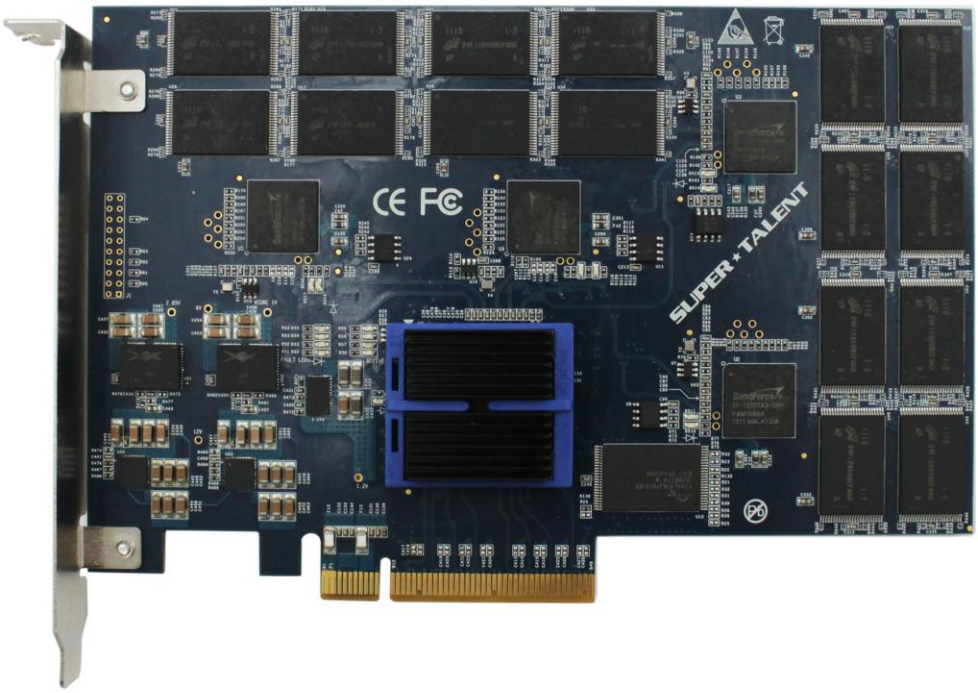
SUPERTALENT UPSTREAM

PCI EXPRESS SOLID STATE DRIVE



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1.0 PRODUCT DESCRIPTION

1.1 PRODUCT OVERVIEW

Upstream is designed to break the throughput bottleneck in the storage subsystem by removing the bandwidth limitation of the SATA bus. The PCIe (Gen.1) x8 interface used by Upstream supports 2GB/sec bandwidth, more than 6 times that of the SATA-II 3Gbps bus, and 3 times faster than the SATA-III bus.

Using the latest NAND flash memory chips and most verified LSI RAID controller, Upstream is able to support Max. Read speeds of up to 1.0GB/sec. It also enables Max. Write speeds as fast as 900MB/sec without the volatile DRAM cache memory. Upstream, which houses four discrete SATA SSDs, comes in a custom formfactor measuring 167.65x 98.4 (mm).

This small formfactor now can be fitted into the 1U/2U/3U rack mount storage server with the RISER card, which is one of the great advantages over the competitors' products

1.2 TARGET APPLICATIONS

- Audio/Video Streaming Server Cache storage
- Data Center Server Cache storage
- Web server Cache storage
- Supercomputing
- Near-line backup
- Security systems

1.3 PRODUCT FEATURES

- PCIe Gen.1 x8 lane host interface
- Max Speed: Read up to 1.0GB/s, Write up to 900MB/s
- Capacity: 220GB, 460GB, 960GB
- MLC NAND Flash (SLC is optional, contact Sales)
- Data Retention: up to 10 years
- Built in wear leveling algorithm and error detection and correction
- 100% tested HW and SW
- Designed and Manufactured in USA

2.0 RAIDDRIVER ARCHITECTURE

2.1 RAIDDRIVE ARCHITECTURE

- LSI SAS 1064E RAID controller for RAID core and SAS microcode
- No DRAM cache
- Supports up to 1TB capacity (960GB)
- NVSRAM for RAID configuration & transaction log
- Redundant flash image for adapter availability

2.2 RAID FEATURES

- User configurable RAID level 0, 1, 1E.
- Instant Availability
- Field-upgradeable firmware in flash ROM

2.3 MONITORS AND INDICATORS

- System status indication through global HDD activity/fault connector
- SMTP support for email notification
- SNMP support for remote manager
- Enclosure management (SES2, SMP and SGPIO) ready

2.4 OPERATING SYSTEM SUPPORT

- Windows® 2000/XP/Server2003/Vista/Win7/2008
- Linux (Most of Linux supported without any specific driver: See the details on test page)
- NetWare
- Oracle Solaris® 10 (built in supported)
- Others. (Contact SuperTalent Sales)

3.0 PRODUCT ORDERING PART NUMBERS

3.1 ORDERING PART STRUCTURE

Upstream is available in capacities up to 1TB, in RAID 0 or RAID 1/1E configurations with MLC NAND flash. (For SLC solution, please contact our Sales) Table 1 shows currently available part numbers and their specifics

Prefix RUS	RAID Level X	Density XXX	Version Number X
STT Upstream	0-RAID 0	220-220GB	M-MLC NAND
		460-460GB	S-SLC NAND (optional)
		960-960GB	

