

ACS-2

Extended Power Conditions (EPC)

June 16, 2009

Revision 12

Technical Editor:

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Document Status

Revision History		
Rev	Date	Description
0	June 10, 2008	1) Initial Revision
1	June 16, 2008	1) Initial revision posted was the wrong version. This is the 'real' initial revision
2	July 15, 2008	1) Address review comments from June 2008 T13 plenary 2) Added interactions with APM, IDLE IMMEDIATE with unload feature, IDLE command, NV Cache Power Management feature, background operations; 3) Minor formatting changes to tables; 4) Added editors notes to record open issues; 5) Changed 'recovery time' resolution to '1 msec' from '100 msec'; 6) Added more details about the power conditions log
3	Sept. 3, 2008	1) Address review comments from Aug. 2008 T13 plenary 2) Clarify the interaction with 'background activities' to only host-initiated activities, as defined by ATA8-ACS 3) Specify new DCO RESTORE behaviour
4	Nov. 13, 2008	1) Included Standby as an EPC power condition in all EPC subcommands 2) Added 'shall' and 'may' in appropriate places. 3) Removed mention of 'Intialized at time of manufacture' 4) Removed duplicate specifications of what log fields get changed by which command. 5) Added specification for reporting a Recovery time that is larger 65535 msec. 6) Changes for consistency and clarification.
5	Dec. 4, 2008	1) Allow non-zero value at poweron for the Standby timer 2) Minor grammar, spelling and clarification corrections. 3) Specify Power Conditions log contents if EPC feature is not supported.
6	Feb. 13, 2009	1) Synch with T10/09-054 <ul style="list-style-type: none"> a. Rename 'Idle1' to 'Idle_A', 'idle2' to 'Idle_B', 'Idle3' to 'Idle_C' 2) Clarify reset processing 3) Automatically enable non-zero timers after power-on reset and DCO RESTORE 4) Redesign of all of the subcommands to mat SAT translation easier 5) Minor typographical corrections 6) Removed power condition id from all log entries 7) Changed Standby units to milliseconds, and added reporting in legacy Standby timer units to the log.

Revision History		
Rev	Date	Description
7	March 1, 2009	<ol style="list-style-type: none"> 1) Made the Power Conditions log not supported if EPC is not supported 2) Moved the Supported, Saveable and Enabled flags in the log 3) Clarified the requirements for starting and stopping the timers. 4) Corrected the handling of hardware and software resets to not change the current power condition. 5) Decided to handle any mapping of the SCSI 'standby_y' state in the SAT-3 standard, and not in this document. 6) Created a new requirement that at time of manufacture, that the Current, Saved and Default settings shall match. This removes any need to handle situations where the Saved settings are not valid. 7) Stated the requirement that if the SET POWER CONDITION TIMER subcommand fails, that no settings shall change. 8) Updated the requirements for DCO 9) Removed the new Normal Returns, in favor of using "Generic Extended Normal Output" instead
8	March 19, 2009	<ol style="list-style-type: none"> 1) Restored the 'changeable' property that was accidentally removed. 2)
9	April 15, 2009	<ol style="list-style-type: none"> 1) Split 'standby' into 'standby_y' and 'standby_z' 2) Changed the rules about when to start/stop the timers when commands are accepted and completed.
10	April 15, 2009	<ol style="list-style-type: none"> 1) Split 'standby' into 'standby_y' and 'standby_z' 2) Changed the rules about when to start/stop the timers when commands are accepted and completed.
11	April 21, 2009	<ol style="list-style-type: none"> 1) Relabel Idle_a -> Idle_a, etc. 2) Make Idle_a and Standby_z mandatory 3) Change requirements for stopping and starting the timers 4) Make IDLE and IDLE IMMEDIATE go to Idle_a 5) Make STANDBY and STANDBY IMMEDIATE go to Standby_z 6) Use 'then' properly.

Revision History		
Rev	Date	Description
12	June 16, 2009	1) Added a flag to the Set Timer Value subcommand to specify the timer value in units of minutes vs. 100 milliseconds 2) Removed the legacy units for the Standby timer from the log 3) Misc. editorial changes for clarification 4) Added interaction with NV Cache Power Management feature set in the NV Cache Power Management command section. 5) Redesigned the log: <ul style="list-style-type: none"> a. rearranged all fields b. renamed the flags to indicate 'timer' instead of 'power condition' (for clarity) c. expanded each section to 20h words (instead of 10h) to allow for future expansion d. added Min & Max timer values for each power condition e. regrouped all flags for each power condition f. changed all timers to 32-bits in length g. changed all timers to 100 millisecond resolution

1 Introduction

This proposal is an attempt to standardize fine grained power management controls. The industry currently has some vendor specific methods.

2 Scope

This is intended for incorporation into ACS-2.

References to sections, tables, etc are to ATA8-ACS revision 6a.

3 Overview

This adds substates (power conditions) to the PM1:Idle power management state, and methods to use and configure their use.

4 Changes to ACS-2

4.1 Changes to clause 2

(No changes)

4.2 Changes to clause 3

~~(No changes)~~ [\(Add the following definition to subclause 3.1\)](#)

[3.1.x power condition: One of the following power management substates: Idle_a, Idle_b, Idle_c, Standby_y or Standby_z \(see xxx \[EPC feature set\]\).](#)

4.3 Changes to clause 4

4.3.1 Overview - Changes to the Feature Set Summary Table

Add: Extended Power Conditions (EPC) to the table as Optional for ATA and Prohibited for ATAPI

4.3.2 Security Mode feature set - Changes to the Security Mode Command Actions Table

(No changes)

4.3.3 Long Logical Sector feature set - Block Size By Command Table

(No changes)

4.3.4 (new) Extended Power Conditions (EPC) feature set

The Extended Power Conditions feature set provides a host with additional methods to control the power condition of a device. These methods include:

- defining power conditions within the PM1:Idle power management state: Idle_a, Idle_b and Idle_c.
- specifying that the device transition to a power condition without delay;
- enabling and initializing any of the power condition timers to specify that the device wait for a period of inactivity before transitioning to a specified power condition; and
- allowing the host to determine the power condition settings of the device.

