To: INCITS Technical Committee T10

From: Kevin Butt

Date: June 12, 2007 5:44 pm

Document: T10/06-138r4

Subject: SSC-3: TapeAlert Delineation

1. Revisions

1) Incorporated feedback from SSC Working Group. Complete rewrite.

2) Reworked to meet comments from Sept 2006 SSC-3 WG. Move to a new log page that will have multiple pieces of information. The intent is that each of these log pages can be expanded with information specific to the TapeAlert (or error). In doing this, I thought it prudent to use a common structure for all specific flags.

3) Corrected math in Degredation Indicator

4) Incorporated changes suggested in the January working group. I have completed scrubbing the device information fields. I have not completed scrubbing the medium information fields, but there has been significant work done so I wanted to get this out to let other eyes have time to look at it. Since the work has been so extensive I have not carried foward markings for all the strikeouts and additions.

5) Mar SSC-3 WG covered through Device information and only the medium identifier (i.e. barcode's).

6) 06-138r4: Incorporated suggestions from Mar WG and did additional work.

2. Introduction

In response to the ISV Feedback this is a proposal for how to modify the TapeAlerts and specify which are hardware, which are media, and which are firmware. Additionally since this is being approached there have been many suggestions for how to greatly improve the useability and use-fulness of this information. I have attempted to incorporate many of these suggestions.

Red text are notes to the editor

~~Red strikethrough is text deleted from existing standard~~

Blue text is text added to existing standard

Green text signifies that I have completed incorporating notes or suggestions. I suggest they be looked at to ensure I incorporated them as the requested desired.

3. Proposal

Add new log pages to log page support table and make optional.

3.1 Add a new Service Information log page

4.2.15.1 TapeAlert introduction

TapeAlert provides an application client with the capability to receive notification of various events and conditions arising in the target device. This standard defines 64 unique TapeAlert flags for a sequential-access device. A Service information log page (see 8.2.3x) is also defined that for each flag provides information necessary for an application client to decide appropriate error recovery procedures. ~~Other standards (e.g., SMC-3) may define other TapeAlert flags.~~

~~TapeAlert flags fall into three categories of severity (see table 8).~~

~~<< Table 8 >>~~

Table 9 specifies the 64 TapeAlert flags for a sequential-access device. See Annex A for additional information about each TapeAlert flag.

TABLE 10. TapeAlert flags

Flag	Name	Type	Deactivation condition	**TapeAlert Flag Specific Information (see 8.2.3x)**
01h	Read Warning	O	Start of next medium load	Tapealert Flag Specific Information descriptor on page 14
02h	Write Warning	O	Start of next medium load	Tapealert Flag Specific Information descriptor on page 14
03h	Hard Error	M	Start of next medium load[a]	
04h	Media	M	Start of next medium load[a]	Tapealert Flag Specific Information descriptor on page 14
05h	Read Failure.	M	Start of next medium load[a]	
06h	Write Failure.	M	Start of next medium load[a]	
07h	Media Life	O	Start of next medium load	Tapealert Flag Specific Information descriptor on page 14
08h	Not data grade	O	Start of next medium load	
09h	Write protect	O	Start of next medium load or removal of write protect	

Type Key:

M=Mandatory

O=Optional

7) Devices compliant with previous versions of this standard may deactivate this TapeAlert flag when de-mounting the current medium.

TABLE 10. TapeAlert flags

Flag	Name	Type	Deactivation condition	TapeAlert Flag Specific Information (see 8.2.3x)
0Ah	Media Removal Prevented	O	After medium removal allowed	
0Bh	Cleaning media	O	Start of next medium load	
0Ch	Unsupported format	O	Start of next medium load or format change	
0Dh	Recoverable mechanical cartridge failure	O	Start of next medium load	
0Eh	Unrecoverable mechanical cartridge failure	O	After service resolution	
0Fh	Memory chip in cartridge failure	O	Start of next medium load	
10h	Forced eject	O	Start of next medium load	
11h	Read only format	O	Start of next medium load or format change	
12h	Tape directory corrupted on load	O	Start of next medium load	
13h	Nearing media life	O	Start of next medium load	Tapealert Flag Specific Information descriptor on page 14
14h	Cleaning required	O	After successful cleaning or cause resolved	Tapealert Flag Specific Information descriptor on page 14
15h	Cleaning requested	O	After successful cleaning	Tapealert Flag Specific Information descriptor on page 14
16h	Expired cleaning media	O	Start of next medium load	Tapealert Flag Specific Information descriptor on page 14
17h	Invalid cleaning tape	O	Start of next medium load	
18h	Retension Requested	O	After successful retention	
19h	Multi-port interface error on a primary port	O	After interface returns to operation	
1Ah	Cooling Fan Failure	O	After service resolution	
1Bh	Power Supply Failure	O	After service resolution	
1Ch	Power Consumption	O	After power consumption returns to within specification	Tapealert Flag Specific Information descriptor on page 14

