SPC BENCHMARK 1™
FULL DISCLOSURE REPORT

PILLAR DATA SYSTEMS
PILLAR AXIOM 600 SERIES 3

SPC-1 V1.12

Submitted for Review: April 19, 2011
Submission Identifier: A00104

First Edition – April 2011

Trademarks

Table of Contents

AUDIT CERTIFICATION

Kurt Shoens
Pillar Data Systems
2840 Junction Avenue
San Jose, CA 95134

April 19, 2011

The SPC Benchmark 1™ Reported Data listed below for the Pillar Axiom 600 Series 3 were produced in compliance with the SPC Benchmark 1™ v1.12 Onsite Audit requirements.

SPC Benchmark 1™ v1.12 Reported Data	
Tested Storage Product (TSP) Name: Pillar Axiom 600 Series 3	
Metric	**Reported Result**
SPC-1 IOPS™	70,102.27
SPC-1 Price-Performance	$7.32/SPC-1 IOPS™
Total ASU Capacity	32,000.000 GB
Data Protection Level	Protected *(Mirroring)*
Total TSC Price (including three-year maintenance)	$513,112

The following SPC Benchmark 1™ Onsite 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 physical inspection and information supplied by Pillar Data Systems:
  - ✓ 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

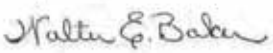
AUDIT CERTIFICATION *(CONT.)*

- The following Host System requirements were verified by physical inspection and information supplied by Pillar Data Systems:
  - ✓ 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 the Host System.
  - ✓ The TSC boundary within the Host System.
- The execution of each Test, Test Phase, and Test Run was observed and found compliant with all of the requirements and constraints of Clauses 4, 5, and 11 of the SPC-1 Benchmark Specification.
- The Test Results Files and resultant Summary Results Files received from Pillar Data Systems 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 and Priced Storage Configuration.
- 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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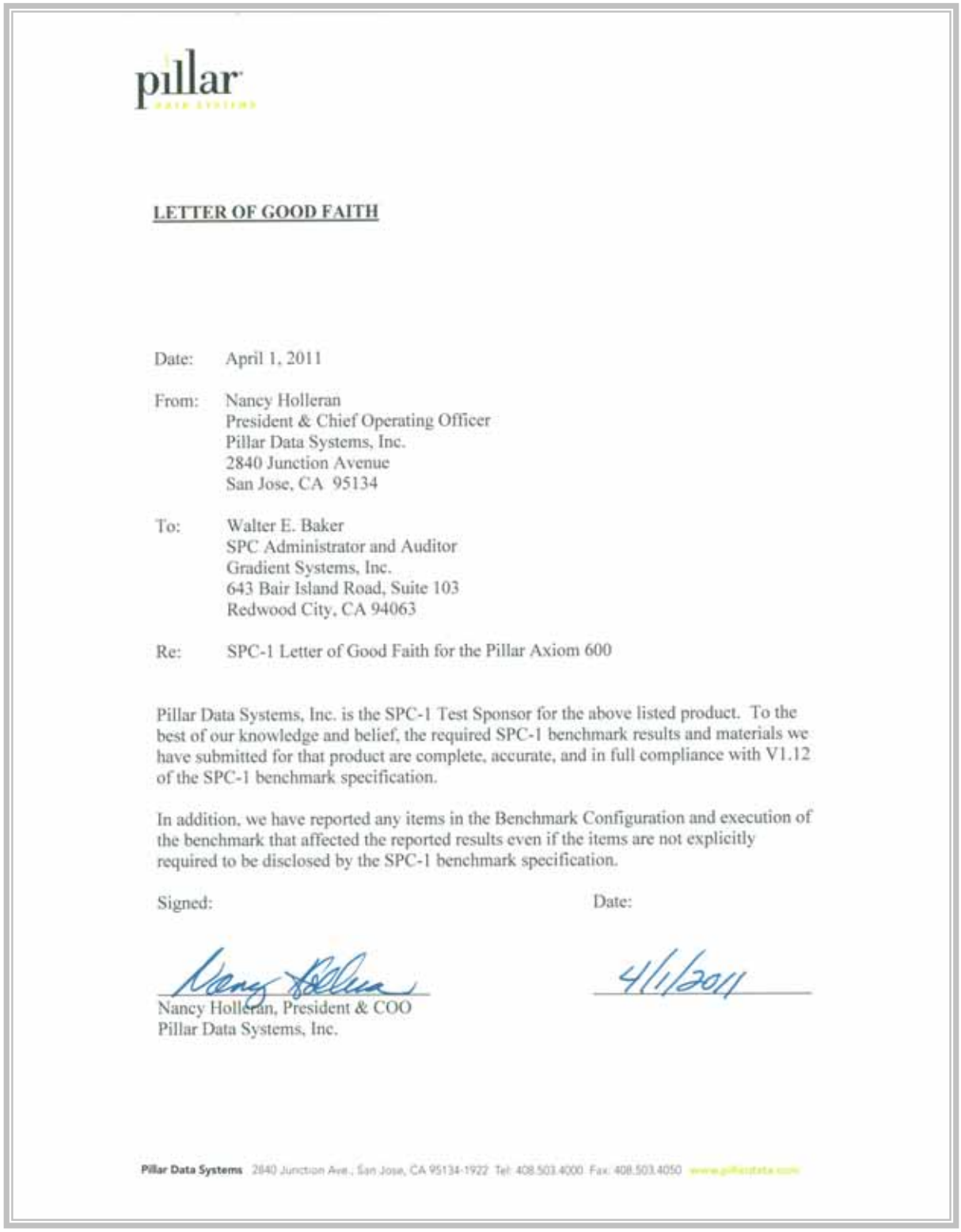
LETTER OF GOOD FAITH



pillar
DATA SYSTEMS

LETTER OF GOOD FAITH

Date: April 1, 2011

From: Nancy Holleran
President & Chief Operating Officer
Pillar Data Systems, Inc.
2840 Junction Avenue
San Jose, CA 95134

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

Re: SPC-1 Letter of Good Faith for the Pillar Axiom 600

Pillar Data Systems, Inc. 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.

Signed: Date:

Nancy Holleran

4/1/2011

Nancy Holleran, President & COO
Pillar Data Systems, Inc.

Pillar Data Systems 2840 Junction Ave., San Jose, CA 95134-1922 Tel: 408.503.4000 Fax: 408.503.4050

EXECUTIVE SUMMARY

Test Sponsor and Contact Information

Test Sponsor and Contact Information	
Test Sponsor Primary Contact	Pillar Data Systems – http://www.pillardata.com Kurt Shoens – kshoens@pillardata.com 2840 Junction Avenue San Jose, CA 95134 Phone: (408) 503-4081 FAX: (408) 503-4050
Test Sponsor Alternate Contact	Pillar Data Systems – http://www.pillardata.com Gokul Sathiacama – gsathiacama@pillardata.com 2840 Junction Avenue San Jose, CA 95134 Phone: (408) 518-4680 FAX: (408) 503-4050
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	April 19, 2011
Date the FDR was submitted to the SPC	April 19, 2011
Date the priced storage configuration is available for shipment to customers	currently available
Date the TSC completed audit certification	April 18, 2011

Tested Storage Product (TSP) Description

As the first and only storage system to provide system wide Quality of Service (QoS) management across multiple tiers of storage and user controlled I/O prioritization, the Axiom 600 makes an ideal platform for SLA driven private clouds and/or public Hosted and Managed Service Providers. The Axiom, finally breaking the legacy First In First Out (FIFO) I/O queuing model that has inhibited the ability to service I/O requests based on business value vs. which I/O request just happened to get issued first, allows for the perfect alignment of system resources to the importance of an application. This unique ability provides for fully deterministic performance under any multi-tenanted load condition thus insuring that SLA's are met regardless of what other activity is going on.

The Axiom 600: Providing stability in a chaotic world, performance when and where it matters; all without over provisioning or administrative micro-management of your storage system.

Summary of Results

SPC-1 Reported Data	
Tested Storage Product (TSP) Name: Pillar Axiom 600 Series 3	
Metric	**Reported Result**
SPC-1 IOPS™	70,102.27
SPC-1 Price-Performance	$7.32/SPC-1 IOPS™
Total ASU Capacity	32,000.000 GB
Data Protection Level	Protected *(Mirroring)*
Total TSC Price (including three-year maintenance)	$513,112

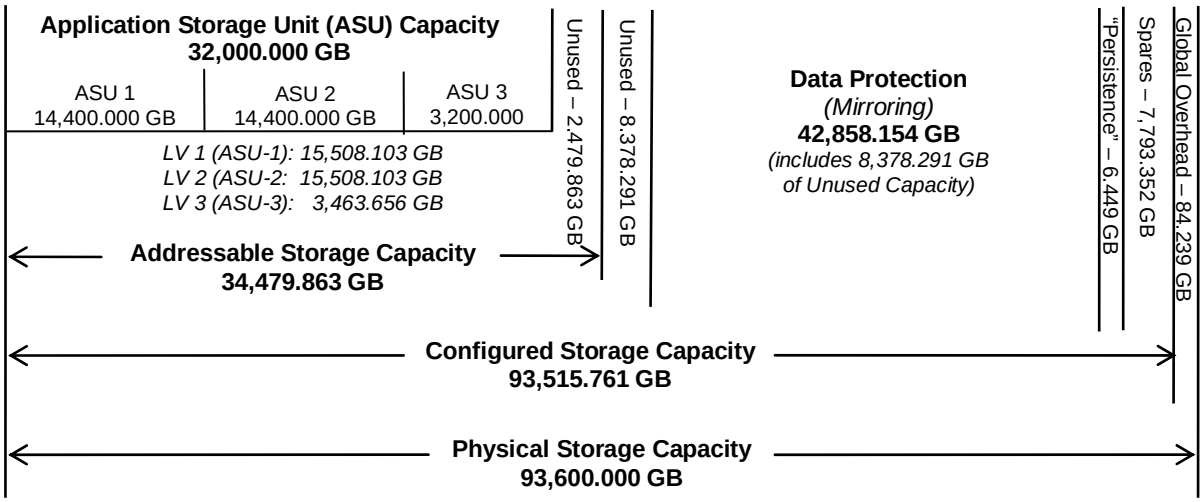
SPC-1 IOPS™ represents the maximum I/O Request Throughput at the 100% load point.

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	34.19%
Protected Application Utilization	71.03%
Unused Storage Ratio	20.55%

Application Utilization: Total ASU Capacity *(32,000.000 GB)* divided by Physical Storage Capacity *(93,600.000 GB)*

Protected Application Utilization: (Total ASU Capacity *32,000.000 (GB)* plus total Data Protection Capacity *(42,858.154 GB)* minus unused Data Protection Capacity *(8,378.291 GB)* divided by Physical Storage Capacity *(93,600.000 GB)*

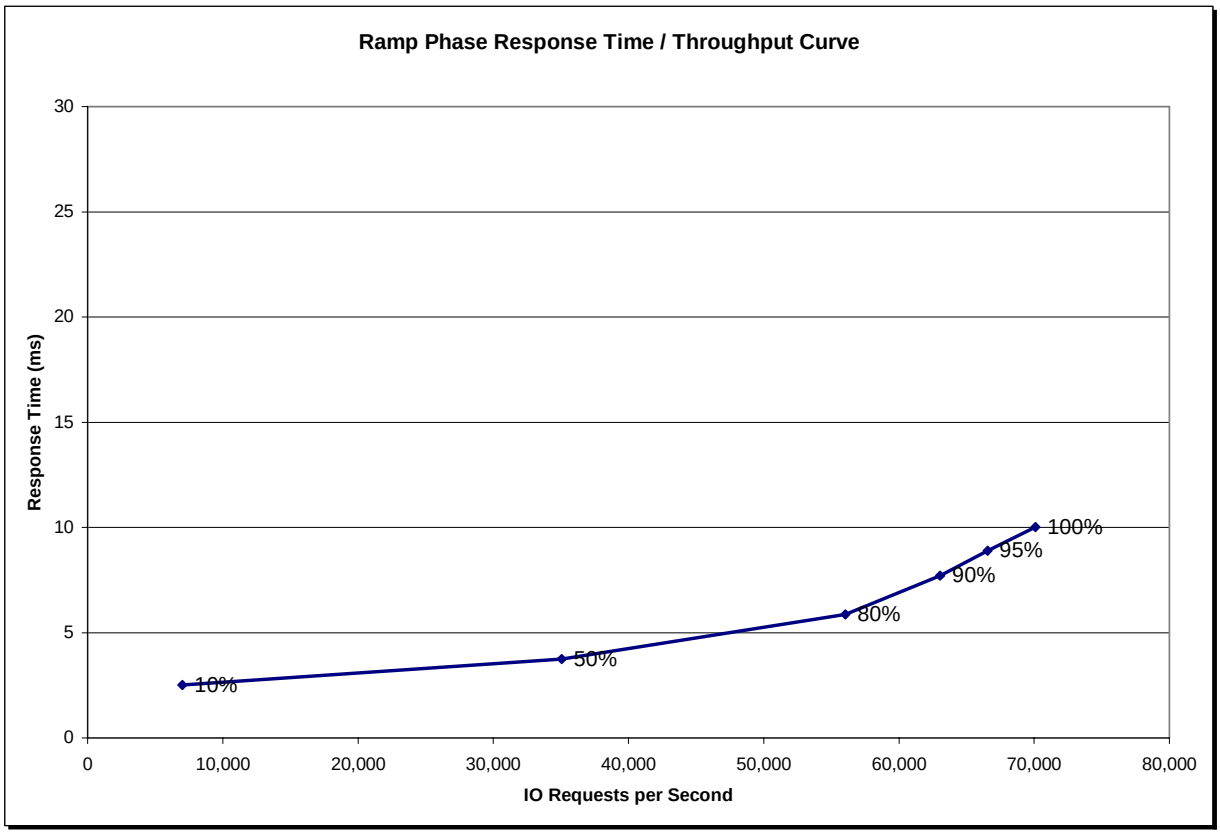
Unused Storage Ratio: Total Unused Capacity *(19,236.445 GB)* divided by Physical Storage Capacity *(93,600.000 GB)* and may not exceed 45%.

Detailed information for the various storage capacities and utilizations is available on pages 19-20 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	7,004.68	35,050.15	56,036.80	63,035.33	66,551.77	70,102.27
Average Response Time (ms):						
All ASUs	2.53	3.75	5.87	7.71	8.90	10.02
ASU-1	3.32	4.87	7.50	9.62	10.96	12.24
ASU-2	3.07	4.72	8.07	10.93	12.73	14.68
ASU-3	0.61	0.93	1.46	2.25	2.88	3.29
Reads	5.50	8.13	12.72	16.20	18.26	20.47
Writes	0.59	0.89	1.41	2.18	2.81	3.22

Priced Storage Configuration Pricing

Description	Quantity	Unit Price	Extended Price	List Unit Price	List Extended Price
Axiom 600 8Gb FC SAN Slammer Series 3	2	$ 18,000	$ 36,000	$ 55,000	$ 110,000
2U PILOT,GEN 3,HSF	1	$ 4,290	$ 4,290	$ 7,800	$ 7,800
Brick,FCV2,12x300GB,15K RPM Drives,HSF	26	$ 15,000	$ 390,000	$ 35,000	$ 910,000
2 Slammer Cable Kit	1	$ -	$ -	$ 2,300	$ 2,300
Optical Cable Kit, K2 Brick Installation	26	$ -	$ -	$ 600	$ 15,600
CABINET ASM,42U WITH RAILS,RITTAL,ROHS	2	$ 2,310	$ 4,620	$ 4,300	$ 8,600
ASM,PDU W/ MOUNTING BRACKETS,30A,ROHS	4	$ 573	$ 2,292	$ 1,042	$ 4,168
CBL,PWR,15 FT,NEMA L6-30P,220V,30A,RoHS	4	$ 110	$ 440	$ 200	$ 800
AxiomONE Storage Services Manager and Operating System	1	$ 17,400	$ 17,400	$ 44,500	$ 44,500
AxiomONE Software - Pooled RAID 10	1	$ -	$ -		
AxiomONE Software - Wide Stripe	1	$ -	$ -		
AxiomONE Software - SNMP Protocol	1	$ -	$ -		
AxiomONE Software - FCP Protocol	1	$ -	$ -		
AxiomONE Software Path Management for Windows, Linux, Solaris, HPUX, AIX	1	$ -	$ -		
Axiom 500/600 Software Subscription & Support (3 year)			$ 14,418		$ 19,224
Axiom 500/600 Four Hour Parts Delivery (3 year)			$ 32,272		$ 100,387
QLE2562, x4 PCIe, 8Gb, Dual Port, FC HBA	1	$ 1,490	$ 1,490	$ 1,490	$ 1,490
BRCD,BR-360-0008-A,360,24P,FULL FAB, 8G SWL SFPs,EGM,90 Days Adv Rplcmnt(-A)Srv&Spt	1	$ 7,105	$ 7,105	$ 11,842	$ 11,842
Brocade 300-SVS-4OS-3, 4HR Onsite Support,BR-300,3 Year	1	$ 2,785	$ 2,785	$ 3,094	$ 3,094
TOTAL			**$ 513,112**		**$ 1,239,805**
		Discount	**58.61%**		

The above pricing includes a generally available discount of 58.61%.

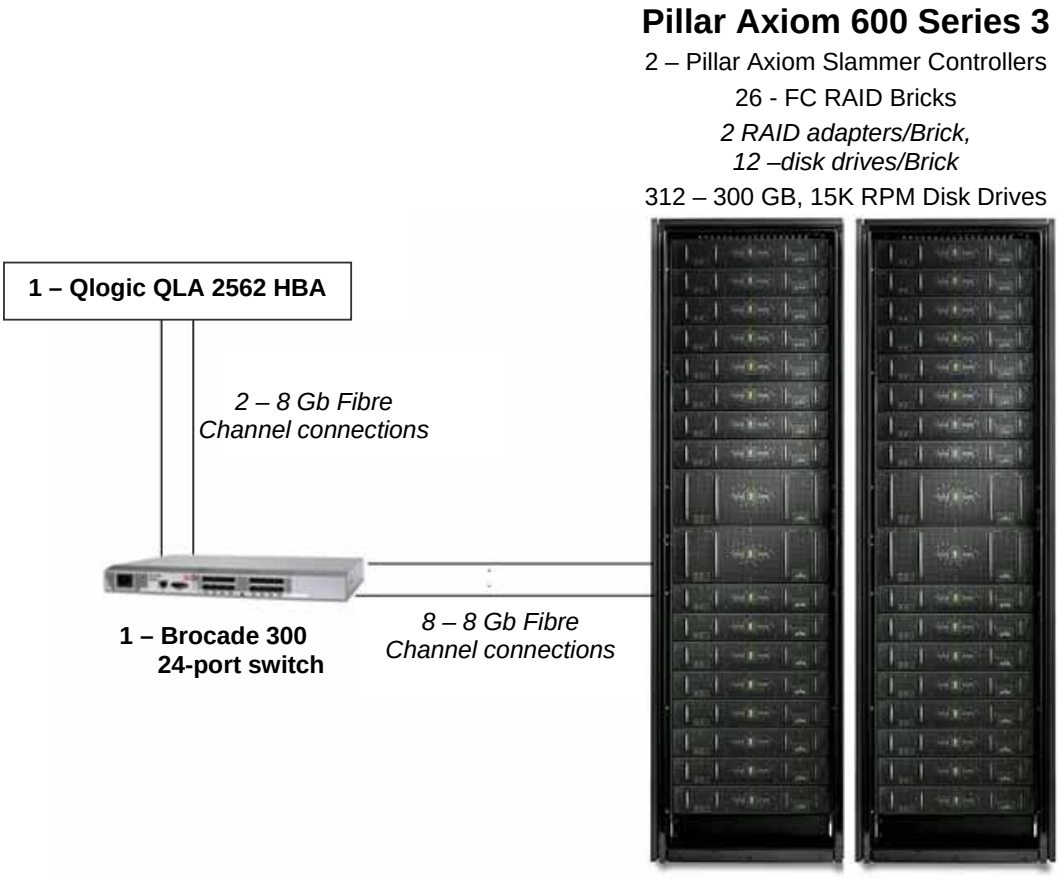
The above pricing includes hardware maintenance and software support for three years, 7 days per week, 24 hours per day. The hardware maintenance and software support provides the following:

- Acknowledgement of new and existing problems with four (4) hours.
- Onsite present 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

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

Priced Storage Configuration Diagram



Priced Storage Configuration Components

Priced Storage Configuration Components:
1 – QLA2462 2 port, 8Gb Fibre Channel HBA
Pillar Axiom 600 Series 3 Dual active/active data mover and manager 24 GB cache/controller *(48 GB total)* 8 – 8Gb FC front-end connections/controller *(16 total)* 8 – 4Gb FC backend connections/controller *(16 total)* *all configured disk drives are accessible by each controller and by each backend connection*
1 – Brocade 300 24-port switch
26- FC RAID Bricks 2 – RAID adapters per Brick 12 – 300 GB, 15K RPM disk drives per Brick *(312 disk drives total)*

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 storage network configuration is illustrated on page 17 *(Benchmark Configuration/Tested Storage Configuration Diagram).*