The following command-related device properties are mandatory if this feature set is supported:

- the SET FEATURES 'Extended Power Conditions' subcommand
- the Power Conditions log
- additional status values returned by the CHECK POWER MODE command
- IDENTIFY DEVICE fields
- DCO controls

4.3.4.1 Power conditions

~~The~~ Idle_a, Idle_b and Idle_c [are](#) power conditions ~~are~~ within the PM1:Idle power management state. ~~The~~ Standby_y and Standby_z [are](#) power conditions ~~are~~ within the PM2:Standby power management state. The power conditions shall be ordered from highest power consumption (and shortest recovery time) to lowest power consumption (and longest recovery time) as follows:

Idle_a power >= Idle_b power >= Idle_c power >= Standby_y power >= Standby_z power

The traditional Standby is also included as an EPC power condition. The traditional Standby timer may be manipulated using either the EPC subcommands or the IDLE and STANDBY commands. The EPC feature set also defines a default Standby timer value, which may be enabled, disabled, queried, etc. in the same manner as the other EPC power conditions.

Each of these power conditions has a set of current, saved and default settings (See [editors note: Power Conditions log]). Default settings are not modifiable. Default and saved settings shall persist across power-on

resets. The current settings shall not persist across power-on resets. At the time of manufacture, the default, saved and current settings in the Power Conditions log shall match.

4.3.4.2 Power condition timers

The device shall have manufacturer specified power-on default settings for the power condition timers. Power condition timers are changeable with the SET FEATURES “Extended Power Conditions” subcommand (see [editors note: set features subcommand]). Configured settings for the timers shall be readable in the Power Conditions log (see [editors note: power conditions log]).

A power condition timer set to zero indicates that the associated power condition is disabled.

The IDENTIFY DEVICE command indicates ~~when-if~~ this feature set is supported, and ~~when-if~~ there are power condition timers enabled.

~~If the power condition is enabled, then t~~The value of each timer specifies the time after command completion that the device shall wait before transitioning to the power condition ~~if the power condition is enabled~~. All enabled power condition timers run concurrently.

~~All power condition timers shall be stopped on acceptance of any command which requires PM0: Active. If timers were not stopped, then they shall continue to run (e.g., CHECK POWER MODE). If a command is accepted that requires a transition to PM0:Active, then the timers shall be stopped. If a command is accepted that does not require a transition to PM0:Active (e.g., a CHECK POWER MODE command), then the timers shall continue to run.~~

On command completion, ~~then~~ all timers that were stopped shall be initialized with the ~~Current Timer~~ Current Timer settings values and started.

~~If a device processes a command while in a power condition, the device may change to a new power condition. As a result of processing any command, the device may change to a different power condition.~~

When an enabled timer expires, the device shall transition to the power condition associated with that timer. Timer expirations shall only cause the device to transition from higher power conditions to lower power conditions (e.g., if the Standby_z timer is set to a smaller interval than the Idle_b timer, and the device is currently in the Standby_z power condition, then the device shall remain in the Standby_z power condition when the Idle_b timer expires). If the timer expiration qualifies the device to transition to more than one enabled power condition, then the device shall transition to the power condition with the least power consumption.

4.3.4.3 Interaction with resets, commands and other features

On successful processing of a power-on reset, the device shall:

1. stop all EPC timers;
2. copy the ~~Saved Enabled~~ Saved Timer Enabled field to the ~~Current Enabled~~ Current Timer Enabled field, for all supported power conditions;
3. copy the ~~Saved Timer field~~ Saved Timer Settings field to the ~~Current Timer field~~ Current Timer Settings field, for all supported power conditions; and
4. reinitialize and restart all enabled EPC timers with Current values.

On successful processing of a hardware reset, a software reset or a DEVICE RESET command, then the device shall:

1. stop all EPC timers;
2. remain in the current power condition; and
3. reinitialize and restart all enabled EPC timers with Current values.

~~On successful processing of a software reset or a DEVICE RESET command, the device shall:~~

- 1. ~~stop all EPC timers;~~
- 2. ~~remain in the current power condition; and~~
- 3. ~~reinitialize and restart all enabled EPC timers with Current values.~~

On successful processing of the IDLE command and if the EPC feature set is supported:

1. in the Standby_z section of the Power Conditions log, the device shall:
 - a. translate the specified Standby timer value to units of 100 milliseconds and set ~~the specified Standby timer value~~ as the Current Standby timer;
 - b. if the specified Standby timer value is non-zero, then the device shall set the Current Timer Enabled field to one; and
 - c. if the specified Standby timer value is zero, then the device shall clear the Current Timer Enabled field to zero;
2. if ~~the device contains cache memory~~volatile write cache is enabled, then the device shall write all cached data to the medium for the device (e.g., as a device does in response to a flush command) prior to entering into any power condition that prevents accessing the media (e.g., before a hard drive stops its spindle motor during transition to the Standby_z power condition);
3. the device shall enter the PM1:Idle state; and
4. the device shall enter the Idle_a power condition.

