

To: T10 Technical Committee
From: Jeff Boutiette (jeffrey.boutiette@seagate.com), Seagate
Date: 28 December 2023
Subject: CDL Policy Simplification

Revision history

Revision 0 (28 December 2023): Initial version

Overview

This is a complete rewrite of 23-075, and as such, I started a new document number for it.

This proposal:

- adds several policies to the Command Duration Limits feature that are intended to provide additional capabilities to a host for specifying its desired performance profile to a target device;
- replaces Command Duration Guidelines with Total Time;
- merges the three separate time policy descriptions into one;
- creates a mechanism for the host to specify whether they want the device to use Inactive Time or Total Time for relative command scheduling (and does it in a way that existing functionality is preserved by just not allowing this bit to be set);
- adds a bitmap in the VPD pages to indicate which policies are supported for each timer; and
- provides for logging of Total Time miss events.

Note that some of the functionality of policies 3h/4h/5h were covered by existing policies. However, the definitions of policies 0h/1h/2h are not consistent across the three separate timers. They are also not consistent with T13, which has consequences in SAT. Creating policies 3h/4h/5h will provide consistency within SPC, and lay the groundwork for consistency with T13 and SAT.

Rationale for Policy 4h

This policy exists as Policy 0h in Command Duration Guidelines; however, Policy 0h is defined differently for Active Time Limit and Inactive Time limit, and therefore a new policy ID is needed. Policy 4h allows a host to specify that if the limit described in the policy is reached, the command should be completed as soon as possible. The effect of this policy is to prioritize the latency of this command over IOPS, once it is determined that the preferred time cannot be met.

Rationale for Policy 5h

This policy, which also already exists for Command Duration Guidelines, allows a host to specify that if the limit described in the policy is reached, the command should continue untimed. The effect of this policy is to prioritize IOPS over latency by returning scheduling control to the device, once it is determined that the preferred time cannot be met. An example use case would be a read command where the host can get the data from other sources, but still wants to verify the integrity of the data on this device as a low priority. ***Setting this policy is different from setting no policy, in that a device should still attempt to schedule the command to meet the preferred time value. Only when the limit passes should the device stop giving priority to this command.***

Unless otherwise indicated additions are shown in blue, deletions in ~~red-strikethrough~~, and comments in green.

Proposal

Modify section 7.3.7 of SPC-6 as follows.

7.3.7 Command Duration Limits Statistics log page

7.3.7.1 Overview

Using the format shown in table 346, the Command Duration Limits Statistics log page contains log parameters (see table 345) that indicate the effects of the Command Duration Limit T2A mode page (see 7.5.11) and the Command Duration Limit T2B mode page (see 7.5.12).

Table 345 – Command Duration Limits Statistics log page parameter codes (part 1 of 2)

| Parameter code | Description | Resettable or Changeable ^a | Reference | Support |
|---|--|--|------------------|------------------|
| 0001h | Restricted (see SPC-6r02) | | | |
| 0011h to 0017h | Restricted (see SPC-6r02) | | | |
| 0021h to 0027h | Restricted (see SPC-6r02) | | | |
| For the Command Duration Limit T2A mode page (see 7.5.11) | | | | |
| 0031h | First T2 command duration limit descriptor | Reset Only | 7.3.7.2 | see ^b |
| 0032h | Second T2 command duration limit descriptor | Reset Only | 7.3.7.2 | see ^b |
| 0033h | Third T2 command duration limit descriptor | Reset Only | 7.3.7.2 | see ^b |
| 0034h | Fourth T2 command duration limit descriptor | Reset Only | 7.3.7.2 | see ^b |
| 0035h | Fifth T2 command duration limit descriptor | Reset Only | 7.3.7.2 | see ^b |
| 0036h | Sixth T2 command duration limit descriptor | Reset Only | 7.3.7.2 | see ^b |
| 0037h | Seventh T2 command duration limit descriptor | Reset Only | 7.3.7.2 | see ^b |
| ^a The keywords in this column – Always, Reset Only, and Never – are defined in 7.3.3. ^b This log parameter shall be supported, if for this T2 command duration limits descriptor (see 7.5.11.2), any of the following fields have a non-zero default value or are changeable: a) the MAX INACTIVE TIME field; or b) the MAX ACTIVE TIME field. | | | | |

