.43	14.87	70.32					

Sustainability – Data Rate Distribution Graph

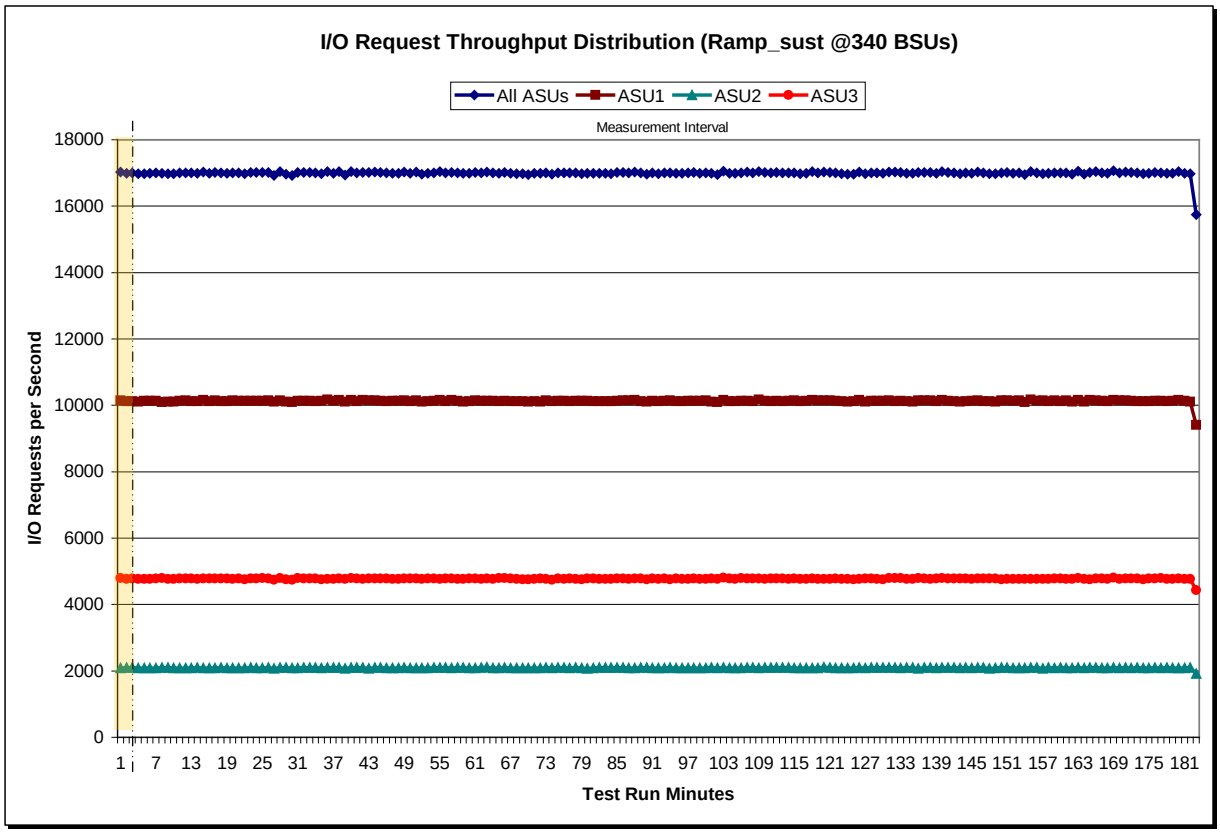


Sustainability – I/O Request Throughput Distribution Data

	Start	Stop	Interval	Duration
Ramp-Up/Start-Up	22:41:58	22:44:58	0-2	0:03:00
Measurement Interval	22:44:58	1:44:58	3-182	3:00:00

Interval	All ASUs	ASU1	ASU2	ASU3	Interval	All ASUs	ASU1	ASU2	ASU3	Interval	All ASUs	ASU1	ASU2	ASU3
0	17,027.67	10,144.63	2,089.32	4,793.72	63	16,995.72	10,138.15	2,090.25	4,767.32	126	16,979.87	10,111.90	2,092.03	4,775.93
1	16,991.43	10,117.95	2,104.05	4,769.43	64	16,989.48	10,116.32	2,083.00	4,790.17	127	17,007.18	10,132.63	2,093.20	4,781.35
2	17,002.90	10,124.65	2,096.57	4,781.68	65	17,017.03	10,127.50	2,095.33	4,794.20	128	17,002.28	10,134.45	2,099.05	4,768.78
3	16,970.72	10,111.42	2,087.82	4,771.48	66	16,992.17	10,121.27	2,087.78	4,783.12	129	16,991.58	10,134.88	2,094.97	4,761.73
4	16,978.40	10,129.17	2,083.92	4,765.32	67	16,976.40	10,118.02	2,084.35	4,774.03	130	17,032.22	10,143.80	2,098.08	4,790.33
5	16,985.33	10,129.37	2,088.83	4,767.13	68	16,973.00	10,123.30	2,087.40	4,762.30	131	17,021.88	10,120.33	2,101.68	4,799.87
6	16,999.48	10,135.05	2,081.62	4,782.82	69	16,955.40	10,113.35	2,090.62	4,751.43	132	17,009.50	10,128.65	2,090.25	4,790.60
7	16,993.05	10,101.33	2,097.95	4,793.77	70	16,986.25	10,125.37	2,089.45	4,771.43	133	16,988.90	10,122.30	2,094.10	4,772.50
8	16,975.32	10,106.95	2,094.72	4,773.65	71	16,984.87	10,108.70	2,089.95	4,786.22	134	16,985.28	10,112.90	2,098.68	4,773.70
9	16,973.53	10,113.20	2,089.98	4,770.35	72	17,008.02	10,143.12	2,093.60	4,771.30	135	17,014.43	10,140.70	2,079.25	4,794.48
10	17,007.15	10,130.37	2,089.47	4,787.32	73	16,960.00	10,125.57	2,088.18	4,746.25	136	17,020.93	10,144.40	2,094.20	4,782.33
11	17,004.03	10,141.23	2,080.90	4,781.90	74	17,001.88	10,131.43	2,094.83	4,775.62	137	17,011.03	10,144.85	2,093.42	4,772.77
12	16,998.73	10,121.35	2,090.88	4,786.50	75	16,996.52	10,129.42	2,097.43	4,769.67	138	16,985.15	10,118.10	2,089.65	4,777.40
13	16,990.03	10,126.92	2,094.63	4,768.48	76	16,998.00	10,123.43	2,086.78	4,787.78	139	17,046.58	10,162.27	2,094.30	4,790.02
14	17,022.62	10,155.33	2,085.52	4,781.77	77	17,003.22	10,132.77	2,099.08	4,771.37	140	17,010.90	10,127.72	2,100.78	4,782.40
15	16,987.53	10,120.97	2,090.48	4,776.08	78	16,970.02	10,131.77	2,080.55	4,757.70	141	16,999.68	10,120.67	2,098.05	4,780.97
16	17,020.77	10,149.50	2,085.38	4,785.88	79	16,989.10	10,137.27	2,075.85	4,775.98	142	16,978.93	10,110.55	2,087.38	4,781.00
17	17,002.43	10,121.72	2,099.07	4,781.65	80	16,987.17	10,122.25	2,086.80	4,778.12	143	16,999.52	10,119.55	2,099.58	4,780.38
18	16,989.77	10,118.75	2,091.95	4,779.07	81	16,992.28	10,123.55	2,098.38	4,770.35	144	16,986.92	10,134.45	2,081.48	4,770.98
19	17,004.50	10,141.50	2,091.98	4,771.02	82	16,993.75	10,116.00	2,103.38	4,774.37	145	17,030.27	10,151.87	2,101.73	4,776.67
20	17,000.72	10,135.93	2,079.95	4,784.83	83	16,981.85	10,116.18	2,094.17	4,771.50	146	17,002.55	10,119.50	2,096.60	4,786.45
21	16,980.38	10,135.83	2,082.40	4,762.15	84	17,010.20	10,131.28	2,096.28	4,782.63	147	16,972.73	10,120.07	2,076.83	4,775.83
22	17,012.05	10,132.48	2,094.17	4,785.40	85	17,020.72	10,146.17	2,093.53	4,781.02	148	16,970.72	10,105.12	2,082.17	4,783.43
23	17,009.00	10,135.33	2,086.80	4,786.87	86	17,001.02	10,147.30	2,086.47	4,767.25	149	16,999.10	10,143.68	2,096.23	4,759.18
24	17,017.88	10,134.72	2,086.77	4,796.40	87	17,029.15	10,157.22	2,090.22	4,781.72	150	17,011.13	10,147.72	2,093.82	4,769.60
25	17,012.42	10,141.87	2,093.48	4,777.07	88	16,999.75	10,122.60	2,096.80	4,780.35	151	16,987.48	10,128.53	2,090.23	4,768.72
26	16,929.22	10,101.57	2,078.87	4,748.78	89	16,966.10	10,113.65	2,098.88	4,753.57	152	16,997.87	10,145.28	2,080.58	4,772.00
27	17,038.98	10,152.25	2,095.72	4,791.02	90	17,005.32	10,135.02	2,089.03	4,781.27	153	16,949.18	10,095.17	2,086.77	4,767.25
28	16,965.38	10,106.40	2,097.95	4,761.03	91	16,976.78	10,116.57	2,088.95	4,771.27	154	17,038.35	10,171.30	2,093.43	4,773.62
29	16,927.63	10,089.17	2,090.45	4,748.02	92	17,006.63	10,138.00	2,087.38	4,781.25	155	17,001.30	10,130.60	2,095.72	4,774.98
30	17,018.35	10,136.85	2,092.10	4,789.40	93	17,003.05	10,147.22	2,094.17	4,761.67	156	16,980.82	10,140.95	2,074.32	4,765.55
31	17,016.13	10,135.58	2,094.28	4,786.27	94	16,988.82	10,122.18	2,080.33	4,786.30	157	16,993.10	10,126.20	2,100.68	4,766.22
32	17,019.92	10,139.27	2,094.82	4,785.83	95	16,984.98	10,121.83	2,089.17	4,773.98	158	17,007.25	10,141.05	2,086.27	4,779.93
33	16,998.32	10,118.48	2,093.32	4,786.52	96	16,996.30	10,138.17	2,084.10	4,774.03	159	17,004.72	10,123.35	2,102.65	4,778.72
34	16,973.88	10,132.35	2,082.22	4,759.32	97	17,009.10	10,136.40	2,086.27	4,786.43	160	17,002.53	10,145.72	2,086.57	4,770.25
35	17,035.45	10,166.60	2,095.08	4,773.77	98	16,992.78	10,137.62	2,083.57	4,771.60	161	16,964.50	10,112.12	2,083.30	4,769.08
36	16,986.25	10,127.98	2,095.50	4,762.77	99	16,996.72	10,144.18	2,086.33	4,766.20	162	17,051.35	10,159.30	2,093.45	4,798.60
37	17,042.00	10,155.88	2,097.78	4,788.33	100	16,987.42	10,111.80	2,098.12	4,777.50	163	16,962.10	10,105.23	2,087.37	4,769.50
38	16,942.15	10,102.60	2,071.00	4,768.55	101	16,946.32	10,092.33	2,085.27	4,768.72	164	17,020.90	10,159.13	2,099.40	4,762.37
39	17,045.75	10,153.73	2,098.00	4,794.02	102	17,057.93	10,158.58	2,098.02	4,801.33	165	17,038.02	10,151.12	2,103.25	4,783.65
40	17,005.40	10,122.53	2,101.27	4,781.60	103	16,993.82	10,121.87	2,090.27	4,781.68	166	17,001.77	10,127.75	2,088.18	4,785.83
41	17,013.72	10,155.15	2,095.65	4,762.92	104	16,991.40	10,127.20	2,090.83	4,773.37	167	16,989.53	10,125.80	2,091.93	4,771.80
42	17,013.47	10,149.47	2,078.55	4,785.45	105	17,007.12	10,137.05	2,080.90	4,789.17	168	17,065.53	10,159.23	2,098.48	4,807.82
43	17,034.23	10,151.95	2,095.55	4,786.73	106	17,022.30	10,138.08	2,096.18	4,788.03	169	17,006.82	10,152.33	2,088.15	4,766.33
44	17,014.78	10,130.57	2,098.33	4,785.88	107	16,999.50	10,126.57	2,097.47	4,775.47	170	17,023.00	10,143.53	2,100.00	4,779.47
45	16,997.48	10,123.90	2,091.58	4,782.00	108	17,035.35	10,171.28	2,088.65	4,775.42	171	17,013.33	10,138.67	2,090.03	4,784.63
46	16,995.17	10,133.07	2,086.90	4,775.20	109	17,008.98	10,133.20	2,103.13	4,772.65	172	17,003.08	10,126.55	2,094.98	4,781.55
47	16,984.78	10,132.10	2,088.47	4,764.22	110	16,999.28	10,125.50	2,097.67	4,776.12	173	16,970.87	10,122.22	2,088.63	4,760.02
48	17,027.23	10,143.15	2,099.27	4,784.82	111	17,013.28	10,130.98	2,098.52	4,783.78	174	16,986.82	10,117.47	2,086.82	4,782.53
49	16,992.87	10,122.03	2,091.92	4,778.92	112	16,996.08	10,118.18	2,098.47	4,779.43	175	17,011.32	10,135.33	2,096.67	4,779.32
50	17,027.55	10,150.52	2,089.15	4,787.88	113	17,005.30	10,137.65	2,094.52	4,773.13	176	17,007.38	10,127.73	2,090.85	4,788.80
51	16,956.87	10,106.68	2,085.77	4,764.42	114	17,007.25	10,141.00	2,090.13	4,776.12	177	16,985.57	10,123.72	2,094.65	4,767.20
52	16,991.28	10,120.12	2,088.92	4,782.25	115	16,978.18	10,114.73	2,089.60	4,773.85	178	16,986.25	10,128.02	2,085.70	4,772.53
53	17,002.33	10,128.35	2,094.13	4,779.85	116	16,987.67	10,130.80	2,091.65	4,765.22	179	17,034.60	10,162.53	2,092.27	4,779.80
54	17,036.87	10,161.13	2,100.75	4,774.98	117	17,034.93	10,157.25	2,092.78	4,784.90	180	16,985.80	10,132.00	2,085.63	4,768.17
55	17,006.67	10,127.25	2,099.00	4,780.42	118	17,007.75	10,147.50	2,092.02	4,768.23	181	16,970.55	10,113.28	2,093.30	4,763.97
56	17,018.50	10,157.80	2,084.48	4,776.22	119	17,021.95	10,144.30	2,107.32	4,770.33	182	15,749.28	9,401.80	1,920.70	4,426.78
57	17,004.28	10,137.03	2,093.60	4,773.65	120	17,010.03	10,148.38	2,095.35	4,766.30	Average	16,992.55	10,127.59	2,090.50	4,774.47
58	16,985.38	10,114.30	2,100.25	4,770.83	121	17,001.43	10,133.53	2,089.63	4,778.27					
59	16,986.52	10,119.22	2,090.20	4,777.10	122	16,982.03	10,119.20	2,088.35	4,774.48					
60	17,014.92	10,147.08	2,086.88	4,780.95	123	16,967.32	10,114.13	2,080.48	4,772.70					
61	17,006.45	10,138.35	2,095.55	4,772.55	124	16,967.33	10,125.12	2,083.60	4,758.62					
62	17,025.90	10,132.63	2,106.83	4,786.43	125	17,022.13	10,159.87	2,094.63	4,767.63					