On successful processing of the IDLE IMMEDIATE command and if the EPC feature set is supported:

1. if the unload feature was selected, then the device shall protect itself (see 7.19.2.2). If volatile write cache is enabled, then the ~~The~~ device shall retain data in the write cache and resume writing the cached data onto the media after receiving a Software Reset, a Hardware Reset, or any new command except IDLE IMMEDIATE with unload feature;
2. if the unload feature was not selected and ~~the device contains cache memory~~volatile write cache is enabled, then the device shall write all cached data to the medium for the device (e.g., as a device does in response to a flush command) prior to entering into any power condition that prevents accessing the media (e.g., before a hard drive stops its spindle motor during transition to the Standby_z power condition);
3. the device shall enter the PM1:Idle state; and
4. the device shall enter the Idle_a power condition.

On successful processing of the STANDBY command and if the EPC feature set is supported:

1. in the Standby_z section of the Power Conditions log,
 - a) translate the specified Standby timer value to units of 100 milliseconds and the device shall set ~~it the specified Standby timer value~~ as the Current Standby timer;
 - b) if the specified Standby timer value is non-zero, then the device shall set the ~~Current Enabled~~Current Timer Enabled field to one; and
 - c) if the specified Standby timer value is zero, then the device shall clear the ~~Current Enabled~~Current Timer Enabled field to zero;
2. if ~~the device contains cache memory~~volatile write cache is enabled, then the device shall write all cached data to the medium for the device (e.g., as a device does in response to a flush command) prior to entering into any power condition that prevents accessing the media (e.g., before a hard drive stops its spindle motor during transition to the Standby_z power condition);
3. the device shall enter the PM2:Standby state; and
4. the device shall enter the Standby_z power condition.

On successful processing of the STANDBY IMMEDIATE command and if the EPC feature set is supported:

1. if ~~the device contains cache memory~~volatile write cache is enabled, then the device shall write all cached data to the medium for the device (e.g., as a device does in response to a flush command) prior to entering into any power condition that prevents accessing the media (e.g., before a hard drive stops its spindle motor during transition to the standby power condition);
2. the device shall enter the PM2:Standby state; and
3. the device shall enter the Standby_z power condition.

The Extended Power Conditions and the Advanced Power Management features are mutually exclusive of each other. All EPC subcommands shall return command aborted if APM is enabled. The SET FEATURES Enable/Disable APM subcommands shall abort if IDENTIFY DEVICE word TBDIDB bit TBD1 is set to one.

If the NV Cache Power Management feature is enabled, then the expiration of an EPC timer shall not cause the device to transition to a lower power state until the NV Cache power mode timer expires.

During background activities, all EPC timers may be paused. On completion of the activity, any paused EPC timers shall be continued from where they were paused.

5 Changes to clause 5

(No changes)

6 Changes to clause 6

(No changes)

7 Changes to clause 7

7.20.11 SET NV CACHE POWER MODE - B6h/00h, Non-Data

7.20.11.1 Feature set

This 48-bit command is mandatory for devices implementing the NV Cache Power Management feature set.

7.20.11.2 Description

This command shall cause the device to set the NV Cache power mode timer and set IDENTIFY DEVICE data word 214 bit 1 to one. The device should minimize power consumption and use the NV Cache to complete read and write requests whenever possible.

When the device spins-up its rotating media, the rotating media shall remain spun-up for at least as many seconds as the value in the Count field.

If the standby timer [or the Standby_y timer or the Standby_z timer \(see xxx \[EPC feature set\]\)](#) expires before the NV Cache power mode timer, the device shall not transition to Standby_mode until the NV Cache power mode timer expires. APM shall not cause the device to transition to a lower power state until the NV Cache power mode timer expires.

7.1.1 SET FEATURES - EFh, Non-Data

7.1.1.1 Feature Set

7.1.1.2 Description

Table 53 - SET FEATURES Feature field definitions (part X of 3)

Value	Description
TBDSF	Extended Power conditions (See 7.1.1.3)

7.1.1.3 Extended Power Conditions (EPC)

Subcommand code TBDSF enables, disables, and configures the use of the Extended Power Conditions feature set (see 4.3.4). If the EPC feature is not supported, then the device shall return command aborted.

7.1.1.4 Inputs for SET FEATURES - Extended Power Conditions

Name	Description
Feature	TBDSF (set features subcommand code)
Count	EPC subcommand dependent
LBA	Bit Description
	23:4 EPC subcommand dependent
	3:0 EPC subcommand (See Table 1)
Device	

	Bit Description 7 Obsolete 6 Shall be set to one 5 Obsolete 4 Transport Dependent - See 3:0 Reserved
Command	7:0 EFh

Table 1 - Extended Power Conditions Subcommands

EPC Subcommand	EPC Subcommand
0h	Restore Power Condition Settings
1h	Go to Power Condition
2h	Set Power Condition Timer
3h	Set Power Condition State
4h .. Fh	Reserved

Table 2 - Power Condition IDs

Power Condition ID	Power Condition Name	Description
00h	Standby_z	A substate of the PM2:Standby state
01h	Standby_y	A substate of the PM2:Standby state
02h..80h		Reserved
81h	Idle_a	A substate of the PM1:Idle state
82h	Idle_b	A substate of the PM1:Idle state
83h	Idle_c	A substate of the PM1:Idle state
84h .. FEh		Reserved
FFh	All	All EPC power conditions

7.48.new.1 Restore Power Condition Settings subcommand

On successful completion of this EPC subcommand, the device shall update the Power Conditions log (see [Editors note: section head in Annex A for TBDLOG]) for the selected Power Condition ID(s) as follows:

1. if Default is set to one, then
 - a. copy the ~~Default Timer field~~Default Timer Settings field to the Current Timer Settings field; and
 - b. copy the ~~Default Enabled~~Default Timer Enabled valuefield to the ~~Current Enabled~~Current Timer Enabled valuefield;
2. if Default is cleared to zero, then
 - a. copy the ~~Saved Timer field~~Saved Timer Settings field to the Current Timer Settings field; and
 - b. copy the ~~Saved Enabled~~Saved Timer Enabled valuefield to the ~~Current Enabled~~Current Timer Enabled valuefield;

and
3. if Save is set to one and the power condition is saveable, then
 - a. copy the ~~Current Timer field~~Current Timer Settings field to the Saved Timer Settings field; and
 - b. copy the ~~Current enable value~~Current Timer Enabled field to the ~~Saved enable value~~Saved Timer Enabled field.

