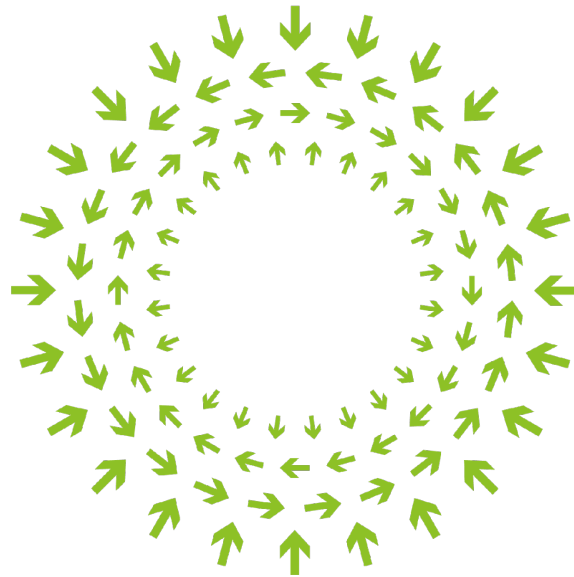




OPEN
Compute Project

Optics Reliability Workstream

Enhanced Telemetry Optics Product Software Specification

V1.0.0

Authors:

Credo: Chris Collins

Version History

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This document references and utilizes information from **OIF-CMIS-05.3** and future looking **OIF-CMIS-05.4** and as such is subject to OIF terms.

1 Compliance with OCP Tenets

A full explanation of the OCP core tenets can be seen [here](#).

1.1 Openness

By contributing the Enhanced Telemetry Optics Product Software Specification to the Open Compute Project, all members may enjoy the benefits of increased reliability and fewer link flaps in large scale AI networks.

1.2 Efficiency

The goal of contributing the Enhanced Telemetry Optics Software Specification is to drive commonality in various optical transceiver implementations. This will enable more efficient qualifications and faster optical deployment by directly reducing the OPEX required by eliminating the need to rewrite host software for each different transceiver. Furthermore, by increasing the reliability and uptime of large-scale GPU clusters, operational efficiencies are enhanced with fewer system restarts, faster LLM training and less manual system debug.

1.3 Impact

Optical transceivers are a critical component in deploying AI fabrics. By helping to enhance their reliability, system operators benefit from fewer network failures and improved operational performance. When bare-metal server access is provided to end users, network operators lose visibility into optical endpoints leaving them blind in the event of a link problem. With remote management capability, compliant optics provide visibility right to the transceiver in the bare metal server. As GPU clusters grow to hundreds of thousands, or even millions of bare-metal compute instances, providing visibility into server link quality across an entire fabric becomes a fundamental necessity.

1.4 Scale

Optical transceivers are being deployed at unprecedented rates in RDMA fabrics for AI. The shipment of 400G, 800G and 1.6T optical transceivers is expected to approach 50 million units per year in 2026. This software specification specifically targets these and future, higher rate, optical transceivers.

1.5 Sustainability

This contribution is specifically focused on making large-scale AI deployments more efficient by decreasing downtime due to optical networking issues. By making the Enhanced Telemetry Optics Software Specification open source, the goal is to ensure that the entire ecosystem of transceiver vendors and network switch vendors can meet the industry demand for equipment.

2 Introduction

2.1 Scope

The purpose of this document is to define a software stack that provides a common means of collecting and extracting specific telemetry information from optical transceivers deployed in AI fabrics. The requirements herein are applicable to 400G, 800G and 1.6T compliant transceivers and are intended to be independent of the module PMD. There are three (3) components to a compliant software system.

1. Transceiver firmware and telemetry metrics
2. Host software (typically residing on a switch)
3. Telemetry server software used to compile, summarize and report overall network health

The focus of this document is on the transceiver implementation and providing a common interface to the host. The Telemetry server software implementation is user dependent and NOT within the scope of this document.

This specification uses many of the transceiver functions defined in OIF-CMIS-05.x and adds specific definition and modifications above and beyond CMIS to achieve the stated goals.

2.2 Conventions

This section lists the standard conventions used in this specification. Normative language is mandatory.

- Shall = requirement
Requirements are mandatory, must be done.
Including the word “not” (as in shall not) specifies a mandatory prohibition, meaning the requirement explicitly forbids the action.
- Should = recommendation
Recommendations are optional yet indicate a preferred direction if implemented
Including the word “not” (as in should not) indicates a strong recommendation against performing an action
- May = allowable
Indicates flexibility of choice (option) with no implied preference.

3 Overview

Compliant transceivers integrate six key functions to facilitate enhanced link visibility and management.

1. Mission mode link monitoring and specific statistics collection on host and line facing receivers
2. A common link health reporting metric along with real time tracking and logging of link telemetry data
3. Transparent, mission mode, in-band communication for remote identification and data exchange between the transceivers at either end of a link.
4. Programmable event notification and non-volatile event logging in transceiver memory
5. Capability for hitless transceiver firmware update on both local and remote transceivers
6. Switch software to enable harvesting of transceiver telemetry, storage and preparation for streaming to a telemetry server

The combination of these six functions allows a network engineer to answer the following questions:

- Are my links up?
 - For links that are up:
 - Who is the link partner?
 - Are the transceivers at both ends reporting healthy links?
 - What is the overall health of the link?
 - Is service required?
 - If service is needed, which portions of the links are unhealthy?
 - If a link flaps, why did it flap?
 - Was it intentional?
 - What caused the flap?

A point-to-point optical link is generally made up of six (6) link segments. Compliant optical transceivers along with the host ports, enable independent monitoring of each link segment. In the event of an issue, this information allows for quick diagnosis of the degraded component and expedites resolution. In addition, in-band remote communication enables telemetry harvesting from each segment by the switch without requiring direct access to the transceiver at the server side of the link.

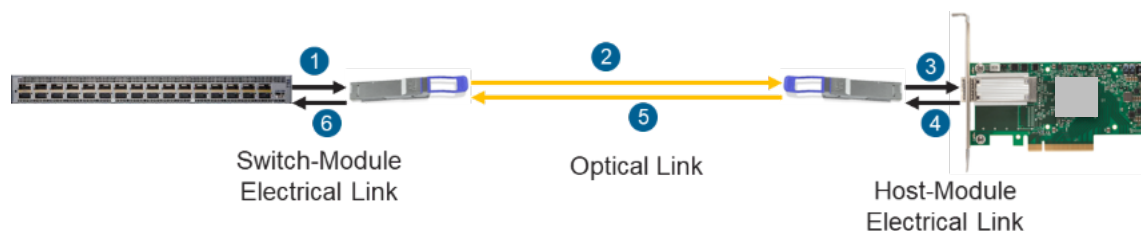


Figure 1: Network Link with two Optical Transceivers

In some instances, breakout links are used where a single switch port may connect to two or more host ports. In this case, each of the link segments will be monitored independently and the module in the switch shall harvest telemetry data from each of the remote link partners using independent messaging interfaces for each link partner.

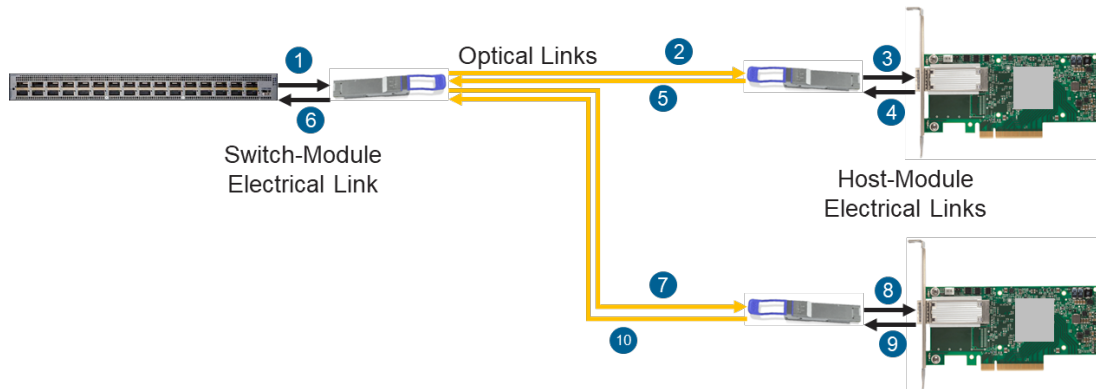


Figure 2: Breakout connection example with two hosts

4 High Level Transceiver Requirements

This section provides high level details on the transceiver requirements for compliant functionality.

The MCU inside the compliant transceiver shall provide an interface for the host to query transceiver status information for both the local transceiver and remote link partner(s) at the far end of the fiber.

4.1 Responding to external queries

The transceiver MCU shall respond to external requests generated locally via the module I2C interface or generated remotely via in-band messaging interface from the far end link partner.

4.2 Module Status and Telemetry Metrics

The following is a list of module status and telemetry metrics that shall be made available by the transceiver to the host system. The transceiver shall be able to gather the following information **locally or from any of its remote link partners** over the in-band messaging interface. NOTE: a transceiver may be connected to more than one link partner in the case of a breakout use case. (i.e. 800G to 2 x 400G).

- a) All module CMIS Bank 0 Pages 00h – 0Fh
- b) CMIS Configuration and Status Pages 0..N[10h-1Fh]
- c) CMIS VDM Pages 0..N[20h-2Fh]
- d) CMIS OIF Restricted Pages 0..N[30h-3Fh]
- e) CMIS OIF Restricted Pages 0[40h-4Fh]
- f) CMIS Reserved Pages 0[50h-9Eh]
- g) CMIS CDB Command Pages 0..1[9Fh]
- h) CMIS CDB Payload Pages 0..1[A0h-AFh]
- i) CMIS Custom Vendor Page 0 [B0h-FFh]

4.3 Module Telemetry Data

Many of the link parameters defined in this section are also defined in the OIF-CMIS-05.3 standard under the VDM section. The data collected for each of the measurements listed below shall be stored in the transceiver non-volatile memory (memory map provided in this document). The transceiver MCU shall update each of these parameters periodically, with a programmable rate between 1 second and 10 seconds.

- a) Signal to Noise (SNR) Measurement on the optical (line) link for each lane
- b) Signal to Noise (SNR) Measurement on the electrical (host) link for each lane
- c) Eye height measurement for each lane (host and line side)
- d) PAM4 level transition parameter (LTP) for each lane (host and line side)
- e) MPI estimation for each optical lane
- f) Pre-FEC BER measurement
- g) FEC Bin histogram (accumulated errors per FEC frame)
- h) Count of un-correctable codewords
- i) Count of relinks (link drop and reacquisition)
- j) Loss of Signal (LOS) and Loss of Link (LOL)
- k) Channel quality metric (built using a combination of the metrics above)
- l) "Uptime"- elapsed time since last new link up on the host and line interfaces
- m) Module temperature
- n) Laser temperature
- o) DDMI Alarm/Warning Flag

4.4 Event Monitor and Logging

Major events shall be logged in a non-volatile circular buffer inside of each transceiver so that they can be retrieved for historical debug even after the transceiver has been removed and re-inserted in a different host system. On power up, it is essential that the transceiver MCU does NOT overwrite data previously stored in the non-volatile circular buffer. This ensures the user can retrieve data from recent failure events even if the module is extracted and plugged in elsewhere.

Major events shall be logged with a corresponding timestamp. Major events include:

- Power-up (with no time stamp)
- Write Epoch time (from local or remote host)
- The events below shall be logged separately for host side and optical side of the transceiver with a time stamp.
- Link-up
 - Loss of Signal (LOS) indicating which receiver
 - Loss of Link (LOL) indicating which receiver

- MPI exceeds a programmable threshold includes the MPI value
 - The threshold should be programmable from local or remote side
 - This parameter only applies to the optical interface
- SNR falls below a programmable threshold and the actual SNR
 - The threshold should be programmable from local or remote side
- Pre-FEC BER exceeds a programmable threshold (with calculated BER)
 - This threshold has a default of 1e-8 and should be programmable from the local or remote side
- FEC histogram exceeds a programmable bin threshold (with maximum observed FEC bin)
 - This threshold has a default (bin 6) and should be programmable from the local or remote side
- Uncorrectable FEC codeword is reported (report the number of uncorrectable since last read)
- Module temperature exceeds a programmable threshold and the measured temperature
- Received optical power exceeds a programmable threshold and the measured Rx power in dBm
- Link-down
- Firmware image overwrite (A/B)
- Firmware image make active (A/B)
- Soft reboot request

As Link-up / down events and pre-FEC BER / histogram events can happen repeatedly, there is a risk of over-running the circular buffer with events and making debug less useful. Hysteresis shall be added to prevent duplicate events within a programmable time period (default 10 seconds).

The event monitor can be accessed locally from the I2C port, remotely via the in-band messaging and locally or remotely using the switch side SDK.

4.5 Other Mandatory Transceiver MCU Features

- a) The transceiver shall record Epoch time to the local transceiver at each power up so that events can be time-stamped with a baseline reference
- b) The module shall be capable of linkup with both another book-ended compliant transceiver (including in-band messaging) as well as 3rd party optics (without enhanced telemetry features).
- c) If the module links to another compliant transceiver, it shall propagate Epoch time to the far side transceiver(s) if they have not already had Epoch time locally written by their hosts
- d) Transceivers shall support hemispherical firmware update mode – with ability to upgrade the firmware in a hitless manner.
- e) The transceiver shall support remote firmware update for the far end transceiver over the in-band communication interface

5 Transceiver CDB Implementation

Each of the telemetry functions detailed in Section 4.3 are implemented in such a way as to ensure efficient telemetry harvesting by the host and over the in-band communication interface. Command Data Block (CDB) is an optional CMIS feature for command-reply message exchange between host and module. A transceiver compliant with this specification shall use the CDB feature exclusively for telemetry collection and transfer to the host system.

A typical CDB command sequence consists of four main steps:

1. Prepare the command message by filling in the required header fields and payload.
2. Trigger the command by writing the message to the appropriate location.
3. Poll the CDB status registers to monitor command execution progress.
4. Retrieve the reply message from the reply header and payload area once the command has completed.

5.1 CDB Control Page Structure (Upper page 0x9F)

Page 9Fh is used for CDB messaging between host and module. Reference CMIS 5.3 section 8.23 Banked Page 9Fh (CDB Message) for detailed information on the register field definitions. The following figures in the CMIS document are particularly relevant.

Table 8-177 – Page 9Fh Overview

Table 8.178 – CDB Command Message Header (Bytes 128 – 133) [host → module]

Table 8.179 – CDB Reply Message Header (Bytes 134 – 135) [module → host]

Table 8.180 – CDB Message Body (Bytes 136 – 255) – Local Payload (LPL up to 120 bytes)

Table 8.181 – CDB Extended Payload (EPL) - (page A0h ~ AFh, up to 2 kbytes)

5.2 Extended Payload (EPL) (banked pages A0h - AFh, up to 2Kbytes)

This area is used for large payloads (up to 2048 bytes) and is addressed in additional pages (A0h–AFh) when the LPL is insufficient.

- For larger payloads (up to 2048 bytes), additional pages (A0h–AFh) are required
- EPLLength specifies the number of bytes in EPL.

5.3 CDB Command Status Registers (Lower Memory Map Bytes 37–38)

These registers shall be updated by the module and shall be read by the host after each command to determine execution status and completion.

After triggering a CDB command, the user shall read and check Page 00h bytes 37 and 38 to determine the command's completion and status. While processing a CDB command, the module shall update the command execution status in CdbStatus 00h:38 or 00h:37 and signals completion in the CDB CMD Completion Flags 00h:8.7 or 00h:8.6.

Note:

- Byte 37: bank 0 CDB status
- Byte 38: bank 1 CDB status

6 Capability Advertisement, Flag Reporting and Counter Mask

This section defines the module's custom capability advertisement mechanism, custom flag summary reporting system for port monitoring, and custom counter mask configuration for the transceiver health score calculation

6.1 Telemetry Version Capability Advertisement

The transceiver supported Telemetry Version is advertised in the Telemetry Version register, which is located on Page 01h, Byte 191. All telemetry behaviors, command groups, and CMDID definitions described in this document correspond to **Telemetry Version 2.0**. As new capabilities are added, the Telemetry Version shall be incremented and documented in this table. Modules supporting new features shall advertise the appropriate telemetry version in this field.

Page	Byte	Field Description	Value
01h	191	Telemetry Version	2

Telemetry commands are organized into Telemetry Command Groups based on their functional classifications. Each Telemetry Command Group occupies a fixed CMDID range, as defined in the table below.