Type Key:

M=Mandatory

O=Optional

7) Devices compliant with previous versions of this standard may deactivate this TapeAlert flag when de-mounting the current medium.

TABLE 10. TapeAlert flags

Flag	Name	Type	Deactivation condition	TapeAlert Flag Specific Information (see 8.2.3x)
1Dh	Drive Preventive Maintenance Required	O	After service resolution	
1Eh	Hardware A	O	After service resolution	
1Fh	Hardware B	M	At power on event	
20h	Primary Interface	O	After interface returns to operation	
21h	Eject media	O	Start of next medium load	
22h	Microcode update fail	O	Start of next microcode update	
23h	Drive humidity	O	After humidity returns to within specification	Tapealert Flag Specific Information descriptor on page 14
24h	Drive temperature	O	After temperature returns to within specification	Tapealert Flag Specific Information descriptor on page 14
25h	Drive voltage	O	After voltage returns to within specification	Tapealert Flag Specific Information descriptor on page 14
26h	Predictive failure	O	After service resolution	
27h	Diagnostics required	O	After service resolution	
28h - 2Eh	Obsolete	O		
2Fh - 31h	Reserved	O		
32h	Lost statistics	O	Start of next medium load	
33h	Tape directory invalid at unload	O	Start of next medium load	
34h	Tape system area write failure	O	Start of next medium load	
35h	Tape system area read failure	O	Start of next medium load	
36h	No Start of Data	O	Start of next medium load	
37h	Loading or threading Failure	O	Start of next medium load	

Type Key:

M=Mandatory

O=Optional

7) Devices compliant with previous versions of this standard may deactivate this TapeAlert flag when de-mounting the current medium.

TABLE 10. TapeAlert flags

Flag	Name	Type	Deactivation condition	TapeAlert Flag Specific Information (see 8.2.3x)
38h	Unrecoverable unload failure	O	After service resolution	
39h	Automation interface failure	O	After service resolution	
3Ah	Microcode failure	O	After service resolution	
3Bh	WORM Medium - Integrity Check Failed	O	Start of next medium load	
3Ch	WORM Medium - Overwrite Attempted	O	Start of next medium load	
3Dh - 40h	Reserved	O	Start of next medium load	

Type Key:

M=Mandatory

O=Optional

7) Devices compliant with previous versions of this standard may deactivate this TapeAlert flag when de-mounting the current medium.

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EDITORS NOTE: Everything beyond this note is new.

8.2.a Service Information log page

The Service Information log page (see Table x1) defines information used for detailed device diagnostics and management.

TABLE x1. Service Information log page

Bit Byte	7	6	5	4	3	2	1	0
0	DS	SPF (0)	PAGE CODE (2Dh)					
1	SUBPAGE CODE (00h)							
2	(MSB)	PAGE LENGTH (n-3)						
3								(LSB)
	Service Information log parameter(s)							
4		Service information log parameter (first)						
x								
	:							
y		Service information log parameter (last)						
n								

See SPC-4 for a description of the DS, SPF, PAGE CODE, SUBPAGE CODE, and PAGE LENGTH fields.

Table x2 specifies the format of a Service Information log parameter.