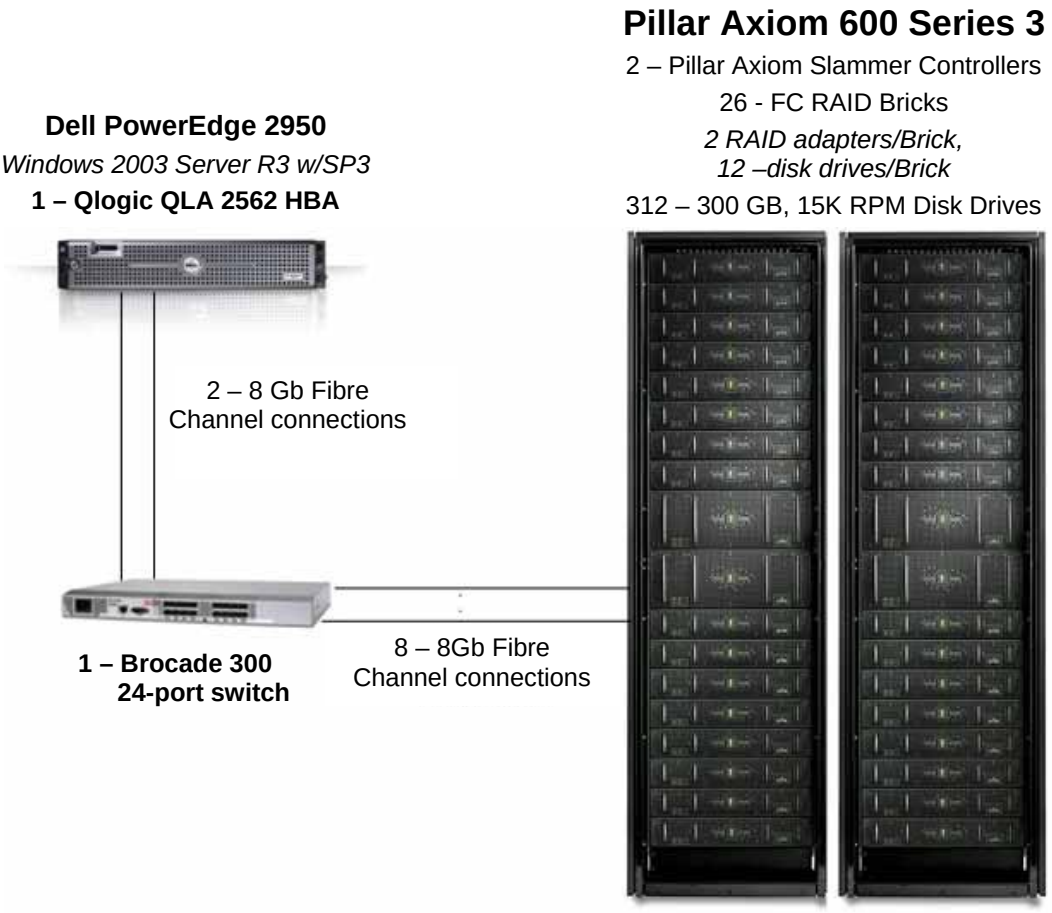
Host System and Tested Storage Configuration (TSC) Table of Components

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 17 *(Host System(s) and Tested Storage Configuration Components).*

Benchmark Configuration/Tested Storage Configuration Diagram



Host System(s) and Tested Storage Configuration Components

Host System:	Tested Storage Configuration (TSC):
Dell PowerEdge 2950	1 – QLA2462 2 port, 8Gb Fibre Channel HBA
2 – 3.0 GHz Intel Xeon X5450 Processors with 12 MB L2 cache/processor:	**Pillar Axiom 600 Series 3** Dual active/active data mover and manager 24 GB cache/controller *(48 GB total)* 8 – 8Gb FC front-end connections/controller *(16 total)* 8 – 4Gb FC backend connections/controller *(16 total)* *all configured disk drives are accessible by each controller and each backend connection*
32 GB main memory	
Windows Server 2003 R3 w/SP3	
Axiom Path Manager v3.2.4	
PCIe	
	1 – Brocade 300 24-port switch
	26- FC RAID Bricks 2 – RAID adapters per Brick 12 – 300 GB, 15K RPM disk drives per Brick *(312 disk drives total)*

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 65.

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)	32,000.000
Addressable Storage Capacity	Gigabytes (GB)	34,479.863
Configured Storage Capacity	Gigabytes (GB)	93,515.761
Physical Storage Capacity	Gigabytes (GB)	93,600.000
Data Protection *(Mirroring)*	Gigabytes (GB)	42,858.154
Required Storage *(including spares)*	Gigabytes (GB)	7,793.009
Global Storage Overhead	Gigabytes (GB)	84,239
Total Unused Storage	Gigabytes (GB)	19,236.445

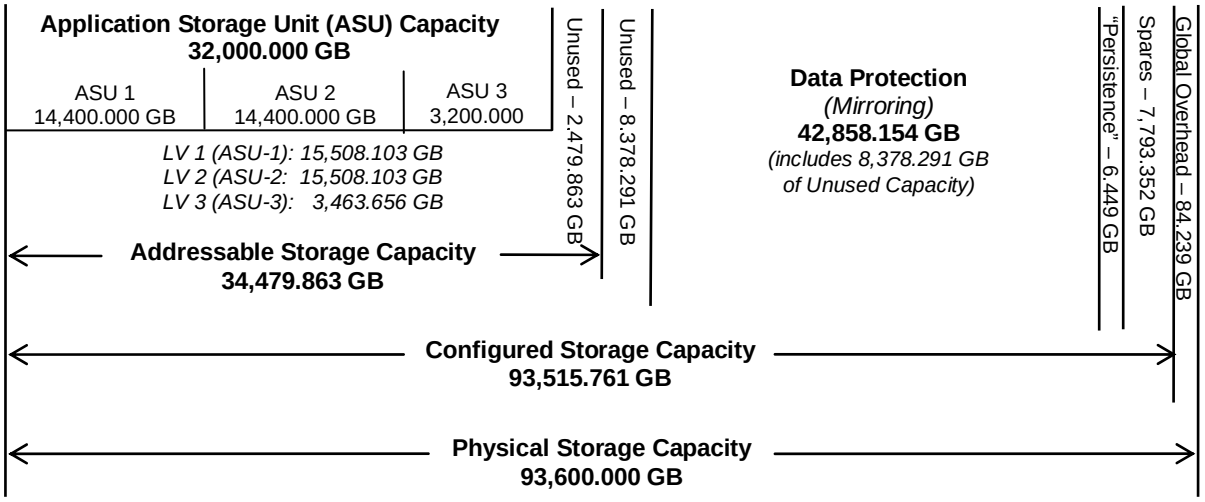
SPC-1 Storage Hierarchy Ratios

	Addressable Storage Capacity	**Configured Storage Capacity**	**Physical Storage Capacity**
Total ASU Capacity	93.81%	34.22%	34.19%
Required for Data Protection *(Mirrored)*		45.83%	45.79%
Addressable Storage Capacity		36.87%	36.84%
Required Storage *(including spares)*		8.33%	8.33%
Configured Storage Capacity			99.91%
Global Storage Overhead			0.09%
Unused Storage:			
Addressable	7.19%		
Configured		17.92%	
Physical			0.00%

The Physical Storage Capacity consisted of 93,600.00 GB distributed over 312 disk drives each with a formatted capacity of 300.00 GB. There was 0.000 GB (0.00%) of Unused Storage within the Physical Storage Capacity. Global Storage Overhead consisted of 83.896 GB (0.09%) of Physical Storage Capacity. There was 16,756.581 GB (17.92%) of Unused Storage within the Configured Storage Capacity. The Total ASU Capacity utilized 92.81% of the Addressable Storage Capacity resulting in 2,479.863 GB (7.19%) of Unused Storage within the Addressable Storage Capacity. The Data Protection *(mirroring)* capacity was 42,858.154 GB of which 34,479.863 GB was utilized. The total Unused Storage was 19,236.445 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 (14,400.000 GB)	**ASU-2 (14,400.000 GB)**	**ASU-3 (3,200.000 GB)**
1 Logical Volume 15,508.103 GB per Logical Volume (14,400.000 used per Logical Volume)	1 Logical Volume 15,508.103 GB per Logical Volume (14,400.000 used per Logical Volume)	1 Logical Volume 3,463.656 GB per Logical Volume (3,200.000 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	34.19%
Protected Application Utilization	71.03%
Unused Storage Ratio	20.55%

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 66.

Sustainability Test Results File

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

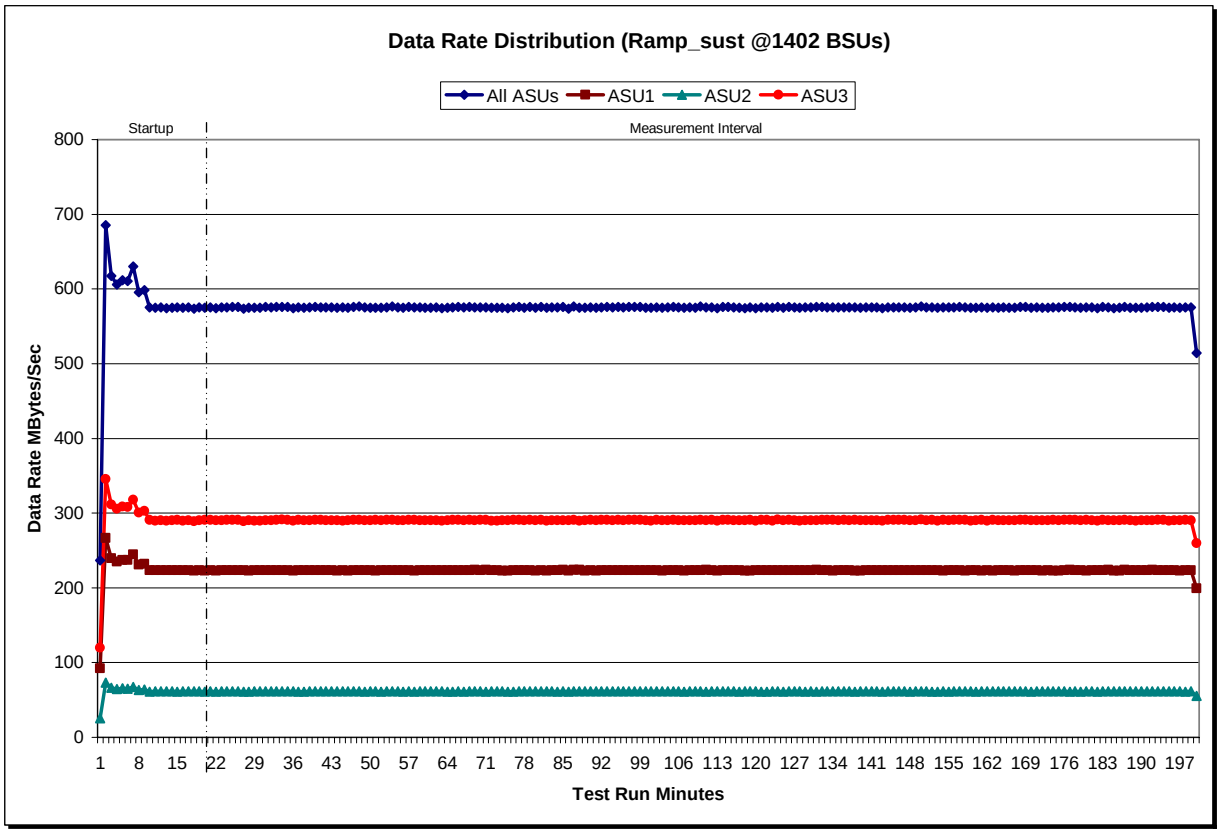
Sustainability Test Results File

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

	Start	Stop	Interval	Duration
Ramp-Up/Start-Up	14:24:53	14:44:52	0-19	0:19:59
Measurement Interval	14:44:52	17:44:52	20-199	3:00:00

Interval	All ASUs	ASU1	ASU2	ASU3	Interval	All ASUs	ASU1	ASU2	ASU3	Interval	All ASUs	ASU1	ASU2	ASU3
0	236.67	91.88	25.21	119.58	67	575.91	223.51	61.42	290.98	134	575.34	223.34	61.48	290.51
1	685.19	266.51	72.98	345.70	68	575.47	223.77	61.42	290.28	135	575.51	223.42	61.48	290.61
2	617.47	239.72	66.31	311.44	69	575.60	223.42	61.56	290.62	136	575.38	223.72	61.35	290.31
3	605.81	235.12	64.70	305.99	70	575.61	223.79	61.13	290.69	137	575.33	222.94	61.33	291.06
4	611.45	237.39	65.52	308.54	71	574.96	223.68	61.65	289.63	138	574.86	223.00	61.56	290.30
5	610.76	237.07	65.30	308.39	72	574.52	223.31	61.44	289.76	139	575.18	223.44	61.55	290.19
6	630.09	244.85	67.27	317.97	73	574.92	223.14	61.58	290.20	140	575.32	223.38	61.38	290.57
7	595.66	231.23	63.58	300.86	74	574.17	222.88	61.20	290.10	141	575.58	223.59	61.60	290.39
8	598.67	232.01	63.78	302.89	75	575.28	223.29	61.27	290.72	142	574.37	223.41	61.23	289.73
9	575.28	223.42	61.26	290.59	76	576.01	223.62	61.64	290.75	143	575.56	223.64	61.34	290.58
10	574.73	223.40	61.36	289.97	77	574.82	223.36	61.44	290.02	144	575.55	223.38	61.50	290.66
11	575.56	223.33	61.68	290.55	78	575.99	223.63	61.36	291.00	145	575.63	223.23	61.35	291.05
12	574.50	223.43	61.38	289.70	79	574.65	222.96	61.41	290.28	146	575.62	223.57	61.41	290.64
13	575.08	223.20	61.36	290.51	80	576.21	223.62	61.66	290.93	147	574.62	223.24	61.15	290.24
14	575.66	223.40	61.29	290.96	81	574.58	223.15	61.62	289.81	148	575.29	223.28	61.50	290.52
15	574.64	223.51	61.39	289.74	82	575.48	223.67	61.62	290.18	149	576.34	223.35	61.43	291.55
16	575.50	223.51	61.53	290.46	83	575.40	223.65	61.29	290.46	150	575.35	223.45	61.56	290.34
17	573.60	222.98	61.49	289.14	84	575.67	224.13	61.51	290.04	151	575.36	223.36	61.13	290.87
18	575.64	223.65	61.54	290.44	85	573.78	222.68	61.07	290.02	152	574.76	223.48	61.30	289.98
19	574.95	223.01	61.23	290.71	86	576.41	223.95	61.70	290.77	153	575.27	223.13	61.43	290.71
20	575.52	223.25	61.47	290.81	87	575.05	224.18	61.40	289.46	154	575.35	223.67	61.32	290.36
21	574.19	222.92	61.10	290.18	88	574.98	223.09	61.41	290.47	155	575.63	223.53	61.43	290.67
22	575.22	223.42	61.43	290.37	89	575.58	223.40	61.51	290.67	156	576.05	223.68	61.50	290.87
23	575.59	223.27	61.42	290.90	90	575.02	223.17	61.47	290.38	157	575.44	222.99	61.44	291.01
24	576.22	223.58	61.56	291.08	91	575.61	223.38	61.60	290.63	158	574.68	223.50	61.35	289.83
25	575.74	223.63	61.41	290.70	92	575.83	223.42	61.69	290.72	159	574.98	223.29	61.34	290.35
26	573.79	223.47	61.01	289.30	93	575.21	223.39	61.47	290.35	160	575.26	222.98	61.51	290.77
27	574.55	223.16	61.28	290.10	94	575.93	223.60	61.54	290.79	161	574.53	223.33	61.55	289.65
28	574.79	223.25	61.73	289.81	95	575.64	223.40	61.83	290.40	162	575.18	222.92	61.34	290.92
29	574.93	223.54	61.50	289.90	96	575.75	223.73	61.36	290.66	163	574.95	223.30	61.37	290.29
30	575.83	223.67	61.61	290.56	97	575.82	223.31	61.51	290.99	164	575.21	223.35	61.78	290.08
31	575.20	223.23	61.67	290.29	98	576.07	223.31	61.68	291.09	165	575.01	223.27	61.45	290.29
32	576.09	223.56	61.46	291.07	99	574.87	223.23	61.57	290.07	166	575.00	223.17	61.81	290.03
33	576.06	223.33	61.43	291.29	100	574.57	223.21	61.60	289.77	167	575.84	223.36	61.34	291.14
34	575.84	223.23	61.51	291.10	101	575.65	223.31	61.53	290.81	168	576.00	223.39	61.80	290.80
35	574.23	223.08	61.43	289.72	102	575.02	223.13	61.45	290.44	169	574.67	223.24	61.31	290.12
36	575.55	223.48	61.32	290.75	103	575.58	223.42	61.67	290.49	170	575.31	223.45	61.34	290.52
37	575.08	223.20	61.34	290.54	104	576.17	223.74	61.64	290.79	171	575.09	223.15	61.63	290.30
38	575.23	223.56	61.52	290.15	105	575.38	223.55	61.44	290.39	172	575.04	223.35	61.51	290.18
39	575.72	223.33	61.45	290.94	106	574.63	223.01	61.25	290.37	173	575.31	223.10	61.63	290.58
40	575.62	223.51	61.49	290.62	107	575.33	223.37	61.71	290.26	174	575.19	223.03	61.63	290.54
41	575.31	223.29	61.69	290.32	108	574.93	223.28	61.36	290.28	175	575.90	223.23	61.59	291.08
42	575.54	223.25	61.86	290.43	109	576.25	223.75	61.47	291.04	176	576.06	223.98	61.22	290.86
43	574.94	223.07	61.47	290.41	110	575.58	223.77	61.34	290.47	177	575.65	223.34	61.41	290.89
44	575.19	223.42	61.79	289.98	111	575.41	223.28	61.44	290.69	178	575.02	223.60	61.22	290.19
45	575.08	223.16	61.56	290.35	112	573.94	223.05	61.40	289.49	179	575.63	223.11	61.38	291.14
46	575.81	223.57	61.61	290.64	113	575.84	223.57	61.60	290.67	180	575.23	223.59	61.50	290.14
47	576.33	223.71	61.50	291.12	114	576.03	223.67	61.57	290.79	181	574.46	223.35	61.34	289.78
48	575.23	223.61	61.31	290.30	115	575.31	223.68	61.47	290.16	182	576.12	223.59	61.50	291.04
49	574.72	223.23	61.38	290.11	116	575.05	223.38	61.16	290.52	183	575.50	223.85	61.61	290.04
50	574.84	222.82	61.35	290.67	117	574.51	222.99	61.34	290.17	184	574.51	223.09	61.37	290.04
51	574.92	223.52	61.31	290.09	118	575.22	223.10	61.44	290.68	185	574.54	223.14	61.36	290.04
52	575.51	223.40	61.45	290.66	119	574.20	223.21	61.37	289.62	186	576.06	223.80	61.44	290.82
53	576.29	223.67	61.52	291.10	120	575.14	223.21	61.32	290.62	187	574.91	223.41	61.45	290.05
54	575.31	223.57	61.41	290.34	121	575.19	223.19	61.28	290.72	188	574.96	223.56	61.57	289.83
55	574.88	223.30	61.16	290.42	122	574.74	223.34	61.59	289.81	189	574.92	223.37	61.46	290.08
56	575.99	223.44	61.63	290.92	123	576.19	223.57	61.48	291.15	190	575.47	223.60	61.64	290.23
57	575.18	223.11	61.28	290.79	124	574.77	223.39	61.28	290.10	191	575.93	223.80	61.69	290.44
58	575.13	223.46	61.40	290.27	125	575.79	223.47	61.54	290.78	192	576.01	223.53	61.50	290.98
59	574.94	223.46	61.42	290.06	126	575.48	223.57	61.59	290.32	193	575.82	223.62	61.53	290.66
60	574.95	223.36	61.53	290.05	127	575.04	223.63	61.61	289.80	194	574.91	223.47	61.51	289.93
61	575.21	223.43	61.42	290.36	128	575.16	223.49	61.32	290.35	195	575.29	223.48	61.36	290.45
62	574.44	223.52	61.36	289.56	129	575.17	223.53	61.50	290.14	196	574.77	223.14	61.35	290.27
63	574.90	223.34	61.28	290.28	130	575.73	223.87	61.32	290.55	197	575.52	223.49	61.26	290.76
64	575.39	223.46	61.31	290.62	131	575.86	223.54	61.45	290.88	198	575.31	223.39	61.57	290.35
65	576.15	223.53	61.57	291.06	132	575.64	223.40	61.49	290.75	199	514.14	199.37	55.21	259.56
66	575.30	223.44	61.31	290.55	133	575.48	222.96	61.51	291.02					