Sustainability – I/O Request Throughput Distribution Graph

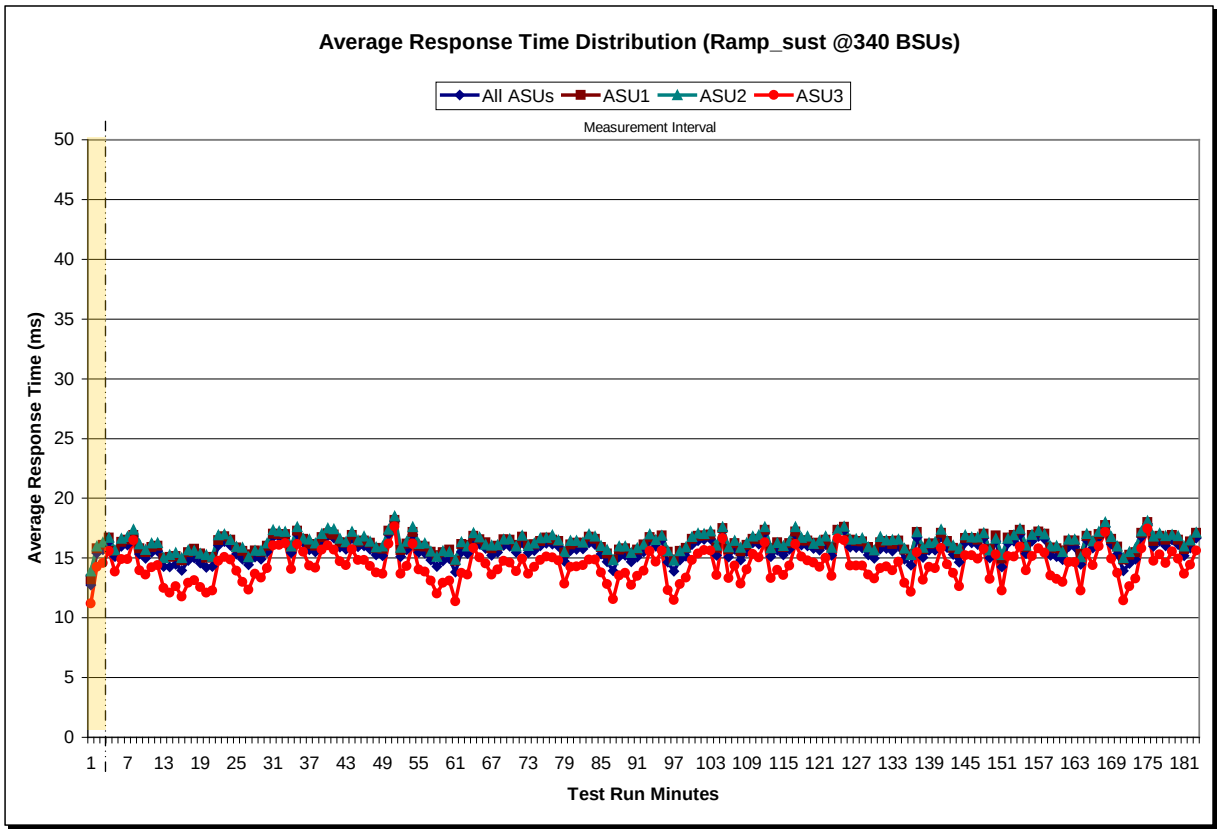


Sustainability – Average Response Time (ms) Distribution Data

	Start	Stop	Interval	Duration
Ramp-Up/Start-Up	22:41:58	22:44:58	0-2	0:03:00
Measurement Interval	22:44:58	1:44:58	3-182	3:00:00

Interval	All ASUs	ASU1	ASU2	ASU3	Interval	All ASUs	ASU1	ASU2	ASU3	Interval	All ASUs	ASU1	ASU2	ASU3
0	12.74	13.22	13.90	11.21	63	16.59	16.83	17.10	15.84	126	15.87	16.42	16.59	14.38
1	15.39	15.80	16.00	14.26	64	16.16	16.57	16.73	15.06	127	15.84	16.37	16.67	14.35
2	15.68	16.07	16.32	14.57	65	15.79	16.31	16.14	14.54	128	15.27	15.93	15.91	13.61
3	16.39	16.70	16.71	15.60	66	15.21	15.80	16.06	13.59	129	14.98	15.64	15.66	13.29
4	15.11	15.59	15.65	13.85	67	15.47	16.03	16.10	14.02	130	15.75	16.29	16.78	14.16
5	15.97	16.34	16.63	14.91	68	16.05	16.56	16.57	14.75	131	15.82	16.41	16.49	14.27
6	16.10	16.53	16.77	14.89	69	16.00	16.52	16.61	14.60	132	15.59	16.16	16.52	13.98
7	16.85	16.90	17.38	16.50	70	15.47	16.11	15.99	13.90	133	15.97	16.46	16.56	14.69
8	15.34	15.82	16.15	13.98	71	16.26	16.77	16.87	14.93	134	14.92	15.68	15.82	12.91
9	14.99	15.49	15.68	13.61	72	15.43	16.13	16.03	13.67	135	14.41	15.30	15.25	12.18
10	15.46	15.90	16.23	14.20	73	15.61	16.12	16.22	14.26	136	16.70	17.18	17.18	15.48
11	15.60	16.02	16.27	14.41	74	16.00	16.41	16.66	14.85	137	15.04	15.74	15.87	13.19
12	14.28	14.98	15.01	12.50	75	16.25	16.69	16.71	15.12	138	15.65	16.18	16.28	14.25
13	14.25	15.07	15.24	12.08	76	16.16	16.53	16.91	15.05	139	15.65	16.21	16.36	14.16
14	14.49	15.15	15.45	12.64	77	15.98	16.42	16.48	14.81	140	16.78	17.10	17.38	15.82
15	13.97	14.79	15.02	11.78	78	14.73	15.45	15.51	12.84	141	15.86	16.41	16.41	14.45
16	14.78	15.47	15.65	12.92	79	15.63	16.12	16.45	14.25	142	15.29	15.85	16.07	13.77
17	15.00	15.76	15.61	13.13	80	15.73	16.27	16.46	14.28	143	14.67	15.40	15.78	12.63
18	14.59	15.39	15.38	12.56	81	15.75	16.28	16.32	14.40	144	16.30	16.68	16.93	15.21
19	14.22	15.00	15.27	12.09	82	16.27	16.79	17.01	14.87	145	16.28	16.67	16.74	15.24
20	14.30	15.09	15.12	12.27	83	16.13	16.59	16.80	14.86	146	16.11	16.54	16.73	14.93
21	16.05	16.50	16.90	14.74	84	15.32	15.90	16.02	13.80	147	16.67	17.01	17.08	15.78
22	16.36	16.83	17.00	15.09	85	14.69	15.35	15.71	12.83	148	15.03	15.74	15.65	13.26
23	16.06	16.53	16.51	14.87	86	13.93	14.85	14.84	11.57	149	16.41	16.89	16.64	15.29
24	15.32	15.86	15.95	13.91	87	15.13	15.69	15.99	13.55	150	14.24	14.95	15.26	12.28
25	14.90	15.59	15.86	13.01	88	15.24	15.79	16.00	13.73	151	16.25	16.69	16.64	15.15
26	14.44	15.30	15.08	12.35	89	14.67	15.42	15.44	12.75	152	16.42	16.93	16.93	15.12
27	15.07	15.62	15.63	13.67	90	15.10	15.70	15.84	13.50	153	16.96	17.35	17.44	15.93
28	14.91	15.50	15.61	13.36	91	15.50	16.11	16.12	13.92	154	15.38	15.91	16.06	13.96
29	15.52	16.02	16.22	14.16	92	16.46	16.76	16.98	15.59	155	16.42	16.90	16.97	15.16
30	16.78	17.02	17.34	16.06	93	15.99	16.50	16.53	14.68	156	16.81	17.19	17.27	15.81
31	16.77	17.00	17.25	16.08	94	16.54	16.90	16.90	15.61	157	16.58	17.03	16.97	15.44
32	16.80	16.98	17.22	16.24	95	14.64	15.53	15.60	12.32	158	15.23	15.86	15.99	13.54
33	15.43	15.96	15.99	14.07	96	13.91	14.87	14.78	11.47	159	15.12	15.80	16.04	13.26
34	17.00	17.27	17.59	16.17	97	14.82	15.60	15.57	12.83	160	14.87	15.63	15.53	12.98
35	16.29	16.60	16.63	15.50	98	15.16	15.85	15.89	13.37	161	15.95	16.45	16.55	14.66
36	15.71	16.16	16.55	14.37	99	16.14	16.61	16.78	14.84	162	15.95	16.44	16.56	14.65
37	15.53	16.02	16.24	14.18	100	16.45	16.83	17.06	15.37	163	14.46	15.34	15.10	12.29
38	16.49	16.75	17.04	15.68	101	16.55	16.88	17.03	15.66	164	16.49	16.86	17.03	15.45
39	16.83	17.07	17.49	16.05	102	16.61	16.96	17.22	15.61	165	15.83	16.39	16.42	14.39
40	16.66	16.95	17.42	15.71	103	15.24	15.86	16.04	13.58	166	16.73	16.99	17.22	15.98
41	15.91	16.32	16.62	14.74	104	17.29	17.51	17.60	16.68	167	17.61	17.74	17.99	17.17
42	15.74	16.25	16.35	14.38	105	15.08	15.74	15.92	13.33	168	16.16	16.60	16.78	14.95
43	16.63	16.93	17.20	15.74	106	15.73	16.23	16.47	14.37	169	15.33	15.94	16.00	13.76
44	15.94	16.35	16.50	14.84	107	14.85	15.57	15.87	12.86	170	13.93	14.88	15.01	11.45
45	16.03	16.45	16.80	14.82	108	15.55	16.10	16.27	14.05	171	14.56	15.27	15.52	12.63
46	15.74	16.28	16.37	14.32	109	16.27	16.59	16.80	15.35	172	14.91	15.48	15.83	13.30
47	15.26	15.82	15.90	13.79	110	16.18	16.55	16.92	15.06	173	16.76	17.11	17.23	15.81
48	15.20	15.75	15.99	13.69	111	17.08	17.34	17.59	16.31	174	17.87	18.02	18.10	17.45
49	16.99	17.29	17.39	16.20	112	15.10	15.79	15.85	13.33	175	15.99	16.40	16.80	14.77
50	18.05	18.17	18.49	17.62	113	15.65	16.30	16.27	14.00	176	16.43	16.83	17.07	15.30
51	15.12	15.65	15.89	13.66	114	15.26	15.91	16.01	13.56	177	16.01	16.51	16.86	14.57
52	15.69	16.19	16.38	14.32	115	15.73	16.23	16.41	14.36	178	16.54	16.93	16.95	15.54
53	16.94	17.16	17.61	16.19	116	16.97	17.22	17.59	16.16	179	16.13	16.54	16.83	14.96
54	15.49	16.02	16.21	14.03	117	16.11	16.45	16.71	15.11	180	15.18	15.72	15.97	13.68
55	15.40	15.96	16.23	13.87	118	16.03	16.44	16.82	14.79	181	15.84	16.38	16.49	14.43
56	14.84	15.51	15.56	13.11	119	15.79	16.25	16.19	14.62	182	16.68	17.08	17.13	15.63
57	14.30	15.21	15.12	12.01	120	15.65	16.14	16.45	14.25	Average	15.72	16.24	16.39	14.33
58	14.77	15.48	15.59	12.92	121	16.13	16.53	16.80	15.00					
59	14.94	15.69	15.50	13.10	122	15.21	15.87	15.88	13.51					
60	13.82	14.76	14.85	11.38	123	17.15	17.36	17.35	16.62					
61	15.50	16.15	16.35	13.73	124	17.28	17.59	17.62	16.47					
62	15.38	16.10	15.98	13.61	125	15.93	16.53	16.54	14.37					

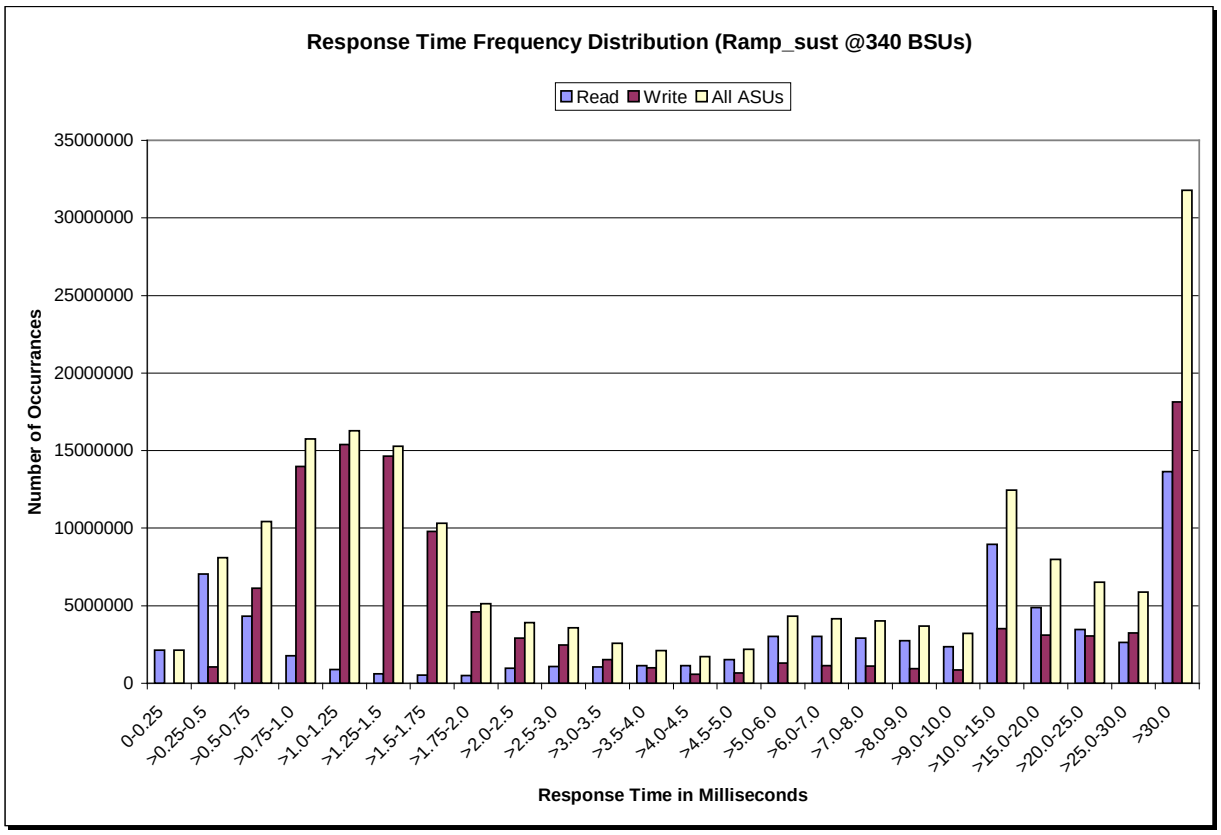
Sustainability – Average Response Time (ms) Distribution Graph



Sustainability – Response Time Frequency Distribution Data

Response Time (ms)	0-0.25	>0.25-0.5	>0.5-0.75	>0.75-1.0	>1.0-1.25	>1.25-1.5	>1.5-1.75	>1.75-2.0
Read	2,134,751	7,040,479	4,316,448	1,776,731	892,224	622,350	539,883	509,987
Write	6	1,060,097	6,120,367	13,967,809	15,383,335	14,655,884	9,786,013	4,617,664
All ASUs	2,134,757	8,100,576	10,436,815	15,744,540	16,275,559	15,278,234	10,325,896	5,127,651
ASU1	1,486,770	5,399,270	5,951,268	7,765,466	7,525,587	6,621,293	4,324,357	2,186,249
ASU2	647,987	2,323,308	2,053,365	2,090,121	1,893,994	1,642,737	1,070,836	546,536
ASU3	-	377,998	2,432,182	5,888,953	6,855,978	7,014,204	4,930,703	2,394,866
Response Time (ms)	**>2.0-2.5**	**>2.5-3.0**	**>3.0-3.5**	**>3.5-4.0**	**>4.0-4.5**	**>4.5-5.0**	**>5.0-6.0**	**>6.0-7.0**
Read	973,730	1,089,740	1,049,929	1,129,492	1,137,756	1,518,010	3,032,549	3,028,718
Write	2,925,181	2,478,471	1,515,464	990,248	573,665	675,877	1,307,020	1,136,847
All ASUs	3,898,911	3,568,211	2,565,393	2,119,740	1,711,421	2,193,887	4,339,569	4,165,565
ASU1	1,915,001	1,887,354	1,536,971	1,444,014	1,297,070	1,711,467	3,391,388	3,289,952
ASU2	486,917	402,020	277,229	202,343	149,330	169,673	352,398	354,911
ASU3	1,496,993	1,278,837	751,193	473,383	265,021	312,747	595,783	520,702
Response Time (ms)	**>7.0-8.0**	**>8.0-9.0**	**>9.0-10.0**	**>10.0-15.0**	**>15.0-20.0**	**>20.0-25.0**	**>25.0-30.0**	**>30.0**
Read	2,902,533	2,739,966	2,364,916	8,952,325	4,890,779	3,470,192	2,623,563	13,650,980
Write	1,106,941	946,116	846,494	3,512,705	3,097,133	3,038,042	3,254,376	18,135,796
All ASUs	4,009,474	3,686,082	3,211,410	12,465,030	7,987,912	6,508,234	5,877,939	31,786,776
ASU1	3,139,931	2,894,461	2,521,127	9,646,158	5,822,006	4,511,758	3,837,592	19,271,427
ASU2	356,970	352,723	298,510	1,230,800	779,233	637,637	577,564	3,680,224
ASU3	512,573	438,898	391,773	1,588,072	1,386,673	1,358,839	1,462,783	8,835,125

Sustainability – Response Time Frequency Distribution Graph



Sustainability – Measured Intensity Multiplier and Coefficient of Variation

Clause 3.4.3

IM – Intensity Multiplier: *The ratio of I/Os for each I/O stream relative to the total I/Os for all I/O streams (ASU1-1 – ASU3-1) as required by the benchmark specification.*

Clauses 5.1.10 and 5.3.13.2

MIM – Measured Intensity Multiplier: *The Measured Intensity Multiplier represents the ratio of measured I/Os for each I/O stream relative to the total I/Os measured for all I/O streams (ASU1-1 – ASU3-1). This value may differ from the corresponding Expected Intensity Multiplier by no more than 5%.*

Clause 5.3.13.3

COV – Coefficient of Variation: *This measure of variation for the Measured Intensity Multiplier cannot exceed 0.2.*

	ASU1-1	ASU1-2	ASU1-3	ASU1-4	ASU2-1	ASU2-2	ASU2-3	ASU3-1
IM	***0.0350***	***0.2810***	***0.0700***	***0.2100***	***0.0180***	***0.0700***	***0.0350***	***0.2810***
MIM	0.0350	0.2810	0.0700	0.2100	0.0180	0.700	0.0350	0.2810
COV	0.005	0.002	0.002	0.002	0.007	0.004	0.006	0.002

Primary Metrics Test – IOPS Test Phase

Clause 5.4.4.2

The IOPS Test Phase consists of one Test Run at the 100% load point with a Measurement Interval of ten (10) minutes. The IOPS Test Phase immediately follows the Sustainability Test Phase without any interruption or manual intervention.