Table 1: Ordering Part Structure

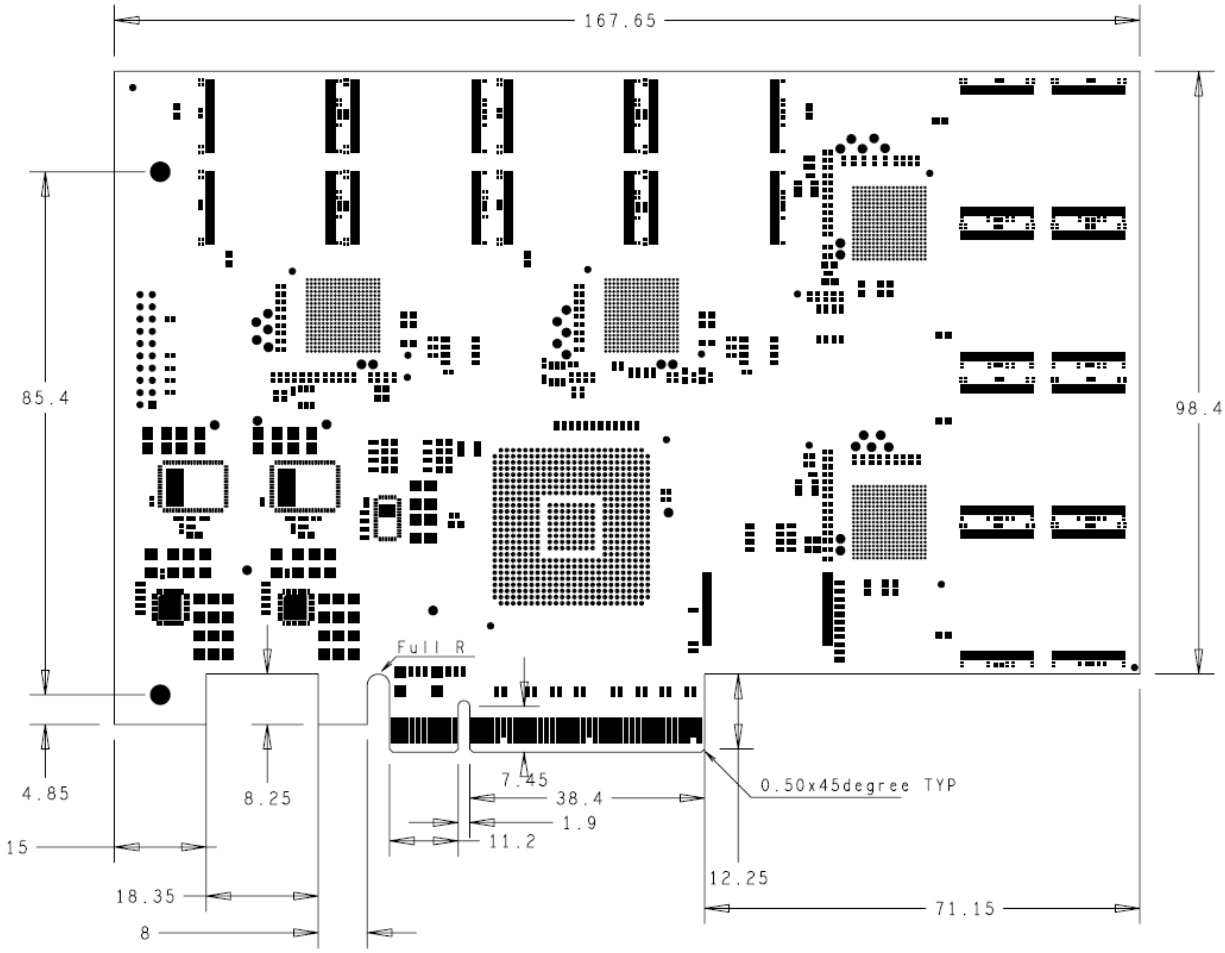
3.2 VALID ORDERING PART NUMBERS

Part Number	Capacity	RAID Level	# of Enclosure	Media Storage
RUS0220M	220GB	0	4	MLC
RUS0460M	460GB	0	4	MLC
RUS0960M	960GB	0	4	MLC

Table 2: Valid Ordering Part Numbers and Descriptions. (*Capacity may differ from User capacity when it is formatted)

4.0 PHYSICAL SPECIFICATIONS

4.1 UPSTREAM BOARD



4.2 DIMENSION

Upstream: 167.65x 98.4 mm

5.0 PERFORMANCE SPECIFICATIONS (EXAMPLE – 220GB / 460GB UPSTREAM)

Interface: PCIe (Generation 1) x8

Access Time: 0.1 ms

Max. Speed: READ up to 1.0GB/sec, WRITE up to 900MB/sec

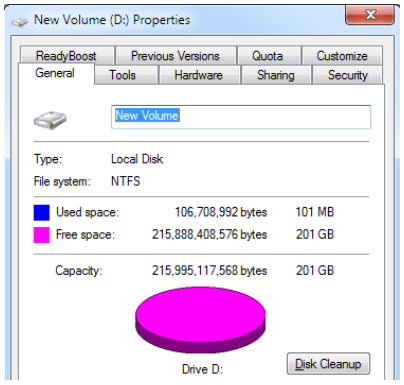
5.1 PERFORMANCE TEST SYSTEM CONFIGURATIONS

The following Performance Benchmark is showing the most popular configuration of the UPSTREAM. The models tested are RUS0220M and RUS0460M (220GB and 460GB model)
*460GB and 960GB models have the best performance and 220GB model has a little lower performance.
** Left – 220GB model, Right – 460GB model

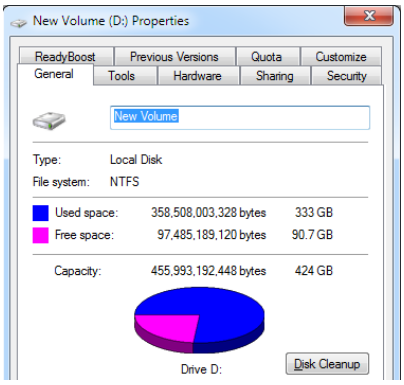
Test Platform	
1. Mother Board:	ASUS P6X58D PREMIUM
2. CPU:	Intel i7 975 @3.33GHz
3. Memory:	DDR3 2000 6GB (3 channel)
4. OS:	Windows 7 ULTIMATE 64bit
5. OS DRIVE:	SuperTalent ULTRA SSD GX2 128GB
6. North Bridge:	INTEL X58
7. South Bridge:	INTEL ICH10R
8. Bios SATA Mode:	AHCI

5.2 BENCHMARKING SOFTWARE AND PROPERTIES SCREENSHOTS

- ATTO Disk Benchmark 2.34
- Crystal Disk Mark 3.0
- AS SSD Benchmark 1.3.3626
- PC Mark Vantage Pro 64-bit
- HD Tune Pro 3.50
- IO Meter 2008.16.18-RC2



(220GB)



(460GB)

5.3 DETAIL PERFORMACE TEST RESULTS

5.3.1 ATTO DISK BENCHMARK 2.46

The following screenshot show the ATTO disk benchmark with the Queue Depth of 10.

This ATTO test only shows the Sequential READ/WRITE speed.

