starline NASdeluxe NDL-3516R/L system

Executive summary

After performing all tests, the Certification Document starline NASdeluxe NDL-3516R/L system has been officially certified according to the Open-E Hardware Certification Program Guide 2.1.

During the tests, it was found that the system is functional and efficient. With the Open-E DSS V7 operating system installed, the starline NASdeluxe NDL-3516R/L is stable and performs well.

In general, the system can be used for many different applications, but the following are recommended:

✓ **Fibre Channel storage**

The following features make starline NASdeluxe NDL-3516R/L a good Fibre Channel Storage solution:

- **Dual port Fibre Channel HBA for stable, low latency and high throughput connection.**
- **Sixteen high class enterprise SATA drives combined with Fibre Channel HBA ensure fast random data access and reliability.**
- **Redundant power supply for system reliability.**

✓ **Storage for backup**

The following features make starline NASdeluxe NDL-3516R/L great storage for a backup:

- **Redundant power supply for system reliability.**
- **Combination of sixteen high class SATA hard drives and controller providing high RAID levels, ensures a lot of secure storage space for backups.**
- **Fibre Channel HBA and fast 1GbE network interfaces allow flexible backup network topology.**

✓ **Storage for virtualization**

For this application the following can be used:

- **Hardware RAID5, RAID6, RAID10, RAID50 or RAID60 for high performance and data safety.**
- **Four 1GbE interfaces for flexible network topology or fast MPIO connection.**
- **Fast Fibre Channel connection to virtualization systems.**

Certification notes

For link aggregation, it is recommended to use balance-alb bonding mode. Fibre Channel is recommended way of sharing storage with virtualization systems.

starline NASdeluxe NDL-3516R/L hardware components

Technical specifications about the certified system are listed below:

Model	starline NASdeluxe NDL-3516R/L
Operating system	Open-E DSS V7 build 8526
Enclosure/chassis	Supermicro CSE-836E16-R1200B
CPU	Intel Xeon E3-1220v2 3.10GHz
Motherboard	Supermicro X10SLL+-F
Memory	2x 8GB DDR3 1600 ECC Supermicro MEM-DR380-HL01-EU16
Network	Intel Ethernet Server Adapter i210 (on-board)
Network	Intel Ethernet Server Adapter i350-T2
Fibre Channel HBA	QLogic QLE2562-CK
HW RAID	Areca ARC-1882LP
Hard disk drives	16x 600GB Seagate Savvio 15K.7 ST3600057SS

TABLE 1: Hardware components list of Certified System with Open-E DSS V7

starline NASdeluxe NDL-3516R/L photos

FIGURE 1: Front photo

FIGURE 2: Rear photo

FIGURE 3: Top photo

Auxiliary systems hardware components

Auxiliary systems with MS Windows or Open-E DSS V7 installed, used in Open-E Hardware Certification Process.

Model	Custom
Operating system	MS Windows Server 2008 R2
Enclosure/chassis	Supermicro CSE-825TQ-R720LPB
Motherboard	Supermicro X8DTH-IF-B
CPU	Intel Xeon X5570 3.30 GHz
Memory	3x 4BG Hynix DDR3 MEM-DR340L-HL02-EU16
Network	Intel Ethernet Server Adapter i350-T2 (on-board)
Fibre Channel HBA	QLogic QLE2562-CK
HW RAID	Areca ARC-1222
Hard disk drives	2x 600GB Seagate Cheetah NS.2 ST3600002SS

TABLE 2: Hardware components of first Workstation with MS Windows

Model	Custom
Operating system	MS Windows Server 2008 R2
Enclosure/chassis	Supermicro CSE-825TQ-R720LPB
Motherboard	Supermicro X8DTH-IF-B
CPU	Intel Xeon X5570 3.30 GHz
Memory	3x 4BG Hynix DDR3 MEM-DR340L-HL02-EU16
Network	Intel Ethernet Server Adapter i350-T2 (on-board)
Fibre Channel HBA	QLogic QLE2562-CK
HW RAID	Areca ARC-1222
Hard disk drives	2x 600GB Seagate Cheetah NS.2 ST3600002SS

TABLE 3: Hardware components of second Workstation with MS Windows

Model	starline NASdeluxe NDL-3516R/L
Operating system	Open-E DSS V7 build 8526
Enclosure/chassis	Supermicro CSE-836E16-R1200B
CPU	Intel Xeon E3-1220v2 3.10GHz
Motherboard	Supermicro X10SLL+-F
Memory	2x 8GB DDR3 1600 ECC Supermicro MEM-DR380-HL01-EU16
Network	Intel Ethernet Server Adapter i210 (on-board)
Network	Intel Ethernet Server Adapter i350-T2
Fibre Channel HBA	QLogic QLE2562-CK
HW RAID	Areca ARC-1882LP
Hard disk drives	16x 600GB Seagate Savvio 15K.7 ST3600057SS

TABLE 4: Hardware components of Workstation with Open-E DSS V7

Model	Supermicro SSE-G24-TG4
Description	24-ports 1GbE and 4-ports 10GbE switch

TABLE 5: Network switch details for 10GbE connections

Administration functionality

The following functionality has been tested.

Drive identifier	OK
Power button	OK
Front and rear LEDs	OK

TABLE 6: Administration functionality test results

Network functionality

Tests performed in this section check the functionality, performance and stability of the network solutions available in the Open-E DSS V7 product on the certified system.

The tests rely on configuring the iSCSI targets and copying the data from many *Workstations with MS Windows* through various network connections with big block size using appropriate testing tools.

Network test topology

Network topology for Network testing is shown below.