The IOPS Test Run generates the SPC-1 IOPS™ primary metric, which is computed as the I/O Request Throughput for the Measurement Interval of the IOPS Test Run.

The Average Response Time is computed for the IOPS Test Run and cannot exceed 30 milliseconds. If the Average Response Time exceeds the 30 millisecond constraint, the measurement is invalid.

Clause 9.4.3.7.2

For the IOPS Test Phase the FDR shall contain:

1. *I/O Request Throughput Distribution (data and graph).*
2. *A Response Time Frequency Distribution.*
3. *An Average Response Time Distribution.*
4. *The human readable Test Run Results File produced by the Workload Generator.*
5. *A listing or screen image of all input parameters supplied t the Workload Generator.*
6. *The total number of I/O Requests completed in the Measurement Interval as well as the number of I/O Requests with a Response Time less than or equal to 30 milliseconds and the number of I/O Requests with a Response Time greater than 30 milliseconds.*

SPC-1 Workload Generator Input Parameters

The SPC-1 Workload Generator input parameters for the Sustainability, IOPS, Response Time Ramp, Repeatability, and Persistence Test Runs are documented in "Appendix E: SPC-1 Workload Generator Input Parameters" on Page 67.

IOPS Test Results File

A link to the test results file generated from the IOPS Test Run is listed below.

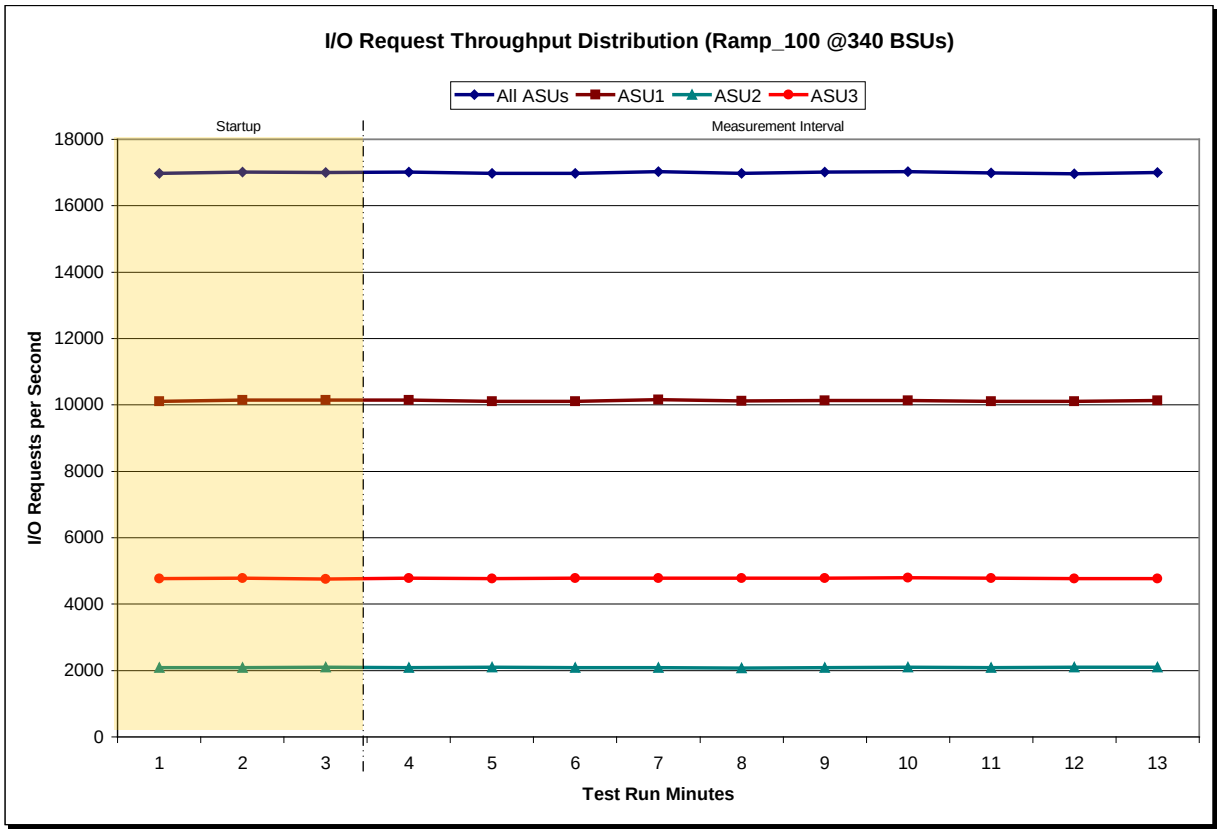
IOPS Test Results File

IOPS Test Run – I/O Request Throughput Distribution Data

340 BSUs	Start	Stop	Interval	Duration
Start-Up/Ramp-Up	1:46:01	1:49:02	0-2	0:03:01
Measurement Interval	1:49:02	1:59:02	3-12	0:10:00

60 second intervals	All ASUs	ASU1	ASU2	ASU3
0	16,974.78	10,113.52	2,092.62	4,768.65
1	17,014.33	10,146.37	2,090.45	4,777.52
2	17,001.52	10,144.78	2,096.57	4,760.17
3	17,009.75	10,144.13	2,085.98	4,779.63
4	16,980.78	10,109.23	2,099.48	4,772.07
5	16,981.67	10,111.88	2,090.12	4,779.67
6	17,023.13	10,154.38	2,087.63	4,781.12
7	16,971.63	10,117.45	2,078.55	4,775.63
8	17,009.00	10,138.00	2,091.00	4,780.00
9	17,027.48	10,136.00	2,103.05	4,788.43
10	16,984.13	10,104.80	2,092.58	4,786.75
11	16,967.85	10,108.67	2,096.08	4,763.10
12	16,999.97	10,130.95	2,097.78	4,771.23
Average	***16,995.54***	***10,125.55***	***2,092.23***	***4,777.76***

IOPS Test Run – I/O Request Throughput Distribution Graph

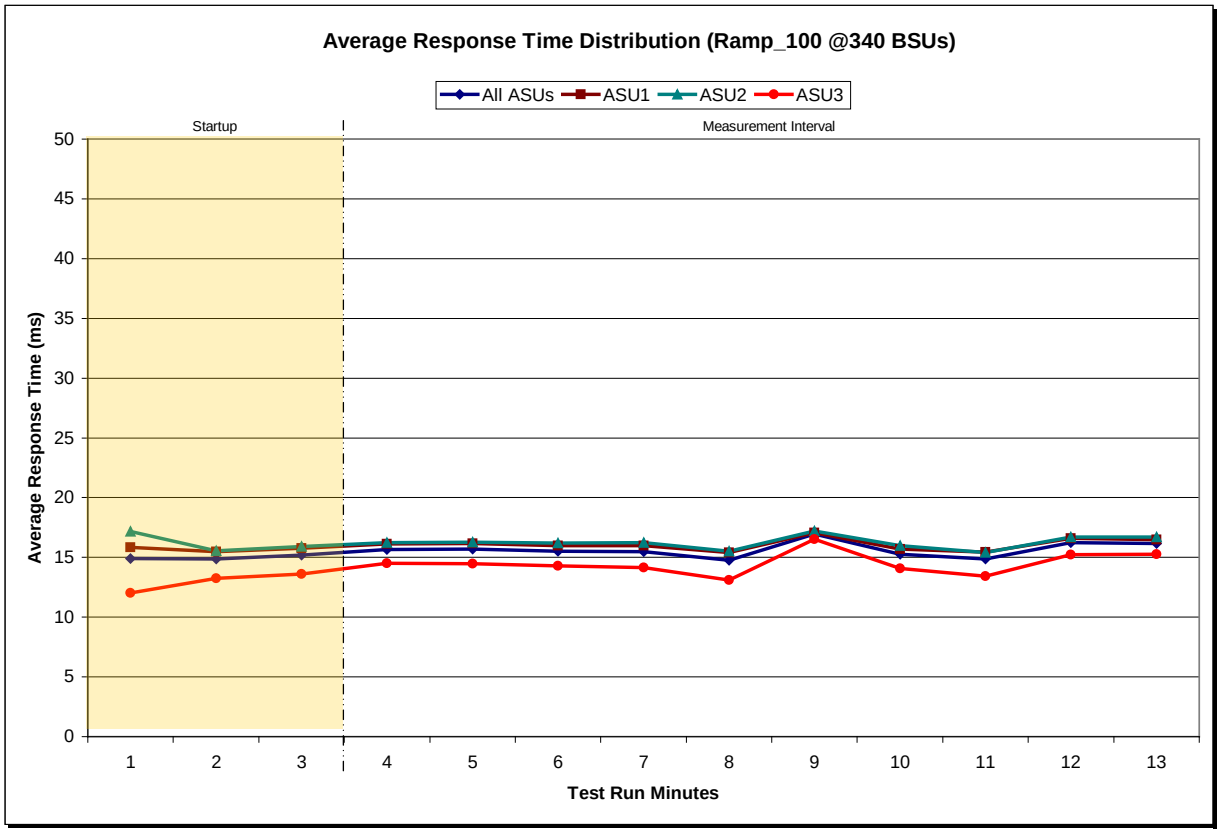


IOPS Test Run – Average Response Time (ms) Distribution Data

340 BSUs	Start	Stop	Interval	Duration
Start-Up/Ramp-Up	1:46:01	1:49:02	0-2	0:03:01
Measurement Interval	1:49:02	1:59:02	3-12	0:10:00

60 second intervals	All ASUs	ASU1	ASU2	ASU3
0	14.92	15.83	17.15	12.01
1	14.86	15.48	15.55	13.25
2	15.18	15.77	15.93	13.59
3	15.67	16.11	16.23	14.50
4	15.70	16.17	16.27	14.46
5	15.53	15.98	16.19	14.29
6	15.49	15.96	16.23	14.14
7	14.78	15.42	15.51	13.09
8	16.94	17.08	17.21	16.52
9	15.27	15.68	16.00	14.07
10	14.88	15.45	15.42	13.44
11	16.22	16.59	16.69	15.23
12	16.16	16.47	16.72	15.25
Average	***15.66***	***16.09***	***16.25***	***14.50***

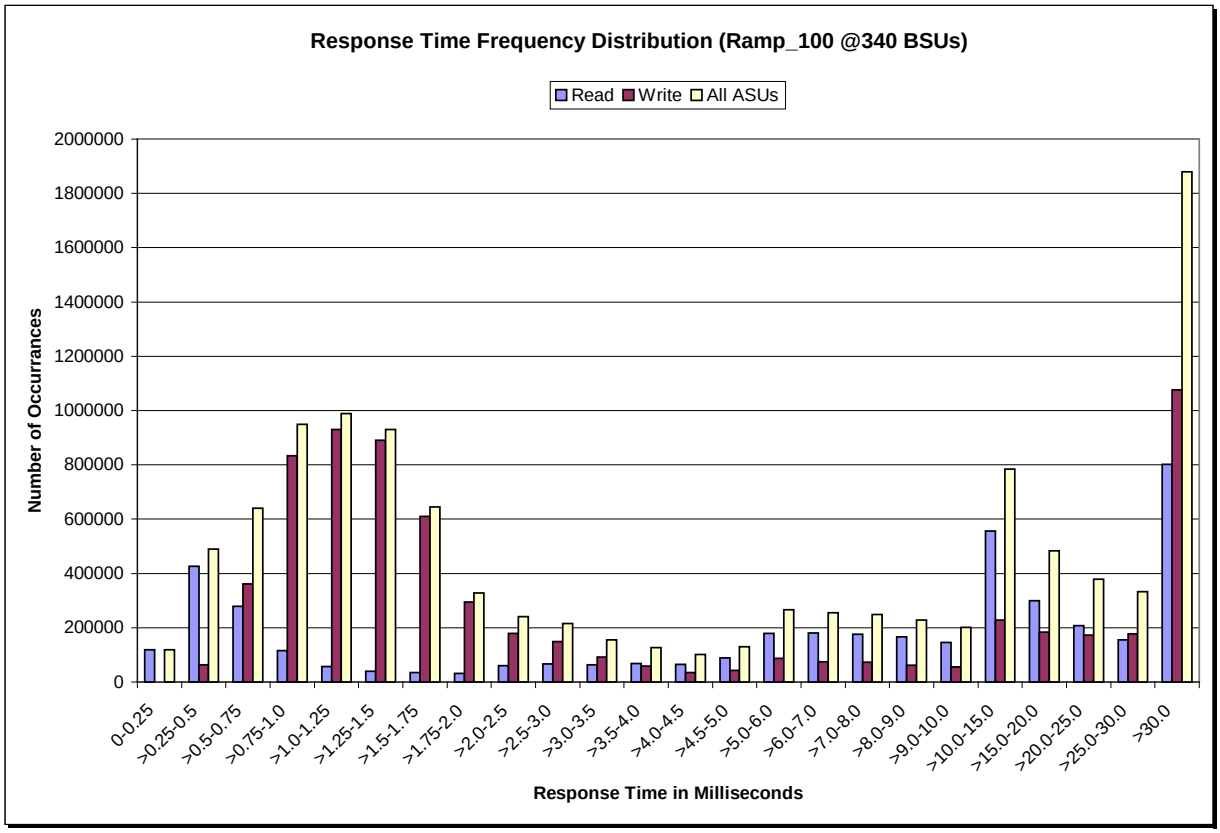
IOPS Test Run – Average Response Time (ms) Distribution Graph



IOPS Test Run – Response Time Frequency Distribution Data

Response Time (ms)	0-0.25	>0.25-0.5	>0.5-0.75	>0.75-1.0	>1.0-1.25	>1.25-1.5	>1.5-1.75	>1.75-2.0
Read	119,389	426,824	278,601	115,134	57,777	39,400	34,139	32,160
Write	0	63,138	360,989	834,367	930,668	890,107	610,395	295,423
All ASUs	119,389	489,962	639,590	949,501	988,445	929,507	644,534	327,583
ASU1	84,216	330,346	369,721	471,438	458,249	404,089	271,668	139,661
ASU2	35,173	137,117	126,955	127,260	115,184	100,297	66,910	34,894
ASU3	0	22,499	142,914	350,803	415,012	425,121	305,956	153,028
Response Time (ms)	**>2.0-2.5**	**>2.5-3.0**	**>3.0-3.5**	**>3.5-4.0**	**>4.0-4.5**	**>4.5-5.0**	**>5.0-6.0**	**>6.0-7.0**
Read	60,884	66,554	63,454	67,866	65,365	88,556	179,409	181,020
Write	179,546	149,161	92,150	59,279	35,596	41,998	87,409	74,625
All ASUs	240,430	215,715	155,604	127,145	100,961	130,554	266,818	255,645
ASU1	118,185	113,112	92,785	86,181	75,409	100,670	204,753	199,310
ASU2	30,208	24,995	17,012	12,596	9,237	10,446	22,410	22,428
ASU3	92,037	77,608	45,807	28,368	16,315	19,438	39,655	33,907
Response Time (ms)	**>7.0-8.0**	**>8.0-9.0**	**>9.0-10.0**	**>10.0-15.0**	**>15.0-20.0**	**>20.0-25.0**	**>25.0-30.0**	**>30.0**
Read	175,609	166,905	145,586	556,357	298,971	206,923	155,661	802,481
Write	73,418	61,856	55,103	227,512	184,046	172,029	177,707	1,076,746
All ASUs	249,027	228,761	200,689	783,869	483,017	378,952	333,368	1,879,227
ASU1	192,619	178,330	156,450	604,576	353,497	264,134	220,407	1,134,744
ASU2	22,387	21,682	18,935	77,083	47,100	37,394	32,869	218,137
ASU3	34,021	28,749	25,304	102,210	82,420	77,424	80,092	526,346