Telemetry Command Group	Description	CMDID Range
Group 0	Telemetry Information	8000h-800Fh
Group 1	Event Log Management	8010h-801Fh
Group 2	Remote CMIS Register Access	8020h-802Fh
Group 3	Remote Firmware Management	8030h-803Fh
Group 4	Diagnostic Features	8040h-804Fh
Group 5 to Group 11	Reserved	8050h-80BFh
Group 12 to Group 15	Custom	80C0h-80FFh

The transparent in-band messaging feature support and status are reported on Page 01h, Byte 192. Each bit reflects either the availability or the current operational status of the corresponding in-band communication function.

Page	Byte	Bit	Name	Field Description
01h	192	7-3	Reserved	Reserved
		2	In-Band Communication Lane Establishment Status	Indicates the in-band lane establishment status 0b: In-band lane not established 1b: In-band lane established
		1-0	In-Band Message Feature Support	Support for In-Band Message Feature 00b: Does not support in-band messaging 01b: Supports in-band messaging

Page	Byte	Bit	Name	Field Description
				10b: Supports in-band messaging with automatic in-band lane detection 11b: Reserved

Note: For Byte 192, Bits 1-0 (In-Band Message Feature Support), a module reporting 01b can establish a link only with a far end module that supports in-band messaging. A module reporting 10b can establish a link with any far end module, with or without in-band communication.

The telemetry capabilities supported by the module are located on Page 01h, Byte 193 which form a 16-bit big-endian register. The table below describes the functional support for each bit.

Page	Byte	Bit	Name	Field Description
01h	193	7	Reserved	Reserved
		6	Diagnostic Features (8040h-804Fh)	Support for diagnostic-related features 0b: Not supported 1b: Supported
		5	Remote Firmware Management (8030h-803Fh)	Support for remote firmware management commands 0: Not supported 1: Supported
		4	Remote CMIS Register Access (8020h-802Fh)	Support for remote CMIS register access 0: Not supported 1: Supported
		3-2	Event Log Management (8010h-801Fh)	Support event logging with time synchronization 00: Not supported 01: Supported for local module only 10: Supported for both local and remote modules 11: Reserved
		1-0	Telemetry Information (8000h-800Fh)	Supports telemetry-related features, such as real-time module health monitoring, rating scores, and link diagnostics 00: Not supported 01: Supported for local module only 10: Supported for both local and remote modules 11: Reserved

6.2 Telemetry Flag Summary Reporting

A custom flag in byte 13 shall be used as a summary of remote and local port flags. The transceiver shall set any corresponding bit if a flag is present on the indicated module and port. The recommended query procedure is to follow the standard module flag handling process. First, read the software interrupt (byte 3, bit 0); then, read byte 13 to determine which ports triggered the flag reporting; finally, parse bytes 162–164 of the corresponding reply message of telemetry data to identify which flags were set.

Page	Byte	Bit	Name	Field Description
00h	13	7-2	Reserved	
		1	Flag Summary of Remote Ports	1: at least one flag is set on any remote port
		0	Flag Summary of Local Ports	1: at least one flag is set on any local port

6.3 Custom Mask for Link Health Score Counters

The custom mask in byte 36 determines which counter types from the Link Health Score defined in Section 8.3 are excluded from rating score calculation. Mask bit value 1 indicates excluded, while value 0 indicates included. Byte 36 is set to 0xFF by default to exclude these two counters from scoring at module power up.

Page	Byte	Bit	Name	Field Description
0	36	7	-	Reserved
		6		
		5		
		4		
		3		
		2		
		1	FEC Counter Mask	Mask bit for FEC Counter This bit is set to 1 by default at module power up, excluding the FEC Counter from scoring.
		0	Link Down Counter Mask	Mask bit for Link Down Counter This bit is set to 1 by default at module power up, excluding the Link Down Counter from scoring.

7 Time Synchronization Control (CMD 0005h-0006h)

This section describes the module time control functionality introduced in CMIS version 5.4, which defines the CDB Get Module Time and Set Module Time commands for maintaining the local module time.

CMDID	Command Title	Field Description
0005h	Get Module Time	Get the time maintained by the module, expressed as ns passed since the POSIX epoch (01.01.1970 00:00:00 UTC)
0006h	Set Module Time	Set or adjust the current time maintained by the module e.g. for timestamping of diagnostics event log records

This specification extends the CMIS time control mechanism to support remote module time query and synchronization by reusing the same CMIS-defined CDB commands. Remote time control is enabled through the interpretation of specific command message fields to indicate remote operation, allowing the host to access and adjust the time of the remote module without introducing new CMIS command definitions.

7.1 Get Module Time (CMD: 0005h)

The Get Module Time command, as defined in CMIS version 5.4, is primarily intended to allow the host to monitor the time maintained by the module. The remote get module time operation defined in this specification is based on the same command.

To enable access to the time maintained by a remote module, this specification extends the interpretation of the command data by utilizing undefined field (Byte 136 and 137) to indicate the target remote port.

7.1.1 Command Message Header

To retrieve the module time from a remote module using the 0x0005 Get Module Time command, the host shall populate the command message with the appropriate Remote Port information as defined below

Get Module Time Message			
Page	Byte	Attribute	Description
9Fh	128	CMDID	0x0005
	129		
	130	EPL length	N/A
	131		
	132	LPL length	VAR
	133	Cdb chk code	VAR
	134	RPL length	N/A
	135	RPL chk code	N/A

Get Module Time Message			
Page	Byte	Attribute	Description
	136	Target	Selection for local or remote module 00h: Retrieve the local module time 01h: Retrieve the remote module time
	137	Remote Port	Select the target remote port. For example, in a 2x400G cable configuration, port 0 refers to the first 400G port, and port 1 refers to the second 400G port. The number of available ports is determined by the AppSel configuration. This field is only valid when Byte 136(Target) is set to 1

7.1.2 Reply Message Header

The reply message of this command is defined the same as the CMIS v5.4

Get Module Time Reply Message			
Page	Byte	Attribute	Description
9Fh	134	RPL length	VAR
	135	RPL chk code	VAR
	136-143	Module Time	S64: New Module Time in ns Module Time represents the nanoseconds that have passed since the POSIX epoch 01.01.1970 00:00:00 (time anchor).

7.1.3 Command Status (Page 0, byte 8 and bytes 37 – 38)

These registers are updated by the module and shall be read by the host after each command to determine execution status and completion

CDB Command Status				
Page	Byte	Bit	Attribute	Description
0h	8	6	CdbCmdCompleteFlag1	Latched Flag to indicate completion of a CDB command for CDB instance 1
		7	CdbCmdCompleteFlag2	Latched Flag to indicate completion of a CDB command for CDB instance 2
	37	7 - 0	CdbStatus1	Status of the most recent CDB command in CDB instance 1
	38	7 - 0	CdbStatus2	Status of the most recent CDB command in CDB instance 2

CdbStatus														
Bit	Attribute	Description												
5 – 0	CdbCommandResult	The CdbCommandResult field provides more detailed classification for each of the three coarse query results that are encoded by the pair of bit 7 (CdbIsBusy) and bit 6 (CdbHasFailed)												
		<table><tr><td>Coarse Status</td><td>CdbIsBusy</td><td>CdbHasFailed</td></tr><tr><td>IN PROGRESS</td><td>1</td><td>X (don't care)</td></tr><tr><td>SUCCESS</td><td>0</td><td>0</td></tr><tr><td>FAILED</td><td>0</td><td>1</td></tr></table>	Coarse Status	CdbIsBusy	CdbHasFailed	IN PROGRESS	1	X (don't care)	SUCCESS	0	0	FAILED	0	1
		Coarse Status	CdbIsBusy	CdbHasFailed										
		IN PROGRESS	1	X (don't care)										
		SUCCESS	0	0										
		FAILED	0	1										
		The interpretation of CdbCommandResult therefore depends on the coarse status as follows:												
		IN PROGRESS												
		00h=Reserved												
		01h=Command is captured but not processed												
02h=Command checking is in progress														
03h=Command execution is in progress														
04h-2Fh=Reserved														
30h-3Fh=Custom														
SUCCESS														
00h=Reserved														
01h=Command completed successfully														
02h=Reserved														
03h=Previous CMD was ABORTED by CMD Abort														
04h-1Fh=Reserved														
20h-2Fh=Reserved														
30h-3Fh=Custom														
FAILED														
00h=Reserved														
01h=CMDID unknown														
02h=Parameter range error or parameter not supported														
03h=Previous CMD was not properly ABORTED (by CMD Abort)														
04h=Command checking time out														
05h=CdbChkCode Error														
06h=Password related error (command specific meaning)														
07h=Command not compatible with operating status														
08h-0Fh=Reserved for STS command checking error														
10h-1Fh=Reserved														
20h-2Fh=For individual STS command or task error														
30h-3Fh=Custom														
6	CdbHasFailed	Bool: CdbHasFailed bit indicates if there was a failure, after the module has completed execution of the last CDB command 0b: Last triggered CDB command completed successfully 1b: Last triggered CDB command failed												

CdbStatus		
Bit	Attribute	Description
7	CdbIsBusy	Bool: CdbIsBusy status bit indicates whether the module is still busy, or idle and ready to accept a new CDB command 0b: Module idle, host can write 1b: Module busy, host needs to wait

7.2 Set Module Time (CMD: 0006h)

The Set Module Time command, as defined in CMIS version 5.4, is intended to allow the host to set or adjust the internal time maintained by the module.

The Remote Set Module Time operation defined in this specification is based on the same CMIS v5.4 Set Module Time command. To enable time synchronization on remote modules, this specification extends the interpretation of the command data by utilizing undefined fields (Byte 145 and Byte 146) to indicate the target module.

7.2.1 Command Message Header

To set the module time on a remote module using the 0x0006 Set Module Time command, the host shall populate the command message with the appropriate Remote Port information as defined below.

Set Module Time Message			
Page	Byte	Attribute	Description
9Fh	128	CMDID	0x0006
	129		
	130	EPL length	N/A
	131		
	132	LPL length	VAR
	133	Cdb chk code	VAR
	134	RPL length	N/A
	135	RPL chk code	N/A
	136-143	TimeSpec	S64: Time in ns to set or adjust ModuleTime IsIncrement 0: ModuleTime = TimeSpec IsIncrement 1: ModuleTime = ModuleTime + TimeSpec
	144	IsIncrement	0: TimeSpec is the new Module Time 1: TimeSpec is added to current Module Time
	145	Target	Selection for local or remote module 0x00: Set the module time on the local module 0x01: Set the module time to all local and remote ports

7.2.2 Reply Message Header

The reply message of this command is defined the same as the CMIS v5.4

Set Module Time Reply Message			
Page	Byte	Attribute	Description
9Fh	134	RPL length	VAR
	135	RPL chk code	VAR
	136-143	Module Time	S64: New Module Time in ns Module Time represents the nanoseconds that have passed since the POSIX epoch 01.01.1970 00:00:00 (time anchor).

7.2.3 Command Status (Page 0, byte 8 and bytes 37 – 38)

These registers are updated by the module and shall be read by the host after each command to determine execution status and completion

CDB Command Status				
Page	Byte	Bit	Attribute	Description
0h	8	6	CdbCmdCompleteFlag1	Latched Flag to indicate completion of a CDB command for CDB instance 1
		7	CdbCmdCompleteFlag2	Latched Flag to indicate completion of a CDB command for CDB instance 2
	37	7 - 0	CdbStatus1	Status of the most recent CDB command in CDB instance 1
	38	7 - 0	CdbStatus2	Status of the most recent CDB command in CDB instance 2

CdbStatus				
Bit	Attribute	Description		
5 – 0	CdbCommandResult	The CdbCommandResult field provides more detailed classification for each of the three coarse query results that are encoded by the pair of bit 7 (CdbIsBusy) and bit 6 (CdbHasFailed)		
		Coarse Status	CdbIsBusy	CdbHasFailed
		IN PROGRESS	1	X (don't care)
		SUCCESS	0	0
		FAILED	0	1
		The interpretation of CdbCommandResult therefore depends on the coarse status as follows: IN PROGRESS		

CdbStatus		
Bit	Attribute	Description
		00h=Reserved 01h=Command is captured but not processed 02h=Command checking is in progress 03h=Command execution is in progress 04h-2Fh=Reserved 30h-3Fh=Custom SUCCESS 00h=Reserved 01h=Command completed successfully 02h=Reserved 03h=Previous CMD was ABORTED by CMD Abort 04h-1Fh=Reserved 20h-2Fh=Reserved 30h-3Fh=Custom FAILED 00h=Reserved 01h=CMDID unknown 02h=Parameter range error or parameter not supported 03h=Previous CMD was not properly ABORTED (by CMD Abort) 04h=Command checking time out 05h=CdbChkCode Error 06h=Password related error (command specific meaning) 07h=Command not compatible with operating status 08h-0Fh=Reserved for STS command checking error 10h-1Fh=Reserved 20h-2Fh=For individual STS command or task error 30h-3Fh=Custom
6	CdbHasFailed	Bool: CdbHasFailed bit indicates if there was a failure, after the module has completed execution of the last CDB command 0b: Last triggered CDB command completed successfully 1b: Last triggered CDB command failed
7	CdbIsBusy	Bool: CdbIsBusy status bit indicates whether the module is still busy, or idle and ready to accept a new CDB command 0b: Module idle, host can write 1b: Module busy, host needs to wait

8 Transceiver Telemetry Information & Metrics

A transceiver aggregates all key link health information in a single CDB telemetry info command page for efficient data transfer. This includes:

- Port health rating score
- Module serial number
- Link down counter and link up time
- Module level and optics flags
- Signal-to-noise ratio (SNR) and PAM Level Transition Parameter (LTP)
- Eye height statistics (lower, middle, upper) in mV
- Module temperature, voltage and optical receiver power
- Pre-FEC BER and Forward Error Correction (FEC) bin counts

8.1 Query Telemetry Capability Advertisement (CMD: 8000h)

The Telemetry Capability Advertisement command (CMD: 8000h) is used by the host to query the telemetry-related capabilities supported by the module.

This command provides a unified mechanism for capability discovery, allowing the host to determine supported telemetry command sets, functional features, and other module-level telemetry capabilities before issuing telemetry operations.

The specific advertisement data returned by the module is selected based on the command argument configuration.

8.1.1 Command Message Header

To trigger the 0x8000 Telemetry Capability Advertisement command, the host shall populate the command message as follows:

- Fill the command argument to config the capability type
- Set LPL length and CDB check code
- Set CMDID to 0x8000 to initiate the Telemetry Capability Advertisement command

CDB Telemetry Capability Advertisement Message			
Page	Byte	Attribute	Description
9Fh	128	CMDID	0x8000
	129		
	130	EPL length	N/A
	131		

CDB Telemetry Capability Advertisement Message			
Page	Byte	Attribute	Description
	132	LPL length	VAR
	133	Cdb chk code	VAR
	134	RPL length	N/A
	135	RPL chk code	N/A
	136	Capability Type	Selects the capability information to be queried. 00h: Telemetry Command Group Support List. See Section 6.1 for a list of Command Groups. 01h: Telemetry Metrics List 02h: Remote (link partner) Telemetry Metrics List
	137	Port	Select the target port. For example, in a 2x200G cable configuration, port 0 refers to the first 200G port, and port 1 refers to the second 200G port. The number of available ports is determined by the AppSel configuration. Note: This field is only valid when the Capability Type is set to 02h

8.1.2 Reply Message Header

The reply message of the Telemetry Capability Advertisement command returns advertisement data corresponding to the capability type.

Telemetry Command Group Support List:

When the Capability Type Telemetry Command Support List is assigned (Byte 136 = 0), the reply message returns a bitmap-based representation of supported telemetry commands groups defined in Section 6.1.

Each Telemetry Command Group is associated with a U16 bitmap. Within each bitmap, each bit indicates whether the corresponding CMDID in the associated CMDID range is supported by the module.

Telemetry Command Support List Reply Message			
Page	Byte	Attribute	Description
9Fh	134	RPL length	VAR
	135	RPL chk code	VAR
	136-137	Telemetry Command Group 0 Bitmap	U16 bitmap indicating supported commands in CMDID range 8000h–800Fh (Group 0)
	138-139	Telemetry Command Group 1 Bitmap	U16 bitmap indicating supported commands in CMDID range 8010h–801Fh (Group 1)

Telemetry Command Support List Reply Message			
Page	Byte	Attribute	Description
	...	...	...
	164-165	Telemetry Command Group 14 Bitmap	U16 bitmap indicating supported commands in CMDID range 80E0h–80EFh (Group 14)
	166-167	Telemetry Command Group 15 Bitmap	U16 bitmap indicating supported commands in CMDID range 80F0h–80FFh (Group 15)

Telemetry Metrics Support List:

When the Capability Type Telemetry Category Support List is assigned (Byte 136 = 1), the reply message returns information indicating which specific metrics are supported.