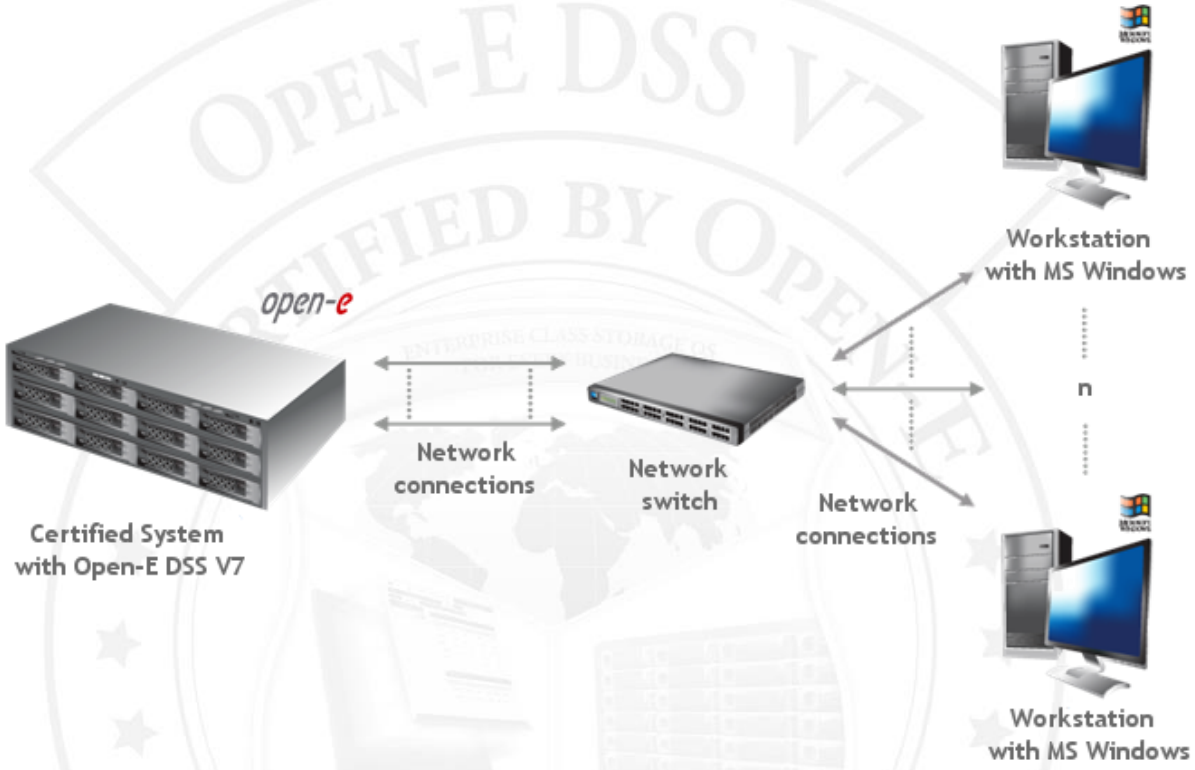

FIGURE 4: Network topology for Network testing

802.3ad bonding mode test

1. Test description

The test relies on configuring the iSCSI targets and copying the data from many *Workstations with MS Windows* through an 802.3ad bonding mode network connection with a 4MB block size using the Iometer testing tool.

2. Test results for 802.3ad bonding mode test performed on Intel Ethernet Server Adapter i350-T2

802.3ad bonding mode performance test results			
NIC model	Intel Ethernet Server Adapter i350-T2		
Workstations with MS Windows	**Write speed [MB/s]**	**Read speed [MB/s]**	**Performance test results**
1st Workstation	44	64	passed
2nd Workstation	81	46	passed

TABLE 7: 802.3ad bonding mode performance test results table for Intel Ethernet Server Adapter i350-T2

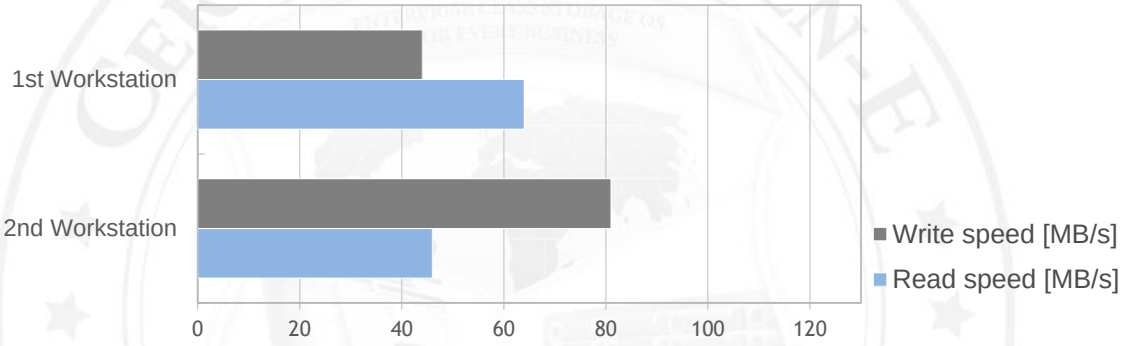

FIGURE 5: 802.3ad bonding mode performance test results chart for Intel Ethernet Server Adapter i350-T2

Balance-alb bonding mode test

1. Test description

The test relies on configuring the iSCSI targets and copying the data from many *Workstations with MS Windows* through a Balance-alb bonding mode network connection with a 4MB block size using the Iometer testing tool.

2. Test results for Balance-alb bonding mode test performed on Intel Ethernet Server Adapter i350-T2

Balance-alb bonding mode performance test results			
NIC model	Intel Ethernet Server Adapter i350-T2		
Workstations with MS Windows	Write speed [MB/s]	Read speed [MB/s]	Performance test results
1st Workstation	65	93	passed
2nd Workstation	60	111	passed

TABLE 8: Balance-alb bonding mode performance test results table for Intel Ethernet Server Adapter i350-T2

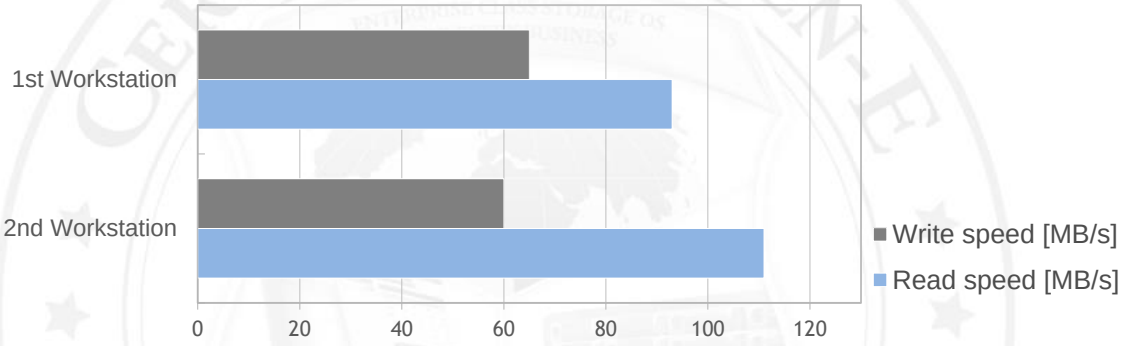

FIGURE 6: Balance-alb bonding mode performance test results chart for Intel Ethernet Server Adapter i350-T2

Balance-rr bonding mode test

1. Test description

The test relies on configuring the iSCSI targets and copying the data from many *Workstations with MS Windows* through a Balance-rr bonding mode network connection with a 4MB block size using the Iometer testing tool.