TABLE x2. Service Information parameter format

Bit Byte	7	6	5	4	3	2	1	0
0	(MSB)	PARAMETER CODE						
1								(LSB)
2	DU	Obsolete	TSD	ETC (0b)	TMC (00b)		FORMAT AND LINKING (01b)	
3	PARAMETER LENGTH (x-3)							
4		Service Information Descriptor (first)						
r								
	:							
t		Service Information Descriptor (last)						
x								

See SPC-4 for a description of the DU bit, TSD bit, ETC bit, TMC field, and the FORMAT AND LINKING field. The ETC bit, TMC bit, and FORMAT AND LINKING field shall be set to the value specified in Table x2.

The value in the PARAMETER CODE field shall be set to the value of the TapeAlert flag for which the information applies. Only parameters relating to an active TapeAlert condition shall be returned. The act of returning a parameter shall not cause deactivation of the TapeAlert condition. The parameters shall be returned in reverse order (i.e. the parameter relating to the least recently asserted TapeAlert flag shall be returned first.)

Service Information Descriptors are returned and provide speficic information about the TapeAlert flag. At least one Service Information Descriptor shall be returned. The format of Service Information Descriptors is shown in Table x3

TABLE x3. Service Information descriptor

Bit Byte	7	6	5	4	3	2	1	0
0	SERVICE INFORMATION DESCRIPTOR TYPE							
1	SERVICE INFORMATION DESCRIPTOR LENGTH (n-1)							
2	Service Information Descriptor Specific Information (see Table x4)							
n								

Only one Service Information Descriptor shall be returned for a specific value of SERVICE INFORMATION DESCRIPTOR TYPE. The SERVICE INFORMATION DESCRIPTOR TYPE field is defined in Table x4

TABLE x4. Service Information Descriptor Type

Value	Service Information Descriptor Type	Reference
00h	Vendor-specific Service Information	Table x15
01h	Device Information	Table x5
02h	Volume Information	Table x10
03h	TapeAlert Flag Specific Information	Table x14
04h - FEh	Reserved	

Parameter codes must be returned in ascending order. **!!!!Discuss This!!!!**

[**[Done]**Only parameters related to flags asserted shall be returned, but the flag clears when the tapealerts are returned. Need to word it in relation to condition is active/deactive. Be clear about reading multiple times.]]

[**[Done]**Make the format a descriptor list and add a code in byte 0 of each descriptor that

indicates which descriptor it is.]]
Make sure to specify there can only be one instance of each descriptor.
Remove vendor-specific from each descriptor since there is a vs descriptor.

8.2.a.1 Device Information Descriptor

Table x5 describes the Device Information Descriptor format. The device information descriptor is returned when the cause of the TapeAlert flag relating to the parameter may be related to the device. There shall be only one Device Information descriptor returned per Service Information parameter returned.

TABLE x5. Device Information Descriptor format

Bit Byte	7	6	5	4	3	2	1	0
0	SERVICE INFORMATION DESCRIPTOR TYPE							
1	DEVICE INFORMATION LENGTH (x-1)							
2	DEVICE SEVERITY CODE							
3	DEVICE COMPONENT CODE							
4	DEVICE COMPONENT CODE QUALIFIER							
6	DEVICE COMPONENT TEXT							
????								
??+1	NUMBER OF DEVICE REQUESTED RECOVERIES							
??+2	DEVICE REQUESTED RECOVERY (first)							
	:							
x	DEVICE REQUESTED RECOVERY (last)							

The DEVICE INFORMATION LENGTH field specifies the length of the information related to the device.

EDITORS NOTE: The device severity code field is intended to replace the existing TapeAlert flags severity

Put spaces between values to allow for future expansion.
3-column table. (i.e. Value, Severity, Description)

The DEVICE SEVERITY CODE is defined in Table x6.

TABLE x6. DEVICE SEVERITY CODE definition

Value	Severity	Description
01h	Informational	No guidance about continued operation without corrective action is given by this standard. The condition should be logged and/or the operator informed.
06h	Retryable	The event that generated this Device Information may be retried.
0Bh	Warning	The system may not be operating optimally. Continued operation w/o corrective action may cause a failure or raise critical tapealert flags. The condition should be logged and/or an operator informed.
10h	Critical	Either a failure has already occurred or a failure is imminent. Corrective action is required. The condition should be logged and/or an operator informed.
15h	Intervention required	If this condition is not corrected, a data loss failure may occur. The condition should be logged and/or an operator informed.
1Ah	Call service	Action by service personnel is required. The condition should be logged and service personnel informed.
All values not listed are Reserved.		

