Hardware Management
ICAP Optical

Version 0.02

Draft

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1 Scope

This document defines the technical specifications for identification and management of optical bays and optical modules for Open Compute Project servers, storage devices and network switches. The specification is limited to the data formats and commands defined in Intelligent Platform Management Interface specification and does not require the presence of an operating system on the device that is managed.

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Revision History

Date	Revision	Description
February 10, 2014	0.01	Initial revision
June 9, 2014	0.02	Added Compact Sensor to detect optical receive loss of single sensors. Added Section OCP Specification Identification.

2 Overview

This describes the Intelligent Platform Management Interface (IPMI) capabilities(ICAP) implemented by an IPM Controller. It extends the IPMI 2.0 specification allowing Data Centers to implement a uniform System Management interface to interact with optical connections between servers, storage devices and network switches.

This specification is one in a series of IPM Controller Capabilities(ICAP) which add functionality not found in the IPMI 2.0 specification.

The requirements present in this document use the prefix OPTI.

2.1 License

2.2 Reference Documents

These documents are referenced by this specification.

2.2.1 Specification Documents

Acronym	Date	Specification
IPMI 2.0	10/1/2013	Intelligent Platform Management Interface Specification Second Generation v2.0, Document Revision 1.1
SFF XFP Diagnostic	1/30/2009	SFF-8472, Diagnostic Monitoring Interface for Optical Transceivers, Revision 10.4

Acronym	Date	Specification
SFF SFP+ Module	7/15/2013	SFF-8431 Specification for SFP+
SFF 8636 CMI	11/25/2013	SFF-8636 Specification for Common Management Interface

2.3 Keywords

shall

A keyword indicating a mandatory requirement; designers are required to implement all such mandatory requirements to ensure interoperability with other products that conform to this specification.

shall not

A keyword used to describe a feature, function, or coded value that is defined in a specification to which this specification makes a normative reference where the use of said feature, function, or coded value is not allowed for implementations of this specification.

2.4 Field Names

Field names within an IPMI Record or Command are in italics. Example: *Contained Entity 1 Instance.*

2.5 Out of Scope

This specification does not contain any requirements for hardware dimensions, connectors and does not mandate Hot Swap of IPMI Controllers.

Ethernet connection or the TCP/UDP protocol is not required to implement this specification.

The electrical interface between the IPM Controller and any device is not defined in this document.

2.6 Private Enterprise Number

The FRU records defined in this document utilize the Private Enterprise Number 42623 assigned to OCP by the Internet Assigned Number Authority , www.iana.org. In a twist of fate that only an IPMI implementer will enjoy, the number assigned to OCP ends in the IPMI UDP port number, 623.

2.7 OCP Specification Identification

This specification is identified by five fields defined in the OCP document Hardware Management SPEC ID. The five field are present in Table 2, OCP Specification Descriptor byte offsets zero to five and Table 4, Get OCP Specification Version byte offsets one to six. The value of the five fields are found in the following requirements.

IPMA-IPM-2.1 The *OCP Specification ID* used to identify any revision of this document

shall be a value of 0x2.

IPMA-IPM-2.2 The *OCP Specification Revision* used to identify this specific document **shall** be a value of 0x0.

2.8 FRU Records

All FRU records defined in this specification contain the Private Enterprise Number as the first three bytes after the record header checksum and is written Least Significant byte first.

3 Optical Interconnect Management

This specification is part of the IPMI Capabilities(ICAP) Identification and Status(IDS) series providing a uniform interface for managing servers, storage devices or network switches. ICAP enables a Data Center System Manager to control rack mounted hardware with minimum operator intervention. The ICAP specifications allow a single technician to operate 10,000 to 50,000 servers.

The IDS set of specifications allow the physical location of a device in a two dimensional grid and provide status information which includes sensors for device present/absent, temperature and voltage.

This document, identified by acronym ICAP-OPTI, defines a set of requirements for an IPM Controller implementing the Intelligent Platform Management Interface (IPMI 2.0) to monitor and control optical modules interconnecting Servers, Storage Devices and Network Switches, which this document collectively calls IT hardware. No distinction is made between the different types of IT hardware. The benefits to the Data Center operator are a uniform, vendor and hardware neutral methods for:

- inventory data collection of model/serial numbers
- on-site customer acceptance tests
- operator training
- test procedures
- diagnostic sensors and control for optical XFP/SFP+/QSFP+ interconnects

The requirements in this document are specific to IPM Controllers in IT hardware and no requirements are made on the System Manager itself. If a System Manager is not present, the IT Hardware will function normally.

This specification is not mandatory for IT Hardware. There is no architectural limitation preventing a single chassis from containing IPM Controllers implementing this specification and IPM Controllers implementing proprietary IPM Controllers.

3.1 Inventory

An IPM Controller allows IT hardware a common interface to identify the location and inventory of optical bays and optical transceivers. A System Manager can keep a real time inventory for a device, rack or room to facilitate planning for network expansion.