IOPS Test Run –Response Time Frequency Distribution Graph



IOPS Test Run – I/O Request Information

I/O Requests Completed in the Measurement Interval	I/O Requests Completed with Response Time = or < 30 ms	I/O Requests Completed with Response Time > 30 ms
11,118,293	9,239,066	1,879,227

IOPS Test Run – Measured Intensity Multiplier and Coefficient of Variation

Clause 3.4.3

IM – Intensity Multiplier: *The ratio of I/Os for each I/O stream relative to the total I/Os for all I/O streams (ASU1-1 – ASU3-1) as required by the benchmark specification.*

Clauses 5.1.10 and 5.3.13.2

MIM – Measured Intensity Multiplier: *The Measured Intensity Multiplier represents the ratio of measured I/Os for each I/O stream relative to the total I/Os measured for all I/O streams (ASU1-1 – ASU3-1). This value may differ from the corresponding Expected Intensity Multiplier by no more than 5%.*

Clause 5.3.13.3

COV – Coefficient of Variation: *This measure of variation for the Measured Intensity Multiplier cannot exceed 0.2.*

	ASU1-1	ASU1-2	ASU1-3	ASU1-4	ASU2-1	ASU2-2	ASU2-3	ASU3-1
IM	***0.0350***	***0.2810***	***0.0700***	***0.2100***	***0.0180***	***0.0700***	***0.0350***	***0.2810***
MIM	0.0349	0.2809	0.0699	0.2100	0.0181	0.0700	0.0350	0.2811
COV	0.007	0.002	0.003	0.002	0.007	0.004	0.004	0.001

Primary Metrics Test – Response Time Ramp Test Phase

Clause 5.4.4.3

The Response Time Ramp Test Phase consists of five Test Runs, one each at 95%, 90%, 80%, 50%, and 10% of the load point (100%) used to generate the SPC-1 IOPS™ primary metric. Each of the five Test Runs has a Measurement Interval of ten (10) minutes. The Response Time Ramp Test Phase immediately follows the IOPS Test Phase without any interruption or manual intervention.

The five Response Time Ramp Test Runs, in conjunction with the IOPS Test Run (100%), demonstrate the relationship between Average Response Time and I/O Request Throughput for the Tested Storage Configuration (TSC) as illustrated in the response time/throughput curve on page 13.

In addition, the Average Response Time measured during the 10% Test Run is the value for the SPC-1 LRT™ metric. That value represents the Average Response Time of a lightly loaded TSC.

Clause 9.4.3.7.3

The following content shall appear in the FDR for the Response Time Ramp Phase:

1. *A Response Time Ramp Distribution.*
2. *The human readable Test Run Results File produced by the Workload Generator for each Test Run within the Response Time Ramp Test Phase.*
3. *For the 10% Load Level Test Run (SPC-1 LRT™ metric) an Average Response Time Distribution.*
4. *A listing or screen image of all input parameters supplied to the Workload Generator.*

SPC-1 Workload Generator Input Parameters

The SPC-1 Workload Generator input parameters for the Sustainability, IOPS, Response Time Ramp, Repeatability, and Persistence Test Runs are documented in "Appendix E: SPC-1 Workload Generator Input Parameters" on Page 67.

Response Time Ramp Test Results File

A link to each test result file generated from each Response Time Ramp Test Run list listed below.

95% Load Level

90% Load Level

80% Load Level

50% Load Level

10% Load Level

Response Time Ramp Distribution (IOPS) Data

The five Test Runs that comprise the Response Time Ramp Phase are executed at 95%, 90%, 80%, 50%, and 10% of the Business Scaling Unit (BSU) load level used to produce the SPC-1 IOPS™ primary metric. The 100% BSU load level is included in the following Response Time Ramp data tables and graphs for completeness.

100% Load Level - 340 BSUs	Start	Stop	Interval	Duration
Start-Up/Ramp-Up	1:46:01	1:49:02	0-2	0:03:01
Measurement Interval	1:49:02	1:59:02	3-12	0:10:00
(60 second intervals)	**All ASUs**	**ASU-1**	**ASU-2**	**ASU-3**
0	16,974.78	10,113.52	2,092.62	4,768.65
1	17,014.33	10,146.37	2,090.45	4,777.52
2	17,001.52	10,144.78	2,096.57	4,760.17
3	17,009.75	10,144.13	2,085.98	4,779.63
4	16,980.78	10,109.23	2,099.48	4,772.07
5	16,981.67	10,111.88	2,090.12	4,779.67
6	17,023.13	10,154.38	2,087.63	4,781.12
7	16,971.63	10,117.45	2,078.55	4,775.63
8	17,009.00	10,138.00	2,091.00	4,780.00
9	17,027.48	10,136.00	2,103.05	4,788.43
10	16,984.13	10,104.80	2,092.58	4,786.75
11	16,967.85	10,108.67	2,096.08	4,763.10
12	16,999.97	10,130.95	2,097.78	4,771.23
Average	16,995.54	10,125.55	2,092.23	4,777.76

95% Load Level - 323 BSUs	Start	Stop	Interval	Duration
Start-Up/Ramp-Up	2:00:04	2:03:05	0-2	0:03:01
Measurement Interval	2:03:05	2:13:05	3-12	0:10:00
(60 second intervals)	**All ASUs**	**ASU-1**	**ASU-2**	**ASU-3**
0	16,156.53	9,628.20	1,990.45	4,537.88
1	16,162.67	9,639.22	1,983.58	4,539.87
2	16,114.28	9,605.83	1,985.07	4,523.38
3	16,136.80	9,624.80	1,980.08	4,531.92
4	16,152.20	9,621.22	1,992.20	4,538.78
5	16,154.05	9,611.28	1,992.38	4,550.38
6	16,150.10	9,629.85	1,983.57	4,536.68
7	16,132.20	9,614.72	1,979.00	4,538.48
8	16,120.25	9,604.52	1,980.58	4,535.15
9	16,167.62	9,634.47	1,980.98	4,552.17
10	16,141.52	9,602.10	2,000.50	4,538.92
11	16,158.80	9,630.63	1,988.10	4,540.07
12	16,159.42	9,625.07	1,993.03	4,541.32
Average	16,147.30	9,619.87	1,987.04	4,540.39

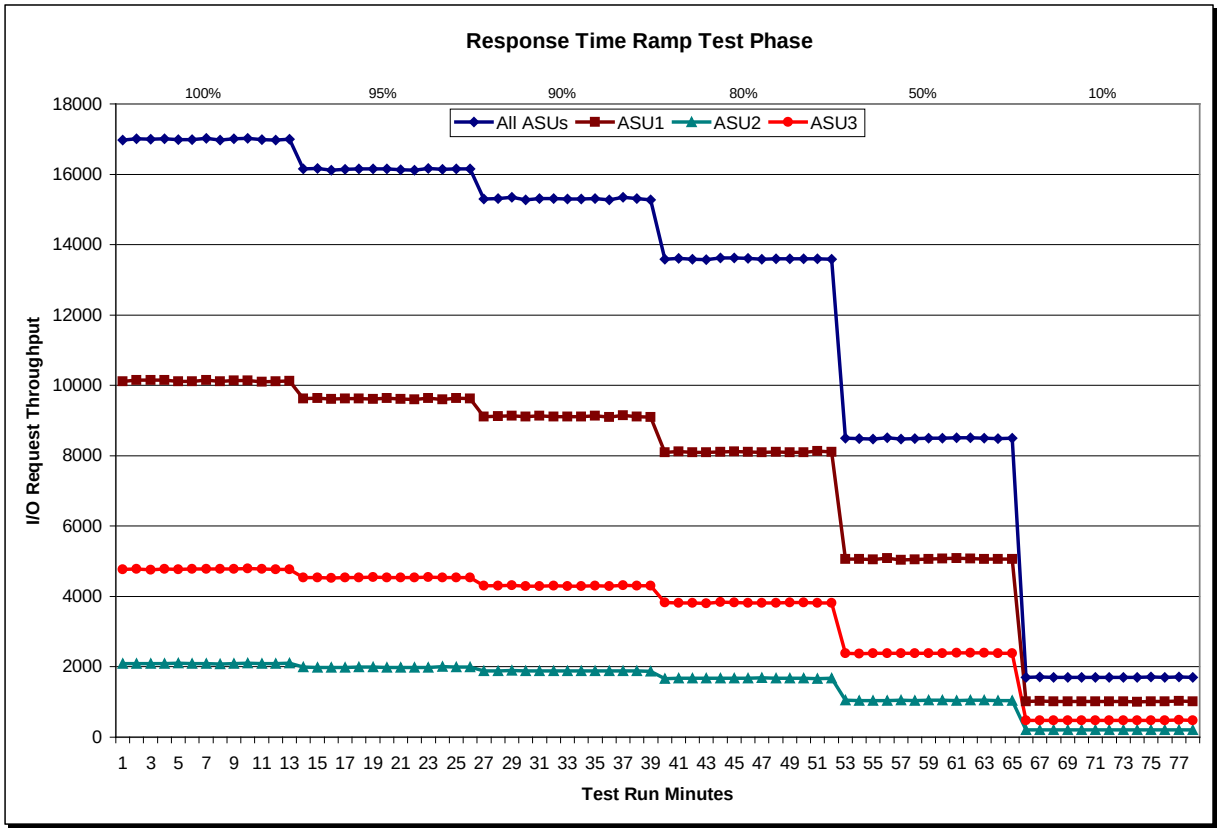
90% Load Level - 306 BSUs	Start	Stop	Interval	Duration
Start-Up/Ramp-Up	2:14:07	2:17:08	0-2	0:03:01
Measurement Interval	2:17:08	2:27:08	3-12	0:10:00
(60 second intervals)	**All ASUs**	**ASU-1**	**ASU-2**	**ASU-3**
0	15,296.90	9,109.70	1,882.10	4,305.10
1	15,306.88	9,121.75	1,878.27	4,306.87
2	15,343.18	9,129.32	1,893.37	4,320.50
3	15,275.83	9,105.48	1,881.23	4,289.12
4	15,314.82	9,134.52	1,882.37	4,297.93
5	15,308.95	9,115.70	1,885.95	4,307.30
6	15,293.42	9,111.77	1,885.18	4,296.47
7	15,295.72	9,115.13	1,885.12	4,295.47
8	15,312.17	9,130.12	1,879.42	4,302.63
9	15,273.83	9,101.27	1,883.33	4,289.23
10	15,347.65	9,142.63	1,889.10	4,315.92
11	15,306.42	9,115.93	1,882.35	4,308.13
12	15,273.40	9,103.32	1,870.37	4,299.72
Average	15,300.22	9,117.59	1,882.44	4,300.19

80% Load Level - 272 BSUs	Start	Stop	Interval	Duration
Start-Up/Ramp-Up	2:28:10	2:31:11	0-2	0:03:01
Measurement Interval	2:31:11	2:41:11	3-12	0:10:00
(60 second intervals)	**All ASUs**	**ASU-1**	**ASU-2**	**ASU-3**
0	13,587.22	8,090.70	1,668.28	3,828.23
1	13,608.48	8,119.98	1,671.13	3,817.37
2	13,591.30	8,091.95	1,679.12	3,820.23
3	13,575.97	8,100.33	1,671.52	3,804.12
4	13,620.18	8,110.32	1,674.47	3,835.40
5	13,616.20	8,116.13	1,674.82	3,825.25
6	13,604.77	8,112.38	1,679.65	3,812.73
7	13,589.40	8,094.50	1,684.72	3,810.18
8	13,602.73	8,111.68	1,673.65	3,817.40
9	13,599.30	8,097.95	1,675.02	3,826.33
10	13,594.57	8,094.98	1,671.48	3,828.10
11	13,600.85	8,126.40	1,661.98	3,812.47
12	13,591.63	8,110.03	1,670.52	3,811.08
Average	13,599.56	8,107.47	1,673.78	3,818.31

50% Load Level - 170 BSUs	Start	Stop	Interval	Duration
Start-Up/Ramp-Up	2:42:13	2:45:14	0-2	0:03:01
Measurement Interval	2:45:14	2:55:14	3-12	0:10:00
(60 second intervals)	**All ASUs**	**ASU-1**	**ASU-2**	**ASU-3**
0	8,498.52	5,060.85	1,048.75	2,388.92
1	8,486.22	5,067.08	1,044.97	2,374.17
2	8,477.60	5,047.45	1,045.45	2,384.70
3	8,507.60	5,082.43	1,040.07	2,385.10
4	8,477.90	5,043.83	1,045.53	2,388.53
5	8,489.03	5,053.87	1,045.37	2,389.80
6	8,495.78	5,062.45	1,046.17	2,387.17
7	8,503.33	5,070.35	1,052.95	2,380.03
8	8,516.33	5,087.27	1,037.68	2,391.38
9	8,510.45	5,070.23	1,048.27	2,391.95
10	8,504.10	5,062.75	1,049.68	2,391.67
11	8,488.33	5,062.17	1,040.92	2,385.25
12	8,494.07	5,061.85	1,042.07	2,390.15
Average	8,498.69	5,065.72	1,044.87	2,388.10

10% Load Level - 34 BSUs	Start	Stop	Interval	Duration
Start-Up/Ramp-Up	2:56:16	2:59:17	0-2	0:03:01
Measurement Interval	2:59:17	3:09:17	3-12	0:10:00
(60 second intervals)	**All ASUs**	**ASU-1**	**ASU-2**	**ASU-3**
0	1,703.68	1,015.52	209.12	479.05
1	1,707.32	1,021.75	209.52	476.05
2	1,704.33	1,017.33	210.23	476.77
3	1,704.77	1,018.52	205.70	480.55
4	1,702.20	1,014.10	209.63	478.47
5	1,695.73	1,014.13	210.10	471.50
6	1,705.80	1,018.23	212.77	474.80
7	1,700.58	1,014.90	211.32	474.37
8	1,695.70	1,008.00	212.78	474.92
9	1,710.48	1,020.45	208.25	481.78
10	1,700.17	1,017.45	207.85	474.87
11	1,717.63	1,021.57	210.52	485.55
12	1,701.32	1,015.95	211.65	473.72
Average	1,703.44	1,016.33	210.06	477.05