Table 3 - Inputs for Restore Power Condition Settings subcommand

Name	Description
Feature	TBDSF (set features subcommand code)
Count	Power Condition (see Table 2)
LBA	Bit Description
	23:7 Reserved
	6 Default 1 = Restore from Default settings 0 = Restore from Saved settings
	5 Reserved
	4 Save 1 = Save settings on completion 0 = Do not save settings on completion
	3:0 Subcommand 0h = Restore power condition settings
Device	Bit Description 7 Obsolete 6 Shall be set to one 5 Obsolete 4 Transport Dependent - See 6.2.12 3:0 Reserved
Command	7:0 EFh

Normal Outputs

See [Editors note: "Generic Extended Normal Output" in ACS-2]

Error Outputs

If any selected Power Condition is not supported or is not changeable or if Save is set to one and any selected power condition is not saveable, then the device shall return command aborted. See [Editors note table 122].

7.48.new.2 Go To Power Condition subcommand

On successful completion of this EPC subcommand, the device shall:

- 1) stop all enabled EPC timers;
- 2) enter the selected EPC power condition after command completion of the SET FEATURES command without having to wait for any timers to expire; and
- 3) the device shall remain in the selected power condition until the device processes the next command or reset.

Table 4 - Inputs for Go To Power Condition subcommand

Name	Description
Feature	TBDSF (set features subcommand code)
Count	Power Condition ID (see Table 2)
LBA	Bit Description
	23:4 Reserved
	3:0 Subcommand 1h = Go To Power Condition
Device	Bit Description 7 Obsolete 6 Shall be set to one 5 Obsolete 4 Transport Dependent - See 6.2.12 3:0 Reserved
Command	7:0 EFh

Normal Outputs

See [Editors note "Generic Extended Normal Output" in ACS-2].

Error Outputs

If the Power condition ID is FFh, a reserved value or is not supported, then the device shall return command aborted. See [Editors note: Table 122].

7.48.new.3 Set Power Condition Timer subcommand

On successful completion of this EPC subcommand, the device shall update the Power Conditions log for the selected and supported Power Condition as follows:

1. copy the Timer field to the ~~Current Timer field~~Current Timer Settings field;
2. if Enable is set to one and the Timer field is non-zero, then enable the Current Timer;
3. if Enable is set to one and the Timer field is zero, then disable the Current Timer;
4. if Enable is cleared to zero, then disable the Current Timer; and
5. if Save is set to one and the Power Condition settings are saveable, then
 - a. copy the ~~Current Timer field~~Current Timer Settings field to the ~~Saved Timer field~~Saved Timer Settings field; and
 - b. copy the ~~Current Enabled~~Current Timer Enabled field to the ~~Saved Enabled~~Saved Timer Enabled field..

Table 5 - Inputs for Set Power Condition Timer subcommand

Name	Description
Feature	TBDSF (set features subcommand code)
Count	Power Condition ID (see Table 2)
LBA	Bit Description
	23:8 Timer (15:0)
	7 Reserved
	6 Timer Units 1 = Timer is specified in units of 1 second <u>minute</u> 0 = Timer is specified in units of 100 milliseconds
	5 Enable 1 = Enable the selected power condition 0 = Disable the selected power condition
	4 Save 1 = Save settings on completion 0 = Do not save settings on completion
	3:0 Subcommand 2h = Set Power Condition Timer
Device	Bit Description 7 Obsolete 6 Shall be set to one 5 Obsolete 4 Transport Dependent – See 6.2.12 3:0 Reserved
Command	7:0 Efh

Timer Value

If Timer Units is cleared to zero, then the Timer (15:0) shall be specified in units of 100 milliseconds.

If Timer Units is set to one, then the Timer (15:0) shall be specified in units of 1 minute.

Normal Outputs

See [Editors note "Generic Extended Normal Output" in ACS-2].

Error Outputs

If the Power Condition is invalid, not changeable or not supported then the device shall return command aborted. If Save is set to one and the selected power condition is not saveable, then the device shall return command aborted. If the new timer value is not supported, the device shall either set the timer with a modified value or return command aborted. If command aborted is returned, then the device shall make no modifications to the power condition settings. See [Editors note Table 122].

7.48.new.4 Set Power Condition State subcommand

On successful completion of this EPC subcommand, the device shall update the Power Conditions log for the Power Condition(s) as follows:

1. If Enable is set to one, then enable the Current Timer; otherwise disable the Current Timer; and
2. If Save is set to one, then copy the ~~Current Enabled~~ Current Timer Enabled value field to the ~~Saved-Enabled~~ Saved Timer Enabled value field.