Table 345 – Command Duration Limits Statistics log page parameter codes (part 2 of 2)

| Parameter code | Description | Resettable or Changeable ^a | Reference | Support |
|---|--|---------------------------------------|-----------|------------------|
| For the Command Duration Limit T2B mode page (see 7.5.12) | | | | |
| 0041h | First T2 command duration limit descriptor | Reset Only | 7.3.7.2 | see ^b |
| 0042h | Second T2 command duration limit descriptor | Reset Only | 7.3.7.2 | see ^b |
| 0043h | Third T2 command duration limit descriptor | Reset Only | 7.3.7.2 | see ^b |
| 0044h | Fourth T2 command duration limit descriptor | Reset Only | 7.3.7.2 | see ^b |
| 0045h | Fifth T2 command duration limit descriptor | Reset Only | 7.3.7.2 | see ^b |
| 0046h | Sixth T2 command duration limit descriptor | Reset Only | 7.3.7.2 | see ^b |
| 0047h | Seventh T2 command duration limit descriptor | Reset Only | 7.3.7.2 | see ^b |
| all others | Reserved | | | |
| ^a The keywords in this column – Always, Reset Only, and Never – are defined in 7.3.3. ^b This log parameter shall be supported, if for this T2 command duration limits descriptor (see 7.5.11.2), any of the following fields have a non-zero default value or are changeable: a) the MAX INACTIVE TIME field; or b) the MAX ACTIVE TIME field; or c) the TOTAL TIME field. | | | | |

The Command Duration Limits Statistics log page has the format shown in table 346.

Table 346 – Command Duration Limits Statistics log page

| Bit Byte | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
|-------------|--|-------------------|-----------------|---|---|---|---|-------|
| 0 | DS | SPF (1b) | PAGE CODE (19h) | | | | | |
| 1 | SUBPAGE CODE (21h) | | | | | | | |
| 2 | (MSB) | PAGE LENGTH (n-3) | | | | | | |
| 3 | | | | | | | | (LSB) |
| | Command duration limits statistics log parameters | | | | | | | |
| 4 | Command duration limits statistics log parameters (see table 345) [first] | | | | | | | |
| ... | | | | | | | | |
| | | | | | | | | |
| | • | | | | | | | |
| ... | Command duration limits statistics log parameters (see table 345) [last] | | | | | | | |
| n | | | | | | | | |

The DS bit, SPF bit, PAGE CODE field, SUBPAGE CODE field, and PAGE LENGTH field are described in 7.3.2. The SPF bit, PAGE CODE field, and SUBPAGE CODE field shall be set as shown in table 346 for the Environmental Limits log page.

The contents of each command duration limits statistics log parameter depends on the value in its PARAMETER CODE field (see table 345)

7.3.7.2 Command Duration Limits log parameter

The Command Duration Limits log parameter has the format shown in table 347. If a Command Duration Limits log parameter is supported, then at least one of the statistics shown in table 347 shall be supported. Each Command Duration Limits log parameter provides statistics for commands that were associated with a command duration limit mode page and T2 command duration limit descriptor (see 7.5.11.2).