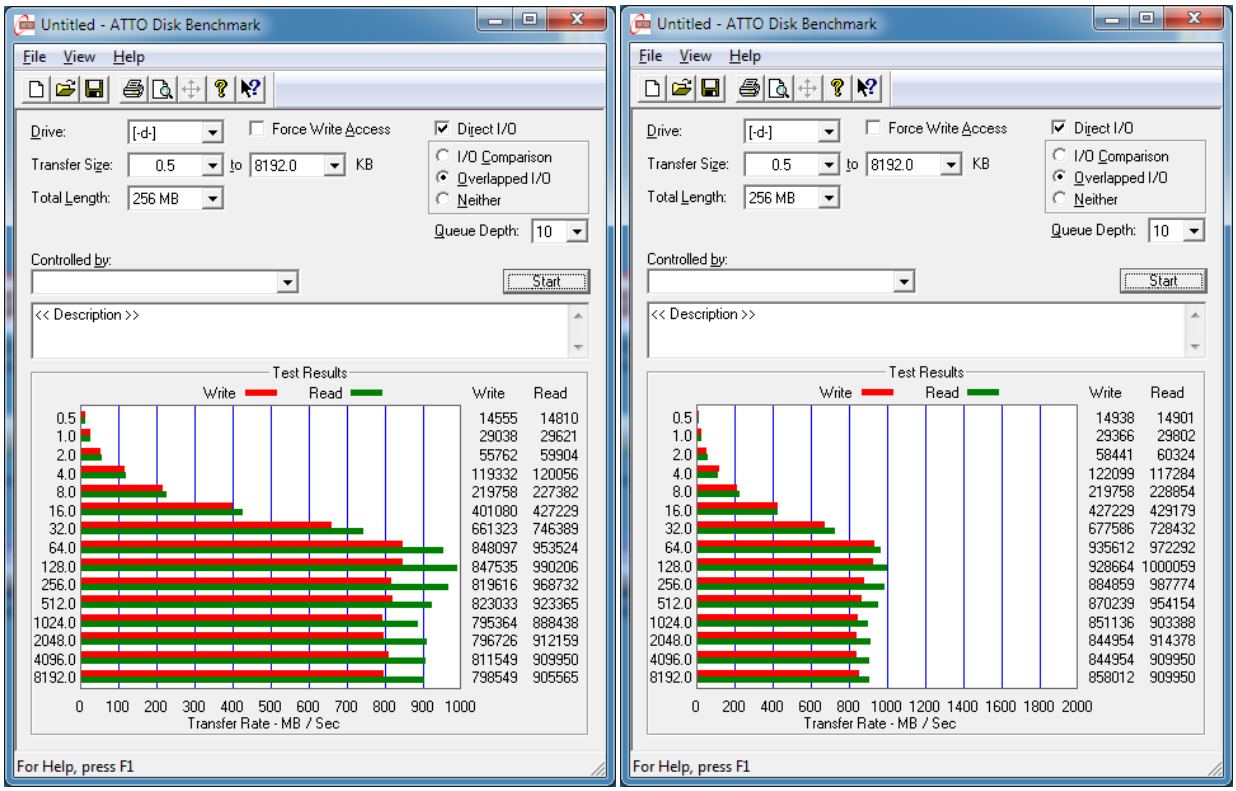


Figure 1: ATTO Disk Benchmark Scores (Left-220GB, Right-460GB)

5.3.2 PC MARK VANTAGE

The RAIDDrive posted excellent scores in Media Center, but relatively slow scores in other applications because they are mostly using small file application except Video Editing.

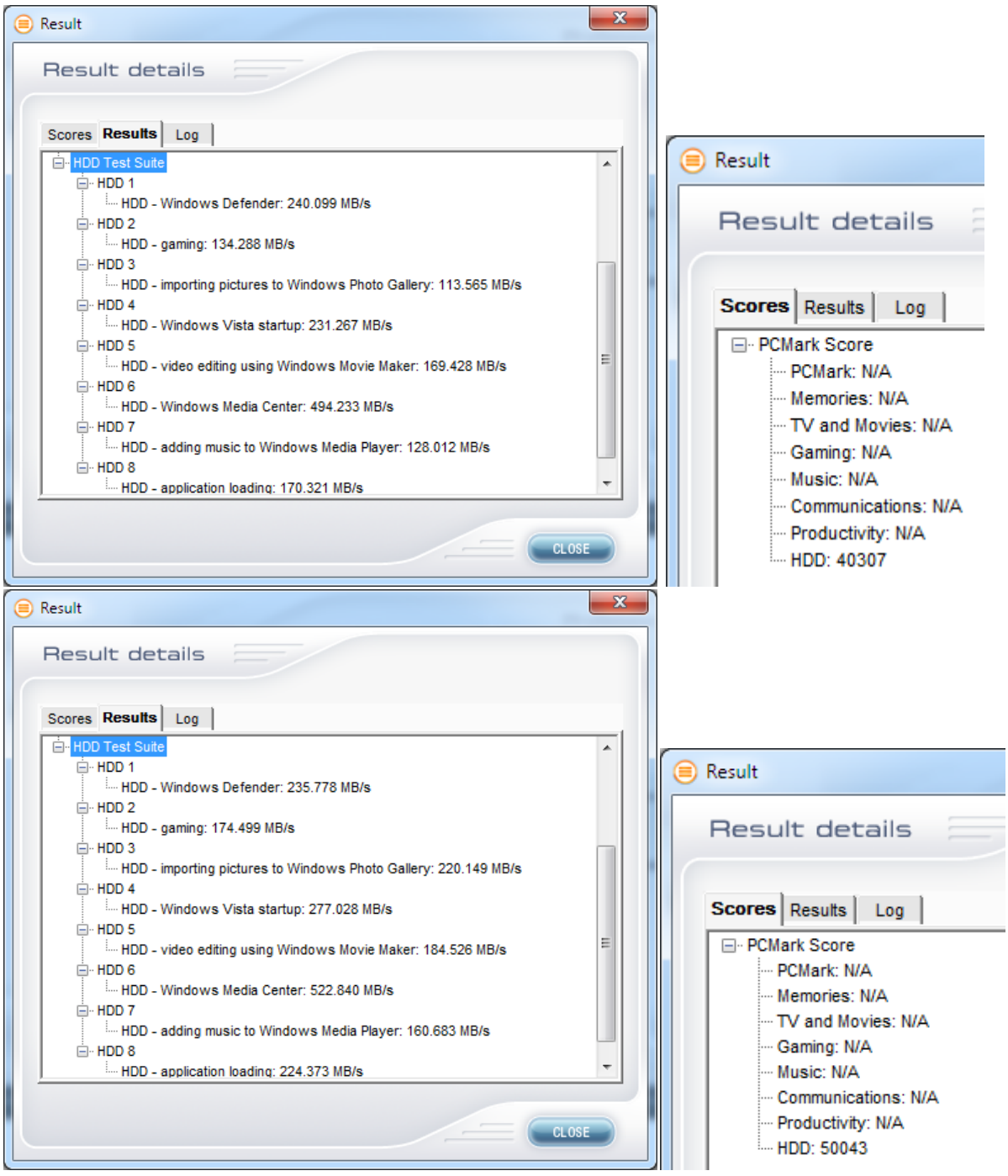


Figure 2: PC Mark Vantage Scores (Upper-220GB, Bottom-460GB)

5.3.3 CRYSTAL DISKMARK

In Crystal DiskMark tested for five loops with 4000MB, 1000MB and 100MB data sizes.