A real time inventory can be kept for optical modules cataloging inventory information such as vendor, model and serial number present in the XFP/SFP+/QSFP/QSFP+ modules. The optical modules can be categorized by wavelength, transmission power and form factor(SFP+, QSFP+, etc). When the module inventory is compared with the monitoring data(below) identification of unused modules allows the Data Center operator to redeploy modules instead of purchasing new ones.

When the optical modules are direct connect, the cable can not be disconnected from transceiver at either end, the cable length can be determined. This allows Data Center operators to query their facility to determine, for example, how many unused one meter QSFP+ cables are present.

This specification supports identifying bays for CXP and OEM optical modules but does not define diagnostic or control mechanisms.

3.2 Monitoring

One goal of the ICAP specifications is to provide Data Center operators information on how close the IT hardware is the operating limits. This information is valuable when raising air temperature in a data hall in an effort to decrease operating costs. Optical module transmission and reception performance varies based on temperature and the silicon process technology used within the optical module. The SFF 8636 CMI specification defines a optical module temperature sensor. The sensor is optional and the optical module vendor is responsible for setting the temperature alarm thresholds. The result is a Data Center that contains a mix of optical modules with no standardized temperature alarms.

A System Manger communicating with a IPM Controller implementing ICAP-OPTI(this specification) can determine, on a optical lane by lane basis, within a cable what optical links are in danger of losing the optical connection. This is done independent of protocol, Fiber Channel, Ethernet, Infiniband and monitoring is done while the link maintains live data traffic.

The transmit output power of an optical module varies based on input voltage to the module. The transmit power of the optical modules can also be raised on SFP+ from 1 to 1.5 watts and for QSFP+ from TBD to 4.5 watts. **Question:** Should an IPMI command to change to transmit power be added.

3.3 Testing

The ICAP-OPTI interface to test the optical link is independent to the protocol used on the optical link. This allows a Data Center to create standardized procedures that test Ethernet, Fiber Channel, Infiniband, SAS and OEM protocols. Sensors on the optical module allow bidirectional end-to-end testing with the receiver reporting DB loss.

A System Manager in contact with the IPM Controllers at both ends of a fiber optic link can detect mismatches in optical transceivers and this can be done prior to physically connecting the fiber optic cable. For example by examining the wavelength.

The optical receive power sensors allow a System Manager to remotely test optical links without physical access to the hardware or removing the cabling and inserting test equipment into the optical path. A technician can test the optical links within a rack, between rooms or between buildings, or Data Center sites.

3.4 Lost Cable Identification

Data Centers are dynamic environments with with technicians working multiple shifts and solving crises situations. A common occurrence often due to data entry is the end point of an optical cable getting lost. One end may be connected to a device but the opposite end can not be found. It is time consuming to trace a physical cable because it must be un-bundled in the overhead racks and physically separated from the other plant cables. Often the effort is so high that the cable is abandoned. With direct attach cables and their maximum length of 300 meters.

Direct connect optical modules contain an identical manufacturer serial number at each end. When a IPM Controller implementing ICAP-OPTI is at each end of the cable a System Manager can scan the database and locate the device down to the optical bay number where the lost cable end point is attached.

4 Optical Module Bays

A location where an optical module transceiver may be present is called a Bay. The location may be an aperture in the chassis or where a transceiver is soldered to a printed circuit board.

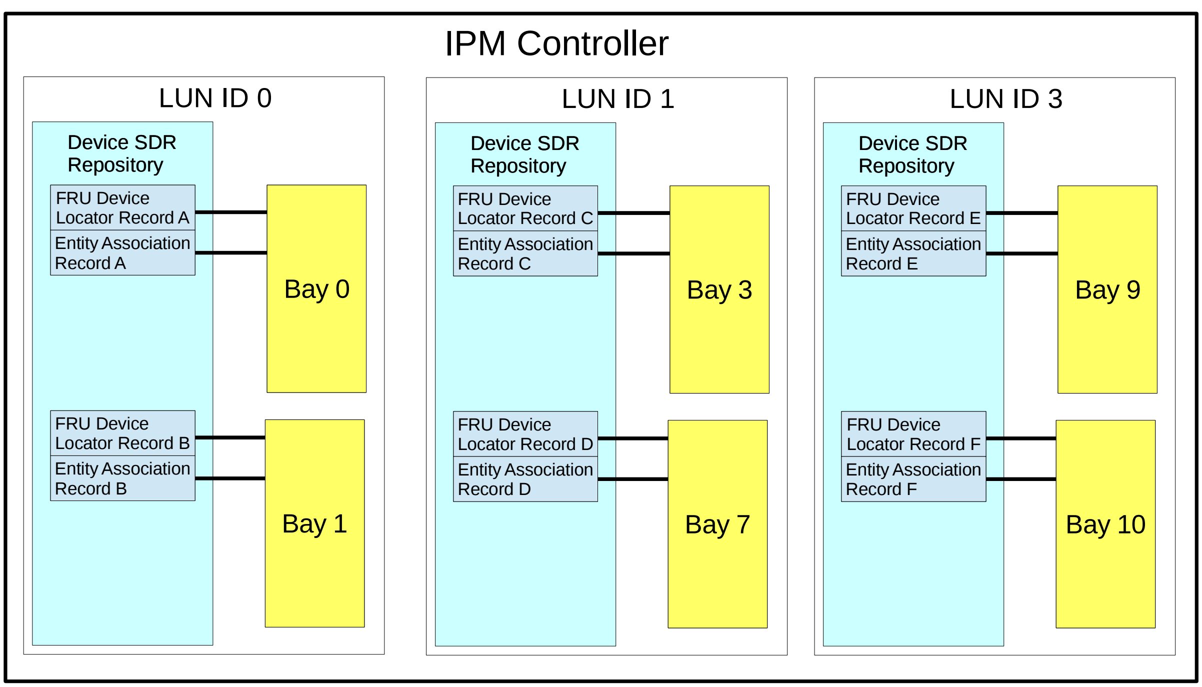
This specification is not designed to allow optical module bays to be inserted or removed while an IPM Controller is operating. It does allow optical modules to be inserted into a bay and removed from a bay while the IPM Controller is operating.