Table 6 - Inputs for Set Power Condition State subcommand

Name	Description
Feature	TBDSF (set features subcommand code)
Count	Power Condition (see Table 2)
LBA	Bit Description
	23:6 Reserved
	5 Enable 1 = Enable the selected power condition 0 = Disable the selected power condition
	4 Save 1 = Save settings on completion 0 = Do not save settings on completion
	3:0 Subcommand 3h = Set Power Condition State
Device	Bit Description 7 Obsolete 6 Shall be set to one 5 Obsolete 4 Transport Dependent – See 6.2.12 3:0 Reserved
Command	7:0 Efh

Normal Outputs

See [Editors note: “Generic Extended Normal Output” in ACS-2].

Error Outputs

If the Power Condition is not valid, not changeable or not supported, then the device shall return command aborted. If Save is set to one and the selected Power Condition is not saveable, then the device shall return command aborted. See [Editors note Table 122].

7.1.2 Changes to DCO IDENTIFY

Word	Content
TBDDCO	Command set/feature set supported TBD1 1 = Reporting support for Extended Power Conditions is changeable

If bit TBD1 of word TBDDCO is set to one, then support for the Extended Power Conditions feature set is changeable.

7.1.3 Changes to DCO SET

Word	Content
TBDDCO	Command set/feature set supported TBD1 1 = Reporting support for Extended Power Conditions is allowed

If bit TBD1 of word TBDDCO is cleared to zero, then the device shall

- a) disable support for the Extended Power Conditions feature;
- b) change the Log Directory to indicate that the Power Conditions log is not supported;
- c) clear bit TBD1 of word TBDIDA in the IDENTIFY DEVICE data to zero;
- d) clear bit TBD1 of word TBDIDB in the IDENTIFY DEVICE data to zero.

7.1.4 Changes to DCO RESTORE

(add this new paragraph to the Description section of DCO RESTORE)

If a DEVICE CONFIGURATION RESTORE command changes reporting of support for the EPC feature set from not supported to supported then the device shall

- a) set IDENTIFY DEVICE data word TBDIDA bit TBD1 to one;
- b) change the Log Directory to indicate that the Power Conditions log is supported; and
- c) initialize the Power Conditions log such that the Default, Saved and Current settings match for all power conditions.

7.1.5 Changes to IDENTIFY DEVICE data

If the proposal adds a feature set or command, there should be an addition to the IDENTIFY DEVICE data to indicate both supported and enabled descriptions. Fill in the description in the table and place a description of each bit or word underneath the table.

Word	O M	S P	F V	Description
TBDIDA	M		F	Supported Settings TBD1 1 = Extended Power Conditions feature set is supported
TBDIDB	M		V	Enabled Settings TBD1 1 = At least one Extended Power Conditions Idle timer is enabled
Key: O/M Mandatory/optional requirement. M Support of the word is mandatory. O Support of the word is optional. F/V Fixed/variable content F The content of the field is fixed and does not change. The DCO command may change the value of a fixed field. For removable media devices, these values may change when media is removed or changed. V The contents of the field is variable and may change depending on the state of the device or the commands executed by the device. X The content of the field may be fixed or variable S/P Content applies to Serial or Parallel transport S Serial Transport P Parallel Transport B Both Serial and Parallel Transports N Belongs to a transport other than Serial or Parallel				

Word TBDIDA, bit TBD 1 shall be set to one if the Extended Power Conditions feature is supported. (See 7.1.1.3)

Word TBDIDB, bit TBD 1 shall be set to one if the Idle_a Timer, Idle_b Timer or Idle_c timers are enabled. If none of these EPC timers are enabled or if the Extended Power Conditions feature set is not supported, then word TBDIDB bit TBD1 shall be cleared to zero. (See 7.1.1.3)

7.2 Changes to Normal and Error Outputs

7.2.1 Changes to Normal Outputs

Table 103 - Check Power Mode Normal Output

Name	Description	
Error	N/A	
Count	Value	Description
	00h	Device is in the PM2:Standby state or Device is in the PM2:Standby state and the Extended Power Conditions feature set is supported and enabled, and the device is in the Standby_z power condition.
	01h	Device is in the PM2:Standby state and the Extended Power Conditions feature set is supported and enabled, and the device is in the Standby_y power condition.
	40h	Device is in the PM0:Active state, and the NV Cache power mode is enabled and the spindle is spun down or spinning down.
	41h	Device is in the PM0:Active state and the NV Cache power mode is enabled and the spindle is spun up or spinning up.
	80h	Device is in the PM1:Idle state and Extended Power Conditions feature set is not supported or not enabled
	81h	Device is in the PM1:Idle State, and Extended Power Conditions feature set is supported and enabled, and the device is in the Idle_a power condition.
	82h	Device is in the PM1:Idle State, and Extended Power Conditions feature set is supported and enabled, and the device is in the Idle_b power condition.
	83h	Device is in the PM1:Idle State, and Extended Power Conditions feature set is supported and enabled, and the device is in the Idle_c power condition.
	FFh	Device is in the PM0:Active state or PM1:Idle State.
LBA	N/A	
Device	<p>Bit Description</p> <p>15 Obsolete</p> <p>14 N/A</p> <p>13 Obsolete</p> <p>12 Transport Dependent - See</p> <p>11:8 Reserved</p>	
Status	<p>7:6 Transport Dependent - See .</p> <p>5 Device Fault - See</p> <p>4 N/A</p> <p>3 Transport Dependent - See .</p> <p>2:1 N/A</p> <p>0 Error - See</p>	

7.2.2 Changes to Error Outputs

None.

Changes to Annex A – Log Definitions

Changes to Table A.2

Add new row:

Log Number	Log Name	Feature set	R/W	Access
TBDLOG	Power Conditions	Extended Power Conditions	RO	GPL

7.2.3 (new log) Power Conditions Log (TBDLOG)

If the Extended Power Conditions feature set is supported, then this non-volatile log shall be supported. If the Extended Power Conditions feature set is not supported, then this log shall not be supported.