Sustainability – Data Rate Distribution Graph

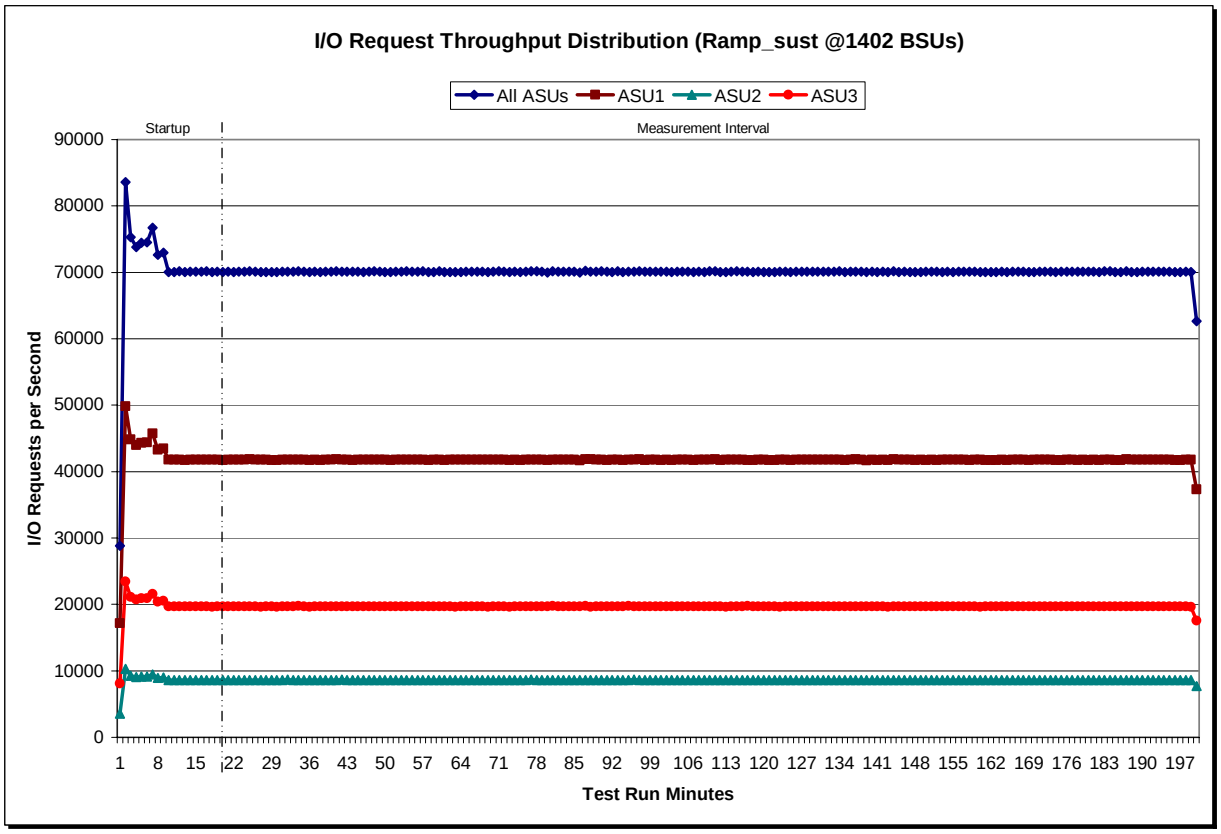


Sustainability – I/O Request Throughput Distribution Data

	Start	Stop	Interval	Duration
Ramp-Up/Start-Up	14:24:53	14:44:52	0-19	0:19:59
Measurement Interval	14:44:52	17:44:52	20-199	3:00:00

Interval	All ASUs	ASU1	ASU2	ASU3	Interval	All ASUs	ASU1	ASU2	ASU3	Interval	All ASUs	ASU1	ASU2	ASU3
0	28,829.82	17,191.02	3,536.10	8,102.70	67	70,139.32	41,780.40	8,637.22	19,721.70	134	70,031.08	41,739.80	8,611.15	19,680.13
1	83,613.53	49,854.50	10,274.85	23,484.18	68	70,049.63	41,781.73	8,619.50	19,648.40	135	70,107.77	41,795.60	8,624.38	19,687.78
2	75,263.68	44,833.92	9,296.95	21,132.82	69	70,139.43	41,798.63	8,628.20	19,712.60	136	70,110.07	41,826.17	8,614.10	19,669.80
3	73,819.70	44,021.68	9,063.37	20,734.65	70	70,152.98	41,823.63	8,615.50	19,713.85	137	70,085.85	41,767.37	8,600.03	19,718.45
4	74,430.10	44,349.90	9,167.00	20,913.20	71	70,140.38	41,824.65	8,639.45	19,676.28	138	70,021.85	41,692.85	8,634.60	19,694.40
5	74,496.52	44,373.68	9,165.78	20,957.05	72	70,012.65	41,735.37	8,633.22	19,644.07	139	70,081.58	41,762.63	8,620.38	19,698.57
6	76,718.08	45,717.52	9,429.50	21,571.07	73	70,091.77	41,762.37	8,640.30	19,689.10	140	70,040.33	41,728.57	8,618.38	19,693.38
7	72,617.52	43,262.43	8,928.83	20,426.25	74	70,029.83	41,753.23	8,596.78	19,679.82	141	70,109.77	41,791.15	8,625.52	19,693.10
8	72,960.25	43,457.03	8,988.35	20,514.87	75	70,088.15	41,796.02	8,602.48	19,689.65	142	70,026.38	41,754.97	8,607.02	19,664.40
9	70,070.75	41,761.37	8,602.92	19,706.47	76	70,151.53	41,793.22	8,652.03	19,706.28	143	70,165.62	41,838.23	8,618.65	19,708.73
10	70,067.32	41,773.92	8,613.03	19,680.37	77	70,147.22	41,819.40	8,628.85	19,698.97	144	70,071.02	41,764.27	8,627.25	19,679.50
11	70,180.33	41,824.45	8,633.90	19,721.98	78	70,118.15	41,788.18	8,616.30	19,713.67	145	70,138.82	41,783.93	8,629.07	19,725.82
12	70,044.27	41,758.38	8,610.13	19,675.75	79	69,996.15	41,712.97	8,607.03	19,676.15	146	70,072.92	41,783.57	8,601.60	19,687.75
13	70,082.03	41,761.90	8,611.13	19,709.00	80	70,167.07	41,804.33	8,624.97	19,737.77	147	70,031.63	41,742.25	8,620.25	19,669.13
14	70,122.05	41,804.33	8,601.30	19,716.42	81	70,107.67	41,789.12	8,633.38	19,685.17	148	70,073.78	41,768.70	8,612.23	19,692.85
15	70,103.53	41,795.50	8,631.22	19,676.82	82	70,107.37	41,795.12	8,639.05	19,673.20	149	70,093.08	41,749.28	8,634.33	19,709.47
16	70,157.35	41,824.92	8,638.82	19,693.62	83	70,125.07	41,794.93	8,611.35	19,718.78	150	70,126.13	41,808.83	8,615.30	19,702.00
17	70,055.67	41,761.52	8,628.93	19,665.22	84	70,087.45	41,790.62	8,626.33	19,670.50	151	70,109.68	41,757.55	8,625.60	19,726.53
18	70,085.00	41,776.68	8,612.50	19,695.82	85	69,965.43	41,685.47	8,592.83	19,687.13	152	70,068.30	41,795.17	8,602.02	19,671.12
19	70,068.52	41,744.75	8,608.43	19,715.33	86	70,246.15	41,878.32	8,637.48	19,730.35	153	70,103.92	41,788.98	8,606.85	19,708.08
20	70,126.10	41,785.18	8,620.35	19,720.57	87	70,100.62	41,835.37	8,602.10	19,663.15	154	70,073.12	41,789.28	8,603.58	19,680.25
21	70,071.70	41,765.28	8,595.53	19,710.88	88	70,089.53	41,767.27	8,632.33	19,689.93	155	70,129.92	41,776.88	8,626.78	19,726.25
22	70,105.77	41,780.30	8,630.15	19,695.32	89	70,177.70	41,809.32	8,642.22	19,726.17	156	70,122.27	41,797.08	8,619.43	19,705.75
23	70,127.62	41,780.98	8,637.97	19,708.67	90	70,093.47	41,758.70	8,630.37	19,704.40	157	70,103.23	41,753.53	8,633.90	19,715.80
24	70,182.57	41,836.20	8,642.68	19,703.68	91	70,074.83	41,762.00	8,630.42	19,682.42	158	70,110.03	41,806.90	8,620.87	19,682.27
25	70,086.00	41,776.80	8,618.77	19,690.43	92	70,163.77	41,795.48	8,646.65	19,721.63	159	70,056.18	41,782.97	8,613.98	19,659.23
26	70,016.93	41,761.55	8,591.38	19,664.00	93	70,033.67	41,745.82	8,601.77	19,686.08	160	70,062.17	41,748.38	8,624.50	19,689.28
27	70,069.18	41,792.78	8,608.27	19,668.13	94	70,139.38	41,775.33	8,629.62	19,734.43	161	70,048.27	41,755.30	8,614.08	19,678.88
28	70,059.78	41,747.17	8,640.70	19,671.92	95	70,140.07	41,779.88	8,653.43	19,706.75	162	70,030.08	41,719.42	8,608.17	19,702.50
29	70,012.37	41,737.98	8,616.43	19,657.95	96	70,164.65	41,831.88	8,628.42	19,704.35	163	70,091.75	41,776.97	8,634.92	19,679.87
30	70,095.32	41,762.68	8,627.12	19,705.52	97	70,082.22	41,744.23	8,625.58	19,712.40	164	70,071.32	41,722.05	8,649.17	19,700.10
31	70,133.40	41,772.25	8,651.23	19,709.92	98	70,138.20	41,802.42	8,631.85	19,703.93	165	70,114.75	41,779.67	8,644.10	19,690.98
32	70,110.98	41,772.10	8,621.37	19,717.52	99	70,092.85	41,783.62	8,612.22	19,697.02	166	70,126.18	41,808.22	8,634.95	19,683.02
33	70,165.57	41,785.82	8,644.25	19,735.50	100	70,099.05	41,757.68	8,639.12	19,702.25	167	70,110.62	41,768.65	8,614.98	19,726.98
34	70,111.32	41,780.53	8,627.67	19,703.12	101	70,135.95	41,801.62	8,629.62	19,704.72	168	70,063.60	41,744.90	8,620.23	19,698.47
35	70,017.47	41,753.22	8,607.75	19,656.50	102	70,075.38	41,754.58	8,625.03	19,695.77	169	70,067.45	41,775.07	8,611.63	19,680.75
36	70,131.00	41,794.17	8,630.40	19,706.43	103	70,097.00	41,773.12	8,633.45	19,690.43	170	70,107.83	41,772.90	8,615.90	19,719.03
37	70,065.38	41,726.60	8,622.07	19,716.72	104	70,128.92	41,804.70	8,631.17	19,693.05	171	70,112.02	41,801.82	8,631.62	19,678.58
38	70,077.87	41,761.35	8,615.70	19,700.82	105	70,117.82	41,796.43	8,624.42	19,696.97	172	70,114.50	41,782.30	8,627.60	19,704.60
39	70,083.42	41,761.40	8,626.17	19,695.85	106	70,071.85	41,757.95	8,612.28	19,701.62	173	70,032.38	41,718.37	8,634.43	19,679.58
40	70,155.98	41,828.05	8,603.03	19,724.90	107	70,101.78	41,778.77	8,639.13	19,683.88	174	70,075.75	41,733.70	8,634.73	19,707.32
41	70,119.37	41,767.55	8,658.00	19,693.82	108	70,063.00	41,769.65	8,609.03	19,684.32	175	70,101.62	41,775.42	8,614.28	19,711.92
42	70,132.28	41,804.87	8,628.08	19,699.33	109	70,168.37	41,814.95	8,630.95	19,722.47	176	70,106.82	41,781.67	8,604.78	19,720.37
43	70,085.87	41,755.50	8,624.75	19,705.62	110	70,161.77	41,859.23	8,600.58	19,701.95	177	70,096.70	41,753.35	8,619.03	19,724.32
44	70,097.62	41,769.12	8,627.95	19,700.55	111	70,066.77	41,742.45	8,617.33	19,706.98	178	70,101.05	41,793.15	8,603.05	19,704.85
45	70,070.62	41,761.57	8,609.43	19,699.62	112	70,032.77	41,761.17	8,615.25	19,656.35	179	70,077.13	41,747.97	8,619.63	19,709.53
46	70,127.05	41,784.10	8,617.82	19,725.13	113	70,112.65	41,770.00	8,623.87	19,718.78	180	70,139.48	41,819.98	8,627.53	19,691.97
47	70,150.30	41,814.78	8,616.20	19,719.32	114	70,154.25	41,809.85	8,617.88	19,726.52	181	70,047.32	41,755.60	8,622.63	19,669.08
48	70,094.47	41,790.12	8,617.60	19,686.75	115	70,079.52	41,793.00	8,612.98	19,673.53	182	70,141.48	41,777.00	8,634.63	19,729.85
49	70,060.48	41,778.45	8,614.35	19,667.68	116	70,092.58	41,745.77	8,613.57	19,733.25	183	70,152.58	41,798.42	8,641.35	19,712.82
50	70,051.10	41,707.87	8,630.95	19,712.28	117	70,049.67	41,737.13	8,619.65	19,692.88	184	70,057.95	41,735.75	8,619.38	19,702.82
51	70,082.90	41,762.07	8,617.15	19,703.68	118	70,120.38	41,795.43	8,624.32	19,700.63	185	70,035.90	41,739.27	8,613.45	19,683.18
52	70,095.92	41,771.35	8,630.72	19,693.85	119	70,074.42	41,764.92	8,621.57	19,687.93	186	70,162.60	41,829.93	8,624.50	19,708.17
53	70,153.90	41,806.27	8,627.58	19,720.05	120	70,069.87	41,745.53	8,606.98	19,717.35	187	70,071.68	41,787.78	8,609.58	19,674.32
54	70,106.72	41,798.85	8,624.97	19,682.90	121	70,063.83	41,746.93	8,618.23	19,698.67	188	70,074.90	41,779.25	8,617.45	19,678.20
55	70,103.07	41,772.30	8,622.38	19,708.38	122	70,092.55	41,809.00	8,627.15	19,656.40	189	70,099.10	41,769.77	8,635.70	19,693.63
56	70,143.18	41,816.17	8,622.88	19,704.13	123	70,132.60	41,796.20	8,620.82	19,715.58	190	70,134.78	41,797.75	8,631.02	19,706.02
57	70,062.37	41,729.33	8,625.58	19,707.45	124	70,048.37	41,752.65	8,611.60	19,684.12	191	70,132.90	41,816.68	8,637.27	19,678.95
58	70,066.75	41,768.13	8,608.02	19,690.60	125	70,136.27	41,806.72	8,625.13	19,704.42	192	70,124.08	41,799.53	8,625.90	19,698.65
59	70,142.27	41,811.02	8,633.00	19,698.25	126	70,100.88	41,808.68	8,620.42	19,671.78	193	70,132.20	41,815.40	8,628.27	19,688.53
60	70,056.75	41,751.32	8,629.43	19,676.00	127	70,113.47	41,792.97	8,631.58	19,688.92	194	70,099.30	41,798.10	8,615.07	19,686.13
61	70,073.40	41,771.45	8,608.05	19,693.90	128	70,129.93	41,781.30	8,628.80	19,719.83	195	70,038.68	41,757.37	8,604.98	19,676.33
62	70,047.23	41,765.60	8,628.08	19,653.55	129	70,077.75	41,777.00	8,627.47	19,673.28	196	70,040.07	41,737.35	8,618.38	19,684.33
63	70,061.48	41,772.13	8,606.50	19,682.85	130	70,118.28	41,814.32	8,598.88	19,705.08	197	70,076.62	41,764.23	8,608.10	19,704.28
64	70,119.17	41,807.52	8,610.50	19,701.15	131	70,120.78	41,800.67	8,607.23	19,712.88	198	70,073.62	41,776.10	8,639.18	19,658.33
65	70,119.83	41,791.20	8,639.53	19,689.10	132	70,128.23	41,804.35	8,610.10	19,713.78	199	62,651.48	37,353.70	7,715.32	17,582.47
66	70,114.62	41,781.98	8,612.45	19,720.18	133	70,146.28	41,804.77	8,622.67	19,718.85	***Average***	***70,055.80***	***41,753.42***	***8,617.32***	***19,685.06***

Sustainability – I/O Request Throughput Distribution Graph

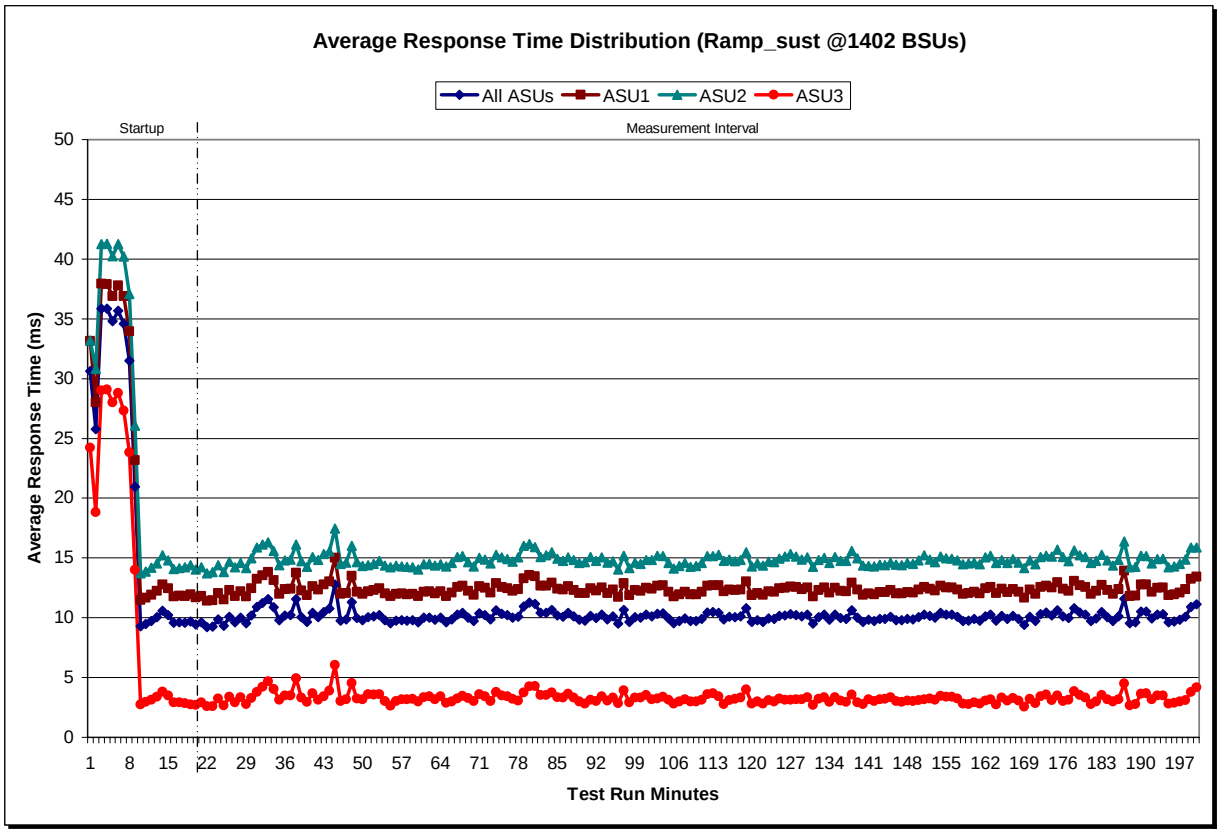


Sustainability – Average Response Time (ms) Distribution Data

	Start	Stop	Interval	Duration
Ramp-Up/Start-Up	14:24:53	14:44:52	0-19	0:19:59
Measurement Interval	14:44:52	17:44:52	20-199	3:00:00