Response Time Ramp Distribution (IOPS) Graph

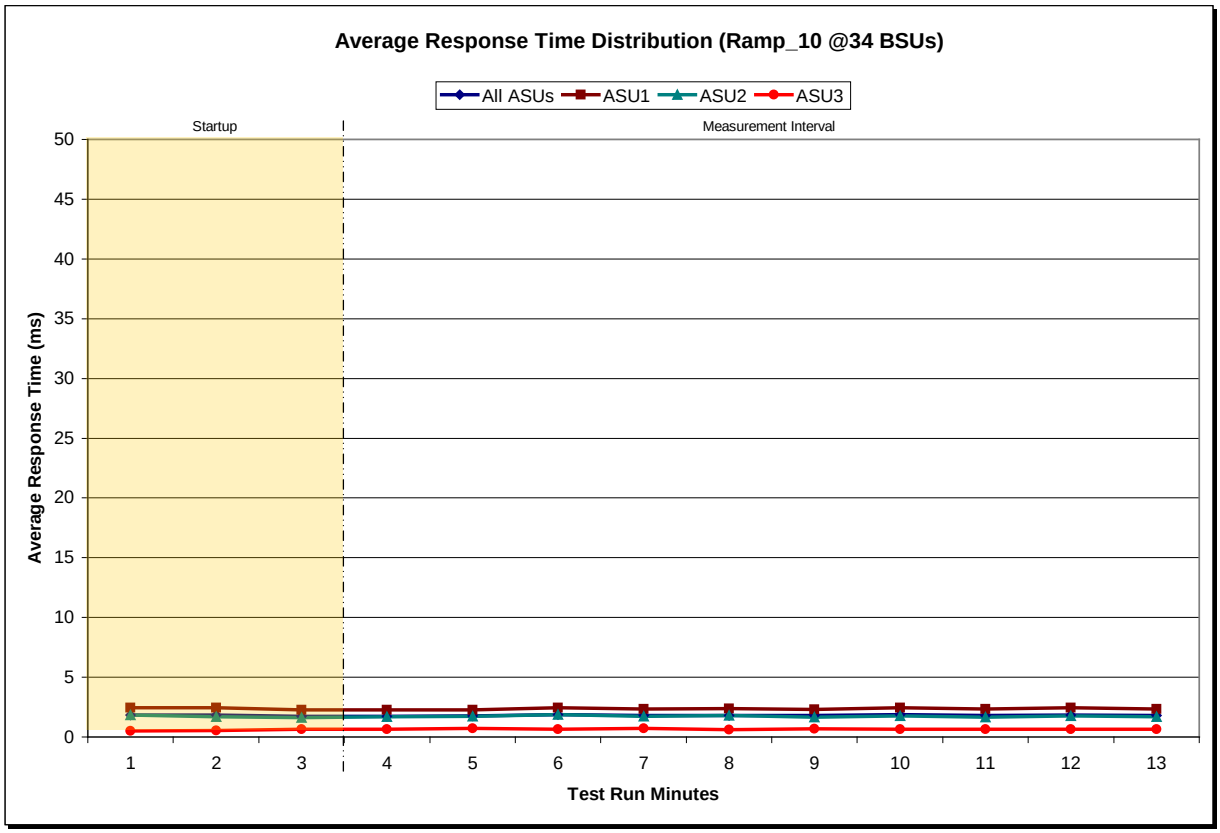


SPC-1 LRT™ Average Response Time (ms) Distribution Data

34 BSUs	Start	Stop	Interval	Duration
Start-Up/Ramp-Up	2:56:16	2:59:17	0-2	0:03:01
Measurement Interval	2:59:17	3:09:17	3-12	0:10:00

60 second intervals	All ASUs	ASU1	ASU2	ASU3
0	1.82	2.44	1.83	0.52
1	1.83	2.45	1.69	0.54
2	1.74	2.28	1.63	0.65
3	1.74	2.28	1.68	0.63
4	1.77	2.28	1.71	0.73
5	1.87	2.45	1.86	0.64
6	1.81	2.35	1.74	0.71
7	1.81	2.36	1.79	0.63
8	1.78	2.32	1.67	0.70
9	1.86	2.44	1.76	0.66
10	1.79	2.35	1.67	0.66
11	1.85	2.44	1.76	0.64
12	1.80	2.36	1.71	0.65
Average	***1.81***	***2.36***	***1.74***	***0.66***

SPC-1 LRT™ Average Response Time (ms) Distribution Graph



SPC-1 LRT™ (10%) – Measured Intensity Multiplier and Coefficient of Variation

Clause 3.4.3

IM – Intensity Multiplier: *The ratio of I/Os for each I/O stream relative to the total I/Os for all I/O streams (ASU1-1 – ASU3-1) as required by the benchmark specification.*

Clauses 5.1.10 and 5.3.13.2

MIM – Measured Intensity Multiplier: *The Measured Intensity Multiplier represents the ratio of measured I/Os for each I/O stream relative to the total I/Os measured for all I/O streams (ASU1-1 – ASU3-1). This value may differ from the corresponding Expected Intensity Multiplier by no more than 5%.*

Clause 5.3.13.3

COV – Coefficient of Variation: *This measure of variation for the Measured Intensity Multiplier cannot exceed 0.2.*

	ASU1-1	ASU1-2	ASU1-3	ASU1-4	ASU2-1	ASU2-2	ASU2-3	ASU3-1
IM	***0.0350***	***0.2810***	***0.0700***	***0.2100***	***0.0180***	***0.0700***	***0.0350***	***0.2810***
MIM	0.0354	0.2810	0.0703	0.2100	0.0180	0.0701	0.0351	0.2801
COV	0.021	0.005	0.013	0.003	0.028	0.014	0.012	0.006

Repeatability Test

Clause 5.4.5

The Repeatability Test demonstrates the repeatability and reproducibility of the SPC-1 IOPS™ primary metric and SPC-1 LRT™ metric generated in earlier Test Runs.

There are two identical Repeatability Test Phases. Each Test Phase contains two Test Runs. Each of the Test Runs will have a Measurement Interval of no less than ten (10) minutes. The two Test Runs in each Test Phase will be executed without interruption or any type of manual intervention.

The first Test Run in each Test Phase is executed at the 10% load point. The Average Response Time from each of the Test Runs is compared to the SPC-1 LRT™ metric. Each Average Response Time value must be less than the SPC-1 LRT™ metric plus 5% or less than the SPC-1 LRT™ metric plus one (1) millisecond (ms).

The second Test Run in each Test Phase is executed at the 100% load point. The I/O Request Throughput from the Test Runs is compared to the SPC-1 IOPS™ primary metric. Each I/O Request Throughput value must be greater than the SPC-1 IOPS™ primary metric minus 5%. In addition, the Average Response Time for each Test Run cannot exceed 30 milliseconds.

If any of the above constraints are not met, the benchmark measurement is invalid.

Clause 9.4.3.7.4

The following content shall appear in the FDR for each Test Run in the two Repeatability Test Phases:

1. *A table containing the results of the Repeatability Test.*
2. *An I/O Request Throughput Distribution graph and table.*
3. *An Average Response Time Distribution graph and table.*
4. *The human readable Test Run Results File produced by the Workload Generator.*
5. *A listing or screen image of all input parameters supplied to the Workload Generator.*

SPC-1 Workload Generator Input Parameters

The SPC-1 Workload Generator input parameters for the Sustainability, IOPS, Response Time Ramp, Repeatability, and Persistence Test Runs are documented in "Appendix E: SPC-1 Workload Generator Input Parameters" on Page 67.

Repeatability Test Results File

The values for the SPC-1 IOPS™, SPC-1 LRT™, and the Repeatability Test measurements are listed in the tables below.

	SPC-1 IOPS™
Primary Metrics	***16,995.54***
Repeatability Test Phase 1	16,994.09
Repeatability Test Phase 2	17,004.33

The SPC-1 IOPS™ values in the above table were generated using 100% of the specified Business Scaling Unit (BSU) load level. Each of the Repeatability Test Phase values for SPC-1 IOPS™ must greater than 95% of the reported SPC-1 IOPS™ Primary Metric.

	SPC-1 LRT™
Primary Metrics	***1.81 ms***
Repeatability Test Phase 1	1.86 ms
Repeatability Test Phase 2	1.83 ms

The average response time values in the SPC-1 LRT™ column were generated using 10% of the specified Business Scaling Unit (BSU) load level. Each of the Repeatability Test Phase values for SPC-1 LRT™ must be less than 105% of the reported SPC-1 LRT™ Primary Metric or less than the reported SPC-1 LRT™ Primary Metric minus one (1) millisecond (ms)..

A link to the test result file generated from each Repeatability Test Run is listed below.

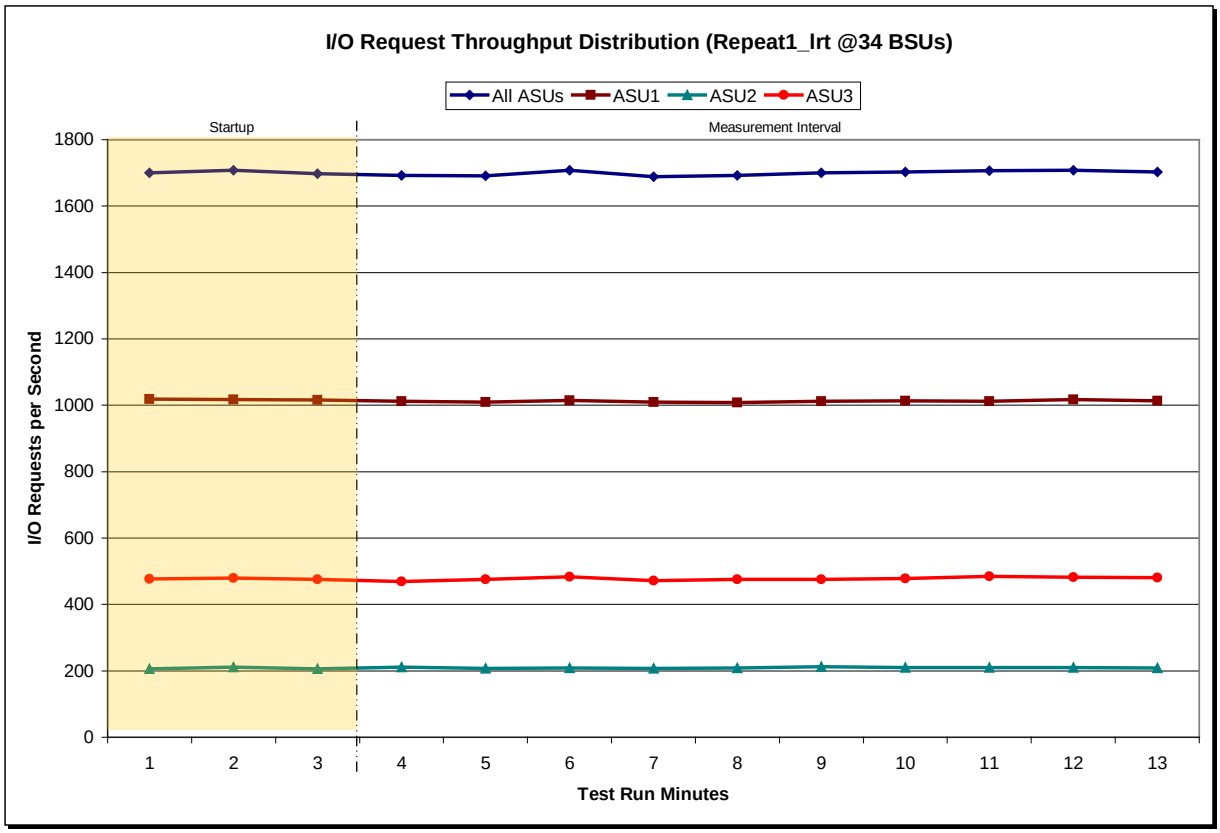
Repeatability Test Phase 1, Test Run 1 (LRT)
Repeatability Test Phase 1, Test Run 2 (IOPS)
Repeatability Test Phase 2, Test Run 1 (LRT)
Repeatability Test Phase 2, Test Run 2 (IOPS)

Repeatability 1 LRT – I/O Request Throughput Distribution Data

34 BSUs	Start	Stop	Interval	Duration
Start-Up/Ramp-Up	3:10:22	3:13:22	0-2	0:03:00
Measurement Interval	3:13:22	3:23:22	3-12	0:10:00

60 second intervals	All ASUs	ASU1	ASU2	ASU3
0	1,700.73	1,017.95	206.45	476.33
1	1,707.88	1,016.78	211.77	479.33
2	1,697.67	1,015.88	206.40	475.38
3	1,692.62	1,012.07	210.87	469.68
4	1,691.53	1,009.03	207.47	475.03
5	1,708.23	1,015.22	209.23	483.78
6	1,689.00	1,009.88	207.05	472.07
7	1,692.22	1,007.87	208.45	475.90
8	1,699.77	1,012.50	212.30	474.97
9	1,702.67	1,013.77	210.10	478.80
10	1,706.15	1,011.47	210.08	484.60
11	1,708.53	1,017.28	209.75	481.50
12	1,702.83	1,013.82	208.37	480.65
Average	***1,699.36***	***1,012.29***	***209.37***	***477.70***

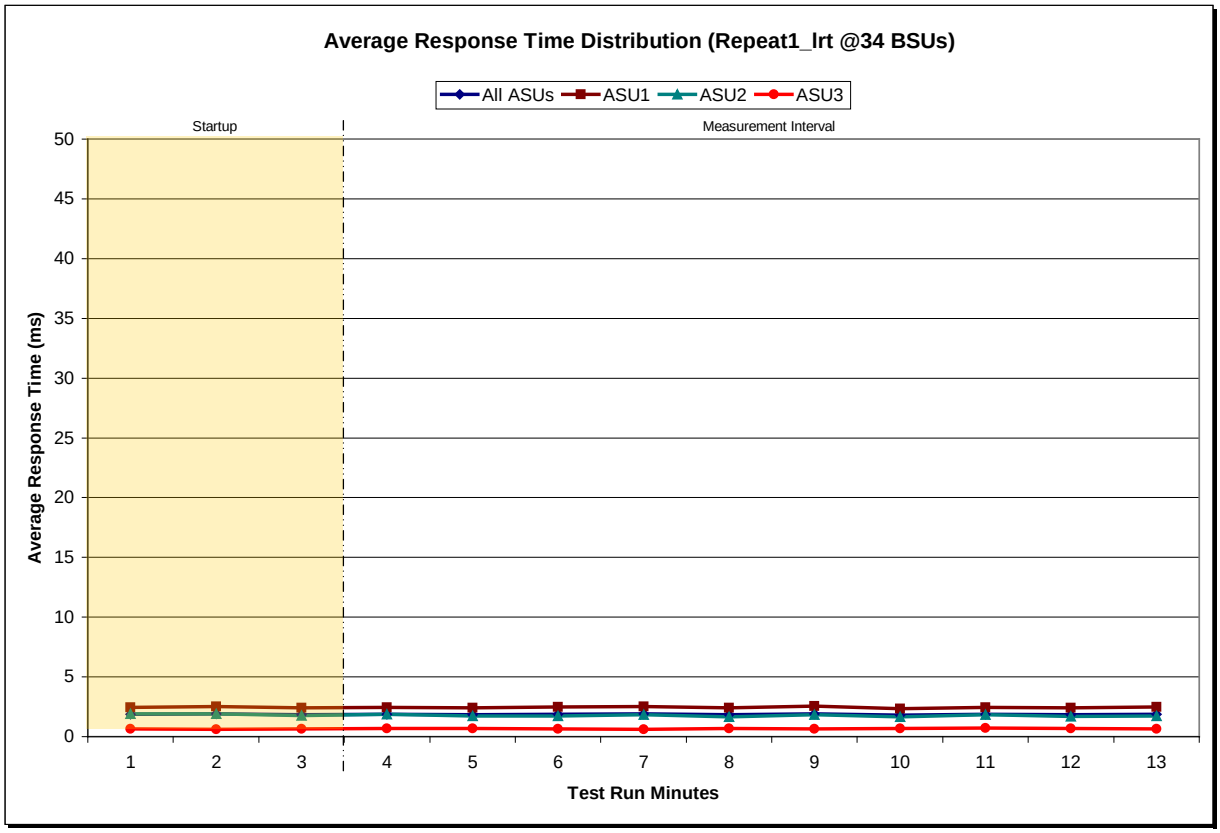
Repeatability 1 LRT – I/O Request Throughput Distribution Graph



Repeatability 1 LRT –Average Response Time (ms) Distribution Data

34 BSUs	Start	Stop	Interval	Duration
Start-Up/Ramp-Up	3:10:22	3:13:22	0-2	0:03:00
Measurement Interval	3:13:22	3:23:22	3-12	0:10:00
60 second intervals	**All ASUs**	**ASU1**	**ASU2**	**ASU3**
0	1.89	2.47	1.90	0.64
1	1.92	2.54	1.91	0.60
2	1.83	2.40	1.75	0.65
3	1.89	2.45	1.86	0.69
4	1.83	2.40	1.73	0.68
5	1.88	2.49	1.73	0.66
6	1.90	2.50	1.84	0.63
7	1.83	2.41	1.67	0.67
8	1.92	2.54	1.85	0.63
9	1.80	2.35	1.66	0.68
10	1.89	2.46	1.84	0.72
11	1.84	2.41	1.70	0.69
12	1.87	2.47	1.71	0.66
Average	***1.86***	***2.45***	***1.76***	***0.67***