2. Test results for Balance-rr bonding mode test performed on Intel Ethernet Server Adapter i350-T2

Balance-rr bonding mode performance test results			
NIC model	Intel Ethernet Server Adapter i350-T2		
Workstations with MS Windows	**Write speed [MB/s]**	**Read speed [MB/s]**	**Performance test results**
1st Workstation	64	50	passed
2nd Workstation	59	85	passed

TABLE 9: Balance-rr bonding mode performance test results table for Intel Ethernet Server Adapter i350-T2

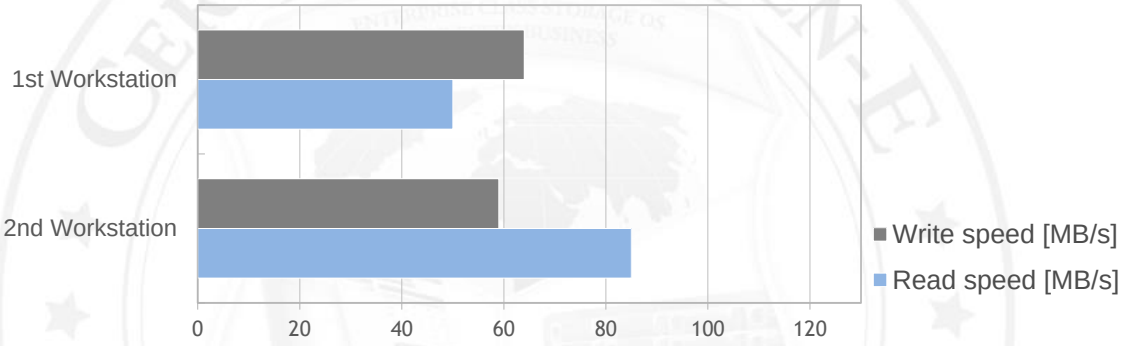

FIGURE 7: Balance-rr bonding mode performance test results chart for Intel Ethernet Server Adapter i350-T2

Single NIC performance test

1. Test description

The test relies on configuring the iSCSI targets and copying the data from *Workstations with MS Windows* through single NIC with a 4MB block size using the Iometer testing tool.

2. Test results for single NIC test performed on Intel Ethernet Server Adapter i350-T2

Single NIC performance test results			
NIC model	Intel Ethernet Server Adapter i350-T2		
Workstations with MS Windows	Write speed [MB/s]	Read speed [MB/s]	Performance test results
1st Workstation	111	112	passed

TABLE 10: Single NIC performance test results table for Intel Ethernet Server Adapter i350-T2

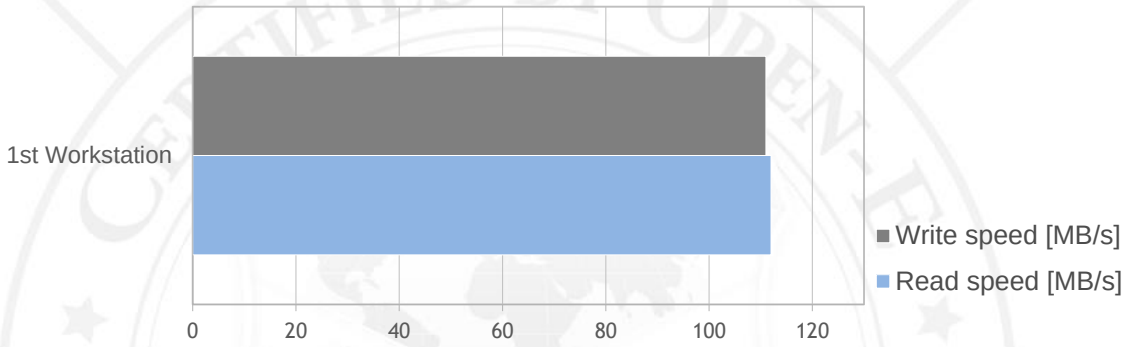

FIGURE 8: Single NIC performance test results chart for Intel Ethernet Server Adapter i350-T2

RAID functionality

Tests performed in this section check the functionality, performance and stability of Open-E DSS V7 storage devices on the certified system.

Tests in this section rely on the creation of the RAID units on 0, 1, 5, 6, 10, 50 and 60 levels, configuring the iSCSI target and copying the data from a *Workstation with MS Windows* via network connection with various block sizes using the Iometer testing tool.

RAID test topology

Network test topology for RAID testing is shown below

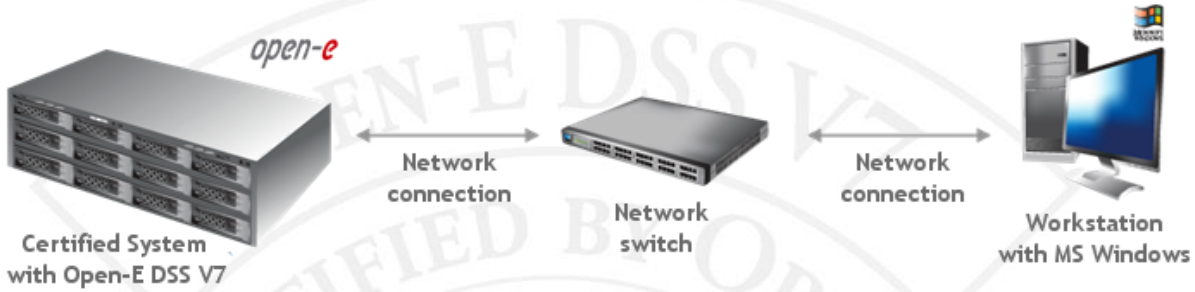

FIGURE 9: Network test topology for RAID testing

Hardware RAID0 test

1. Test description

The test relies on creation of the RAID0 unit on all hard disk drives, configuring the iSCSI target and copying the data from a *Workstation with MS Windows* via network connection with various block sizes using the Iometer testing tool.