Table 347 – Command Duration Limits log parameter

| Bit Byte | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
|-------------|---|----------|----------|----------|---|--------------------|---|---|
| 0 | (MSB) _____ | | | | | | | |
| 1 | PARAMETER CODE (see table 345) _____ (LSB) | | | | | | | |
| 2 | Parameter control byte – unbounded data counter log parameter (see 7.3.2.2.3) | | | | | | | |
| | DU | Obsolete | TSD (1b) | Obsolete | | FORMAT AND LINKING | | |
| 3 | PARAMETER LENGTH (10h) _____ | | | | | | | |
| 4 | (MSB) _____ | | | | | | | |
| ... | NUMBER OF INACTIVE TARGET MISS COMMANDS _____ | | | | | | | |
| 7 | (LSB) | | | | | | | |
| 8 | (MSB) _____ | | | | | | | |
| ... | NUMBER OF ACTIVE TARGET MISS COMMANDS _____ | | | | | | | |
| 11 | (LSB) | | | | | | | |
| 12 | (MSB) _____ | | | | | | | |
| ... | NUMBER OF TOTAL INACTIVE TARGET AND ACTIVE-TARGET MISS COMMANDS _____ | | | | | | | |
| 15 | (LSB) | | | | | | | |
| 16 | (MSB) _____ | | | | | | | |
| ... | NUMBER OF COMMANDS _____ | | | | | | | |
| 19 | (LSB) | | | | | | | |

The PARAMETER CODE field is described in 7.3.2.2.1 and shall be as shown in table 347 for the Command Duration Limits log parameter.

The DU bit, TSD bit, and FORMAT AND LINKING field are described in 7.3.2.2.1. The DU bit and FORMAT AND LINKING field shall be set as described for an unbounded data counter log parameter (see 7.3.2.2.3) for the Command Duration Limits log parameter. The TSD bit shall be set as shown in table 347 for a Command Duration Limits log parameter.

The PARAMETER LENGTH field is described in 7.3.2.2.1 and shall be set as shown in table 347 for the Command Duration Limits parameter.

The NUMBER OF INACTIVE TARGET MISS COMMANDS field indicates the number of commands for which the ~~MAX~~ INACTIVE TIME POLICY field (see 7.5.11.2) was processed.

The NUMBER OF ACTIVE TARGET MISS COMMANDS field indicates the number of commands for which the ~~MAX~~ ACTIVE TIME POLICY field (see 7.5.11.2) was processed.

~~The NUMBER OF INACTIVE TARGET AND ACTIVE TARGET MISS COMMANDS field indicates the sum of the number of commands for which the MAX INACTIVE TIME POLICY field was processed and the number of commands for which the MAX ACTIVE TIME POLICY field was processed.~~

The NUMBER OF TOTAL TARGET MISS COMMANDS field indicates the number of commands for which the TOTAL TIME POLICY field (see 7.5.11.2) was processed.

The NUMBER OF COMMANDS field indicates the number of commands processed using the associated command duration limits descriptor.

Modify section 7.5.11 of SPC-6 as follows.

7.5.11 Command Duration Limit T2A mode page

7.5.11.1 Overview

The Command Duration Limit T2A mode page (see table 453) provides controls for command duration limit (see SAM-5) that are applicable to all device types, for commands for which the REPORT SUPPORTED OPERATION CODES command parameter data RWCDLP bit and CDLP field (see 6.32) indicate the Command Duration Limit T2A mode page. The mode page policy (see 7.5.3) for this mode page should be per I_T nexus. The mode page policy may be shared. If a field in this mode page is changed while there is a command already in the task set, then the new value of the field shall not apply to that command.

If the QUEUE ALGORITHM MODIFIER field (see 7.5.13) is set to 0h (i.e., restricted reordering), then the device server shall process commands as described in 7.5.13 independent of the contents of the Command Duration Limit T2A mode page.