Interval	All ASUs	ASU1	ASU2	ASU3	Interval	All ASUs	ASU1	ASU2	ASU3	Interval	All ASUs	ASU1	ASU2	ASU3
0	30.65	33.16	33.19	24.22	67	10.40	12.69	15.16	3.47	134	10.24	12.50	15.08	3.35
1	25.76	27.99	30.81	18.83	68	10.02	12.24	14.65	3.27	135	9.96	12.23	14.75	3.06
2	35.84	37.93	41.26	29.03	69	9.71	11.93	14.28	3.01	136	9.91	12.20	14.76	2.94
3	35.85	37.90	41.29	29.10	70	10.38	12.63	15.03	3.59	137	10.62	12.93	15.59	3.57
4	34.81	36.91	40.26	27.99	71	10.23	12.47	14.85	3.42	138	10.01	12.34	14.98	2.90
5	35.68	37.78	41.24	28.79	72	9.85	12.10	14.53	3.04	139	9.63	11.90	14.36	2.75
6	34.61	36.89	40.21	27.33	73	10.62	12.87	15.26	3.79	140	9.83	12.04	14.32	3.18
7	31.49	33.95	37.09	23.84	74	10.31	12.56	15.04	3.49	141	9.73	11.95	14.28	3.01
8	20.95	23.17	26.07	14.01	75	10.23	12.46	14.92	3.44	142	9.90	12.13	14.44	3.18
9	9.30	11.48	13.70	2.75	76	10.00	12.23	14.67	3.21	143	9.90	12.14	14.40	3.20
10	9.48	11.65	13.87	2.94	77	10.08	12.38	15.05	3.05	144	10.08	12.33	14.61	3.34
11	9.71	11.90	14.18	3.12	78	10.94	13.28	16.01	3.76	145	9.78	12.01	14.42	3.04
12	10.03	12.24	14.54	3.37	79	11.27	13.58	16.17	4.23	146	9.77	12.03	14.41	2.97
13	10.57	12.80	15.22	3.81	80	11.18	13.46	15.91	4.28	147	9.90	12.15	14.56	3.07
14	10.22	12.46	14.81	3.48	81	10.41	12.67	15.09	3.54	148	9.85	12.10	14.52	3.02
15	9.57	11.77	14.09	2.93	82	10.42	12.68	15.21	3.51	149	10.04	12.34	14.79	3.08
16	9.62	11.85	14.13	2.92	83	10.65	12.91	15.49	3.74	150	10.26	12.58	15.23	3.18
17	9.59	11.81	14.23	2.84	84	10.18	12.41	14.93	3.37	151	10.14	12.42	14.88	3.23
18	9.67	11.96	14.42	2.75	85	10.09	12.33	14.77	3.31	152	10.00	12.27	14.65	3.15
19	9.45	11.69	14.03	2.69	86	10.40	12.62	15.05	3.65	153	10.39	12.69	15.13	3.46
20	9.60	11.80	14.23	2.93	87	10.11	12.33	14.83	3.33	154	10.27	12.54	14.96	3.39
21	9.21	11.40	13.73	2.61	88	9.83	12.08	14.58	2.99	155	10.24	12.51	14.93	3.38
22	9.26	11.46	13.83	2.59	89	9.77	12.04	14.67	2.79	156	10.09	12.35	14.79	3.26
23	9.87	12.06	14.39	3.23	90	10.15	12.45	15.10	3.12	157	9.71	11.98	14.46	2.80
24	9.31	11.51	13.82	2.66	91	9.99	12.27	14.78	3.04	158	9.76	12.06	14.54	2.77
25	10.09	12.29	14.68	3.40	92	10.27	12.53	15.05	3.40	159	9.88	12.18	14.62	2.93
26	9.62	11.82	14.22	2.93	93	9.86	12.08	14.61	3.08	160	9.74	12.03	14.47	2.81
27	10.00	12.20	14.56	3.33	94	10.10	12.36	14.71	3.30	161	10.13	12.45	15.04	3.06
28	9.54	11.77	14.15	2.77	95	9.51	11.72	14.03	2.84	162	10.25	12.58	15.18	3.15
29	10.19	12.46	14.97	3.29	96	10.64	12.88	15.19	3.91	163	9.76	12.06	14.58	2.75
30	10.92	13.26	15.89	3.79	97	9.63	11.87	14.16	2.91	164	10.14	12.41	14.82	3.30
31	11.24	13.54	16.13	4.23	98	10.06	12.30	14.61	3.31	165	9.89	12.14	14.56	3.08
32	11.55	13.81	16.31	4.68	99	10.00	12.24	14.52	3.29	166	10.13	12.37	14.89	3.29
33	10.88	13.15	15.58	4.03	100	10.27	12.51	14.85	3.52	167	9.90	12.16	14.62	3.07
34	9.80	12.00	14.39	3.12	101	10.12	12.41	14.84	3.17	168	9.41	11.66	14.16	2.57
35	10.18	12.37	14.81	3.50	102	10.34	12.69	15.19	3.25	169	10.08	12.33	14.80	3.22
36	10.22	12.43	14.88	3.48	103	10.38	12.69	15.15	3.37	170	9.71	11.98	14.46	2.85
37	11.56	13.75	16.13	4.92	104	9.94	12.18	14.57	3.14	171	10.30	12.57	15.07	3.41
38	10.05	12.27	14.73	3.30	105	9.54	11.78	14.10	2.80	172	10.42	12.67	15.19	3.56
39	9.65	11.86	14.26	2.94	106	9.72	11.94	14.33	2.98	173	10.19	12.52	15.13	3.09
40	10.42	12.63	15.10	3.68	107	9.94	12.18	14.58	3.17	174	10.63	12.97	15.69	3.48
41	10.06	12.34	14.85	3.13	108	9.72	11.95	14.27	2.99	175	10.11	12.42	15.10	3.03
42	10.47	12.79	15.33	3.43	109	9.73	11.96	14.34	2.97	176	9.99	12.25	14.74	3.11
43	10.78	13.04	15.56	3.89	110	9.91	12.15	14.56	3.12	177	10.79	13.07	15.62	3.86
44	12.79	15.01	17.47	6.04	111	10.43	12.69	15.14	3.59	178	10.44	12.70	15.24	3.54
45	9.76	11.97	14.49	3.02	112	10.46	12.70	15.15	3.66	179	10.27	12.56	15.10	3.30
46	9.87	12.06	14.60	3.16	113	10.41	12.71	15.25	3.43	180	9.73	12.00	14.58	2.78
47	11.29	13.50	16.03	4.54	114	9.86	12.19	14.76	2.77	181	9.95	12.23	14.75	3.00
48	9.97	12.18	14.65	3.23	115	10.07	12.36	14.87	3.09	182	10.46	12.75	15.27	3.52
49	9.80	12.00	14.34	3.16	116	10.03	12.29	14.73	3.20	183	10.05	12.31	14.79	3.16
50	10.06	12.21	14.41	3.59	117	10.11	12.34	14.83	3.31	184	9.74	11.97	14.37	2.97
51	10.12	12.32	14.52	3.55	118	10.81	13.04	15.48	4.01	185	10.10	12.40	14.85	3.17
52	10.24	12.44	14.75	3.60	119	9.64	11.89	14.28	2.82	186	11.58	13.92	16.39	4.49
53	9.78	12.02	14.36	3.03	120	9.81	12.06	14.53	2.98	187	9.53	11.80	14.23	2.65
54	9.52	11.79	14.22	2.64	121	9.65	11.92	14.35	2.79	188	9.60	11.84	14.27	2.77
55	9.76	11.99	14.37	3.01	122	9.95	12.20	14.67	3.09	189	10.50	12.77	15.18	3.64
56	9.81	12.02	14.28	3.15	123	9.89	12.17	14.64	2.98	190	10.53	12.79	15.15	3.69
57	9.76	11.96	14.24	3.15	124	10.16	12.44	14.94	3.24	191	9.93	12.16	14.54	3.15
58	9.80	12.00	14.22	3.22	125	10.17	12.47	15.12	3.13	192	10.27	12.51	14.92	3.47
59	9.60	11.79	14.04	3.00	126	10.29	12.61	15.35	3.14	193	10.29	12.53	14.94	3.49
60	9.99	12.18	14.49	3.36	127	10.23	12.55	15.13	3.16	194	9.62	11.88	14.23	2.80
61	10.01	12.20	14.52	3.40	128	10.11	12.40	14.87	3.18	195	9.68	11.94	14.28	2.90
62	9.83	12.03	14.35	3.17	129	10.25	12.51	15.04	3.34	196	9.82	12.08	14.50	2.99
63	10.01	12.20	14.48	3.40	130	9.52	11.76	14.25	2.70	197	10.08	12.39	14.86	3.11
64	9.61	11.82	14.27	2.87	131	10.05	12.30	14.82	3.20	198	10.92	13.25	15.88	3.78
65	9.85	12.09	14.59	3.00	132	10.25	12.53	15.01	3.33	199	11.13	13.42	15.88	4.18
66	10.26	12.58	15.09	3.23	133	9.84	12.11	14.59	2.95	***Average***	***10.11***	***12.37***	***14.82***	***3.27***

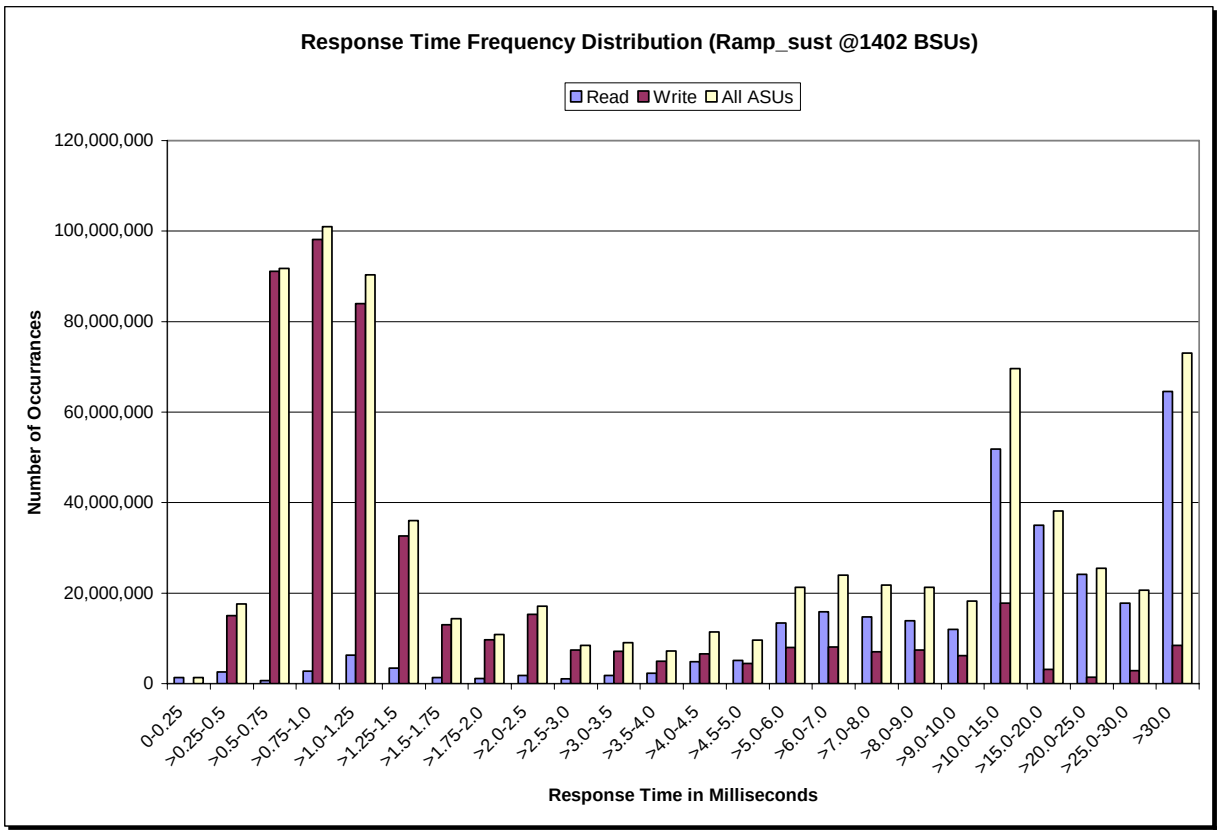
Sustainability – Average Response Time (ms) Distribution Graph



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	1,334,885	2,546,988	670,158	2,789,832	6,309,331	3,429,010	1,377,030	1,095,807
Write	-	15,024,098	91,121,271	98,151,748	83,988,470	32,602,913	12,987,833	9,700,593
All ASUs	1,334,885	17,571,086	91,791,429	100,941,580	90,297,801	36,031,923	14,364,863	10,796,400
ASU1	1,251,860	9,618,348	43,311,976	45,705,585	39,172,989	15,312,945	6,247,343	4,746,644
ASU2	83,025	1,754,442	10,039,548	11,160,657	10,036,599	3,984,358	1,600,092	1,206,899
ASU3	-	6,198,296	38,439,905	44,075,338	41,088,213	16,734,620	6,517,428	4,842,857
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	1,819,935	1,045,497	1,844,619	2,319,922	4,805,115	5,093,277	13,371,042	15,833,078
Write	15,276,801	7,372,616	7,166,393	4,954,070	6,605,667	4,490,436	7,975,317	8,107,678
All ASUs	17,096,736	8,418,113	9,011,012	7,273,992	11,410,782	9,583,713	21,346,359	23,940,756
ASU1	7,691,693	3,976,397	4,663,741	4,198,130	7,156,406	6,511,691	15,387,082	17,541,843
ASU2	1,899,340	891,195	915,358	720,818	1,121,592	947,867	2,191,039	2,551,980
ASU3	7,505,703	3,550,521	3,431,913	2,355,044	3,132,784	2,124,155	3,768,238	3,846,933
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	14,702,177	13,845,895	12,026,494	51,798,064	35,005,930	24,126,588	17,783,665	64,552,912
Write	7,042,376	7,416,649	6,187,801	17,804,699	3,161,352	1,386,403	2,844,931	8,471,164
All ASUs	21,744,553	21,262,544	18,214,295	69,602,763	38,167,282	25,512,991	20,628,596	73,024,076
ASU1	15,989,727	15,314,022	13,194,694	53,006,473	31,596,878	21,150,891	16,167,829	53,670,197
ASU2	2,392,075	2,400,812	2,073,603	8,178,547	5,034,390	3,730,599	3,179,429	15,312,434
ASU3	3,362,751	3,547,710	2,945,998	8,417,743	1,536,014	631,501	1,281,338	4,041,445

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	0.004	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 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 66.

IOPS Test Results File

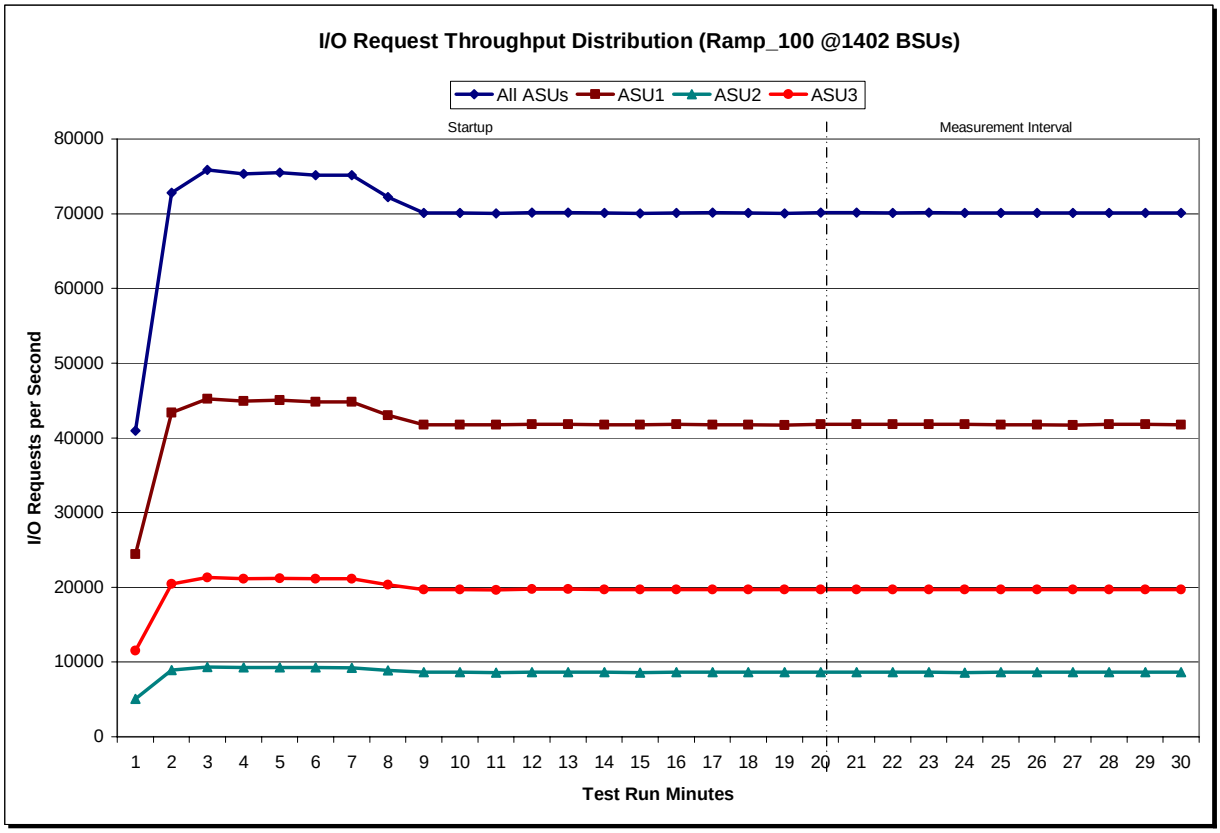
A link to the test results file generated from the IOPS Test Run is listed below.

IOPS Test Results File

IOPS Test Run – I/O Request Throughput Distribution Data

1402 BSUs	Start	Stop	Interval	Duration	*Measurement*	Start	Stop	Interval	Duration
Start-Up/Ramp-Up	18:08:00	18:27:58	0-19	0:19:58	*Interval*	18:27:58	18:37:58	20-29	0:10:00
60 second intervals	All ASUs	ASU1	ASU2	ASU3	60 second intervals	All ASUs	ASU1	ASU2	ASU3
0	40,955.90	24,412.63	5,043.32	11,499.95	20	70,126.20	41,796.23	8,614.90	19,715.07
1	72,784.25	43,364.35	8,948.42	20,471.48	21	70,112.83	41,802.60	8,617.63	19,692.60
2	75,827.20	45,209.48	9,327.03	21,290.68	22	70,124.63	41,816.85	8,631.18	19,676.60
3	75,323.17	44,897.55	9,262.12	21,163.50	23	70,110.60	41,801.15	8,610.15	19,699.30
4	75,506.43	45,011.63	9,277.32	21,217.48	24	70,077.23	41,736.47	8,615.47	19,725.30
5	75,181.60	44,817.45	9,247.23	21,116.92	25	70,078.63	41,762.83	8,616.70	19,699.10
6	75,160.92	44,816.77	9,235.05	21,109.10	26	70,073.85	41,719.90	8,642.50	19,711.45
7	72,211.80	43,037.77	8,869.30	20,304.73	27	70,105.53	41,805.20	8,614.25	19,686.08
8	70,097.83	41,783.37	8,634.20	19,680.27	28	70,121.92	41,795.10	8,616.00	19,710.82
9	70,087.80	41,747.98	8,615.83	19,723.98	29	70,091.28	41,739.68	8,644.72	19,706.88
10	70,047.00	41,776.55	8,610.15	19,660.30	***Average***	***70,102.27***	***41,777.60***	***8,622.35***	***19,702.32***
11	70,166.73	41,792.48	8,646.08	19,728.17					
12	70,141.37	41,786.25	8,627.95	19,727.17					
13	70,095.28	41,772.28	8,623.07	19,699.93					
14	70,063.88	41,776.58	8,608.82	19,678.48					
15	70,083.63	41,787.25	8,620.37	19,676.02					
16	70,124.27	41,784.87	8,627.03	19,712.37					
17	70,096.38	41,782.23	8,629.85	19,684.30					
18	70,058.18	41,709.52	8,633.70	19,714.97					
19	70,128.22	41,803.33	8,617.57	19,707.32					

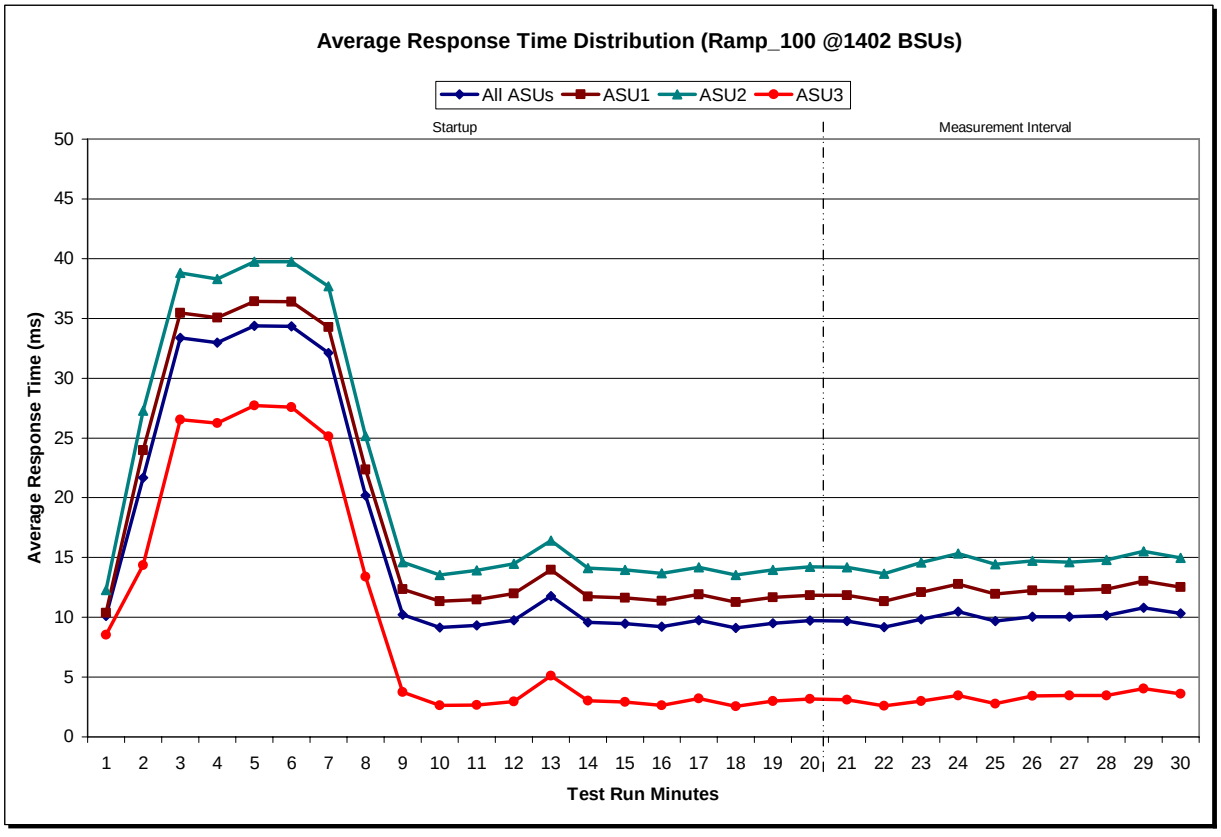
IOPS Test Run – I/O Request Throughput Distribution Graph