Break into a hierarchy of codes similar to ASC/ASCQ and use three levels of hierarchy with perhaps the third level being a text field or index to text field.

The DEVICE COMPONENT CODE is defined in Table x7

TABLE x7. DEVICE COMPONENT CODE definition

Value	Description
00h	No message
10h	Device Data Path
20h	Mechanical
30h	Primary Interface
40h	Automation Interface
50h	RAS Interface
60h	Electronic Components
70h	Microcode
F0h-FFh	Vendor-Specific

EDITORS NOTE: How do I add qualifiers in a general way?

The DEVICE COMPONENT CODE QUALIFIER is defined in Table x8

TABLE x8. DEVICE COMPONENT CODE QUALIFIER definition

Value	Description
11h	Read/Write Head
12h	Compresson Core
13h	Cryptographic Core
14h	Data Buffer
15h	ASIC
21h	Reel Motor
22h	Servo
23h	Head Actuator
24h	Loader
25h	Threader
26h	Door
31h	Automation Interface Hardware
32h	Automation Interface Memory
33h	Primary Interface Hardware
34h	Primary Interface Memory
35h	Primary Interface Transceiver

TABLE x8. DEVICE COMPONENT CODE QUALIFIER definition

Value	Description
36h	Panel Hardware
37h	Panel Memory
41h	Nonvolatile Data Store
42h	Nonvolatile Microcode Store
43h	RAM
44h	Master CPU
45h	Slave Processor(s)
51h	Master Code Image
52h	Servo Code Image
53h	Interface Code Image
54h	Slave Code Image
F0h-FFh	Vendor-Specific

How many bytes for the text?

The DEVICE COMPONENT TEXT is a ????-byte null-terminated field containing ....

Make this field a “What operator should do” by turning this into a list of messages in a prioritized list of operator sequences similar to ADC Requested Recovery. This makes sense even if multiple tapealerts are returned because there is a priorization of earliest assertion. I think this is the best we can do on creating actions for the root cause.

The NUMBER OF DEVICE REQUESTED RECOVERIES specifies the number of DEVICE REQUESTED RECOVERIES that follow.

The DEVICE REQUESTED RECOVERY values are defined in Table x9 and shall be returned in prioritized order.

TABLE x9. DEVICE RECOVERIES REQUESTED definition

Value	Description
00h	No recovery requested
01h	Retrieve device debug logs
02h	Clean device
03h	Update microcode
04h	Power off device and call service
05h	Leave the device in current state and call service
06h	Remove power from the device then apply power
07h - FFh	Reserved

8.2.a.2 Volume Information Descriptor

Table x10 defines the Volume Information Descriptor format. This descriptor is returned when the cause of the TapeAlert flag associated with the parameter may be related to the Volume.

TABLE x10. Volume Information Descriptor format

Bit Byte	7	6	5	4	3	2	1	0
0	SERVICE INFORMATION DESCRIPTOR TYPE							
1	VOLUME INFORMATION LENGTH (s)							
2	VOLUME SEVERITY CODE							
3	VOLUME INFORMATION CODE							
4	VOLUME INFORMATION CODE QUALIFIER							
	volume Identification Descriptor(s)							
5	VOLUME IDENTIFICATION LENGTH (n-5)							
6	volume Identification Descriptor (first)							
x								
y	volume Identification Descriptor (last)							
n								

The VOLUME INFORMATION LENGTH field specifies the length of the information related to the volume.

The VOLUME SEVERITY CODE is defined in Table x11

TABLE x11. VOLUME SEVERITY CODE definition

Value	Severity	Description
01h	Informational	No guidance about continued operation without corrective action is given by this standard. The condition should be logged and/or the operator informed.
06h	Retryable	The event that generated this Volume Information may be retried.
0Bh	Warning	The volume may not be optimal. Continued operation w/o corrective action may cause a failure or raise critical tapealert flags. The condition should be logged and/or an operator informed.
10h	Critical	Either a failure has already occurred or a failure is imminent. Corrective action is required. The condition should be logged and/or an operator informed.
15h	Intervention Required	If this condition is not corrected, a data loss failure may occur. The condition should be logged and/or an operator informed.
1Ah	Call Service	Action by service personnel is required. The condition should be logged and service personnel informed.
All values not listed are Reserved.		

