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**Serial ATA
International Organization**

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Title : Digital: Out of band management control
structures**

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Author Information

Author Name	Company	Email address
Kevin Marks	Dell Inc	Kevin.Marks@dell.com

Workgroup Chair Information

Workgroup (Phy, Digital, etc...)	Chairperson Name	Email address
Digital	James C. Hatfield	james.c.hatfield@seagate.com

Document History

Version	Date	Comments
0	6 Febuary 2017	Initial release.
1	2 March 2017	Removed extra IDENTIFY DEVICE / ID log bit indicating support, as it is already indicated in the log. Also change any fields that contained OOB to spell it out to make it less confusing with OOB signaling.
2	3 March 2017	Changes based on feedback from Seagate on the digital call and feedback from Toshiba including making log persistent.
3	20 March 2017	Editorial pass and fixed power state requirements for transmisstion of the stopping transmission packet and resumption. Lastly removed serveral editorial comments.
4	27 March 2017	Changes based on 3/27 Digital Meeting.
5	01 May 2017	Added requirement to send stopping transmission packet twice@ 1 second interval, add footnote to table X+4 that the test mode should resume where it left off when returning from standby.
6	15 May 2017	Syncing with changes proposed in T10/17-073r1
7	23 May 2017	Changes base on 5/22 Digital WG call – made stopping transmission requirement prior to entering mode, and global changed to see SFF-8609 instead of defined in, add sentence about relationship to DevSleep.
8	17 July 2017	Updates to match SPL-5 changed for T10 Cap WG meeting (editorial).
9	17 July 2017	Changes base on 7/17 Digital WG call – split up two if sentence structure into two paragraphs.
10	31 July 2017	Changes based internal review and 7/31 WG call and 8/14 WG call
11	13 November 2017	Changes based on 30 day member review. Spelled out RE bit nd TRE bits.

Introduction (Not part of any proposed text)

SFF-8609 provides an OOB method to communicate various attributes (e.g., current temperature) by modulating this information over the DAS signal on a SATA device. This proposal defines a model and log to control the enablement of this reporting, the frequency of reporting, and enablement of test modes. Also a similar proposal is currently being proposed for T10's SPL-5 project.

1 Technical Specification Changes

1.1 <Title of section being changed>

[editor note: Existing text is black. New text is marked as underlined in blue color. Material to be deleted ~~is red with strikethrough markings~~. <<.. indicates editorial text ..>> Indicates that reference or code value may change when integrated

3.3 References under development

The following standards specifications published by the Storage Networking Industry Association - SFF Technology Affilate ~~Small Form Factor (SFF) Committee~~ are referenced:

- a) SFF-8086;
- b) SFF-8087;
- c) SFF-8088;
- d) SFF-8111;
- e) SFF-8144;
- f) SFF-8146;
- g) SFF-8201;
- h) SFF-8301;
- i) SFF-8470;
- j) SFF-8482;
- k) SFF-8484;
- l) SFF-8553;
- m) SFF-8609;
- ~~m~~n) SFF-8630;
- ~~n~~o) SFF-8639; and
- ~~o~~p) SFF-8680.

For more information on the current status of SFF documents, contact the Storage Networking Industry Association (SNIA) (see www.snia.org/sff).

~~These standards are available for download through <http://www.sffcommittee.org>:~~

4 Definitions, abbreviations, and conventions

4.1 Terminology

4.1.1 Definitions and abbreviations

<<...>>

4.1.1.Y out of band management interface

The management interface defined in 13.X

<<...>>

6.13.3.3 Functional definition

Table 45 defines the two activity signal states and the corresponding conditions.

Table 45 – Activity signal functional states

State	Condition ^b
Signal asserted (driven low)	Command(s) outstanding ^a
Signal negated (high impedance)	All other conditions

^a Devices may omit asserting the activity signal for commands that do not access the media and have an expected service time too short to allow visual perception of the signal. Command(s) outstanding does not include the software reset, power-on reset, or COMRESET command protocols. As a consequence, pin P11 shall not be driven low by the device prior to return of the reset signature for the reset command protocols. This is behaviorally different than the parallel ATA DASP- signal.