4.1 Logical Bay Identification

A FRU Device Locator Record identifies the logical bay location. It contains the UNICODE characters that uniquely identify the Optical Module Bay either in manufacturer documentation or the characters printed on the face plate adjacent to the Bay. This allows the System Manager to create language dependent error messages that are specific to an Optical Module Bay.

Each LUN ID has a separate Device SDR repository. A single Device SDR Repository contains all bays FRU Device Locator Records that are managed by the LUN ID. There are a maximum of four LUN IDs within an IPM Controller.

Illustration 1: IPMC to Device SDR Repository Mapping



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Each optical bay's FRU Device Locator record contains an Entity ID Instance Number that is unique from all other optical bays' FRU Device Locator records within the same Device SDR Repository.

OPTI-BAY-4.1	Each Optical Module Bay managed by a LUN ID **shall** have a Device SDR Repository at the identical LUN ID containing a FRU Device Locator Record with the *Entity ID* field set to E2h.
OPTI-BAY-4.2	Each IPMI FRU Device Locator Record for an Optical Module Bay **shall** have the field *Device String* set to a value that uniquely identifies the Optical Module Bay.
OPTI-BAY-4.3	All Compact and Full Sensor Records for the Optical Module Bay **shall** be present in the same LUN ID's Device SDR Repository containing the optical module bay's FRU Device Locator Record.
OPTI-BAY-4.4	No FRU Device Locator Records for the optical module bays **shall** have an identical value with any other Optical Module Bay FRU Device Locator Record's *FRU Entity Instance* field.
OPTI-BAY-4.5	If the optical module bay is for a XFP/SFP+, the FRU Device Locator Record for a optical module bay **shall** have the *Device Type* field(byte 11) set to a value to C2h(Table 10: IPMB/I2C Device Type Codes).
OPTI-BAY-4.6	If the optical module bay is for a XFP/SFP+, the FRU Device Locator Record for a optical module bay **shall** have the *Device Type Modifier* field(byte 12) set to a value to C2h(Table 10: IPMB/I2C Device Type Codes).
OPTI-BAY-4.7	If the optical module bay is for a QSFP/QSFP+, the FRU Device Locator Record for a optical module bay **shall** have the *Device Type* field(byte 11) set to a value to C3h(Table 10: IPMB/I2C Device Type Codes).
OPTI-BAY-4.8	If the optical module bay is for a QSFP/QSFP+, the FRU Device Locator Record for a optical module bay **shall** have the *Device Type Modifier* field(byte 12) set to a value to C3h(Table 10: IPMB/I2C Device Type Codes).

Each FRU Device Locator Record has a corresponding Entity Association Record. Both records are located in the same Device SDR Repository. There are additional requirements for the Entity Association Record fields *Contained Entity 1* and *Contained Entity 1 Instance* that vary based on the optical module type. See **TODO:** add cross reference.