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

1402 BSUs	Start	Stop	Interval	Duration	Measurement	Start	Stop	Interval	Duration
Start-Up/Ramp-Up	18:08:00	18:27:58	0-19	0:19:58	*Interval*	18:27:58	18:37:58	20-29	0:10:00
60 second intervals	**All ASUs**	**ASU1**	**ASU2**	**ASU3**	**60 second intervals**	**All ASUs**	**ASU1**	**ASU2**	**ASU3**
0	10.10	10.38	12.28	8.53	**20**	9.67	11.84	14.18	3.10
1	21.68	23.96	27.30	14.38	**21**	9.17	11.34	13.63	2.60
2	33.37	35.46	38.81	26.54	**22**	9.83	12.08	14.57	2.97
3	32.97	35.04	38.31	26.25	**23**	10.46	12.76	15.34	3.44
4	34.39	36.43	39.75	27.72	**24**	9.69	11.97	14.44	2.78
5	34.33	36.40	39.75	27.59	**25**	10.06	12.23	14.71	3.41
6	32.12	34.26	37.69	25.12	**26**	10.05	12.22	14.62	3.46
7	20.19	22.37	25.17	13.38	**27**	10.16	12.36	14.78	3.46
8	10.21	12.36	14.61	3.73	**28**	10.81	13.04	15.53	4.04
9	9.16	11.33	13.54	2.64	**29**	10.32	12.53	14.99	3.60
10	9.31	11.49	13.94	2.65	***Average***	***10.02***	***12.24***	***14.68***	***3.29***
11	9.74	11.97	14.45	2.94					
12	11.77	13.96	16.42	5.10					
13	9.58	11.73	14.12	3.03					
14	9.47	11.63	13.98	2.92					
15	9.21	11.38	13.68	2.63					
16	9.74	11.91	14.20	3.20					
17	9.11	11.28	13.54	2.57					
18	9.51	11.67	13.96	2.99					
19	9.71	11.86	14.23	3.17					

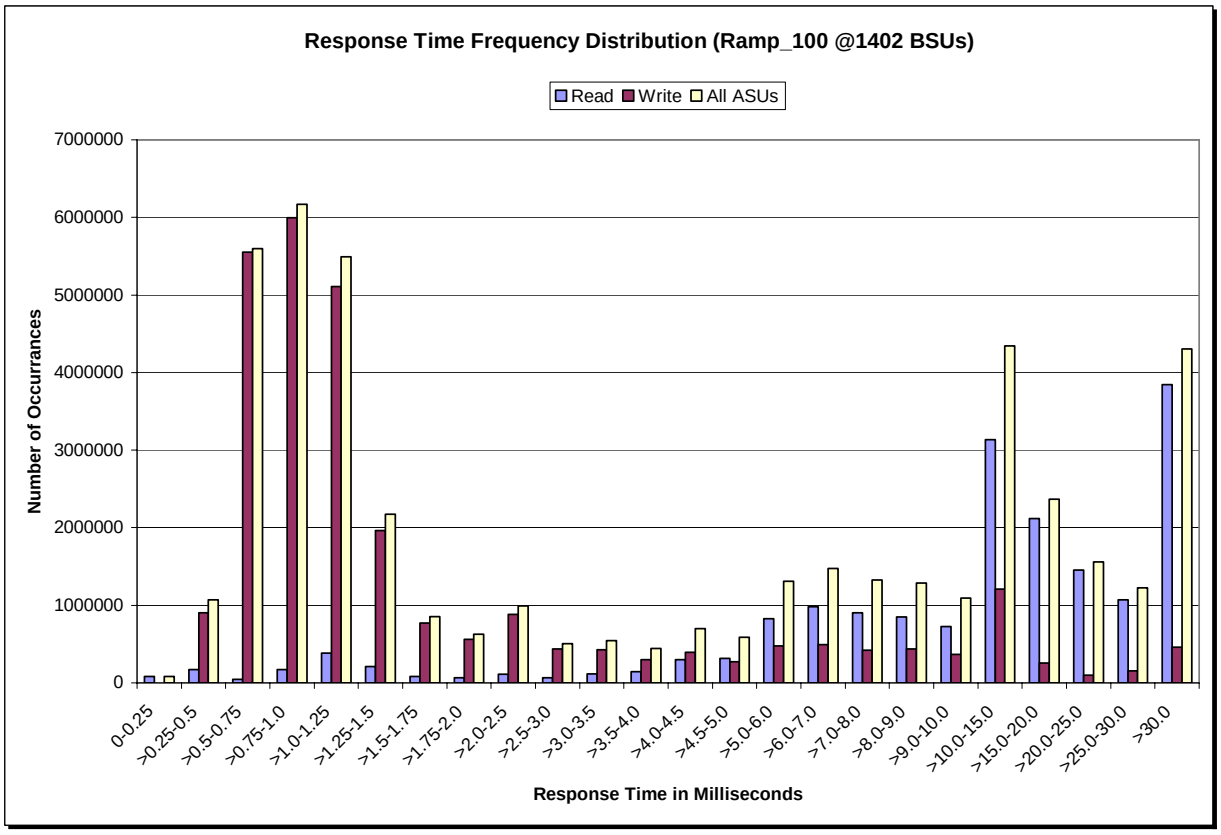
IOPS Test Run – Average Response Time (ms) Distribution Graph



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	85,596	169,637	44,118	171,157	384,533	210,462	84,037	65,053
Write	0	901,395	5,550,007	5,997,530	5,107,082	1,963,618	768,563	560,863
All ASUs	85,596	1,071,032	5,594,125	6,168,687	5,491,615	2,174,080	852,600	625,916
ASU1	80,504	593,295	2,636,695	2,788,820	2,380,219	922,020	370,882	276,293
ASU2	5,092	105,652	610,986	682,446	609,488	241,337	95,279	70,719
ASU3	0	372,085	2,346,444	2,697,421	2,501,908	1,010,723	386,439	278,904
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	112,362	66,409	116,050	144,914	301,165	318,306	828,573	984,302
Write	880,256	439,703	425,275	296,754	395,286	270,716	479,481	492,865
All ASUs	992,618	506,112	541,325	441,668	696,451	589,022	1,308,054	1,477,167
ASU1	451,063	241,934	283,682	257,566	440,779	403,699	947,105	1,085,844
ASU2	111,147	53,877	55,064	43,633	68,401	58,157	135,126	157,668
ASU3	430,408	210,301	202,579	140,469	187,271	127,166	225,823	233,655
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	903,478	850,195	728,736	3,134,318	2,116,701	1,454,567	1,073,255	3,844,141
Write	420,121	438,004	365,870	1,207,026	252,540	102,074	154,569	460,694
All ASUs	1,323,599	1,288,199	1,094,606	4,341,344	2,369,241	1,556,641	1,227,824	4,304,835
ASU1	976,799	933,293	796,248	3,263,824	1,935,528	1,282,691	967,622	3,168,185
ASU2	146,686	145,722	124,895	508,495	309,801	227,330	190,475	916,075
ASU3	200,114	209,184	173,463	569,025	123,912	46,620	69,727	220,575

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
46,122,357	41,817,522	4,304,835

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	0.2810	0.0700	0.2100	0.0180	0.0700	0.0350	0.2811
COV	0.003	0.001	0.002	0.001	0.003	0.002	0.003	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 66.

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 - 1402 BSUs	Start	Stop	Interval	Duration
Start-Up/Ramp-Up	18:08:00	18:27:58	0-19	0:19:58
Measurement Interval	18:27:58	18:37:58	20-29	0:10:00

(60 second intervals)	All ASUs	ASU-1	ASU-2	ASU-3
0	40,955.90	24,412.63	5,043.32	11,499.95
1	72,784.25	43,364.35	8,948.42	20,471.48
2	75,827.20	45,209.48	9,327.03	21,290.68
3	75,323.17	44,897.55	9,262.12	21,163.50
4	75,506.43	45,011.63	9,277.32	21,217.48
5	75,181.60	44,817.45	9,247.23	21,116.92
6	75,160.92	44,816.77	9,235.05	21,109.10
7	72,211.80	43,037.77	8,869.30	20,304.73
8	70,097.83	41,783.37	8,634.20	19,680.27
9	70,087.80	41,747.98	8,615.83	19,723.98
10	70,047.00	41,776.55	8,610.15	19,660.30
11	70,166.73	41,792.48	8,646.08	19,728.17
12	70,141.37	41,786.25	8,627.95	19,727.17
13	70,095.28	41,772.28	8,623.07	19,699.93
14	70,063.88	41,776.58	8,608.82	19,678.48
15	70,083.63	41,787.25	8,620.37	19,676.02
16	70,124.27	41,784.87	8,627.03	19,712.37
17	70,096.38	41,782.23	8,629.85	19,684.30
18	70,058.18	41,709.52	8,633.70	19,714.97
19	70,128.22	41,803.33	8,617.57	19,707.32
20	70,126.20	41,796.23	8,614.90	19,715.07
21	70,112.83	41,802.60	8,617.63	19,692.60
22	70,124.63	41,816.85	8,631.18	19,676.60
23	70,110.60	41,801.15	8,610.15	19,699.30
24	70,077.23	41,736.47	8,615.47	19,725.30
25	70,078.63	41,762.83	8,616.70	19,699.10
26	70,073.85	41,719.90	8,642.50	19,711.45
27	70,105.53	41,805.20	8,614.25	19,686.08
28	70,121.92	41,795.10	8,616.00	19,710.82
29	70,091.28	41,739.68	8,644.72	19,706.88
Average	70,102.27	41,777.60	8,622.35	19,702.32

95% Load Level - 1331 BSUs	Start	Stop	Interval	Duration
Start-Up/Ramp-Up	19:43:07	20:03:06	0-19	0:19:59
Measurement Interval	20:03:06	20:13:06	20-29	0:10:00

(60 second intervals)	All ASUs	ASU-1	ASU-2	ASU-3
0	20,816.48	12,411.48	2,562.00	5,843.00
1	53,093.70	31,672.28	6,497.70	14,923.72
2	76,351.78	45,511.15	9,400.40	21,440.23
3	77,055.67	45,935.45	9,475.75	21,644.47
4	73,487.42	43,782.82	9,054.67	20,649.93
5	75,820.63	45,188.53	9,325.30	21,306.80
6	76,016.98	45,299.70	9,345.20	21,372.08
7	73,788.28	43,958.28	9,085.08	20,744.92
8	76,009.17	45,308.05	9,338.48	21,362.63
9	67,115.28	39,972.72	8,275.98	18,866.58
10	66,543.35	39,688.53	8,189.20	18,665.62
11	66,549.33	39,664.70	8,194.77	18,689.87
12	66,518.93	39,616.90	8,175.65	18,726.38
13	66,591.60	39,703.77	8,194.60	18,693.23
14	66,580.33	39,712.33	8,184.47	18,683.53
15	66,482.50	39,612.13	8,163.32	18,707.05
16	66,502.10	39,645.23	8,155.37	18,701.50
17	66,583.45	39,705.62	8,190.93	18,686.90
18	66,545.63	39,652.15	8,186.27	18,707.22
19	66,574.62	39,687.47	8,186.68	18,700.47
20	66,559.20	39,669.28	8,197.17	18,692.75
21	66,567.37	39,675.47	8,187.30	18,704.60
22	66,552.62	39,676.07	8,183.98	18,692.57
23	66,519.45	39,630.93	8,180.13	18,708.38
24	66,580.15	39,669.02	8,210.65	18,700.48
25	66,559.23	39,675.28	8,195.88	18,688.07
26	66,530.53	39,667.40	8,167.77	18,695.37
27	66,557.08	39,661.87	8,186.12	18,709.10
28	66,492.90	39,607.47	8,179.12	18,706.32
29	66,599.12	39,667.37	8,203.20	18,728.55
Average	66,551.77	39,660.02	8,189.13	18,702.62

90% Load Level - 1261 BSUs	Start	Stop	Interval	Duration
Start-Up/Ramp-Up	21:23:38	21:43:39	0-19	0:20:01
Measurement Interval	21:43:39	21:53:39	20-29	0:10:00

(60 second intervals)	All ASUs	ASU-1	ASU-2	ASU-3
0	18,412.12	10,992.48	2,257.58	5,162.05
1	63,444.27	37,833.27	7,801.05	17,809.95
2	30,530.67	18,209.52	3,749.62	8,571.53
3	64,538.12	38,469.55	7,952.48	18,116.08
4	74,473.75	44,368.13	9,172.48	20,933.13
5	76,441.08	45,584.77	9,398.95	21,457.37
6	73,869.17	44,017.58	9,083.57	20,768.02
7	75,934.87	45,270.25	9,361.98	21,302.63
8	76,094.28	45,339.92	9,352.08	21,402.28
9	75,420.95	44,934.40	9,273.55	21,213.00
10	70,309.72	41,906.97	8,661.53	19,741.22
11	63,041.48	37,593.55	7,742.83	17,705.10
12	63,080.77	37,576.42	7,785.17	17,719.18
13	63,054.42	37,577.88	7,749.02	17,727.52
14	63,103.62	37,598.03	7,757.17	17,748.42
15	62,981.72	37,527.82	7,754.42	17,699.48
16	63,071.60	37,617.93	7,760.78	17,692.88
17	63,060.30	37,576.58	7,770.83	17,712.88
18	63,039.85	37,551.37	7,766.82	17,721.67
19	63,013.63	37,561.77	7,738.68	17,713.18
20	63,046.67	37,536.50	7,771.85	17,738.32
21	63,002.87	37,533.75	7,737.73	17,731.38
22	63,035.13	37,553.07	7,755.72	17,726.35
23	62,976.50	37,528.97	7,739.37	17,708.17
24	63,038.17	37,594.25	7,738.87	17,705.05
25	63,052.75	37,579.33	7,745.25	17,728.17
26	63,009.75	37,558.13	7,760.07	17,691.55
27	63,010.82	37,564.78	7,753.43	17,692.60
28	63,072.60	37,589.32	7,763.55	17,719.73
29	63,108.08	37,645.40	7,759.75	17,702.93
Average	63,035.33	37,568.35	7,752.56	17,714.43

80% Load Level - 1121 BSUs	Start	Stop	Interval	Duration
Start-Up/Ramp-Up	22:30:42	22:50:43	0-19	0:20:01
Measurement Interval	22:50:43	23:00:43	20-29	0:10:00

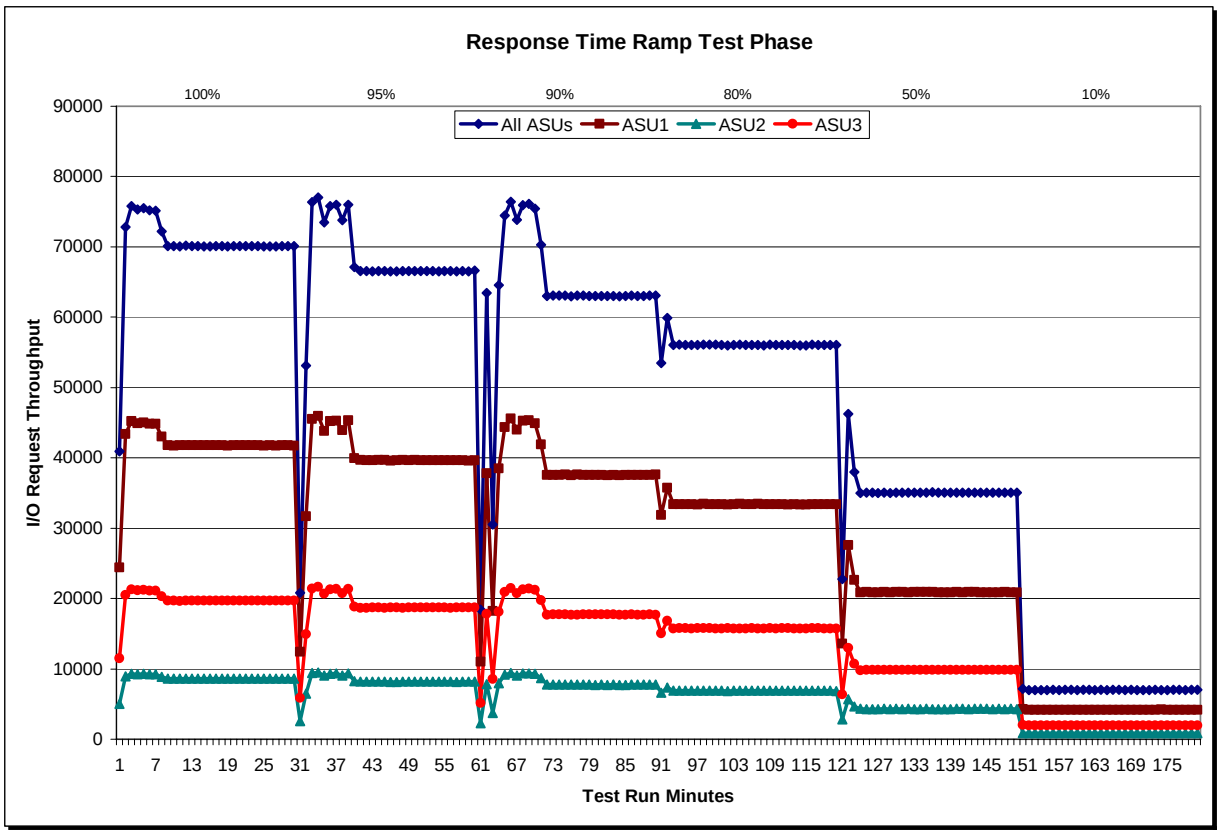
(60 second intervals)	All ASUs	ASU-1	ASU-2	ASU-3
0	53,501.10	31,890.53	6,586.07	15,024.50
1	59,897.60	35,712.72	7,362.78	16,822.10
2	56,040.80	33,391.72	6,903.90	15,745.18
3	56,110.48	33,428.63	6,906.27	15,775.58
4	56,066.52	33,402.58	6,901.22	15,762.72
5	56,016.63	33,383.83	6,891.68	15,741.12
6	56,040.22	33,355.38	6,887.82	15,797.02
7	56,106.15	33,456.52	6,891.18	15,758.45
8	56,095.72	33,425.87	6,906.28	15,763.57
9	56,076.07	33,419.33	6,904.32	15,752.42
10	56,054.77	33,425.78	6,891.13	15,737.85
11	55,960.85	33,338.62	6,865.62	15,756.62
12	56,053.00	33,403.47	6,897.63	15,751.90
13	56,082.10	33,437.73	6,911.17	15,733.20
14	56,033.78	33,409.30	6,892.32	15,732.17
15	56,035.57	33,390.78	6,887.18	15,757.60
16	56,067.38	33,438.37	6,891.38	15,737.63
17	56,004.38	33,379.45	6,891.30	15,733.63
18	56,089.60	33,412.60	6,904.82	15,772.18
19	56,050.08	33,420.32	6,884.35	15,745.42
20	56,070.07	33,408.35	6,896.35	15,765.37
21	56,059.85	33,372.55	6,912.05	15,775.25
22	56,068.45	33,423.37	6,903.98	15,741.10
23	55,980.12	33,353.32	6,891.12	15,735.68
24	55,978.50	33,363.37	6,883.62	15,731.52
25	56,089.10	33,427.73	6,888.85	15,772.52
26	56,040.38	33,391.52	6,890.97	15,757.90
27	56,028.98	33,408.05	6,890.63	15,730.30
28	56,029.68	33,407.17	6,890.07	15,732.45
29	56,022.85	33,414.13	6,878.02	15,730.70
Average	56,036.80	33,396.96	6,892.57	15,747.28

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

50% Load Level - 701 BSUs	Start	Stop	Interval	Duration
Start-Up/Ramp-Up	23:59:21	0:19:20	0-19	0:19:59
Measurement Interval	0:19:20	0:29:20	20-29	0:10:00
(60 second intervals)	All ASUs	ASU-1	ASU-2	ASU-3
0	22,756.02	13,569.47	2,801.30	6,385.25
1	46,256.27	27,576.58	5,687.32	12,992.37
2	38,011.67	22,651.73	4,670.83	10,689.10
3	35,020.82	20,887.20	4,321.30	9,812.32
4	35,058.32	20,901.17	4,301.35	9,855.80
5	35,045.57	20,893.45	4,312.13	9,839.98
6	35,000.13	20,863.13	4,312.25	9,824.75
7	35,070.47	20,895.20	4,322.47	9,852.80
8	35,017.38	20,882.17	4,310.70	9,824.52
9	35,057.35	20,894.73	4,319.08	9,843.53
10	35,043.32	20,897.50	4,306.47	9,839.35
11	35,044.78	20,880.17	4,315.33	9,849.28
12	35,073.88	20,898.63	4,301.12	9,874.13
13	35,084.12	20,909.70	4,309.98	9,864.43
14	35,077.60	20,913.03	4,317.93	9,846.63
15	35,095.80	20,944.95	4,312.93	9,837.92
16	35,035.83	20,880.78	4,309.08	9,845.97
17	35,036.07	20,885.03	4,311.73	9,839.30
18	35,045.07	20,878.58	4,310.55	9,855.93
19	35,073.90	20,912.47	4,316.08	9,845.35
20	35,047.40	20,866.08	4,317.72	9,863.60
21	35,068.13	20,912.92	4,312.07	9,843.15
22	35,065.62	20,903.25	4,316.77	9,845.60
23	35,042.15	20,874.00	4,320.57	9,847.58
24	35,037.05	20,883.28	4,315.55	9,838.22
25	35,043.28	20,883.37	4,309.63	9,850.28
26	35,034.93	20,889.73	4,316.27	9,828.93
27	35,065.08	20,896.50	4,311.15	9,857.43
28	35,050.95	20,870.13	4,318.37	9,862.45
29	35,046.87	20,893.37	4,312.18	9,841.32
Average	35,050.15	20,887.26	4,315.03	9,847.86