2. Test results for RAID0 and Intel Ethernet Server Adapter i350-T2

RAID0 performance test results			
Block size [KB]	Write speed [MB/s]	Read speed [MB/s]	Performance test results
4	17	27	passed
32	60	88	passed
64	81	105	passed
128	85	109	passed
256	100	111	passed
512	104	112	passed
1024	106	112	passed
4096	111	118	passed

TABLE 11: RAID0 performance test results table for Intel Ethernet Server Adapter i350-T2

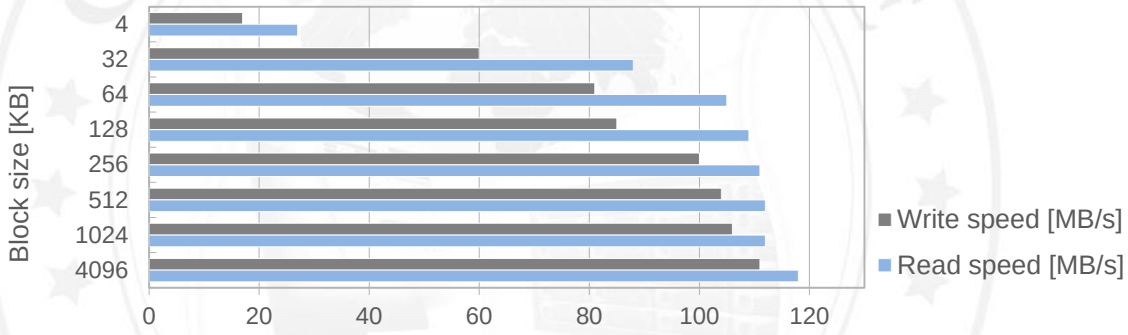

FIGURE 10: RAID0 performance test results chart for Intel Ethernet Server Adapter i350-T2

Hardware RAID1 test

1. Test description

The test relies on creation of the RAID1 unit on all hard disk drives, configuring the iSCSI target and copying the data from a *Workstation with MS Windows* via network connection with various block sizes using the Iometer testing tool.

2. Test results for RAID1 and Intel Ethernet Server Adapter i350-T2

RAID1 performance test results			
Block size [KB]	Write speed [MB/s]	Read speed [MB/s]	Performance test results
4	17	26	passed
32	60	88	passed
64	80	108	passed
128	85	109	passed
256	100	112	passed
512	104	112	passed
1024	107	112	passed
4096	113	113	passed

TABLE 12: RAID1 performance test results table for Intel Ethernet Server Adapter i350-T2

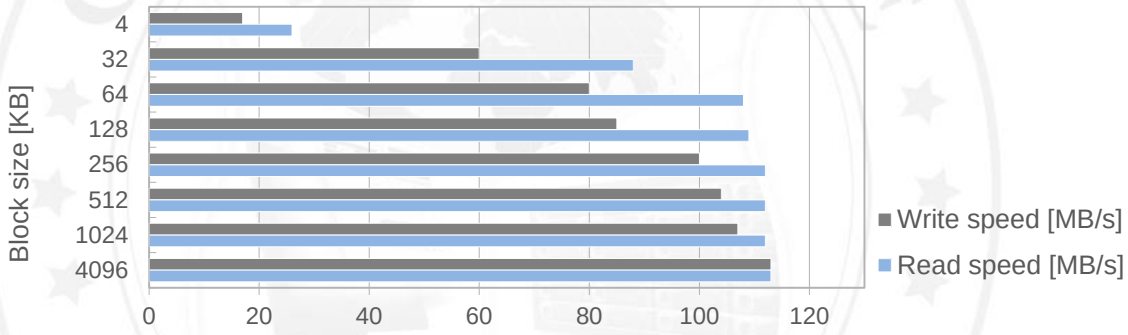

FIGURE 11: RAID1 performance test results chart for Intel Ethernet Server Adapter i350-T2

Hardware RAID5 test

1. Test description

The test relies on creation of the RAID5 unit on all hard disk drives, configuring the iSCSI target and copying the data from a *Workstation with MS Windows* via network connection with various block sizes using the Iometer testing tool.

2. Test results for RAID5 and Intel Ethernet Server Adapter i350-T2

RAID5 performance test results			
Block size [KB]	Write speed [MB/s]	Read speed [MB/s]	Performance test results
4	17	27	passed
32	60	90	passed
64	81	105	passed
128	86	111	passed
256	101	112	passed
512	104	112	passed
1024	107	112	passed
4096	112	112	passed

TABLE 13: RAID5 performance test results table for Intel Ethernet Server Adapter i350-T2

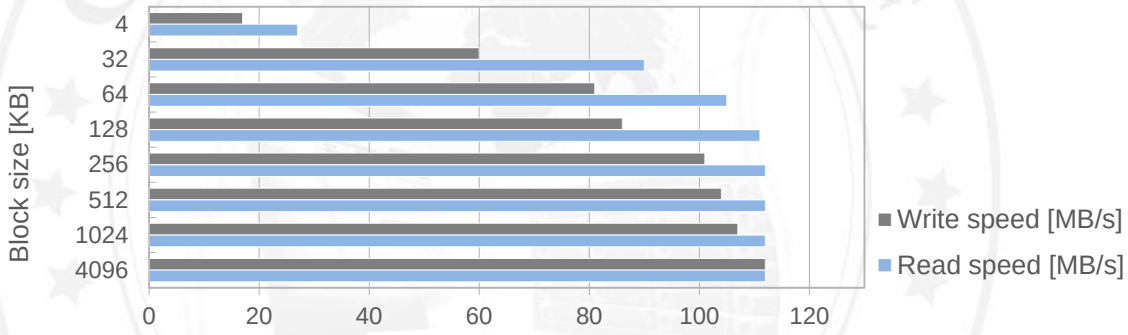

FIGURE 12: RAID5 performance test results chart for Intel Ethernet Server Adapter i350-T2

Hardware RAID6 test

1. Test description

The test relies on creation of the RAID6 unit on all hard disk drives, configuring the iSCSI target and copying the data from a *Workstation with MS Windows* via network connection with various block sizes using the Iometer testing tool.

2. Test results for RAID6 and Intel Ethernet Server Adapter i350-T2

RAID6 performance test results			
Block size [KB]	Write speed [MB/s]	Read speed [MB/s]	Performance test results
4	16	27	passed
32	60	90	passed
64	81	107	passed
128	86	110	passed
256	100	111	passed
512	104	111	passed
1024	106	112	passed
4096	113	113	passed

TABLE 14: RAID6 performance test results table for Intel Ethernet Server Adapter i350-T2

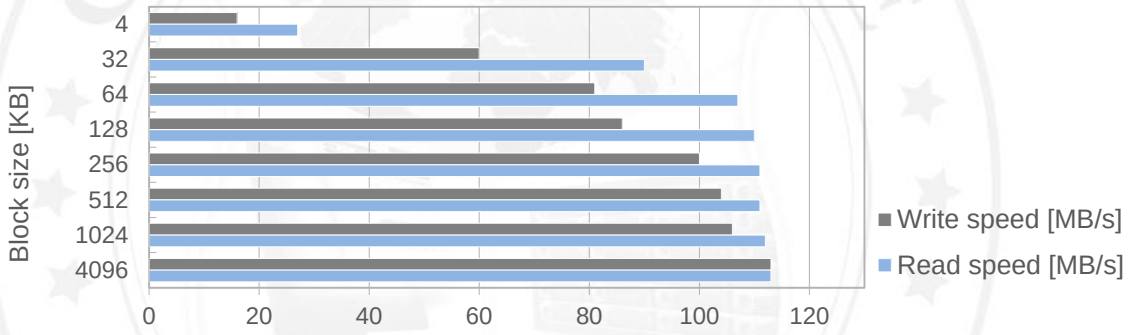

FIGURE 13: RAID6 performance test results chart for Intel Ethernet Server Adapter i350-T2

Hardware RAID10 test

1. Test description

The test relies on creation of the RAID10 unit on all hard disk drives, configuring the iSCSI target and copying the data from a *Workstation with MS Windows* via network connection with various block sizes using the Iometer testing tool.