Table 453 – Command Duration Limit T2A mode page

| Bit Byte | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
|-------------|--|----------|-----------------|---|---------------------------|---|---|-----|
| 0 | PS | SPF (1b) | PAGE CODE (0Ah) | | | | | |
| 1 | SUBPAGE CODE (07h) | | | | | | | |
| 2 | (MSB) | | | | | | | |
| 3 | PAGE LENGTH (00E4h) | | | | | | | |
| 4 | (LSB) | | | | | | | |
| 5 | Reserved | | | | | | | |
| 6 | Reserved | | | | | | | ITS |
| 7 | PERF VERSUS SCHEDULING TIME COMM. LINES | | | | Restricted (See SPC-6r02) | | | |
| | T2 command duration limit descriptor list | | | | | | | |
| 8 | T2 command duration limit descriptor [first] | | | | | | | |
| ... | | | | | | | | |
| 39 | | | | | | | | |
| 40 | T2 command duration limit descriptor [second] | | | | | | | |
| ... | | | | | | | | |
| 71 | | | | | | | | |
| | • | | | | | | | |
| 200 | T2 command duration limit descriptor [seventh] | | | | | | | |
| ... | | | | | | | | |
| 231 | | | | | | | | |

The PS bit, SPF bit, PAGE CODE field, SUBPAGE CODE field, and PAGE LENGTH field are described in 7.5.8.

The SPF bit, PAGE CODE field, SUBPAGE CODE field, and PAGE LENGTH field shall be set as shown in table 453 for the Command Duration Limit T2A mode page.

The inactive timer scheduling (ITS) bit specifies which time field within each T2 command duration limit descriptor (see 7.5.11.2) shall be used to compute a Scheduling time (see 7.5.11.2).

The PERFORMANCE VERSUS ~~SCHEDULING TIME COMMAND-DURATION GUIDELINES~~ field (see table 454) specifies the maximum percentage increase in average command completion times that are caused by actions that the device server performs based on the ~~contents of the COMMAND-DURATION GUIDELINE field in every~~ Scheduling time computed for each T2 command duration limit descriptor (see 7.5.11.2) in the Command Duration Limit T2A mode page (see 7.5.11) and every T2 command duration limit descriptor in the Command Duration Limit T2B mode page (see 7.5.12).

Table 454 – PERF VERSUS ~~SCHEDULING TIME COMMAND-DURATION GUIDELINES~~ field

| Code | Maximum percentage increase in average command completion times |
|------------|---|
| 0h | 0% |
| 1h | 0.5% |
| 2h | 1.0% |
| 3h | 1.5% |
| 4h | 2.0% |
| 5h | 2.5% |
| 6h | 3% |
| 7h | 4% |
| 8h | 5% |
| 9h | 8% |
| Ah | 10% |
| Bh | 15% |
| Ch | 20% |
| 0Dh to 0Fh | Reserved |

The T2 command duration limit descriptor (see 7.5.11.2) describes the command duration limit information that corresponds to the duration limit descriptor index in the CDB if the Command Duration Limit T2A mode page is indicated (see 5.2).

7.5.11.2 T2 command duration limit descriptor

The T2 command duration limit descriptor (see table 455) describes the command duration limit information that corresponds to one duration limit descriptor index.

Table 455 – T2 command duration limit descriptor format

| Bit Byte | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
|-------------|---------------------------|---|---|---|--------------------------------|---|-------|---------|
| 0 | Reserved | | | | T2CDLUNITS | | | |
| 1 | Reserved | | | | | | | |
| 2 | (MSB) | | | | | | | |
| 3 | MAX INACTIVE TIME | | | | | | (LSB) | |
| 4 | (MSB) | | | | | | | |
| 5 | MAX ACTIVE TIME | | | | | | (LSB) | |
| 6 | MAX INACTIVE TIME POLICY | | | | MAX ACTIVE TIME POLICY | | | |
| 7 | Reserved | | | | | | | |
| 8 | (MSB) | | | | | | | |
| 9 | Restricted (see SPC-6r02) | | | | | | (LSB) | |
| 10 | (MSB) | | | | | | | |
| 11 | COM..GUIDELINE TOTAL TIME | | | | | | (LSB) | |
| 12 | Restricted (see SPC-6r02) | | | | Restricted (see SPC-6r02) | | | |
| 13 | Restricted (see SPC-6r02) | | | | Restricted (see SPC-6r02) | | | |
| 14 | Reserved | | | | COM...POLICY TOTAL TIME POLICY | | | |
| 15 | Reserved | | | | | | | BYP_SEQ |
| 16 | | | | | | | | |
| ... | Reserved | | | | | | | |
| 31 | | | | | | | | |