Telemetry Category Support List Reply Message			
Page	Byte	Attribute	Description
9Fh	134	RPL length	VAR
	135	RPL chk code	VAR
	136	Telemetry Category 1	bit7: Module Temperature bit6: Eye (Media Side) bit5: Eye (Host Side) bit4: LTP bit3: SNR bit2: Flags bit1: Link up time bit0: Link down counter
	137	Telemetry Category 2	bit5-7: reserved bit4: FEC info bit3: Laser Temperature bit2: MPI bit1: Optical power info bit0: Module Voltage

8.1.3 Command Status (Page 0, byte 8 and bytes 37 – 38)

These registers are updated by the module and shall be read by the host after each command to determine execution status and completion

CDB Command Status				
Page	Byte	Bit	Attribute	Description
0h	8	6	CdbCmdCompleteFlag1	Latched Flag to indicate completion of a CDB command for CDB instance 1

CDB Command Status				
Page	Byte	Bit	Attribute	Description
		7	CdbCmdCompleteFlag2	Latched Flag to indicate completion of a CDB command for CDB instance 2
	37	7 - 0	CdbStatus1	Status of the most recent CDB command in CDB instance 1
	38	7 - 0	CdbStatus2	Status of the most recent CDB command in CDB instance 2

CdbStatus			
Bit	Attribute	Description	
5 – 0	CdbCommandResult	The CdbCommandResult field provides more detailed classification for each of the three coarse query results that are encoded by the pair of bit 7 (CdbIsBusy) and bit 6 (CdbHasFailed)	
		Coarse Status	CdbIsBusy CdbHasFailed
		IN PROGRESS	1 X (don't care)
		SUCCESS	0 0
		FAILED	0 1
		The interpretation of CdbCommandResult therefore depends on the coarse status as follows:	
		IN PROGRESS	
		00h=Reserved	
		01h=Command is captured but not processed	
		02h=Command checking is in progress	
		03h=Command execution is in progress	
		04h-2Fh=Reserved	
		30h-3Fh=Custom	
		SUCCESS	
		00h=Reserved	
		01h=Command completed successfully	
		02h=Reserved	
		03h=Previous CMD was ABORTED by CMD Abort	
		04h-1Fh=Reserved	
		20h-2Fh=Reserved	
		30h-3Fh=Custom	
		FAILED	
		00h=Reserved	
		01h=CMDID unknown	
		02h=Parameter range error or parameter not supported	
		03h=Previous CMD was not properly ABORTED (by CMD Abort)	
		04h=Command checking time out	
		05h=CdbChkCode Error	
		06h=Password related error (command specific meaning)	

		07h=Command not compatible with operating status 08h-0Fh=Reserved for STS command checking error 10h-1Fh=Reserved 20h-2Fh=For individual STS command or task error 30h-3Fh=Custom
6	CdbHasFailed	Bool: CdbHasFailed bit indicates if there was a failure, after the module has completed execution of the last CDB command 0b: Last triggered CDB command completed successfully 1b: Last triggered CDB command failed
7	CdbIsBusy	Bool: CdbIsBusy status bit indicates whether the module is still busy, or idle and ready to accept a new CDB command 0b: Module idle, host can write 1b: Module busy, host needs to wait

8.2 Query Telemetry Data (CMD: 8001h)

The telemetry info command is used to request and retrieve detailed telemetry and diagnostic information from the module. This command allows the host to access a wide range of real-time status and performance metrics for monitoring and troubleshooting purposes. Note this command is a custom CDB command ID that shall be supported by transceivers complying with this specification.

8.2.1 Command Message Header

To trigger the 0x8001 telemetry command, the host shall write the CDB command message as follows:

- Fill the command argument to config the target, side and port
- Set LPL length and CDB check code
- Set CMDID to 0x8001 to initiate the telemetry command.
- Attributes are in **big-endian** format

CDB Telemetry Command Message			
Page	Byte	Attribute	Description
9Fh	128	CMDID	0x8001
	129		
	130	EPL length	N/A
	131		
	132	LPL length	VAR
	133	Cdb chk code	VAR
	134	RPL length	N/A
	135	RPL chk code	N/A

CDB Telemetry Command Message			
Page	Byte	Attribute	Description
	136	Target	selection for local or remote end 0: local end 1: remote end
	137	Side	Interface Selection 0: host side 1: media side
	138	Port	Select the target port. For example, in a 2x200G cable configuration, port 0 refers to the first 200G port, and port 1 refers to the second 200G port. The number of available ports is determined by the AppSel configuration.

8.2.2 Reply Message Header

Once the telemetry command has been successfully processed by the module, the user application can retrieve the information listed below.

CDB Query Telemetry Info Reply Message			
Page	Byte	Attribute	Description
9Fh	134	RPL length	VAR
	135	RPL chk code	VAR
	136	Module Status	bit 0: link status 1 = Target is online and accessible. 0 = Target is offline and not accessible. bit 1 - 7: Reserved
	137	Lowest Rating Category Mask (MSB)	16-bit bitmask (MSB). If a bit is set, that category is one of the worst contributors. Multiple bits may be set if multiple categories share the lowest rating score bit7- 0: Reserved
	138	Lowest Rating Category Mask (LSB)	16-bit bitmask (LSB). If a bit is set, that category is one of the worst contributors. Multiple bits may be set if multiple categories share the lowest rating score. bit7: Reserved bit6: All flags bit5: Eye Height bit4: SNR bit3: MPI bit2: Pre-FEC BER bit1: FEC Bin Counter bit0: Link Down Counter

CDB Query Telemetry Info Reply Message			
Page	Byte	Attribute	Description
	139	Rating Score	Overall rating score for the port health status, serving as a quick reference indicator. - Critical Problem Score <= 40 - Satisfactory Score = 41 - 79 - Excellent Score >= 80
	140	Serial Number	Module serial number
	141		
	142		
	143		
	144		
	145		
	146		
	147		
	148		
	149		
	150		
	151		
	152		
	153		
	154		
	155		
	156	Link Down Counter	Serdes link down counter (This value indicates a Layer 1 PHY down condition, such as the absence of received optical signal)
	157		
	158	Link Up Time	Number of seconds that have elapsed since last link up
	159		
	160		
	161		
	162	Module Flag	These registers capture and latch warning and alarm events for module voltage, temperature. Reading the register will clear all bits, resetting the status until a new event occurs. bit7: Vcc monitor low warning flag bit6: Vcc monitor high warning flag bit5: Vcc monitor low alarm flag bit4: Vcc monitor high alarm flag bit3: Temp monitor low warning flag bit2: Temp monitor high warning flag bit1: Temp monitor low alarm flag bit0: Temp monitor high alarm flag

CDB Query Telemetry Info Reply Message			
Page	Byte	Attribute	Description
	163	Optical Power Flag	These registers capture and latch warning and alarm events for optical power. Reading the register will clear all bits, resetting the status until a new event occurs. bit7: Optical Rx power low warning flag bit6: Optical Rx power high warning flag bit5: Optical Rx power low alarm flag bit4: Optical Rx power high alarm flag bit3: Optical Tx power low warning flag bit2: Optical Tx power high warning flag bit1: Optical Tx power low alarm flag bit0: Optical Tx power high alarm flag
	164	Optical Laser Bias Flag	These registers capture and latch warning and alarm events for laser bias. Reading the register will clear all bits, resetting the status until a new event occurs. bit3: Optical Tx laser bias low warning flag bit2: Optical Tx laser bias high warning flag bit1: Optical Tx laser bias low alarm flag bit0: Optical Tx laser bias high alarm flag
	165	Reserved	Reserved
	166	SNR	The worst lane's SNR value in units of 1/256 dB
	167		
	168	LTP	The worst lane's LTP value in units of 1/256 dB.
	169		
	170	Eye Height (Lower)	Eye height (in mV) of worst lane
	171		
	172	Eye Height (Middle)	
	173		
	174	Eye Height (Upper)	
	175		
	176	Module Temperature	Module temperature monitor in 1/256 degree Celsius
	177		
	178	Module Voltage	Supply voltage monitors in 100 μV
	179		
	180	Optical Rx Power (Min of all channels)	Optical Rx power in 0.1 μW increments, yielding a total measurement range of 0 to 6.5535 mW (~-40 to +8.2 dBm for non-zero values)
	181		
	182	Optical Rx Power (Max of all channels)	
	183		
	184	Optical Tx Power (Min of all channels)	Optical Tx power in 0.1 μW increments, yielding a total measurement range of 0 to 6.5535 mW (~-40 to +8.2 dBm for non-zero values)
	185		
	186		

CDB Query Telemetry Info Reply Message			
Page	Byte	Attribute	Description
	187	Optical Tx Power (Max of all channels)	
	188	MPI Indicator	Module provides an MPI (multipath interference) measurement. A value of 0 indicates that the computation is ongoing.
	189		
	190	Laser Temperature	Laser Temperature monitor in 1/256 degree Celsius
	191		
	192-197	Reserved	Reserved
	198	Pre-FEC BER	Bit7-3: Scaled Exponent (s)
	199		Bit2-0: Mantissa (m), most significant bits 10-8
	200	Post-FEC Errors	Mantissa (m), least significant bits 7-0
	201		Number of uncorrected errors detected at the receiver.
	202		
	203		
	204		
	205	FEC bin 0	Number of FEC frames with zero post-FEC errors
	206		
	207		
	208		
	209		
	210	FEC bin 1	Number of FEC frames with 1 symbol error
	211		
	212		
	213		
	214	FEC bin 2	Number of FEC frames with 2 symbol errors
	215		
	216		
	217		
	218	FEC bin 3	Number of FEC frames with 3 symbol errors
	219		
	220		
	221		
	222	FEC bin 4	Number of FEC frames with 4 symbol errors
	223		
	224		
	225		
	226		

CDB Query Telemetry Info Reply Message			
Page	Byte	Attribute	Description
	227		
	228	FEC bin 5	Number of FEC frames with 5 symbol errors
	229		
	230		
	231		
	232	FEC bin 6	Number of FEC frames with 6 symbol errors
	233		
	234		
	235		
	236	FEC bin 7	Number of FEC frames with 7 symbol errors
	237		
	238		
	239		
	240	FEC bin 8	Number of FEC frames with 8 symbol errors
	241		
	242	FEC bin 9	Number of FEC frames with 9 symbol errors
	243		
	244	FEC bin 10	Number of FEC frames with 10 symbol errors
	245		
	246	FEC bin 11	Number of FEC frames with 11 symbol errors
	247		
	248	FEC bin 12	Number of FEC frames with 12 symbol errors
	249		
	250	FEC bin 13	Number of FEC frames with 13 symbol errors
	251		
	252	FEC bin 14	Number of FEC frames with 14 symbol errors
	253		
	254	FEC bin 15	Number of FEC frames with 15 symbol errors
	255		

8.2.3 CDB Command Status (Page 0, byte 8 and bytes 37 – 38)

These registers are updated by the module and shall be read by the host after each command to determine execution status and completion

CDB Command Status				
Page	Byte	Bit	Attribute	Description
0h	8	6	CdbCmdCompleteFlag1	Latched Flag to indicate completion of a CDB command for CDB instance 1

	7	CdbCmdCompleteFlag2	Latched Flag to indicate completion of a CDB command for CDB instance 2
37	7 - 0	CdbStatus1	Status of the most recent CDB command in CDB instance 1
38	7 - 0	CdbStatus2	Status of the most recent CDB command in CDB instance 2

CdbStatus														
Bit	Attribute	Description												
5 – 0	CdbCommandResult	The CdbCommandResult field provides more detailed classification for each of the three coarse query results that are encoded by the pair of bit 7 (CdbIsBusy) and bit 6 (CdbHasFailed)												
		<table><tr><td>Coarse Status</td><td>CdbIsBusy</td><td>CdbHasFailed</td></tr><tr><td>IN PROGRESS</td><td>1</td><td>X (don't care)</td></tr><tr><td>SUCCESS</td><td>0</td><td>0</td></tr><tr><td>FAILED</td><td>0</td><td>1</td></tr></table>	Coarse Status	CdbIsBusy	CdbHasFailed	IN PROGRESS	1	X (don't care)	SUCCESS	0	0	FAILED	0	1
		Coarse Status	CdbIsBusy	CdbHasFailed										
		IN PROGRESS	1	X (don't care)										
		SUCCESS	0	0										
		FAILED	0	1										
		The interpretation of CdbCommandResult therefore depends on the coarse status as follows:												
		IN PROGRESS 00h=Reserved 01h=Command is captured but not processed 02h=Command checking is in progress 03h=Command execution is in progress 04h-2Fh=Reserved 30h-3Fh=Custom												
		SUCCESS 00h=Reserved 01h=Command completed successfully 02h=Reserved 03h=Previous CMD was ABORTED by CMD Abort 04h-1Fh=Reserved 20h-2Fh=Reserved 30h-3Fh=Custom												
		FAILED 00h=Reserved 01h=CMDID unknown 02h=Parameter range error or parameter not supported 03h=Previous CMD was not properly ABORTED (by CMD Abort) 04h=Command checking time out												

CdbStatus		
Bit	Attribute	Description
		05h=CdbChkCode Error 06h=Password related error (command specific meaning) 07h=Command not compatible with operating status 08h-0Fh=Reserved for STS command checking error 10h-1Fh=Reserved 20h-2Fh=For individual STS command or task error 30h-3Fh=Custom
6	CdbHasFailed	Bool: CdbHasFailed bit indicates if there was a failure, after the module has completed execution of the last CDB command 0b: Last triggered CDB command completed successfully 1b: Last triggered CDB command failed
7	CdbIsBusy	Bool: CdbIsBusy status bit indicates whether the module is still busy, or idle and ready to accept a new CDB command 0b: Module idle, host can write 1b: Module busy, host needs to wait

8.3 Rating Score Formula (Link Health Score)

The rating score provides a quantitative assessment of port health based on key optical and electrical parameters. It is evaluated against defined thresholds. The condition of each category is assessed first, then the minimum score from all categories is selected as the final score. Averaging of the fields is not used as a single bad field (such as a high pre-FEC BER) could be accidentally masked if it were averaged with many other acceptable categories. The host and media sides utilize different scoring metrics based on their specific configurations and supported feature sets.

Host Side Metrics for Link Health Score			
Category	Field Name	Condition	Score
1	Link Down Counter*	0	80
		>=1	40
2	FEC Histogram Bin*	FEC bin < 4	80
		FEC bin 4 ~ 7	60
		FEC bin > 7	40
3	Pre-FEC BER	< 1e-8	80
		1e-5 ~ 1e-8	60
		> 1e-5	40

Host Side Metrics for Link Health Score						
Category	Field Name	Condition				Score
4	SNR	> 18 dB				80
		14.5 ~ 18 dB				60
		< 14.5 dB				40
5	Eye Height	100G/lane	> 30 mV	50G/lane	> 55 mV	80
			15 ~ 30 mV		25 ~ 55 mV	60
			< 15 mV		< 25 mV	40
6	Module flag	no flag				80
		warning flags				60
		alarm flags				40

* Fields that are excluded by default from the Link Health Score (see Section 6.3)

Media Side Metrics for Link Health Score			
Category	Field Name	Condition	Score
1	Link Down Counter*	0	80
		>=1	40
2	FEC Histogram Bin*	FEC bin < 4	80
		FEC bin 4 ~ 7	60
		FEC bin > 7	40
3	Pre-FEC BER	< 1e-8	80
		1e-5 ~ 1e-8	60
		> 1e-5	40
4	MPI	< -35 dB	80
		-30 ~ -35 dB	60
		> -30 dB	40
5	SNR	> 18 dB	80
		14.5 ~ 18 dB	60
		< 14.5 dB	40

6	Eye Height	100G/lane	> 30 mV	50G/lane	> 55 mV	80
			15 ~ 30 mV		25 ~ 55 mV	60
			< 15 mV		< 25 mV	40
7	Module flag	no flag				80
		warning flags				60
		alarm flags				40
8	Optical Power Flag	no flag				80
		warning flags				60
		alarm flags				40
9	Optical Laser Bias Flag	no flag				80
		warning flags				60
		alarm flags				40

* Fields that are excluded by default from the Link Health Score (see Section 6.3)

8.4 CDB Reset Telemetry Counter (CMD: 8002h)

The Reset Telemetry Counter command is used to reset the accumulated Forward Error Correction (FEC) bin counters and the module link-down counter within the telemetry data.

