SPC BENCHMARK 1™
FULL DISCLOSURE REPORT

SILICON GRAPHICS INTERNATIONAL CORP.
SGI® INFINITESTORAGE 5500-SP

SPC-1 V1.12

Submitted for Review: March 22, 2012
Submission Identifier: A00114

First Edition – March 2012

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AUDIT CERTIFICATION

Jerry Lohr
Silicon Graphics International Corp.
46600 Landing Parkway
Fremont, CA 94538

March 22, 2012

The SPC Benchmark 1™ Reported Data listed below for the SGI® InfiniteStorage 5500-SP was produced in compliance with the SPC Benchmark 1™ v1.12 Remote Audit requirements.

SPC Benchmark 1™ v1.12 Reported Data	
Tested Storage Product (TSP) Name: SGI® InfiniteStorage 5500-SP	
Metric	**Reported Result**
SPC-1 IOPS™	82,519.75
SPC-1 Price-Performance	$3.52/SPC-1 IOPS™
Total ASU Capacity	13,457.424 GB
Data Protection Level	Protected *(Mirroring)*
Total TSC Price (including three-year maintenance)	$290,492.00

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 were verified by information supplied by Silicon Graphics International Corp.:
  - ✓ 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.
- SPC-1 Workload Generator commands and parameters used for the audited SPC Test Runs.

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

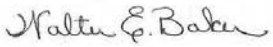
AUDIT CERTIFICATION *(CONT.)*

- The following Host System requirements were verified by information supplied by Silicon Graphics International Corp.:
  - ✓ The type of each 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 Silicon Graphics International Corp. 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
- The differences between the Tested Storage Configuration and Priced Storage Configuration were documented and, if applied to the Tested Storage Configuration, would not have an impact on the audited benchmark measurements.
- 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.

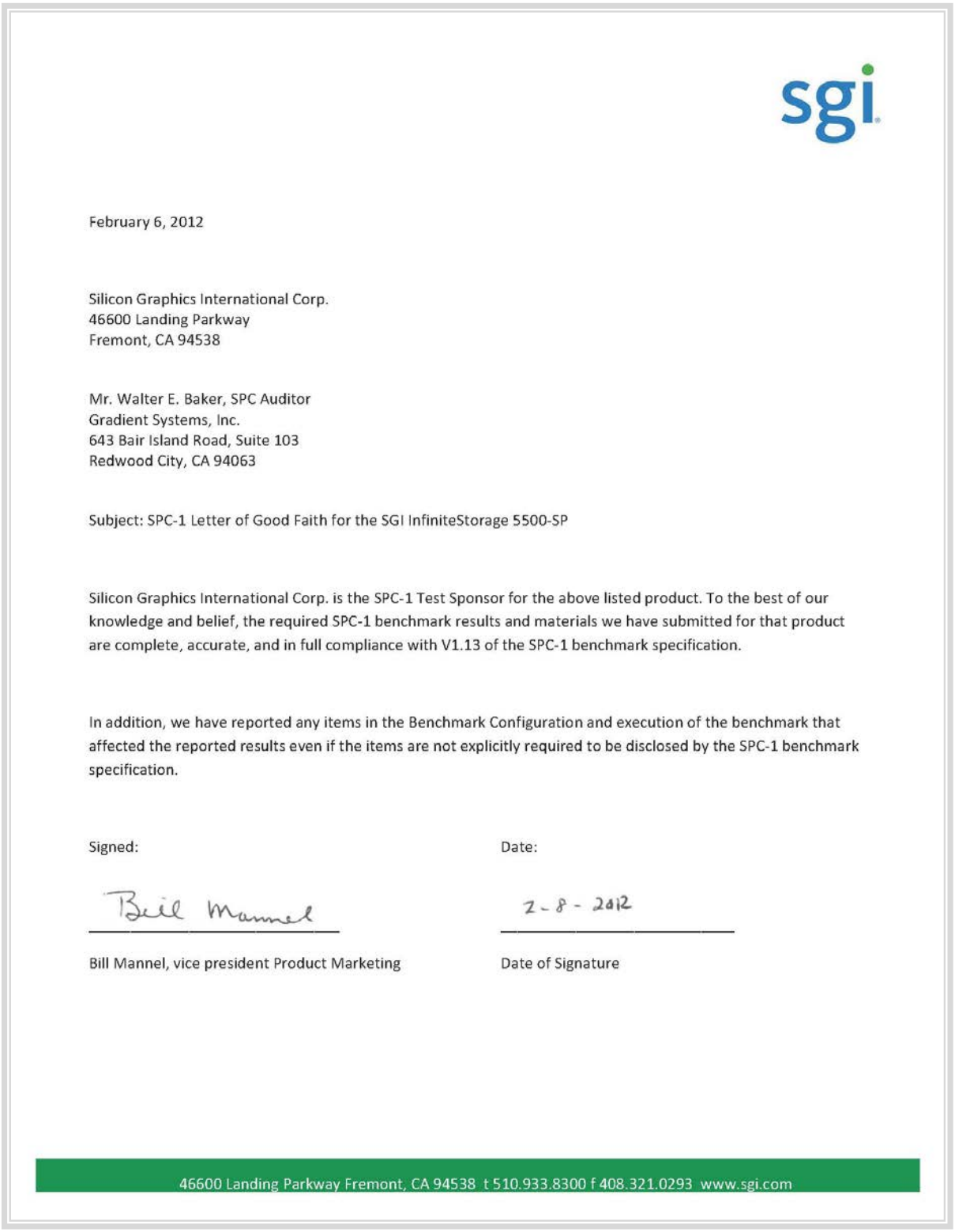
Respectfully,



Walter E. Baker
SPC Auditor

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

LETTER OF GOOD FAITH



February 6, 2012

Silicon Graphics International Corp.
46600 Landing Parkway
Fremont, CA 94538

Mr. 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 SGI InfiniteStorage 5500-SP

Silicon Graphics International Corp. 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 V1.13 of the SPC-1 benchmark specification.

In addition, we have reported any items in the Benchmark Configuration and execution of the benchmark that affected the reported results even if the items are not explicitly required to be disclosed by the SPC-1 benchmark specification.

Signed: Bill Mannel

Bill Mannel, vice president Product Marketing

Date: 2-8-2012

Date of Signature

46600 Landing Parkway Fremont, CA 94538 t 510.933.8300 f 408.321.0293 www.sgi.com

EXECUTIVE SUMMARY

Test Sponsor and Contact Information

Test Sponsor and Contact Information	
Test Sponsor Primary Contact	Silicon Graphics International Corp. – http://www.sgi.com Jerry Lohr – glohr@sgi.com 46600 Landing Parkway Fremont, CA 94538 Phone: (510) 933.5238
Test Sponsor Alternate Contact	Silicon Graphics International Corp. – http://www.sgi.com Floyd Christofferson – floydc@sgi.com 46600 Landing Parkway Fremont, CA 94538 Phone: (510) 933-5135
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	V2.2.0
Date Results were first used publicly	March 22, 2012
Date the FDR was submitted to the SPC	March 22, 2012
Date the Priced Storage Configuration is available for shipment to customers	currently available
Date the TSC completed audit certification	March 22, 2012

Tested Storage Product (TSP) Description

SGI® InfiniteStorage 5500 (IS5500) storage system meets both an organization's demanding performance and capacity requirements while not sacrificing simplicity or efficiency. This sixth-generation storage system offers ultimate flexibility. It comes in the IS5500-SP version used in the SPC-1 Tested Storage Configuration, with standard firmware compatible with a broad range of heterogeneous environments. In addition, the platform comes in the IS5500 custom version, with specially tuned firmware for high performance SGI environments.

Summary of Results

SPC-1 Reported Data	
Tested Storage Product (TSP) Name: SGI® InfiniteStorage 5500-SP	
Metric	**Reported Result**
SPC-1 IOPS™	82,519.75
SPC-1 Price-Performance™	$3.52/SPC-1 IOPS™
Total ASU Capacity	13,457.424 GB
Data Protection Level	Protected *(Mirroring)*
Total TSC Price (including three-year maintenance)	$290,492.00

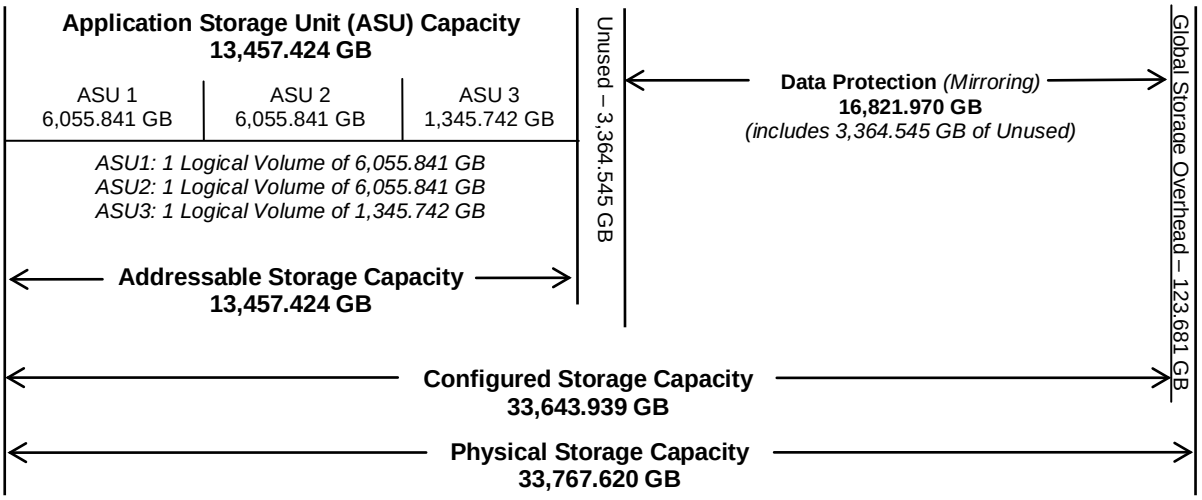
SPC-1 IOPS™ represents the maximum I/O Request Throughput at the 100% load point.

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 *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	39.85%
Protected Application Utilization	79.71%
Unused Storage Ratio	19.93%

Application Utilization: Total ASU Capacity *(13,457.424 GB)* divided by Physical Storage Capacity *(33,767.620 GB)*

Protected Application Utilization: Total ASU Capacity *(13,457.424 GB)* plus total Data Protection Capacity *(6,729.090 GB)* minus unused Data Protection Capacity *(3,364.545 GB)* divided by Physical Storage Capacity *(33,767.620 GB)*

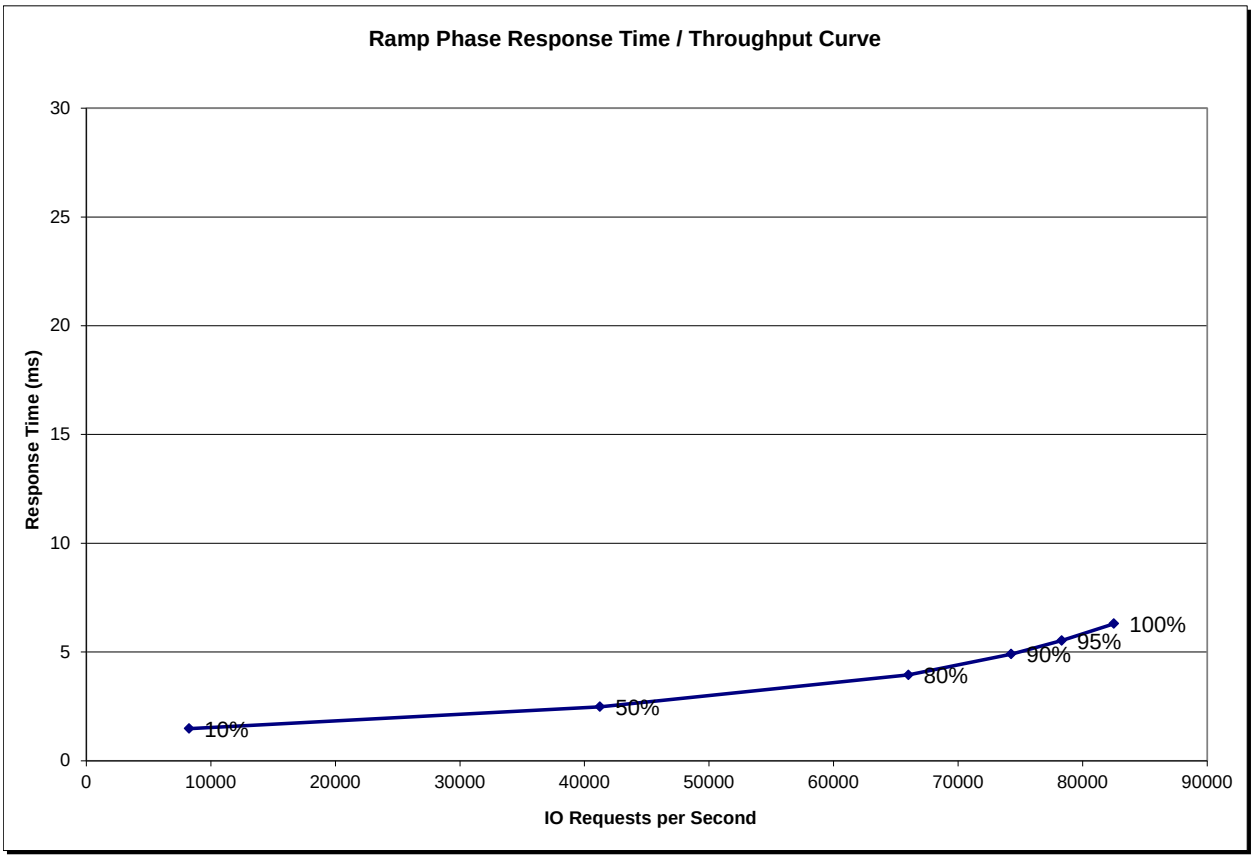
Unused Storage Ratio: Total Unused Capacity *(6,729.090 GB)* divided by Physical Storage Capacity *(33,767.620 GB)* and may not exceed 45%.

Detailed information for the various storage capacities and utilizations is available on pages 21-22 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	8,253.08	41,245.12	66,012.74	74,266.49	78,326.05	82,519.75
Average Response Time (ms):						
All ASUs	1.48	2.48	3.95	4.91	5.53	6.30
ASU-1	2.07	3.35	5.16	6.27	6.97	7.80
ASU-2	1.70	3.32	6.12	8.41	10.02	12.17
ASU-3	0.14	0.28	0.41	0.47	0.50	0.54
Reads	3.56	5.90	9.42	11.77	13.30	15.20
Writes	0.12	0.26	0.38	0.43	0.47	0.51

Priced Storage Configuration Pricing

Marketing Code	Description	Quantity	Unit List price	Unit Maintenance	Extended Price
SP10066	IS5500-SP, 4U 60bay, 24GB cache, Duplex, eight 8Gb FC host ports	1	$50,293.00	$7,574.00	$57,867.00
SP10062	60-bay drive module for IS5000-SP Family Duplex ESM for dual controllers	3	$21,595.00	$5,123.00	$80,154.00
IS-D146-I60-G-10	146GB 15K SAS 2.5" PI&FDE 60bay 10 pack for IS5000/IS5000-SP Family	23	$5,229.00	$0.00	$120,267.00
SP12087	IS5500-SP, High Performance feature key	1	$14,888.00	$0.00	$14,888.00
SP12088	IS5500-SP, Advanced software feature to unlock between 193 - 240 slots	1	$4,586.00	$0.00	$4,586.00
SP12081	SANtricity ES 10.XX FOR WINDOWS for IS5500-SP	1	$1,888.00	$770.00	$2,658.00
PCIE-FC8-2P-G2	Dual port 8Gb FC PCIE Gen2 HBA	4	$2,100.00	$0.00	$8,400.00
X-F44-OPT-3M-Z	3 meter optical 2/4/8Gbit FC 10Gb enet cable	8	$84.00	$0.00	$672.00
IS-RMKIT-UNIV-Z	Rackmount kit for OEM racks, mounts to rails	4	$250.00	$0.00	$1,000.00
	all requred SFPs and SAS cables are included with each appproriate component				
Total					**$290,492.00**

The above pricing includes hardware maintenance and software support for three years, 7 days per week, 24 hours per day. The hardware maintenance and software support provides the following:

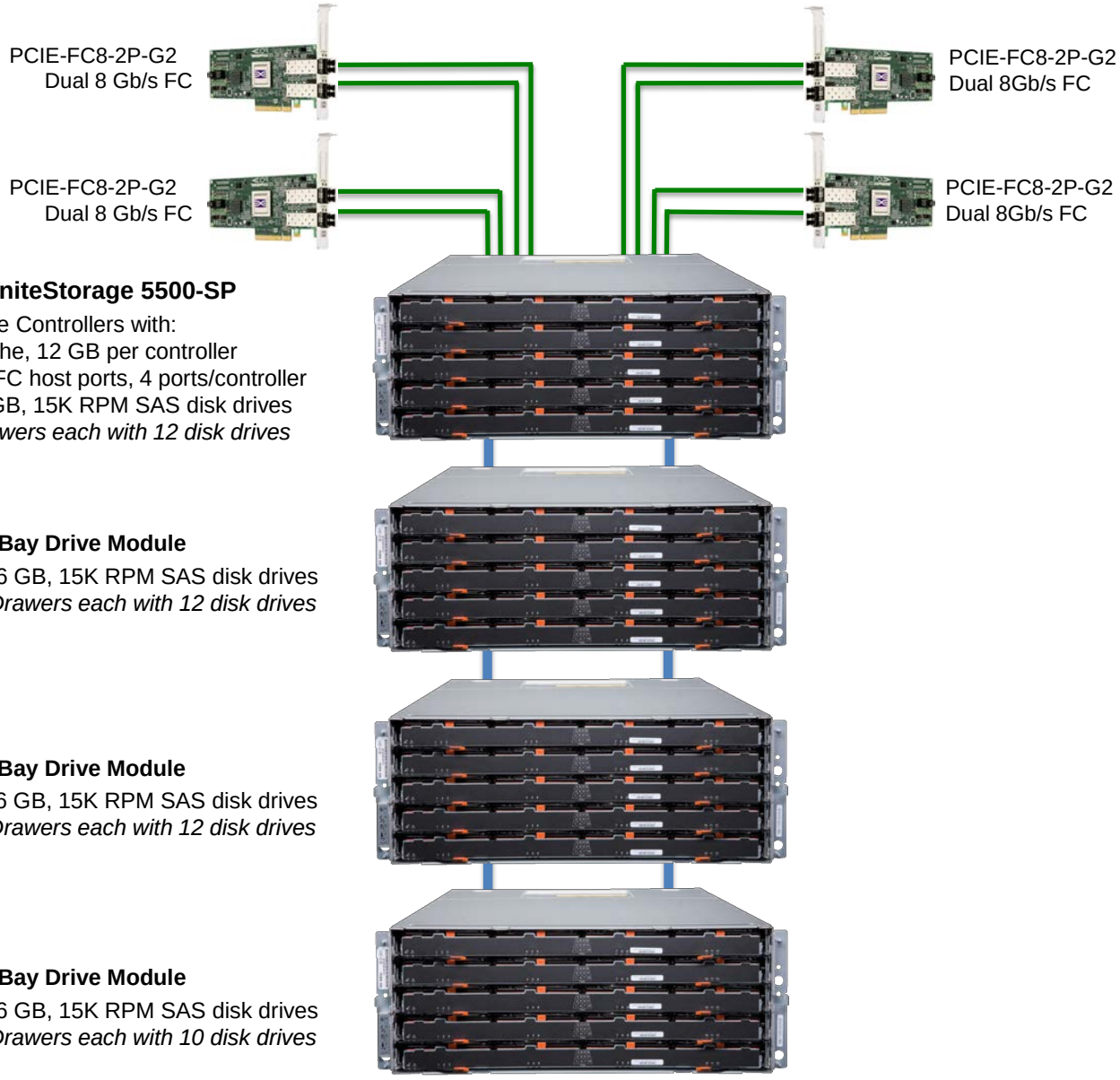
- Acknowledgement of new and existing problems with four (4) hours.
- Onsite presence of a qualified maintenance engineer or provision of a customer replaceable part within four (4) hours of the above acknowledgement for any hardware failure that results in an inoperative Price Storage Configuration that can be remedied by the repair or replacement of a Priced Storage Configuration component.

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

- A panel on the front bezel is silver with SGI logo and product name rather than black with NetApp logo and product name.
- An equivalent SGI-branded FC8 HBA is priced rather than the generic Emulex part.
- The TSC used an internal engineering feature code that included the High Performance Tier.
- The Priced Storage Configuration uses the base feature code and an optional feature key installed with the SANtricity GUI to enable the High Performance Tier.

The above differences, if applied to the TSC, would not have a negative impact on the reported SPC-1 performance.

Priced Storage Configuration Diagram



Priced Storage Configuration Components

Priced Storage Configuration:
4 – SGI dual port 8 Gb FC PCIe Gen2 HBAs
SANtricity ES 10.XX for Windows for IS5500-SP
SGI® InfiniteStorage 5500-SP Dual-Active Controllers with: 24 GB cache , 12 GB per controller High Performance Tier Enabled 8 – 8 Gb FC host ports, 4 ports per controller 2 – 6 Gb SAS connections, 1 per controller
3 – SGI 60-Bay Drive Modules
230 - 146 GB, 15K RPM SAS disk drives 60 disk drives in the controller module 60 disk drives in two 60-Bay Drive Modules 50 disk drives in one 60-Bay Drive Module

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 18 *(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 Benchmark Configuration (BC)/Tested Storage Configuration (TSC) was configured with local storage and, as such, did not employ a storage network.

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 19 *(Host Systems and Tested Storage Configuration Components).*

Benchmark Configuration/Tested Storage Configuration Diagram

2 – Dell PowerEdge™ R710 Servers
Microsoft Windows Server 2003
Enterprise Edition *(32-bit)* w/SP2

4 – Emulex LPe12002 dual-port FC HBAs
(2 HBAs per server)

NetApp® E5460 Storage System
Dual-Active Controllers with:
24 GB cache, 12 GB per controller
8 – 8Gb FC host ports, 4 ports/controller
60 – 146 GB, 15K RPM SAS disk drives
5 Drawers each with 12 disk drives

Expansion Enclosure
60 – 146 GB, 15K RPM SAS disk drives
5 Drawers each with 12 disk drives

Expansion Enclosure
60 – 146 GB, 15K RPM SAS disk drives
5 Drawers each with 12 disk drives

Expansion Enclosure
50 – 146 GB, 15K RPM SAS disk drives
5 Drawers each with 10 disk drives

Host Systems and Tested Storage Configuration Components

<table>
<tr><th>Host Systems:</th><th>Tested Storage Configuration (TSC)</th></tr>
<tr><td rowspan="2">2 – Dell PowerEdge™ R710 Servers
each with:</td><td>4 – Emulex LPe12002 dual-port FC HBAs</td></tr>
<tr><td>SANtricity for Windows</td></tr>
<tr><td>Dual quad core Intel® X5570 Xeon® processor; 2.93 GHz, 8 MB L3 cache per processor</td><td rowspan="3">NetApp® E5460 Storage System
Dual Active Controllers with:
24 GB cache, 12 GB per controller
8 – 8 Gb FC host ports, 4 ports per controller
2 – 6 Gb SAS connections, 1 per controller</td></tr>
<tr><td>16 GB main memory</td></tr>
<tr><td rowspan="2">Microsoft Windows Server 2003 (32-bit) Enterprise Edition, 5.2.3790 SP2 build 3790</td></tr>
<tr><td>3 –Expansion Enclosures</td></tr>
<tr><td>PCIe</td><td>230 – 146 GB, 15K RPM SAS disk drives
60 disk drives in the controller module
60 disk drives in two Expansion Enclosures
50 disk drives in one Expansion Enclosure</td></tr>
</table>

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 61 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 62 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 67.

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 57 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)	13,457.424
Addressable Storage Capacity	Gigabytes (GB)	13,457.424
Configured Storage Capacity	Gigabytes (GB)	33,643.939
Physical Storage Capacity	Gigabytes (GB)	33,767.620
Data Protection *(Mirroring)*	Gigabytes (GB)	16,821.970
Required Storage	Gigabytes (GB)	0.000
Global Storage Overhead	Gigabytes (GB)	3,364.545
Total Unused Storage	Gigabytes (GB)	6,729.090

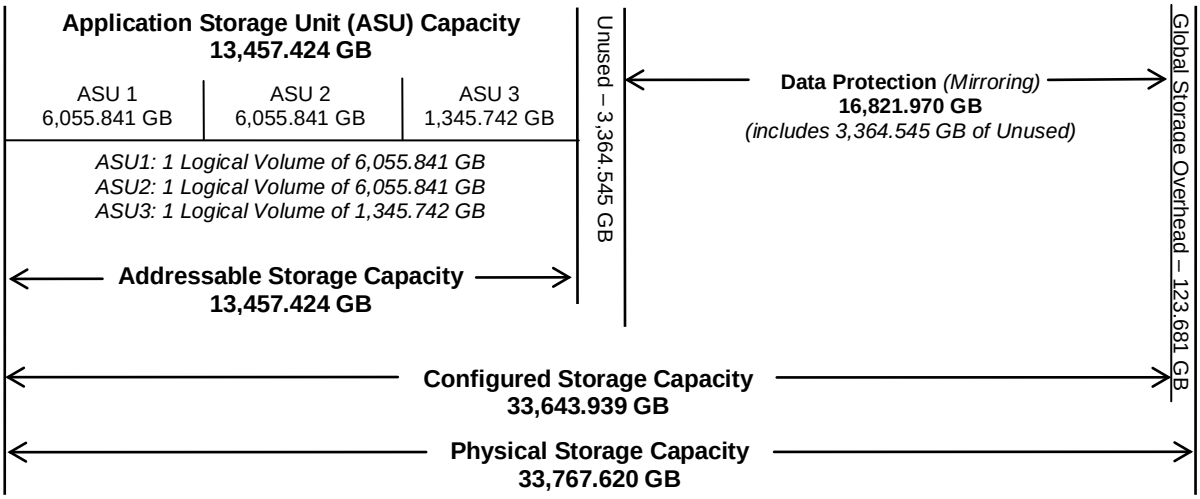
SPC-1 Storage Hierarchy Ratios

	Addressable Storage Capacity	**Configured Storage Capacity**	**Physical Storage Capacity**
Total ASU Capacity	100.00%	40.00%	39.85%
Required for Data Protection *(Mirroring)*		50.00%	49.82%
Addressable Storage Capacity		40.00%	39.85%
Required Storage		0.00%	0.005
Configured Storage Capacity			99.63%
Global Storage Overhead			0.37%
Unused Storage:			
Addressable	0.00%		
Configured		20.00%	
Physical			0.00%

The Physical Storage Capacity consisted of 33,767.620 GB distributed over 230 disk drives, each with a formatted capacity of 146.816 GB. There was 0.000 GB (0.00%) of Unused Storage within the Physical Storage Capacity. Global Storage Overhead consisted of 123.681 GB (0.37%) of the Physical Storage Capacity. There was 6,729.090 GB (20.00%) of Unused Storage within the Configured Storage Capacity. The Total ASU Capacity utilized 100% of the Addressable Storage Capacity resulting in 0.00 GB (0.00%) of Unused Storage within the Addressable Storage Capacity. The Data Protection *(Mirroring)* capacity was 16,821.970 GB of which 13,457.424 GB was utilized. The total Unused Storage was 6,729.090 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 (6,055.841 GB)	**ASU-2 (6,055.841 GB)**	**ASU-3 (1,345.742 GB)**
1 Logical Volume 6,055.841 GB per Logical Volume (6,055.841 used per Logical Volume)	1 Logical Volume 6,055.841 GB per Logical Volume (6,055.841 used per Logical Volume)	1 Logical Volume 1,345.742 GB per Logical Volume (1,345.742 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	39.85%
Protected Application Utilization	79.71%
Unused Storage Ratio	19.93%

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 58 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 68.

Sustainability Test Results File

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

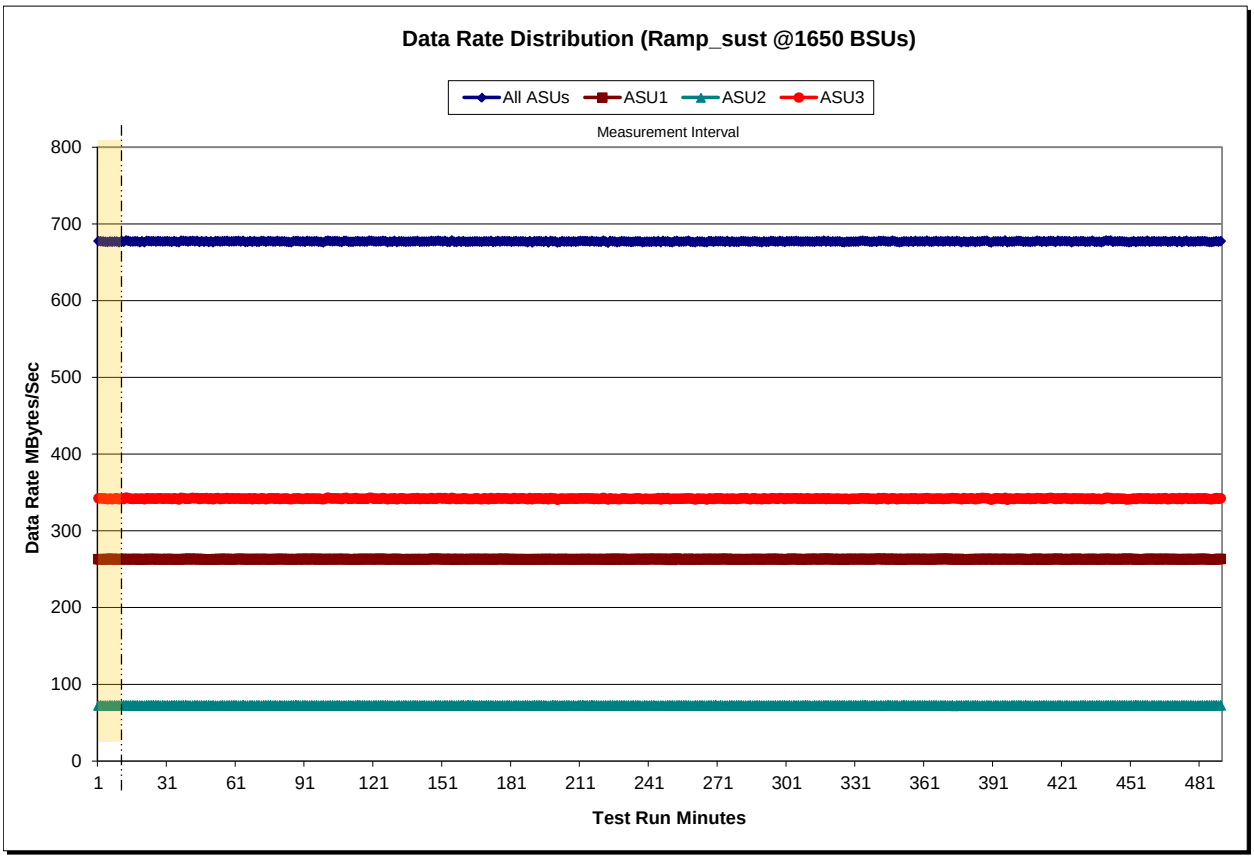
Sustainability Test Results File

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

The Sustainability Data Rate table of data is not embedded in this document due to its size. The table is available via the following URL:

Sustainability Data Rate Table

Sustainability – Data Rate Distribution Graph

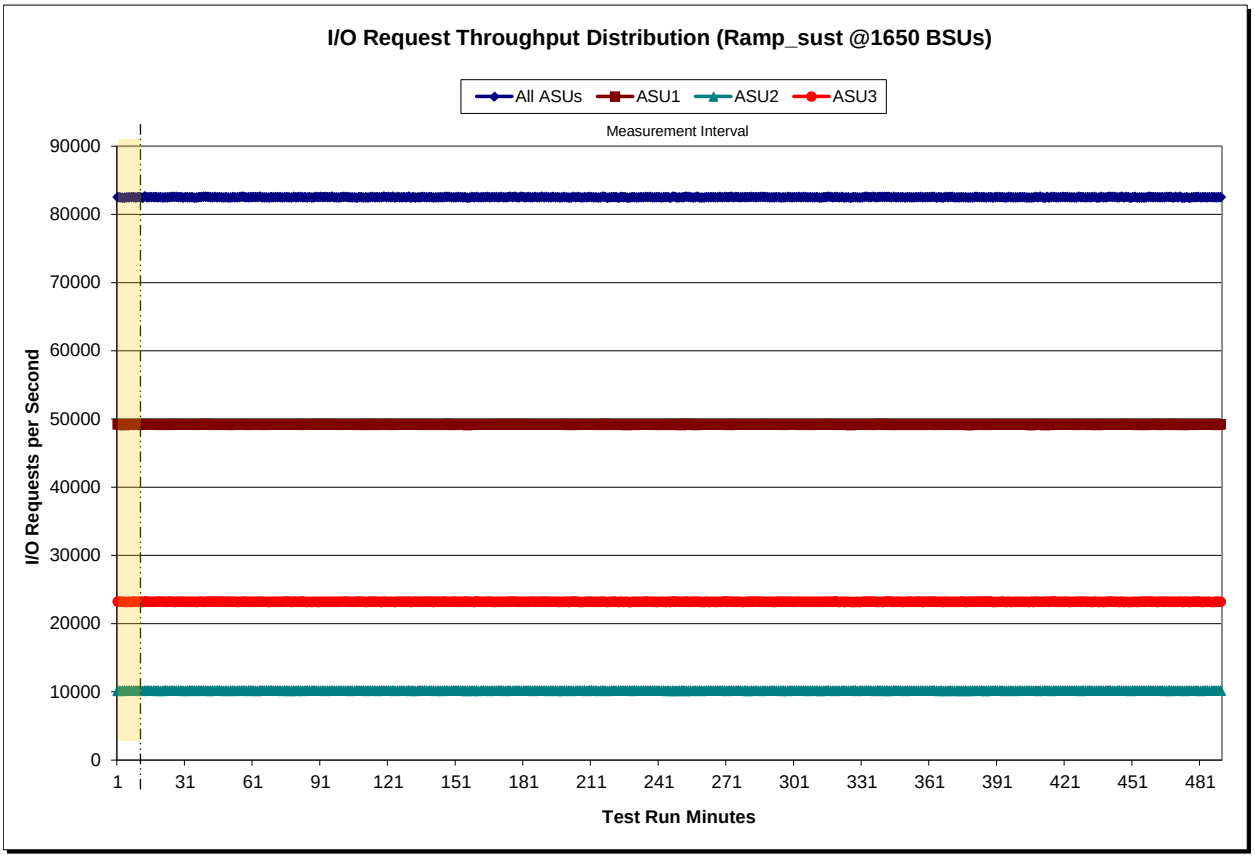


Sustainability – I/O Request Throughput Distribution Data

The Sustainability I/O Request Throughput table of data is not embedded in this document due to its size. The table is available via the following URL:

Sustainability I/O Request Throughput Table

Sustainability – I/O Request Throughput Distribution Graph

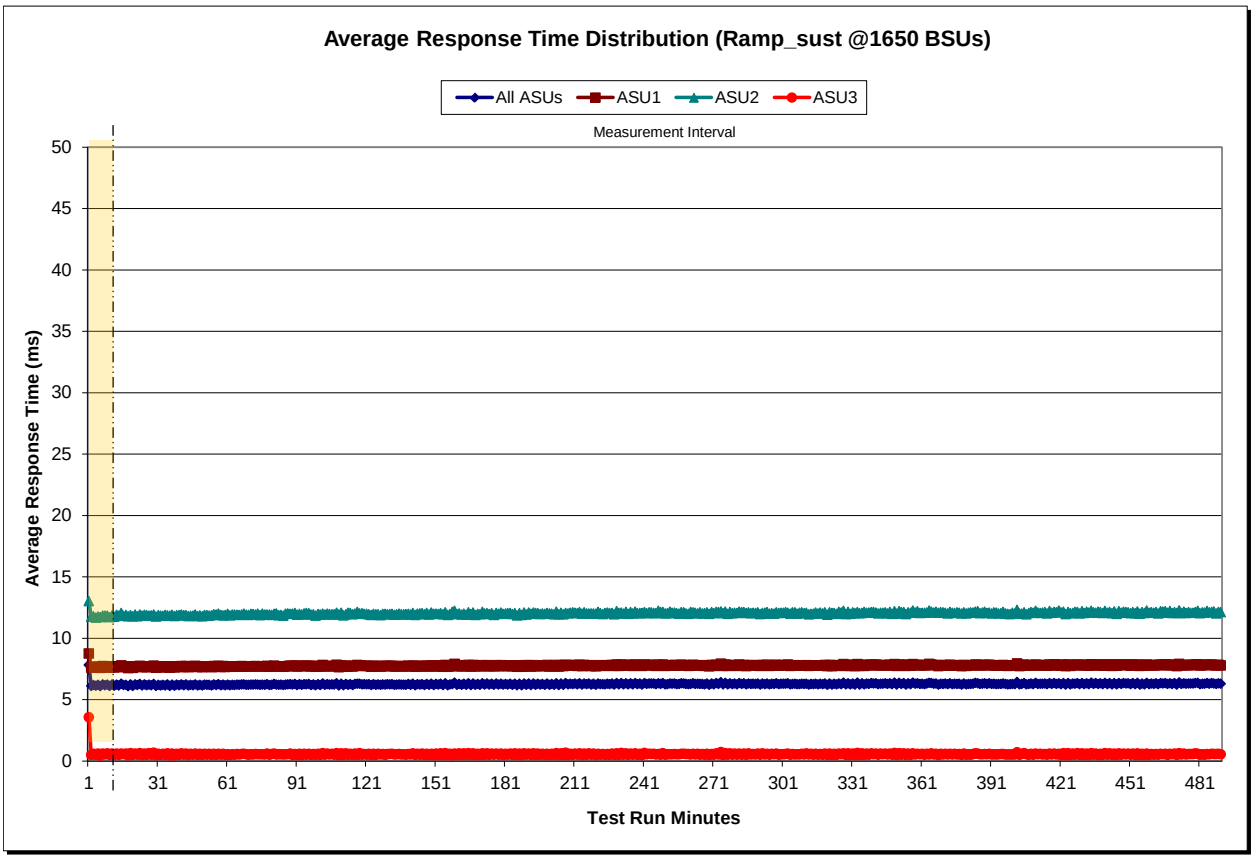


Sustainability – Average Response Time (ms) Distribution Data

The Sustainability Average Response Time table of data is not embedded in this document due to its size. The table is available via the following URL:

Sustainability Average Response Time Table

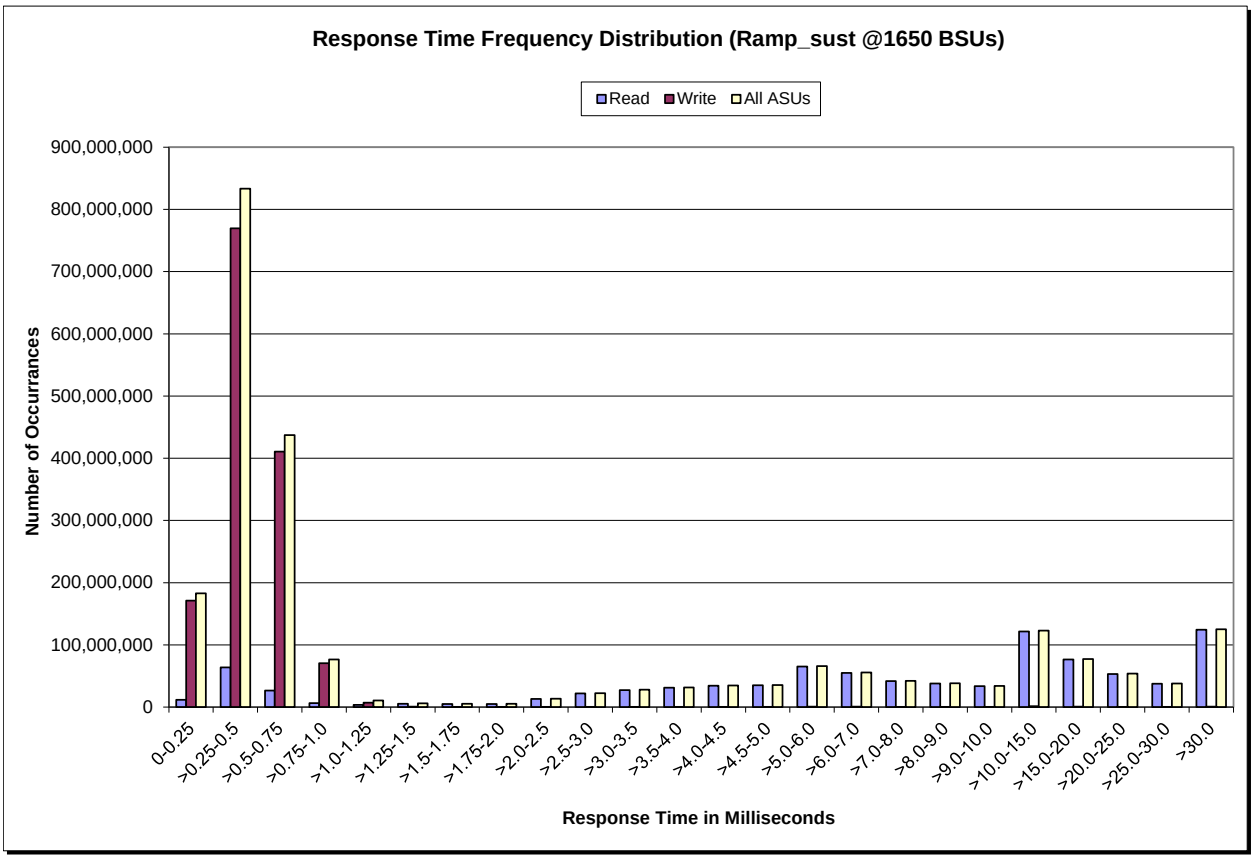
Sustainability – Average Response Time (ms) Distribution Graph



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	11,847,729	63,636,594	26,654,842	6,353,222	3,526,135	5,219,320	4,986,331	4,929,651
Write	171,003,975	769,588,773	410,583,165	70,343,538	7,148,696	808,238	272,638	234,932
All ASUs	182,851,704	833,225,367	437,238,007	76,696,760	10,674,831	6,027,558	5,258,969	5,164,583
ASU1	115,731,237	395,901,713	166,576,661	24,181,771	4,337,936	4,646,204	4,719,367	4,758,583
ASU2	26,442,695	97,198,095	40,484,199	5,887,485	1,081,094	831,097	412,046	299,450
ASU3	40,677,772	340,125,559	230,177,147	46,627,504	5,255,801	550,257	127,556	106,550
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	4,986,331	4,929,651	13,144,603	21,929,027	27,378,258	31,066,082	34,260,264	35,077,098
Write	272,638	234,932	459,197	442,229	456,099	500,744	513,559	504,454
All ASUs	5,258,969	5,164,583	13,603,800	22,371,256	27,834,357	31,566,826	34,773,823	35,581,552
ASU1	4,719,367	4,758,583	12,678,221	21,088,090	26,000,139	29,032,983	31,545,649	32,143,365
ASU2	412,046	299,450	710,209	1,085,609	1,624,555	2,305,715	2,987,757	3,205,476
ASU3	127,556	106,550	215,370	197,557	209,663	228,128	240,417	232,711
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	65,200,595	55,062,791	41,797,357	37,755,491	33,724,969	121,581,045	76,511,571	53,298,840
Write	864,806	589,438	476,037	412,533	387,712	1,387,453	718,820	385,664
All ASUs	66,065,401	55,652,229	42,273,394	38,168,024	34,112,681	122,968,498	77,230,391	53,684,504
ASU1	59,296,587	49,230,928	36,830,626	33,731,779	30,040,066	106,310,771	65,111,676	44,235,252
ASU2	6,367,495	6,154,651	5,231,892	4,254,454	3,898,525	16,027,293	11,807,473	9,289,571
ASU3	401,319	266,650	210,876	181,791	174,090	630,434	311,242	159,681

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	0.0700	0.0350	0.2810
COV	0.002	0.001	0.002	0.001	0.003	0.002	0.002	0.001

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 to 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 68.

IOPS Test Results File

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

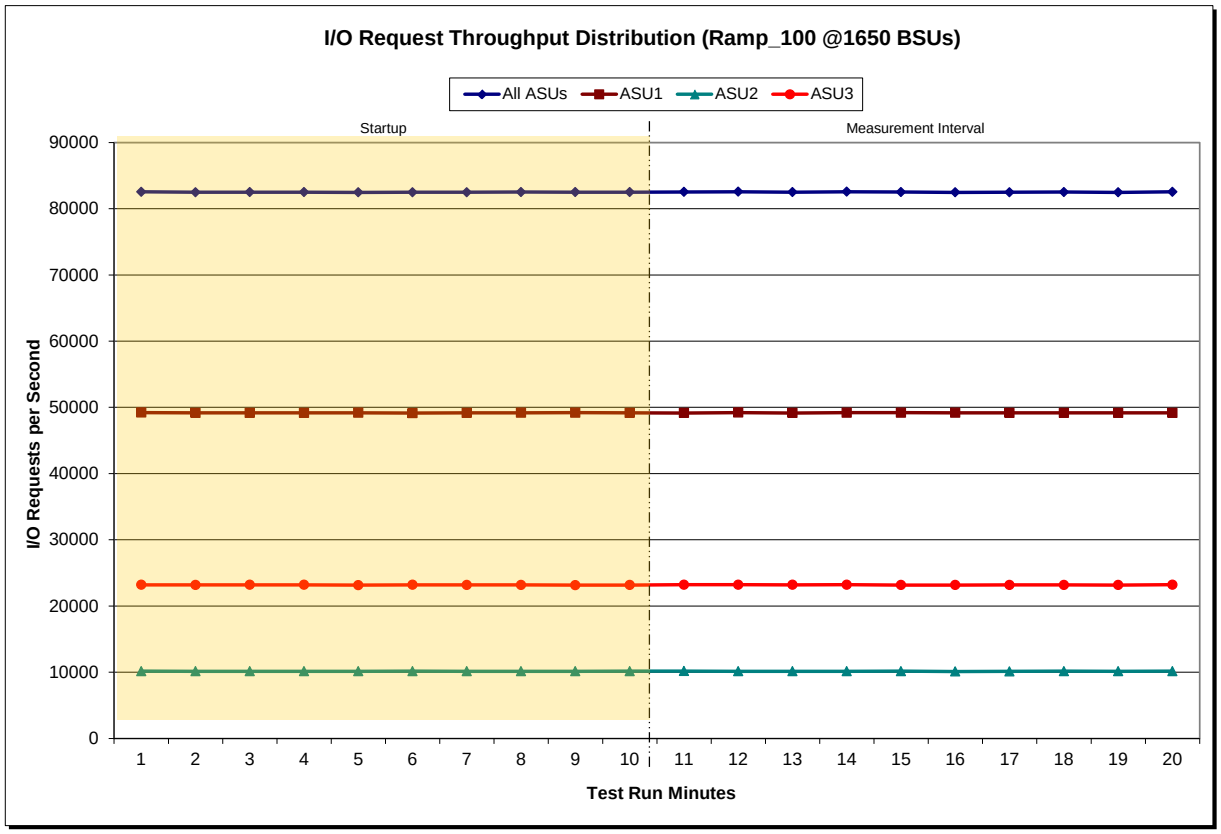
IOPS Test Results File

IOPS Test Run – I/O Request Throughput Distribution Data

1,650 BSUs	Start	Stop	Interval	Duration
Start-Up/Ramp-Up	19:24:37	19:34:38	0-9	0:10:01
Measurement Interval	19:34:38	19:44:38	10-19	0:10:00

60 second intervals	All ASUs	ASU1	ASU2	ASU3
0	82,558.92	49,208.95	10,154.60	23,195.37
1	82,493.78	49,165.40	10,142.43	23,185.95
2	82,507.18	49,162.78	10,139.03	23,205.37
3	82,502.77	49,163.77	10,142.08	23,196.92
4	82,478.62	49,180.52	10,143.83	23,154.27
5	82,488.23	49,129.32	10,152.52	23,206.40
6	82,490.13	49,162.00	10,151.67	23,176.47
7	82,519.90	49,184.05	10,151.05	23,184.80
8	82,497.67	49,194.60	10,143.90	23,159.17
9	82,503.58	49,166.42	10,161.77	23,175.40
10	82,535.42	49,150.28	10,173.78	23,211.35
11	82,565.12	49,209.17	10,139.55	23,216.40
12	82,501.58	49,153.12	10,146.52	23,201.95
13	82,569.13	49,204.67	10,145.25	23,219.22
14	82,523.20	49,202.28	10,160.22	23,160.70
15	82,472.88	49,190.23	10,117.53	23,165.12
16	82,482.85	49,171.03	10,125.72	23,186.10
17	82,521.55	49,170.53	10,160.35	23,190.67
18	82,475.20	49,163.95	10,144.28	23,166.97
19	82,550.55	49,174.43	10,158.18	23,217.93
Average	***82,519.75***	***49,178.97***	***10,147.14***	***23,193.64***

IOPS Test Run – I/O Request Throughput Distribution Graph

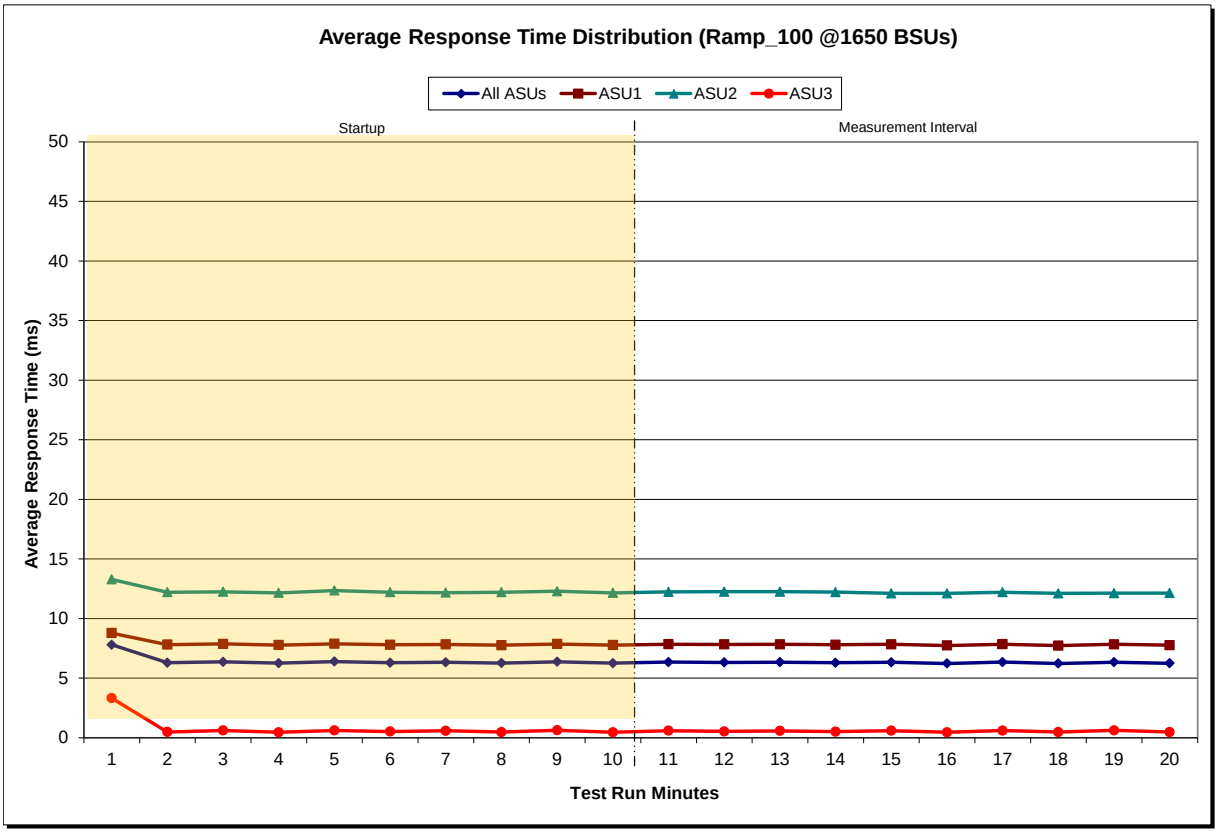


IOPS Test Run – Average Response Time (ms) Distribution Data

1,650 BSUs	Start	Stop	Interval	Duration
Start-Up/Ramp-Up	19:24:37	19:34:38	0-9	0:10:01
Measurement Interval	19:34:38	19:44:38	10-19	0:10:00