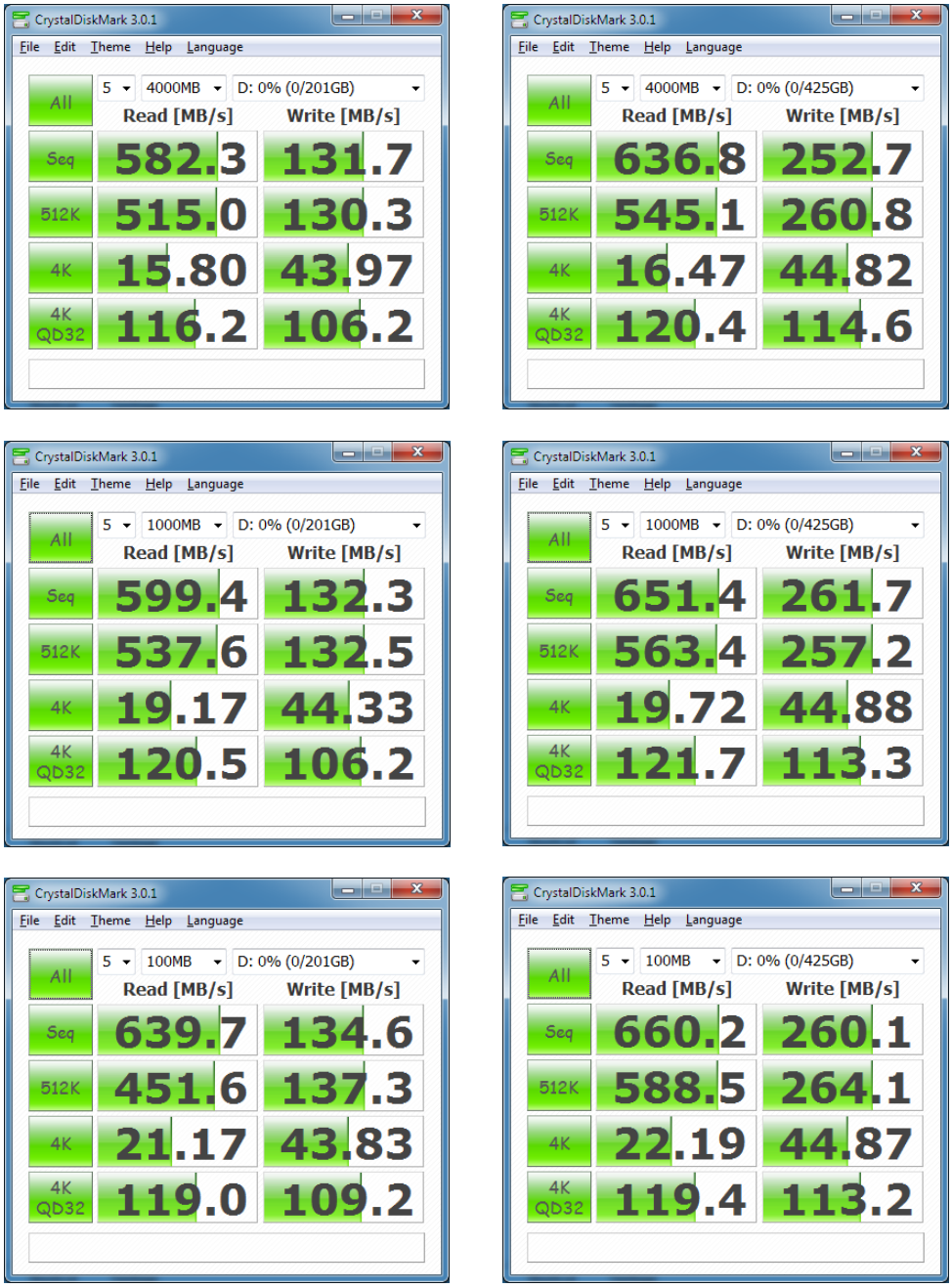
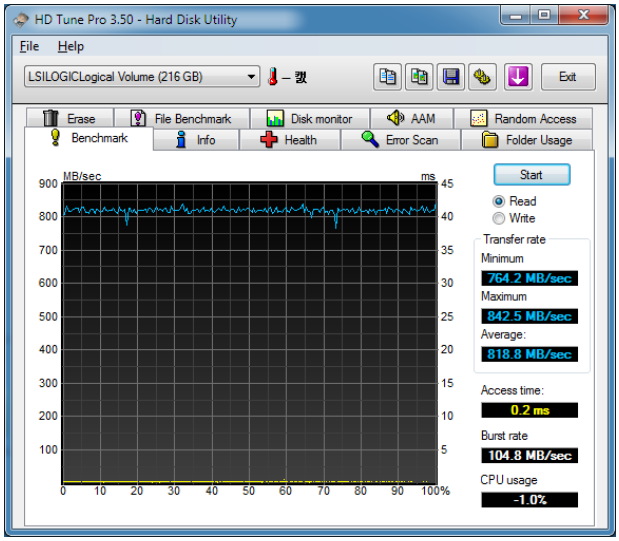
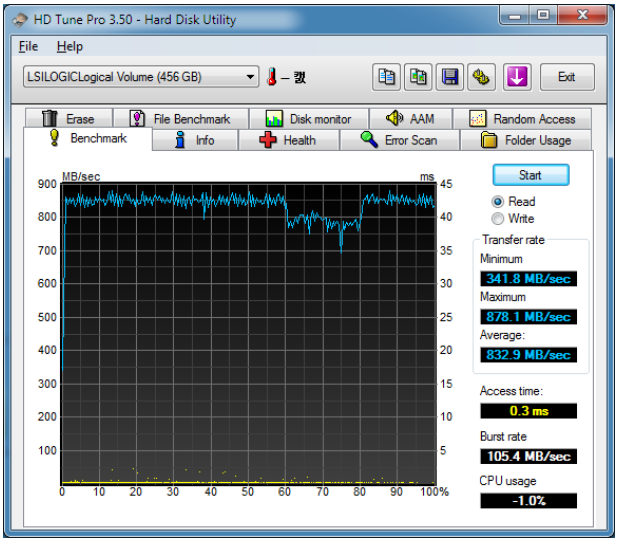