8.4.1 Command Message Header

To trigger the 0x8002 Reset Telemetry Counter command, the host shall fill in the command message as follows:

- Fill the command argument to config the target, side and port
- Set LPL length and CDB check code
- Set CMDID to 0x8002 to initiate the Reset Telemetry Counter command

CDB Reset FEC Bin Counter Message			
Page	Byte	Attribute	Description
9Fh	128	CMDID	0x8002
	129		
	130	EPL length	N/A
	131		
	132	LPL length	VAR
	133	Cdb chk code	VAR
	134	RPL length	N/A

CDB Reset FEC Bin Counter Message			
Page	Byte	Attribute	Description
	135	RPL chk code	N/A
	136	Target	selection for local or remote end 0: local end 1: remote end
	137	Side	selection for cable side 0: host side 1: media side
	138	Port	port number, e.g. for a 2x200G 0: 1st 200G 1: 2nd 200G The number of available ports is determined by the AppSel configuration.

8.4.2 Reply Message Header

CDB Reset FEC Bin Counter Command (Reply)	
Reply	Description
RPL length	VAR
RPL chk code	VAR

8.4.3 CDB Command Status (Page 0, byte 8 and bytes 37 – 38)

These registers are updated by the module and shall be read by the host after each command to determine execution status and completion.

CDB Command Status				
Page	Byte	Bit	Attribute	Description
0h	8	6	CdbCmdCompleteFlag1	Latched Flag to indicate completion of a CDB command for CDB instance 1
		7	CdbCmdCompleteFlag2	Latched Flag to indicate completion of a CDB command for CDB instance 2
	37	7 - 0	CdbStatus1	Status of the most recent CDB command in CDB instance 1

	38	7 - 0	CdbStatus2	Status of the most recent CDB command in CDB instance 2
--	----	-------	------------	---

CdbStatus														
Bit	Attribute	Description												
5 – 0	CdbCommandResult	The CdbCommandResult field provides more detailed classification for each of the three coarse query results that are encoded by the pair of bit 7 (CdbIsBusy) and bit 6 (CdbHasFailed)												
		<table><tr><td>Coarse Status</td><td>CdbIsBusy</td><td>CdbHasFailed</td></tr><tr><td>IN PROGRESS</td><td>1</td><td>X (don't care)</td></tr><tr><td>SUCCESS</td><td>0</td><td>0</td></tr><tr><td>FAILED</td><td>0</td><td>1</td></tr></table>	Coarse Status	CdbIsBusy	CdbHasFailed	IN PROGRESS	1	X (don't care)	SUCCESS	0	0	FAILED	0	1
		Coarse Status	CdbIsBusy	CdbHasFailed										
		IN PROGRESS	1	X (don't care)										
		SUCCESS	0	0										
		FAILED	0	1										
		The interpretation of CdbCommandResult therefore depends on the coarse status as follows:												
		IN PROGRESS 00h=Reserved 01h=Command is captured but not processed 02h=Command checking is in progress 03h=Command execution is in progress 04h-2Fh=Reserved 30h-3Fh=Custom												
		SUCCESS 00h=Reserved 01h=Command completed successfully 02h=Reserved 03h=Previous CMD was ABORTED by CMD Abort 04h-1Fh=Reserved 20h-2Fh=Reserved 30h-3Fh=Custom												
		FAILED 00h=Reserved 01h=CMDID unknown 02h=Parameter range error or parameter not supported 03h=Previous CMD was not properly ABORTED (by CMD Abort) 04h=Command checking time out 05h=CdbChkCode Error												

CdbStatus		
Bit	Attribute	Description
		06h=Password related error (command specific meaning) 07h=Command not compatible with operating status 08h-0Fh=Reserved for STS command checking error 10h-1Fh=Reserved 20h-2Fh=For individual STS command or task error 30h-3Fh=Custom
6	CdbHasFailed	Bool: CdbHasFailed bit indicates if there was a failure, after the module has completed execution of the last CDB command 0b: Last triggered CDB command completed successfully 1b: Last triggered CDB command failed
7	CdbIsBusy	Bool: CdbIsBusy status bit indicates whether the module is still busy, or idle and ready to accept a new CDB command 0b: Module idle, host can write 1b: Module busy, host needs to wait

8.5 CDB Telemetry Counter Mask Control (CMD: 8003h)

The Telemetry Counter Mask Control command is used to control which counter types from section 8.3 are excluded or included from rating score calculation.

8.5.1 Command Message Header

To trigger the 0x8003 Telemetry Counter Mask Control command, the host shall fill in the command message as follows:

- Fill the command argument to config the target, port, and counter mask value
- Set LPL length and CDB check code
- Set CMDID on 0x8003 to initiate the Reset Telemetry Counter Mask command.

CDB Reset Telemetry Counter Mask Message			
Page	Byte	Attribute	Description
9Fh	128	CMDID	0x8003
	129		
	130	EPL length	N/A
	131		
	132	LPL length	VAR
	133	Cdb chk code	VAR
	134	RPL length	N/A

CDB Reset Telemetry Counter Mask Message			
Page	Byte	Attribute	Description
	135	RPL chk code	N/A
	136	Target	Selection for local or remote end 0: local end 1: remote end
	137	Reserved	reserved
	138	Port	port number, e.g. for a 2x200G 0: 1st 200G 1: 2nd 200G The number of available ports is determined by the AppSel configuration.
	139	Counter Mask Value	Counter mask value to set. When a bit is set to 1, the corresponding counter is excluded from the rating score calculation. bit 0: LinkDownCounterMask (set to 1 = link down counter excluded from scoring) bit 1: FecCounterMask bit 2 - 7: Reserved

8.5.2 Reply Message Header

CDB Reset Telemetry Counter Mask Reply Message			
Page	Byte	Attribute	Description
9Fh	134	RPL length	VAR
	135	RPL chk code	VAR

8.5.3 CDB Command Status (Page 0, byte 8 and bytes 37 – 38)

These registers are updated by the module and shall be read by the host after each command to determine execution status and completion

CDB Command Status				
Page	Byte	Bit	Attribute	Description
0h	8	6	CdbCmdCompleteFlag1	Latched Flag to indicate completion of a CDB command for CDB instance 1
		7	CdbCmdCompleteFlag2	Latched Flag to indicate completion of a CDB command for CDB instance 2
	37	7 - 0	CdbStatus1	Status of the most recent CDB command in CDB instance 1

	38	7 - 0	CdbStatus2	Status of the most recent CDB command in CDB instance 2
--	----	-------	------------	---

CdbStatus														
Bit	Attribute	Description												
5 – 0	CdbCommandResult	The CdbCommandResult field provides more detailed classification for each of the three coarse query results that are encoded by the pair of bit 7 (CdbIsBusy) and bit 6 (CdbHasFailed)												
		<table><tr><td>Coarse Status</td><td>CdbIsBusy</td><td>CdbHasFailed</td></tr><tr><td>IN PROGRESS</td><td>1</td><td>X (don't care)</td></tr><tr><td>SUCCESS</td><td>0</td><td>0</td></tr><tr><td>FAILED</td><td>0</td><td>1</td></tr></table>	Coarse Status	CdbIsBusy	CdbHasFailed	IN PROGRESS	1	X (don't care)	SUCCESS	0	0	FAILED	0	1
		Coarse Status	CdbIsBusy	CdbHasFailed										
		IN PROGRESS	1	X (don't care)										
		SUCCESS	0	0										
		FAILED	0	1										
		The interpretation of CdbCommandResult therefore depends on the coarse status as follows:												
		IN PROGRESS												
		00h=Reserved												
		01h=Command is captured but not processed												
02h=Command checking is in progress														
03h=Command execution is in progress														
04h-2Fh=Reserved														
30h-3Fh=Custom														
SUCCESS														
00h=Reserved														
01h=Command completed successfully														
02h=Reserved														
03h=Previous CMD was ABORTED by CMD Abort														
04h-1Fh=Reserved														
20h-2Fh=Reserved														
30h-3Fh=Custom														
FAILED														
00h=Reserved														
01h=CMDID unknown														
02h=Parameter range error or parameter not supported														
03h=Previous CMD was not properly ABORTED (by CMD Abort)														
04h=Command checking time out														
05h=CdbChkCode Error														
06h=Password related error (command specific meaning)														
07h=Command not compatible with operating status														
08h-0Fh=Reserved for STS command checking error														

CdbStatus		
Bit	Attribute	Description
		10h-1Fh=Reserved 20h-2Fh=For individual STS command or task error 30h-3Fh=Custom
6	CdbHasFailed	Bool: CdbHasFailed bit indicates if there was a failure, after the module has completed execution of the last CDB command 0b: Last triggered CDB command completed successfully 1b: Last triggered CDB command failed
7	CdbIsBusy	Bool: CdbIsBusy status bit indicates whether the module is still busy, or idle and ready to accept a new CDB command 0b: Module idle, host can write 1b: Module busy, host needs to wait

8.6 Telemetry Threshold Control (CMD: 8004h)

The Telemetry Threshold Control command (CMDID: 8004h) is used to configure and manage telemetry threshold parameters within the module. This command allows the host to directly specify signal quality threshold values on a per-module basis, enabling customized evaluation of telemetry rating scores according to performance characteristics.

8.6.1 Threshold Configuration Method

The Telemetry Threshold Control command supports both threshold configuration and retrieval operations. Based on the operation field in the command payload, the host may either program TH1 and TH2 values for the selected telemetry category or retrieve the currently configured threshold values.

Threshold configuration applies only to telemetry categories representing continuous or signal quality metrics. Event-based indicators and status flags are not subject to threshold control.

The following telemetry categories support threshold configuration:

- **FEC BIN LEVEL:** Thresholds are specified in **FEC bin number**
- **Pre-FEC BER:** Thresholds are specified in **F16 format** as defined in the CMIS specification
- **SNR:** Thresholds are specified in **1/256 dB units**
- **Eye Height:** Thresholds are specified in **mV units**

For different telemetry categories, higher numerical values may represent either better or worse signal quality depending on the metric definition. Therefore, the comparison relationship between the measured telemetry value and thresholds TH1 and TH2 is defined on a per-

category basis. Unless otherwise noted, **TH1 represents the boundary between Score 80 and Score 60, while TH2 represents the boundary between Score 60 and Score 40.**

The relationship between telemetry measurements and thresholds TH1 and TH2 is category-dependent. The table below summarizes the threshold comparison rules and score classification for each supported telemetry category.

Telemetry Category	Unit/Format	Score 80	Score 60	Score 40
FEC Bins	FEC bin number	Value < TH1	TH1 ≤ Value ≤ TH2	Value > TH2
Pre-FEC Ber	F16	Value < TH1	TH1 ≤ Value ≤ TH2	Value > TH2
SNR	1/256 dB	Value > TH1	TH2 ≤ Value ≤ TH1	Value < TH2
EYE Height	mV	Value > TH1	TH2 ≤ Value ≤ TH1	Value < TH2

8.6.2 Command Message Header

To configure or retrieve telemetry threshold settings using the Telemetry Threshold Control command (CMDID: 0x8004), the host shall populate the command message fields including Target, Port, Operation Type, Category Type, and threshold values, as defined below

Telemetry threshold configuration is applied on a per-module basis rather than a per-port basis. The Port field is used to identify the module instance associated with the specified port, and any threshold configuration applied through this command affects the module corresponding to the selected port.

Telemetry Threshold Control Message			
Page	Byte	Attribute	Description
9Fh	128	CMDID	0x8004
	129		
	130	EPL length	N/A
	131		
	132	LPL length	VAR
	133	Cdb chk code	VAR
	134	RPL length	N/A
	135	RPL chk code	N/A
	136	Target	selection for local or remote end 0: local end 1: remote end
	137	Port	Select the target port For example, in a 2x200G cable configuration, port 0 refers to the first 200G port, and port 1 refers to the second 200G port. The number of available ports is determined by the AppSel configuration.
	138	Operation	Indicates the type of threshold operation to be performed.

Telemetry Threshold Control Message			
Page	Byte	Attribute	Description
			00h: Retrieve current threshold configuration 01h: Set threshold for the specified telemetry category
	139	Category Type	Selects the telemetry category for which threshold values are to be retrieved or configured 00h: FEC Bins 01h: Pre-FEC BER 02h: SNR 03h: Eye Height (50G per lane) 04h: Eye Height (100G per lane) Other value: reserved
	140	TH1	Threshold 1
	141		TH1 represents the boundary between Score 80 and Score 60 This field is only valid when Operation is set to 01h
	142	TH2	Threshold 2
	143		TH2 represents the boundary between Score 60 and Score 40 This field is only valid when Operation is set to 01h

8.6.3 Reply Message Header

The Telemetry Threshold Control Reply Message returns the currently effective threshold configuration for the specified telemetry category.

Regardless of the operation type specified in the corresponding Telemetry Threshold Control command, if the command is successfully processed without error, the reply message shall include the latest configured threshold values, TH1 and TH2, for the selected telemetry category.

Telemetry Threshold Control Reply Message			
Page	Byte	Attribute	Description
9Fh	134	RPL length	VAR
	135	RPL chk code	VAR
	136	TH1	Threshold 1
	137		TH1 represents the boundary between Score 80 and Score 60
	138	TH2	Threshold 2
	139		TH2 represents the boundary between Score 60 and Score 40

8.6.4 Command Status (Page 0, byte 8 and bytes 37 – 38)

These registers are updated by the module and shall be read by the host after each command to determine execution status and completion

CDB Command Status				
Page	Byte	Bit	Attribute	Description
0h	8	6	CdbCmdCompleteFlag1	Latched Flag to indicate completion of a CDB command for CDB instance 1
		7	CdbCmdCompleteFlag2	Latched Flag to indicate completion of a CDB command for CDB instance 2
	37	7 - 0	CdbStatus1	Status of the most recent CDB command in CDB instance 1
	38	7 - 0	CdbStatus2	Status of the most recent CDB command in CDB instance 2

CdbStatus				
Bit	Attribute	Description		
5 - 0	CdbCommandResult	The CdbCommandResult field provides more detailed classification for each of the three coarse query results that are encoded by the pair of bit 7 (CdbIsBusy) and bit 6 (CdbHasFailed)		
		Coarse Status	CdbIsBusy	CdbHasFailed
		IN PROGRESS	1	X (don't care)
		SUCCESS	0	0
		FAILED	0	1
		The interpretation of CdbCommandResult therefore depends on the coarse status as follows:		
		IN PROGRESS		
		00h=Reserved		
		01h=Command is captured but not processed		
		02h=Command checking is in progress		
03h=Command execution is in progress				
04h-2Fh=Reserved				
30h-3Fh=Custom				
SUCCESS				
00h=Reserved				
01h=Command completed successfully				
02h=Reserved				
03h=Previous CMD was ABORTED by CMD Abort				
04h-1Fh=Reserved				
20h-2Fh=Reserved				
30h-3Fh=Custom				
FAILED				

CdbStatus		
Bit	Attribute	Description
		00h=Reserved 01h=CMDID unknown 02h=Parameter range error or parameter not supported 03h=Previous CMD was not properly ABORTED (by CMD Abort) 04h=Command checking time out 05h=CdbChkCode Error 06h=Password related error (command specific meaning) 07h=Command not compatible with operating status 08h-0Fh=Reserved for STS command checking error 10h-1Fh=Reserved 20h-2Fh=For individual STS command or task error 30h-3Fh=Custom
6	CdbHasFailed	Bool: CdbHasFailed bit indicates if there was a failure, after the module has completed execution of the last CDB command 0b: Last triggered CDB command completed successfully 1b: Last triggered CDB command failed
7	CdbIsBusy	Bool: CdbIsBusy status bit indicates whether the module is still busy, or idle and ready to accept a new CDB command 0b: Module idle, host can write 1b: Module busy, host needs to wait

8.7 Autonomous Shutdown Configuration (CMD: 8005h)

The transceiver supports an auto-shutdown feature that transitions the module to a fault state when an unhealthy link condition is detected. When auto-shutdown is triggered, the module reports a fault cause value of 0x26 in the Fault Cause register (Page 0, Byte 41) and records an event (Event ID: 0x0C) in the event log.

By default, the auto-shutdown feature is disabled.