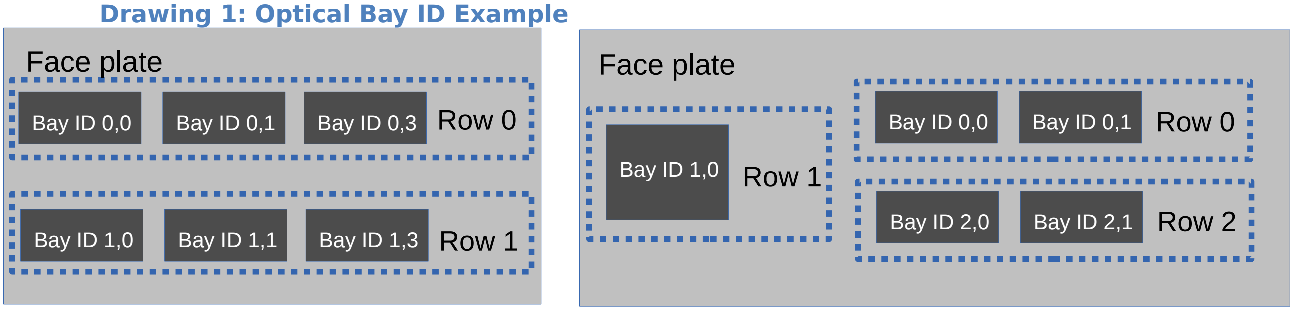
OPTI-BAY-4.9	Each FRU Device Locator Record **shall** have in the same Device SDR Repository an Entity Association Record with the *Container Entity Instance* field set to the same value found in it's associated FRU Device Locator Record *Entity Instance* Field.
OPTI-BAY-4.10	Each Entity Association Record associated with a Optical Bay **shall** have the *Container Entity ID* field set to E2h.

4.2 Physical Bay Identification

Each Optical Module Bay is identified with a physical location in a grid so System

Managers can draw the face plate and visually indicate the bay. The front, back and top of a chassis has a logical two dimension grid where each cell in the grid contains a optical bay. The bays physical location is assigned a row and column number Bay ID. The numeric format for a Bay ID is row number, column number. A Bay ID is unique to the face plate it present on. The upper left hand cell containg a optical bay is assigned a Bay ID of zero, zero.

Drawing 1: Optical Bay ID Example



Each IPM Controller identifies all Optical Module Bays it monitors with one or more Optical Module Bay Address Record.

Table 1. Optical Module Bay Address Record

Offset	Field Length	Field Name
0	1	*Record Type ID*. For all records defined in this specification a value of D0h (OEM) is used.
1	1	End of List/Version [7:7]- End of List. Set to one for the last record. [6:4]- Reserved. Write as 0h. [3:0]- Record Format Version. For this specification 0h.
2	1	Record Length
3	1	*Record Checksum*. The zero Checksum of the record.
4	1	*Header Checksum.* The zero Checksum of the header.
5	3	*Manufacturer ID*. The Private Enterprise number assigned to OCP. Write as 42623 (A67Fh) . Least significant byte first.
8	1	*OCP Record ID*. 04h
9	1	*Record Format Version*. [7:4] Reserved. Write as 0h. [3:0] Format Version ID. Use 0h to identify this table.
9	1	*Bay Type.* 00h Module/connector soldered to motherboard 03h SFP 04h SFP+ 06h XFP 0Bh DWDM-SFP 0Ch QSFP 0Dh QSFP+ 0Eh CXP

Offset	Field Length	Field Name
		Question: Should Shielded Mini Multilane HD 4X, Shielded Mini Multilane HD 8X, QSFP28/CXP2 80h-Ffh OEM Defined All other values reserved.
10	1	*Bay Location Flag*. [7:4] Reserved. Write as zero. [3:0] *Module Bay location*. 0h Rear of chassis 1h front of chassis 2h top of module 3h bottom of module 4h internal interface. 14h OEM defined 15h OEM defined All other values reserved
11	1	*Bay Count*. The number N, of Optical Module Bay Addresses Descriptors in this record.
12	5*N	*Bay Address Lis*t. A variable length list containing Bay Address Count entries. Each entry is five bytes formatted according to Table 2. Optical Module Bay Address Descriptor.

Each Optical Module Bay is identified with an Optical Module Bay Address Descriptor.

Table 2. Optical Module Bay Address Descriptor

Offset	Field Length	Field Name
0	1	*IPMB Address* . The IPMB Address of the Optical Module Bay. Derived from the value found in the FRU Device Locator Record field *Device Access Address* .
1	1	*Internal Address*. [7:4] *Channel number*. The Channel number of the bay. Identical to the value found in the FRU Device Locator Record field *Channel Number*. [3:2] Reserved. Write as zero. [1:0] *LUN ID*. The LUN ID within the IPMB address where the FRU is addressed. This is identical to the value found in the FRU Device Locator Record field *Access LUN.*
2	1	*FRU ID*. The FRU ID of the Optical Module Bay. This is identical to the value found in the FRU Device Locator Record field FRU Device ID.
3	1	*Row Count*. The row number where the optical module is located. Row zero is the top most row in the chassis.
4	1	*Column Count*. The column within the row where the Optical Module Bay is located. Column zero is the left most column.

OPTI-BAY-4.11 If an Optical Module Bay is present on the LUN ID being managed the IPM Controller's FRU Info located at the identical LUN ID, FRU ID 0 **shall** contain one or more Optical Module Bay Address Records.

OPTI-BAY-4.12 Each Optical Module Bay Address Descriptor **shall** have a single IPMI FRU Device locator record with an identical IPMB Address, Channel Number and FRU ID.