The T2CDLUNITS field (see table 456) specifies the time units for the MAX INACTIVE TIME field, the MAX ACTIVE TIME field, and the ~~COMMAND-DURATION-GUIDELINE~~ TOTAL TIME field. The default value for the T2CDLUNITS field is the smallest value that the device server allows for time units. Parameter rounding is not permitted (see 5.10) for this value.

Table 456 – T2CDLUNITS field

| Code | Description |
|------------|--------------------|
| 0h | No value specified |
| 6h | 500 nanoseconds |
| 8h | 1 microsecond |
| Ah | 10 milliseconds |
| Eh | 500 milliseconds |
| all others | Reserved |

The **MAX INACTIVE TIME** field specifies an upper limit on the time that elapses from the time at which the SCSI Command Received transport protocol service indication is invoked (see SAM-6) until the time at which the device server initiates actions to access, transfer, or act upon the specified data, **after which the action indicated by the INACTIVE TIME POLICY field will be taken.** ~~A MAX INACTIVE TIME field set to a non-zero value specifies the time upper limit in units indicated by the T2CDLUNITS field. A MAX INACTIVE TIME field set to zero specifies that no time upper limit is specified by this T2 command duration limit descriptor.~~ A non-zero value in this field specifies a time value, with units indicated by a non-zero value in the T2CDLUNITS field. If this field is set to 0h, or if the T2CDLUNITS field is set to 0h, the **MAX INACTIVE TIME** field shall be ignored. This value may be rounded as described in 5.10.

The **MAX ACTIVE TIME** field specifies the upper limit on the time that elapses from the time at which the device server initiates actions to access, transfer, or act upon the specified data until the time the device server returns status for the command, **after which the action indicated by the ACTIVE TIME POLICY field will be taken.** ~~A MAX ACTIVE TIME field set to a non-zero value specifies the time upper limit in units specified by the T2CDLUNITS field. A MAX ACTIVE TIME field set to zero specifies that no time upper limit is specified by this T2 command duration limit descriptor.~~ A non-zero value in this field specifies a time value, with units indicated by a non-zero value in the T2CDLUNITS field. If this field is set to 0h, or if the T2CDLUNITS field is set to 0h, the **MAX ACTIVE TIME** field shall be ignored. This value may be rounded as described in 5.10.

The **TOTAL TIME** field specifies the upper limit on the time for the completion of a command (i.e., the overall length of time for which the command is known to the device server), **after which the action indicated by the TOTAL TIME POLICY field will be taken.** A non-zero value in this field specifies a time value, with units indicated by a non-zero value in the T2CDLUNITS field. If this field is set to 0h, or if the T2CDLUNITS field is set to 0h, the **TOTAL TIME** field shall be ignored. This value may be rounded as described in 5.10.

~~The MAX INACTIVE TIME POLICY field (see table 457) specifies the policy action taken if the max inactive limit is not met (i.e., the time used to cause a command to become an enabled command exceeds the time specified by the MAX INACTIVE TIME field and the T2CDLUNITS field).~~

If a time value is specified by the INACTIVE TIME, ACTIVE TIME, or TOTAL TIME fields, then the corresponding time policy field (INACTIVE TIME POLICY, ACTIVE TIME POLICY, or TOTAL TIME POLICY, respectively) specifies the policy action taken after the specified time is exceeded.