^b If the device supports the out of band management interface (see 13.X) (i.e., the OUT OF BAND MANAGEMENT INTERFACE SUPPORTED bit is set to one (see 13.7.9.2.29)) and the out of band management interface is enabled (i.e., the REPORTING ENABLED bit set is set to one (see 13.7.Z.1)), then the device may toggle the activity signal as defined in SFF-8609 while transferring attribute information using the out of band management interface even if no commands are outstanding.

<<...>>

13.7 SATA logs

13.7.1 SATA logs overview

There are several log “files” available in a SATA device. ~~They are all read-only.~~ [Whether a log is read-only or is able to be written is indicated in Table 113.](#) The READ LOG EXT command [and READ LOG DMA EXT command, if supported](#) in the General Purpose Logging feature set (see ACS-4) are used to read the SATA logs. ~~In some cases the READ LOG DMA EXT command may also be used (see ACS-4).~~ [If the log is writeable, then the WRITE LOG EXT command and the WRITE LOG DMA EXT command, if supported in the General Purpose Logging feature set \(see ACS-4\) are used to write the SATA logs.](#)

Each log has an “address” that it is referenced. Each log contains zero or more “pages” of data. Each “page” contains 512 bytes of data.

<<...>>

13.7.2 Log address definitions

The log addresses assigned for Serial ATA are defined in Table 113.

Table 113 – Log addresses for Serial ATA

Log Address	Description	R/W	Reference
00h..0Fh	As defined in the ACS-4 standard	-	-
10h	NCQ Queued Error log	RO	13.7.4
11h	Phy Event Counters log	RO	13.9.4
12h	NCQ NON-DATA log	RO	13.7.5

13h	NCQ Send and Receive log	RO	13.7.6
14h	Hybrid Information log	RO	13.7.7
15h	Rebuild Assist log	R/W	13.7.8
16h	Out Of Band Management Control	R/W	13.7.Z
16h ..17h	Reserved	-	-
18h..FFh	As defined in the ACS-4 standard	-	-
Key –			
_____ RO – Log is read only.			
_____ R/W – Log is read or written.			

[<<...>>](#)

13.7.3 General purpose log directory (00h)

[<<...>>](#)

Devices supporting the Out Of Band Management Control log reflect this support in the General Purpose Log Directory (00h) by having the value 1 at offset 02Ch and the value 0 at offset 02Dh of that log to indicate existence of a log at address 16h of 1 page in length.

[<<...>>](#)

Table 114 – General purpose log directory values for Serial ATA

Byte	Log	Value
000h..01Fh	-	As defined in the ACS-4 standard
<<...>>	<<...>>	<<...>>
02Ah	15h	1 if Rebuild Assist log is supported 0 if Rebuild Assist log is not supported
02Bh	15h	0
02Ch	16h	1 if Out Of Band Management Control log is supported 0 if Out Of Band Management Control log is not supported
02Dh	16h	0
02Ch..02Fh	-	Reserved
18h..FFh	-	As defined in the ACS-4 standard

[13.7.Z](#) [Out Of Band Management Control log \(16h\)](#)

[13.7.Z.1](#) [Out Of Band Management Control log overview](#)

The Out Of Band Management Control log is one page in length that contains parameters that control the reporting of out of band attributes as defined in SFF-8609 over the out of band management interface (see [13.X](#)). If the OUT OF BAND MANAGEMENT INTERFACE SUPPORTED bit (see [13.7.9.2.29](#)) is set to one, then the Out Of Band Management Control log shall be supported.

The log is readable and writeable.

The contents of the Out Of Band Management Control log shall persist across all resets.