8.7.1 Command Message Header

After a module reset or power reset, the auto-shutdown feature remains disabled by default. Configuration or status retrieval of the auto-shutdown feature may be performed by following the procedure below:

- Set the auto shutdown operation and auto shutdown control parameters as required
- Set LPL length and CDB check code
- Set CMDID to 0x8005 to initiate the Autonomous Shutdown Configuration command.

Autonomous Shutdown Configuration Command Message			
Page	Byte	Attribute	Description
9Fh	128	CMDID	0x8005

Autonomous Shutdown Configuration Command Message			
Page	Byte	Attribute	Description
	129		
	130	EPL length	N/A
	131		
	132	LPL length	VAR
	133	Cdb chk code	VAR
	134	RPL length	N/A
	135	RPL chk code	N/A
	136	Auto Shutdown Operation	Selection for auto-shutdown operation 00h: Retrieve the auto shutdown enable/disable status 01h: Configure auto-shutdown enable/disable
	137	Auto Shutdown Control	Selection for auto-shutdown setting 00h: Disable auto-shutdown (default) 01h: Enable auto-shutdown Note: This field is only valid when the auto shutdown operation field is set to 1

8.7.2 Reply Message Header

The Autonomous Shutdown Configuration Command Reply Message returns the current auto-shutdown enable status.

Autonomous Shutdown Configuration Command Reply Message			
Page	Byte	Attribute	Description
9Fh	134	RPL length	VAR
	135	RPL chk code	VAR
	136	Auto-Shutdown Enable Status	Returns the current auto-shutdown enable status 00h: Auto-shutdown disabled 01h: Auto-shutdown enabled

8.7.3 Command Status (Page 0, byte 8 and bytes 37 – 38)

These registers are updated by the module and shall be read by the host after each command to determine execution status and completion

CDB Command Status				
Page	Byte	Bit	Attribute	Description
0h	8	6	CdbCmdCompleteFlag1	Latched Flag to indicate completion of a CDB command for CDB instance 1

CDB Command Status				
Page	Byte	Bit	Attribute	Description
		7	CdbCmdCompleteFlag2	Latched Flag to indicate completion of a CDB command for CDB instance 2
	37	7 - 0	CdbStatus1	Status of the most recent CDB command in CDB instance 1
	38	7 - 0	CdbStatus2	Status of the most recent CDB command in CDB instance 2

CdbStatus			
Bit	Attribute	Description	
5 - 0	CdbCommandResult	The CdbCommandResult field provides more detailed classification for each of the three coarse query results that are encoded by the pair of bit 7 (CdbIsBusy) and bit 6 (CdbHasFailed)	
		Coarse Status	CdbIsBusy CdbHasFailed
		IN PROGRESS	1 X (don't care)
		SUCCESS	0 0
		FAILED	0 1
		The interpretation of CdbCommandResult therefore depends on the coarse status as follows:	
		IN PROGRESS	
		00h=Reserved	
		01h=Command is captured but not processed	
		02h=Command checking is in progress	
		03h=Command execution is in progress	
		04h-2Fh=Reserved	
		30h-3Fh=Custom	
		SUCCESS	
		00h=Reserved	
		01h=Command completed successfully	
		02h=Reserved	
		03h=Previous CMD was ABORTED by CMD Abort	
		04h-1Fh=Reserved	
		20h-2Fh=Reserved	
		30h-3Fh=Custom	
		FAILED	
		00h=Reserved	
		01h=CMDID unknown	
		02h=Parameter range error or parameter not supported	
		03h=Previous CMD was not properly ABORTED (by CMD Abort)	
		04h=Command checking time out	
		05h=CdbChkCode Error	
		06h=Password related error (command specific meaning)	

CdbStatus		
Bit	Attribute	Description
		07h=Command not compatible with operating status 08h-0Fh=Reserved for STS command checking error 10h-1Fh=Reserved 20h-2Fh=For individual STS command or task error 30h-3Fh=Custom
6	CdbHasFailed	Bool: CdbHasFailed bit indicates if there was a failure, after the module has completed execution of the last CDB command 0b: Last triggered CDB command completed successfully 1b: Last triggered CDB command failed
7	CdbIsBusy	Bool: CdbIsBusy status bit indicates whether the module is still busy, or idle and ready to accept a new CDB command 0b: Module idle, host can write 1b: Module busy, host needs to wait

9 CDB Event Log Management (CMD: 8010h-801Fh)

Optical transceivers support event logging management to record critical events into non-volatile memory. They also provide a mechanism to read back the logs from memory for diagnostics and troubleshooting.

The Event Log Management command group provides commands that allow the host to manage and retrieve event log information recorded by the module. All commands defined in this section are part of the CDB Event Log Management command group and are assigned CMDIDs in the range of 8010h to 801Fh.

9.1 Event Log Entry Structure, IDs and Threshold

This section illustrates the Event Log Entry structure, supported Event Log IDs, and threshold conditions for recording.

9.1.1 Event Log Entry Structure

Each event log entry occupies 32 bytes, consisting of 2 bytes for the UID (unique ID) and 30 bytes for informative data

- All fields are stored in little-endian byte order.
- A 16-bit UID is a sequence number that indicates the history of each event log. The smallest number is the oldest record. The UID can wrap around when it reaches U16_MAX.

Byte	Field Name	Description
0-1	UID	Unique ID as a sequence id of the log
2-9	TIME_NSEC	Main timestamp of the event, in nanoseconds (UTC).
10-11	EVENT_ID	Event type identifier. (See Section 9.1.2 for details.)
12-15	DETAIL0	Event information, which may include technical details or troubleshooting data.
16-19	DETAIL1	Additional event information, often used for debugging or further explanation
20-23	DETAIL2	Additional event information, often used for debugging or further explanation
24-27	DETAIL3	Additional event information, often used for debugging or further explanation
28-31	Reserved	

9.1.2 Event Log IDs, Types and Thresholds

The following table lists supported event IDs (UID) associated with all events that shall be logged in non-volatile transceiver memory. Each event is identified by a unique Event ID and has an associated threshold value that determines when the event shall be triggered and recorded. This feature allows a user to unplug a module without losing all link event history which may be an essential part of network troubleshooting.

Event ID	Event Name	Description	Threshold
0x0008	MODULE_TEMPERATURE	Module temperature over threshold event	>70°C or < 0°C
0x0009	MODULE_VOLTAGE	Module voltage over or under threshold event	> 3.465V or <3.135V
0x000A	MODULE_RESET	Module reset event	
0x000B	OPTICAL_POWER_ALARM	Optical power exceeds alarm threshold event	Rx: >4.3dB or < -5.0dB Tx: >4.3dB or < -3.5dB
0x000C	MODULE_AUTO_SHUTDOWN	Module auto shutdown event	
0x0102	DSP_CMD_TIMEOUT	DSP firmware command execution timeout event	>30ms
0x0106	DSP_LOS	DSP loss of signal event	
0x0107	DSP_LOL	DSP loss of lock event	
0x0108	DSP_PREFEC_BER	DSP pre-FEC BER exceeds threshold event	> 1e-5
0x0109	DSP_FEC_BIN	DSP FEC BIN exceeds threshold event	FEC Bin index 8 or higher contains non-zero entry
0x010A	DSP_MPI	Multipath interference high threshold event	> -30 dB (and ≠ 0)
0x0200	FW_UPGRADE	Module firmware upgrade event	

9.1.3 Event Log Detail Fields

This section describes the content of the DETAIL0, DETAIL1, DETAIL2 and DETAIL3 fields for each supported event log type. Both fields are stored as 32-bit data in little-endian byte order. Their meaning is specific to each event ID.

9.1.3.1 MODULE_TEMPERATURE (Event ID: 0x0008)

Field	Bits	Description
DETAIL0	31-0	Bit 31-8: Reserved The value of lower page byte 9 at the time of the event Bit 7: Voltage low warning Bit 6: Voltage high warning Bit 5: Voltage low alarm Bit 4: Voltage high alarm Bit 3: Temperature low warning Bit 2: Temperature high warning Bit 1: Temperature low alarm Bit 0: Temperature high alarm
DETAIL1	31-0	Measured temperature at the time of the event, in 1/256-degree Celsius increments (signed 16-bit value stored in a 32-bit field)
DETAIL2	31-0	Reserved
DETAIL3	31-0	Reserved

9.1.3.2 MODULE_VOLTAGE (Event ID: 0x0009)

Field	Bits	Description
DETAIL0	31-0	Bit 31-8: Reserved
		The value of lower page byte 9 at the time of the event
		Bit 7: Voltage low warning
		Bit 6: Voltage high warning
		Bit 5: Voltage low alarm
		Bit 4: Voltage high alarm
		Bit 3: Temperature low warning
		Bit 2: Temperature high warning
		Bit 1: Temperature low alarm
		Bit 0: Temperature high alarm
DETAIL1	31-0	Measured supply voltage at the time of the event, in 100 μ V increments
DETAIL2	31-0	Reserved
DETAIL3	31-0	Reserved

9.1.3.3 MODULE_RESET (Event ID: 0x000A)

Field	Bits	Description
DETAIL0	31-24	Active firmware image slot: Value 1: Image A Value 2: Image B
	23-16	MCU firmware sub-version number
	15-0	Boot mode identifier indicating the reset cause Cold Boot: 0x434C (ASCII: CL) Warm Boot: 0x5752 (ASCII: WR) Watchdog Reset: 0x4F47 (ASCII: OG) Boot Error: 0x524F (ASCII: RO) Soft Reset: 0x5357 (ASCII: SW)
DETAIL1	31-24	MCU firmware major version number
	23-16	MCU firmware minor version number
	15-0	Customer code in ascii format (e.g., HW)
DETAIL2	31-0	Reserved
DETAIL3	31-0	Reserved

9.1.3.4 OPTICAL_POWER_ALARM (Event ID: 0x000B)

Field	Bits	Description
DETAIL0	31-0	Optical power alarm bitmap aggregated across all ports: Bit 5: Rx optical power low alarm

		Bit 4: Rx optical power high alarm Bit 1: Tx optical power low alarm Bit 0: Tx optical power high alarm
DETAIL1	31-16	Optical power of the worst-case lane among active Tx low alarms, in 0.1 μ W increments. This field is valid only when Bit 1 in DETAIL0 is set
	15-0	Optical power of the worst-case lane among active Tx high alarms, in 0.1 μ W increments. This field is valid only when Bit 0 in DETAIL0 is set
DETAIL2	31-16	Optical power of the worst-case lane among active Rx low alarms, in 0.1 μ W increments. This field is valid only when Bit 5 in DETAIL0 is set
	15-0	Optical power of the worst-case lane among active Rx high alarms, in 0.1 μ W increments. This field is valid only when Bit 4 in DETAIL0 is set
DETAIL3	31-0	Reserved

9.1.3.5 MODULE_AUTO_SHUTDOWN (Event ID: 0x000C)

Field	Bits	Description
DETAIL0	31-16	Category bit index indicating which telemetry quality triggered auto shutdown: Bit 22: Flags Bit 21: Eye height Bit 20: SNR Bit 19: Reserved Bit 18: Pre-FEC BER Bit 17: FEC bin counter Bit 16: Link down counter
	15-5	Reserved
	4	Side identifier: Value 0: Host side Value 1: Media side
	3-0	Datapath port number on which the shutdown condition was detected
DETAIL1	31-0	The metric value that caused the shutdown threshold to be reached
DETAIL2	31-0	Reserved
DETAIL3	31-0	Reserved

9.1.3.6 DSP_CMD_TIMEOUT (Event ID: 0x0102)

Field	Bits	Description
DETAIL0	31-0	Vendor defined
DETAIL1	31-0	Vendor defined

DETAIL2	31-0	Vendor defined
DETAIL3	31:0	Vendor defined

9.1.3.7 DSP_LOS (Event ID: 0x0106)

Field	Bits	Description
DETAIL0	31-0	Tx lane Loss of Signal bitmap. Each bit corresponds to a TX lane, where bit 0 represents lane 1, bit 1 represents lane 2, and so on.
DETAIL1	31-0	Rx lane Loss of Signal bitmap. Each bit corresponds to a Rx Lane, where bit 0 represents lane 1, bit 1 represents lane 2, and so on.
DETAIL2	31-0	Reserved
DETAIL3	31-0	Reserved

9.1.3.8 DSP_LOL (Event ID: 0x0107)

Field	Bits	Description
DETAIL0	31-0	Tx lane Loss of Lock bitmap. Each bit corresponds to a TX Lane, where bit 0 represents lane 1, bit 1 represents lane 2, and so on.
DETAIL1	31-0	Rx lane Loss of Lock bitmap. Each bit corresponds to a Rx Lane, where bit 0 represents lane 1, bit 1 represents lane 2, and so on.
DETAIL2	31-0	Reserved
DETAIL3	31-0	Reserved

9.1.3.9 DSP_PREFEC_BER (Event ID: 0x0108)

Field	Bits	Description
DETAIL0	31-16	Reserved
	15-0	Measured F16 pre-FEC bit error ratio Bit [15:11]: Scaled Exponent (s) Bit [10:8]: Mantissa (m), most significant bits 10-8 Bit [7:0]: Mantissa (m), least significant bits 7-0
DETAIL1	31-0	Reserved
DETAIL2	31-0	Reserved
DETAIL3	31-0	Reserved

9.1.3.10 DSP_FEC_BIN (Event ID: 0x0109)

Field	Bits	Description
DETAIL0	31-0	FEC bin occupancy bitmap for bins 8 through 15. Bit N indicates that FEC bin (8 + N) contains at least one non-zero entry. Bits 0–7 correspond to bins 8–15 respectively

Field	Bits	Description
DETAIL1	31-5	Reserved
	4	Side identifier: Value 0: Host side Value 1: Media side
	3-0	Datapath port number
DETAIL2	31-0	Number of FEC frames in the highest bin
DETAIL3	31-0	Reserved

9.1.3.11 DSP_MPI (Event ID: 0x010A)

Field	Bits	Description
DETAIL0	31-0	Vendor defined
DETAIL1	31-0	Vendor defined
DETAIL2	31-0	Vendor defined
DETAIL3	31-0	Vendor defined

9.1.3.12 FW_UPGRADE (Event ID: 0x0200)

Field	Bits	Description
DETAIL0	15-8	MCU firmware sub-version number of the new firmware image
	7-0	Target firmware image slot: Value 1: Image A Value 2: Image B
DETAIL1	31-24	MCU firmware major version number
	23-16	MCU firmware minor version number
	15-0	Customer code in ascii format (e.g., HW)
DETAIL2	31-0	Reserved
DETAIL3	31-0	Reserved

9.2 Get Event Log (CMD: 8010h, option = 0)

Use command ID 0x8010 with option = 0 to retrieve the event logs from the module.

9.2.1 Command Message Header

- Fill the **UID** attribute (bytes 136–139) to assign the starting entry to be read; otherwise, set it to U32_MAX and the module will return the log from the oldest record

- The **Request Count** attribute (byte 140) shall not exceed 6; otherwise, an error will occur. See Section 9.2.2 for details.

Note: Port attribute can be ignored when accessing the local end, because all ports from the local end share the same event log list.

CDB Eventlog Management Command Message			
Page	Byte	Attribute	Description
9Fh	128	CMDID	0x8010
	129		
	130	EPL length	VAR
	131		
	132	IPL length	VAR
	133	Cdb chk code	VAR
	134	RPL length	VAR
	135	RPL chk code	VAR
	136	UID	Read from oldest event log entry index, if it is 0xFFFFFFFF
	137		
	138		
	139		
	140	Request count	Request read back event log count (max 6 per command)
	141	Option	Event log management option: 0: Read event log from flash 1: Wipe all event logs and reset it to initial state
	142	Target	Target side of the link 0: local end 1: remote end
	143	Port	Target port For example, in a 2x200G cable configuration, port 0 refers to the first 200G port, and port 1 refers to the second 200G port. The number of available ports is determined by the AppSel configuration.

9.2.2 Reply Message Header

Once the event log management command is successfully processed by the module, the user application can retrieve the information listed below.