Table 457 – MAX INACTIVE TIME POLICY field Time policy field actions

| Code | Description |
|----------|---|
| 0h | The device server shall complete the command at the earliest possible time (i.e., do nothing based on the max time limit not being met). |
| 1h to Ch | Reserved |
| Dh | The device server shall complete the command with GOOD status, with the sense key set to COMPLETED and the sense code set to DATA CURRENTLY UNAVAILABLE. |
| Eh | Reserved |
| Fh | The device server shall terminate the command with CHECK CONDITION status, with the sense key set to ABORTED COMMAND and the additional sense code set to COMMAND TIMEOUT BEFORE PROCESSING. |

| Code | Description |
|-----------------|---|
| 0h to 2h | Obsolete |
| 3h ^a | The device server shall apply the command duration limits descriptor that has the next higher index to this command. ^b |
| 4h | The device server shall complete the command at the earliest possible time following the timer expiration. |
| 5h | The device server shall continue as if no time limit had been set for this command. |
| 6h to Ch | Reserved |
| Dh | The device server shall complete the command with GOOD status, with the sense key set to COMPLETED and the sense code set to DATA CURRENTLY UNAVAILABLE. |
| Eh | The device server shall terminate the command with CHECK CONDITION status, with the sense key set to ABORTED COMMAND and the additional sense code set to COMMAND TIMEOUT DURING PROCESSING or COMMAND TIMEOUT DURING PROCESSING DUE TO ERROR RECOVERY. If that command is a read command and any data has been transferred to the application client, then the device server may indicate the contiguous range of LBAs that have been transferred to the application client, starting with the LBA specified by that read command and ending with the LBA indicated by the value in the INFORMATION field of the sense data. |
| Fh | The device server shall terminate the command with CHECK CONDITION status, with the sense key set to ABORTED COMMAND and the additional sense code set to: <ul style="list-style-type: none"> a) COMMAND TIMEOUT BEFORE PROCESSING, if this policy is set in the INACTIVE TIME POLICY or TOTAL TIME POLICY fields; or b) COMMAND TIMEOUT DURING PROCESSING, if this policy is set in the ACTIVE TIME POLICY field. |
| | ^a If this value is set in the seventh T2 command duration limits descriptor, then the device server shall terminate the MODE SELECT command with CHECK CONDITION status, with the sense key set to ILLEGAL REQUEST, and the additional sense code set to INVALID FIELD IN PARAMETER LIST. ^b Accumulated time towards the time limit shall not be reset as a result of processing this policy action. If this results in the time limit being exceeded immediately upon applying the new command duration limits descriptor, then the policy action specified by the new descriptor shall be taken immediately. |

~~The MAX ACTIVE TIME POLICY field (see table 458) specifies the policy action taken if the max active time limit is not met (i.e., the time used to process a command exceeds the time specified by the MAX ACTIVE TIME field and the T2CDLUNITS field).~~

Table 458 — MAX ACTIVE TIME POLICY field << strike this table >>>

~~The COMMAND DURATION GUIDELINE field specifies the preferred length of time for the completion of a command. The preferred length of time for the command completion is specified as the non-zero time in units indicated by the T2CDLUNITS field to be added to fastest time for completion of a read command for which the device server is able to return the requested data only by accessing the media. If the T2CDLUNITS field is set to 0h, the COMMAND DURATION GUIDELINE field shall be ignored. Parameter rounding is not permitted (see 5.10) for this value.~~

~~A COMMAND DURATION GUIDELINE field set to zero indicates that no command completion guidance is provided by this T2 command duration limits descriptor.~~

~~The combination of COMMAND DURATION GUIDELINE field and the T2CDLUNITS field (i.e., the command duration guideline) shall affect device server processing of a command that selects a T2 command duration limits descriptor as follows:~~

- ~~a) the length of time with which the device server completes that command is:
 - ~~A) faster for smaller non-zero command duration guideline values; and~~
 - ~~B) slower for larger non-zero command duration guideline values,~~~~
~~in comparison to the non-zero command duration guideline values specified by other T2 command duration limits descriptors; and~~
- ~~b) larger magnitudes of the difference between the non-zero command duration guideline values in two different T2 command duration limits descriptors result in larger probabilities of differences between the length of time of command completions for the commands that select those descriptors.~~