Table 7 - Power Conditions Log

Word Offset	Data Type	Description
00h	word	Idle_a Power Condition Flags
		Bits Description
		15 Power Condition Supported Shall be set to one to indicate that the Idle_a power condition is supported.
		14 Timer Saveable 1= Idle_a power condition timer is saveable 0= Idle_a power condition timer is not saveable
		13 Timer Changeable 1= Idle_a power condition timer is changeable 0= Idle_a power condition timer is not changeable
		12 Default Timer Enabled 1= Default Idle_a timer power condition is enabled 0= Default Idle_a timer power condition is disabled
		11 Saved Timer Enabled 1= Saved Idle_a timer power condition is enabled 0= Saved Idle_a timer power condition is disabled
		10 Current Timer Enabled 1= Current Idle_a timer power condition is enabled 0= Current Idle_a timer power condition is disabled
		9:0 Reserved
01h	word	Reserved
02h	Dword	<p>Default Idle_a Timer setting</p> <p>This is the minimum time that the device shall wait after command completion before entering the Idle_a power condition of the PM1:Idle power management state. A value of zero indicates that this power condition is disabled. A value of FFFFFFFFhFFFF FFFFh indicates that the time is greater than or equal to 429_496_729_500 milliseconds.</p> <p>Measurement Units: 100 milliseconds.</p>

Word Offset	Data Type	Description				
04h	Dword	<p>Saved Idle_a Timer setting</p> <p>This is the minimum time that the device shall wait after command completion before entering the Idle_a power condition of the PM1:Idle power management state. A value of zero indicates that this power condition is disabled. A value of FFFFFFFFhFFFF_FFFFh indicates that the time is greater than or equal to 429_496_729_500 milliseconds.</p> <p>Measurement Units: 100 milliseconds</p>				
06h	Dword	<p>Current Idle_a Timer setting</p> <p>This is the minimum time that the device shall wait after command completion before entering the Idle_a power condition of the PM1:Idle power management state. A value of zero indicates that this power condition is disabled. A value of FFFFFFFFhFFFF_FFFFh indicates that the time is greater than or equal to 429_496_729_500 milliseconds.</p> <p>Measurement Units: 100 milliseconds</p>				
08h	Dword	<p>Nominal Recovery time from Idle_a to PM0:Active</p> <p>This is the nominal time required to transition from Idle_a to PM0:Active. This time does not include processing time for the command that caused this transition to occur . A value of zero indicates that the nominal recovery time is not specified. A value of FFFFFFFFhFFFF_FFFFh indicates that the recovery time is greater than or equal to 429_496_729_50065535 milliseconds.</p> <p>Measurement Units: 100 milliseconds</p> <p>This value shall be preserved over all resets</p>				
0Ah	Dword	<p>Minimum Idle_a timer setting</p> <p>This is the minimum timer value allowed by the Set Power Condition Timer subcommand for the Idle_a timer. A value of zero indicates that the minimum timer value is not specified. A value of FFFFFFFFhFFFF_FFFFh indicates that the minimum timer value is greater than or equal to 429_496_729_500 milliseconds.</p> <p>Measurement Units: 100 milliseconds</p> <p>This value shall be preserved over all resets</p>				
0Ch	Dword	<p>Maximum Idle_a timer setting</p> <p>This is the maximum timer value allowed by the Set Power Condition Timer subcommand for the Idle_a timer. A value of zero indicates that the maximum timer value is not specified. A value of FFFF_FFFFh indicates that the maximum timer value is greater than or equal to 429_496_729_500 milliseconds.</p> <p>Measurement Units: 100 milliseconds</p> <p>This value shall be preserved over all resets</p>				
0Eh..1Fh	Dword	Reserved				
10h20h	word	Idle_b Power Condition Flags				
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Word Offset	Data Type	Description
		15 Power Condition Supported 1= Idle_b power condition is supported 0= Idle_b power condition is not supported
		14 Timer Saveable 1= Idle_b power condition is timer is saveable 0= Idle_b power condition is timer is not saveable
		13 Timer Changeable 1= Idle_b power condition is timer is changeable 0= Idle_b power condition is timer is not changeable
		12 Default Timer Enabled 1= Default Idle_b power condition is timer is enabled 0= Default Idle_b power condition is timer is disabled
		11 Saved Timer Enabled 1= Saved Idle_b power condition is timer is enabled 0= Saved Idle_b power condition is timer is disabled
		10 Current Timer Enabled 1= Current Idle_b power condition is timer is enabled 0= Current Idle_b power condition is timer is disabled
		9:0 Reserved
241h	word	Reserved
242h	Dword	Default Idle_b Timer setting This is the minimum time that the device shall wait after command completion before entering the Idle_b power condition of the PM1:Idle power management state. A value of zero indicates that this power condition is disabled. A value of FFFFFFFFh FFFF FFFFh indicates that the time is greater than or equal to 429_496_729_500 milliseconds. Measurement Units: 100 milliseconds.
244h	Dword	Saved Idle_b Timer setting This is the minimum time that the device shall wait after command completion before entering the Idle_b power condition of the PM1:Idle power management state. A value of zero indicates that this power condition is disabled. A value of FFFFFFFFh FFFF FFFFh indicates that the time is greater than or equal to 429_496_729_500 milliseconds. Measurement Units: 100 milliseconds
246h	Dword	Current Idle_b Timer setting This is the minimum time that the device shall wait after command completion before entering the Idle_b power condition of the PM1:Idle power management state. A value of zero indicates that this power condition is disabled. A value of FFFFFFFFh FFFF FFFFh indicates that the time is greater than or equal to 429_496_729_500 milliseconds. Measurement Units: 100 milliseconds