60 second intervals	All ASUs	ASU1	ASU2	ASU3
0	7.80	8.78	13.29	3.32
1	6.29	7.81	12.20	0.48
2	6.36	7.87	12.24	0.60
3	6.25	7.77	12.15	0.46
4	6.39	7.88	12.35	0.61
5	6.29	7.80	12.21	0.52
6	6.32	7.82	12.17	0.58
7	6.26	7.76	12.20	0.48
8	6.38	7.86	12.29	0.62
9	6.26	7.77	12.16	0.46
10	6.34	7.84	12.23	0.59
11	6.32	7.82	12.25	0.53
12	6.33	7.83	12.25	0.57
13	6.29	7.80	12.21	0.51
14	6.33	7.84	12.10	0.59
15	6.23	7.74	12.11	0.46
16	6.35	7.85	12.21	0.60
17	6.23	7.73	12.11	0.47
18	6.34	7.84	12.13	0.61
19	6.25	7.76	12.13	0.47
Average	***6.30***	***7.80***	***12.17***	***0.54***

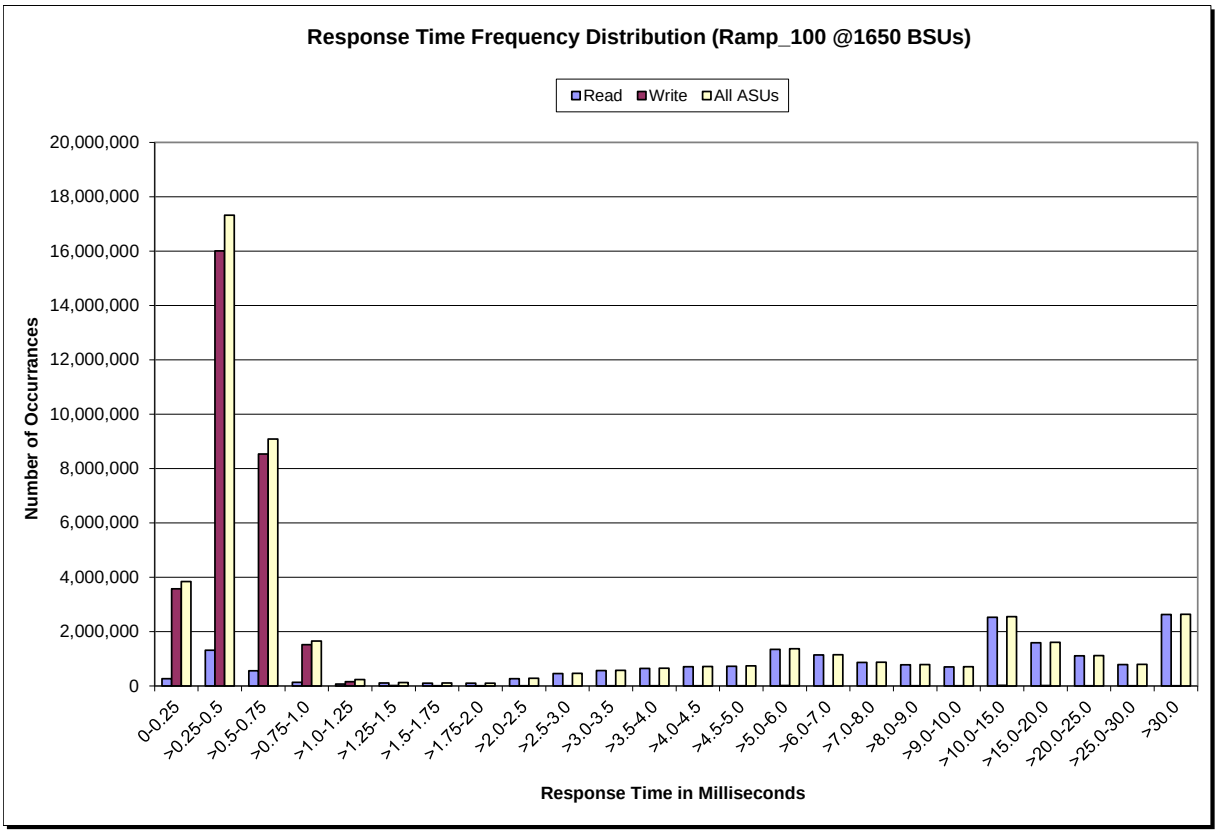
IOPS Test Run – Average Response Time (ms) Distribution Graph



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	269,049	1,317,063	557,793	134,196	73,155	108,712	102,934	101,512
Write	3,571,882	16,005,080	8,531,560	1,518,838	161,243	17,994	5,615	4,659
All ASUs	3,840,931	17,322,143	9,089,353	1,653,034	234,398	126,706	108,549	106,171
ASU1	2,435,208	8,230,139	3,470,914	524,021	93,146	96,750	97,332	97,862
ASU2	551,147	2,020,318	843,638	127,318	23,124	17,583	8,534	6,183
ASU3	854,576	7,071,686	4,774,801	1,001,695	118,128	12,373	2,683	2,126
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	271,460	454,115	566,916	643,143	709,626	726,401	1,349,060	1,140,548
Write	9,106	8,838	9,359	10,150	10,385	9,939	17,398	11,435
All ASUs	280,566	462,953	576,275	653,293	720,011	736,340	1,366,458	1,151,983
ASU1	261,609	436,685	538,477	600,779	652,924	665,298	1,226,408	1,020,067
ASU2	14,763	22,431	33,498	47,888	62,243	66,485	131,974	126,670
ASU3	4,194	3,837	4,300	4,626	4,844	4,557	8,076	5,246
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	866,255	782,491	699,910	2,525,960	1,591,791	1,110,184	789,278	2,626,539
Write	9,383	8,092	7,767	27,319	14,802	8,585	5,017	8,705
All ASUs	875,638	790,583	707,677	2,553,279	1,606,593	1,118,769	794,295	2,635,244
ASU1	763,628	699,159	623,660	2,209,156	1,355,881	922,298	638,690	1,846,877
ASU2	107,838	87,895	80,531	331,842	244,233	192,846	153,573	785,550
ASU3	4,172	3,529	3,486	12,281	6,479	3,625	2,032	2,817

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
49,511,242	46,875.998	2,635,244

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	0.0350	0.2810	0.0700	0.2100	0.0180	0.0700	0.0350	0.2811
COV	0.002	0.001	0.001	0.001	0.004	0.002	0.002	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 68.

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 - 1,650 BSUs	Start	Stop	Interval	Duration
Start-Up/Ramp-Up	19:24:37	19:34:38	0-9	0:10:01
Measurement Interval	19:34:38	19:44:38	10-19	0:10:00

(60 second intervals)	All ASUs	ASU-1	ASU-2	ASU-3
0	82,558.92	49,208.95	10,154.60	23,195.37
1	82,493.78	49,165.40	10,142.43	23,185.95
2	82,507.18	49,162.78	10,139.03	23,205.37
3	82,502.77	49,163.77	10,142.08	23,196.92
4	82,478.62	49,180.52	10,143.83	23,154.27
5	82,488.23	49,129.32	10,152.52	23,206.40
6	82,490.13	49,162.00	10,151.67	23,176.47
7	82,519.90	49,184.05	10,151.05	23,184.80
8	82,497.67	49,194.60	10,143.90	23,159.17
9	82,503.58	49,166.42	10,161.77	23,175.40
10	82,535.42	49,150.28	10,173.78	23,211.35
11	82,565.12	49,209.17	10,139.55	23,216.40
12	82,501.58	49,153.12	10,146.52	23,201.95
13	82,569.13	49,204.67	10,145.25	23,219.22
14	82,523.20	49,202.28	10,160.22	23,160.70
15	82,472.88	49,190.23	10,117.53	23,165.12
16	82,482.85	49,171.03	10,125.72	23,186.10
17	82,521.55	49,170.53	10,160.35	23,190.67
18	82,475.20	49,163.95	10,144.28	23,166.97
19	82,550.55	49,174.43	10,158.18	23,217.93
Average	***82,519.75***	***49,178.97***	***10,147.14***	***23,193.64***

95% Load Level - 1,567 BSUs	Start	Stop	Interval	Duration
Start-Up/Ramp-Up	19:45:04	19:55:05	0-9	0:10:01
Measurement Interval	19:55:05	20:05:05	10-19	0:10:00

(60 second intervals)	All ASUs	ASU-1	ASU-2	ASU-3
0	78,416.30	46,702.52	9,647.08	22,066.70
1	78,332.07	46,707.58	9,633.20	21,991.28
2	78,416.88	46,727.60	9,641.40	22,047.88
3	78,358.22	46,727.42	9,637.93	21,992.87
4	78,409.37	46,733.20	9,636.00	22,040.17
5	78,328.85	46,662.88	9,647.32	22,018.65
6	78,340.45	46,733.60	9,615.30	21,991.55
7	78,369.32	46,723.48	9,640.47	22,005.37
8	78,328.82	46,696.72	9,639.27	21,992.83
9	78,391.25	46,709.37	9,642.52	22,039.37
10	78,277.37	46,646.08	9,629.85	22,001.43
11	78,287.70	46,667.35	9,621.22	21,999.13
12	78,324.55	46,691.85	9,621.23	22,011.47
13	78,369.10	46,696.42	9,630.27	22,042.42
14	78,295.03	46,674.88	9,621.95	21,998.20
15	78,340.77	46,705.72	9,633.63	22,001.42
16	78,345.62	46,698.55	9,650.57	21,996.50
17	78,338.83	46,699.85	9,632.88	22,006.10
18	78,345.05	46,699.02	9,664.68	21,981.35
19	78,336.50	46,691.55	9,636.35	22,008.60
Average	***78,326.05***	***46,687.13***	***9,634.26***	***22,004.66***

90% Load Level - 1,485 BSUs	Start	Stop	Interval	Duration
Start-Up/Ramp-Up	20:05:30	20:15:31	0-9	0:10:01
Measurement Interval	20:15:31	20:25:31	10-19	0:10:00

(60 second intervals)	All ASUs	ASU-1	ASU-2	ASU-3
0	74,321.55	44,299.40	9,161.12	20,861.03
1	74,200.40	44,215.53	9,119.10	20,865.77
2	74,278.98	44,231.15	9,145.28	20,902.55
3	74,283.65	44,289.15	9,136.97	20,857.53
4	74,299.53	44,265.97	9,136.30	20,897.27
5	74,190.22	44,241.72	9,120.77	20,827.73
6	74,256.08	44,248.42	9,134.43	20,873.23
7	74,199.35	44,258.38	9,117.32	20,823.65
8	74,235.20	44,264.88	9,133.17	20,837.15
9	74,253.73	44,264.60	9,140.25	20,848.88
10	74,251.15	44,248.13	9,131.22	20,871.80
11	74,324.32	44,304.52	9,150.67	20,869.13
12	74,270.50	44,263.27	9,144.80	20,862.43
13	74,281.95	44,281.38	9,133.62	20,866.95
14	74,273.78	44,250.82	9,143.60	20,879.37
15	74,280.13	44,254.12	9,138.80	20,887.22
16	74,294.98	44,290.63	9,139.10	20,865.25
17	74,208.90	44,235.37	9,133.08	20,840.45
18	74,199.92	44,205.30	9,126.22	20,868.40
19	74,279.30	44,276.97	9,134.97	20,867.37
Average	***74,266.49***	***44,261.05***	***9,137.61***	***20,867.84***

80% Load Level - 1,320 BSUs	Start	Stop	Interval	Duration
Start-Up/Ramp-Up	20:25:57	20:35:58	0-9	0:10:01
Measurement Interval	20:35:58	20:45:58	10-19	0:10:00

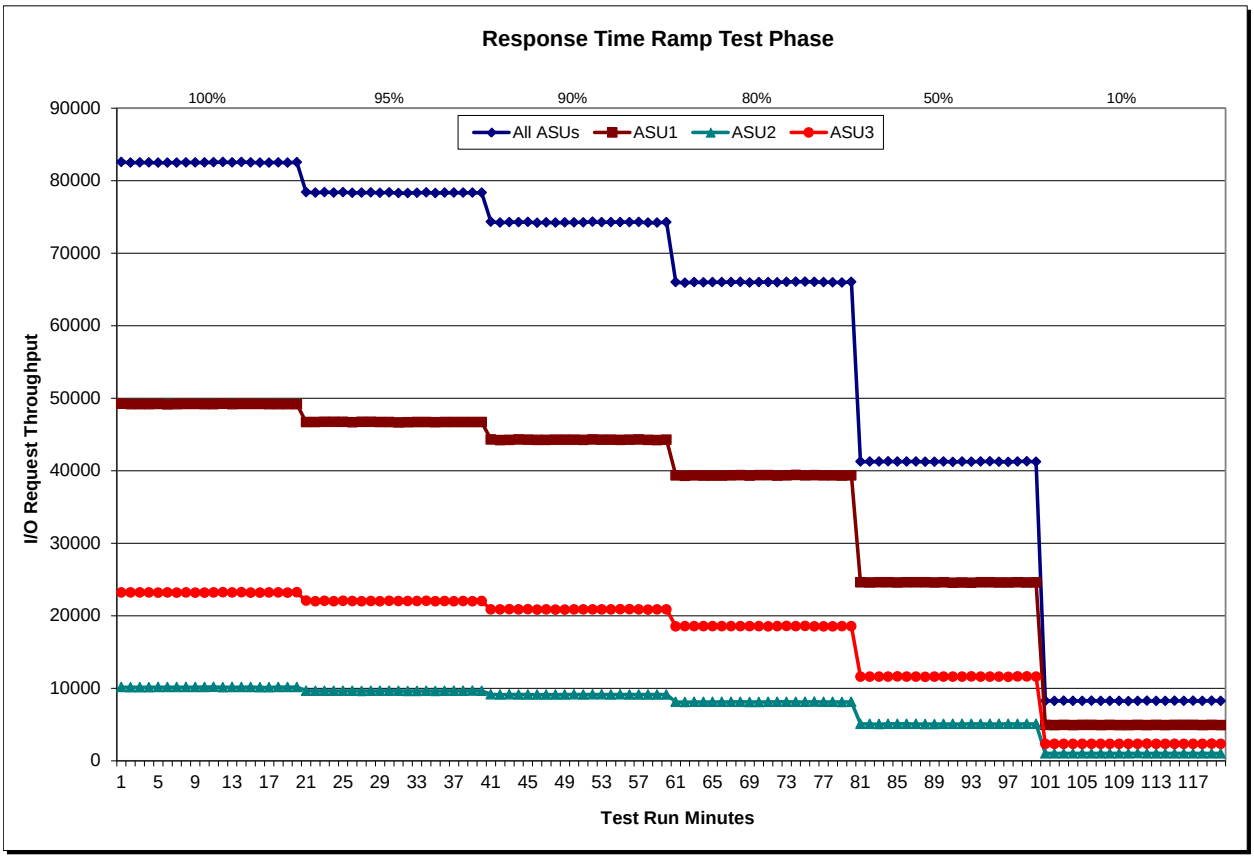
(60 second intervals)	All ASUs	ASU-1	ASU-2	ASU-3
0	65,993.33	39,348.70	8,116.72	18,527.92
1	65,914.97	39,292.13	8,088.73	18,534.10
2	65,993.80	39,339.78	8,114.62	18,539.40
3	65,968.22	39,303.93	8,117.13	18,547.15
4	65,998.82	39,321.08	8,119.98	18,557.75
5	65,990.65	39,319.05	8,116.82	18,554.78
6	66,009.52	39,343.82	8,115.28	18,550.42
7	66,020.80	39,360.15	8,123.17	18,537.48
8	65,950.95	39,303.98	8,097.20	18,549.77
9	66,015.42	39,365.57	8,094.77	18,555.08
10	66,013.72	39,366.53	8,114.42	18,532.77
11	65,974.83	39,301.80	8,122.02	18,551.02
12	66,024.47	39,333.50	8,124.33	18,566.63
13	66,075.73	39,404.45	8,113.75	18,557.53
14	66,051.38	39,345.78	8,118.67	18,586.93
15	66,039.77	39,362.85	8,146.45	18,530.47
16	65,992.70	39,353.08	8,109.58	18,530.03
17	65,975.40	39,333.45	8,115.20	18,526.75
18	65,955.97	39,321.48	8,097.92	18,536.57
19	66,023.47	39,348.43	8,112.72	18,562.32
Average	***66,012.74***	***39,347.14***	***8,117.51***	***18,548.10***