Repeatability 1 LRT –Average Response Time (ms) Distribution Graph

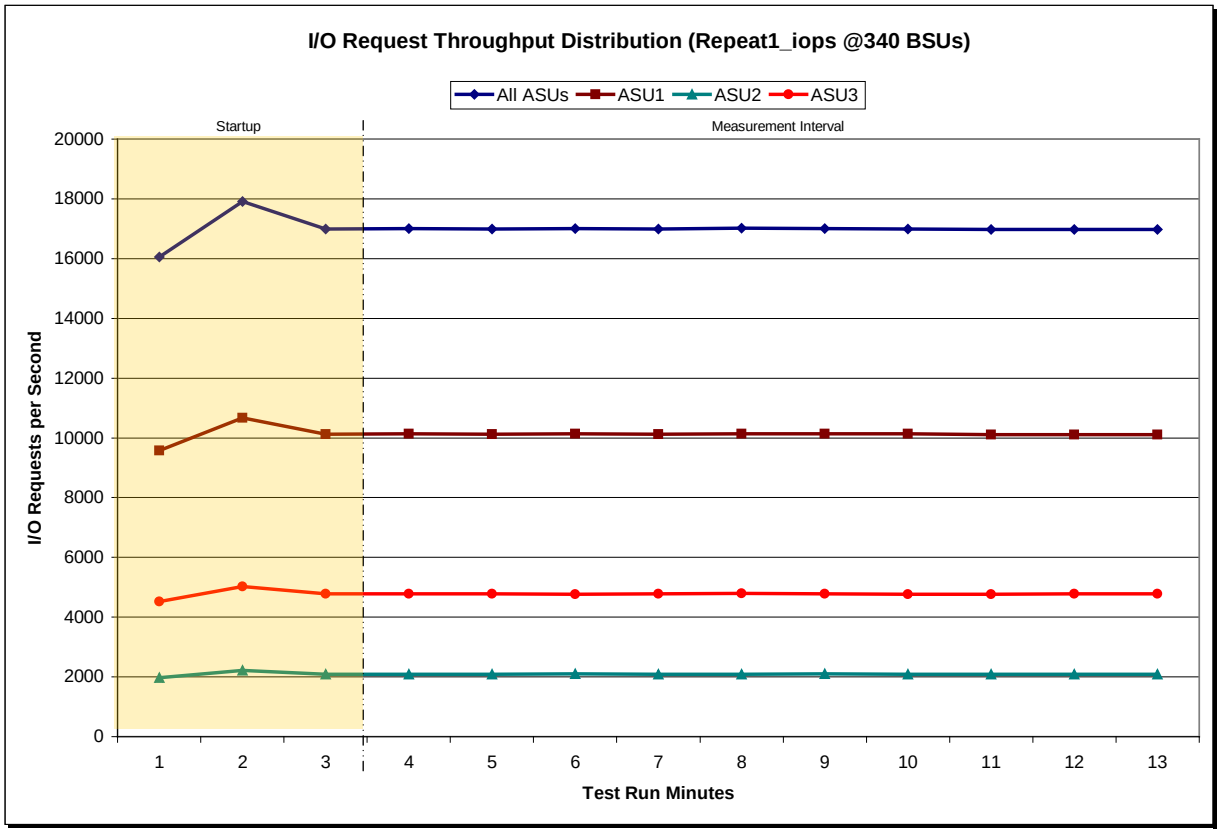


Repeatability 1 IOPS – I/O Request Throughput Distribution Data

340 BSUs	Start	Stop	Interval	Duration
Start-Up/Ramp-Up	3:24:24	3:27:25	0-2	0:03:01
Measurement Interval	3:27:25	3:37:25	3-12	0:10:00

60 second intervals	All ASUs	ASU1	ASU2	ASU3
0	16,061.73	9,568.30	1,968.98	4,524.45
1	17,918.18	10,668.30	2,217.73	5,032.15
2	16,986.07	10,123.03	2,082.73	4,780.30
3	17,006.08	10,133.93	2,091.20	4,780.95
4	16,996.63	10,115.73	2,094.03	4,786.87
5	17,000.58	10,132.67	2,095.88	4,772.03
6	16,987.83	10,115.62	2,092.12	4,780.10
7	17,018.35	10,138.22	2,092.07	4,788.07
8	17,010.82	10,134.23	2,102.47	4,774.12
9	16,991.82	10,130.87	2,093.92	4,767.03
10	16,973.52	10,114.85	2,089.18	4,769.48
11	16,972.58	10,111.20	2,085.00	4,776.38
12	16,982.70	10,110.25	2,092.95	4,779.50
Average	***16,994.09***	***10,123.76***	***2,092.88***	***4,777.45***

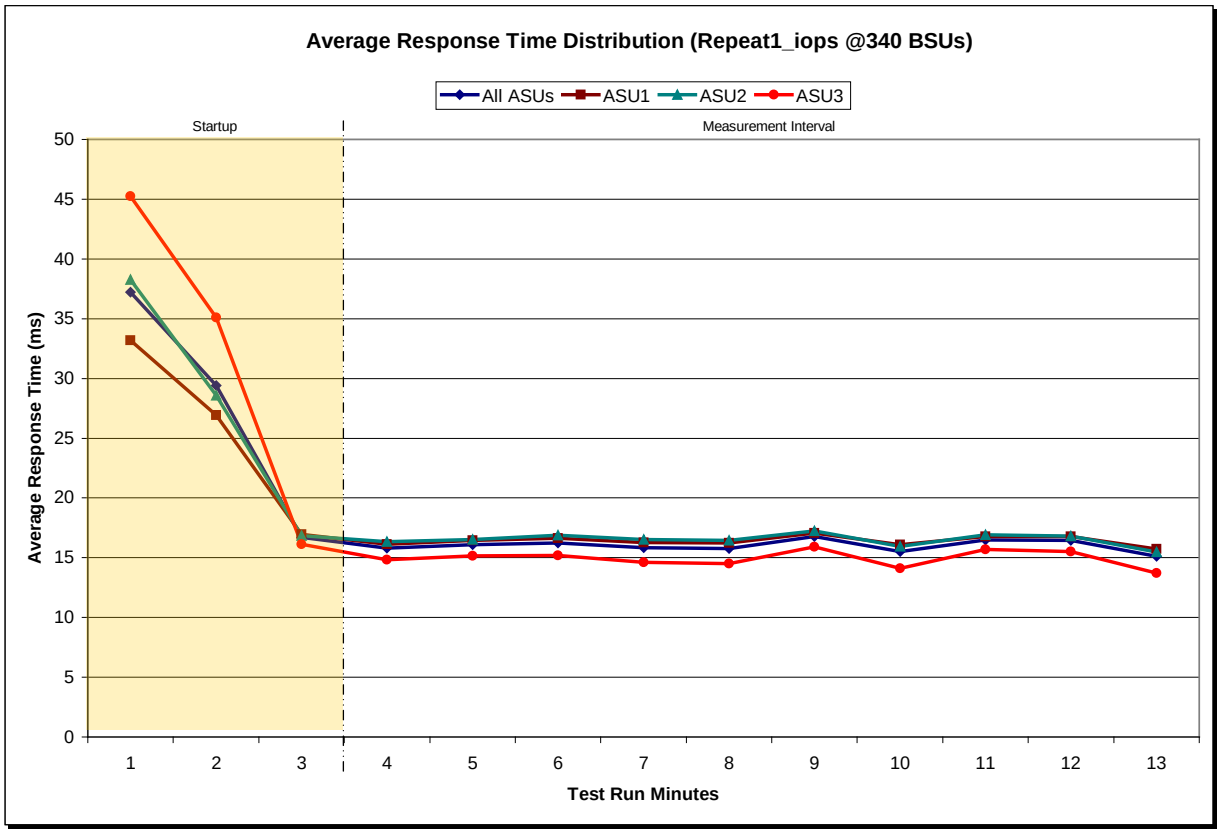
Repeatability 1 IOPS – I/O Request Throughput Distribution Graph



Repeatability 1 IOPS –Average Response Time (ms) Distribution Data

340 BSUs	Start	Stop	Interval	Duration
Start-Up/Ramp-Up	3:24:24	3:27:25	0-2	0:03:01
Measurement Interval	3:27:25	3:37:25	3-12	0:10:00
60 second intervals	**All ASUs**	**ASU1**	**ASU2**	**ASU3**
0	37.21	33.20	38.25	45.24
1	29.43	26.93	28.57	35.10
2	16.71	16.95	16.86	16.13
3	15.79	16.14	16.33	14.83
4	16.10	16.47	16.53	15.15
5	16.25	16.62	16.89	15.20
6	15.83	16.26	16.54	14.60
7	15.77	16.22	16.44	14.52
8	16.77	17.08	17.23	15.92
9	15.52	16.09	15.95	14.10
10	16.48	16.76	16.93	15.71
11	16.44	16.79	16.80	15.53
12	15.13	15.72	15.49	13.72
Average	***16.01***	***16.41***	***16.51***	***14.93***

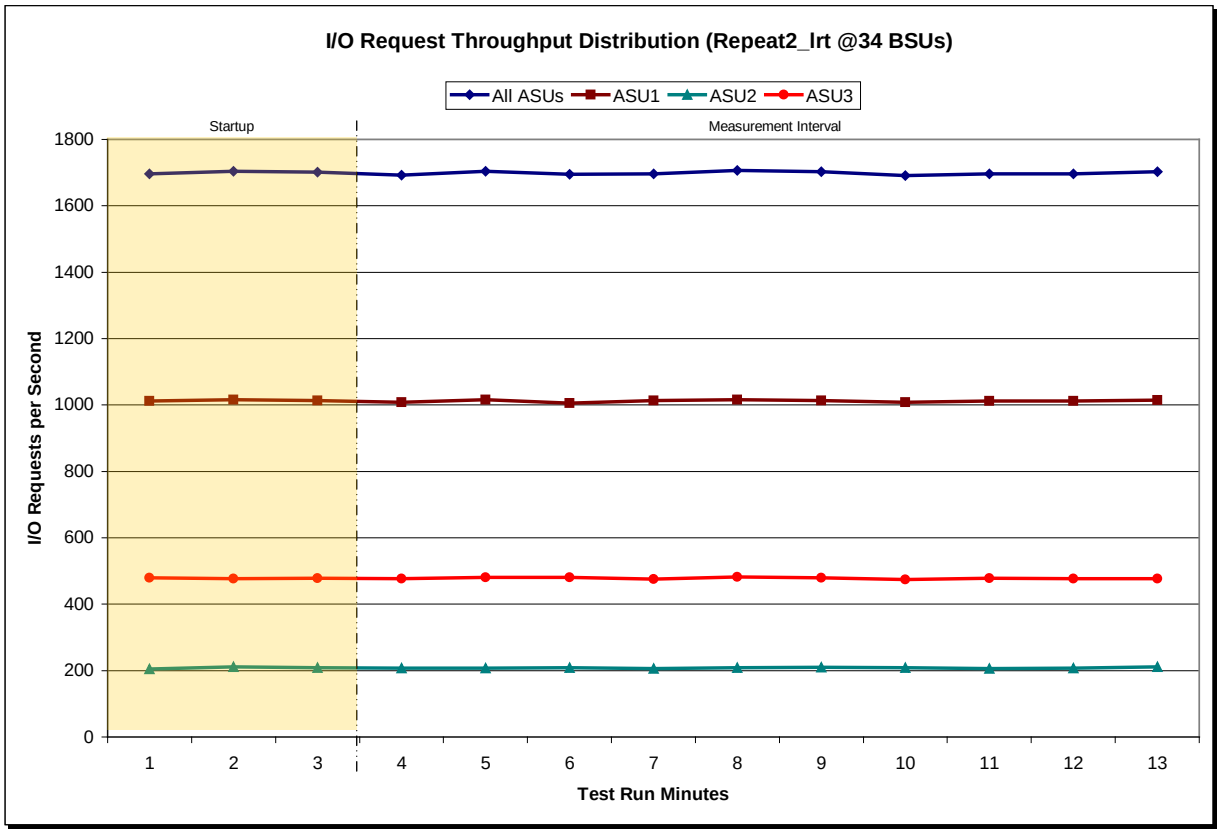
Repeatability 1 IOPS –Average Response Time (ms) Distribution Graph



Repeatability 2 LRT – I/O Request Throughput Distribution Data

34 BSUs	Start	Stop	Interval	Duration
Start-Up/Ramp-Up	3:38:29	3:41:29	0-2	0:03:00
Measurement Interval	3:41:29	3:51:29	3-12	0:10:00
60 second intervals	**All ASUs**	**ASU1**	**ASU2**	**ASU3**
0	1,696.18	1,012.07	205.03	479.08
1	1,703.70	1,015.62	210.83	477.25
2	1,701.43	1,013.97	208.70	478.77
3	1,692.17	1,008.03	207.50	476.63
4	1,704.22	1,015.73	207.17	481.32
5	1,695.00	1,005.07	208.62	481.32
6	1,695.77	1,013.52	206.45	475.80
7	1,707.12	1,016.20	209.23	481.68
8	1,703.37	1,013.68	209.70	479.98
9	1,691.22	1,008.25	208.52	474.45
10	1,696.92	1,012.48	205.88	478.55
11	1,696.33	1,012.30	207.32	476.72
12	1,703.25	1,015.32	211.50	476.43
Average	***1,698.54***	***1,012.06***	***208.19***	***478.29***

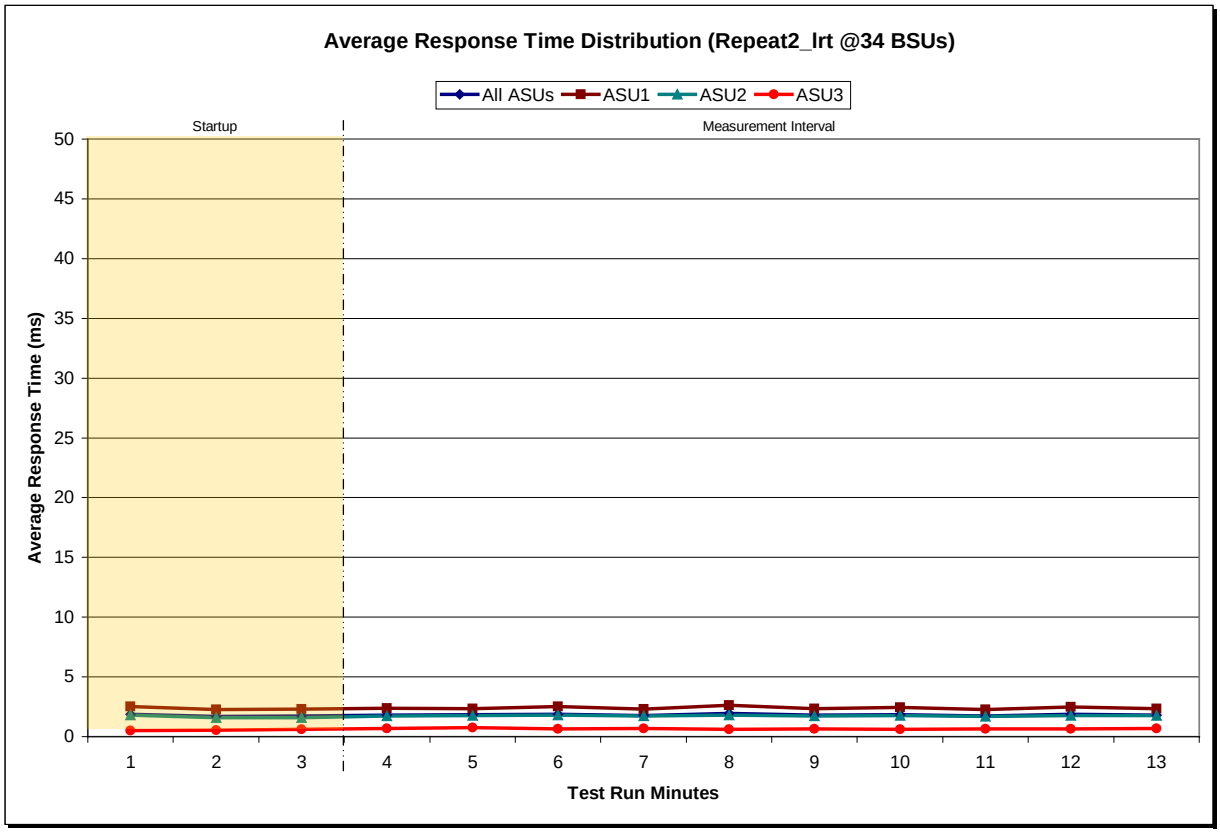
Repeatability 2 LRT – I/O Request Throughput Distribution Graph