2. Test results for RAID10 and Intel Ethernet Server Adapter i350-T2

RAID10 performance test results			
Block size [KB]	Write speed [MB/s]	Read speed [MB/s]	Performance test results
4	17	26	passed
32	60	90	passed
64	80	107	passed
128	85	110	passed
256	100	110	passed
512	104	111	passed
1024	107	112	passed
4096	112	112	passed

TABLE 15: RAID10 performance test results table for Intel Ethernet Server Adapter i350-T2

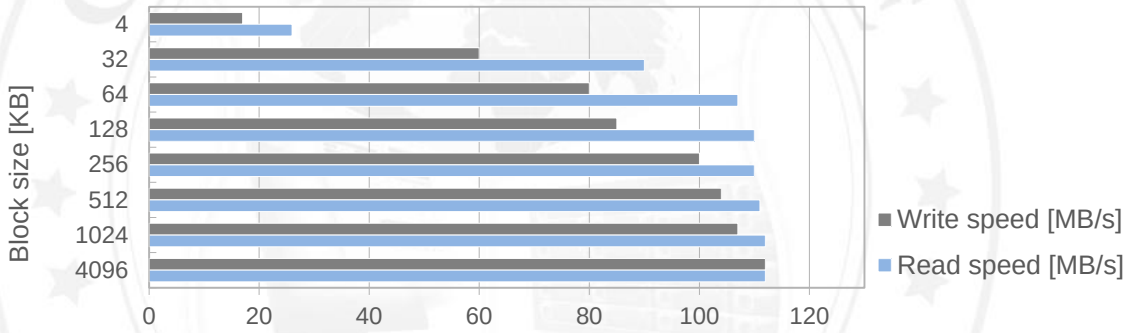

FIGURE 14: RAID10 performance test results chart for Intel Ethernet Server Adapter i350-T2

Hardware RAID50 test

1. Test description

The test relies on creation of the RAID50 unit on all hard disk drives, configuring the iSCSI target and copying the data from a *Workstation with MS Windows* via network connection with various block sizes using the Iometer testing tool.

2. Test results for RAID50 and Intel Ethernet Server Adapter i350-T2

RAID50 performance test results			
Block size [KB]	Write speed [MB/s]	Read speed [MB/s]	Performance test results
4	35	27	passed
32	98	95	passed
64	100	97	passed
128	102	98	passed
256	105	94	passed
512	108	97	passed
1024	109	96	passed
4096	108	95	passed

TABLE 16: RAID50 performance test results table for Intel Ethernet Server Adapter i350-T2

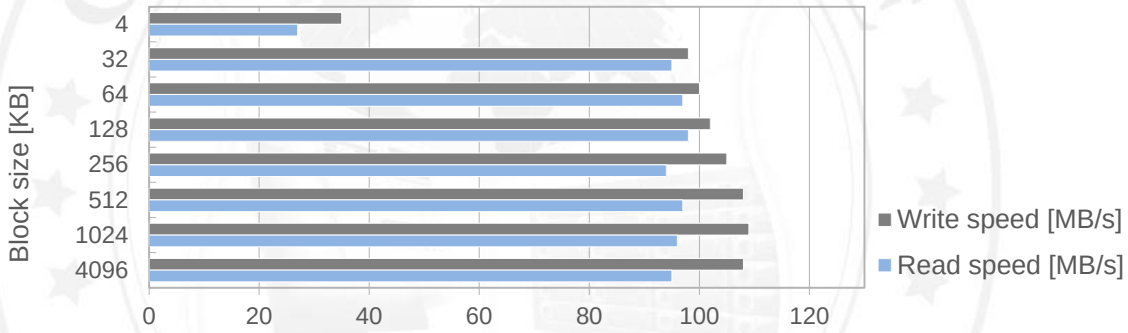

FIGURE 15: RAID50 performance test results chart for Intel Ethernet Server Adapter i350-T2

Hardware RAID60 test

1. Test description

The test relies on creation of the RAID60 unit on all hard disk drives, configuring the iSCSI target and copying the data from a *Workstation with MS Windows* via network connection with various block sizes using the Iometer testing tool.

2. Test results for RAID60 and Intel Ethernet Server Adapter i350-T2

RAID60 performance test results			
Block size [KB]	Write speed [MB/s]	Read speed [MB/s]	Performance test results
4	17	24	passed
32	72	81	passed
64	86	97	passed
128	96	100	passed
256	105	102	passed
512	105	101	passed
1024	107	100	passed
4096	111	102	passed

TABLE 17: RAID60 performance test results table for Intel Ethernet Server Adapter i350-T2

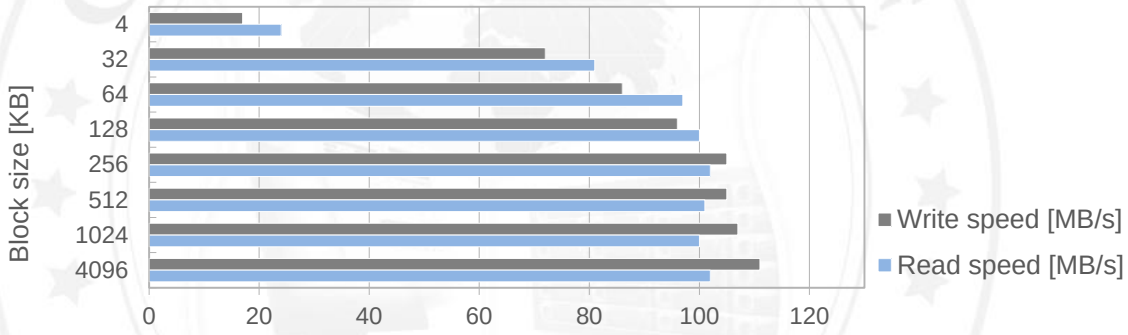

FIGURE 16: RAID60 performance test results chart for Intel Ethernet Server Adapter i350-T2

NAS functionality

Tests performed in this section check the functionality, performance and stability of the NAS protocols in the Open-E DSS V7 product on the certified system.