OPTI-BAY-4.13 Each Optical Module Bay, populated with a module or un-populated, **shall** have a single Optical Module Bay Address Descriptor.

OPTI-BAY4.14 The contents of the Optical Module Bay Address Record **shall not** change once it has been read.

OPTI-BAY-4.15 If the Optical Module Bay Address Record field *Bay Location Flag* is Rear then each Optical Module Bay Address Descriptor **shall** have a unique Row Count/Column Count combination from all other Optical Module Bays on the rear face plate.

OPTI-BAY-4.16 If the Optical Module Bay Address Record field *Bay Location Flag* is Front then each Optical Module Bay Address Descriptor **shall** have a unique Row Count/Column Count combination from all other Optical Module Bays on the front face plate.

OPTI-BAY-4.17 The *Row Count* field of the Optical Module Bay Address Descriptor **shall** be starting from the top of the face plate with the top row assigned value of zero.

OPTI-BAY-4.18 The *Column Count* field of the Optical Module Bay Address Descriptor **shall** be starting from the left of the face plate with the left most column assigned value of zero.

OPTI-BAY-4.19 The Column Count fields of the Optical Module Bay Address Descriptor within a single row **shall** be assigned in monotonically increasing order starting from the left of the face plate.

4.3 Bay Sensors

Optical modules can be inserted and removed while the IT hardware is running. The IPM Controller is responsible for detecting optical module insertion, generating sensor SDR records and inserting them in the Device SDR repository. When an optical module is removed the IPM Controller removes all SDR records it created when the module was inserted.

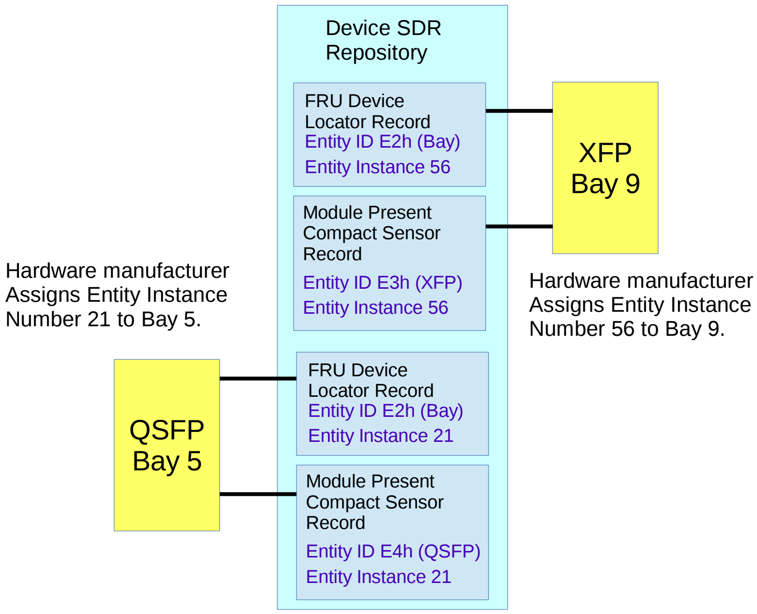
OPTI-BAY-4.20 The IPM Controller **shall** detect the insertion of am optical module into a bay and complete the addition of all the optical module's Compact and Full sensor data records into the device SDR within twenty seconds.

OPTI-BAY-4.21 The IPM Controller **shall** detect the removal of an optical module into a bay and remove the optical module's Compact and Full sensor data records from the device SDR within twenty seconds.

The Entity Instance number present in the FRU Device Locator Record for a single optical module bay is identical for all Compact and Full Sensor Records related to a single optical module bay and it's optical module. When the optical module is inserted in the bay the IPM Controller copies the Entity Instance Number from the

FRU Device Locator record and copies the sensor thresholds to create the Full Sensor Record. Then the Full sensor record is inserted into the same LUN ID's Device SDR repository where the FRU Device Locator Record was found.

Illustration 2: Optical Module Not Present In Bay



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4.3.1 Module Presence Sensor

Each Optical Module Bay has an IPMI sensor to detect when the an optical module is present. The sensor is present in the Device SDR repository at all times.

OPTI-BAY-4.22 For each Optical Module Bay FRU Device Locator Record there **shall** be a Presence Detect Compact Sensor Record with the *Entity Instance*(byte 10) field identical to the FRU Device Locator Record's *FRU Entity Instance* Field(byte 14).

OPTI-BAY-4.23 The Optical Module Bay Presence Detect Compact Sensor Record and Optical Module Bay FRU Device Locator Record that have identical values for the Entity Instance **shall** be present in the same LUN ID's Device SDR.

OPTI-BAY-4.24 Each Optical Module Bay Presence Detect Compact Sensor Record s**hall** have the *Entity ID* field(byte 9) set to E2h(Table 8: Entity ID Assignments).

OPTI-BAY-4.25 Each Optical Module Bay Presence Detect Compact Sensor Record s**hall** have the *Event/Reading Type Code* field set to 8h, Device Absent/Device Present.