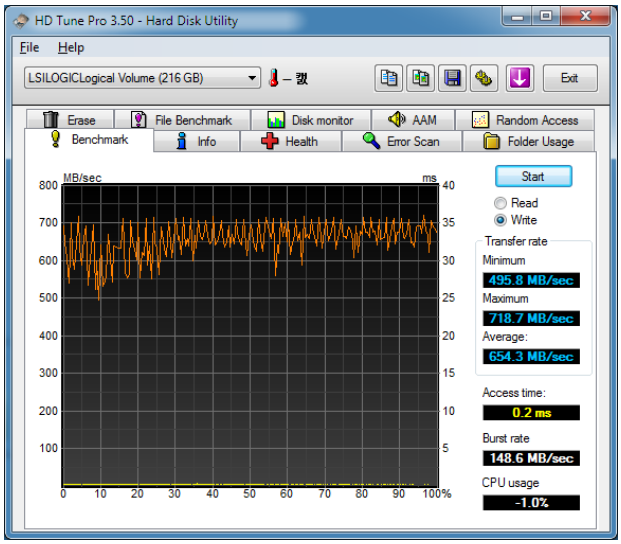
Figure 3: Crystal DiskMark Scores (Left-220GB, Right-460GB)

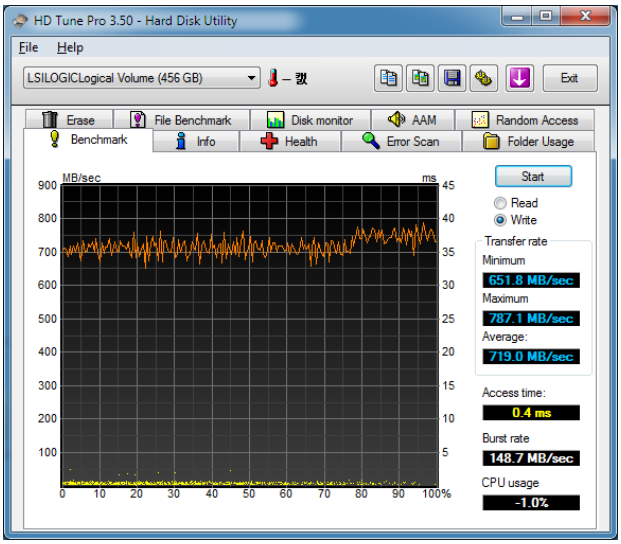
5.3.4 HD TUNE PRO 3.50

HD TUNE showed average read speeds of around 850MB/sec and average write speeds of around 700MB/sec, This HD TUNE benchmark shows Sequential speed and the next page shows the random access on READ and WRITE.









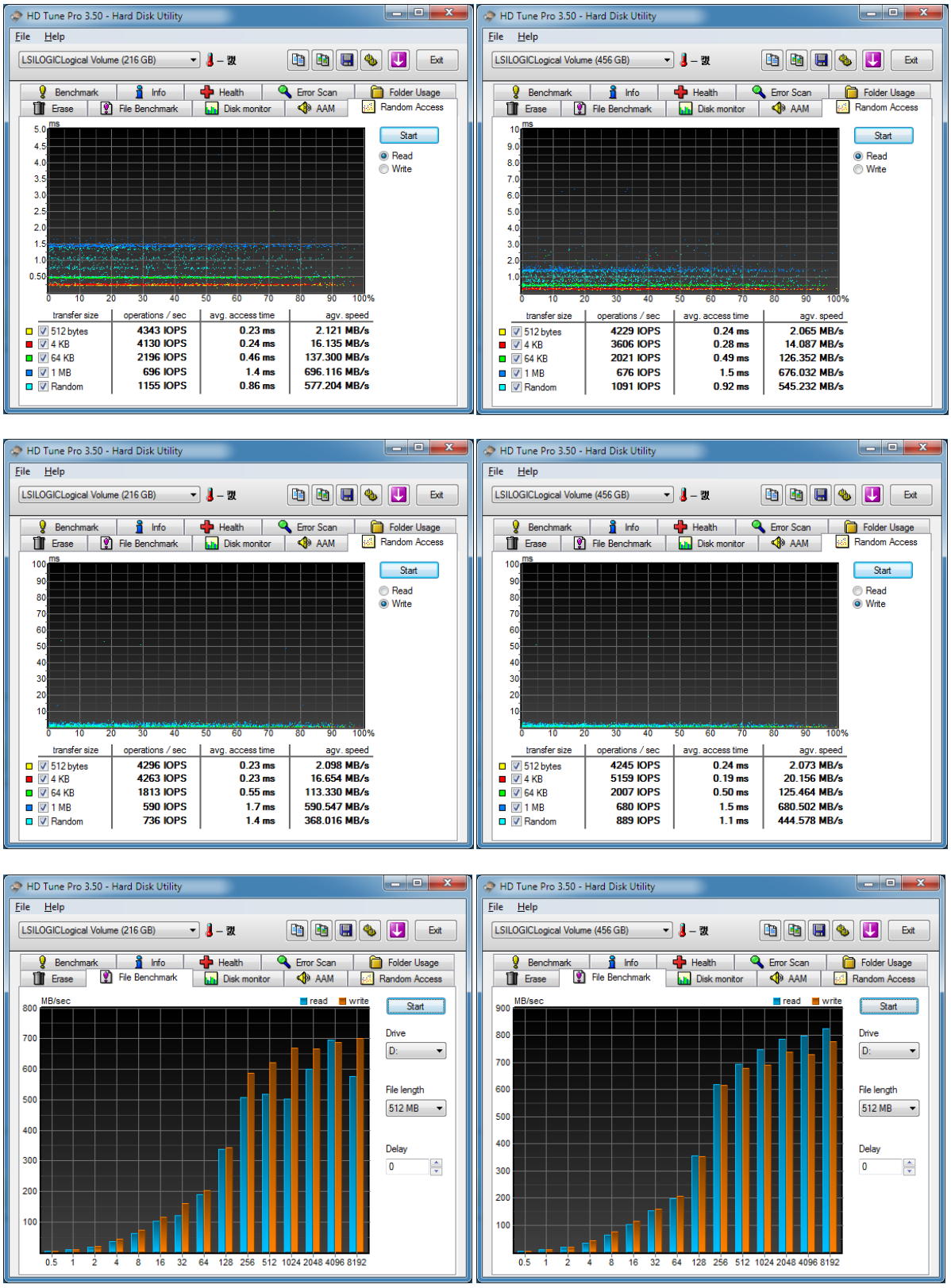


Figure 4: HD TUNE PRO 3.50 Scores

5.3.5 AS SSD BENCHMARK 1.3.3626

The AS SSD Benchmark is almost same as the mix of Crystal DiskMark and PC Mark Vantage.