The tests rely on creating NAS shares and copying the data from a *Workstation with MS Windows* via network connection with various block sizes using the Iometer testing tool.

NAS test topology

Network topology for NAS testing is shown below.

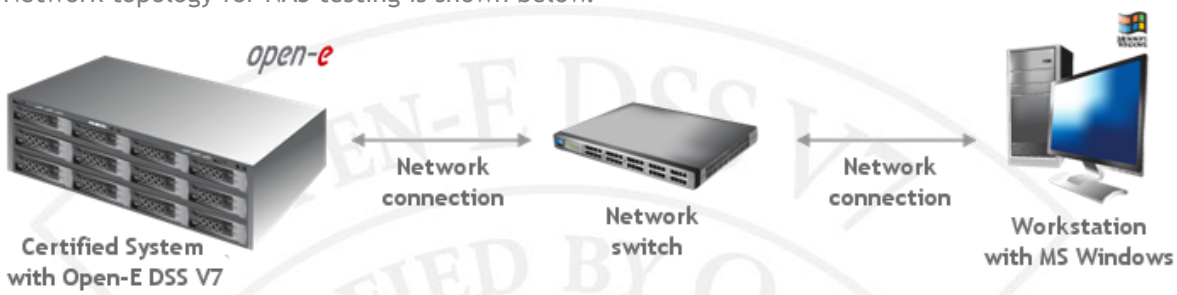

FIGURE 17: Network topology for NAS testing

SMB test

1. Test description

The tests rely on creating NAS shares and copying the data from a *Workstation with MS Windows* via network connection with various block sizes using the Iometer testing tool.

2. Test results for SMB and Intel Ethernet Server Adapter i350-T2

SMB performance test results			
Block size [KB]	Write speed [MB/s]	Read speed [MB/s]	Performance test results
4	25	33	passed
32	85	86	passed
64	112	80	passed
128	112	93	passed
256	111	104	passed
512	111	109	passed
1024	111	109	passed
4096	110	111	passed

TABLE 18: SMB performance test results table for Intel Ethernet Server Adapter i350-T2

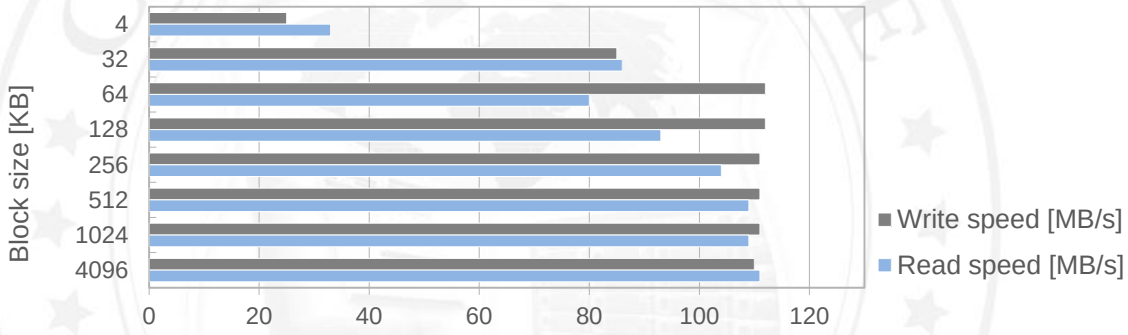

FIGURE 18: SMB performance test results chart for Intel Ethernet Server Adapter i350-T2

iSCSI functionality

Tests performed in this section check the functionality, performance and stability of the iSCSI protocol in the Open-E DSS V7 product on the certified system.

iSCSI Initiator test topology

Network topology for iSCSI Initiator testing is shown below.

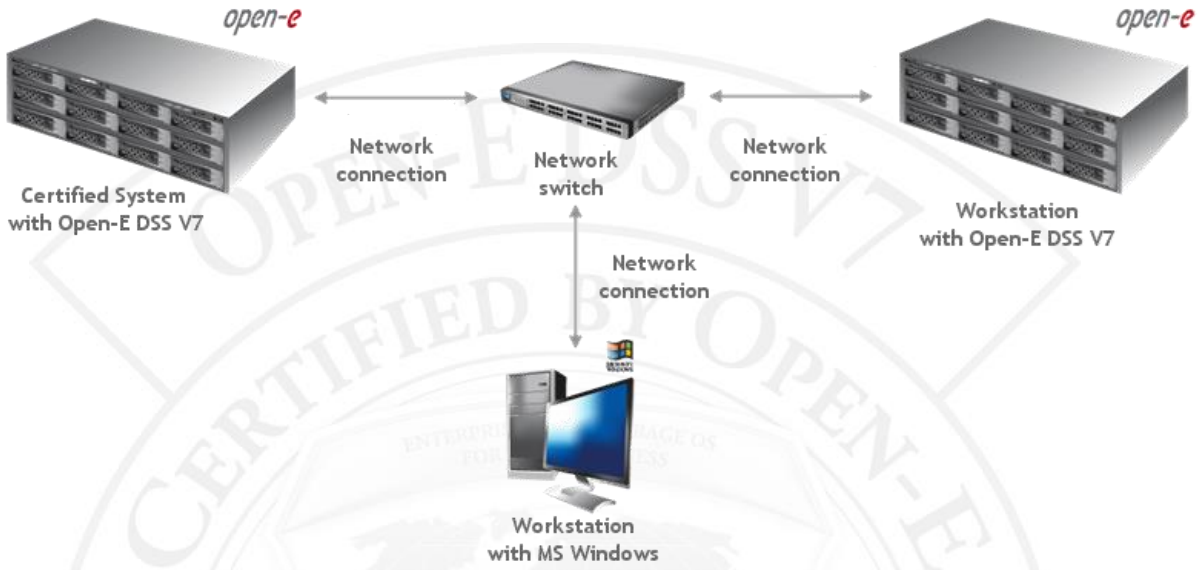

FIGURE 19: Network topology for iSCSI Initiator testing

iSCSI Target test topology

Network topology for iSCSI Target testing is shown below.