Response Time Ramp Distribution (IOPS) Data *(cont.)*

50% Load Level - 825 BSUs	Start	Stop	Interval	Duration
Start-Up/Ramp-Up	20:46:23	20:56:24	0-9	0:10:01
Measurement Interval	20:56:24	21:06:24	10-19	0:10:00
(60 second intervals)	All ASUs	ASU-1	ASU-2	ASU-3
0	41,252.27	24,584.70	5,094.30	11,573.27
1	41,245.40	24,568.83	5,080.62	11,595.95
2	41,247.23	24,611.73	5,050.35	11,585.15
3	41,284.83	24,610.68	5,082.92	11,591.23
4	41,253.25	24,556.62	5,089.00	11,607.63
5	41,270.62	24,591.35	5,088.97	11,590.30
6	41,266.27	24,599.72	5,066.50	11,600.05
7	41,223.03	24,590.05	5,062.77	11,570.22
8	41,227.95	24,581.35	5,065.30	11,581.30
9	41,269.00	24,600.07	5,079.52	11,589.42
10	41,200.18	24,542.03	5,072.55	11,585.60
11	41,244.08	24,578.47	5,073.18	11,592.43
12	41,233.23	24,538.75	5,091.47	11,603.02
13	41,263.30	24,609.18	5,066.55	11,587.57
14	41,282.27	24,605.17	5,078.73	11,598.37
15	41,235.85	24,570.58	5,069.52	11,595.75
16	41,205.55	24,557.23	5,082.12	11,566.20
17	41,267.38	24,592.35	5,066.37	11,608.67
18	41,292.62	24,581.02	5,084.47	11,627.13
19	41,226.73	24,563.98	5,068.42	11,594.33
Average	***41,245.12***	***24,573.88***	***5,075.34***	***11,595.91***

10% Load Level - 165 BSUs	Start	Stop	Interval	Duration
Start-Up/Ramp-Up	21:06:48	21:16:49	0-9	0:10:01
Measurement Interval	21:16:49	21:26:49	10-19	0:10:00
(60 second intervals)	All ASUs	ASU-1	ASU-2	ASU-3
0	8,243.92	4,918.18	1,016.62	2,309.12
1	8,248.15	4,911.30	1,008.67	2,328.18
2	8,262.80	4,932.67	1,010.12	2,320.02
3	8,241.83	4,909.35	1,017.22	2,315.27
4	8,256.37	4,916.98	1,019.38	2,320.00
5	8,268.28	4,932.57	1,017.73	2,317.98
6	8,233.97	4,902.32	1,010.07	2,321.58
7	8,257.58	4,919.48	1,017.43	2,320.67
8	8,236.92	4,913.52	1,010.43	2,312.97
9	8,226.15	4,906.25	1,018.30	2,301.60
10	8,256.13	4,914.45	1,023.18	2,318.50
11	8,264.15	4,913.35	1,018.18	2,332.62
12	8,235.38	4,916.80	1,008.60	2,309.98
13	8,241.88	4,903.05	1,017.30	2,321.53
14	8,260.37	4,930.03	1,017.97	2,312.37
15	8,252.45	4,918.22	1,018.90	2,315.33
16	8,267.47	4,932.23	1,011.47	2,323.77
17	8,234.12	4,913.00	1,009.78	2,311.33
18	8,283.37	4,930.57	1,021.38	2,331.42
19	8,235.48	4,904.28	1,012.83	2,318.37
Average	***8,253.08***	***4,917.60***	***1,015.96***	***2,319.52***

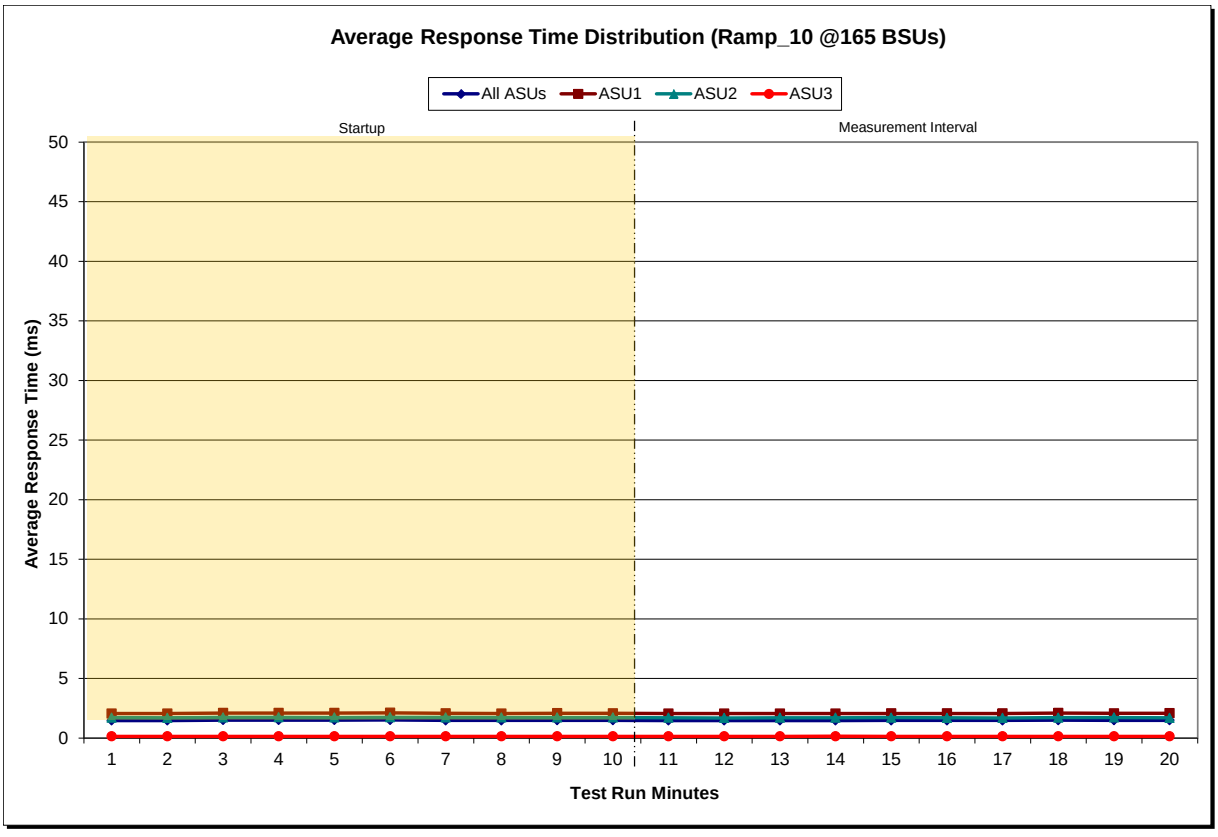
Response Time Ramp Distribution (IOPS) Graph



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

165 BSUs	Start	Stop	Interval	Duration
Start-Up/Ramp-Up	21:06:48	21:16:49	0-9	0:10:01
Measurement Interval	21:16:49	21:26:49	10-19	0:10:00
60 second intervals	**All ASUs**	**ASU1**	**ASU2**	**ASU3**
0	1.47	2.05	1.72	0.14
1	1.47	2.06	1.69	0.15
2	1.50	2.10	1.73	0.14
3	1.51	2.10	1.74	0.15
4	1.50	2.10	1.72	0.14
5	1.52	2.12	1.74	0.15
6	1.48	2.07	1.73	0.14
7	1.48	2.05	1.72	0.15
8	1.49	2.08	1.72	0.14
9	1.49	2.07	1.72	0.15
10	1.47	2.06	1.70	0.14
11	1.47	2.05	1.69	0.15
12	1.47	2.05	1.71	0.14
13	1.47	2.05	1.70	0.15
14	1.48	2.06	1.71	0.14
15	1.48	2.06	1.70	0.14
16	1.48	2.06	1.68	0.14
17	1.50	2.09	1.71	0.15
18	1.49	2.08	1.72	0.14
19	1.49	2.08	1.70	0.14
Average	***1.48***	***2.07***	***1.70***	***0.14***

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	0.0351	0.2810	0.0700	0.2097	0.0180	0.0700	0.0351	0.2810
COV	0.006	0.003	0.005	0.004	0.017	0.005	0.008	0.002

Repeatability Test

Clause 5.4.5

The Repeatability Test demonstrates the repeatability and reproducibility of the SPC-1 IOPS™ primary metric and the 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 68.

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	***82.519.75***
Repeatability Test Phase 1	82,498.65
Repeatability Test Phase 2	82,497.71

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	***1.48 ms***
Repeatability Test Phase 1	1.48 ms
Repeatability Test Phase 2	1.48 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)...

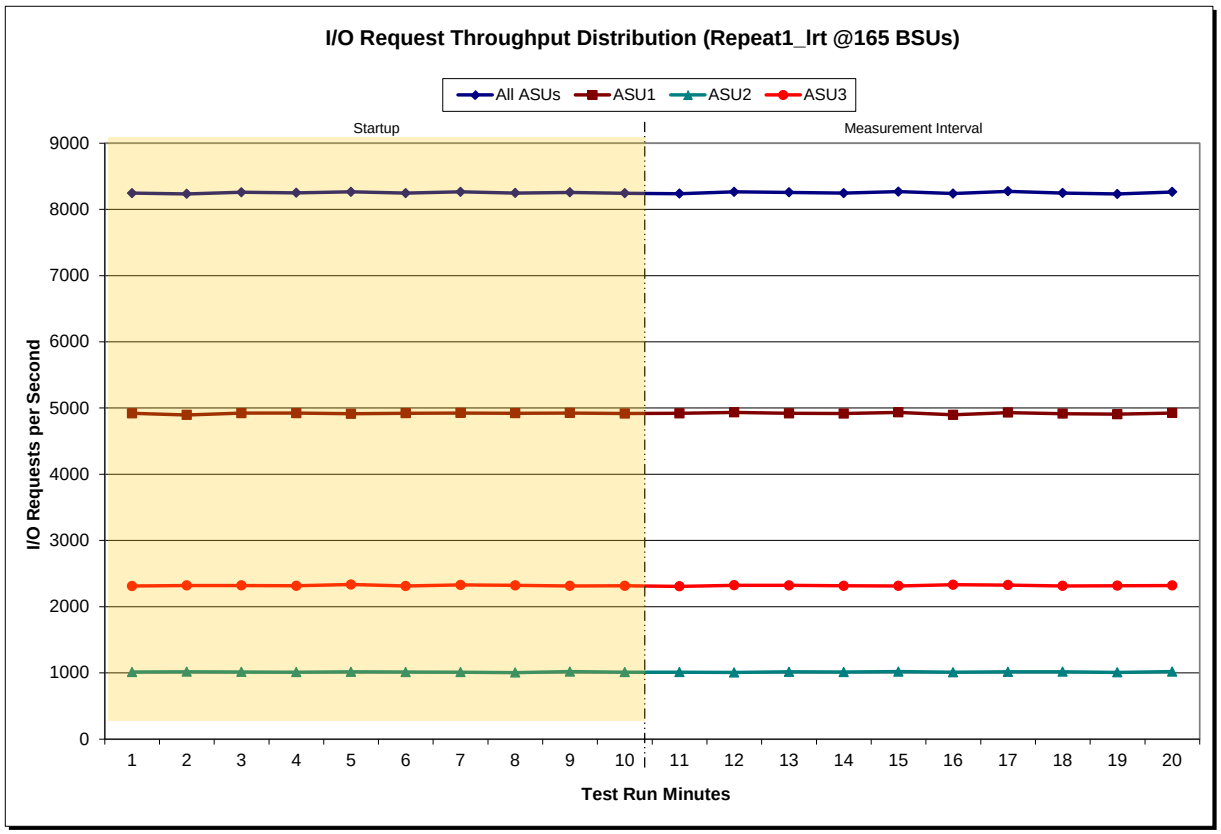
A link to the test result file generated from each Repeatability Test Run is listed below.

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

165 BSUs	Start	Stop	Interval	Duration
Start-Up/Ramp-Up	21:27:19	21:37:19	0-9	0:10:00
Measurement Interval	21:37:19	21:47:19	10-19	0:10:00
60 second intervals	**All ASUs**	**ASU1**	**ASU2**	**ASU3**
0	8,245.13	4,920.48	1,013.45	2,311.20
1	8,233.95	4,895.73	1,017.73	2,320.48
2	8,258.87	4,923.82	1,014.98	2,320.07
3	8,249.63	4,923.97	1,010.75	2,314.92
4	8,264.60	4,913.77	1,016.02	2,334.82
5	8,246.10	4,922.08	1,012.18	2,311.83
6	8,264.22	4,924.67	1,011.58	2,327.97
7	8,246.67	4,921.03	1,004.48	2,321.15
8	8,256.80	4,924.63	1,018.85	2,313.32
9	8,244.42	4,916.92	1,011.80	2,315.70
10	8,237.72	4,919.80	1,010.93	2,306.98
11	8,264.20	4,934.90	1,005.98	2,323.32
12	8,257.13	4,919.93	1,015.87	2,321.33
13	8,244.82	4,917.32	1,012.00	2,315.50
14	8,268.00	4,935.12	1,019.72	2,313.17
15	8,238.22	4,897.02	1,009.67	2,331.53
16	8,272.88	4,931.33	1,015.32	2,326.23
17	8,246.73	4,915.82	1,017.55	2,313.37
18	8,231.98	4,907.62	1,007.27	2,317.10
19	8,263.97	4,925.10	1,019.32	2,319.55
Average	***8,252.57***	***4,920.40***	***1,013.36***	***2,318.81***

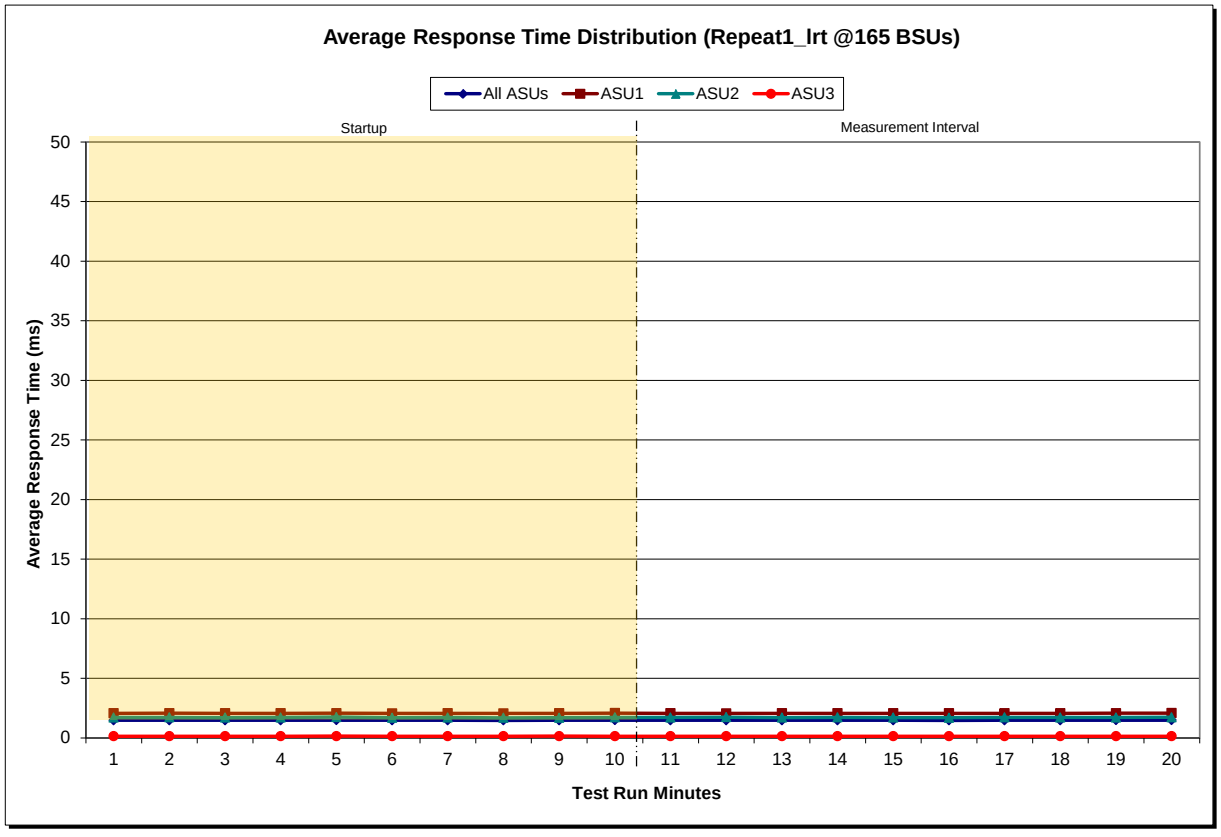
Repeatability 1 LRT – I/O Request Throughput Distribution Graph