OPTI-BAY-4.26 When an Optical Module is removed all Full and Compact Sensor records **shall** be removed from the Device SDR prior to the IPM controller setting the Optical Module Bay's Presence Detect sensor state to 0h(Device Removed / Device Absent). **Todo** Move Down to XFP and QSFP use Entity ID

OPTI-BAY-4.27	When an Optical Module is detected all it's Full and Compact Sensor records **shall** be inserted into the Device SDR prior to the IPM controller setting the Optical Module Bay's Presence Detect sensor state to 1h(Device Inserted / Device Present). **Todo** Move Down to XFP and QSFP use Entity ID
OPTI-BAY-4.28	The Compact Sensor Record defining an Optical Module Bay Presence Detect sensor shall not be removed from the Device SDR Repository.

5 XFP and SFP Modules

The 10 Gigabit Small Form Factor Pluggable (XFP) module optical interface allows IT hardware to communicate using Ethernet, Fibre Channel, InfiniBand and SONET/SDH at rates up to 10Gig/sec. The SFF XFP Diagnostic specification mandates a 2 wire serial interface that an IPM Controller uses to provide identification of the type XFP, maximum transceiver separation, temperature sensors and diagnostics.

The SFF SFP+ Module specification references the SFF XFP Diagnostic specification and makes no changes to the diagnostic capabilities present in SFP+ modules. The SFP+ modules contain a different serial interface. The SFP+ and XFP modules are not physically interchangeable.

An IPM Controller provides a sensor to measure received optical power in 0.1 uWatt increments. Differences in fiber optical cable length, fiber diameter and the temperature of the transmitter cause variations in received optical power. Each optical module provides optical power alarm thresholds which the IPM Controller uses to create an IPMI Full Sensor Record.

5.1 XFP/SFP+ Memory Map

The SFF XFP Diagnostic specification defines two blocks of 128 bytes that define the capabilities of the optical module.

The SFF XFP Diagnostic , Table 3.1 Two-wire interface ID: Data Fields – Address A0h in this document is called the Identity Block, is read only and contains information that identify the optical compatibility, maximum fiber length, signaling rate and vendor identification of the XFP/SFP+.

The SFF XFP Diagnostic , Table 3.1a Diagnostics: Data Fields – Address A2 in this document called the Diagnostic Block, is writable by both the XFP/SFP+ module and the IPM Controller. It contains the thermal/voltage thresholds, current sensor readings, measured transmit/receive laser power and diagnostic status. This block contains a byte, offset 110, that disables/enables the laser output. This function is an optional features of the optical module and if present allows the IPM Controller to test the connectivity with remote optical transceiver.

This specification has no requirements on the protocol interface between the IPM Controller and the XFP/SFP+ module. It may be proprietary or use the interface defined in XFP or SFP+ specifications.

Question: Is there any vendor independent way to set/get the wavelength of the XFP? The ITU-T defines the wavelength and frequency but that usually involves a vendor defined ID written to a I2C address.

5.2 Module Identification

An IPM Controller maps the optical module's 's Identity Blocks data bytes to a FRU ID's FRU Information area as SDR Multi Record. An IPM Controller is not required to read the Identify data until it is received an IPMI Read FRU Info command for the FRU ID. Once the IPM Controller or the System Manager has read the Identity Block data no changes are allowed to that data until the IPM Controller is rebooted.

Table 3. XFP/SFP+ Module Description Record

Offset	Field Length	Field Name
0	1	*Record Type ID*. For all records defined in this specification a value of D0h (OEM) is used.
1	1	End of List/Version [7:7]- End of List. Set to one for the last record. [6:4]- Reserved. Write as 0h. [3:0]- Record Format Version. For this specification 0h.
2	1	Record Length
3	1	*Record Checksum*. The zero Checksum of the record.
4	1	*Header Checksum.* The zero Checksum of the header.
5	3	*Manufacturer ID*. The Private Enterprise number assigned to OCP. Write as 42623 (A67Fh) . Least significant byte first.
8	1	*OCP Record ID*. 05h
9	1	*Record Format Version*. [7:4] Reserved. Write as 0h. [3:0] Format Version ID. Use 0h to identify this table.
10	128	*XFP Module Description*. The block of 128 byes starting at the XFP/SFP+ address A0h as defined by the SFF XFP Diagnostic specification.

OPTI-SFP-5.1 For each XFP/SFP+ Module detected the IPM Controller **shall** validate the Identity Block CRC values at offset 63 is valid for bytes 0 through 62 and the CRC value at offset 95 is valid for bytes offset 64 through 94 before creating the XFP Module's Mutli record containing a single XFP/SFP+ Module Description Record.