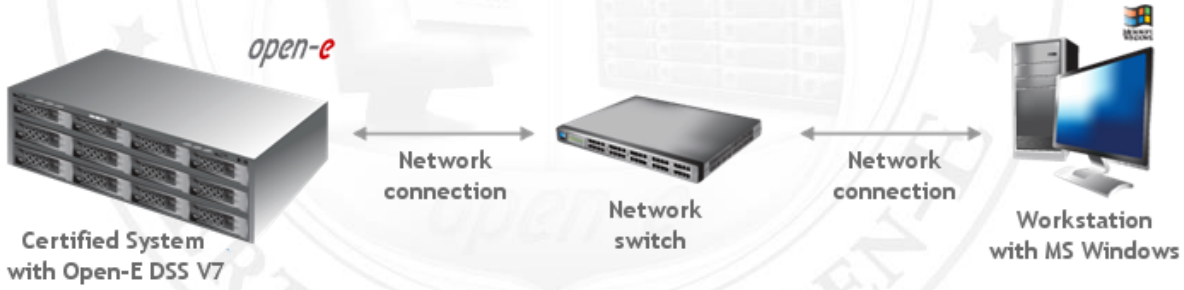

FIGURE 20: Network topology for iSCSI Target testing

iSCSI Initiator test

1. Test description

The test relies on using the storage connected via the built-in iSCSI Initiator for NAS volumes, creating SMB shares on these NAS volumes and copying data from a *Workstation with MS Windows* to them with various block sizes using the Iometer testing tool.

2. Test results for iSCSI Initiator and Intel Ethernet Server Adapter i350-T2

iSCSI Initiator performance test results			
Block size [KB]	Write speed [MB/s]	Read speed [MB/s]	Performance test results
4	29	35	passed
32	73	81	passed
64	112	78	passed
128	112	93	passed
256	111	104	passed
512	105	109	passed
1024	110	109	passed
4096	110	111	passed

TABLE 19: iSCSI Initiator performance test results table for Intel Ethernet Server Adapter i350-T2

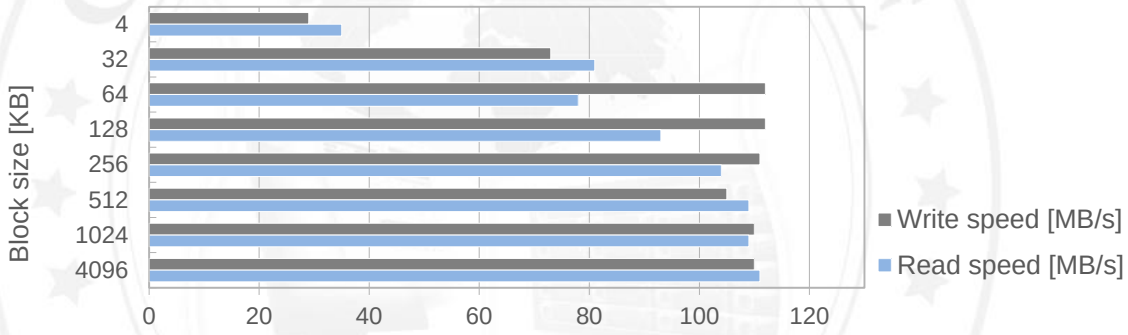

FIGURE 21: iSCSI Initiator performance test results chart for Intel Ethernet Server Adapter i350-T2

iSCSI Target test

1. Test description

The test relies on creating the iSCSI target on the certified system and copying the data from a *Workstation with MS Windows* to it with various block sizes using the Iometer tool.

2. Test results for iSCSI Target and Intel Ethernet Server Adapter i350-T2

iSCSI Target performance test results			
Block size [KB]	Write speed [MB/s]	Read speed [MB/s]	Performance test results
4	16	32	passed
32	57	90	passed
64	78	108	passed
128	82	110	passed
256	95	111	passed
512	100	111	passed
1024	106	110	passed
4096	102	112	passed

TABLE 20: iSCSI Target performance test results table for Intel Ethernet Server Adapter i350-T2

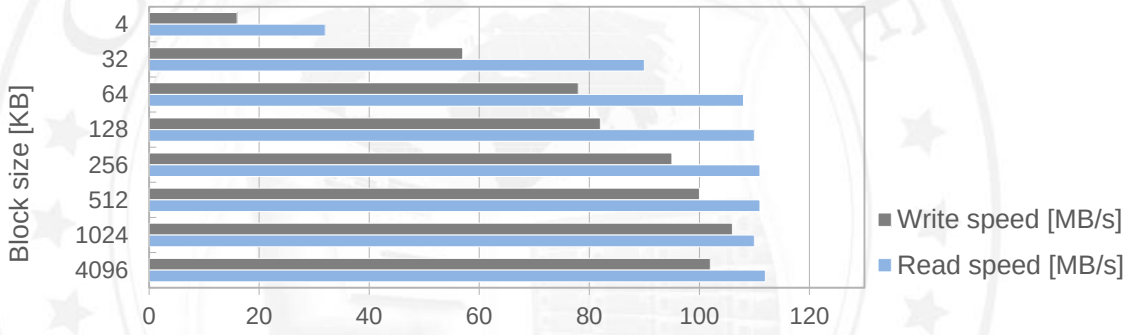

FIGURE 22: iSCSI Target performance test results chart for Intel Ethernet Server Adapter i350-T2

Fibre Channel functionality

Tests performed in this section check the functionality, performance, and stability of the Fibre Channel protocol in the Open-E DSS V7 product on the certified system.

Fibre Channel Initiator test topology

Network topology for Fibre Channel Initiator testing is shown below.