Word Offset	Data Type	Description																
248h	Dword	<p>Nominal Recovery time from Idle_b to PM0:Active</p> <p>This is the nominal time required to transition from Idle_b to PM0:Active. This time does not include processing time for the command that caused this transition to occur. A value of zero indicates that the nominal recovery time is not specified. A value of FFFFFFFFhFFFF_FFFFh indicates that the recovery time is greater than or equal to 65535 milliseconds.</p> <p>Measurement Units: 100 milliseconds</p> <p>This value shall be preserved over all resets</p>																
24Ah	Dword	<p>Minimum Idle_b timer setting</p> <p>This is the minimum timer value allowed by the Set Power Condition Timer subcommand for the Idle_b timer. A value of zero indicates that the minimum timer value is not specified. A value of FFFFFFFFhFFFF_FFFFh indicates that the minimum timer value is greater than or equal to 429_496_729_500 milliseconds.</p> <p>Measurement Units: 100 milliseconds</p> <p>This value shall be preserved over all resets</p>																
24Ch	Dword	<p>Maximum Idle_b timer setting</p> <p>This is the maximum timer value allowed by the Set Power Condition Timer subcommand for the Idle_b timer. A value of zero indicates that the maximum timer value is not specified. A value of FFFFFFFFhFFFF_FFFFh indicates that the maximum timer value is greater than or equal to 429_496_729_500 milliseconds.</p> <p>Measurement Units: 100 milliseconds</p> <p>This value shall be preserved over all resets</p>																
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Word Offset	Data Type	Description
		9:0 Reserved
421h	word	Reserved
422h	Dword	<p>Default Idle_c Timer setting</p> <p>This is the minimum time that the device shall wait after command completion before entering the Idle_c power condition of the PM1:Idle power management state. A value of zero indicates that this power condition is disabled. A value of FFFFFFFFhFFFF_FFFFh indicates that the time is greater than or equal to 429_496_729_500 milliseconds.</p> <p>Measurement Units: 100 milliseconds.</p>
424h	Dword	<p>Saved Idle_c Timer setting</p> <p>This is the minimum time that the device shall wait after command completion before entering the Idle_c power condition of the PM1:Idle power management state. A value of zero indicates that this power condition is disabled. A value of FFFFFFFFhFFFF_FFFFh indicates that the time is greater than or equal to 429_496_729_500 milliseconds.</p> <p>Measurement Units: 100 milliseconds</p>
426h	Dword	<p>Current Idle_c Timer setting</p> <p>This is the minimum time that the device shall wait after command completion before entering the Idle_c power condition of the PM1:Idle power management state. A value of zero indicates that this power condition is disabled. A value of FFFFFFFFhFFFF_FFFFh indicates that the time is greater than or equal to 429_496_729_500 milliseconds.</p> <p>Measurement Units: 100 milliseconds</p>
428h	Dword	<p>Nominal Recovery time from Idle_c to PM0:Active</p> <p>This is the nominal time required to transition from Idle_c to PM0:Active. This time does not include processing time for the command that caused this transition to occur. A value of zero indicates that the nominal recovery time is not specified. A value of FFFFFFFFhFFFF_FFFFh indicates that the recovery time is greater than or equal to 65535 milliseconds.</p> <p>Measurement Units: 100 milliseconds</p> <p>This value shall be preserved over all resets</p>
42Ah	Dword	<p>Minimum Idle_c timer setting</p> <p>This is the minimum timer value allowed by the Set Power Condition Timer subcommand for the Idle_c timer. A value of zero indicates that the minimum timer value is not specified. A value of FFFFFFFFhFFFF_FFFFh indicates that the minimum timer value is greater than or equal to 429_496_729_500 milliseconds.</p> <p>Measurement Units: 100 milliseconds</p> <p>This value shall be preserved over all resets</p>

Word Offset	Data Type	Description																
42Ch	Dword	<p>Maximum Idle_c timer setting</p> <p>This is the maximum timer value allowed by the Set Power Condition Timer subcommand for the Idle_c timer. A value of zero indicates that the maximum timer value is not specified. A value of FFFFFFFFhFFFF_FFFFh indicates that the maximum timer value is greater than or equal to 429_496_729_500 milliseconds.</p> <p>Measurement Units: 100 milliseconds</p> <p>This value shall be preserved over all resets</p>																
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632h	Dword	<p>Default Standby_y Timer setting</p> <p>This is the minimum time that the device shall wait after command completion before entering the Standby_y power condition of the PM1:Idle power management state. A value of zero indicates that this power condition is disabled. A value of FFFFFFFFhFFFF_FFFFh indicates that the time is greater than or equal to 429_496_729_500 milliseconds.</p> <p>Measurement Units: 100 milliseconds.</p>																
634h	Dword	<p>Saved Standby_y Timer setting</p> <p>This is the minimum time that the device shall wait after command completion before entering the Standby_y power condition of the PM1:Idle power management state. A value of zero indicates that this power condition is disabled. A value of FFFFFFFFhFFFF_FFFFh indicates that the time is greater than or equal to 429_496_729_500 milliseconds.</p> <p>Measurement Units: 100 milliseconds</p>																