5.3 Sensors

The XFP/SFP+ Identity block contains a flag(byte 92, bit 6) that when set indicates the optical module implements a group of five diagnostic sensors. The module's Diagnostic block contains sensor thresholds and readings for optical input power, input bais current, temperature, laser transmit and optical receive power. The IPM Controller reads the Diagnostic Block and creates an IPMI Full Sensor Record for each of the five sensors.

The optical module measures optical receive power. It ranges from 0 to 6.5 milli Watt in 0.1 uWatt increments and varies by wavelength, temperature and input power to the transmitter.

The optical module includes threshold values for the receive optical power level and Data Centers may use sensor readings to determine which IT hardware would most likely be affected when a room temperate is raised. The optical link can be monitored in real time and if the link margin falls below the optical module vendor's defined thresholds a technician can investigate and rectify the degradation before it affects traffic on the optical link.

This specification is designed to work with internally calibrated XFP/SPF+ optical modules. There is no support for externally calibrated modules.

Question: Should a second sensor Event Reading code 8h(enabled/disabled) be added to indicate the XFP/SFP+ is present but CRC in requirement OPTI-QSF-8.23 did validate or there is some other problem?

OPTI-SFP-5.2 For each XFP/SFP+ Module detected the IPM Controller **shall** validate that the Diagnostic Block CRC value at offset 95 is valid for bytes 0 through 94 before creating the XFP Module's Full and Compact Sensor SDR Records.

5.3.1 Module Temperature Sensor

Each XFP/SFP+ Module has an internal temperature sensor. This document does not define how often the IPM Controller reads the XFP/SFP+ Module Temperature.

OPTI-SFP-5.3 If bit 6, address 92 of the Identity Block is set the IPM Controller **shall** create a Full Sensor Record for the XFP/SFP+ module containing the module temperature with the *Entity ID* field set to E3h.

OPTI-SFP-5.4 The XFP/SFP+ Module temperature Full Sensor SDR **shall** have the *Sensor Type* field set to 1h Temperature,

OPTI-SFP-5.5 The XFP/SFP+ Module temperature Full Sensor SDR **shall** contain an upper critical threshold created from the Diagnostic Block byte offsets 0 and 1.

OPTI-SFP-5.6 The XFP/SFP+ Module temperature Full Sensor SDR **shall** contain lower critical threshold created from the Diagnostic Block byte offsets 2 and 3.

OPTI-SFP-5.7 The XFP/SFP+ Module temperature Full Sensor SDR **shall** contain an upper non-critical threshold created from the Diagnostic Block byte offsets 4 and 5.

OPTI-SFP-5.8 The XFP/SFP+ Module temperature Full Sensor SDR **shall** contain an upper non-critical threshold created from the Diagnostic Block byte offsets 6 and 7.

OPTI-SFP-5.9 The IPM Controller **shall read** the Diagnostic Block byte offsets 96 and 97 when determining the XFP/SFP+ Module temperature.

OPTI-SFP-5.10 If bit 4, address 92 of the Identity Block is set, the IPM Controller **shall** convert XFP/SFP+ Module temperature sensor data to IPMI sensor readings using the values in the Identity Block fields bytes 84 through 87.

OPTI-SFP-5.11 If bit 4, address 92 of the Identity Block is set, the XFP/SFP+ Module temperature Full Sensor SDR threshold values **shall** contain values calculated using the Identity Block field's bytes 84 through 87.

5.3.2 Module Input Voltage Sensor

Each XFP/SFP+ Module has an input voltage sensor. This document does not define how often the IPM Controller reads the XFP/SFP+ Module input voltage.

OPTI-SFP-5.12 If bit 6, address 92 of the Identity Block is set, the IPM Controller **shall** create a Full Sensor Record for the XFP module containing the module input voltage with an entity ID of E3h.

OPTI-SFP-5.13 The XFP/SFP+ Module temperature Full Sensor SDR **shall** have the *Sensor Type* field set to 2h Voltage,

OPTI-SFP-5.14 The XFP/SFP+ Module voltage Full Sensor SDR **shall** contain an upper critical threshold created from the Diagnostic Block byte offsets 8 and 9.

OPTI-SFP-5.15 The XFP/SFP+ Module input voltage Full Sensor SDR **shall** contain lower critical threshold created from the Diagnostic Block byte offsets 10 and 11.

OPTI-SFP-5.16 The XFP/SFP+ Module input voltage Full Sensor SDR **shall** contain an upper non-critical threshold created from the Diagnostic Block byte offsets 12 and 13.

OPTI-SFP-5.17 The XFP/SFP+ Module input voltage Full Sensor SDR **shall** contain an upper non-critical threshold created from the Diagnostic Block byte offsets 14 and 15.

OPTI-SFP-5.18 The IPM Controller **shall** read the Diagnostic Block byte offsets 98 and 99 as when determining the XFP/SFP+ Module input voltage.

OPTI-SFP-5.19 The XFP/SFP+ Module input voltage Full Sensor SDR **shall** have the field *Sensor Direction* field(byte 29) set to 01h(input sensor). **Question:** Should it be an output sensor(output from the IPM Controller to XFP ? Also change title of this section in Ouput Sensor.)