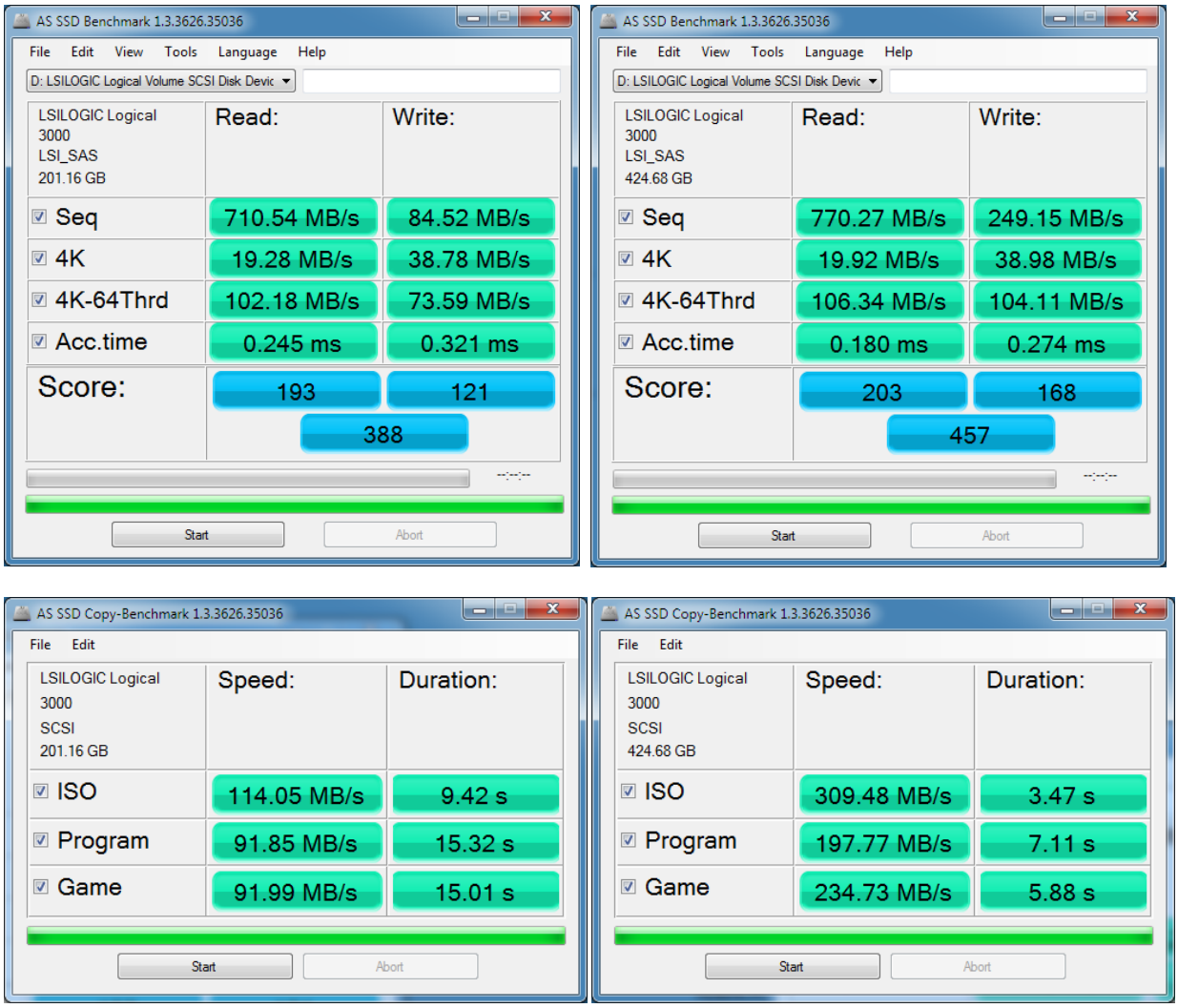


Figure 5: AS SSD Scores

***Some says AS SSD and Crystal Benchmark program shows you "in-compressible" data. Do you really think so?**

5.3.6 IO METER

IO Meter tests the RAIDDrive's transaction speed in I/O operations per second. We ran this test with queue depth settings of 1 ~ 32. The larger queue depth tended to offer the highest transaction speeds. We specially ran this program for 50 minutes per each thread at the Steady State SSD status.

	IOps						MBps					
	QD=1	QD=2	QD=4	QD=8	QD=16	QD=32	QD=1	QD=2	QD=4	QD=8	QD=16	QD=32
4KB-RR	3,939	7,841	14,637	20,979	24,295	23,278	15.4	30.6	57.2	82.0	94.9	90.9
4KB-RW	10,616	20,850	28,293	28,903	28,757	27,099	41.5	81.4	110.5	112.9	112.3	105.9
4KB-SR	8,533	14,889	24,939	29,344	27,261	26,880	33.3	58.2	97.4	114.6	106.5	105.0
4KB-SW	10,698	20,809	28,111	29,169	27,545	26,891	41.8	81.3	109.8	113.9	107.6	105.0
8KB-RR	3,667	7,184	12,228	17,914	20,105	19,905	28.6	56.1	95.5	139.9	157.1	155.5
8KB-RW	9,038	17,247	25,015	26,580	26,594	24,419	70.6	134.7	195.4	207.7	207.8	190.8
8KB-SR	7,320	13,069	20,261	26,800	27,090	25,664	57.2	102.1	158.3	209.4	211.6	200.5
8KB-SW	9,215	16,602	23,499	26,486	25,985	24,708	72.0	129.7	183.6	206.9	203.0	193.0
16KB-RR	2,931	5,492	9,085	13,476	15,914	16,532	45.8	85.8	142.0	210.6	248.7	258.3
16KB-RW	7,047	13,183	20,374	21,958	21,440	21,316	110.1	206.0	318.3	343.1	335.0	333.1
16KB-SR	5,628	10,023	16,460	24,606	25,647	21,998	87.9	156.6	257.2	384.5	400.7	343.7
16KB-SW	7,236	13,065	19,924	23,327	23,539	20,774	113.1	204.1	311.3	364.5	367.8	324.6
32KB-RR	2,021	4,397	6,433	9,092	10,324	10,906	63.2	137.4	201.0	284.1	322.6	340.8
32KB-RW	5,017	8,941	11,865	12,127	13,787	11,016	156.8	279.4	370.8	379.0	430.8	344.3
32KB-SR	3,987	7,577	12,882	19,809	21,884	18,273	124.6	236.8	402.6	619.0	683.9	571.0
32KB-SW	4,945	9,188	14,496	18,735	15,170	16,565	154.5	287.1	453.0	585.5	474.1	517.7
64KB-RR	1,727	3,181	4,722	5,940	6,632	7,011	107.9	198.8	295.1	371.2	414.5	438.2
64KB-RW	3,435	5,922	6,813	6,742	7,025	6,299	214.7	370.1	425.8	421.4	439.1	393.7
64KB-SR	2,613	5,751	10,330	11,851	13,199	13,058	163.3	359.4	645.6	740.7	824.9	816.1
64KB-SW	3,128	6,042	9,478	8,280	10,013	10,233	195.5	377.6	592.4	517.5	625.8	639.6
128KB-RR	1,500	2,588	3,381	4,181	3,904	4,540	187.5	323.4	422.7	522.6	488.0	567.6
128KB-RW	2,554	3,790	3,797	3,533	3,757	3,102	319.3	473.7	474.7	441.6	469.6	387.8
128KB-SR	2,383	4,800	6,123	6,719	6,932	6,841	297.9	600.0	765.3	839.9	866.6	855.1
128KB-SW	2,661	4,906	4,711	4,524	5,402	4,881	332.6	613.3	588.9	565.5	675.2	610.2
Database	4,577	8,039	13,583	19,175	22,043	22,899	35.8	62.8	106.1	149.8	172.2	178.9
File Server	3,927	6,969	11,462	16,938	21,392	20,220	42.8	75.4	124.5	183.6	230.8	218.3
Web Server	3,519	6,109	10,756	14,350	17,433	18,466	54.8	93.2	164.7	219.9	264.7	280.2
Workstation	4,178	7,839	12,283	19,063	23,222	22,399	32.6	61.2	96.0	148.9	181.4	175.0
256KB Stream Read	949	1,082	983	1,430	1,266	1,305	237.3	270.4	245.8	357.4	316.6	326.3
256KB Stream Write	2,160	2,298	2,371	2,593	2,646	2,526	539.9	574.5	592.7	648.2	661.5	631.5
512KB Stream Read	1,149	1,528	1,585	1,672	1,691	1,686	574.4	763.8	792.5	836.1	845.5	842.9
512KB Stream Write	1,174	1,327	1,428	1,130	1,086	1,387	587.1	663.5	713.8	565.2	543.0	693.6