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636h	Dword	<p>Current Standby_y Timer setting</p> <p>This is the minimum time that the device shall wait after command completion before entering the Standby_y power condition of the PM1:Idle power management state. A value of zero indicates that this power condition is disabled. A value of FFFFFFFFhFFFF_FFFFh indicates that the time is greater than or equal to 429_496_729_500 milliseconds.</p> <p>Measurement Units: 100 milliseconds</p>								
638h	Dword	<p>Nominal Recovery time from Standby_y to PM0:Active</p> <p>This is the nominal time required to transition from Standby_y to PM0:Active. This time does not include processing time for the command that caused this transition to occur. A value of zero indicates that the nominal recovery time is not specified. A value of FFFFFFFFhFFFF_FFFFh indicates that the recovery time is greater than or equal to 429_496_729_500 milliseconds.</p> <p>Measurement Units: 100 milliseconds</p> <p>This value shall be preserved over all resets</p>								
63Ah	Dword	<p>Minimum Standby_y timer setting</p> <p>This is the minimum timer value allowed by the Set Power Condition Timer subcommand for the Standby_y timer. A value of zero indicates that the minimum timer value is not specified. A value of FFFFFFFFhFFFF_FFFFh indicates that the minimum timer value is greater than or equal to 429_496_729_500 milliseconds.</p> <p>Measurement Units: 100 milliseconds</p> <p>This value shall be preserved over all resets</p>								
63Ch	Dword	<p>Maximum Standby_y timer setting</p> <p>This is the maximum timer value allowed by the Set Power Condition Timer subcommand for the Standby_y timer. A value of zero indicates that the maximum timer value is not specified. A value of FFFFFFFFhFFFF_FFFFh indicates that the maximum timer value is greater than or equal to 429_496_729_500 milliseconds.</p> <p>Measurement Units: 100 milliseconds</p> <p>This value shall be preserved over all resets</p>								
63Eh..7Fh	Dword	Reserved								
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Word Offset	Data Type	Description
		12 Default Timer Enabled 1= Default Standby_z power condition is timer is enabled 0= Default Standby_z power condition is timer is disabled
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		10 Current Timer Enabled 1= Current Standby_z power condition is timer is enabled 0= Current Standby_z power condition is timer is disabled
		9:0 Reserved
841h	word	Reserved
842h	Dword	Default Standby_z Timer setting This is the minimum time that the device shall wait after command completion before entering the Standby_z power condition of the PM1:Idle power management state. A value of zero indicates that this power condition is disabled. A value of FFFFFFFFh FFFF FFFFh indicates that the time is greater than or equal to 429_496_729_500 milliseconds. Measurement Units: 100 milliseconds.
844h	Dword	Saved Standby_z Timer setting This is the minimum time that the device shall wait after command completion before entering the Standby_z power condition of the PM1:Idle power management state. A value of zero indicates that this power condition is disabled. A value of FFFFFFFFh FFFF FFFFh indicates that the time is greater than or equal to 429_496_729_500 milliseconds. Measurement Units: 100 milliseconds
846h	Dword	Current Standby_z Timer setting This is the minimum time that the device shall wait after command completion before entering the Standby_z power condition of the PM1:Idle power management state. A value of zero indicates that this power condition is disabled. A value of FFFFFFFFh FFFF FFFFh indicates that the time is greater than or equal to 429_496_729_500 milliseconds. Measurement Units: 100 milliseconds
848h	Dword	Nominal Recovery time from Standby_z to PM0:Active This is the nominal time required to transition from Standby_z to PM0:Active. This time does not include processing time for the command that caused this transition to occur . A value of zero indicates that the nominal recovery time is not specified. A value of FFFFFFFFh FFFF FFFFh indicates that the recovery time is greater than or equal to 429_496_729_500 milliseconds. Measurement Units: 100 milliseconds This value shall be preserved over all resets

Word Offset	Data Type	Description
84Ah	Dword	<p>Minimum Standby_z timer setting</p> <p>This is the minimum timer value allowed by the Set Power Condition Timer subcommand for the Standby_z timer. A value of zero indicates that the minimum timer value is not specified. A value of FFFFFFFFhFFFF FFFFh indicates that the minimum timer value is greater than or equal to 429_496_729_500 milliseconds.</p> <p>Measurement Units: 100 milliseconds</p> <p>This value shall be preserved over all resets</p>
84Ch	Dword	<p>Maximum Standby_z timer setting</p> <p>This is the maximum timer value allowed by the Set Power Condition Timer subcommand for the Standby_z timer. A value of zero indicates that the maximum timer value is not specified. A value of FFFFFFFFhFFFF FFFFh indicates that the maximum timer value is greater than or equal to 429_496_729_500 milliseconds.</p> <p>Measurement Units: 100 milliseconds</p> <p>This value shall be preserved over all resets</p>
84Eh..9Fh	Dword	Reserved
A50h..FFh		Reserved

7.3 Changes to Annex B - Command Set Summary

7.3.1 Changes to the Command Matrix Table

None.

7.3.2 Changes to the Command Codes Table

None.

7.3.3 Changes to the Historical Command Assignments Table

None.

7.3.4 Changes to the Historical Set Feature Code Assignments Table

(suggested change to column labeling/formatting, plus adding EPC feature)

Feature Code	Description	ATA/ATAPI-							ATA8 - ACS	ACS - 2
		1	2	3	4	5	6	7		
TBDSF	Extended Power Conditions	R	R	R	R	R	R	R	R	C
Key:		A = Reserved for assignment by the CompactFlash? Association. F = If the device does not implement the CFA feature set, this command code is Vendor specific. M = Reserved for the Media Card Pass Through Command feature set. S = Reserved for Serial ATA. T = Reserved for Technical Report T13/DT1696 (Time-Limited Commands). C = a defined command. E = a retired command. O = Obsolete. R = Reserved, undefined in current specifications. V = Vendor specific commands.								