CDB Event Log Management Reply Message			
Page	Byte	Reply	Description
9Fh	134	RPL length	VAR
	135	RPL chk code	VAR
	136	Request Count	Number of valid event entries returned
	137	Event Log Entry 1	Refer to section 9.1.1
	138		
	139		
	140		
	141		
	142		
	143		
	144		
	145		
	146		
	147		
	148		
	149		
	150		
	151		
	152		
	153		
	154		
	155		
	156		
	157		
	158		
	159		
	160		
	161		
	162		
	163		
	164		
	165		
	166		
	167		
	168		
	169	Event Log Entry 2	Refer to section 9.1.1
	170		

CDB Event Log Management Reply Message			
Page	Byte	Reply	Description
	171		
	172		
	173		
	174		
	175		
	176		
	177		
	178		
	179		
	180		
	181		
	182		
	183		
	184		
	185		
	186		
	187		
	188		
	189		
	190		
	191		
	192		
	193		
	194		
	195		
	196		
	197		
	198		
	199		
	200		
	201	Event Log Entry 3	Refer to section 9.1.1
	202		
	203		
	204		
	205		
	206		
	207		

CDB Event Log Management Reply Message			
Page	Byte	Reply	Description
	208		
	209		
	210		
	211		
	212		
	213		
	214		
	215		
	216		
	217		
	218		
	219		
	220		
	221		
	222		
	223		
	224		
	225		
	226		
	227		
	228		
	229		
	230		
	231		
	232		
	233-255	Reserved	

9.2.3 CDB Command Status (Page 0, byte 8 and bytes 37 – 38)

These registers are updated by the module and shall be read by the host after each command to determine execution status and completion

CDB Command Status				
Page	Byte	Bit	Attribute	Description
0h	8	6	CdbCmdCompleteFlag1	Latched Flag to indicate completion of a CDB command for CDB instance 1

	7	CdbCmdCompleteFlag2	Latched Flag to indicate completion of a CDB command for CDB instance 2
37	7 - 0	CdbStatus1	Status of the most recent CDB command in CDB instance 1
38	7 - 0	CdbStatus2	Status of the most recent CDB command in CDB instance 2

CdbStatus														
Bit	Attribute	Description												
5 - 0	CdbCommandResult	The CdbCommandResult field provides more detailed classification for each of the three coarse query results that are encoded by the pair of bit 7 (CdbIsBusy) and bit 6 (CdbHasFailed)												
		<table><tr><td>Coarse Status</td><td>CdbIsBusy</td><td>CdbHasFailed</td></tr><tr><td>IN PROGRESS</td><td>1</td><td>X (don't care)</td></tr><tr><td>SUCCESS</td><td>0</td><td>0</td></tr><tr><td>FAILED</td><td>0</td><td>1</td></tr></table>	Coarse Status	CdbIsBusy	CdbHasFailed	IN PROGRESS	1	X (don't care)	SUCCESS	0	0	FAILED	0	1
		Coarse Status	CdbIsBusy	CdbHasFailed										
		IN PROGRESS	1	X (don't care)										
		SUCCESS	0	0										
		FAILED	0	1										
		The interpretation of CdbCommandResult therefore depends on the coarse status as follows:												
		IN PROGRESS												
		00h=Reserved												
		01h=Command is captured but not processed												
02h=Command checking is in progress														
03h=Command execution is in progress														
04h-2Fh=Reserved														
30h-3Fh=Custom														
SUCCESS														
00h=Reserved														
01h=Command completed successfully														
02h=Reserved														
03h=Previous CMD was ABORTED by CMD Abort														
04h-1Fh=Reserved														
20h-2Fh=Reserved														
30h-3Fh=Custom														
FAILED														
00h=Reserved														
01h=CMDID unknown														
02h=Parameter range error or parameter not supported														
03h=Previous CMD was not properly ABORTED (by CMD Abort)														
04h=Command checking time out														
05h=CdbChkCode Error														
06h=Password related error (command specific meaning)														
07h=Command not compatible with operating status														

CdbStatus		
Bit	Attribute	Description
		08h-0Fh=Reserved for STS command checking error 10h-1Fh=Reserved 20h-2Fh=For individual STS command or task error 30h-3Fh=Custom
6	CdbHasFailed	Bool: CdbHasFailed bit indicates if there was a failure, after the module has completed execution of the last CDB command 0b: Last triggered CDB command completed successfully 1b: Last triggered CDB command failed
7	CdbIsBusy	Bool: CdbIsBusy status bit indicates whether the module is still busy, or idle and ready to accept a new CDB command 0b: Module idle, host can write 1b: Module busy, host needs to wait

9.2.4 Event log parsing example

The screenshot below shows how an event log could be parsed and displayed

ID	Time	Event	Detail1	Detail2
000001	1970-01-01 00:00:00.006	Module Reset	(0x000A) Slot 1 COLD	0x0100434C 0x64005244

9.3 Reset Event Log (CMD: 8010h, option = 1)

To wipe and reset all event logs, use the same command ID (0x8010) with option = 1. All event logs will be erased and reset to their initial state after the command is processed.

9.3.1 Command Message Header

- Fill the option with 1 to reset all event log
- If the **Target** attribute (byte 142) is set to 0, then the **Port** attribute can be ignored because all ports from the local end share the same event log list.

CDB Event Log Management Command			
Page	Byte	Attribute	Description
9Fh	128	CMDID	0x8010
	129		
	130	EPL length	N/A
	131		
	132	LPL length	VAR
	133	Cdb chk code	VAR
	134	RPL length	N/A

CDB Event Log Management Command			
Page	Byte	Attribute	Description
	135	RPL chk code	N/A
	136	N/A	
	137		
	138		
	139		
	140	N/A	
	141	Option	Event log management option: 0: Read event log from flash 1: Wipe all event logs and reset it to initial state
	142	Target	Select to wipe and reset all event logs for the local or remote endpoint 0: Local end 1: Remote end
	143	Port	Select the target port. For example, in a 2x200G cable configuration, port 0 refers to the first 200G port, and port 1 refers to the second 200G port. The number of available ports is determined by the AppSel configuration.

9.3.2 Reply Message Header

CDB Event Log Management Command Reply Message			
Page	Byte	Attribute	Description
9Fh	134	RPL length	VAR
	135	RPL chk code	VAR

9.3.3 Command Status (Page 0, byte 8 and bytes 37 – 38)

These registers are updated by the module and shall be read by the host after each command to determine execution status and completion

CDB Command Status				
Page	Byte	Bit	Attribute	Description
0h	8	6	CdbCmdCompleteFlag1	Latched Flag to indicate completion of a CDB command for CDB instance 1
		7	CdbCmdCompleteFlag2	Latched Flag to indicate completion of a CDB command for CDB instance 2
	37	7 - 0	CdbStatus1	Status of the most recent CDB command in CDB instance 1
	38	7 - 0	CdbStatus2	Status of the most recent CDB command in CDB instance 2

CdbStatus				
Bit	Attribute	Description		
5 - 0	CdbCommandResult	The CdbCommandResult field provides more detailed classification for each of the three coarse query results that are encoded by the pair of bit 7 (CdbIsBusy) and bit 6 (CdbHasFailed)		
		Coarse Status	CdbIsBusy	CdbHasFailed
		IN PROGRESS	1	X (don't care)
		SUCCESS	0	0
		FAILED	0	1
		The interpretation of CdbCommandResult therefore depends on the coarse status as follows:		
		IN PROGRESS		
		00h=Reserved		
		01h=Command is captured but not processed		
		02h=Command checking is in progress		
03h=Command execution is in progress				
04h-2Fh=Reserved				
30h-3Fh=Custom				
SUCCESS				
00h=Reserved				
01h=Command completed successfully				
02h=Reserved				
03h=Previous CMD was ABORTED by CMD Abort				
04h-1Fh=Reserved				
20h-2Fh=Reserved				
30h-3Fh=Custom				
FAILED				
00h=Reserved				
01h=CMDID unknown				
02h=Parameter range error or parameter not supported				
03h=Previous CMD was not properly ABORTED (by CMD Abort)				
04h=Command checking time out				
05h=CdbChkCode Error				
06h=Password related error (command specific meaning)				
07h=Command not compatible with operating status				
08h-0Fh=Reserved for STS command checking error				
10h-1Fh=Reserved				
20h-2Fh=For individual STS command or task error				
30h-3Fh=Custom				
6	CdbHasFailed	Bool: CdbHasFailed bit indicates if there was a failure, after the module has completed execution of the last CDB command		
		0b: Last triggered CDB command completed successfully		

		1b: Last triggered CDB command failed
7	CdbIsBusy	Bool: CdbIsBusy status bit indicates whether the module is still busy, or idle and ready to accept a new CDB command 0b: Module idle, host can write 1b: Module busy, host needs to wait

10 Remote CMIS Register Access (CMD: 8020h-802Fh)

Two remote CMIS access commands are supported to enable arbitrary reading from and writing to all CMIS pages from a remote endpoint on an optical link. Remote CMIS access commands enable reading from and writing to all CMIS pages on the remote end of the link.

- Remote CMIS byte read and write (CMD: 8020h) via LPL with limited access length up to 114 bytes.
- Remote CMIS page read and write (CMD: 8021h) via EPL with full page access up to 128 bytes.

10.1 CDB Remote CMIS Byte Access (CMD: 8020h)

To partially read from or write to a remote module's CMIS registers, the host shall fill in the command message as follows:

- Fill in the command arguments to select the port, register bank, register page, address, and length.
- Set the operation to 0 for read or 1 for write and set the length (maximum up to 114 bytes).
- For write operations, the data shall be filled in the field starting from byte 142.
- Set the LPL length and the CDB check code.

Note on CMIS remote register:

- Writing remote byte 126 and 127 has no effect. No error will be reported.
- Reading remote bytes 126 and 127 will always return the remote module's byte 126 and 127. It will not return Bank and Page in command.

10.1.1 Command Message Header

CDB Byte Access Command Message			
Page	Byte	Attribute	Description
9Fh	128	CMDID	0x8020
	129		
	130	EPL length	N/A
	131		
	132	IPL length	VAR
	133	Cdb chk code	VAR
	134	RPL length	N/A
	135	RPL chk code	N/A

CDB Byte Access Command Message			
Page	Byte	Attribute	Description
	136	Port	Select the target remote port. For example, in a 2x200G cable configuration, port 0 refers to the first 200G port, and port 1 refers to the second 200G port. The number of available ports is determined by the AppSel configuration.
	137	Bank	Select remote CMIS register bank. See byte 126. Please note remote byte 126 is not changed in the process
	138	Page	Select remote CMIS register page. See Byte 127. Please note remote byte 127 is not changed in the process.
	139	Address	Select address of first CMIS register.
	140	Length	Select reading or writing length of remote registers. Valid from 1 ~ 114
	141	Operation	Select the access operation for writing to or reading from the remote end 0: read 1: write
	142-255	Data for write	The data is written to the remote end if the operation is set to 1 (write)

10.1.2 Reply Message Header

Once the remote byte access command has been successfully processed by the module, the user application can retrieve the following information to obtain the read data.

CDB Byte Access Reply Message			
Page	Byte	Attribute	Description
9Fh	134	RPL length	VAR
	135	RPL chk code	VAR
	136-141	Reserved	
	142-255	Data for read	The data is read from the remote end if the operation is set to 0 (read)

10.1.3 CDB Command Status (Page 0, byte 8 and bytes 37 – 38)

These registers are updated by the module and shall be read by the host after each command to determine execution status and completion

CDB Command Status				
Page	Byte	Bit	Attribute	Description
0h	8	6	CdbCmdCompleteFlag1	Latched Flag to indicate completion of a CDB command for CDB instance 1
		7	CdbCmdCompleteFlag2	Latched Flag to indicate completion of a CDB command for CDB instance 2
	37	7 - 0	CdbStatus1	Status of the most recent CDB command in CDB instance 1
	38	7 - 0	CdbStatus2	Status of the most recent CDB command in CDB instance 2

CdbStatus														
Bit	Attribute	Description												
5 - 0	CdbCommandResult	The CdbCommandResult field provides more detailed classification for each of the three coarse query results that are encoded by the pair of bit 7 (CdbIsBusy) and bit 6 (CdbHasFailed)												
		<table><tr><td>Coarse Status</td><td>CdbIsBusy</td><td>CdbHasFailed</td></tr><tr><td>IN PROGRESS</td><td>1</td><td>X (don't care)</td></tr><tr><td>SUCCESS</td><td>0</td><td>0</td></tr><tr><td>FAILED</td><td>0</td><td>1</td></tr></table>	Coarse Status	CdbIsBusy	CdbHasFailed	IN PROGRESS	1	X (don't care)	SUCCESS	0	0	FAILED	0	1
		Coarse Status	CdbIsBusy	CdbHasFailed										
		IN PROGRESS	1	X (don't care)										
		SUCCESS	0	0										
		FAILED	0	1										
		The interpretation of CdbCommandResult therefore depends on the coarse status as follows:												
		IN PROGRESS												
		00h=Reserved												
		01h=Command is captured but not processed												
02h=Command checking is in progress														
03h=Command execution is in progress														
04h-2Fh=Reserved														
30h-3Fh=Custom														
SUCCESS														
00h=Reserved														
01h=Command completed successfully														
02h=Reserved														
03h=Previous CMD was ABORTED by CMD Abort														
04h-1Fh=Reserved														
20h-2Fh=Reserved														
30h-3Fh=Custom														
FAILED														
00h=Reserved														
01h=CMDID unknown														
02h=Parameter range error or parameter not supported														

CdbStatus		
Bit	Attribute	Description
		03h=Previous CMD was not properly ABORTED (by CMD Abort) 04h=Command checking time out 05h=CdbChkCode Error 06h=Password related error (command specific meaning) 07h=Command not compatible with operating status 08h-0Fh=Reserved for STS command checking error 10h-1Fh=Reserved 20h-2Fh=For individual STS command or task error 30h-3Fh=Custom
6	CdbHasFailed	Bool: CdbHasFailed bit indicates if there was a failure, after the module has completed execution of the last CDB command 0b: Last triggered CDB command completed successfully 1b: Last triggered CDB command failed
7	CdbIsBusy	Bool: CdbIsBusy status bit indicates whether the module is still busy, or idle and ready to accept a new CDB command 0b: Module idle, host can write 1b: Module busy, host needs to wait

10.2 Remote CMIS Page Access (CMD: 8021h)

To access the entire CMIS page registers, the user application shall fill in the message for the page access command

- Fill in the port, bank, page, address in the command message.
- Set the operation to 0 for read or 1 for write and set the length and corresponding EPL length, 256 for page 0, 128 for other pages.
- Read/Write data are managed starting from the byte 0x80 of page 0xA0.
- To write the entire page registers, the user shall fill in the EPL pages before sending the command message.
- To read the entire page, the user can read the EPL pages after the command message has been successfully processed by the module.

10.2.1 Command Message Header

CDB Page Access Command Message			
Page	Byte	Attribute	Description
9Fh	128	CMDID	0x8021
	129		
	130	EPL length	256: for page 0 128: for page 1 ~ 255
	131		

CDB Page Access Command Message			
Page	Byte	Attribute	Description
	132	IPL length	VAR
	133	Cdb chk code	VAR
	134	RPL length	N/A
	135	RPL chk code	N/A
	136	Port	Select the target remote port. For example, in a 2x200G cable configuration, port 0 refers to the first 200G port, and port 1 refers to the second 200G port. The number of available ports is determined by the AppSel configuration.
	137	Bank	Select remote CMIS register bank. See byte 126. Please note remote byte 126 is not changed in the process
	138	Page	Select remote CMIS register page. See Byte 127. Please note remote byte 127 is not changed in the process.
	139	EPL chk code	One's complement of the sum of all data to be written in pages 0xA0 and 0xA1. Please note that only page 0 uses both 0xA0 and 0xA1 to carry lower and upper page 0 data; for other pages, only 0xA0 is used.
	140	Operation	Select the access operation for writing to or reading from the remote end 0: read 1: write

10.2.2 Reply Message Header

Once the remote byte access command has been successfully processed by the module, the user application can retrieve the following information to obtain the read data.