Byte	Description
0..2	Reserved
3	Bits

	7:4 <u>Reserved</u> 3:0 <u>NUMBER OF VALID DESCRIPTORS field (N)</u>
<u>4</u>	<u>Bits</u> 7 <u>REPORTING ENABLED bit</u> 6:0 <u>Reserved</u>
<u>5</u>	<u>Reserved</u>
<u>6..7</u>	<u>PROTOCOL REVISION CODE field</u>
<u>8</u>	<u>1st attribute control descriptor</u>
<u>39</u>	
<u>40</u>	<u>2nd attribute control descriptor</u>
<u>71</u>	
<u>...</u>	<u>...</u>
<u>8+(32x(N-1))</u>	<u>Nth attribute control descriptor</u>
<u>7+(32*N)</u>	

Figure X – Out Of Band Management Control

The NUMBER OF VALID DESCRIPTORS field specifies the number of valid attribute control descriptors contained in the log.

The REPORTING ENABLED bit set to one specifies that the device shall enable the transfer of attribute information over the out of band management interface (see SFF-8609), based on fields in the attribute control descriptors in this log. The REPORTING ENABLED bit cleared to zero specifies that the device shall not transfer any information over the out of band management interface. If the CURRENT HARDWARE FEATURE CONTROL IDENTIFIER field (see 13.7.9.3.13Old) <<.. this reference will need to be updated as it gets shifted ..>> is or becomes non-zero, then this bit shall be cleared to zero and shall not be changeable by writing to this log (i.e., writing to the REPORTING ENABLED bit shall be ignored).

If the REPORTING ENABLED bit is changed from one to zero by writing to this log, then the device transfers the stopping transmission (see SFF-8609) as described in 13.X.1.

If the REPORTING ENABLED bit is changed from zero to one by writing to this log, then the device transfers the protocol revision code packet (see SFF-8609) as described in 13.X.1.

The PROTOCOL REVISION CODE field specifies the revision of SFF-8609 specification implemented. The SFF-8609 revision code consists of two numeric values separated by a period (e.g., SFF-8609 Revision 1.2). The PROTOCOL REVISION CODE field is encoded such that the first byte (i.e., most significant byte) of this field contains the numerical value of the revision that precedes the period and the second byte (i.e., least significant byte) of this field contains the numerical value of the revision that follows the period (e.g., SFF-8609 Revision 1.2 is encoded as 0102h). This field shall not be changeable by writing to this log (i.e., writing to the PROTOCOL REVISION CODE field shall be ignored).

The attribute control descriptors contains a list of descriptors that controls if the attribute identified by the descriptor identifier is transferred over the out of band management interface and other related control settings.

Figure X+1 defines the format of the attribute control descriptor.

Byte	Description
0	Bits 7:4 Reserved 3:0 DESCRIPTOR IDENTIFIER field
1	Reserved
2:31	Attribute control descriptor specific

Figure X+1 – Attribute control descriptor format

The DESCRIPTOR IDENTIFIER field specifies the attribute associated with this descriptor. Figure X+2 defines the values of the DESCRIPTOR IDENTIFIER field.

Value ^a	Description	Reference
0h	Temperature attribute control	13.7.Z.2
All Others	Restricted for SFF-8609	

^a The code values are the same as the Data Code values in the Data Type Definition (see SFF-8609)

Figure X+2 – DESCRIPTOR IDENTIFIER field

The attribute control descriptor specific parameters contain parameters that control the reporting of the specific descriptor type (i.e., attribute) based on the descriptor identifier.

13.7.Z.2 Temperature attribute control descriptor format

Figure X+3 defines the format of the Temperature attribute control descriptor.

Byte	Description
0	Bits 7:4 Reserved 3:0 DESCRIPTOR IDENTIFIER (0h)
1..3	Reserved
4	Bits 7:1 Reserved 0 TEMPERATURE REPORTING ENABLED bit
5	REPORTING INTERVAL field
6..7	Reserved
8	Bits 7:2 Reserved 1:0 TEST MODE field
9	Reserved
10	TEST MODE TEMPERATURE field
11:32	Reserved

Figure X+3 – Temperature attribute control descriptor format

The TEMPERATURE REPORTING ENABLED bit set to one specifies that reporting of this attribute is enabled over the out of band management interface. The TEMPERATURE REPORTING ENABLED bit cleared to zero specifies that reporting of this attribute is not enabled.

