Project name
CFast Validation

Revision
PA3

Issued
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Test protocol CFast Swissbit 10GB pSLC

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1. Introduction

This is the test protocol following the CF card test specification. As most tests are somewhat complicated and only aims to point out one or more important property of the CF card some written text is required for the test.

The reference CFast card mentioned in this report is: APCFA008GBAN-WFTM1, which this CFast replaces.

Tests were mainly performed with a USB card reader.

In some cases where the test case is denoted as PASS/FAIL. Then test the result is one of:

- **PASSED**
- **PASSED** WC (with comment)
- **FAILED**
- N/A (Not Applicable).

1.1. References

[1] CF Validation Tests

2. Collect general information

General test info

Revision of test specification	PA6
Date	2021-03-31
Tests performed by	Jens Rubensson

Information about the CF card

	Ref CFast	CFast under test
CF card model name	Apacer APCFA008GBAN-WFTM1	Swissbit SFCA010GH1AO1TO-I-5S-21P-STD
Data sheet	 CFast_2H-M_15nm_ APCFAxxxGBAN-XFTI	 **F_86_fact_sheet-192 0413.pdf**
Distributor		
Distributor article number		
<u>According to specification:</u> Maximum performance	*Read (sequential) up to* 140 MB/s *Write (sequential) up to* 100 MB/s	Read: **Not specified for the 10 GB card**, up to 373 MB/s (10GB – 160 GB cards) Write: **Not specified for the 10 GB card**, up to 236 MB/s (10GB – 160 GB cards)
IOPS Performance (4K Random Read)	Read: x IOPs Write: x IOPs	Read: **Not specified for the 10 GB card**, random Read 4K up to 13,100 IOPs (10GB – 160 GB cards) Write: **Not specified for the 10 GB card**, random Write 4K up

		to 8,500 IOPs (10GB – 160 GB cards)
Endurance	7 TB(Written)	Not specified
Hardware BCH ECC	*Correct up to*	
	up to 72-bit ECC/1KB	Number not specified "Flexible BCH and GCC ECC engines provide superior error correction performance"
MTBF	> 1'000'000 hours	> 2,000,000 hours @ 25°C
Other information		

CF Data

	Ref CFast	CFast under test
SMART support	Yes	Yes
Exported drive info file	 DriveInfo.txt	 DriveInfo.txt
Number of bytes in kB (disk properties in explorer. Use "Capacity/1024")	7 460 937.5 kB	9 762 792 kB (FAT32)

3. Generic test cases

Read/write performance test

	Ref CFast	CFast under test
Exported performance file *(Windows only)*	 FileBenchmarkA.txt  Liberty HD Tune File Benchmark Apacer 8(	 FileBenchmark.txt  filebenchmark_xm2.txt