Repeatability 2 LRT –Average Response Time (ms) Distribution Data

34 BSUs	Start	Stop	Interval	Duration
Start-Up/Ramp-Up	3:38:29	3:41:29	0-2	0:03:00
Measurement Interval	3:41:29	3:51:29	3-12	0:10:00
60 second intervals	**All ASUs**	**ASU1**	**ASU2**	**ASU3**
0	1.85	2.50	1.80	0.51
1	1.69	2.26	1.58	0.54
2	1.73	2.29	1.60	0.62
3	1.82	2.37	1.72	0.69
4	1.82	2.33	1.78	0.76
5	1.89	2.50	1.80	0.63
6	1.78	2.30	1.71	0.70
7	1.96	2.64	1.78	0.62
8	1.80	2.35	1.72	0.66
9	1.85	2.45	1.75	0.60
10	1.74	2.26	1.70	0.64
11	1.88	2.49	1.75	0.65
12	1.81	2.34	1.78	0.69
Average	***1.83***	***2.40***	***1.75***	***0.66***

Repeatability 2 LRT –Average Response Time (ms) Distribution Graph

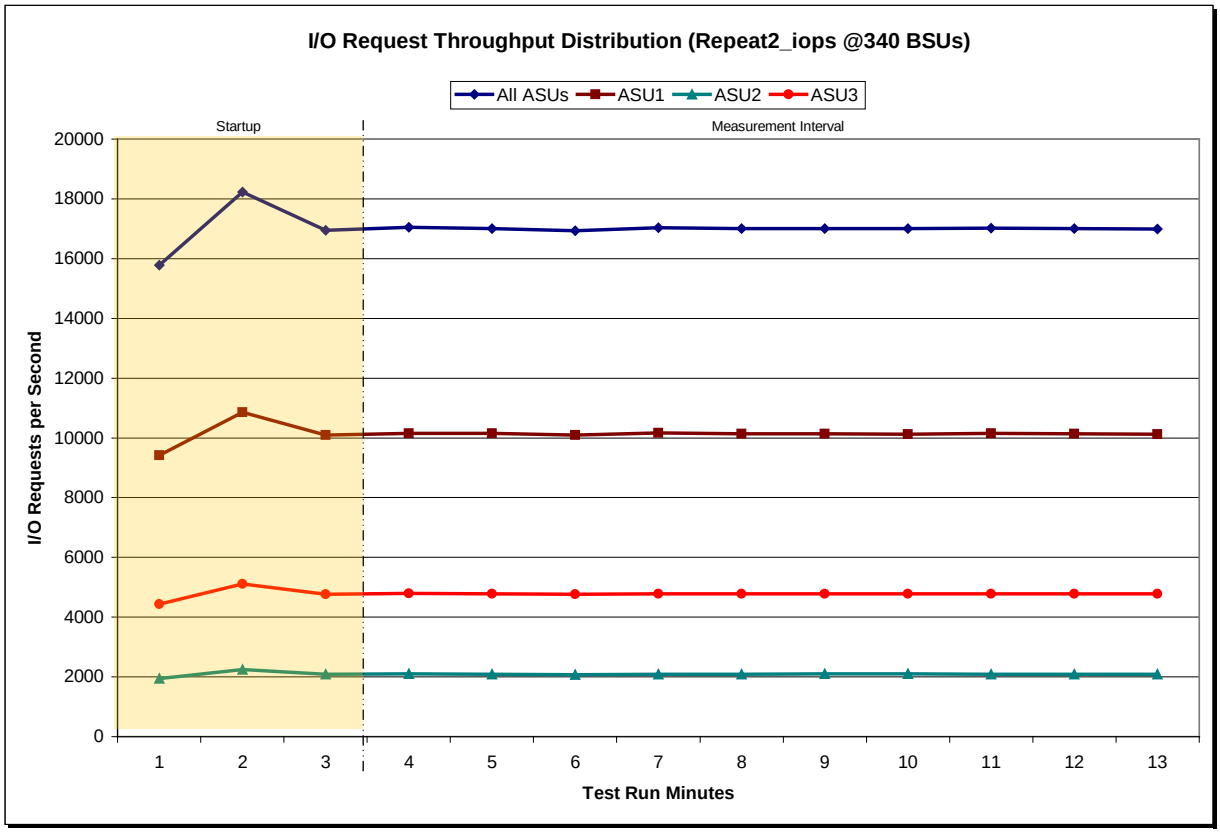


Repeatability 2 IOPS – I/O Request Throughput Distribution Data

340 BSUs	Start	Stop	Interval	Duration
Start-Up/Ramp-Up	3:52:31	3:55:32	0-2	0:03:01
Measurement Interval	3:55:32	4:05:32	3-12	0:10:00

60 second intervals	All ASUs	ASU1	ASU2	ASU3
0	15,784.92	9,412.62	1,940.08	4,432.22
1	18,224.30	10,857.30	2,248.82	5,118.18
2	16,954.57	10,092.28	2,094.58	4,767.70
3	17,050.38	10,152.62	2,096.32	4,801.45
4	17,007.97	10,144.17	2,089.12	4,774.68
5	16,931.42	10,092.52	2,079.10	4,759.80
6	17,035.90	10,160.67	2,091.32	4,783.92
7	17,003.58	10,131.98	2,093.82	4,777.78
8	17,007.35	10,132.47	2,096.23	4,778.65
9	17,000.05	10,122.87	2,098.33	4,778.85
10	17,013.90	10,148.65	2,087.05	4,778.20
11	17,007.87	10,136.53	2,087.78	4,783.55
12	16,984.90	10,120.12	2,081.75	4,783.03
Average	***17,004.33***	***10,134.26***	***2,090.08***	***4,779.99***

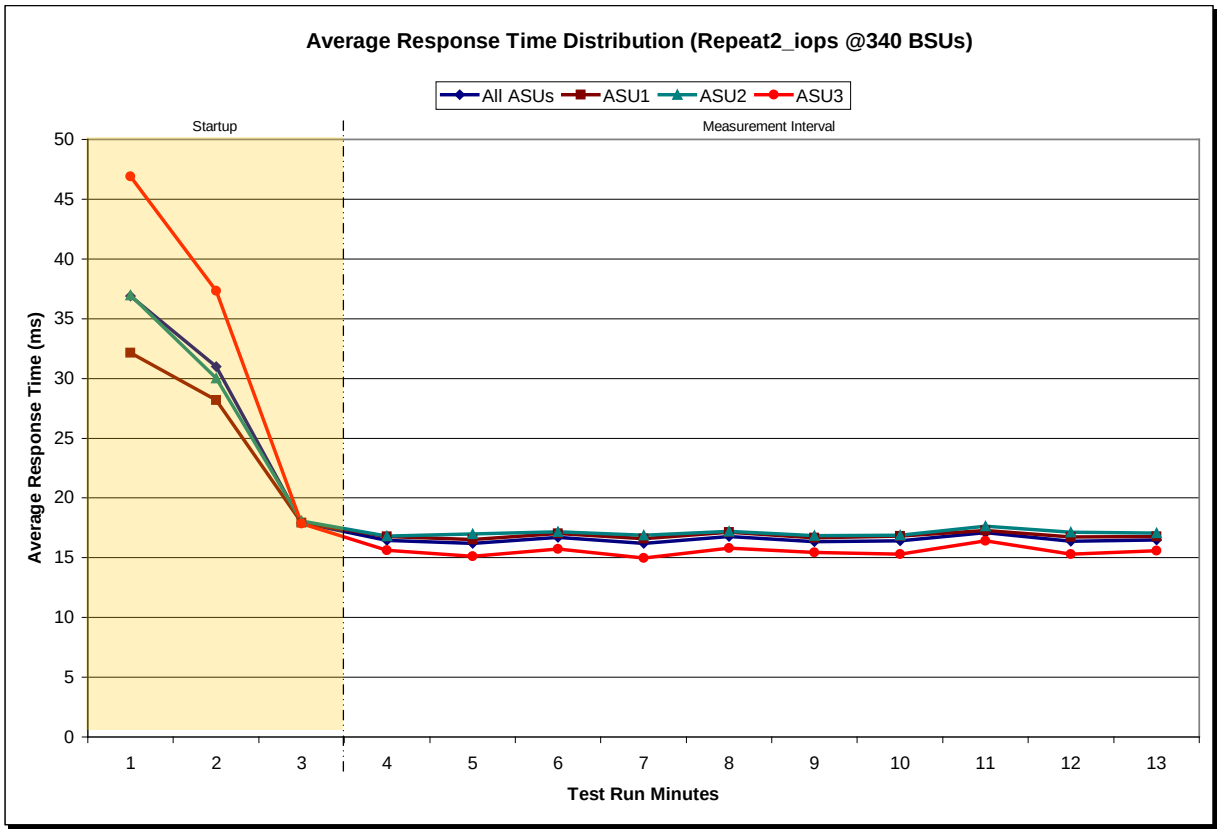
Repeatability 2 IOPS – I/O Request Throughput Distribution Graph



Repeatability 2 IOPS –Average Response Time (ms) Distribution Data

340 BSUs	Start	Stop	Interval	Duration
Start-Up/Ramp-Up	3:52:31	3:55:32	0-2	0:03:01
Measurement Interval	3:55:32	4:05:32	3-12	0:10:00
60 second intervals	**All ASUs**	**ASU1**	**ASU2**	**ASU3**
0	36.89	32.15	36.98	46.91
1	30.99	28.19	30.04	37.34
2	17.93	17.94	18.07	17.85
3	16.46	16.78	16.82	15.63
4	16.19	16.54	16.99	15.11
5	16.69	17.03	17.18	15.75
6	16.18	16.61	16.88	14.97
7	16.77	17.14	17.19	15.79
8	16.35	16.66	16.86	15.46
9	16.40	16.81	16.89	15.32
10	17.09	17.28	17.64	16.42
11	16.37	16.72	17.12	15.28
12	16.48	16.79	17.06	15.57
Average	***16.50***	***16.84***	***17.06***	***15.53***

Repeatability 2 IOPS –Average Response Time (ms) Distribution Graph



Repeatability 1 (LRT)
Measured Intensity Multiplier and Coefficient of Variation

Clause 3.4.3

IM – Intensity Multiplier: *The ratio of I/Os for each I/O stream relative to the total I/Os for all I/O streams (ASU1-1 – ASU3-1) as required by the benchmark specification.*

Clauses 5.1.10 and 5.3.13.2

MIM – Measured Intensity Multiplier: *The Measured Intensity Multiplier represents the ratio of measured I/Os for each I/O stream relative to the total I/Os measured for all I/O streams (ASU1-1 – ASU3-1). This value may differ from the corresponding Expected Intensity Multiplier by no more than 5%.*

Clause 5.3.13.3

COV – Coefficient of Variation: *This measure of variation for the Measured Intensity Multiplier cannot exceed 0.2.*

	ASU1-1	ASU1-2	ASU1-3	ASU1-4	ASU2-1	ASU2-2	ASU2-3	ASU3-1
IM	***0.0350***	***0.2810***	***0.0700***	***0.2100***	***0.0180***	***0.0700***	***0.0350***	***0.2810***
MIM	0.0350	0.2802	0.0701	0.2104	0.0179	0.0703	0.0350	0.2811
COV	0.023	0.005	0.015	0.005	0.016	0.012	0.017	0.007

Repeatability 1 (IOPS)
Measured Intensity Multiplier and Coefficient of Variation

	ASU1-1	ASU1-2	ASU1-3	ASU1-4	ASU2-1	ASU2-2	ASU2-3	ASU3-1
IM	***0.0350***	***0.2810***	***0.0700***	***0.2100***	***0.0180***	***0.0700***	***0.0350***	***0.2810***
MIM	0.0351	0.2808	0.0699	0.2099	0.0181	0.0701	0.0350	0.2811
COV	0.005	0.001	0.003	0.002	0.007	0.004	0.006	0.001

Repeatability 2 (LRT)
Measured Intensity Multiplier and Coefficient of Variation

	ASU1-1	ASU1-2	ASU1-3	ASU1-4	ASU2-1	ASU2-2	ASU2-3	ASU3-1
IM	***0.0350***	***0.2810***	***0.0700***	***0.2100***	***0.0180***	***0.0700***	***0.0350***	***0.2810***
MIM	0.0349	0.2816	0.0695	0.2099	0.0180	0.0699	0.0347	0.2816
COV	0.024	0.006	0.014	0.007	0.026	0.011	0.013	0.004

Repeatability 2 (IOPS)
Measured Intensity Multiplier and Coefficient of Variation

	ASU1-1	ASU1-2	ASU1-3	ASU1-4	ASU2-1	ASU2-2	ASU2-3	ASU3-1
IM	***0.0350***	***0.2810***	***0.0700***	***0.2100***	***0.0180***	***0.0700***	***0.0350***	***0.2810***
MIM	0.0351	0.2810	0.0700	0.2099	0.0180	0.0699	0.0350	0.2811
COV	0.006	0.002	0.006	0.002	0.008	0.003	0.004	0.001

Data Persistence Test

Clause 6

The Data Persistence Test demonstrates the Tested Storage Configuration (TSC):

- *Is capable of maintain data integrity across a power cycle.*
- *Ensures the transfer of data between Logical Volumes and host systems occurs without corruption or loss.*

The SPC-1 Workload Generator will write 16 block I/O requests at random over the total Addressable Storage Capacity of the TSC for ten (10) minutes at a minimum of 25% of the load used to generate the SPC-1 IOPS™ primary metric. The bit pattern selected to be written to each block as well as the address of the block will be retained in a log file.

The Tested Storage Configuration (TSC) will be shutdown and restarted using a power off/power on cycle at the end of the above sequence of write operations. In addition, any caches employing battery backup must be flushed/emptied.

The SPC-1 Workload Generator will then use the above log file to verify each block written contains the correct bit pattern.

Clause 9.4.3.8

The following content shall appear in this section of the FDR:

1. *A listing or screen image of all input parameters supplied to the Workload Generator.*
2. *For the successful Data Persistence Test Run, a table illustrating key results. The content, appearance, and format of this table are specified in Table 9-12. Information displayed in this table shall be obtained from the Test Run Results File referenced below in #3.*
3. *For the successful Data Persistence Test Run, the human readable Test Run Results File produced by the Workload Generator.*

SPC-1 Workload Generator Input Parameters

The SPC-1 Workload Generator input parameters for the Sustainability, IOPS, Response Time Ramp, Repeatability, and Persistence Test Runs are documented in "Appendix E: SPC-1 Workload Generator Input Parameters" on Page 67.

Data Persistence Test Results File

A link to each test result file generated from each Data Persistence Test is listed below.

Persistence 1 Test Results File

Persistence 2 Test Results File

Data Persistence Test Results

Data Persistence Test Results	
Data Persistence Test Run Number: 1	
Total Number of Logical Blocks Written	40,597,328
Total Number of Logical Blocks Verified	37,241,856
Total Number of Logical Blocks that Failed Verification	0
Time Duration for Writing Test Logical Blocks	10 minutes
Size in Bytes of each Logical Block	512
Number of Failed I/O Requests in the process of the Test	0

In some cases the same address was the target of multiple writes, which resulted in more Logical Blocks Written than Logical Blocks Verified. In the case of multiple writes to the same address, the pattern written and verified must be associated with the last write to that address.

PRICED STORAGE CONFIGURATION AVAILABILITY DATE

Clause 9.2.4.9

The committed delivery data for general availability (Availability Date) of all products that comprise the Priced Storage Configuration must be reported. When the Priced Storage Configuration includes products or components with different availability dates, the reported Availability Date for the Priced Storage Configuration must be the date at which all components are committed to be available.

The Huawei OceanStor™ S2600 as documented in this Full Disclosure Report is currently available for customer purchase and shipment.

PRICING INFORMATION

Clause 9.4.3.3.6

The Executive Summary shall contain a pricing spreadsheet as documented in Clause 8.3.1.

Pricing information may found in the Priced Storage Configuration Pricing section on page 14.

TESTED STORAGE CONFIGURATION (TSC) AND PRICED STORAGE CONFIGURATION DIFFERENCES

Clause 9.4.3.3.7

The Executive Summary shall contain a pricing a list of all differenced between the Tested Storage Configuration (TSC) and the Priced Storage Configuration.

A list of all differences between the Tested Storage Configuration (TSC) and Priced Storage Configuration may be found in the Executive Summary portion of this document on page 14.

ANOMALIES OR IRREGULARITIES

Clause 9.4.3.10

The FDR shall include a clear and complete description of any anomalies or irregularities encountered in the course of executing the SPC-1 benchmark that may in any way call into question the accuracy, verifiability, or authenticity of information published in this FDR.

There were no anomalies or irregularities encountered during the SPC-1 Remote Audit of the Huawei OceanStor™ S2600 .

APPENDIX A: SPC-1 GLOSSARY

"Decimal" *(powers of ten)* Measurement Units

In the storage industry, the terms "kilo", "mega", "giga", "tera", "peta", and "exa" are commonly used prefixes for computing performance and capacity. For the purposes of the SPC workload definitions, all of the following terms are defined in "powers of ten" measurement units.