The REPORTING INTERVAL field specifies the interval in seconds (i.e., how often) that the device should transfer this attribute over the out of band management interface. The interval is from the

start of the transfer of this attribute over the out of band management interface to the start of the next transfer of this attribute. If the device processes a General Purpose Logging feature set command that attempts to set the REPORTING INTERVAL field to zero, then the device shall:

- a) return command aborted; and
- b) set sense key set to ILLEGAL REQUEST, and the additional sense code set to INVALID FIELD IN PARAMETER LIST, if the Sense Data Reporting feature set is supported and enabled (see ACS-4).

The TEST MODE field enables a test mode for this attribute that allows for simulating temperature conditions as described in table X+4.

If the TEST MODE field is set to a non-zero value and the device processes General Purpose Logging feature set command that changes any of the changeable fields in this descriptor, then the device should restart the test mode as if the TEST MODE field was just changed to another non-zero value (e.g., if a test mode sequence is in progress, and the device server processes a General Purpose Logging feature set command that changes REPORTING INTERVAL field, then the device should restart the test mode sequence using the new reporting interval value.

Table X+4 — TEST MODE field

Value	Description ^a
00b	Test mode is disabled and the device should transfer the actual temperature of the Serial ATA device over the out of band management interface based on other fields in this descriptor.
01b	<p>A test mode is enabled and the device should transfer a sequence of incrementing temperature values expressed in two's complement over the out of band management interface. If the device is transferring the attribute information, then the device shall start at the temperature specified in the TEST MODE TEMPERATURE field and increment the reported temperature by one every reporting interval (i.e., based on the REPORTING INTERVAL field). Once the temperature being reported reaches 7Fh (i.e., 127 degrees Celsius), the device shall stop incrementing the reported temperature value and continue to report this value until:</p> <ul style="list-style-type: none"> a) the test mode is disabled (i.e., TEST MODE field is cleared to 00b); b) the test mode is changed to a different test mode; or c) one of the following occurs: <ul style="list-style-type: none"> A) software reset; B) power-on reset; or C) a hard reset.
10b	<p>A test mode is enabled and the device should transfer a sequence of decrementing temperature values expressed in two's complement over the out of band management interface. If the device is transferring the attribute information, then the device shall start at the temperature specified in the TEST MODE TEMPERATURE field and decrement the reported temperature by one every reporting interval (i.e., based on the REPORTING INTERVAL field). Once the temperature being reported reaches 80h (i.e., -128 degrees Celsius), the device shall stop decrementing the reported temperature value and continue to report this value until:</p> <ul style="list-style-type: none"> a) the test mode is disabled (i.e., TEST MODE field is cleared to 00b); b) the test mode is changed to a different test mode; or c) one of the following occurs: <ul style="list-style-type: none"> A) software reset; B) power-on reset; or C) a hard reset.
11b	A test mode is enabled and the device should transfer the temperature specified in the TEST MODE TEMPERATURE field over the out of band management interface for every reporting interval (i.e., based on the REPORTING INTERVAL field).
<p>^a If a test mode is enabled (i.e., TEST MODE field is set to non-zero value), and the device stopped transferring this attribute information as part of a change to the standby mode (see ACS-4) as described in 13.X.1, then as a result of the device returning to the active mode (see ACS-4) or idle mode (see ACS-4) the device should continue transferring this attribute information from where it left off in the test mode (e.g., if the device was transferring a sequence of incrementing temperatures as part of the TEST MODE field being set to 01b and 75 degrees Celsius was the last temperature transferred prior to a changing to a standby mode, then after changing back to an active mode or idle mode, the device should resume transferring the temperature continuing at 76 degrees Celsius).</p>	

The TEST MODE TEMPERATURE field specifies the temperature in degrees Celsius in two's complement notation used in test modes specified by the TEST MODE field. This field is ignored if the TEST MODE field is cleared to 00b.