The VOLUME INFORMATION CODE is defined in Table x13

TABLE x12. VOLUME INFORMATION CODE definition

Value	Description
00h	No message
01h	Good WORM volume
06h	Good Encrypted volume
0Bh	Good Data volume
10h	Good Cleaning volume
15h	Good FMR volume
1Ah	Bad WORM volume
1Fh	Bad Encrypted volume
25h	Bad Data volume
2Ah	Bad Cleaning volume
2Fh	Bad FMR volume

The VOLUME INFORMATION CODE QUALIFIER is defined in Table x13

TABLE x13. VOLUME INFORMATION CODE QUALIFIER definition

Value	Description
00h	No message
01h	Read Only Permitted at this logical position
06h	Encryption key required
0Bh	Read Only Permitted
10h	Rewrite volume if possible
15h	Tape Directory Invalid. Re-read volume if possible
1Ah	Cannot Read or Write
1Fh	Replace volume
25h	Medium auxiliary memory error

The VOLUME IDENTIFICATION LENGTH field specifies the length of the following volume Identification Descriptors.

The Volume Identification Descriptor format is identical to the MAM ATTRIBUTE format for medium auxiliary memory (see SPC-4). If the Volume Information Descriptor is returned and:

1) a MAM attribute exists for the volume identifier parameter of the device type attributes (i.e., set by the SMC device), then this attribute shall be returned as a Volume Identification Descriptor;
2) a MAM attribute exists for the barcode parameter of the host type attributes (i.e., set by an application client), then this attribute shall be returned as a Volume Identification Descriptor; and
3) a MAM attribute exists for the medium serial number parameter of the medium type attributes (i.e., set by the manufacture), then this attribute shall be returned as a Volume Identification Descriptor;

8.2.a.3 Tapealert Flag Specific Information Descriptor

Table x14 describes the Tapealert Flag Information descriptor format. Table 10 specifies for which flags this descriptor is returned.

TABLE x14. Tapealert Flag Specific Information descriptor

Bit Byte	7	6	5	4	3	2	1	0
0	SERVICE INFORMATION DESCRIPTOR TYPE							
1	TAPEALERT FLAG SPECIFIC INFORMATION LENGTH (2)							
2	(MSB)	CURRENT PERCENTAGE						
3								(LSB)

The CURRENT PERCENTAGE field returns a signed percentage indicating how close to operating limits the item is. The value returned is the signed percentage * 16384. If the magnitude of the percentage is less than or equal to 100%, then the device is operating within specification. If the magnitude is greater than 100% then the device is outside the operating specifications. The equation that shall be used is

$$\frac{measuredValue - \left[\frac{(upperLimit - lowerLimit)}{2} + lowerLimit\right]}{upperLimit - \left[\frac{(upperLimit - lowerLimit)}{2} + lowerLimit\right]} \times 16384$$

(e.g. The power specification states the operating range is between 4.78 V and 5.32 V and the measured voltage is 4.70 V, then the value returned would be determined by the equation

$$\frac{4.7 - \left[\frac{(5.32 - 4.78)}{2} + 4.78\right]}{5.32 - \left[\frac{(5.32 - 4.78)}{2} + 4.78\right]} \times 16384 = -21239$$

and the value AD09h would be returned.

Alternately, if the media life is specified to be 260 full backups and the media has had 234 backups performed. Then the value returned would be determined by the equation

$$\frac{234 - \left[\frac{(260 - 0)}{2} + 0\right]}{260 - \left[\frac{(260 - 0)}{2} + 0\right]} \times 16384 = 13107$$

and a value of 3333h would be returned.)

8.2.a.4 Vendor-specific Service Information Descriptor

Table x15 describes the Vendor-specific Service Information descriptor format.

TABLE x15. Vendor-specific Service Information descriptor

Bit / Byte	7	6	5	4	3	2	1	0
0	SERVICE INFORMATION DESCRIPTOR TYPE							
1	VENDOR-SPECIFIC SERVICE INFORMATION LENGTH (n-1)							
2	Vendor-specific Information							
n								