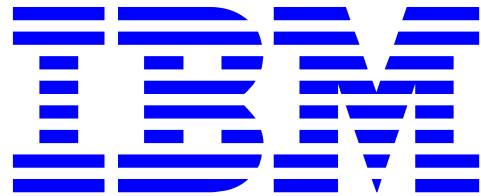To: INCITS Technical Committee T10

From: Kevin Butt

Date: September 19, 2007 11:46 am

Document: T10/06-138r5

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.

7) 06-138r5: Incorporated suggestions from the July WG and did additional work.

8) 06-138r6: Made changes during Sept WG and approved for inclusion into SSC-3.

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 usefulness 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 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 default severity (see table 9).

TABLE 9. TapeAlert flags default severity

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.		

Table 10 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 Number	Name	Default Severity	Type	Deactivation condition	TapeAlert Flag Specific Information available (see 8.2.3x)
01h	Read Warning	0Bh	O	Start of next medium load	Y
02h	Write Warning	0Bh	O	Start of next medium load	Y
03h	Hard Error	0Bh	M	Start of next medium load [a]	N
04h	Media	10h	M	Start of next medium load [a]	Y
05h	Read Failure.	10h	M	Start of next medium load [a]	N
06h	Write Failure.	10h	M	Start of next medium load [a]	N
07h	Media Life	0Bh	O	Start of next medium load	Y
08h	Not data grade	0Bh	O	Start of next medium load	N
09h	Write protect	10h	O	Start of next medium load or removal of write protect	N
0Ah	Media Removal Prevented	01h	O	After medium removal allowed	N
0Bh	Cleaning media	01h	O	Start of next medium load	N
0Ch	Unsupported format	01h	O	Start of next medium load or format change	N
0Dh	Recoverable mechanical cartridge failure	10h	O	Start of next medium load	N
0Eh	Unrecoverable mechanical cartridge failure	10h	O	After service resolution	N
0Fh	Memory chip in cartridge failure	0Bh	O	Start of next medium load	N
10h	Forced eject	10h	O	Start of next medium load	N
11h	Read only format	0Bh	O	Start of next medium load or format change	N
12h	Tape directory corrupted on load	0Bh	O	Start of next medium load	N
13h	Nearing media life	01h	O	Start of next medium load	Y
14h	Cleaning required	10h	O	After successful cleaning or cause resolved	Y
15h	Cleaning requested	0Bh	O	After successful cleaning	Y
16h	Expired cleaning media	10h	O	Start of next medium load	Y
Type Key:					
M=Mandatory					
O=Optional					
a) Devices compliant with previous versions of this standard may deactivate this TapeAlert flag when de-mounting the current medium.					

TABLE 10. TapeAlert flags

Flag Number	Name	Default Severity	Type	Deactivation condition	TapeAlert Flag Specific Information available (see 8.2.3x)
17h	Invalid cleaning tape	10h	O	Start of next medium load	N
18h	Retension Requested	0Bh	O	After successful retention	N
19h	Multi-port interface error on a primary port	0Bh	O	After interface returns to operation	N
1Ah	Cooling Fan Failure	0Bh	O	After service resolution	N
1Bh	Power Supply Failure	0Bh	O	After service resolution	N
1Ch	Power Consumption	0Bh	O	After power consumption returns to within specification	Y
1Dh	Drive Preventive Mainte-nance Required	0Bh	O	After service resolution	N
1Eh	Hardware A	10h	O	After service resolution	N
1Fh	Hardware B	10h	M	At power on event	N
20h	Primary Interface	0Bh	O	After interface returns to operation	N
21h	Eject media	10h	O	Start of next medium load	N
22h	Microcode update fail	0Bh	O	Start of next microcode update	N
23h	Drive humidity	0Bh	O	After humidity returns to within specifica-tion	Y
24h	Drive temperature	0Bh	O	After temperature returns to within specifi-cation	Y
25h	Drive voltage	0Bh	O	After voltage returns to within specification	Y
26h	Predictive failure	10h	O	After service resolution	Y
27h	Diagnostics required	0Bh	O	After service resolution	N
28h - 2Eh	Obsolete		O		N
2Fh - 31h	Reserved		O		N
32h	Lost statistics	0Bh	O	Start of next medium load	N
33h	Tape directory invalid at unload	0Bh	O	Start of next medium load	N