CDB Page Access Reply Message			
Page	Byte	Attribute	Description
9Fh	134	RPL length	VAR
	135	RPL chk code	VAR
	136-255	Reserved	

10.2.3 Command Status (Page 0, byte 8 and bytes 37 – 38)

These registers are updated by the module and shall be read by the host after each command to determine execution status and completion

CDB Command Status				
Page	Byte	Bit	Attribute	Description
0h	8	6	CdbCmdCompleteFlag1	Latched Flag to indicate completion of a CDB command for CDB instance 1
		7	CdbCmdCompleteFlag2	Latched Flag to indicate completion of a CDB command for CDB instance 2
	37	7 - 0	CdbStatus1	Status of the most recent CDB command in CDB instance 1
	38	7 - 0	CdbStatus2	Status of the most recent CDB command in CDB instance 2

CdbStatus														
Bit	Attribute	Description												
5 - 0	CdbCommandResult	The CdbCommandResult field provides more detailed classification for each of the three coarse query results that are encoded by the pair of bit 7 (CdbIsBusy) and bit 6 (CdbHasFailed)												
		<table><tr><td>Coarse Status</td><td>CdbIsBusy</td><td>CdbHasFailed</td></tr><tr><td>IN PROGRESS</td><td>1</td><td>X (don't care)</td></tr><tr><td>SUCCESS</td><td>0</td><td>0</td></tr><tr><td>FAILED</td><td>0</td><td>1</td></tr></table>	Coarse Status	CdbIsBusy	CdbHasFailed	IN PROGRESS	1	X (don't care)	SUCCESS	0	0	FAILED	0	1
		Coarse Status	CdbIsBusy	CdbHasFailed										
		IN PROGRESS	1	X (don't care)										
		SUCCESS	0	0										
		FAILED	0	1										
		The interpretation of CdbCommandResult therefore depends on the coarse status as follows:												
		IN PROGRESS												
		00h=Reserved												
		01h=Command is captured but not processed												
02h=Command checking is in progress														
03h=Command execution is in progress														
04h-2Fh=Reserved														
30h-3Fh=Custom														
SUCCESS														
00h=Reserved														
01h=Command completed successfully														
02h=Reserved														
03h=Previous CMD was ABORTED by CMD Abort														
04h-1Fh=Reserved														
20h-2Fh=Reserved														
30h-3Fh=Custom														
FAILED														
00h=Reserved														
01h=CMDID unknown														
02h=Parameter range error or parameter not supported														

CdbStatus		
Bit	Attribute	Description
		03h=Previous CMD was not properly ABORTED (by CMD Abort) 04h=Command checking time out 05h=CdbChkCode Error 06h=Password related error (command specific meaning) 07h=Command not compatible with operating status 08h-0Fh=Reserved for STS command checking error 10h-1Fh=Reserved 20h-2Fh=For individual STS command or task error 30h-3Fh=Custom
6	CdbHasFailed	Bool: CdbHasFailed bit indicates if there was a failure, after the module has completed execution of the last CDB command 0b: Last triggered CDB command completed successfully 1b: Last triggered CDB command failed
7	CdbIsBusy	Bool: CdbIsBusy status bit indicates whether the module is still busy, or idle and ready to accept a new CDB command 0b: Module idle, host can write 1b: Module busy, host needs to wait

11 Firmware Management Features (CMD: 8030h-803Fh)

Compliant optical transceivers shall support two methods for determining available firmware management features. The standard firmware upgrade flow follows the CMIS-defined firmware management commands. Specifically, CMIS v5.3 Section 9.7 defines a set of Firmware Management CDB commands that provide a standardized, host-controlled mechanism for firmware image download, activation, and status monitoring.

In addition to the CMIS standard flow, a vendor-defined firmware upgrade protocol is provided within the Firmware Management command group, using CMDIDs in the range of 8030h to 803Fh. This vendor-defined protocol enables remote firmware upgrades through in-band communication between the local and opposite ends.

To perform a remote upgrade, a recommended upgrade flow using the commands shown in the block diagram below is introduced.

- CMD 8030h: Get firmware information.
- CMD 8031h: Start remote firmware download.
- CMD 8033h: Transfer firmware data blocks to the remote end.
- CMD 8034h: Complete the remote firmware download process.
- CMD 8035h: Run the remote firmware image.
- CMD 8036h: Commit the remote firmware image as the default for future resets.

11.1 Remote Get Firmware information (CMD: 8030h)

Vendor-defined commands are provided to query remote firmware version and status information in addition to the standard CDB firmware information retrieval from CMIS 5.3.

11.1.1 Command Message Header

Issue the command to remotely query the firmware versions and default running firmware images present in the module.

CDB Remote Get FW Info Command Message			
Page	Byte	Attribute	Description
9Fh	128	CMDID	0x8030
	129		
	130	EPL length	N/A
	131		
	132	IPL length	VAR

CDB Remote Get FW Info Command Message			
Page	Byte	Attribute	Description
	133	Cdb chk code	VAR
	134	RPL length	N/A
	135	RPL chk code	N/A
	136	Port	Select the target remote port. For example, in a 2x200G cable configuration, port 0 refers to the first 200G port, and port 1 refers to the second 200G port. The number of available ports is determined by the AppSel configuration.

11.1.2 Reply Message Header

Once the remote byte access command has been successfully processed by the module, the user application can retrieve the following information to obtain the read data.

CDB Get FW Info Reply Message			
Page	Byte	Attribute	Description
9Fh	134	RPL length	VAR
	135	RPL chk code	VAR
	136	FirmwareStatus	Bitmask to indicate FW Status. Image in Bank A: Bit 0: Operational Status Bit 1: Administrative Status Bit 2: Validity Status Bit 3: Reserved Image in Bank B: Bit 4: Operational Status Bit 5: Administrative Status Bit 6: Validity Status Bit 7: Reserved Encoding as follows: Operational Status: 1 = running, 0 = not running Administrative Status: 1=committed, 0=uncommitted Validity Status: 1 = invalid, 0 = valid Note: Zero-encoding of valid maintains backwards compatibility with CMIS 4.0+ Hints: 0x00h Factory image is running (if supported)

CDB Get FW Info Reply Message			
Page	Byte	Attribute	Description
0h	137	ImageInformation	Bit 0: Firmware image A information in 9Fh:138-173 Bit 1: Firmware image B information in 9Fh:174-209 Bit 2: Factory or Boot image information in 9Fh:201-245
	138	ImageAMajor	Image A firmware major revision
	139	ImageAMinor	Image A firmware minor revision
	140	ImageABuild	Image A firmware build number
	141		
	142 - 173	ImageAExtraString	Additional information
	174	ImageBMajor	Image B firmware major revision
	175	ImageBMinor	Image B firmware minor revision
	176	ImageBBuild	Image B firmware build number
	177		
	178-209	ImageBExtraString	Additional information
	210	FactoryBootMajor	Factory or Boot image firmware major revision
	211	FactoryBootMinor	Factory or Boot image firmware minor revision
	212	FactoryBootBuild	Factory or Boot image firmware build number
	213		
	214-245	FactoryBootExtraStr	Additional information

11.1.3 CDB Command Status (Page 0, byte 8 and bytes 37 – 38)

These registers are updated by the module and shall be read by the host after each command to determine execution status and completion.

CDB Command Status				
Page	Byte	Bit	Attribute	Description
0h	8	6	CdbCmdCompleteFlag1	Latched Flag to indicate completion of a CDB command for CDB instance 1
		7	CdbCmdCompleteFlag2	Latched Flag to indicate completion of a CDB command for CDB instance 2
	37	7 - 0	CdbStatus1	Status of the most recent CDB command in CDB instance 1
	38	7 - 0	CdbStatus2	Status of the most recent CDB command in CDB instance 2

CdbStatus				
Bit	Attribute	Description		
5 – 0	CdbCommandResult	The CdbCommandResult field provides more detailed classification for each of the three coarse query results that are encoded by the pair of bit 7 (CdbIsBusy) and bit 6 (CdbHasFailed)		
		Coarse Status	CdbIsBusy	CdbHasFailed
		IN PROGRESS	1	X (don't care)
		SUCCESS	0	0
		FAILED	0	1
		The interpretation of CdbCommandResult therefore depends on the coarse status as follows:		
		IN PROGRESS		
		00h=Reserved		
		01h=Command is captured but not processed		
		02h=Command checking is in progress		
03h=Command execution is in progress				
04h-2Fh=Reserved				
30h-3Fh=Custom				
SUCCESS				
00h=Reserved				
01h=Command completed successfully				
02h=Reserved				
03h=Previous CMD was ABORTED by CMD Abort				
04h-1Fh=Reserved				
20h-2Fh=Reserved				
30h-3Fh=Custom				
FAILED				
00h=Reserved				
01h=CMDID unknown				
02h=Parameter range error or parameter not supported				
03h=Previous CMD was not properly ABORTED (by CMD Abort)				
04h=Command checking time out				
05h=CdbChkCode Error				
06h=Password related error (command specific meaning)				
07h=Command not compatible with operating status				
08h-0Fh=Reserved for STS command checking error				
10h-1Fh=Reserved				
20h-2Fh=For individual STS command or task error				
30h-3Fh=Custom				
6	CdbHasFailed	Bool: CdbHasFailed bit indicates if there was a failure, after the module has completed execution of the last CDB command 0b: Last triggered CDB command completed successfully		

		1b: Last triggered CDB command failed
7	CdbIsBusy	Bool: CdbIsBusy status bit indicates whether the module is still busy, or idle and ready to accept a new CDB command 0b: Module idle, host can write 1b: Module busy, host needs to wait

11.2 Remote Start Remote Firmware Download (CMD: 8031h)

The host issues this command to initiate a firmware update.

11.2.1 Command Message Header

Initiate the remote firmware upgrade process by sending this command to the module. If this command fails, the process is aborted.

CDB Remote Start FW Download Command Message Header			
Page	Byte	Attribute	Description
9Fh	128	CMDID	0x8031
	129		
	130	EPL length	N/A
	131		
	132	IPL length	VAR
	133	Cdb chk code	VAR
	134	RPL length	N/A
	135	RPL chk code	N/A
	136	Image Size	U32 Size of firmware image to download into the module. This shall be the file size including the LPL bytes sent as vendor data in this message.
	137		
	138		
	139		
	140	Port	Select the target remote port. For example, in a 2x200G cable configuration, port 0 refers to the first 200G port, and port 1 refers to the second 200G port. The number of available ports is determined by the AppSel configuration.
	141-143	Reserved	Reserved
	144-255	Vendor Data	The vendor may send up to 112 bytes of information in the Start Firmware Download command. It is recommended that the binary file delivered has up to 112 bytes of header that is sent to the module.

CDB Remote Start FW Download Command Message Header			
Page	Byte	Attribute	Description
			The information within this field can e.g. be used by a vendor to reject an incorrect file (binary file) and prevent firmware loading of an incorrect file presented to the module.

11.2.2 Reply Message Header

CDB Remote Start FW Download Command (Reply)			
Page	Byte	Reply	Description
9Fh	134	RPL length	VAR
	135	RPL chk code	VAR

11.2.3 CDB Command Status (Page 0, byte 8 and bytes 37 – 38)

These registers are updated by the module and shall be read by the host after each command to determine execution status and completion

CDB Command Status				
Page	Byte	Bit	Attribute	Description
0h	8	6	CdbCmdCompleteFlag1	Latched Flag to indicate completion of a CDB command for CDB instance 1
		7	CdbCmdCompleteFlag2	Latched Flag to indicate completion of a CDB command for CDB instance 2
	37	7 - 0	CdbStatus1	Status of the most recent CDB command in CDB instance 1
	38	7 - 0	CdbStatus2	Status of the most recent CDB command in CDB instance 2

CdbStatus			
Bit	Attribute	Description	
5 – 0	CdbCommandResult	The CdbCommandResult field provides more detailed classification for each of the three coarse query results that are encoded by the pair of bit 7 (CdbIsBusy) and bit 6 (CdbHasFailed)	
		Coarse Status	CdbIsBusy CdbHasFailed
		IN PROGRESS	1 X (don't care)
		SUCCESS	0 0
		FAILED	0 1

CdbStatus		
Bit	Attribute	Description
		The interpretation of CdbCommandResult therefore depends on the coarse status as follows: IN PROGRESS 00h=Reserved 01h=Command is captured but not processed 02h=Command checking is in progress 03h=Command execution is in progress 04h-2Fh=Reserved 30h-3Fh=Custom SUCCESS 00h=Reserved 01h=Command completed successfully 02h=Reserved 03h=Previous CMD was ABORTED by CMD Abort 04h-1Fh=Reserved 20h-2Fh=Reserved 30h-3Fh=Custom FAILED 00h=Reserved 01h=CMDID unknown 02h=Parameter range error or parameter not supported 03h=Previous CMD was not properly ABORTED (by CMD Abort) 04h=Command checking time out 05h=CdbChkCode Error 06h=Password related error (command specific meaning) 07h=Command not compatible with operating status 08h-0Fh=Reserved for STS command checking error 10h-1Fh=Reserved 20h-2Fh=For individual STS command or task error 30h-3Fh=Custom
6	CdbHasFailed	Bool: CdbHasFailed bit indicates if there was a failure, after the module has completed execution of the last CDB command 0b: Last triggered CDB command completed successfully 1b: Last triggered CDB command failed
7	CdbIsBusy	Bool: CdbIsBusy status bit indicates whether the module is still busy, or idle and ready to accept a new CDB command 0b: Module idle, host can write 1b: Module busy, host needs to wait

11.3 Remote Abort Remote Firmware Download (CMD: 8032h)

Aborts the firmware download if a FW Start has been issued.

11.3.1 Command Message Header

Abort the remote firmware upgrade process by sending this command to the module. If this command fails, the process is aborted.

CDB Remote Abort FW Download Command Message Header			
Page	Byte	Attribute	Description
9Fh	128	CMDID	0x8032
	129		
	130	EPL length	N/A
	131		
	132	IPL length	VAR
	133	Cdb chk code	VAR
	134	RPL length	N/A
	135	RPL chk code	N/A
	136	Port	Select the target remote port. For example, in a 2x200G cable configuration, port 0 refers to the first 200G port, and port 1 refers to the second 200G port. The number of available ports is determined by the AppSel configuration.

11.3.2 Reply Message Header

CDB Remote Abort FW Download Command (Reply)			
Page	Byte	Reply	Description
9Fh	134	RPL length	VAR
	135	RPL chk code	VAR

11.3.3 CDB Command Status (Page 0, byte 8 and bytes 37 – 38)

These registers are updated by the module and shall be read by the host after each command to determine execution status and completion

CDB Command Status				
Page	Byte	Bit	Attribute	Description
0h	8	6	CdbCmdCompleteFlag1	Latched Flag to indicate completion of a CDB command for CDB instance 1

CDB Command Status				
Page	Byte	Bit	Attribute	Description
		7	CdbCmdCompleteFlag2	Latched Flag to indicate completion of a CDB command for CDB instance 2
	37	7 - 0	CdbStatus1	Status of the most recent CDB command in CDB instance 1
	38	7 - 0	CdbStatus2	Status of the most recent CDB command in CDB instance 2

CdbStatus			
Bit	Attribute	Description	
5 – 0	CdbCommandResult	The CdbCommandResult field provides more detailed classification for each of the three coarse query results that are encoded by the pair of bit 7 (CdbIsBusy) and bit 6 (CdbHasFailed)	
		Coarse Status	CdbIsBusy CdbHasFailed
		IN PROGRESS	1 X (don't care)
		SUCCESS	0 0
		FAILED	0 1
		The interpretation of CdbCommandResult therefore depends on the coarse status as follows:	
		IN PROGRESS	
		00h=Reserved	
		01h=Command is captured but not processed	
		02h=Command checking is in progress	
		03h=Command execution is in progress	
		04h-2Fh=Reserved	
		30h-3Fh=Custom	
		SUCCESS	
		00h=Reserved	
		01h=Command completed successfully	
		02h=Reserved	
		03h=Previous CMD was ABORTED by CMD Abort	
		04h-1Fh=Reserved	
		20h-2Fh=Reserved	
		30h-3Fh=Custom	
		FAILED	
		00h=Reserved	
		01h=CMDID unknown	
		02h=Parameter range error or parameter not supported	
		03h=Previous CMD was not properly ABORTED (by CMD Abort)	
		04h=Command checking time out	
		05h=CdbChkCode Error	
		06h=Password related error (command specific meaning)	

		07h=Command not compatible with operating status 08h-0Fh=Reserved for STS command checking error 10h-1Fh=Reserved 20h-2Fh=For individual STS command or task error 30h-3Fh=Custom
6	CdbHasFailed	Bool: CdbHasFailed bit indicates if there was a failure, after the module has completed execution of the last CDB command 0b: Last triggered CDB command completed successfully 1b: Last triggered CDB command failed
7	CdbIsBusy	Bool: CdbIsBusy status bit indicates whether the module is still busy, or idle and ready to accept a new CDB command 0b: Module idle, host can write 1b: Module busy, host needs to wait

11.4 Remote Firmware Data Transfer (CMD: 8033h)

Transfer the firmware image to the remote end in blocks.

- For each block, send the appropriate command to write the data.
- If any block transfer fails, abort the process and perform cleanup.
- Continue until the entire firmware image has been transferred.