13.X Out Of Band Management Interface

13.X.1 Out Of Band Management Interface Overview

The out of band management interface provides the ability to report attribute information about the Serial ATA device using the methods defined in SFF-8609. The attribute information is defined in the Out Of Band Management Control log (see 13.7.Z.1) and corresponds to the Data Code values in the Data Type Definition in SFF-8609. Support for the out of band management interface is indicated by the OUT OF BAND MANAGEMENT INTERFACE SUPPORTED bit (see 13.7.9.2.29). The out of band management interface is enabled if the the REPORTING ENABLED bit is set to one in Out Of Band Management Control log.

The behavior of the out of band management interface when the device is in the DevSleep interface power state (see 8.1) is vendor specific.

The attribute information is transferred as described in SFF-8609. Fields in the Out Of Band Management Control log specify the frequency at which attribute information is transferred. The device transfers the enabled attribute information over the out of band management interface.

For each enabled attribute, the device should transfer the attribute information based on the reporting interval.

If

- a) multiple attributes are enabled; and
- b) multiple attributes should be transferred at the same time based on the reporting interval of the enabled attributes.

then the device shall choose the attribute to be transferred next based on a vendor specific algorithm.

If:

- 1) the REPORTING ENABLED bit (see 13.7.Z.1) is cleared to zero (i.e., the out of band management interface is disabled); and
- 2) the device processes a General Purpose Logging feature set command that causes the REPORTING ENABLED bit to change from zero to one (i.e., enabling the out of band management interface).

then device shall transfer the protocol revision code packet (see SFF-8609) five times at a one second interval, before transferring any enabled attribute information.

If the out of band management interface is enabled (i.e., the REPORTING ENABLED bit is set to one), then after a:

- a) power-on reset;
- b) hardware reset; or
- c) download microcode activation (see ACS-4).

the device shall transfer the protocol revision code packet five times at a one second interval, before transferring any enabled attribute information.

If the REPORTING ENABLED bit is set to one and the device is going to the:

- a) standby mode (see ACS-4); or
- b) sleep mode (see ACS-4).

then the device should transfer the stopping transmission packet (see SFF-8609), twice with no more than one second from the start of the first packet transfer to the start of the second, prior to entry into this mode.

If the stopping transmission packet was transferred as part of entry into the standby mode or sleep mode, then the device should stop transferring the attribute information over the out of band management interface until the device goes back to the:

- a) active mode (see ACS-4); or
- b) idle mode (see ACS-4).

If the device server processes a General Purpose Logging feature set command that causes:

- the REPORTING ENABLED bit (see 13.7.Z.1) to change from one to zero; or
- the attribute enable bit (e.g., TEMPERATURE REPORTING ENABLED bit (see 13.7.Z.2)) in all attribute control descriptors (see 13.7.Z.1) to become or remain zero when the REPORTING ENABLED bit is set to one,

then the device should transfer the stopping transmission packet twice with no more than one second from the start of the first packet transfer to the start of the second, prior to stopping transmission of the attribute information over the out of band management interface.

13.2.2 IDENTIFY DEVICE

13.2.2.1 IDENTIFY DEVICE information

The IDENTIFY DEVICE information structure is defined in Table 101.

Table 101 – IDENTIFY DEVICE information (part 2 of 4)

Word	O/M	F/V	Description
<<...>>	<<...>>	<<...>>	<<...>>
77	O	R F F F F F V F	Serial ATA Additional capabilities 15:9:10 Reserved 9 Supports Out Of Band Management Interface <<.. bit # is TBD..>> 8 Power Disable feature always enabled 7 DevSleep_to_ReducedPwrState 6 Supports RECEIVE FPDMA QUEUED and SEND FPDMA QUEUED commands 5 Supports NCQ NON-DATA command 4 Supports NCQ Streaming 3:1 Coded value indicating current negotiated Serial ATA signal speed 0 Shall be cleared to zero
<<...>>	<<...>>	<<...>>	<<...>>
79	O	R V V V V V V V V V V V F	Serial ATA features enabled 15:12 Reserved 11 Rebuild Assist enabled 10 Power Disable feature enabled 9 Hybrid Information feature is enabled 8 Device Sleep enabled 7 Device Automatic Partial to Slumber transitions enabled 6 Software settings preservation enabled 5 Hardware Feature Control enabled 4 In-order data delivery enabled 3 Device initiating interface power management enabled 2 DMA Setup Auto-Activate optimization enabled 1 Non-zero buffer offsets in DMA Setup FIS enabled 0 Shall be cleared to zero

<<...>>

13.2.2.18 Word 77, Serial ATA additional capabilities

Word 77 reports additional optional capabilities supported by the device. Support for this Word is optional and if not supported, the Word shall be cleared to zero indicating the device has no support for Serial ATA additional capabilities.