10% Load Level - 140 BSUs	Start	Stop	Interval	Duration
Start-Up/Ramp-Up	1:50:09	2:10:10	0-19	0:20:01
Measurement Interval	2:10:10	2:20:10	20-29	0:10:00
(60 second intervals)	All ASUs	ASU-1	ASU-2	ASU-3
0	7,131.82	4,256.85	871.05	2,003.92
1	7,005.43	4,175.58	867.30	1,962.55
2	7,001.23	4,166.07	857.85	1,977.32
3	7,004.88	4,171.23	864.93	1,968.72
4	6,993.42	4,162.43	860.20	1,970.78
5	7,008.52	4,174.03	863.85	1,970.63
6	6,976.12	4,162.32	852.38	1,961.42
7	7,007.42	4,172.92	867.37	1,967.13
8	7,025.20	4,182.12	867.18	1,975.90
9	7,000.70	4,163.45	860.78	1,976.47
10	7,009.68	4,180.80	862.83	1,966.05
11	7,017.77	4,183.57	860.57	1,973.63
12	6,983.68	4,161.65	856.93	1,965.10
13	7,010.48	4,174.38	863.10	1,973.00
14	7,000.10	4,176.43	868.75	1,954.92
15	7,013.73	4,177.52	858.22	1,978.00
16	7,012.35	4,185.90	862.37	1,964.08
17	7,002.68	4,174.37	860.97	1,967.35
18	7,006.77	4,169.80	868.48	1,968.48
19	6,998.78	4,172.98	865.07	1,960.73
20	6,998.73	4,172.08	858.47	1,968.18
21	7,003.23	4,176.23	864.12	1,962.88
22	7,013.02	4,180.60	858.40	1,974.02
23	7,004.63	4,191.88	855.78	1,956.97
24	6,991.47	4,166.70	867.35	1,957.42
25	7,008.32	4,187.03	862.35	1,958.93
26	7,013.68	4,180.77	857.82	1,975.10
27	6,983.78	4,157.82	862.13	1,963.83
28	7,019.22	4,182.42	864.75	1,972.05
29	7,010.75	4,171.25	859.03	1,980.47
Average	7,004.68	4,176.68	861.02	1,966.99

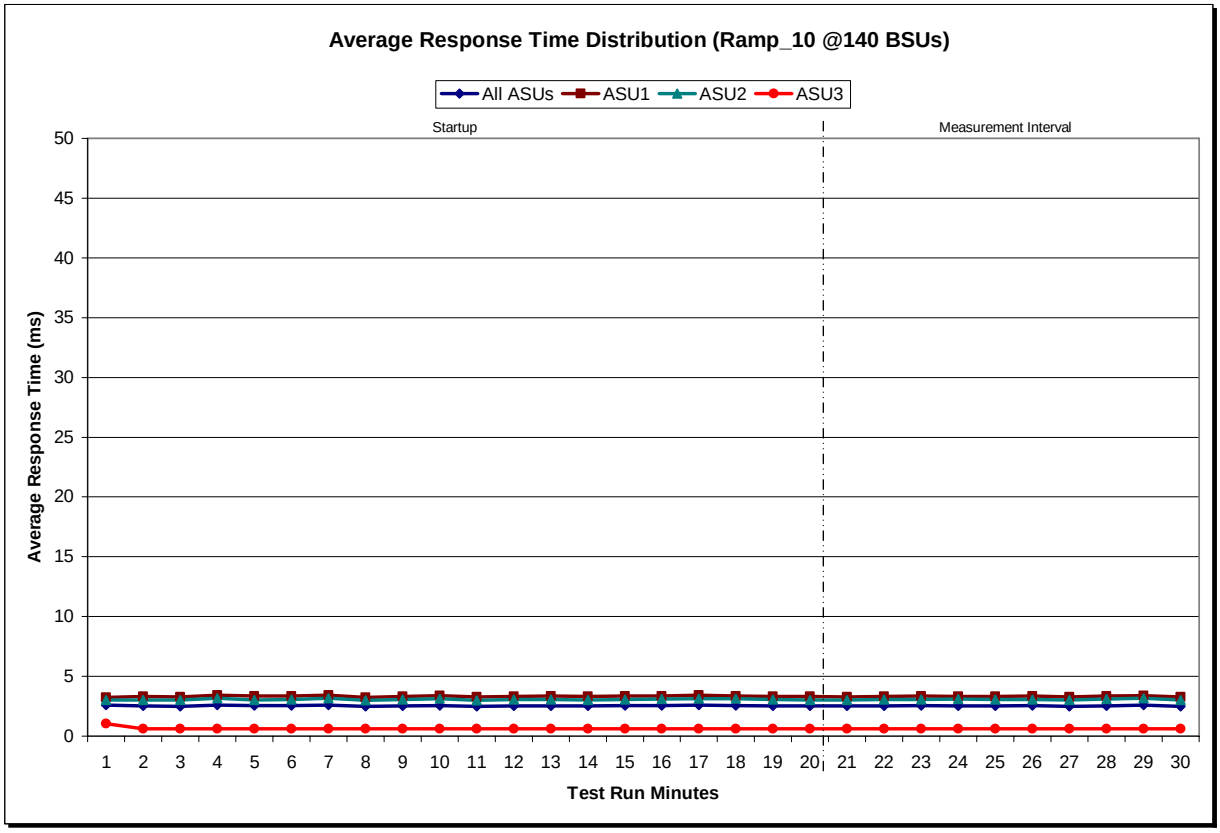
Response Time Ramp Distribution (IOPS) Graph



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

140 BSUs *Start-Up/Ramp-Up*	Start 1:50:09	Stop 2:10:10	Interval 0-19	Duration 0:20:01	*Measurement Interval*	Start 2:10:10	Stop 2:20:10	Interval 20-29	Duration 0:10:00
60 second intervals	**All ASUs**	**ASU1**	**ASU2**	**ASU3**	**60 second intervals**	**All ASUs**	**ASU1**	**ASU2**	**ASU3**
0	2.61	3.25	3.04	1.05	**20**	2.51	3.29	3.04	0.61
1	2.52	3.32	3.02	0.61	**21**	2.51	3.30	3.05	0.61
2	2.50	3.29	3.03	0.60	**22**	2.54	3.34	3.06	0.61
3	2.61	3.43	3.17	0.62	**23**	2.52	3.30	3.08	0.61
4	2.54	3.35	3.04	0.60	**24**	2.53	3.31	3.06	0.61
5	2.55	3.36	3.08	0.61	**25**	2.54	3.33	3.06	0.61
6	2.61	3.43	3.17	0.62	**26**	2.50	3.28	3.04	0.61
7	2.47	3.24	2.98	0.60	**27**	2.53	3.33	3.09	0.61
8	2.53	3.32	3.07	0.62	**28**	2.59	3.40	3.17	0.62
9	2.56	3.37	3.12	0.62	**29**	2.49	3.27	3.04	0.60
10	2.49	3.27	3.00	0.60	***Average***	***2.53***	***3.32***	***3.07***	***0.61***
11	2.53	3.33	3.07	0.61					
12	2.53	3.33	3.06	0.61					
13	2.51	3.30	3.02	0.61					
14	2.55	3.34	3.08	0.62					
15	2.54	3.33	3.10	0.62					
16	2.59	3.40	3.11	0.61					
17	2.55	3.34	3.12	0.62					
18	2.52	3.31	3.06	0.61					
19	2.53	3.32	3.04	0.61					

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	0.2813	0.0702	0.2098	0.0179	0.0700	0.0350	0.2808
COV	0.009	0.002	0.004	0.003	0.010	0.009	0.007	0.004

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 66.

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	***70,102.27***
Repeatability Test Phase 1	70,095.88
Repeatability Test Phase 2	70,095.18

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	***2.53 ms***
Repeatability Test Phase 1	2.52 ms
Repeatability Test Phase 2	2.53 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)..

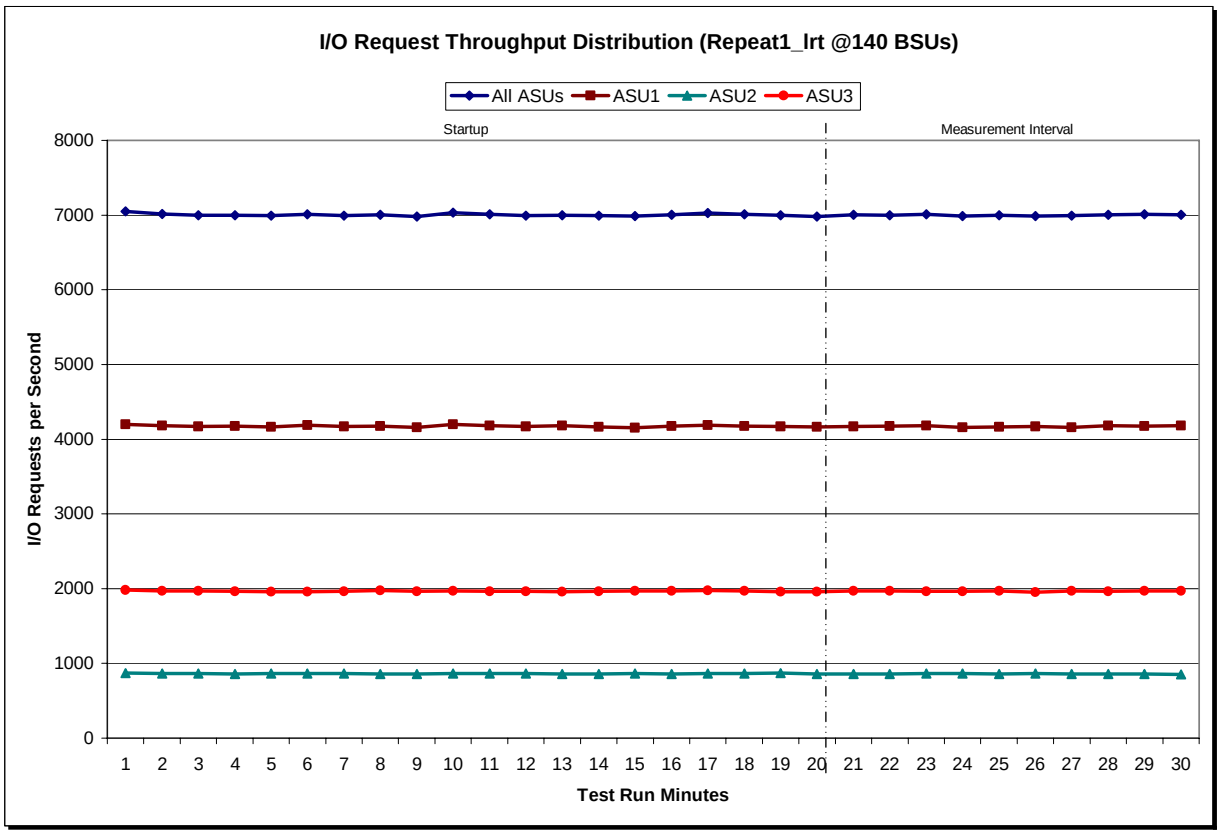
A link to the test result file generated from each Repeatability Test Run is listed below.

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

140 BSUs *Start-Up/Ramp-Up*	Start 2:23:22	Stop 2:43:21	Interval 0-19	Duration 0:19:59	*Measurement Interval*	Start 2:43:21	Stop 2:53:21	Interval 20-29	Duration 0:10:00
60 second intervals	All ASUs	ASU1	ASU2	ASU3	60 second intervals	All ASUs	ASU1	ASU2	ASU3
0	7,048.87	4,201.40	867.52	1,979.95	20	7,000.88	4,169.82	860.67	1,970.40
1	7,017.75	4,184.02	865.12	1,968.62	21	7,000.38	4,172.87	856.72	1,970.80
2	7,000.48	4,171.12	861.58	1,967.78	22	7,011.15	4,183.95	863.47	1,963.73
3	6,997.27	4,174.62	858.50	1,964.15	23	6,988.33	4,159.07	862.60	1,966.67
4	6,989.95	4,165.25	864.30	1,960.40	24	6,997.82	4,165.72	860.55	1,971.55
5	7,010.63	4,189.35	863.68	1,957.60	25	6,985.52	4,170.37	863.57	1,951.58
6	6,992.98	4,167.40	861.43	1,964.15	26	6,990.48	4,157.97	861.05	1,971.47
7	7,003.08	4,173.58	856.33	1,973.17	27	7,001.67	4,179.15	859.48	1,963.03
8	6,983.38	4,159.55	857.88	1,965.95	28	7,007.80	4,178.07	860.13	1,969.60
9	7,029.60	4,196.80	861.85	1,970.95	29	7,004.40	4,180.82	854.68	1,968.90
10	7,010.88	4,178.77	866.05	1,966.07	*Average*	***6,998.84***	***4,171.78***	***860.29***	***1,966.77***
11	6,993.13	4,168.22	862.73	1,962.18					
12	6,997.93	4,180.93	856.63	1,960.37					
13	6,990.22	4,166.73	858.40	1,965.08					
14	6,986.07	4,150.82	864.78	1,970.47					
15	7,004.80	4,177.27	858.42	1,969.12					
16	7,024.25	4,184.33	865.93	1,973.98					
17	7,010.03	4,176.03	865.60	1,968.40					
18	6,997.63	4,168.73	869.33	1,959.57					
19	6,980.68	4,166.02	857.10	1,957.57					

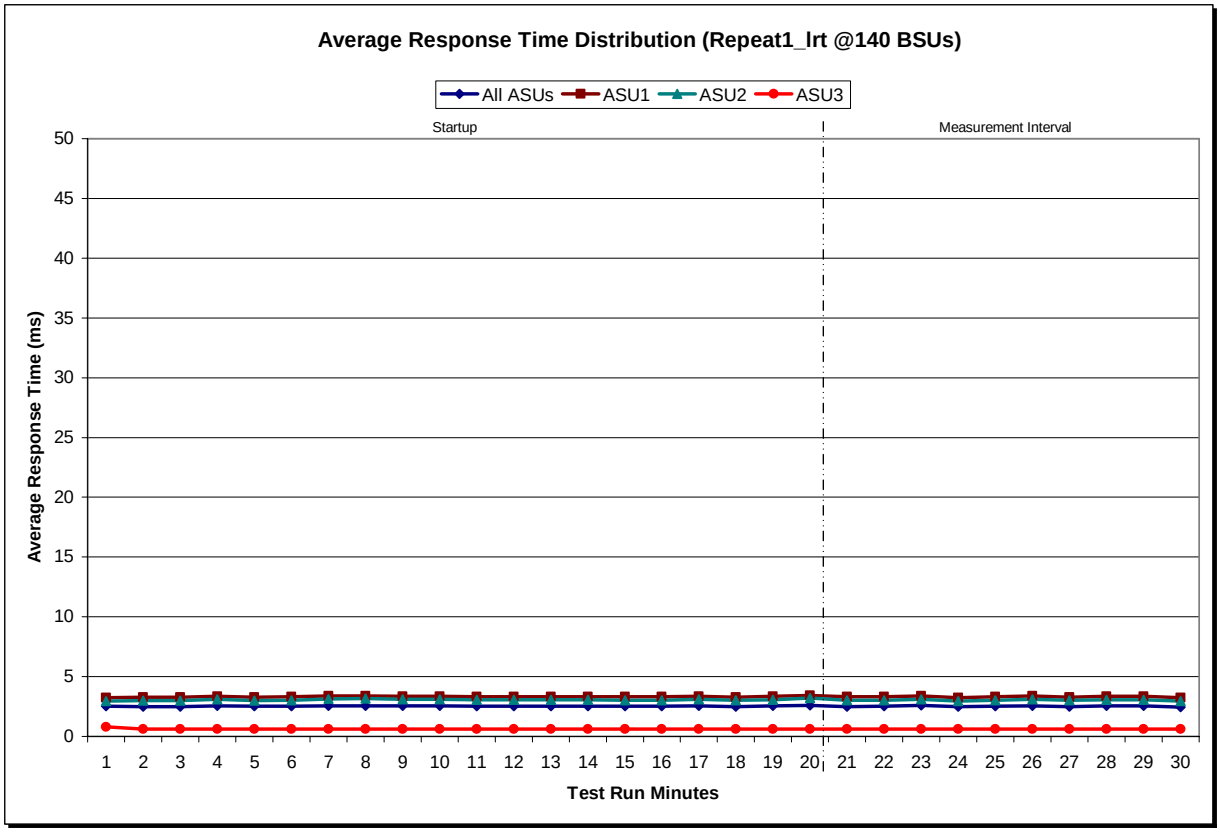
Repeatability 1 LRT – I/O Request Throughput Distribution Graph



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

140 BSUs	Start	Stop	Interval	Duration	*Measurement*	Start	Stop	Interval	Duration
Start-Up/Ramp-Up	2:23:22	2:43:21	0-19	0:19:59	*Interval*	2:43:21	2:53:21	20-29	0:10:00
60 second intervals	**All ASUs**	**ASU1**	**ASU2**	**ASU3**	**60 second intervals**	**All ASUs**	**ASU1**	**ASU2**	**ASU3**
0	2.51	3.23	2.96	0.80	**20**	2.50	3.29	3.02	0.59
1	2.50	3.29	2.99	0.61	**21**	2.51	3.31	3.01	0.61
2	2.50	3.29	2.99	0.61	**22**	2.58	3.39	3.11	0.61
3	2.55	3.35	3.09	0.61	**23**	2.47	3.24	2.96	0.61
4	2.51	3.29	3.00	0.62	**24**	2.52	3.32	3.04	0.61
5	2.52	3.30	3.03	0.61	**25**	2.57	3.37	3.09	0.62
6	2.57	3.38	3.12	0.61	**26**	2.49	3.28	3.01	0.60
7	2.57	3.37	3.16	0.61	**27**	2.54	3.34	3.05	0.62
8	2.54	3.35	3.08	0.61	**28**	2.54	3.34	3.06	0.61
9	2.54	3.33	3.08	0.61	**29**	2.45	3.22	2.95	0.60
10	2.52	3.31	3.05	0.61	***Average***	***2.52***	***3.31***	***3.03***	***0.61***
11	2.52	3.32	3.05	0.61					
12	2.53	3.33	3.05	0.61					
13	2.53	3.32	3.07	0.61					
14	2.51	3.31	3.02	0.61					
15	2.52	3.32	3.01	0.61					
16	2.56	3.36	3.09	0.63					
17	2.49	3.28	3.01	0.60					
18	2.54	3.34	3.06	0.61					
19	2.61	3.42	3.19	0.62					

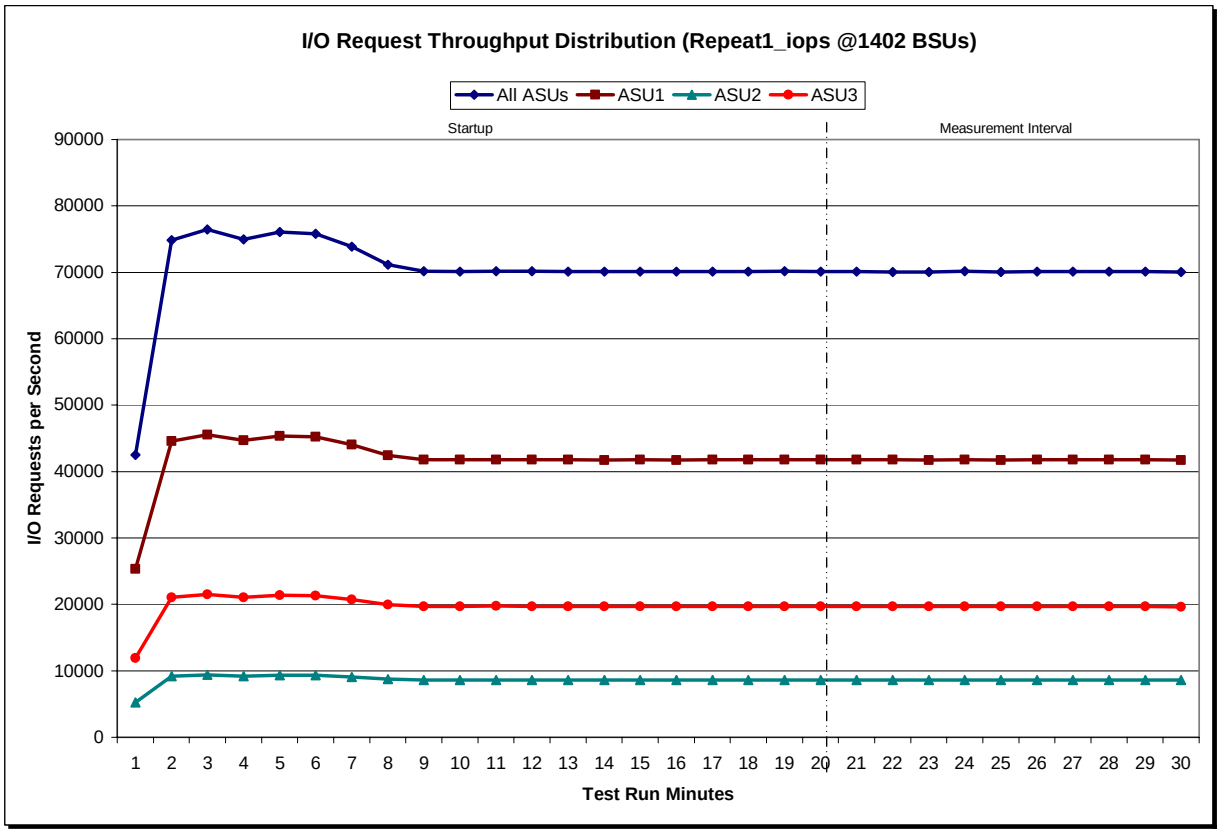
Repeatability 1 LRT –Average Response Time (ms) Distribution Graph