Figure 6: IO Meter Scores (220GB)

	IOps						MBps					
	QD=1	QD=2	QD=4	QD=8	QD=16	QD=32	QD=1	QD=2	QD=4	QD=8	QD=16	QD=32
4KB-RR	4,139	8,150	15,564	25,204	27,798	27,407	16.2	31.8	60.8	98.5	108.6	107.1
4KB-RW	10,689	20,975	29,053	29,007	29,320	28,225	41.8	81.9	113.5	113.3	114.5	110.3
4KB-SR	8,652	15,126	25,521	29,566	27,570	26,798	33.8	59.1	99.7	115.5	107.7	104.7
4KB-SW	10,775	21,050	28,654	29,538	28,156	26,748	42.1	82.2	111.9	115.4	110.0	104.5
8KB-RR	3,906	7,554	14,220	23,398	26,046	25,409	30.5	59.0	111.1	182.8	203.5	198.5
8KB-RW	9,221	17,790	26,211	27,737	27,611	25,332	72.0	139.0	204.8	216.7	215.7	197.9
8KB-SR	7,515	13,532	21,053	27,097	26,924	25,677	58.7	105.7	164.5	211.7	210.3	200.6
8KB-SW	9,302	16,906	24,098	27,125	26,708	25,177	72.7	132.1	188.3	211.9	208.7	196.7
16KB-RR	3,437	6,616	12,122	20,148	22,603	21,991	53.7	103.4	189.4	314.8	353.2	343.6
16KB-RW	7,254	13,683	21,792	24,838	24,792	22,570	113.3	213.8	340.5	388.1	387.4	352.7
16KB-SR	6,059	10,548	17,181	25,156	25,660	21,996	94.7	164.8	268.4	393.1	400.9	343.7
16KB-SW	7,360	13,549	21,047	24,809	24,864	21,554	115.0	211.7	328.9	387.6	388.5	336.8
32KB-RR	2,840	5,301	9,425	14,432	17,417	17,215	88.8	165.7	294.5	451.0	544.3	538.0
32KB-RW	5,125	9,323	14,854	19,355	19,994	17,627	160.1	291.3	464.2	604.8	624.8	550.8
32KB-SR	4,451	8,132	13,931	21,702	22,169	18,148	139.1	254.1	435.3	678.2	692.8	567.1
32KB-SW	5,116	9,610	15,692	20,869	20,957	17,643	159.9	300.3	490.4	652.2	654.9	551.3
64KB-RR	2,329	4,197	6,693	9,415	11,416	11,597	145.6	262.3	418.3	588.4	713.5	724.8
64KB-RW	3,539	6,276	9,276	11,404	12,569	12,971	221.2	392.3	579.7	712.8	785.6	810.7
64KB-SR	3,119	6,364	11,142	13,756	15,002	14,606	194.9	397.8	696.4	859.7	937.6	912.9
64KB-SW	3,429	7,262	12,462	14,028	14,289	14,298	214.3	453.9	778.9	876.8	893.1	893.6
128KB-RR	1,977	3,328	4,717	5,899	6,581	6,673	247.1	416.0	589.6	737.4	822.6	834.2
128KB-RW	2,679	4,544	5,659	6,326	6,551	6,689	334.9	568.0	707.4	790.7	818.9	836.2
128KB-SR	2,623	5,107	6,840	7,501	7,602	7,604	327.9	638.4	855.0	937.6	950.3	950.5
128KB-SW	2,773	5,283	6,924	7,019	7,035	7,047	346.6	660.4	865.5	877.3	879.4	880.8
Database	4,725	9,021	15,192	23,359	26,371	25,392	36.9	70.5	118.7	182.5	206.0	198.4
File Server	4,064	7,566	13,358	20,893	25,184	24,076	44.2	82.3	145.1	226.3	272.2	259.9
Web Server	3,668	6,915	12,212	18,432	22,658	22,268	55.6	106.3	186.0	279.2	344.1	337.9
Workstation	4,285	8,197	14,778	23,120	26,636	25,324	33.5	64.0	115.5	180.6	208.1	197.8
256KB Stream Read	2,077	3,169	3,550	3,549	3,524	3,573	519.4	792.3	887.4	887.2	881.0	893.2
256KB Stream Write	2,334	3,347	3,383	3,417	3,423	3,474	583.6	836.7	845.7	854.2	855.7	868.5
512KB Stream Read	1,290	1,745	1,834	1,833	1,842	1,839	645.1	872.4	917.1	916.4	921.0	919.4
512KB Stream Write	1,294	1,666	1,676	1,679	1,703	1,718	647.0	833.0	838.1	839.5	851.6	858.9

Figure 7: IO Meter Scores (460GB)

6.0 ELECTRICAL SPECIFICATIONS

6.1 POWER SUPPLY REQUIREMENTS

Power Rail	Voltage Tolerance	Supply Current	Capacitive Load
+3.3V	Max +/-9%	Max 3.0A	Max 1000µF
+12V	Max +/-8%	Max 2.1A	Max 1000µF

7.0 ENVIRONMENTAL SPECIFICATIONS

Operating Temperature: Commercial Temp Range Only

- Commercial +0°C to +70°C

Storage Temperature: -40°C to +70°C

Humidity: 5% to ~ 90% RH

8.0 QUALITY AND RELIABILITY SPECIFICATIONS

Data Retention: Maximum of 10 years at clean status.