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

165 BSUs	Start	Stop	Interval	Duration
Start-Up/Ramp-Up	21:27:19	21:37:19	0-9	0:10:00
Measurement Interval	21:37:19	21:47:19	10-19	0:10:00
60 second intervals	**All ASUs**	**ASU1**	**ASU2**	**ASU3**
0	1.48	2.06	1.71	0.14
1	1.48	2.07	1.72	0.14
2	1.48	2.06	1.70	0.14
3	1.48	2.06	1.72	0.14
4	1.49	2.07	1.75	0.15
5	1.48	2.06	1.70	0.14
6	1.48	2.06	1.71	0.15
7	1.47	2.06	1.69	0.14
8	1.48	2.06	1.69	0.15
9	1.49	2.08	1.72	0.14
10	1.48	2.06	1.71	0.14
11	1.48	2.05	1.74	0.14
12	1.48	2.06	1.71	0.15
13	1.48	2.07	1.72	0.14
14	1.48	2.06	1.70	0.15
15	1.47	2.06	1.69	0.14
16	1.48	2.06	1.72	0.15
17	1.48	2.06	1.71	0.14
18	1.48	2.07	1.71	0.15
19	1.49	2.08	1.73	0.14
Average	***1.48***	***2.06***	***1.71***	***0.14***

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

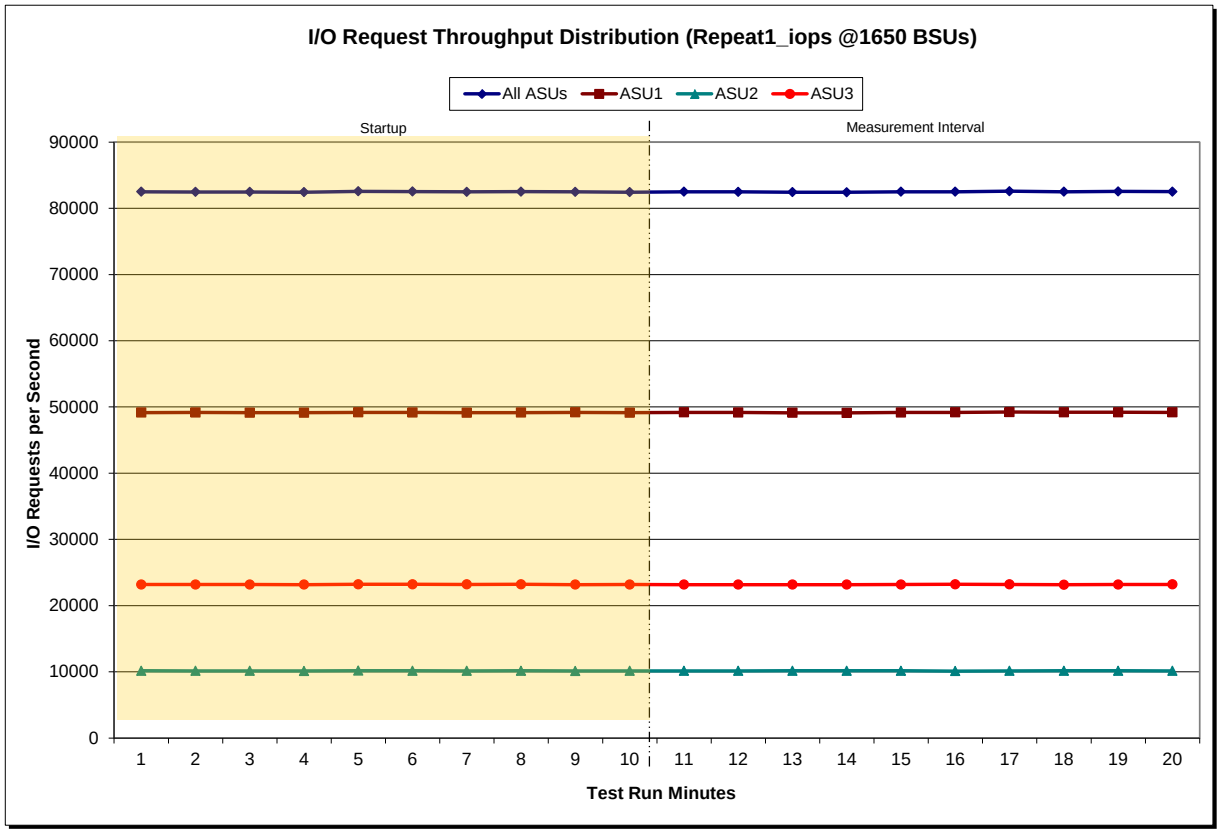


Repeatability 1 IOPS – I/O Request Throughput Distribution Data

1,650 BSUs	Start	Stop	Interval	Duration
Start-Up/Ramp-Up	21:47:46	21:57:47	0-9	0:10:01
Measurement Interval	21:57:47	22:07:47	10-19	0:10:00

60 second intervals	All ASUs	ASU1	ASU2	ASU3
0	82,500.07	49,155.52	10,158.20	23,186.35
1	82,476.50	49,160.17	10,137.20	23,179.13
2	82,469.73	49,135.18	10,144.90	23,189.65
3	82,437.68	49,143.07	10,124.10	23,170.52
4	82,560.65	49,177.72	10,173.05	23,209.88
5	82,541.38	49,172.42	10,155.83	23,213.13
6	82,490.35	49,140.42	10,147.88	23,202.05
7	82,526.23	49,159.18	10,152.42	23,214.63
8	82,483.05	49,187.62	10,124.72	23,170.72
9	82,445.80	49,129.93	10,138.10	23,177.77
10	82,502.63	49,182.00	10,151.20	23,169.43
11	82,481.92	49,163.75	10,148.27	23,169.90
12	82,437.30	49,113.38	10,157.32	23,166.60
13	82,415.18	49,100.02	10,153.23	23,161.93
14	82,498.90	49,161.72	10,157.60	23,179.58
15	82,497.40	49,178.52	10,108.60	23,210.28
16	82,576.05	49,229.25	10,146.08	23,200.72
17	82,506.98	49,200.05	10,159.18	23,147.75
18	82,543.98	49,207.33	10,158.30	23,178.35
19	82,526.18	49,187.35	10,144.10	23,194.73
Average	***82,498.65***	***49,172.34***	***10,148.39***	***23,177.93***

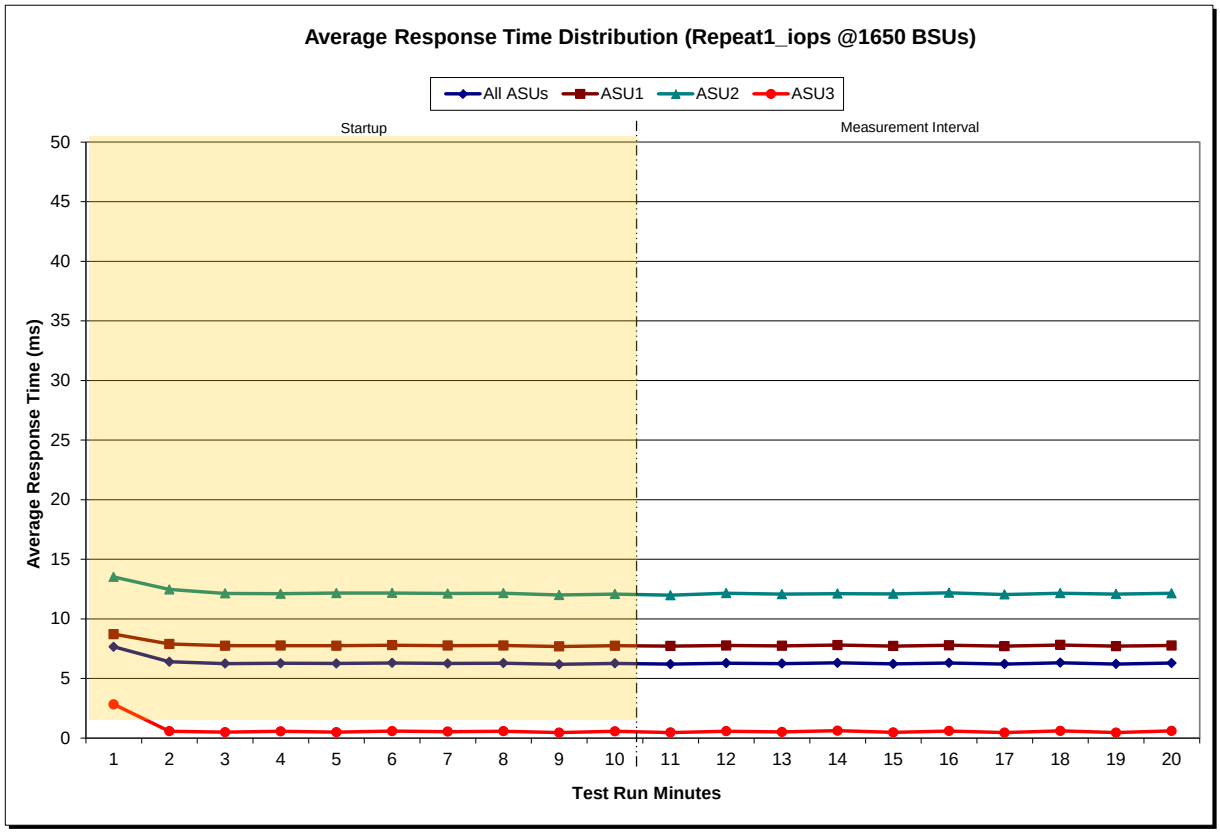
Repeatability 1 IOPS – I/O Request Throughput Distribution Graph



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

1,650 BSUs	Start	Stop	Interval	Duration
Start-Up/Ramp-Up	21:47:46	21:57:47	0-9	0:10:01
Measurement Interval	21:57:47	22:07:47	10-19	0:10:00
60 second intervals	**All ASUs**	**ASU1**	**ASU2**	**ASU3**
0	7.65	8.72	13.52	2.82
1	6.39	7.89	12.47	0.58
2	6.25	7.74	12.14	0.50
3	6.27	7.76	12.10	0.57
4	6.25	7.75	12.16	0.50
5	6.30	7.79	12.17	0.58
6	6.26	7.75	12.12	0.53
7	6.28	7.77	12.15	0.57
8	6.18	7.68	12.00	0.45
9	6.26	7.75	12.08	0.56
10	6.21	7.72	11.98	0.47
11	6.28	7.76	12.15	0.58
12	6.24	7.74	12.07	0.51
13	6.31	7.80	12.12	0.62
14	6.22	7.71	12.10	0.47
15	6.30	7.78	12.18	0.59
16	6.21	7.71	12.05	0.45
17	6.32	7.80	12.15	0.60
18	6.21	7.71	12.08	0.46
19	6.29	7.77	12.15	0.60
Average	***6.26***	***7.75***	***12.10***	***0.53***

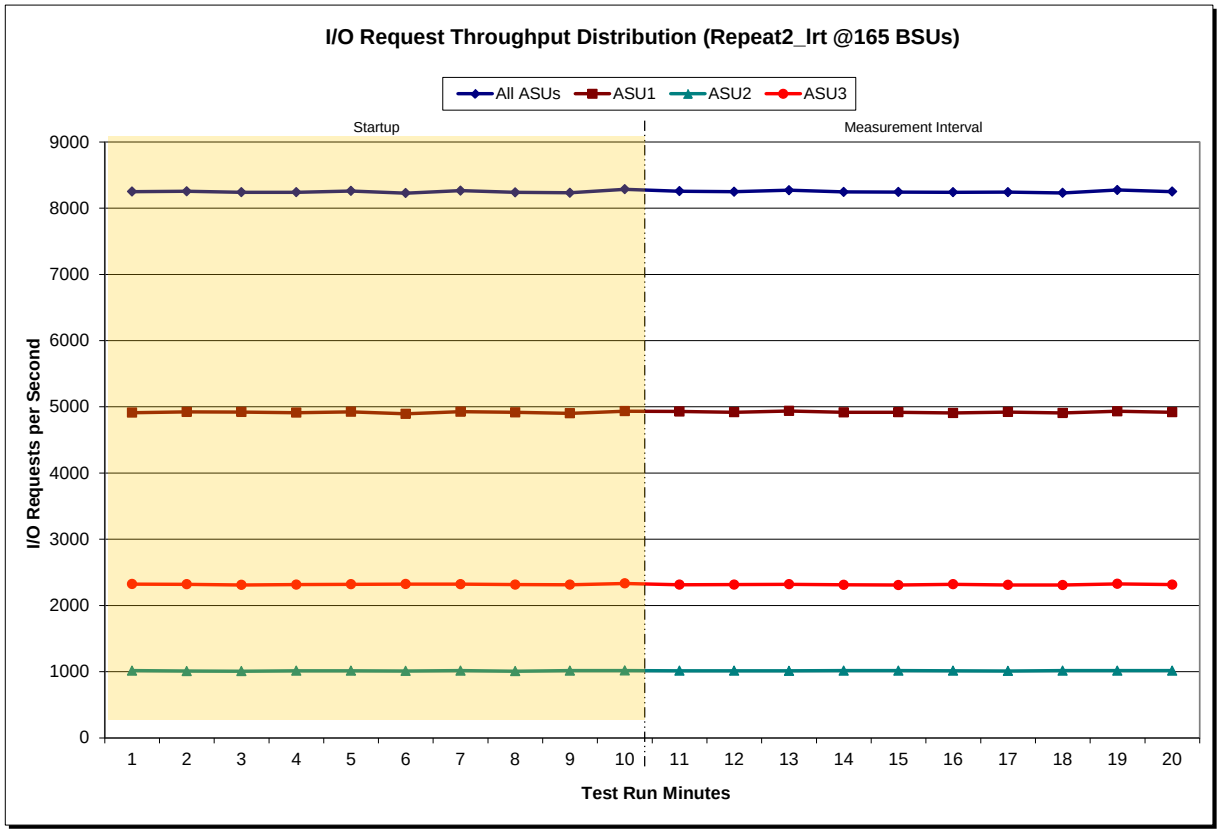
Repeatability 1 IOPS –Average Response Time (ms) Distribution Graph



Repeatability 2 LRT – I/O Request Throughput Distribution Data

165 BSUs	Start	Stop	Interval	Duration
Start-Up/Ramp-Up	22:08:17	22:18:17	0-9	0:10:00
Measurement Interval	22:18:17	22:28:17	10-19	0:10:00
60 second intervals	**All ASUs**	**ASU1**	**ASU2**	**ASU3**
0	8,250.65	4,911.35	1,016.62	2,322.68
1	8,254.97	4,923.82	1,010.32	2,320.83
2	8,240.67	4,921.55	1,008.30	2,310.82
3	8,241.40	4,911.77	1,013.70	2,315.93
4	8,260.75	4,925.57	1,014.53	2,320.65
5	8,227.63	4,894.27	1,010.60	2,322.77
6	8,264.47	4,926.68	1,016.00	2,321.78
7	8,239.20	4,916.67	1,007.85	2,314.68
8	8,233.07	4,902.70	1,016.40	2,313.97
9	8,286.27	4,935.00	1,018.07	2,333.20
10	8,257.32	4,929.00	1,014.32	2,314.00
11	8,248.13	4,918.12	1,014.33	2,315.68
12	8,271.73	4,938.10	1,013.08	2,320.55
13	8,245.30	4,917.27	1,016.38	2,311.65
14	8,243.13	4,918.40	1,016.08	2,308.65
15	8,240.77	4,906.70	1,014.80	2,319.27
16	8,241.72	4,921.03	1,010.38	2,310.30
17	8,231.05	4,907.18	1,015.23	2,308.63
18	8,275.27	4,932.75	1,016.30	2,326.22
19	8,250.57	4,918.98	1,015.80	2,315.78
Average	***8,250.50***	***4,920.75***	***1,014.67***	***2,315.07***