Repeatability 1 IOPS – I/O Request Throughput Distribution Data

1402 BSUs *Start-Up/Ramp-Up*	Start 3:10:37	Stop 3:30:37	Interval 0-19	Duration 0:20:00	*Measurement Interval*	Start 3:30:37	Stop 3:40:37	Interval 20-29	Duration 0:10:00
60 second intervals	All ASUs	ASU1	ASU2	ASU3	60 second intervals	All ASUs	ASU1	ASU2	ASU3
0	42,476.40	25,308.95	5,234.25	11,933.20	20	70,123.98	41,806.15	8,618.50	19,699.33
1	74,862.65	44,588.73	9,215.85	21,058.07	21	70,069.40	41,760.85	8,625.18	19,683.37
2	76,459.23	45,568.30	9,401.48	21,489.45	22	70,038.27	41,703.03	8,630.65	19,704.58
3	74,966.53	44,689.93	9,204.82	21,071.78	23	70,152.68	41,794.85	8,649.38	19,708.45
4	76,089.02	45,343.63	9,353.92	21,391.47	24	70,051.57	41,734.37	8,626.07	19,691.13
5	75,806.88	45,200.10	9,306.20	21,300.58	25	70,130.93	41,796.90	8,626.40	19,707.63
6	73,865.08	44,039.60	9,076.18	20,749.30	26	70,133.40	41,792.38	8,644.25	19,696.77
7	71,113.07	42,409.30	8,732.65	19,971.12	27	70,078.00	41,770.30	8,613.63	19,694.07
8	70,145.15	41,790.02	8,637.28	19,717.85	28	70,125.85	41,794.85	8,622.28	19,708.72
9	70,088.18	41,774.92	8,619.20	19,694.07	29	70,054.68	41,757.33	8,637.08	19,660.27
10	70,141.20	41,798.03	8,609.42	19,733.75	***Average***	***70,095.88***	***41,771.10***	***8,629.34***	***19,695.43***
11	70,160.10	41,794.68	8,639.02	19,726.40					
12	70,087.57	41,762.20	8,622.85	19,702.52					
13	70,076.13	41,751.95	8,643.35	19,680.83					
14	70,079.97	41,773.03	8,625.07	19,681.87					
15	70,076.53	41,741.93	8,643.28	19,691.32					
16	70,117.37	41,812.68	8,610.83	19,693.85					
17	70,130.35	41,793.93	8,620.37	19,716.05					
18	70,140.83	41,784.60	8,636.42	19,719.82					
19	70,096.88	41,814.82	8,614.13	19,667.93					

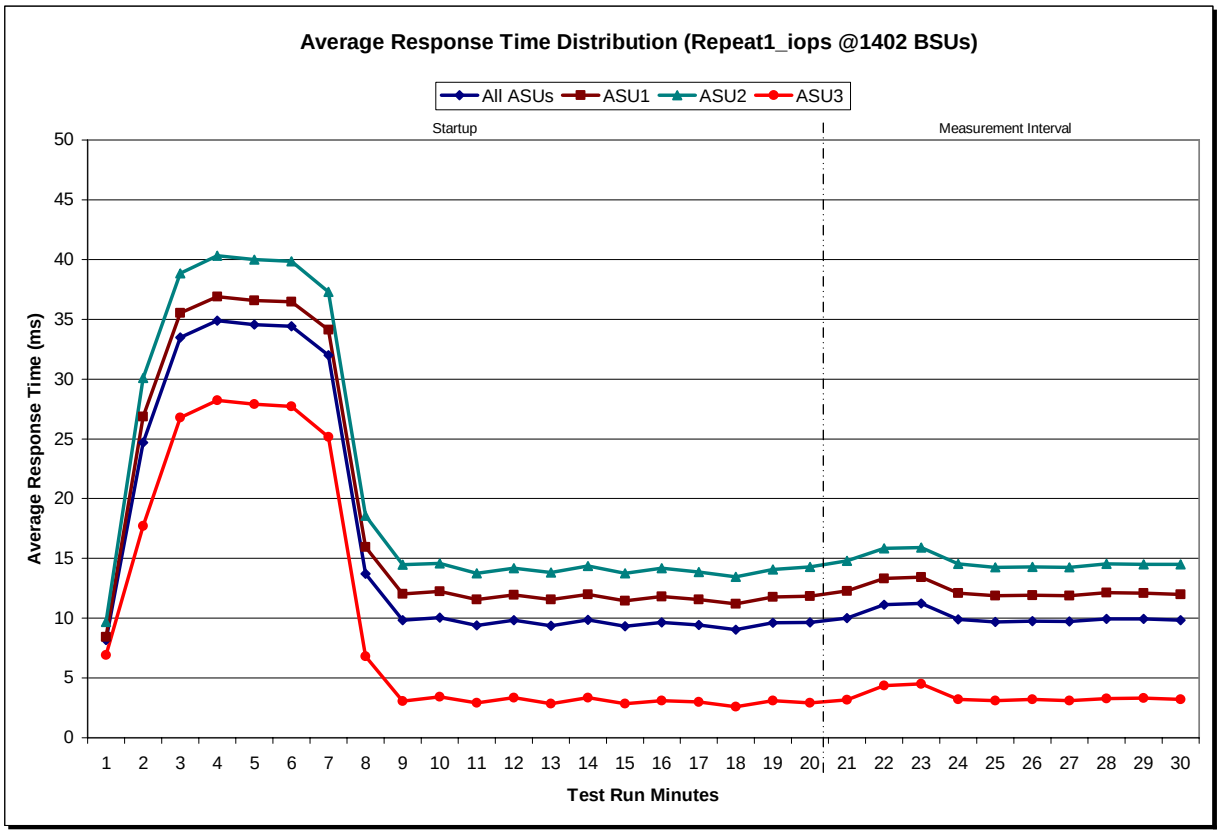
Repeatability 1 IOPS – I/O Request Throughput Distribution Graph



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

1402 BSUs	Start	Stop	Interval	Duration	*Measurement*	Start	Stop	Interval	Duration
Start-Up/Ramp-Up	3:10:37	3:30:37	0-19	0:20:00	*Interval*	3:30:37	3:40:37	20-29	0:10:00
60 second intervals	All ASUs	ASU1	ASU2	ASU3	60 second intervals	All ASUs	ASU1	ASU2	ASU3
0	8.16	8.41	9.70	6.93	20	10.02	12.26	14.80	3.19
1	24.68	26.84	30.10	17.71	21	11.12	13.33	15.84	4.35
2	33.49	35.54	38.85	26.78	22	11.21	13.42	15.89	4.50
3	34.88	36.90	40.32	28.22	23	9.89	12.08	14.55	3.20
4	34.56	36.58	40.00	27.89	24	9.69	11.87	14.24	3.09
5	34.42	36.46	39.86	27.73	25	9.75	11.90	14.30	3.21
6	32.00	34.13	37.28	25.17	26	9.71	11.89	14.26	3.10
7	13.70	15.94	18.58	6.81	27	9.94	12.13	14.55	3.28
8	9.81	12.03	14.49	3.05	28	9.93	12.10	14.49	3.33
9	10.04	12.23	14.56	3.44	29	9.84	12.00	14.49	3.21
10	9.39	11.54	13.77	2.93	***Average***	***10.11***	***12.30***	***14.74***	***3.45***
11	9.82	11.96	14.18	3.36					
12	9.38	11.54	13.80	2.85					
13	9.86	11.99	14.38	3.34					
14	9.32	11.46	13.73	2.84					
15	9.66	11.82	14.17	3.10					
16	9.44	11.57	13.87	2.98					
17	9.05	11.19	13.48	2.57					
18	9.62	11.77	14.07	3.10					
19	9.63	11.83	14.29	2.91					

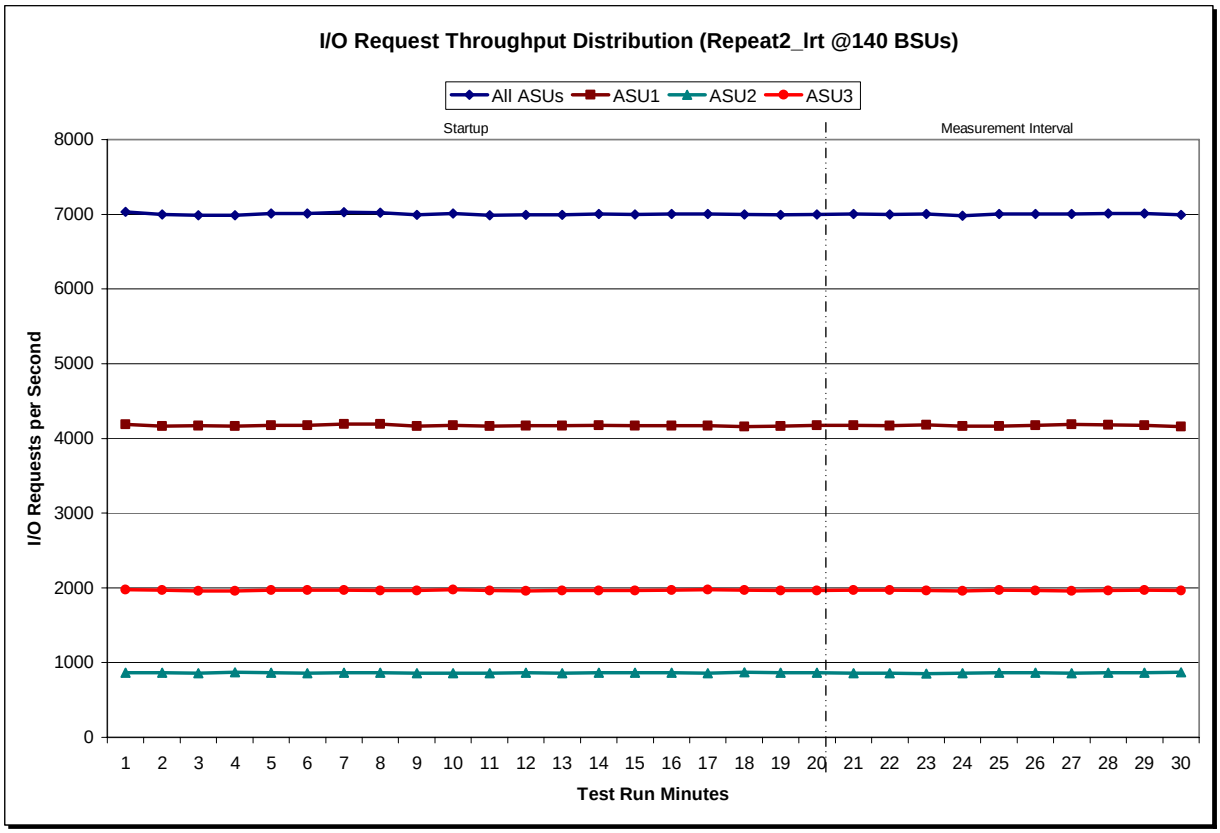
Repeatability 1 IOPS –Average Response Time (ms) Distribution Graph



Repeatability 2 LRT – I/O Request Throughput Distribution Data

140 BSUs *Start-Up/Ramp-Up*	Start 3:42:45	Stop 4:02:42	Interval 0-19	Duration 0:19:57	*Measurement Interval*	Start 4:02:42	Stop 4:12:42	Interval 20-29	Duration 0:10:00
60 second intervals	**All ASUs**	**ASU1**	**ASU2**	**ASU3**	**60 second intervals**	**All ASUs**	**ASU1**	**ASU2**	**ASU3**
0	7,031.00	4,189.65	862.98	1,978.37	**20**	7,001.83	4,173.78	859.27	1,968.78
1	6,997.38	4,162.78	863.92	1,970.68	**21**	6,997.63	4,169.37	856.88	1,971.38
2	6,987.68	4,169.92	860.55	1,957.22	**22**	7,001.97	4,184.00	854.93	1,963.03
3	6,988.10	4,163.83	867.12	1,957.15	**23**	6,979.45	4,164.03	856.67	1,958.75
4	7,008.75	4,176.85	861.47	1,970.43	**24**	7,003.12	4,164.72	866.75	1,971.65
5	7,008.67	4,177.85	860.03	1,970.78	**25**	7,004.57	4,177.45	862.65	1,964.47
6	7,024.15	4,193.38	862.85	1,967.92	**26**	7,002.80	4,187.32	855.72	1,959.77
7	7,018.83	4,191.38	864.37	1,963.08	**27**	7,009.28	4,180.65	865.77	1,962.87
8	6,989.60	4,165.90	860.40	1,963.30	**28**	7,008.95	4,173.78	866.00	1,969.17
9	7,011.85	4,174.77	858.88	1,978.20	**29**	6,990.80	4,158.03	868.43	1,964.33
10	6,986.13	4,166.40	857.98	1,961.75	***Average***	***7,000.04***	***4,173.31***	***861.31***	***1,965.42***
11	6,992.50	4,169.27	862.63	1,960.60					
12	6,991.30	4,167.05	860.32	1,963.93					
13	7,001.65	4,176.15	862.48	1,963.02					
14	7,000.65	4,170.90	864.78	1,964.97					
15	7,006.37	4,172.18	866.27	1,967.92					
16	7,005.53	4,169.83	861.05	1,974.65					
17	6,995.00	4,156.72	866.88	1,971.40					
18	6,993.65	4,163.92	863.72	1,966.02					
19	6,999.10	4,172.82	863.90	1,962.38					

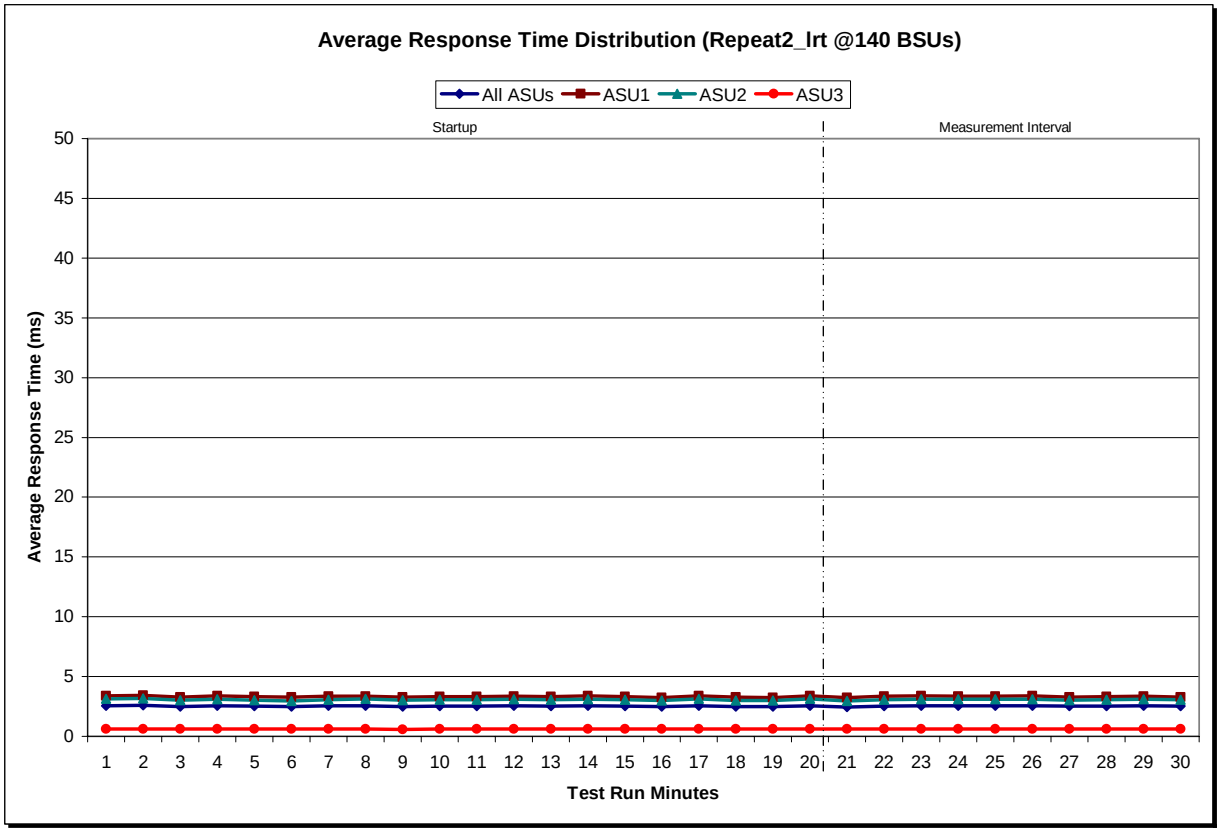
Repeatability 2 LRT – I/O Request Throughput Distribution Graph



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

140 BSUs	Start	Stop	Interval	Duration	*Measurement*	Start	Stop	Interval	Duration
Start-Up/Ramp-Up	3:42:45	4:02:42	0-19	0:19:57	*Interval*	4:02:42	4:12:42	20-29	0:10:00
60 second intervals	**All ASUs**	**ASU1**	**ASU2**	**ASU3**	**60 second intervals**	**All ASUs**	**ASU1**	**ASU2**	**ASU3**
0	2.57	3.38	3.13	0.61	**20**	2.45	3.22	2.94	0.60
1	2.59	3.41	3.18	0.61	**21**	2.53	3.33	3.06	0.62
2	2.49	3.26	3.01	0.60	**22**	2.56	3.37	3.08	0.61
3	2.56	3.37	3.09	0.62	**23**	2.54	3.34	3.09	0.62
4	2.51	3.30	3.03	0.61	**24**	2.56	3.36	3.11	0.61
5	2.48	3.26	2.97	0.60	**25**	2.57	3.38	3.10	0.61
6	2.55	3.35	3.06	0.62	**26**	2.51	3.29	3.01	0.61
7	2.56	3.35	3.13	0.60	**27**	2.52	3.30	3.06	0.60
8	2.49	3.28	3.01	0.59	**28**	2.56	3.36	3.10	0.62
9	2.52	3.31	3.05	0.61	**29**	2.50	3.29	3.04	0.61
10	2.52	3.30	3.05	0.61	***Average***	***2.53***	***3.32***	***3.06***	***0.61***
11	2.55	3.36	3.10	0.61					
12	2.53	3.33	3.05	0.60					
13	2.57	3.38	3.09	0.62					
14	2.51	3.30	3.04	0.61					
15	2.47	3.25	2.99	0.60					
16	2.56	3.37	3.12	0.62					
17	2.49	3.28	3.00	0.61					
18	2.48	3.26	2.98	0.61					
19	2.57	3.37	3.12	0.62					