11.4.1 Command Message Header

CDB Remote FW Data Transfer Command Message			
Page	Byte	Attribute	Description
9Fh	128	CMDID	0x8033
	129		
	130	EPL length	N/A
	131		
	132	IPL length	VAR
	133	Cdb chk code	VAR
	134	RPL length	N/A
	135	RPL chk code	N/A
	136	BlockAddress	U32 Starting byte address of this block of data within the supplied image file minus the size of the “Start Command Payload Size”. See CMIS section 7.3.1.2.
	137		
	138		
	139		

CDB Remote FW Data Transfer Command Message			
Page	Byte	Attribute	Description
	140	Port	Select the target remote port. For example, in a 2x200G cable configuration, port 0 refers to the first 200G port, and port 1 refers to the second 200G port. The number of available ports is determined by the AppSel configuration.

Command Data (EPL)			
Page	Byte	Attribute	Description
A0h-AFh	128-255	FirmwareBlock	Firmware image data

11.4.2 Reply Message Header

CDB Remote FW Data Transfer Command (Reply)			
Page	Byte	Reply	Description
9Fh	134	RPL length	VAR
	135	RPL chk code	VAR

11.4.3 CDB Command Status (Page 0, byte 8 and bytes 37 – 38)

These registers are updated by the module and shall be read by the host after each command to determine execution status and completion

CDB Command Status				
Page	Byte	Bit	Attribute	Description
0h	8	6	CdbCmdCompleteFlag1	Latched Flag to indicate completion of a CDB command for CDB instance 1
		7	CdbCmdCompleteFlag2	Latched Flag to indicate completion of a CDB command for CDB instance 2
	37	7 - 0	CdbStatus1	Status of the most recent CDB command in CDB instance 1
	38	7 - 0	CdbStatus2	Status of the most recent CDB command in CDB instance 2

CdbStatus		
Bit	Attribute	Description
5 – 0	CdbCommandResult	The CdbCommandResult field provides more detailed classification for each of the three coarse query results that are encoded by the pair of bit 7 (CdbIsBusy) and bit 6 (CdbHasFailed)

CdbStatus				
Bit	Attribute	Description		
		Coarse Status	CdbIsBusy	CdbHasFailed
		IN PROGRESS	1	X (don't care)
		SUCCESS	0	0
		FAILED	0	1
		The interpretation of CdbCommandResult therefore depends on the coarse status as follows: IN PROGRESS 00h=Reserved 01h=Command is captured but not processed 02h=Command checking is in progress 03h=Command execution is in progress 04h-2Fh=Reserved 30h-3Fh=Custom SUCCESS 00h=Reserved 01h=Command completed successfully 02h=Reserved 03h=Previous CMD was ABORTED by CMD Abort 04h-1Fh=Reserved 20h-2Fh=Reserved 30h-3Fh=Custom FAILED 00h=Reserved 01h=CMDID unknown 02h=Parameter range error or parameter not supported 03h=Previous CMD was not properly ABORTED (by CMD Abort) 04h=Command checking time out 05h=CdbChkCode Error 06h=Password related error (command specific meaning) 07h=Command not compatible with operating status 08h-0Fh=Reserved for STS command checking error 10h-1Fh=Reserved 20h-2Fh=For individual STS command or task error 30h-3Fh=Custom		
6	CdbHasFailed	Bool: CdbHasFailed bit indicates if there was a failure, after the module has completed execution of the last CDB command 0b: Last triggered CDB command completed successfully 1b: Last triggered CDB command failed		
7	CdbIsBusy	Bool: CdbIsBusy status bit indicates whether the module is still busy, or idle and ready to accept a new CDB command 0b: Module idle, host can write 1b: Module busy, host needs to wait		

11.5 Remote Complete Firmware Download (CMD 8034h)

After all blocks have been transferred, send this command to signal the completion of the remote firmware download.

- If this command fails (e.g., due to a bad image CRC), the update is considered failed, and cleanup is performed.
- If successful, proceed with the next steps.

11.5.1 Command Message Header

CDB Remote Complete FW Download Command Message			
Page	Byte	Attribute	Description
9Fh	128	CMDID	0x8034
	129		
	130	EPL length	N/A
	131		
	132	IPL length	VAR
	133	Cdb chk code	VAR
	134	RPL length	N/A
	135	RPL chk code	N/A
	136	Port	Select the target remote port. For example, in a 2x200G cable configuration, port 0 refers to the first 200G port, and port 1 refers to the second 200G port. The number of available ports is determined by the AppSel configuration.

11.5.2 Reply Message Header

CDB Remote Complete FW Download Command (Reply)			
Page	Byte	Reply	Description
9Fh	134	RPL length	VAR
	135	RPL chk code	VAR

11.5.3 CDB Command Status (Page 0, byte 8 and bytes 37 – 38)

These registers are updated by the module and shall be read by the host after each command to determine execution status and completion

CDB Command Status				
Page	Byte	Bit	Attribute	Description
0h	8	6	CdbCmdCompleteFlag1	Latched Flag to indicate completion of a CDB command for CDB instance 1
		7	CdbCmdCompleteFlag2	Latched Flag to indicate completion of a CDB command for CDB instance 2
	37	7 - 0	CdbStatus1	Status of the most recent CDB command in CDB instance 1
	38	7 - 0	CdbStatus2	Status of the most recent CDB command in CDB instance 2

CdbStatus				
Bit	Attribute	Description		
5 – 0	CdbCommandResult	The CdbCommandResult field provides more detailed classification for each of the three coarse query results that are encoded by the pair of bit 7 (CdbIsBusy) and bit 6 (CdbHasFailed)		
		Coarse Status	CdbIsBusy	CdbHasFailed
		IN PROGRESS	1	X (don't care)
		SUCCESS	0	0
		FAILED	0	1
		The interpretation of CdbCommandResult therefore depends on the coarse status as follows:		
		IN PROGRESS		
		00h=Reserved		
		01h=Command is captured but not processed		
		02h=Command checking is in progress		
03h=Command execution is in progress				
04h-2Fh=Reserved				
30h-3Fh=Custom				
SUCCESS				
00h=Reserved				
01h=Command completed successfully				
02h=Reserved				
03h=Previous CMD was ABORTED by CMD Abort				
04h-1Fh=Reserved				
20h-2Fh=Reserved				
30h-3Fh=Custom				
FAILED				

CdbStatus		
Bit	Attribute	Description
		00h=Reserved 01h=CMDID unknown 02h=Parameter range error or parameter not supported 03h=Previous CMD was not properly ABORTED (by CMD Abort) 04h=Command checking time out 05h=CdbChkCode Error 06h=Password related error (command specific meaning) 07h=Command not compatible with operating status 08h-0Fh=Reserved for STS command checking error 10h-1Fh=Reserved 20h-2Fh=For individual STS command or task error 30h-3Fh=Custom
6	CdbHasFailed	Bool: CdbHasFailed bit indicates if there was a failure, after the module has completed execution of the last CDB command 0b: Last triggered CDB command completed successfully 1b: Last triggered CDB command failed
7	CdbIsBusy	Bool: CdbIsBusy status bit indicates whether the module is still busy, or idle and ready to accept a new CDB command 0b: Module idle, host can write 1b: Module busy, host needs to wait

11.6 Remote Run Firmware Image (CMD: 8035h)

Issue this command to instruct the remote end to run the newly downloaded firmware image.

- This step may be used to switch to the new firmware version after an update.

11.6.1 Command Message Header

CDB Remote Run FW Image Command Message			
Page	Byte	Attribute	Description
9Fh	128	CMDID	0x8035
	129		
	130	EPL length	N/A
	131		
	132	IPL length	VAR
	133	Cdb chk code	VAR
	134	RPL length	N/A

CDB Remote Run FW Image Command Message			
Page	Byte	Attribute	Description
	135	RPL chk code	N/A
	136	Port	Select the target remote port. For example, in a 2x200G cable configuration, port 0 refers to the first 200G port, and port 1 refers to the second 200G port. The number of available ports is determined by the AppSel configuration.
	137	ImageToRun	00h = Traffic affecting Reset to Inactive Image. 01h = Attempt Hitless Reset to Inactive Image. 02h = Traffic affecting Reset to Running Image. 03h = Attempt Hitless Reset to Running Image
	138	DelayToReset	U16 Indicates the delay in ms after receiving this command before a reset will occur, starting from the time the CDB complete Flag is set (or NACK clearing if the CDB background mode is not set). Note: When DelayToReset is 0, the module may reset before the host has read the CdbStatus message.
	139		

11.6.2 Reply Message Header

CDB Remote Run FW Image Command (Reply)			
Page	Byte	Reply	Description
9Fh	134	RPL length	VAR
	135	RPL chk code	VAR

11.6.3 CDB Command Status (Page 0, byte 8 and bytes 37 – 38)

These registers are updated by the module and shall be read by the host after each command to determine execution status and completion

CDB Command Status				
Page	Byte	Bit	Attribute	Description
0h	8	6	CdbCmdCompleteFlag1	Latched Flag to indicate completion of a CDB command for CDB instance 1
		7	CdbCmdCompleteFlag2	Latched Flag to indicate completion of a CDB command for CDB instance 2
	37	7 - 0	CdbStatus1	Status of the most recent CDB command in CDB instance 1

	38	7 - 0	CdbStatus2	Status of the most recent CDB command in CDB instance 2
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CdbStatus				
Bit	Attribute	Description		
5 – 0	CdbCommandResult	The CdbCommandResult field provides more detailed classification for each of the three coarse query results that are encoded by the pair of bit 7 (CdbIsBusy) and bit 6 (CdbHasFailed)		
		Coarse Status	CdbIsBusy	CdbHasFailed
		IN PROGRESS	1	X (don't care)
		SUCCESS	0	0
		FAILED	0	1
		The interpretation of CdbCommandResult therefore depends on the coarse status as follows:		
		IN PROGRESS		
		00h=Reserved		
		01h=Command is captured but not processed		
		02h=Command checking is in progress		
		03h=Command execution is in progress		
		04h-2Fh=Reserved		
		30h-3Fh=Custom		
		SUCCESS		
		00h=Reserved		
		01h=Command completed successfully		
		02h=Reserved		
		03h=Previous CMD was ABORTED by CMD Abort		
		04h-1Fh=Reserved		
20h-2Fh=Reserved				
30h-3Fh=Custom				
FAILED				
00h=Reserved				
01h=CMDID unknown				
02h=Parameter range error or parameter not supported				
03h=Previous CMD was not properly ABORTED (by CMD Abort)				
04h=Command checking time out				
05h=CdbChkCode Error				
06h=Password related error (command specific meaning)				
07h=Command not compatible with operating status				
08h-0Fh=Reserved for STS command checking error				
10h-1Fh=Reserved				
20h-2Fh=For individual STS command or task error				
30h-3Fh=Custom				

CdbStatus		
Bit	Attribute	Description
6	CdbHasFailed	Bool: CdbHasFailed bit indicates if there was a failure, after the module has completed execution of the last CDB command 0b: Last triggered CDB command completed successfully 1b: Last triggered CDB command failed
7	CdbIsBusy	Bool: CdbIsBusy status bit indicates whether the module is still busy, or idle and ready to accept a new CDB command 0b: Module idle, host can write 1b: Module busy, host needs to wait

11.7 Remote Commit Firmware Image (CMD: 8036h)

Once the new firmware is running and verified to be working properly, send this command to commit the running image.

- This sets the new firmware as the default image to be used after any future resets.

11.7.1 Command Message Header

CDB Remote Commit FW Image Command Message			
Page	Byte	Attribute	Description
9Fh	128	CMDID	0x8036
	129		
	130	EPL length	N/A
	131		
	132	IPL length	VAR
	133	Cdb chk code	VAR
	134	RPL length	N/A
	135	RPL chk code	N/A
	136	Port	Select the target remote port. For example, in a 2x200G cable configuration, port 0 refers to the first 200G port, and port 1 refers to the second 200G port. The number of available ports is determined by the AppSel configuration.

11.7.2 Reply Message Header

CDB Remote Commit FW Image Command (Reply)			
Page	Byte	Reply	Description
9Fh	134	RPL length	VAR
	135	RPL chk code	VAR

11.7.3 CDB Command Status (Page 0, byte 8 and bytes 37-38)

These registers are updated by the module and shall be read by the host after each command to determine execution status and completion

CDB Command Status				
Page	Byte	Bit	Attribute	Description
0h	8	6	CdbCmdCompleteFlag1	Latched Flag to indicate completion of a CDB command for CDB instance 1
		7	CdbCmdCompleteFlag2	Latched Flag to indicate completion of a CDB command for CDB instance 2
	37	7 - 0	CdbStatus1	Status of the most recent CDB command in CDB instance 1
	38	7 - 0	CdbStatus2	Status of the most recent CDB command in CDB instance 2

CdbStatus			
Bit	Attribute	Description	
5 – 0	CdbCommandResult	The CdbCommandResult field provides more detailed classification for each of the three coarse query results that are encoded by the pair of bit 7 (CdbIsBusy) and bit 6 (CdbHasFailed)	
		Coarse Status	CdbIsBusy CdbHasFailed
		IN PROGRESS	1 X (don't care)
		SUCCESS	0 0
		FAILED	0 1
		The interpretation of CdbCommandResult therefore depends on the coarse status as follows: IN PROGRESS 00h=Reserved 01h=Command is captured but not processed 02h=Command checking is in progress 03h=Command execution is in progress 04h-2Fh=Reserved 30h-3Fh=Custom SUCCESS	

CdbStatus		
Bit	Attribute	Description
		00h=Reserved 01h=Command completed successfully 02h=Reserved 03h=Previous CMD was ABORTED by CMD Abort 04h-1Fh=Reserved 20h-2Fh=Reserved 30h-3Fh=Custom FAILED 00h=Reserved 01h=CMDID unknown 02h=Parameter range error or parameter not supported 03h=Previous CMD was not properly ABORTED (by CMD Abort) 04h=Command checking time out 05h=CdbChkCode Error 06h=Password related error (command specific meaning) 07h=Command not compatible with operating status 08h-0Fh=Reserved for STS command checking error 10h-1Fh=Reserved 20h-2Fh=For individual STS command or task error 30h-3Fh=Custom
6	CdbHasFailed	Bool: CdbHasFailed bit indicates if there was a failure, after the module has completed execution of the last CDB command 0b: Last triggered CDB command completed successfully 1b: Last triggered CDB command failed
7	CdbIsBusy	Bool: CdbIsBusy status bit indicates whether the module is still busy, or idle and ready to accept a new CDB command 0b: Module idle, host can write 1b: Module busy, host needs to wait

12 Host Software

12.1 Telemetry SDK

An SDK defines a standard set of commands for a host to interact with a compliant transceiver. A SONiC implementation is provided. This section describes the list of commands that can be issued from the host for retrieving current link status, retrieving historical event logs, clearing event logs or counters or upgrading firmware. The intention is for the host to continuously harvest the current link status to create link performance timeline that can be streamed to a telemetry server for aggregation into a fabric-wide network map.

12.2 Transceiver Communications

All compliant transceiver communication with the local host is performed over the I2C interface. The commands issued to the local compliant module over I2C may request telemetry data from the local transceiver or from one of the remote link partners. In the case where telemetry data is requested from a remote end point, the local transceiver is responsible for retrieving the remote data and presenting it to the local host. The local host does not directly communicate with the remote link partner modules.

12.3 Command Line APIs

The following commands will be available to interact with compliant transceivers. The low-level commands that are required to build these APIs are defined in this CMIS or in this document.

- Standard CMIS register access – supported from SONiC
- Remote CMIS Register Access (Ability to extract all standard CMIS data from a remote link partner) – see section 4.2. Note there may be multiple remote sides of the link in a breakout or shuffle application.
- Download and display all module telemetry parameters in section 8.2 for any local or remote port
- Local or Remote hitless firmware update see section 11.
- Get or set Epoch time see section 7.
- Event Logs (Local) see section 9.
 - Download last event – output shall be human readable – not bit field
 - Download last [programmable #] of events
 - Clear event log [adjust pointers]
 - R/W event hysteresis (default 10s)
- Event Logs (Remote) see section 9.
 - Download last event – output shall be human readable – not bit field
 - Download last [programmable #] of events
 - Clear event log [adjust pointers]

- R/W event hysteresis (default 10s)
- Module link rating (link health score) display – section 8.3
- The host switch shall record its own pre-FEC BER, uncorrectable codewords measured at its own Serdes Rx input to combine with the telemetry extracted from the optical transceivers.