Bits 15:9~~10~~ are reserved.

[Bit 9 is a copy of the OUT OF BAND MANAGEMENT INTERFACE SUPPORTED bit \(see 13.7.9.2.29\).](#)
[<<.. bit # is TBD..>>](#)

Bit 8 is a copy of the POWER DISABLE FEATURE ALWAYS ENABLED bit (see 13.7.9.2.16).

13.2.2.20 Word 79, Serial ATA features enabled

Word 79 reports that optional features supported by the device are enabled. This Word shall be supported if optional Word 78 is supported and shall not be supported if optional Word 78 is not supported.

Bits 15:12 are reserved.

Bit 11 is a copy of the REBUILD ASSIST ENABLED bit (see 13.7.9.3.11).

[<<..>>](#)

13.7.9 Identify Device Data log (30h)

13.7.9.1 Serial ATA settings (page 08h)

The Serial ATA log page (see Table 119) provides information about the Serial ATA Transport.

Table 119 – Serial ATA (page 08h)
(part 1 of 3)

Offset	Type	Contents	Reference
0..7	Qword	Serial ATA Page Information Header Bit Meaning 63 Shall be set to one. 62:24 Reserved 32:16 PAGE NUMBER field. Shall be set to 08h. 15:0 REVISION NUMBER field. Shall be set to 0001h.	
8:15	Qword	SATA Capabilities Bit Meaning 63 Shall be set to one. 62:3 3 2 Reserved 32 OUT OF BAND MANAGEMENT INTERFACE SUPPORTED bit <<.. bit # is TBD..>> 31 POWER DISABLE FEATURE ALWAYS ENABLED bit 30 POWER DISABLE FEATURE SUPPORTED bit 29 REBUILD ASSIST SUPPORTED bit 28 DIPM SSP PRESERVATION SUPPORTED bit 27 HYBRID INFORMATION SUPPORTED bit 26 DEVSLEEP TO REDUCEDPWRSTATE CAPABILITY SUPPORTED bit 25 DEVICE SLEEP SUPPORTED bit <<..>>	13.7.9.2.29 13.7.9.2.16 13.7.9.3-402.28 13.7.9.2.27 13.7.9.2.26 13.7.9.2.25 13.7.9.2.15 13.7.9.2.24 <<..>>
16..23	Qword	Current SATA Settings	

		Bit Meaning 63 Shall be set to one. 62:14 Reserved 13 HYBRID INFORMATION ENABLED bit 12 REBUILD ASSIST ENABLED bit 11 POWER DISABLE FEATURE ENABLED bit 10 DEVICE SLEEP ENABLED bit 9 AUTOMATIC PARTIAL TO SLUMBER TRANSITIONS ENABLED bit 8 SOFTWARE SETTINGS PRESERVATION ENABLED bit <<..>>	 13.7.9.3.12 13.7.9.3.11 13.7.9.3.10 13.7.9.3.9 13.7.9.3.8 13.7.9.3.7 <<..>>
<<..>>	<<..>>	<<..>>	<<..>>

[13.7.9.2.29 OUT OF BAND MANAGEMENT INTERFACE SUPPORTED bit](#)

[If the OUT OF BAND MANAGEMENT INTERFACE SUPPORTED bit is set to one, then the device supports the out of band management interface \(see 13.X\).](#)

[If the OUT OF BAND MANAGEMENT INTERFACE SUPPORTED bit is cleared to zero, then the device does not support the out of band management interface.](#)

[IDENTIFY DEVICE data Word 77 bit 9 is a copy of this bit.](#)
[<<.. bit # is TBD..>>](#)