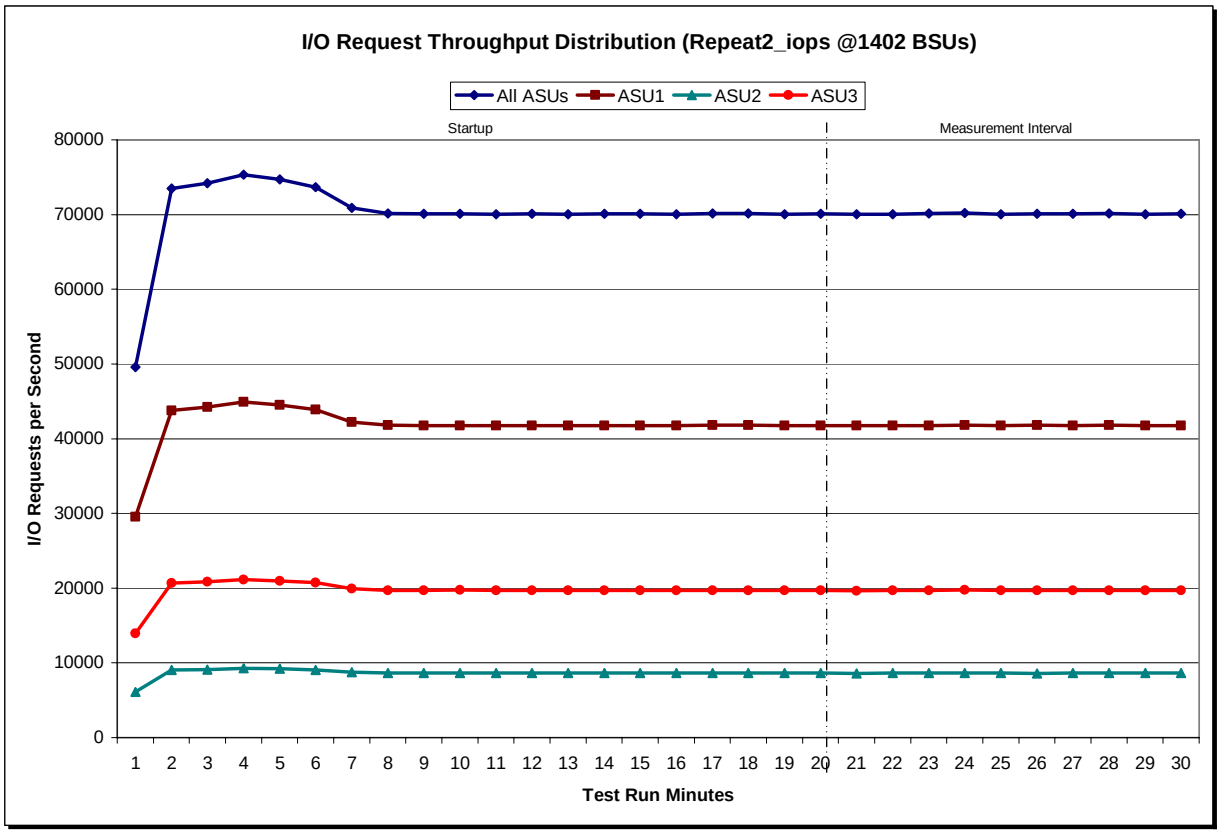
Repeatability 2 LRT –Average Response Time (ms) Distribution Graph



Repeatability 2 IOPS – I/O Request Throughput Distribution Data

1402 BSUs *Start-Up/Ramp-Up*	Start 4:34:47	Stop 4:54:47	Interval 0-19	Duration 0:20:00	*Measurement Interval*	Start 4:54:47	Stop 5:04:47	Interval 20-29	Duration 0:10:00
60 second intervals	All ASUs	ASU1	ASU2	ASU3	60 second intervals	All ASUs	ASU1	ASU2	ASU3
0	49,601.97	29,573.15	6,092.42	13,936.40	20	70,015.63	41,748.58	8,601.55	19,665.50
1	73,504.57	43,771.68	9,055.98	20,676.90	21	70,063.13	41,733.03	8,621.52	19,708.58
2	74,208.28	44,230.48	9,113.42	20,864.38	22	70,124.63	41,783.35	8,644.83	19,696.45
3	75,324.07	44,910.60	9,268.95	21,144.52	23	70,214.43	41,827.18	8,636.87	19,750.38
4	74,699.57	44,501.97	9,205.42	20,992.18	24	70,063.32	41,749.10	8,616.08	19,698.13
5	73,662.47	43,880.95	9,070.98	20,710.53	25	70,097.33	41,789.93	8,608.02	19,699.38
6	70,899.15	42,235.97	8,733.50	19,929.68	26	70,086.50	41,777.43	8,623.70	19,685.37
7	70,153.95	41,822.32	8,629.97	19,701.67	27	70,123.25	41,794.82	8,634.57	19,693.87
8	70,104.53	41,783.27	8,623.00	19,698.27	28	70,060.57	41,755.93	8,630.53	19,674.10
9	70,118.82	41,753.55	8,638.78	19,726.48	29	70,103.02	41,756.02	8,621.90	19,725.10
10	70,059.37	41,727.95	8,629.38	19,702.03	***Average***	***70,095.18***	***41,771.54***	***8,623.96***	***19,699.69***
11	70,119.18	41,780.38	8,630.30	19,708.50					
12	70,038.03	41,740.75	8,614.35	19,682.93					
13	70,068.80	41,777.75	8,611.15	19,679.90					
14	70,114.05	41,777.43	8,644.72	19,691.90					
15	70,062.00	41,765.07	8,627.48	19,669.45					
16	70,131.62	41,796.57	8,619.03	19,716.02					
17	70,131.68	41,805.70	8,645.43	19,680.55					
18	70,060.97	41,743.23	8,622.48	19,695.25					
19	70,078.38	41,772.73	8,622.07	19,683.58					

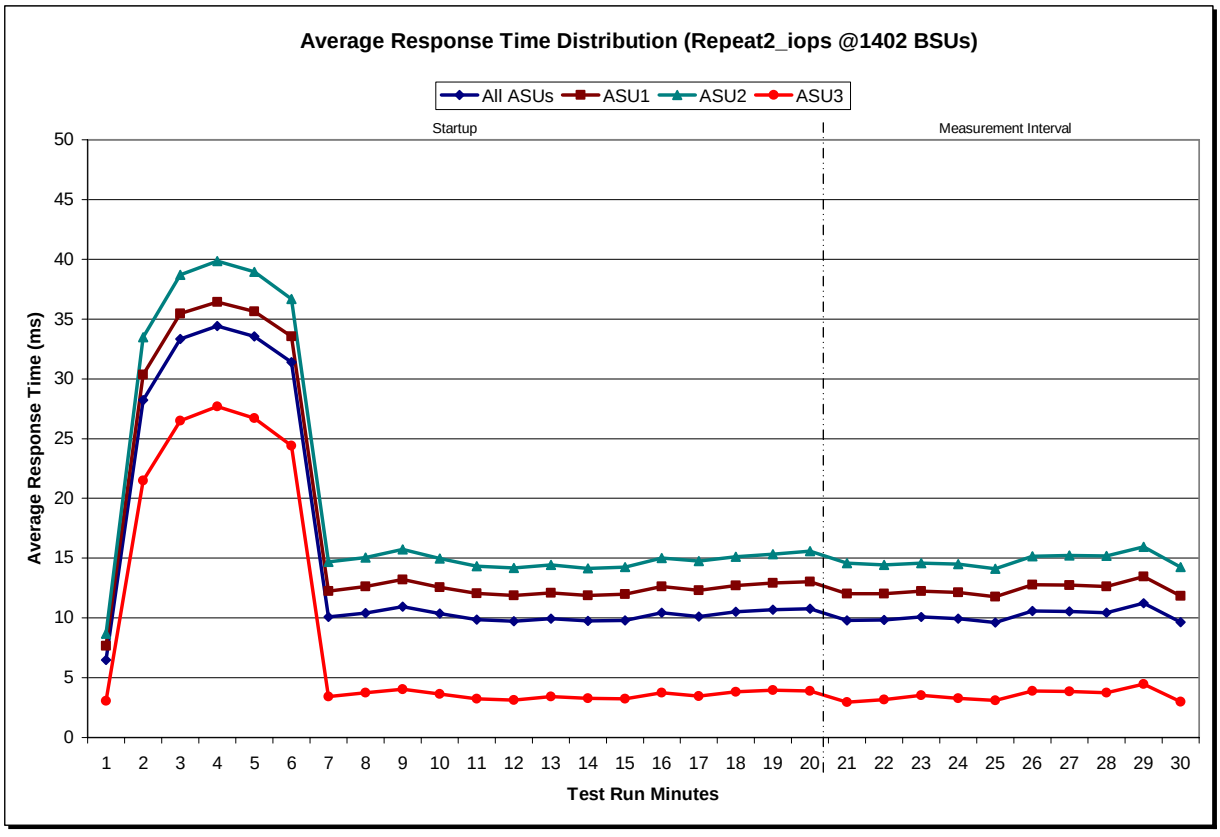
Repeatability 2 IOPS – I/O Request Throughput Distribution Graph



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

1402 BSUs	Start	Stop	Interval	Duration	*Measurement*	Start	Stop	Interval	Duration
Start-Up/Ramp-Up	4:34:47	4:54:47	0-19	0:20:00	*Interval*	4:54:47	5:04:47	20-29	0:10:00
60 second intervals	**All ASUs**	**ASU1**	**ASU2**	**ASU3**	**60 second intervals**	**All ASUs**	**ASU1**	**ASU2**	**ASU3**
0	6.49	7.66	8.67	3.06	**20**	9.79	12.01	14.59	2.96
1	28.23	30.33	33.48	21.48	**21**	9.83	12.03	14.44	3.16
2	33.34	35.46	38.68	26.50	**22**	10.08	12.24	14.57	3.53
3	34.40	36.43	39.85	27.68	**23**	9.93	12.13	14.50	3.27
4	33.54	35.63	38.93	26.73	**24**	9.62	11.79	14.12	3.08
5	31.37	33.56	36.67	24.42	**25**	10.57	12.77	15.15	3.88
6	10.07	12.25	14.68	3.42	**26**	10.55	12.75	15.24	3.84
7	10.42	12.62	15.03	3.73	**27**	10.46	12.64	15.19	3.74
8	10.93	13.20	15.75	4.03	**28**	11.24	13.46	15.95	4.46
9	10.36	12.57	14.96	3.65	**29**	9.64	11.84	14.24	2.99
10	9.86	12.06	14.33	3.24	***Average***	***10.17***	***12.37***	***14.80***	***3.49***
11	9.71	11.88	14.20	3.13					
12	9.94	12.10	14.42	3.42					
13	9.74	11.88	14.14	3.27					
14	9.80	11.97	14.26	3.24					
15	10.43	12.62	15.03	3.76					
16	10.11	12.29	14.74	3.45					
17	10.50	12.69	15.12	3.83					
18	10.70	12.92	15.33	3.98					
19	10.77	13.02	15.58	3.89					

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	0.0349	0.2812	0.0702	0.2098	0.0178	0.0702	0.0349	0.2810
COV	0.011	0.002	0.007	0.003	0.010	0.005	0.008	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	0.0699	0.2100	0.0180	0.0701	0.0351	0.2810
COV	0.002	0.001	0.002	0.001	0.004	0.002	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	0.0348	0.2808	0.0701	0.2104	0.0181	0.0700	0.0350	0.2808
COV	0.007	0.002	0.006	0.004	0.008	0.007	0.008	0.002

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	0.0701	0.0350	0.2810
COV	0.002	0.001	0.001	0.001	0.002	0.002	0.002	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 66.

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	151,426,672
Total Number of Logical Blocks Verified	63,469,216
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 Pillar Axiom 600 Series 3 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 Onsite Audit of the Pillar Axiom 600 Series 3 .

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.

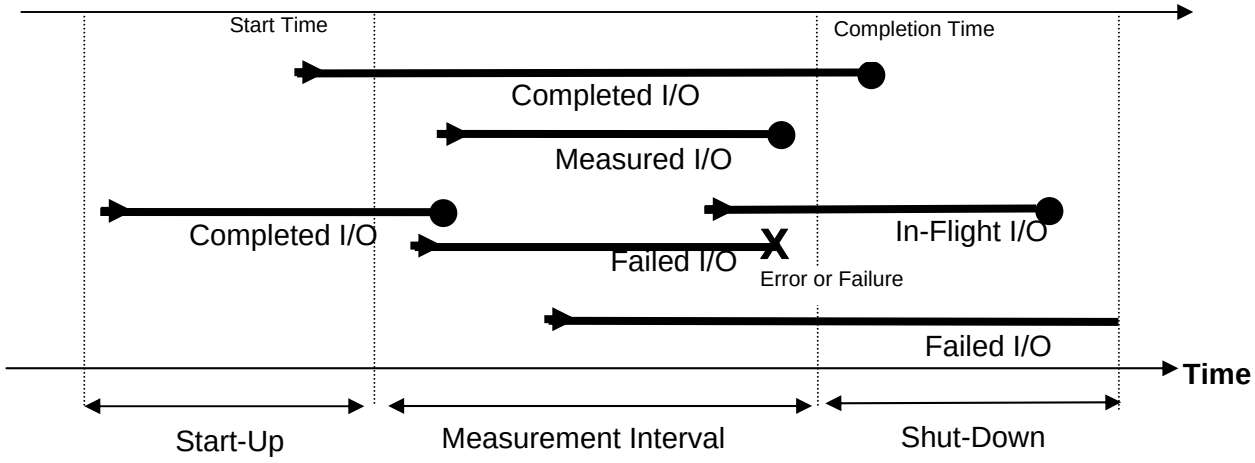
Test: A collection of Test Phases and or Test Runs sharing a common objective.

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

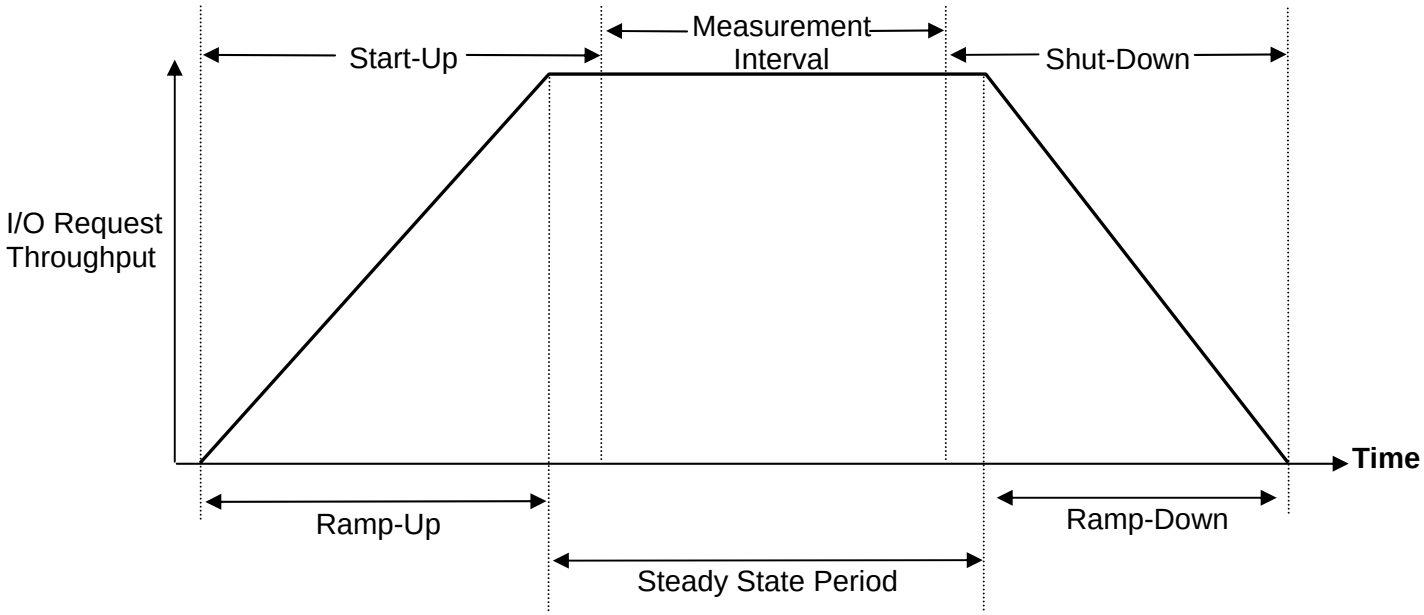
period, Shut-Down period, and Ramp-Down period as illustrated in the "SPC-1 Test Run Components" below. All SPC-1 Test Runs shall have a Steady State period and a Measurement Interval.

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 parameters were changed from their default values during the execution of the scripts documented in *Appendix C: Tested Storage Configuration (TSC) Creation*:

AccessBias=Random
IOBias=Write
The above two parameter values result in a RAID-10 configuration

Profile=HighThroughput
This parameter stripes the LUNs over all the arrays

RelativePriority=Premium
Specifies allocation on fibre channel enclosures

Redundancy=Standard
No additional mirroring other that provided by RAID-10

CloneStorage.MaximumCapacity=0
No space set aside for block-level snapshots on the LUN

The following parameter was changed from its default value as documented in *Appendix C: Tested Storage Configuration (TSC) Creation*:

Axiom Path Manager load balancing set to **Round Robin** for all LUNs
Specifies that accesses to the LUNs alternate between the two host HBA ports

APPENDIX C: TESTED STORAGE CONFIGURATION (TSC) CREATION

Create RAID-10 Volumes

The **pdscli** utility submits configuration commands to the Axiom system. The appropriate configuration commands were issued from the **doCreateLun.dat** Perl script to configure a total of 60 LUNs, 20 used for each ASU.

The ASU-1 and ASU-2 LUNs were created using the following script invocation:

./doCreateLun 40 720 10.20.20.90 0

The ASU-3 LUNs were created using the following script invocation:

./doCreateLun 20 160 10.20.20.90 40

doCreateLun.dat

```
my $numLun = $ARGV[0];
my $lun_size = $ARGV[1];
my $AxiomIP = $ARGV[2];
my $base = $ARGV[3];
(defined $numLun) ||
    die "Please use doCreateLun <numLun> <lun_size> <Axiom-ip> <base>";
(defined $lun_size) ||
    die "Please use doCreateLun <numLun> <lun_size> <Axiom-ip> <base>";
(defined $AxiomIP) ||
    die "Please use doCreateLun <numLun> <lun_size> <Axiom-ip> <base>";
(defined $base) ||
    die "Please use doCreateLun <numLun> <lun_size> <Axiom-ip> <base>";
$cmd = "./pdscli sub -H $AxiomIP -u administrator -p password";
for($i=0; $i < $numLun; $i++)
{
     $lun = $i + $base;
     print "\n  Create Lun: L_$lun, LunID=$lun\n";
     system("$cmd CreateLUN VolumeGroup=/ EnableiSCSIAccess=0
EnableFibreChannelAccess=1 "
           . "Name=L_$lun Profile=HighThroughput Capacity=$lun_size
RelativePriority=Premium "
           . "AccessBias=Random IOBias=Write StorageClass=FibreChannelHardDiskDrives
"
           . "Redundancy=Standard Mapped=0 CloneStorage.MaximumCapacity=0
LUNNumber=$lun");
}
```

Configure ASU-1, ASU-2, and ASU-3 from the RAID-10 Volumes

A Windows striped volume was create for ASU-1, ASU-2, and ASU-3 with the following steps:

Initialize the LUNs and convert them to dynamic disks

- Start the Windows Computer Manager and select **Disk Management.**
- Right-click on Disk 1 and select **Initialize**.

- Right-click on Disk 1 and select **Convert to Dynamic Disk**. Select all 60 of the new LUNs for conversion.

Configure ASU-1

- Right click on Disk 1 and select **New Volume**
- In the New Volume Wizard, select **Next**
- Select Volume to create: **Striped**, then **Next**
- Add disks 2-10 and 31-40 then select **Next**
- Assign Drive Letter **F** then **Next**
- Select **Do not format this volume**, then **Next**
- Select **Finish**

Configure ASU-2

- Right click on Disk 11 and select **New Volume**
- In the New Volume Wizard, select **Next**
- Select Volume to create: **Striped**, then **Next**
- Add disks 12-20 and 41-50 then select **Next**
- Assign Drive Letter **E** then **Next**
- Select **Do not format this volume**, then **Next**
- Select **Finish**

Configure ASU-3

- Right click on Disk 21 and select **New Volume**
- In the New Volume Wizard, select **Next**
- Select Volume to create: **Striped**, then **Next**
- Add disks 22-30 and 51-60 then select **Next**
- Assign Drive Letter **G** then **Next**
- Select **Do not format this volume**, then **Next**
- Select **Finish**

Set Axiom Path Manager scheduling to "Round Robin"

- On the GUI, select **Storage > Host**
- Click the check box next to the test host and select **Modify host settings** from the drop-down menu
- Click on the **Settings** tab
- Click Select **All** to select all LUNs
- Select **Round Robin** from the Load Balancing drop-down menu
- Click on the **Update Settings** button
- Click on the **OK** button

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, Repeatability and Persistence Tests, is listed below.

```
javaparms="-Xmx1024m"
sd=asu1_1,lun=\\.\F:,size=14400g
sd=asu2_1,lun=\\.\E:,size=14400g
sd=asu3_1,lun=\\.\G:,size=3200g
```

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.

```
cd c:\spc1-results
java -Xmx1024m metrics -b 1402 -s 1200 -t 10860 -r 660
java -Xmx1024m repeat1 -b 1402 -s 1200 -t 660
java -Xmx1024m repeat2 -b 1402 -s 1200 -t 660
java -Xmx1024m persist1 -b 1402
```

Persistence Test Run 2

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

```
cd c:\spc1-results
java -Xmx1024m persist2
```

APPENDIX F: THIRD PARTY QUOTATION

From: Veronica Graves [mailto:veronica.graves@qlogic.com]
Sent: Wednesday, April 06, 2011 3:28 PM
To: Jeff Nelson
Cc: John Lynes; Veronica Graves
Subject: RE: QLE2562E

Hi Jeff,

QLE2562-SP
Price is $1175.00 each
Single Pack – Sold individually.

QLE2562-BK
Price is $1170.00
Bulk Pack – Only sold in increments of 20.

Lead time on this product is 3 to 5 business days.

Best Regards
Veronica Graves
QLogic Corporation
PH (949) 389-6837
Fax (949) 389-6008
Email Veronica.Graves@Qlogic.com