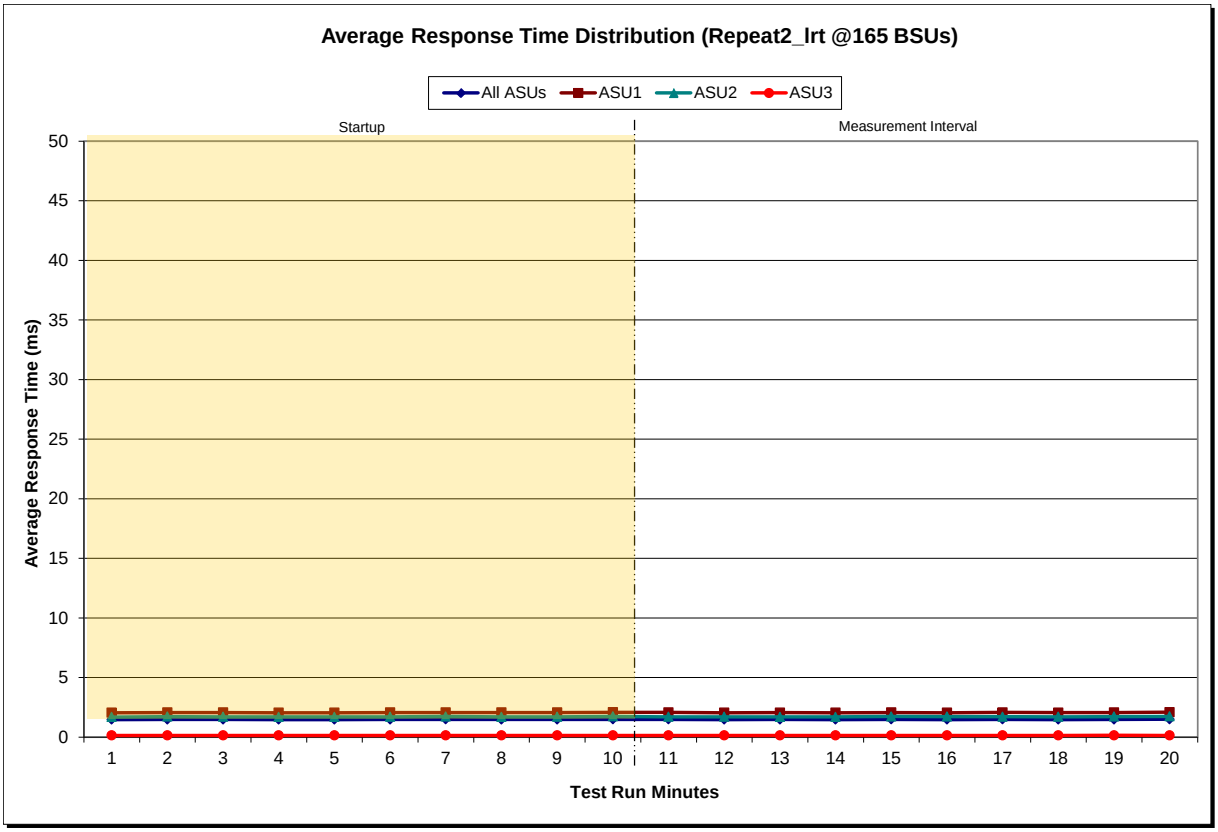
Repeatability 2 LRT – I/O Request Throughput Distribution Graph



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

165 BSUs	Start	Stop	Interval	Duration
Start-Up/Ramp-Up	22:08:17	22:18:17	0-9	0:10:00
Measurement Interval	22:18:17	22:28:17	10-19	0:10:00
60 second intervals	**All ASUs**	**ASU1**	**ASU2**	**ASU3**
0	1.47	2.05	1.69	0.14
1	1.48	2.06	1.72	0.14
2	1.48	2.07	1.70	0.14
3	1.47	2.05	1.70	0.14
4	1.47	2.04	1.69	0.14
5	1.48	2.06	1.70	0.14
6	1.48	2.07	1.73	0.14
7	1.48	2.06	1.69	0.14
8	1.48	2.06	1.70	0.14
9	1.49	2.08	1.74	0.14
10	1.48	2.07	1.70	0.14
11	1.47	2.05	1.70	0.14
12	1.48	2.06	1.70	0.15
13	1.47	2.05	1.70	0.14
14	1.49	2.07	1.73	0.15
15	1.47	2.05	1.72	0.14
16	1.49	2.07	1.72	0.15
17	1.47	2.06	1.70	0.14
18	1.48	2.06	1.72	0.15
19	1.50	2.09	1.74	0.14
Average	***1.48***	***2.06***	***1.71***	***0.14***

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

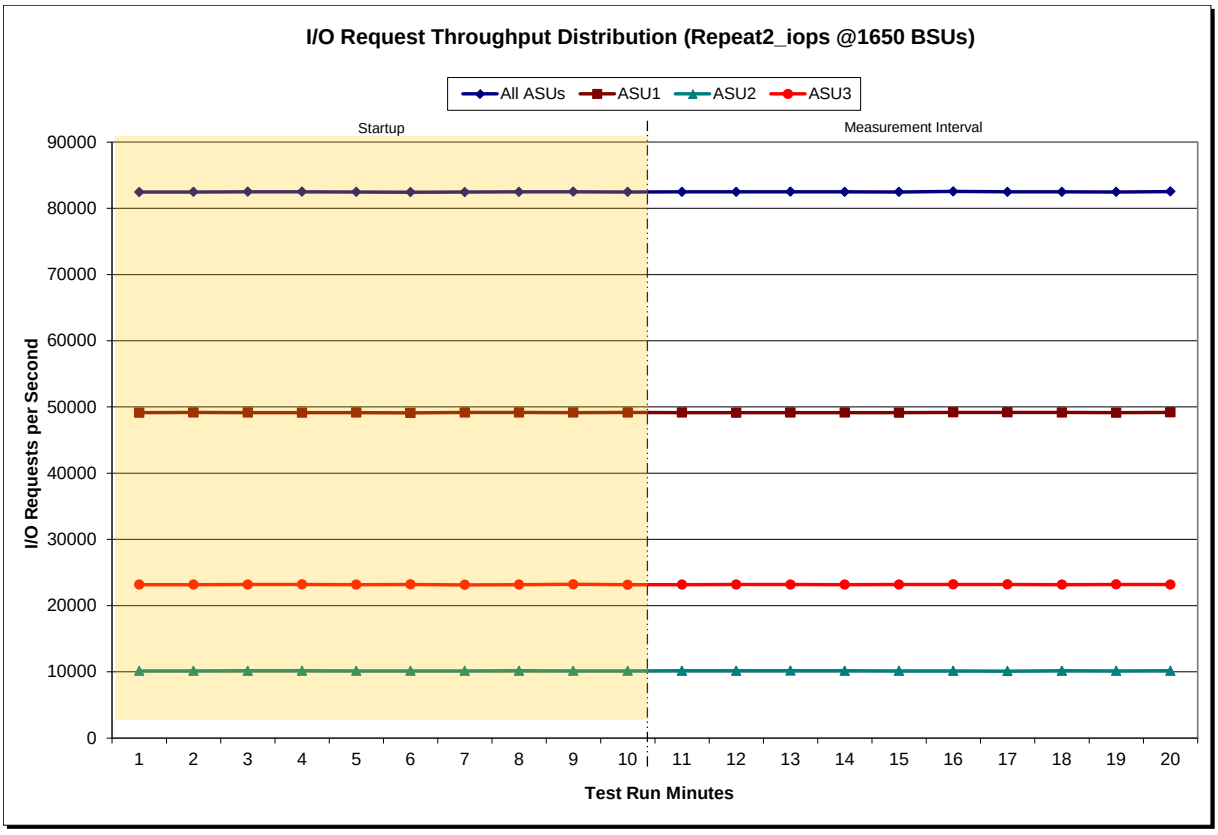


Repeatability 2 IOPS – I/O Request Throughput Distribution Data

165 BSUs	Start	Stop	Interval	Duration
Start-Up/Ramp-Up	22:28:44	22:38:45	0-9	0:10:01
Measurement Interval	22:38:45	22:48:45	10-19	0:10:00

60 second intervals	All ASUs	ASU1	ASU2	ASU3
0	82,457.03	49,142.85	10,142.37	23,171.82
1	82,468.85	49,162.28	10,146.05	23,160.52
2	82,501.65	49,150.05	10,159.68	23,191.92
3	82,494.98	49,135.25	10,154.40	23,205.33
4	82,471.05	49,157.65	10,142.63	23,170.77
5	82,440.12	49,103.28	10,140.17	23,196.67
6	82,461.85	49,171.95	10,150.12	23,139.78
7	82,490.27	49,160.92	10,155.05	23,174.30
8	82,508.68	49,148.82	10,150.90	23,208.97
9	82,462.87	49,162.72	10,146.35	23,153.80
10	82,486.87	49,153.80	10,157.43	23,175.63
11	82,488.95	49,137.48	10,162.68	23,188.78
12	82,504.50	49,147.45	10,168.47	23,188.58
13	82,490.75	49,151.40	10,166.55	23,172.80
14	82,475.38	49,139.72	10,145.27	23,190.40
15	82,546.55	49,186.97	10,151.32	23,208.27
16	82,493.58	49,177.75	10,116.48	23,199.35
17	82,483.35	49,163.88	10,155.27	23,164.20
18	82,476.00	49,130.72	10,140.47	23,204.82
19	82,531.12	49,186.00	10,161.88	23,183.23
Average	***82,497.71***	***49,157.52***	***10,152.58***	***23,187.61***

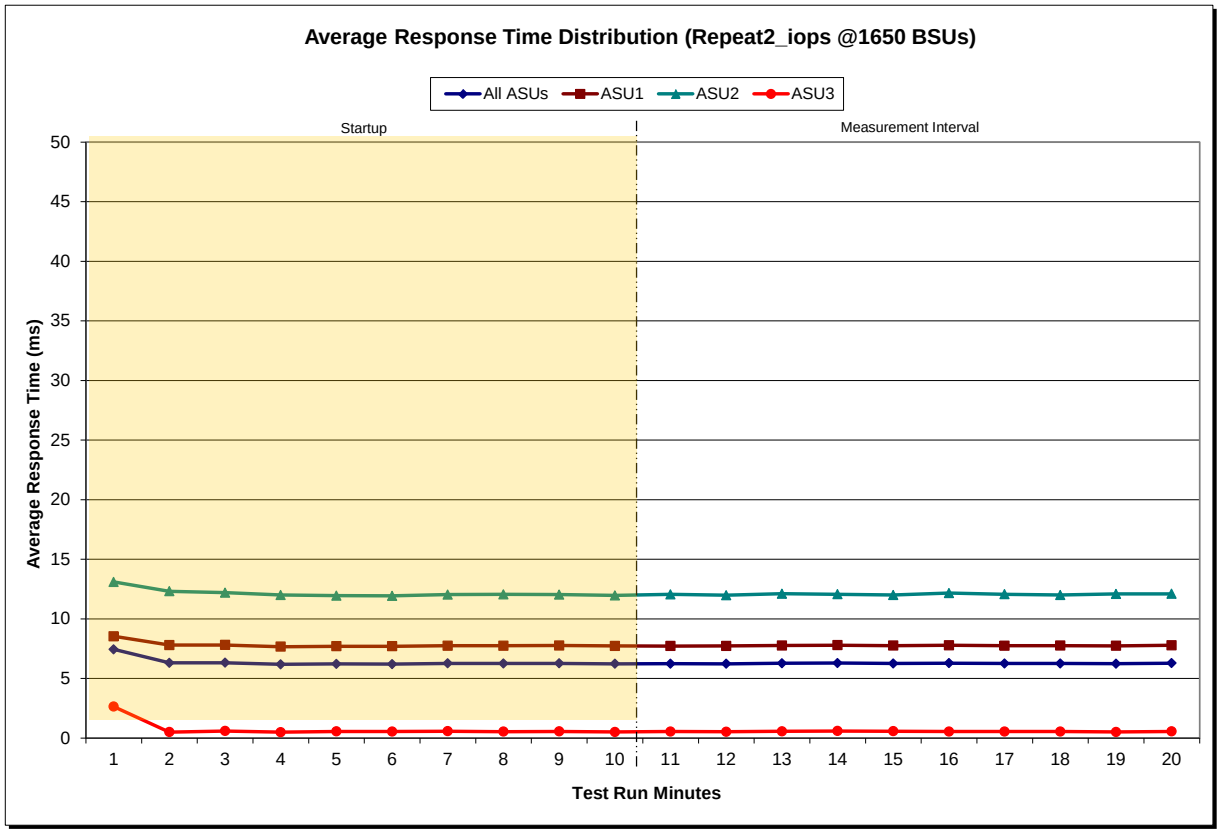
Repeatability 2 IOPS – I/O Request Throughput Distribution Graph



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

165 BSUs	Start	Stop	Interval	Duration
Start-Up/Ramp-Up	22:28:44	22:38:45	0-9	0:10:01
Measurement Interval	22:38:45	22:48:45	10-19	0:10:00
60 second intervals	**All ASUs**	**ASU1**	**ASU2**	**ASU3**
0	7.44	8.54	13.09	2.64
1	6.31	7.80	12.31	0.50
2	6.32	7.81	12.20	0.59
3	6.18	7.67	12.00	0.49
4	6.22	7.70	11.95	0.56
5	6.21	7.70	11.93	0.54
6	6.26	7.75	12.03	0.57
7	6.25	7.75	12.05	0.54
8	6.26	7.76	12.04	0.55
9	6.22	7.73	11.97	0.51
10	6.24	7.72	12.05	0.54
11	6.23	7.72	11.98	0.53
12	6.28	7.76	12.11	0.57
13	6.29	7.79	12.06	0.59
14	6.26	7.75	12.00	0.57
15	6.28	7.78	12.16	0.55
16	6.25	7.75	12.06	0.55
17	6.25	7.75	12.00	0.54
18	6.24	7.73	12.09	0.51
19	6.29	7.79	12.10	0.55
Average	***6.26***	***7.75***	***12.06***	***0.55***

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	0.2812	0.0700	0.2101	0.0180	0.0700	0.0349	0.2810
COV	0.008	0.003	0.005	0.002	0.006	0.005	0.009	0.003

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	0.0350	0.2809	0.0700	0.2101	0.0180	0.0700	0.0350	0.2809
COV	0.002	0.001	0.001	0.001	0.004	0.001	0.003	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	0.0352	0.2809	0.0699	0.2104	0.0180	0.0701	0.0349	0.02806
COV	0.005	0.003	0.004	0.003	0.014	0.004	0.008	0.001

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	0.0350	0.2809	0.0700	0.2100	0.0180	0.0700	0.0350	0.2811
COV	0.002	0.001	0.001	0.001	0.004	0.002	0.001	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 68.

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	181,482,448
Total Number of Logical Blocks Verified	95,718,336
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 SGI® InfiniteStorage 5500-SP 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 be 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 differences 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 SGI® InfiniteStorage 5500-SP .

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.

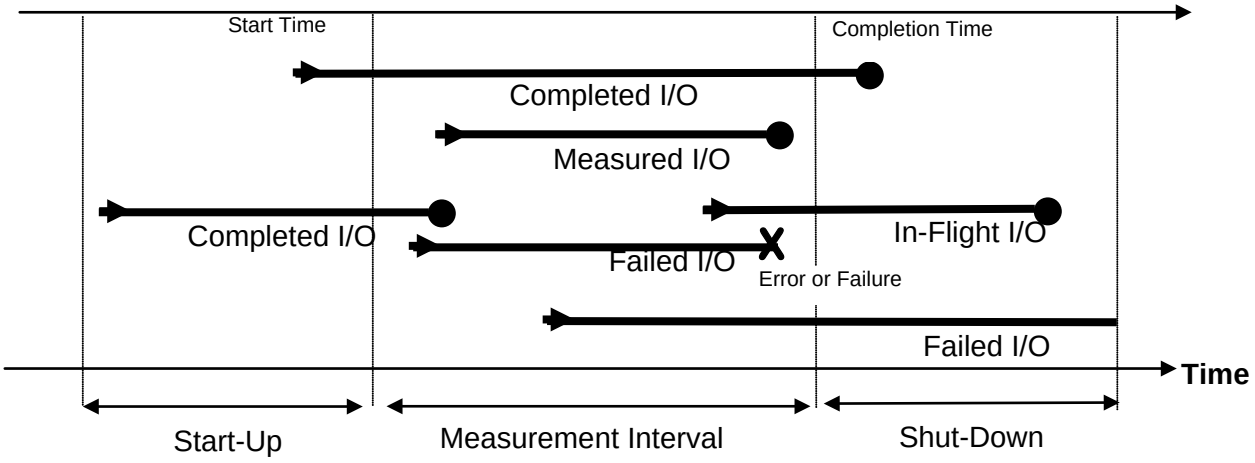
Test: A collection of Test Phases and or Test Runs sharing a common objective.

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

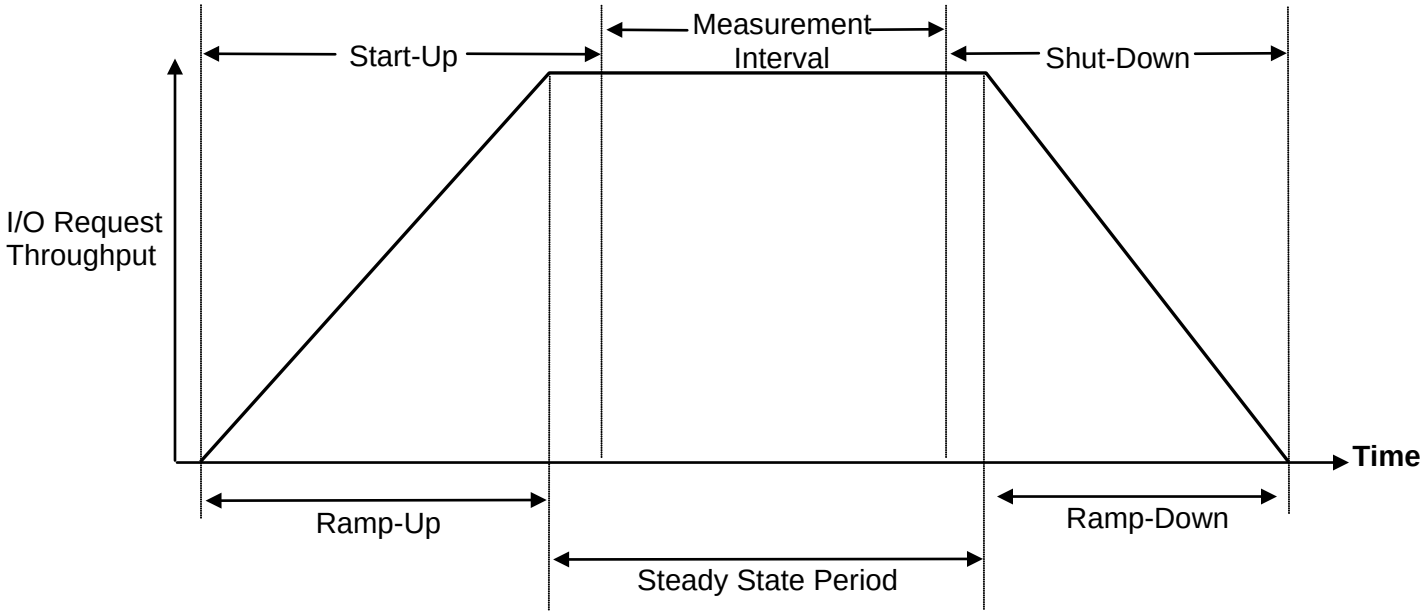
period, Shut-Down period, and Ramp-Down period as illustrated in the "SPC-1 Test Run Components" below. All SPC-1 Test Runs shall have a Steady State period and a Measurement Interval.