Type Key:

M=Mandatory

O=Optional

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

TABLE 10. TapeAlert flags

Flag Number	Name	Default Severity	Type	Deactivation condition	TapeAlert Flag Specific Information available (see 8.2.3x)
34h	Tape system area write failure	10h	O	Start of next medium load	N
35h	Tape system area read failure	10h	O	Start of next medium load	N
36h	No Start of Data	10h	O	Start of next medium load	N
37h	Loading or threading Failure	10h	O	Start of next medium load	N
38h	Unrecoverable unload failure	10h	O	After service resolution	N
39h	Automation interface failure	10h	O	After service resolution	N
3Ah	Microcode failure	0Bh	O	After service resolution	N
3Bh	WORM Medium - Integrity Check Failed	0Bh	O	Start of next medium load	N
3Ch	WORM Medium - Overwrite Attempted	0Bh	O	Start of next medium load	N
3Dh - 40h	Reserved		O	Start of next medium load	N

Type Key:
    M=Mandatory
    O=Optional
 a) 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 Current Service Information log page

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

TABLE x1. Current 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	Timestamp Descriptor							
15								
16	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 LINK-ING field. The ETC bit, TMC bit, and FORMAT AND LINKING field shall be set to the value specified in table x2.

> EDITORS NOTE: Search on all instances of flag relating to TapeAlert and rename to Flag Number.

The value in the PARAMETER CODE field shall be set to the Flag Number (see table 10) of the TapeAlert flag for which the information applies. When a TapeAlert flag is activated, the parameter in this log page relating to that TapeAlert flag is created. This parameter shall continue to be reported until overwritten by the next activation of the associated TapeAlert flag or until cleared by a Log Select command. The act of returning a parameter shall not clear that parameter and shall not cause deactivation of the TapeAlert flag.

The Timestamp Descriptor is defined by the REPORT TIMESTAMP parameter data format (see SPC-4) with values reflecting the time the TapeAlert flag specified by the PARAMETER CODE field was activated.

Service Information Descriptors are returned and provide specific 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 n	Service Information Descriptor Specific Information (see table x4)							

Only one Service Information Descriptor shall be returned for a specific value of SERVICE INFOR-MATION DESCRIPTOR TYPE per parameter. 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 x12
01h	Device Information	table x5
02h	Volume Information	table x8
03h	TapeAlert Flag Specific Information	table x11
04h - FEh	Reserved	

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	DEC							
4	DECQ							
5	DECT LENGTH							
6	DECT							
n								
n+1	NUMBER OF DEVICE REQUESTED RECOVERIES							
n+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.

The DEVICE SEVERITY CODE is defined in table 9.

The device element code (DEC) is defined in table x6

TABLE x6. DEVICE ELEMENT CODE definition

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

The device element code qualifier (DECQ) is a vendor-specific value providing more detailed information about the element specified by the DEC field.

The DECT LENGTH specifies the length of the DECT field that immediately follows.

The device element code text (DECT) is a null-terminated field of DECT LENGTH containing a description of what caused the TapeAlert to be activated.

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

The DEVICE REQUESTED RECOVERY values are defined in table x7 and shall be returned in prioritized order.

TABLE x7. DEVICE REQUESTED RECOVERY 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 x8 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 x8. 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	VIC							
4	VICQ							
	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 9

The volume information code (VIC) is defined in table x9

TABLE x9. 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 Microcode Update volume
1Ah	Bad WORM volume
1Fh	Bad Encrypted volume
25h	Bad Data volume
2Ah	Bad Cleaning volume
2Fh	Bad Microcode Update volume

The volume information code qualifier (VICQ) is defined in table x10

TABLE x10. 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 for the entire volume
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 x11 describes the Tapealert Flag Information descriptor format. table 10 specifies for which flags this descriptor is returned.

TABLE x11. 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 x12 describes the Vendor-specific Service Information descriptor format.

TABLE x12. 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								