~~EXAMPLE — A host may specify a set of command duration guidelines that is independent of a device server's performance characteristics by specifying 10 milliseconds as the command duration guideline in one or more T2 command duration limits descriptors as a method of associating them with the most rapid preferred command completion. For all other T2 command duration limits descriptors, the command duration guideline is specified as the preferred number of 10 millisecond intervals for command completion minus the average number of milliseconds in which a seek finishes for a hypothetical, average hard disk drive. If for any other T2 command duration limits descriptor, the computed command duration limits guideline value is less than 10 milliseconds, then 10 milliseconds is used as the command duration guideline for that T2 command duration limits descriptor. The magnitude relationships computed in this way provide useful guidance to the device server.~~

~~The contents of the PERFORMANCE VERSUS COMMAND DURATION GUIDELINES field (see 7.5.11.1) may affect the timing relationships between the processing commands based on the specified command duration guideline and the contents of the COMMAND DURATION GUIDELINE POLICY field.~~

~~The command duration guideline interacts with the processing of the COMMAND DURATION GUIDELINE POLICY field.~~

~~The COMMAND DURATION GUIDELINE POLICY field ((see table 459) specified the policy action taken if a non-zero COMMAND DURATION GUIDELINE field specifies a command duration guideline that the device is unable to achieve for a command.~~

Table 459 — COMMAND DURATION GUIDELINE POLICY field << strike this table >>>

<<< FRIENDLY REMINDER TO THE EDITOR: Table renumbering will be required from here forward >>>

The CDL INACTIVE TIME POLICIES SUPPORTED, CDL ACTIVE TIME POLICIES SUPPORTED, and CDL TOTAL TIME POLICIES SUPPORTED fields (the CDL policy support fields) in the Extended INQUIRY Data VPD page (see 7.7.7) indicate which values in table 457 are supported in each time policy field. The bit positions that are set to one in each of the CDL policy support fields shall have a one-for-one correspondence to the policy values that are supported (e.g., if only bit positions 13 and 15 are set to one in CDL INACTIVE TIME POLICIES SUPPORTED, then only policies Dh and Fh are supported in INACTIVE TIME POLICY). If an unsupported policy value is selected, the device server shall terminate the MODE SELECT command with CHECK CONDITION status, with the sense key set to ILLEGAL REQUEST, and the additional sense code set to INVALID FIELD IN CDB.

If the ITS bit in the mode page containing this descriptor is set to one, and there exists a non-zero value in the INACTIVE TIME field, compute a Scheduling time for this command by adding the value in the INACTIVE TIME field to the fastest time for completion of this command for which the device server is able to return the requested data only by accessing the media.

If the ITS bit in the mode page containing this descriptor is set to zero, and there exists a non-zero value in the TOTAL TIME field, compute a Scheduling time for this command by adding the value in the TOTAL TIME field to the fastest time for completion of this command for which the device server is able to return the requested data only by accessing the media.

A non-zero Scheduling time shall affect device server processing of a command as follows:

- a) the length of time with which the device server completes that command is:
 - A) faster for smaller Scheduling times; and
 - B) slower for larger Scheduling times,in comparison to the Scheduling times computed for other T2 command duration limit descriptors; and
- b) larger magnitudes of the difference between the Scheduling times in two different T2 command duration limit descriptors result in larger probabilities of differences between the length of time of command completions for the commands that select those T2 command duration limit descriptors.

EXAMPLE – A host may specify times in a Scheduling time value that are independent of a device's performance characteristics by specifying 10 milliseconds as the time in one or more Command Duration Limits Descriptors as a method of associating those descriptors with the most rapid preferred command completion (i.e., 10 milliseconds is the smallest time specified by the application client in any descriptor). For all other descriptors, the equivalent time is specified as the preferred number of 10 millisecond intervals minus the average number of milliseconds in which a seek finishes for a hypothetical hard disk drive (i.e., a time that is less than 10 milliseconds). The magnitude relationships computed in this way provide useful Scheduling time information to the device server.