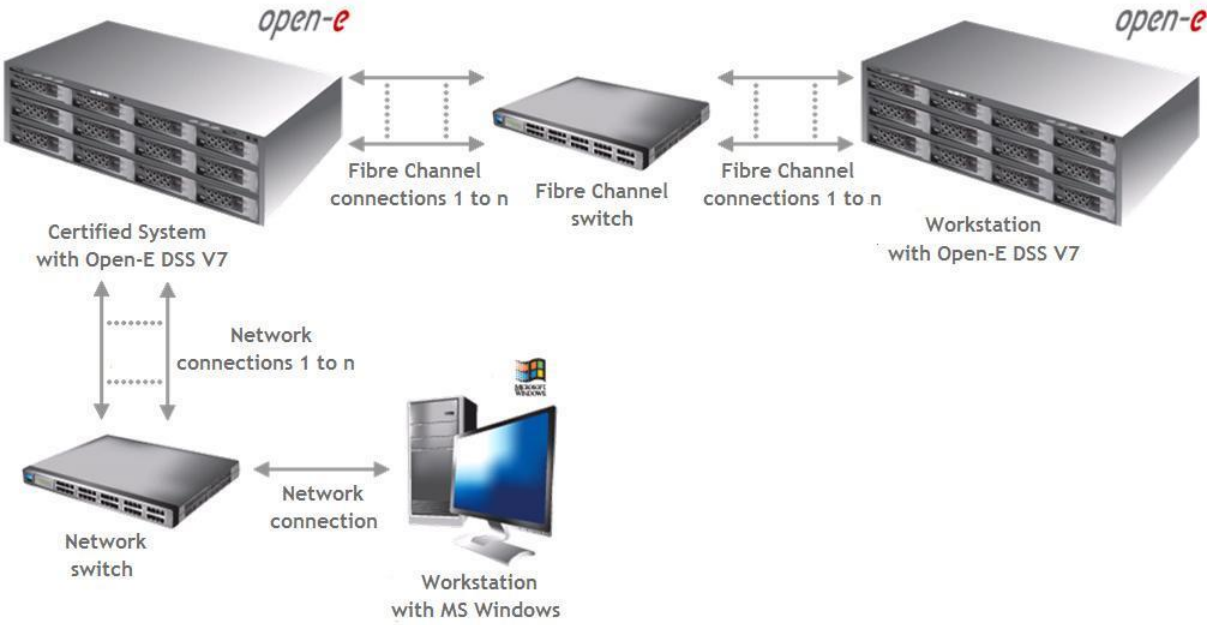

FIGURE 23: Network topology for Fibre Channel Initiator testing

Fibre Channel Target test topology

Network topology for Fibre Channel Target testing is shown below.

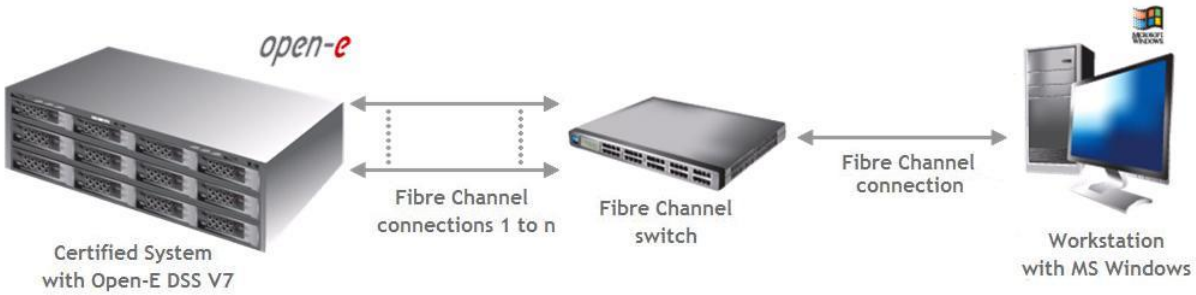

FIGURE 24: Network topology for Fibre Channel Target testing

Fibre Channel Initiator test

1. Test description

Test relies on creating the Fibre Channel Target on *Workstation with Open-E DSS V7*, connecting to the target using *Certified System with Open-E DSS V7* Fibre Channel Initiator and copying the data to the previously exported Fibre Channel LUNs using the Iometer through the SMB protocol using *Workstation with MS Windows* on the certified system.
All the tests were performed using 1GbE network connections and 8Gb Fibre Channel connection.

2. Test results for Fibre Channel Initiator and QLogic QLE2562-CK

Fibre Channel Initiator performance test results			
Block size [KB]	Write speed [MB/s]	Read speed [MB/s]	Performance test results
4	23	35	passed
32	90	85	passed
64	112	80	passed
128	112	93	passed
256	111	104	passed
512	112	109	passed
1024	111	108	passed
4096	110	110	passed

TABLE 21: Fibre Channel Initiator performance test results table for QLogic QLE2562-CK

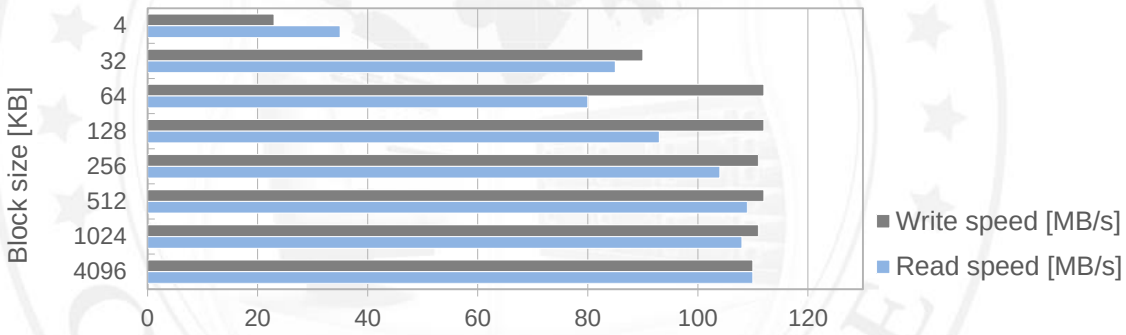

FIGURE 25: Fibre Channel Initiator performance test results chart for QLogic QLE2562-CK

Fibre Channel Target test

1. Test description

Test relies on creating the Fibre Channel Target on *Certified System with Open-E DSS V7*, connecting to the target using *Workstation with MS Windows* with a Fibre Channel Controller in the initiator mode and copying the data to connected LUN using Iometer.
All the tests were performed using 8Gb Fibre Channel connection.

2. Test results for Fibre Channel Target and QLogic QLE2562-CK

Fibre Channel Target performance test results			
Block size [KB]	**Write speed [MB/s]**	**Read speed [MB/s]**	**Performance test results**
4	47	246	passed
32	150	744	passed
64	480	755	passed
128	640	780	passed
256	719	759	passed
512	748	770	passed
1024	760	775	passed
4096	784	785	passed

TABLE 22: Fibre Channel Target performance test results table for QLogic QLE2562-CK

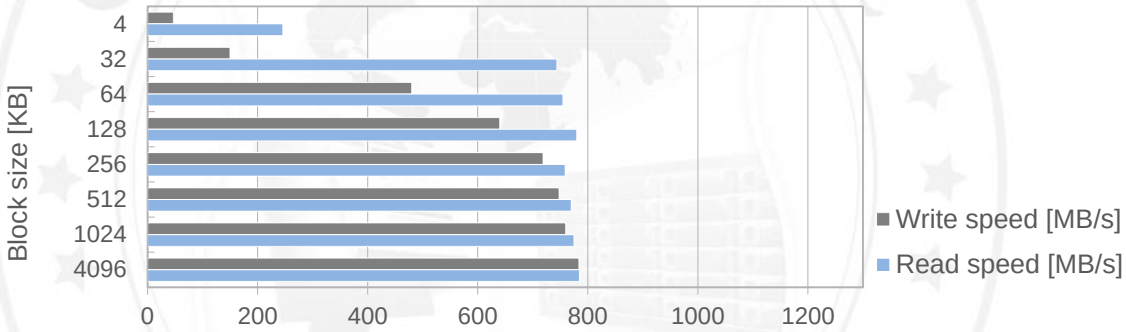

FIGURE 26: Fibre Channel Target performance test results chart for QLogic QLE2562-CK