- A kilobyte (KB) is equal to 1,000 (10^3) bytes.
- A megabyte (MB) is equal to 1,000,000 (10^6) bytes.
- A gigabyte (GB) is equal to 1,000,000,000 (10^9) bytes.
- A terabyte (TB) is equal to 1,000,000,000,000 (10^{12}) bytes.
- A petabyte (PB) is equal to 1,000,000,000,000,000 (10^{15}) bytes
- An exabyte (EB) is equal to 1,000,000,000,000,000,000 (10^{18}) bytes

"Binary" *(powers of two)* Measurement Units

The sizes reported by many operating system components use "powers of two" measurement units rather than "power of ten" units. The following standardized definitions and terms are also valid and may be used in this document.

- A kibibyte (KiB) is equal to 1,024 (2^{10}) bytes.
- A mebibyte (MiB) is equal to 1,048,576 (2^{20}) bytes.
- A gigibyte (GiB) is equal to 1,073,741,824 (2^{30}) bytes.
- A tebibyte (TiB) is equal to 1,099,511,627,776 (2^{40}) bytes.
- A pebibyte (PiB) is equal to 1,125,899,906,842,624 (2^{50}) bytes.
- An exbibyte (EiB) is equal to 1,152,921,504,606,846,967 (2^{60}) bytes.

SPC-1 Data Repository Definitions

Total ASU Capacity: The total storage capacity read and written in the course of executing the SPC-1 benchmark.

Application Storage Unit (ASU): The logical interface between the storage and SPC-1 Workload Generator. The three ASUs (Data, User, and Log) are typically implemented on one or more Logical Volume.

Logical Volume: The division of Addressable Storage Capacity into individually addressable logical units of storage used in the SPC-1 benchmark. Each Logical Volume is implemented as a single, contiguous address space.

Addressable Storage Capacity: The total storage (sum of Logical Volumes) that can be read and written by application programs such as the SPC-1 Workload Generator.

Configured Storage Capacity: This capacity includes the Addressable Storage Capacity and any other storage (parity disks, hot spares, etc.) necessary to implement the Addressable Storage Capacity.

Physical Storage Capacity: The formatted capacity of all storage devices physically present in the Tested Storage Configuration (TSC).

Data Protection Overhead: The storage capacity required to implement the selected level of data protection.

Required Storage: The amount of Configured Storage Capacity required to implement the Addressable Storage Configuration, excluding the storage required for the three ASUs.

Global Storage Overhead: The amount of Physical Storage Capacity that is required for storage subsystem use and unavailable for use by application programs.

Total Unused Storage: The amount of storage capacity available for use by application programs but not included in the Total ASU Capacity.

SPC-1 Data Protection Levels

Protected: This level will ensure data protection in the event of a single point of failure of any configured storage device. A brief description of the data protection utilized is included in the Executive Summary.

Unprotected: No claim of data protection is asserted in the event of a single point of failure.

SPC-1 Test Execution Definitions

Average Response Time: The sum of the Response Times for all Measured I/O Requests divided by the total number of Measured I/O Requests.

Completed I/O Request: An I/O Request with a Start Time and a Completion Time (see "I/O Completion Types" below).

Completion Time: The time recorded by the Workload Generator when an I/O Request is satisfied by the TSC as signaled by System Software.

Data Rate: The data transferred in all Measured I/O Requests in an SPC-1 Test Run divided by the length of the Test Run in seconds.

Expected I/O Count: For any given I/O Stream and Test Phase, the product of 50 times the BSU level, the duration of the Test Phase in seconds, and the Intensity Multiplier for that I/O Stream.

Failed I/O Request: Any I/O Request issued by the Workload Generator that could not be completed or was signaled as failed by System Software. A Failed I/O Request has no Completion Time (see "I/O Completion Types" below).

I/O Request Throughput: The total number of Measured I/O requests in an SPC-1 Test Run divided by the duration of the Measurement Interval in seconds.

In-Flight I/O Request: An I/O Request issued by the I/O Command Generator to the TSC that has a recorded Start Time, but does not complete within the Measurement Interval (see "I/O Completion Types" below).

Measured I/O Request: A Completed I/O Request with a Completion Time occurring within the Measurement Interval (see "I/O Completion Types" below).

Measured Intensity Multiplier: The percentage of all Measured I/O Requests that were issued by a given I/O Stream.

Measurement Interval: The finite and contiguous time period, after the TSC has reached Steady State, when data is collected by a Test Sponsor to generate an SPC-1 test result or support an SPC-1 test result.

Ramp-Up: The time required for the Benchmark Configuration (BC) to produce Steady State throughput after the Workload Generator begins submitting I/O Requests to the TSC for execution.

Ramp-Down: The time required for the BC to complete all I/O Requests issued by the Workload Generator. The Ramp-Down period begins when the Workload Generator ceases to issue new I/O Requests to the TSC.

Response Time: The Response Time of a Measured I/O Request is its Completion Time minus its Start Time.

Start Time: The time recorded by the Workload Generator when an I/O Request is submitted, by the Workload Generator, to the System Software for execution on the Tested Storage Configuration (TSC).

Start-Up: The period that begins after the Workload Generator starts to submit I/O requests to the TSC and ends at the beginning of the Measurement Interval.

Shut-Down: The period between the end of the Measurement Interval and the time when all I/O Requests issued by the Workload Generator have completed or failed.

Steady State: The consistent and sustainable throughput of the TSC. During this period the load presented to the TSC by the Workload Generator is constant.

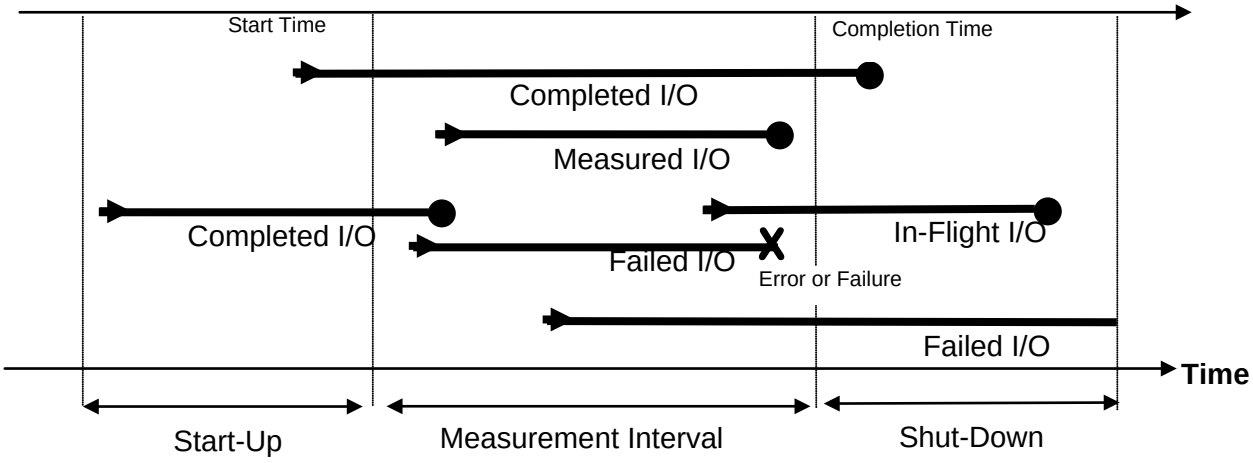
Test: A collection of Test Phases and or Test Runs sharing a common objective.

Test Run: The execution of SPC-1 for the purpose of producing or supporting an SPC-1 test result. SPC-1 Test Runs may have a finite and measured Ramp-Up period, Start-Up

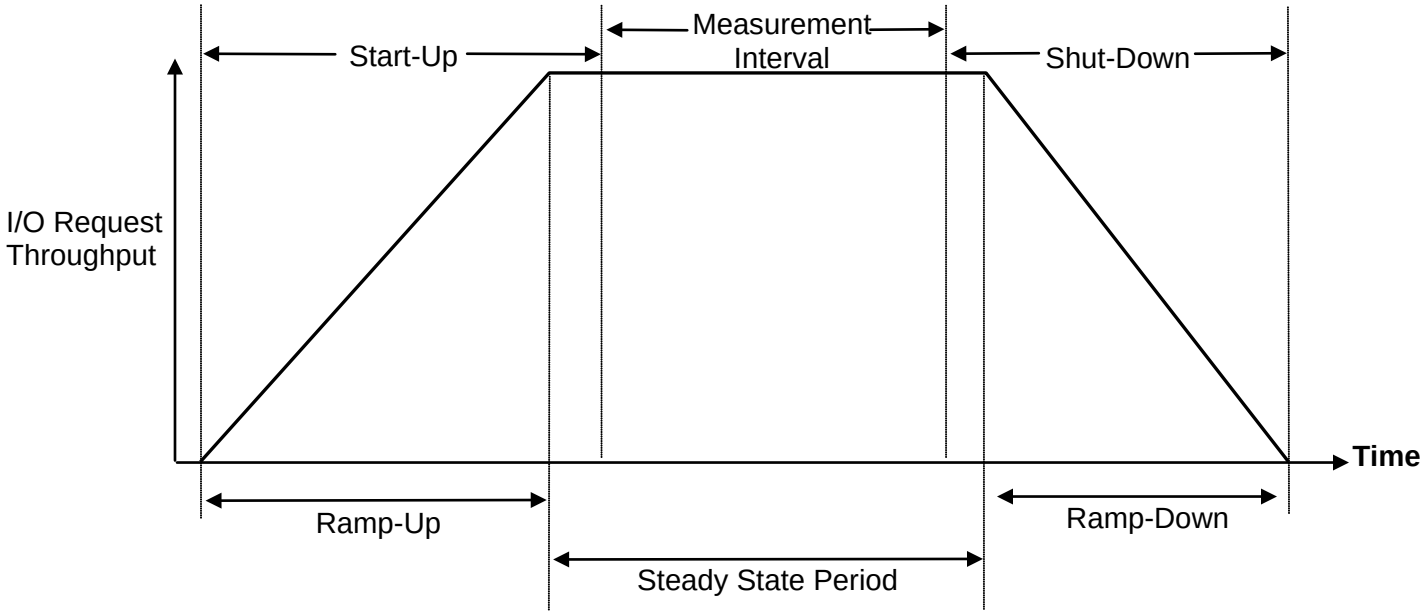
period, Shut-Down period, and Ramp-Down period as illustrated in the "SPC-1 Test Run Components" below. All SPC-1 Test Runs shall have a Steady State period and a Measurement Interval.

Test Phase: A collection of one or more SPC-1 Test Runs sharing a common objective and intended to be run in a specific sequence.

I/O Completion Types



SPC-1 Test Run Components



APPENDIX B: CUSTOMER TUNABLE PARAMETERS AND OPTIONS

Windows 2003 Server

The execution throttle, **queue depth**, was changed from a default value of 16 to 256 for each HBA in the configuration.

S2600 Storage System

Enable **write cache with mirroring** for all of the SPC-1 Logical Volumes

Set the cache high-low watermarks: **low watermark** is 70% and **high watermark** is 80%

Set the read cache policy to **intelligent prefetch**

APPENDIX C: TESTED STORAGE CONFIGURATION (TSC) CREATION

Create RAID10 LUNs

The **makelun.script** script creates four (4) RAID10 groups with one (1) LUN in each group. The four LUNs are mapped to the single Host System.

makelun.script

```
createrg -n RAID10_1 -l 10 -m 2 -d 0,0:0,1:0,2:0,3:0,4:0,5:0,6:0,7:0,8:0,9:0,10:0,11:
createrg -n RAID10_2 -l 10 -m 2 -d 1,0:1,1:1,2:1,3:1,4:1,5:1,6:1,7:1,8:1,9:1,10:1,11:
createrg -n RAID10_3 -l 10 -m 2 -d 2,0:2,1:2,2:2,3:2,4:2,5:2,6:2,7:2,8:2,9:2,10:2,11:
createrg -n RAID10_4 -l 10 -m 2 -d 3,0:3,1:3,2:3,3:3,4:3,5:3,6:3,7:3,8:3,9:3,10:3,11:
createlun -i 0 -n LUN_1 -s 747900 -u 512 -c A -w 1 -m 1 -p 3
createlun -i 1 -n LUN_2 -s 747900 -u 512 -c B -w 1 -m 1 -p 3
createlun -i 2 -n LUN_3 -s 747900 -u 512 -c A -w 1 -m 1 -p 3
createlun -i 3 -n LUN_4 -s 747900 -u 512 -c B -w 1 -m 1 -p 3
addmap -gi 0 -dl 0
addmap -gi 0 -dl 1
addmap -gi 0 -dl 2
addmap -gi 0 -dl 3
```

Create the SPC-1 Logical Volumes

The following steps define the Windows partitions, volumes, and stripe sets used in this SPC-1 configuration.

1. Execute **doSPC.bat**, which performs the following steps:

- Create four primary partitions, one per RAID10 LUN, using **align.script**. Each partition will have a starting offset of 32768 and utilize all of the remaining capacity in the LUN.
- Convert the RAID10 LUNs to Dynamic Disks using **convertDynamic.script**.
- Perform the following using **createVolumes.script**:
  - Create a Windows striped (RAID 0) volume using all four 32 MB volumes.
  - Delete the large volume on each of the Dynamic Disks.
  - Create a Windows striped (RAID 0) volume for ASU1
    - Select all four volumes
    - Set capacity to 336384 MB (MiB)
    - Assign drive letter "H" to the volume and do not format
  - Create a Windows striped (RAID 0) volume for ASU2
    - Select all four volumes
    - Set capacity to 336384 MB (MiB)
    - Assign drive letter "I" to the volume and do not format
  - Create a Windows striped (RAID 0) volume for ASU3

- Select all four volumes
- Set capacity to 74752 MB (MiB)
- Assign drive letter "J" to the volume and do not format

2. Reboot the Host System.
3. Using the Windows Disk Administrator, import foreign disks or reactivate the Windows stripe sets as necessary.

doSPC.bat

```
@echo ********************************************************
@echo * Warning make sure your boot device is PhysicalDrive 0 *
@echo ********************************************************

timeout /t 15 /NOBREAK
diskpart /s align.script
timeout /t 15 /NOBREAK
diskpart /s convertDynamic.script
timeout /t 15 /NOBREAK
diskpart /s createVolumes.script
```

align.script

```
select disk 1
create partition primary align=32768
select disk 2
create partition primary align=32768
select disk 3
create partition primary align=32768
select disk 4
create partition primary align=32768
```

convertDynamic.script

```
select disk 1
convert dynamic noerr
select disk 2
convert dynamic noerr
select disk 3
convert dynamic noerr
select disk 4
convert dynamic noerr
```

createVolumes.script

```
create volume stripe disk=1,2,3,4

list volume

select volume 0
delete volume noerr
select volume 1
delete volume noerr
select volume 2
delete volume noerr
select volume 3
delete volume noerr

create volume stripe size=336384 disk=1,2,3,4
assign letter=H
create volume stripe size=336384 disk=1,2,3,4
assign letter=I
create volume stripe size=74752 disk=1,2,3,4
assign letter=J
```

APPENDIX D: SPC-1 WORKLOAD GENERATOR STORAGE COMMANDS AND PARAMETERS

The content of SPC-1 Workload Generator command and parameter file, used in this benchmark, is listed below.

```
javaparms="-Xmx1024m -Xms1024m -Xss512k"
sd=asu1_1,lun=\\.\H:,size=1314g
sd=asu2_1,lun=\\.\I:,size=1314g
sd=asu3_1,lun=\\.\J:,size=292g
```

APPENDIX E: SPC-1 WORKLOAD GENERATOR INPUT PARAMETERS

Primary Metrics Test, Repeatability Test, and Persistence Test Run 1

The following script was used to execute the Primary Metrics Test *(Sustainability Test Phase, IOPS Test Phase, and Response Time Ramp Test Phase)*, Repeatability Test *(Repeatability Test Phase 1 and Repeatability Test Phase 2)*, and Persistence Test Run 1 in an uninterrupted sequence.

```
java -Xmx1024m -Xms1024m -Xss512k metrics -b 340
java -Xmx1024m -Xms1024m -Xss512k repeat1 -b 340
java -Xmx1024m -Xms1024m -Xss512k repeat2 -b 340
java -Xmx1024m -Xms1024m -Xss512k persist1 -b 340
```

Persistence Test Run 2

The following script was used to execute Persistence Test Run 2.

```
java -Xmx1024m -Xms1024m -Xss512k persist2
```