The contents of the PERFORMANCE VERSUS SCHEDULING TIME field (see 7.5.11.1) may affect the timing relationships between the processing commands based on Scheduling times.

The device may perform the comparisons between Command Duration Limits Descriptors that are described in this subclause) as part of processing command that writes the Command Duration Limit T2A mode page (see 7.5.11) or the Command Duration Limit T2BA mode page (see 7.5.12).

A bypass sequestration (BYP_SEQ) bit set to zero specifies that the device server processes a command associated with this T2 command duration limit descriptor as a non-sequestered command or a sequestered command as described in 5.16. A BYP_SEQ bit set to one specifies that the device server processes a command associated with this T2 command duration limit descriptor as a non-sequestered command (see 5.16).

Modify section 7.7.7 of SPC-6 as follows.

7.7.7 Extended INQUIRY Data VPD page

The Extended INQUIRY Data VPD page (see table 553 551) provides the application client with a means to obtain information about the logical unit.

Table 553 551 – Extended INQUIRY Data VPD page (part 1 of 2)

| Bit Byte | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
|-------------|----------------------|---|-----|------------------------|---|---------|---------|---------|
| 0 | PERIPHERAL QUALIFIER | | | PERIPHERAL DEVICE TYPE | | | | |
| 1 | PAGE CODE (86h) | | | | | | | |
| 2 | (MSB) _____ | | | | | | | |
| 3 | PAGE LENGTH (003Ch) | | | | | | | (LSB) |
| 4 | ACTIVATE MICROCODE | | SPT | | | GRD_CHK | APP_CHK | REF_CHK |

<<< EDITOR'S NOTE: NO CHANGE BETWEEN THESE ROWS >>>

| | | | | | | | | | |
|-----|---------------------------------|--------------------------------------|----------------------|----------------------|----------------------|----------------------|----------------------|----------|-------|
| 17 | (MSB) | MAXIMUM MODE PAGE CHANGE LOGS | | | | | | | (LSB) |
| 18 | | | | | | | | | |
| 19 | Download microcode support byte | | | | | | | | |
| | DM_MD_4 ^a | DM_MD_5 ^b | DM_MD_6 ^c | DM_MD_7 ^d | DM_MD_D ^e | DM_MD_E ^f | DM_MD_F ^g | Reserved | |
| 20 | (MSB) | CDL INACTIVE TIME POLICIES SUPPORTED | | | | | | | (LSB) |
| 21 | | | | | | | | | |
| 22 | (MSB) | CDL ACTIVE TIME POLICIES SUPPORTED | | | | | | | (LSB) |
| 23 | | | | | | | | | |
| 24 | (MSB) | CDL TOTAL TIME POLICIES SUPPORTED | | | | | | | (LSB) |
| 25 | | | | | | | | | |
| 26 | | Reserved | | | | | | | |
| ... | | | | | | | | | |
| 63 | | | | | | | | | |

^a The DM_MD_4 bit indicates support for the download microcode and activate (i.e., 04h) mode.

^b The DM_MD_5 bit indicates support for the download microcode, save, and activate (i.e., 05h) mode.

^c The DM_MD_6 bit indicates support for the download microcode with offsets and activate (i.e., 06h) mode.

<< EDITOR'S NOTE: APPEND THE FOLLOWING TO THE END OF SECTION 7.7.7 >>

The CDL INACTIVE TIME POLICIES SUPPORTED, CDL ACTIVE TIME POLICIES SUPPORTED, and CDL TOTAL TIME POLICIES SUPPORTED fields specify which values are supported in the time policy fields of each T2 command duration limit descriptor (see 7.5.11.2).