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

The following Emulex LPe12002 HBA parameters/options were changed from their default values using the **Emulex HBAnywhere** utility:

	Default Value	New Value
ExtTransferSize	***0***	***2***
QueueDepth	***32***	***254***

APPENDIX C: TESTED STORAGE CONFIGURATION (TSC) CREATION

Before creating volumes on the storage array, please refer to Appendix B *(page 61)* for a listing of the required Emulex LPe12002 HBA parameters/options.

Storage Array Volume Creation

The storage management utility, **SANtricity**, was used to create 23 volume groups on the storage subsystem. Each volume group contains a single RAID1 (mirrored) volume. All 23 RAID1 volumes are visible by each Host System.

The physical storage volumes are created on the storage array using the SANtricity Storage Manger script editor. Launch SANtricity Storage Manager. From the Enterprise Management window, right-click the name of the storage array that you will be creating volumes on and select ***Execute Script*** from the pop-up menu. In the Script Editor window load the **SPC1_RAID_Config.script** script *(listed below)*. Once the script is loaded, select ***Execute*** from the Tools menu. The **SPC1_RAID_Config.script** script appears at the end of the appendix.

SPC-1 Logical Volume Creation

The steps that follow are executed on a single Host System to define the Windows partitions, volumes, and stripe sets that comprise the SPC-1 Logical Volumes/Application Storage Units (ASUs).

1. Start the Windows Disk Administrator to discover the twenty-three RAID volumes, then exit the Disk Administrator
2. Use diskpar.exe to set the starting offset for each of the storage system volumes. Starting offset is 65536 sectors *(512 bytes per sector)*. Use all of the remaining capacity to create a single volume in each partition.
3. Start the Disk Management utility under Computer Management.
4. Convert all of the storage system volumes to Dynamic Disks.
5. Create a Windows Striped (RAID 0) volume using all twenty-three 32MB partitions.
6. Delete the remaining large volume on each of the Dynamic Disks.
7. Create a Windows Striped (RAID 0) volume for ASU 3.
    a. Select all twenty-three volumes.
    b. Set capacity to 55,800 MB.
    c. Assign drive letter "N" to the volume. Do not format the volume.
8. Create a Windows Striped (RAID 0) volume for ASU 1.
    a. Select all twenty-three volumes.
    b. Set capacity to 251,100 MB.
    c. Assign drive letter "L" to the volume. Do not format the volume.

9. Create a Windows Striped (RAID 0) volume for ASU 2.
    a. Select all twenty-three volumes.
    b. Set capacity to 251,100 MB.
    c. Assign drive letter "M" to the volume. Do not format the volume.
10. Reboot the Host Systems.
11. After each reboot completes, start the Disk Administrator utility on each of the Host Systems.
12. On each Host System, select either the import foreign disk or reactivate Windows stripe sets option, as necessary, then assign drive letters to the stripe sets as there were assigned in steps 7-9 above.

SPC1_RAID_Config.script

```
/* SPC-1 RAID configuration */
/* 23 x 5+5 Volume Groups   */

create volume drives[ 0,1,1  0,2,1  0,3,1  0,4,1  0,5,1  0,1,2  0,2,2  0,3,2  0,4,2
0,5,2 ]
RAIDLevel=1
segmentSize=128
userLabel="LUN_0"
capacity=599 GB
owner = A;
create volume drives[ 0,1,3  0,2,3  0,3,3  0,4,3  0,5,3  0,1,4  0,2,4  0,3,4  0,4,4
0,5,4 ]
RAIDLevel=1
segmentSize=128
userLabel="LUN_1"
capacity=599 GB
owner = A;
create volume drives[ 0,1,5  0,2,5  0,3,5  0,4,5  0,5,5  0,1,6  0,2,6  0,3,6  0,4,6
0,5,6 ]
RAIDLevel=1
segmentSize=128
userLabel="LUN_2"
capacity=599 GB
owner = A;
create volume drives[ 1,1,1  1,2,1  1,3,1  1,4,1  1,5,1  1,1,2  1,2,2  1,3,2  1,4,2
1,5,2 ]
RAIDLevel=1
segmentSize=128
userLabel="LUN_3"
capacity=599 GB
owner = A;
create volume drives[ 1,1,3  1,2,3  1,3,3  1,4,3  1,5,3  1,1,4  1,2,4  1,3,4  1,4,4
1,5,4 ]
RAIDLevel=1
segmentSize=128
userLabel="LUN_4"
capacity=599 GB
owner = A;
create volume drives[ 1,1,5  1,2,5  1,3,5  1,4,5  1,5,5  1,1,6  1,2,6  1,3,6  1,4,6
1,5,6 ]
RAIDLevel=1
```

```
segmentSize=128
userLabel="LUN_5"
capacity=599 GB
owner = A;
create volume drives[ 2,1,1  2,2,1  2,3,1  2,4,1  2,5,1  2,1,2  2,2,2  2,3,2  2,4,2
2,5,2 ]
RAIDLevel=1
segmentSize=128
userLabel="LUN_6"
capacity=599 GB
owner = A;
create volume drives[ 2,1,3  2,2,3  2,3,3  2,4,3  2,5,3  2,1,4  2,2,4  2,3,4  2,4,4
2,5,4 ]
RAIDLevel=1
segmentSize=128
userLabel="LUN_7"
capacity=599 GB
owner = A;
create volume drives[ 2,1,5  2,2,5  2,3,5  2,4,5  2,5,5  2,1,6  2,2,6  2,3,6  2,4,6
2,5,6 ]
RAIDLevel=1
segmentSize=128
userLabel="LUN_8"
capacity=599 GB
owner = A;
create volume drives[ 3,1,1  3,2,1  3,3,1  3,4,1  3,5,1  3,1,2  3,2,2  3,3,2  3,4,2
3,5,2 ]
RAIDLevel=1
segmentSize=128
userLabel="LUN_9"
capacity=599 GB
owner = A;
create volume drives[ 3,1,3  3,2,3  3,3,3  3,4,3  3,5,3  3,1,4  3,2,4  3,3,4  3,4,4
3,5,4 ]
RAIDLevel=1
segmentSize=128
userLabel="LUN_10"
capacity=599 GB
owner = A;
create volume drives[ 3,1,5  3,2,5  3,3,5  3,4,5  3,5,5  3,1,6  3,2,6  3,3,6  3,4,6
3,5,6 ]
RAIDLevel=1
segmentSize=128
userLabel="LUN_11"
capacity=599 GB
owner = A;

create volume drives[ 0,1,7  0,2,7  0,3,7  0,4,7  0,5,7  0,1,8  0,2,8  0,3,8  0,4,8
0,5,8 ]
RAIDLevel=1
segmentSize=128
userLabel="LUN_12"
capacity=599 GB
owner = b;
create volume drives[ 0,1,9  0,2,9  0,3,9  0,4,9  0,5,9  0,1,10  0,2,10  0,3,10
0,4,10  0,5,10 ]
RAIDLevel=1
segmentSize=128
userLabel="LUN_13"
capacity=599 GB
owner = b;
create volume drives[ 0,1,11  0,2,11  0,3,11  0,4,11  0,5,11  0,1,12  0,2,12  0,3,12
0,4,12  0,5,12 ]
```

```
RAIDLevel=1
segmentSize=128
userLabel="LUN_14"
capacity=599 GB
owner = b;
create volume drives[ 1,1,7  1,2,7  1,3,7  1,4,7  1,5,7  1,1,8  1,2,8  1,3,8  1,4,8
1,5,8 ]
RAIDLevel=1
segmentSize=128
userLabel="LUN_15"
capacity=599 GB
owner = b;
create volume drives[ 1,1,9  1,2,9  1,3,9  1,4,9  1,5,9  1,1,10  1,2,10  1,3,10
1,4,10  1,5,10 ]
RAIDLevel=1
segmentSize=128
userLabel="LUN_16"
capacity=599 GB
owner = b;
create volume drives[ 1,1,11  1,2,11  1,3,11  1,4,11  1,5,11  1,1,12  1,2,12  1,3,12
1,4,12  1,5,12 ]
RAIDLevel=1
segmentSize=128
userLabel="LUN_17"
capacity=599 GB
owner = b;
create volume drives[ 2,1,7  2,2,7  2,3,7  2,4,7  2,5,7  2,1,8  2,2,8  2,3,8  2,4,8
2,5,8 ]
RAIDLevel=1
segmentSize=128
userLabel="LUN_18"
capacity=599 GB
owner = b;
create volume drives[ 2,1,9  2,2,9  2,3,9  2,4,9  2,5,9  2,1,10  2,2,10  2,3,10
2,4,10  2,5,10 ]
RAIDLevel=1
segmentSize=128
userLabel="LUN_19"
capacity=599 GB
owner = b;
create volume drives[ 2,1,11  2,2,11  2,3,11  2,4,11  2,5,11  2,1,12  2,2,12  2,3,12
2,4,12  2,5,12 ]
RAIDLevel=1
segmentSize=128
userLabel="LUN_20"
capacity=599 GB
owner = b;
create volume drives[ 3,1,7  3,2,7  3,3,7  3,4,7  3,5,7  3,1,8  3,2,8  3,3,8  3,4,8
3,5,8 ]
RAIDLevel=1
segmentSize=128
userLabel="LUN_21"
capacity=599 GB
owner = b;
create volume drives[ 3,1,9  3,2,9  3,3,9  3,4,9  3,5,9  3,1,10  3,2,10  3,3,10
3,4,10  3,5,10 ]
RAIDLevel=1
segmentSize=128
userLabel="LUN_22"
capacity=599 GB
owner = b;

/* define host mappings */
```

```
set volume["LUN_0"]  logicalUnitNumber=0  hostGroup=defaultGroup;
set volume["LUN_1"]  logicalUnitNumber=1  hostGroup=defaultGroup;
set volume["LUN_2"]  logicalUnitNumber=2  hostGroup=defaultGroup;
set volume["LUN_3"]  logicalUnitNumber=3  hostGroup=defaultGroup;
set volume["LUN_4"]  logicalUnitNumber=4  hostGroup=defaultGroup;
set volume["LUN_5"]  logicalUnitNumber=5  hostGroup=defaultGroup;
set volume["LUN_6"]  logicalUnitNumber=6  hostGroup=defaultGroup;
set volume["LUN_7"]  logicalUnitNumber=7  hostGroup=defaultGroup;
set volume["LUN_8"]  logicalUnitNumber=8  hostGroup=defaultGroup;
set volume["LUN_9"]  logicalUnitNumber=9  hostGroup=defaultGroup;
set volume["LUN_10"] logicalUnitNumber=10 hostGroup=defaultGroup;
set volume["LUN_11"] logicalUnitNumber=11 hostGroup=defaultGroup;
set volume["LUN_12"] logicalUnitNumber=12 hostGroup=defaultGroup;
set volume["LUN_13"] logicalUnitNumber=13 hostGroup=defaultGroup;
set volume["LUN_14"] logicalUnitNumber=14 hostGroup=defaultGroup;
set volume["LUN_15"] logicalUnitNumber=15 hostGroup=defaultGroup;
set volume["LUN_16"] logicalUnitNumber=16 hostGroup=defaultGroup;
set volume["LUN_17"] logicalUnitNumber=17 hostGroup=defaultGroup;
set volume["LUN_18"] logicalUnitNumber=18 hostGroup=defaultGroup;
set volume["LUN_19"] logicalUnitNumber=19 hostGroup=defaultGroup;
set volume["LUN_20"] logicalUnitNumber=20 hostGroup=defaultGroup;
set volume["LUN_21"] logicalUnitNumber=21 hostGroup=defaultGroup;
set volume["LUN_22"] logicalUnitNumber=22 hostGroup=defaultGroup;

set allVolumes  mirrorEnabled = True writeCacheEnabled = True
cacheWithoutBatteryEnabled = False cacheReadPrefetch = False;

set storageArray cacheBlockSize = 32;
set storageArray cacheFlushStart = 50  cacheFlushStop = 50;
```

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 to execute the Primary Metrics *(Sustainability Test Phase, IOPS Test Phase, and Response Time Ramp Test Phase)* Test and Repeatability Test *(Repeatability Test Phase 1 and Repeatability Test Phase 2)*, which used multiple Host Systems, is listed below.

```
* spc1.cfg

host=master
slaves=(bmr710g_s1,bmr710g_s2,bmr710g_s3,bmr710g_s4,bmr710g_s5,bmr710g_s6,bmr710g_s7
,bmr710g_s8,bmr710g_s9,bmr710h_s1,bmr710h_s2,bmr710h_s3,bmr710h_s4,bmr710h_s5,bmr710
h_s6,bmr710h_s7,bmr710h_s8,bmr710h_s9)

javaparms="-Xmx512m -Xms512m"

sd=asu1_1,lun=\\.\L:,size=6055840972800
sd=asu2_1,lun=\\.\M:,size=6055840972800
sd=asu3_1,lun=\\.\N:,size=1345742438400
```

The content of SPC-1 Workload Generator command and parameter file used in this benchmark to execute the Persistence Test, which used a single Host System, is listed below.

```
* spc1_persist.cfg

javaparms="-Xmx512m -Xms512m"

sd=asu1_1,lun=\\.\L:,size=6055840972800
sd=asu2_1,lun=\\.\M:,size=6055840972800
sd=asu3_1,lun=\\.\N:,size=1345742438400
```

APPENDIX E: SPC-1 WORKLOAD GENERATOR INPUT PARAMETERS

The following script was used to execute the required ASU pre-fill, 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. The script also included the appropriate commands to capture the detailed TSC profile listings required for a Remote Audit.

```
echo "ASU prefill started......"
cd \bench\vdbench\vdbench503
vdbench -f \bench\vdbench\spc1\spc1_prefill.parm -o \bench\vdbench\spc1\PreFill
cd \bench\vdbench\spc1
echo "ASU prefill complete....."

echo "Capture a storage profile at the start of the run....."
cd "\Program Files\StorageManager\client"
smcli 10.113.168.176 10.113.168.177 -c "show storageArray time; show storageArray
profile; show storageArray time;" -o \bench\vdbench\spc1\config_at_start.txt -quick
cd \bench\vdbench\spc1

copy /Y spc1_iops.cfg spc1.cfg

java -Xmx640m -Xms640m metrics -b 1650 -s 600 -t 28800

java -Xmx640m -Xms640m repeat1 -b 1650 -s 600

java -Xmx640m -Xms640m repeat2 -b 1650 -s 600

copy /Y spc1_persist.cfg spc1.cfg

java -Xmx640m -Xms640m persist1 -b 1650

rem java -Xmx640m -Xms640m persist2

rem echo "Capture a storage profile at the end of the run....."
rem cd "\Program Files\StorageManager\client"
rem smcli 10.113.168.176 10.113.168.177 -c "show storageArray time; show
storageArray profile; show storageArray time;" -o
\bench\vdbench\spc1\config_at_end.txt -quick
rem cd \bench\vdbench\spc1
```

Persistence Test Run 2

The following script was used to execute Persistence Test Run 2 *(read phase)* after the required TSC power shutdown and restart.

```
java -Xmx640m -Xms640m persist2

echo "Capture a storage profile at the end of the run....."
cd "\Program Files\StorageManager\client"
smcli 10.113.168.176 10.113.168.177 -c "show storageArray time; show storageArray
profile; show storageArray time;" -o \bench\vdbench\spc1\config_at_end.txt -quick
cd \bench\vdbench\spc1
```

Slave JVMs

There were nine Slave JVMs used in the Primary Metrics and Repeatability Tests. The two files, listed below, illustrate the command to start the first Slave JVM (**slave1.cmd**) with the appropriate parameter file (**slave1.parm**). A similar pair of files was used to start the remaining eight Slave JVMs.

slave1.cmd

```
@echo off
echo ****************************************
echo * Sleeping 15 seconds...                *
echo ****************************************
sleep 15

java -Xmx512m -Xms512m spc1 -fslave1.parm
```

slave1.parm

```
*slave1.parm

host=bmr710g_s1
master=bmr710g

eof
```