Performance Read / Write at 1024 kB	HD tune: HD tune results from the ref card are not reliable. **CrystalDiskMark XM2:** * MB/s = 1,000,000 bytes/s [SATA/600 = 600,000,000 bytes/s] * KB = 1000 bytes, KiB = 1024 bytes Sequential Read (Q= 32,T= 1) : 111.379 MB/s Sequential Write (Q= 32,T= 1) : 42.736 MB/s Random Read 4KiB (Q= 8,T= 8) : 60.385 MB/s [14742.4 IOPS] Random Write 4KiB (Q= 8,T= 8) : 32.980 MB/s [8051.8 IOPS] Random Read 4KiB (Q= 32,T= 1) : 48.969 MB/s [11955.3 IOPS] Random Write 4KiB (Q= 32,T= 1) : 27.980 MB/s [6831.1 IOPS] Random Read 4KiB (Q= 1,T= 1) : 13.106 MB/s [3199.7 IOPS] Random Write 4KiB (Q= 1,T= 1) : 16.868 MB/s [4118.2 IOPS]	HD Tune: Read: 158 MB/s Write: 85 MB/s **CrystalDiskMark XM2:** * MB/s = 1,000,000 bytes/s [SATA/600 = 600,000,000 bytes/s] * KB = 1000 bytes, KiB = 1024 bytes Sequential Read (Q= 32,T= 1) : 214.524 MB/s Sequential Write (Q= 32,T= 1) : 84.425 MB/s Random Read 4KiB (Q= 8,T= 8) : 21.318 MB/s [5204.6 IOPS] Random Write 4KiB (Q= 8,T= 8) : 10.686 MB/s [2608.9 IOPS] Random Read 4KiB (Q= 32,T= 1) : 17.475 MB/s [4266.4 IOPS] Random Write 4KiB (Q= 32,T= 1) : 9.177 MB/s [2240.5 IOPS] Random Read 4KiB (Q= 1,T= 1) : 9.233 MB/s [2254.2 IOPS] Random Write 4KiB (Q= 1,T= 1) : 6.523 MB/s [1592.5 IOPS] **CrystalDiskMark USB card reader:** * MB/s = 1,000,000 bytes/s [SATA/600 = 600,000,000 bytes/s] * KB = 1000 bytes, KiB = 1024 bytes Sequential Read (Q= 32,T= 1) : 145.960 MB/s Sequential Write (Q= 32,T= 1) : 83.453 MB/s Random Read 4KiB (Q= 8,T= 8) : 15.520 MB/s [3789.1 IOPS] Random Write 4KiB (Q= 8,T= 8) : 11.187 MB/s [2731.2 IOPS] Random Read 4KiB (Q= 32,T= 1) : 16.496 MB/s [4027.3 IOPS] Random Write 4KiB (Q= 32,T= 1) : 12.029 MB/s [2936.8 IOPS]

	Random Read 4KiB (Q= 1,T= 1) : 9.394 MB/s [2293.5 IOPS] Random Write 4KiB (Q= 1,T= 1) : 7.901 MB/s [1929.0 IOPS]

Random Access read/write performance test

	Ref CFast	CFast under test
Exported performance file: *Read test (Windows only)*	 RandomAccessRead.txt	 random read.txt
Exported performance file: *Write test (Windows only)*	 RandomAccessWrite.txt	 random write.txt

4 KB write test

	Operations/sec	Avg. access time	Maximum access time	Average speed
CF under test	1600 IOPS	0.624 ms	28.856 ms	6.253 MB/s
Ref CF	3841 IOPS	0.260 ms	1.025 ms	15.004 MB/s

CF-card reader power loss test

Test files OK (PASS/FAIL) File system/partitions OK (PASS/FAIL) No permanent damage (PASS/FAIL)	Not performed. Windows freezes when USB power is cut.

Temperature test

Maximum temperature (PASS/FAIL)	**PASSED** usb card reader: PassMark BurnInTest, in 80°C for 2 hours. HD tune File benchmark: Read / Write at 1024 kB

	Read: 165 MB/s Write: 85 MB/s
Minimum temperature (PASS/FAIL)	**PASSED** XM9 unit was cooled down to –20 °C and then started up with linux test image. HD tune File benchmark -35 °C, usb card reader Read / Write at 1024 kB Read: 155 MB/s Write: 82 MB/s

Tear down inspection

Flash chips inside the CF card	-
Flash controller	-
Operating temperature	-
Data sheet *(if found)*	-
Is CF-card molded on the inside?	-

4. Product specific test cases

4.1. XM9

Power down recovery

Power down recovery test (PASS/FAIL)	-	**PASSED**
	Ref CF (if available)	*CF under test*

Start up

Start up test (PASS/FAIL)	-	**PASSED**
	Ref CF (if available)	*CF under test*

Performance test

Performance test (PASS/FAIL)	-	**PASSED**
	Ref CF (if available)	*CF under test*
Time to copy 10x100 MB	(C:\ -> C:\) < 11s	XM9, Linux prodtest image /opt/x -> /opt/x 8s

Vibration

	Ref CF (if available)	*CF under test*
Vibration test (PASS/FAIL)	-	-
Bump test (PASS/FAIL)	-	-

Startup time

	Ref CF (if available)	*CF under test*
Firmware initialization time	-	-
Total boot time	-	XM9, linux prod test image 25 s

BIOS settings

Does unit boot with factory default settings (yes/no)	-
Required changes to boot (if no)	-
Possible optimizations	-

Production tests

Time to copy CF-card in production tests	-
Passed production tests (PASS/FAIL)	-