Wear Leveling: Dynamic and static wear-leveling

Bad Block Management: Drive will self identify bad blocks and remap physical to logical addresses to avoid bad blocks.

ECC/EDC (Error Correction Code/Error Detection Code): Built in error detection and correction will correct physical bit errors in NAND.

MTBF: >1,500,000 hours

Power Cycle: TBD

9.0 COMPLIANCE SPECIFICATIONS

All Upstream models are compliant with the following standards and regulations:

- RoHS

10.0 PIN DESCRIPTIONS

10.1 RAIDDRIVE PCIE PIN ASSIGNMENTS

Pin	Side B		Side A	
	Name	Description	Name	Description
1	+12V	12V Power	PRSNT1#	Hot-Plug presence detect
2	+12V	12V Power	+12V	12V Power
3	RSVD	12V Power	+12V	12V Power
4	GND	Ground	GND	Ground
5	SMCLK	Not Used	JTAG2	Not Used
6	SMDAT	Not Used	JTAG3	TDI (Test Data Input)
7	GND	Ground	JTAG4	TDO (Test Data Output)
8	+3.3V	3.3V Power	JTAG5	Not Used
9	JTAG1	Not Used	+3.3V	3.3V power
10	3.3Vaux	Not Used	+3.3V	3.3V power
11	WAKE#	Not Used	PERST#	Fundamental reset
Mechanical Key				
12	RSVD	Reserved	GND	Ground
13	GND	Ground	REFCLK+	Reference clock (differential pair)
14	PETp0	Transmitter differential pair, Lane 0	REFCLK-	
15	PETn0		GND	Ground
16	GND	Ground	PERp0	Receiver differential pair, Lane 0
17	PRSNT2#	Not Used	PERn0	
18	GND	Ground	GND	Ground
End of the x1 connector				
19	PETp1	Transmitter differential pair, Lane 1	RSVD	Reserved
20	PETn1		GND	Ground
21	GND	Ground	PERp1	Receiver differential pair, Lane 1
22	GND	Ground	PERn1	
23	PETp2	Transmitter differential pair, Lane 2	GND	Ground
24	PETn2		GND	Ground
25	GND	Ground	PERp2	Receiver differential pair, Lane 2
26	GND	Ground	PERn2	

Pin	Side B		Side A	
	Name	Description	Name	Description
27	PETp3	Transmitter differential pair, Lane 3	GND	Ground
28	PETn3		GND	Ground
29	GND	Ground	PERp3	Receiver differential pair, Lane 3
30	RSVD	Reserved	PERn3	
31	PRSNT2#	Not Used	GND	Ground
32	GND	Ground	RSVD	Reserved
	End of the x4 connector			
33	PETp4	Transmitter differential pair, Lane 4	RSVD	Reserved
34	PETn4		GND	Ground
35	GND	Ground	PERp4	Receiver differential pair, Lane 4
36	GND	Ground	PERn4	
37	PETp5	Transmitter differential pair, Lane 5	GND	Ground
38	PETn5		GND	Ground
39	GND	Ground	PERp5	Receiver differential pair, Lane 5
40	GND	Ground	PERn5	
41	PETp6	Transmitter differential pair, Lane 6	GND	Ground
42	PETn6		GND	Ground
43	GND	Ground	PERp6	Receiver differential pair, Lane 6
44	GND	Ground	PERn6	
45	PETp7	Transmitter differential pair, Lane 7	GND	Ground
46	PETn7		GND	Ground
47	GND	Ground	PERp7	Receiver differential pair, Lane 7
48	PRSNT2#	Hot-Plug presence detect	PERn7	
49	GND	Ground	GND	Ground
	End of the x8 connector			

Table 3: Data Pin Signal Assignment

11.0 OS INSTALLATION TEST RESULT

The following OS had been installed / tested / verified.

Windows	2000, 2003, XP, Vista, 7, 2008		Need Driver USB drive
Linux	RHEL	5.3 5.7 6.0 6.1	No Need Driver
	CentOS	5.6 6.0	No Need Driver
	Fedora	13 14 15 16	No Need Driver
	SUSE	11	No Need Driver
	OpenSUSE	11.4	No Need Driver
	Ubuntu	10.04 11.04	No Need Driver
	Mint	11	No Need Driver
	Debian	201012	No Need Driver

12.0 INSTALLATION

BEFORE YOU BEGIN INSTALLATION

Thanks for purchasing the UPSTREAM as your data storage solution. The following shows you simple step-by-step instructions for installing and configuring the UPSTREAM.

PACKAGE CONTENTS

1. If your package is missing any of the items listed below, please contact your dealer before you install.
2. The UPSTREAM box includes the following items.
    a. UPSTREAM in an ESD-protective bag.
    b. CD – containing drivers, user's manual, other information for drive.
    c. You can download the latest driver from Super Talent website/FORUM.
        i. http://www.supertalent.com/home/forum/viewforum.php?f=52

TOOLS REQUIRED

An ESD grounding strap or mat is required. You may also require some standard tools to open your system's case.

INSTALLATION (PLEASE REFER TO THE USER'S MANUAL FOR THE DETAILS)

1. Unpack the UPSTREAM box
2. Power PC/Server off
3. Install the UPSTREAM (PCIe x8 slot should be available)
4. Power up the system
5. Go into computer BIOS
    a. Make sure BOOT PRIORITY is correctly set.
        i. First, you verify the Upstream is detected and recognized.
        ii. If you want to install the OS on to the Upstream, OS DVD disk is #1 and Upstream is #2.
    b. See the "How to set up the RAIDDRIVE" pdf file in a CD for the details.
6. You do not need any specific driver at most of latest Linux OS installation.
    a. See the OS Test result.
    b. When installing the Windows OS, prepare a USB Flash Drive with driver.

FOR MORE INFORMATION

For Technical Support:

If additional support is needed, please visit the Super Talent Web site at www.supertalent.com for the following topics:

- **Warranty Services:** Includes the warranty service policy and the RMA request forms.
- **Technical Information:** Includes product data sheets and various SSD whitepapers.
- **Tools Section:** Includes frequently asked questions (FAQs).

For More Information or Further Technical Support Please Contact:

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CHANGE RECORD

Version	Release Date	Changes
1.0	November 07, 2011	Initial Release

Table 4: Change Record