OPTI-SFP-5.20 If bit 4, address 92 of the Identity Block is set, the IPM Controller **shall** convert XFP/SFP+ Module input voltage sensor data to IPMI sensor readings using the values in the Identity Block fields bytes 88 through 91.

OPTI-SFP-5.21 If bit 4, address 92 of the Identity Block is set, the XFP/SFP+ Module input voltage Full Sensor SDR threshold values **shall** contain values calculated using the Identity Block field's bytes 88 through 91.

5.3.3 Optical Transmit Power Sensor

The optical transmit power can vary from 0 to 6.5 milli Watt. Each XFP/SFP+ Module has a single optical transmit power sensor. This document does not define how often the IPM Controller reads the XFP/SFP+ Module optical transmit power sensor.

OPTI-SFP-5.22 If bit 6, address 92 of the Identity Block is set the IPM Controller **shall** create a Full Sensor Record for the XFP module containing the module optical transmit power with an entity ID of E3h.

OPTI-SFP-5.23 The XFP/SFP+ Module optical transmit power Full Sensor SDR **shall** have the *Sensor Type* field set to D3h, Table 9: Sensor Type Codes, Optical Transmit Power,

OPTI-SFP-5.24 The XFP/SFP+ Module optical transmit power Full Sensor SDR **shall** contain an upper critical threshold created from the Diagnostic Block byte offsets 24 and 25.

OPTI-SFP-5.25 The XFP/SFP+ Module optical transmit power Full Sensor SDR **shall** contain lower critical threshold created from the Diagnostic Block byte offsets 26 and 27.

OPTI-SFP-5.26 The XFP/SFP+ Module optical transmit power Full Sensor SDR **shall** contain an upper non-critical threshold created from the Diagnostic Block byte offsets 28 and 29.

OPTI-SFP-5.27 The XFP/SFP+ Module optical transmit power Full Sensor SDR **shall** contain an upper non-critical threshold created from the Diagnostic Block byte offsets 30 and 31.

OPTI-SFP-5.28 The IPM Controller **shall** read the Diagnostic Block byte offsets 98 and 99 as when determining the XFP/SFP+ Module optical transmit power.

OPTI-SFP-5.29 The XFP/SFP+ Module optical transmit power Full Sensor SDR **shall** have the *Sensor Direction* field(byte 29) set to 10h(output sensor).

OPTI-SFP-5.30 If bit 4, address 92 of the Identity Block is set, the IPM Controller **shall** convert XFP/SFP+ Module laser transmit sensor data to IPMI sensor readings using the values in the Identity Block fields bytes 80 through 83.

OPTI-SFP-5.31 If bit 4, address 92 of the Identity Block is set, the XFP/SFP+ Module laser transmit Full Sensor SDR threshold values **shall** contain values calculated using the Identity Block field's bytes 80 through 83.

5.3.4 Optical Receive Power Sensor

Each XFP/SFP+ Module has an optical receive power sensor. The optical received power is measured in Milliwatts as an received power average or as a receive modulation amplitude. The received power can range between 0 to 1.5 Milliwatts. This document does not define how often the IPM Controller reads the XFP/SFP+ Module optical receive power sensor.

OPTI-SFP-5.32 If bit 6, address 92 of the Identity Block is set, the IPM Controller **shall** create a Full Sensor Record for the XFP module containing the module optical receive power with an entity ID of E3h.

OPTI-SFP-5.33 If bit 3, address 92 of the Identify Block is set, the XFP/SFP+ Module optical receive power Full Sensor SDR **shall** have the *Sensor Type* field set to D1h, Table 9: Sensor Type Codes, Optical Receive Power Average,

OPTI-SFP-5.34 If bit 3, address 92 of the Identify Block is not set, the XFP/SFP+ Module optical receive power Full Sensor SDR **shall** have the *Sensor Type* field set to D2h Optical Receive Power Modulation Amplitude,

OPTI-SFP-5.35 The XFP/SFP+ Module optical receive power Full Sensor SDR **shall** contain an upper critical threshold created from the Diagnostic Block byte offsets 32 and 33.

OPTI-SFP-5.36 The XFP/SFP+ Module optical receive power Full Sensor SDR **shall** contain lower critical threshold created from the Diagnostic Block byte offsets 34 and 35.

OPTI-SFP-5.37 The XFP/SFP+ Module optical receive power Full Sensor SDR **shall** contain an upper non-critical threshold created from the Diagnostic Block byte offsets 36 and 37.

OPTI-SFP-5.38 The XFP/SFP+ Module optical receive power Full Sensor SDR **shall** contain an upper non-critical threshold created from the Diagnostic Block byte offsets 38 and 39.

OPTI-SFP-5.39 The IPM Controller **shall** read the Diagnostic Block byte offsets 104 and 105 as when determining the XFP/SFP+ Module optical receive power.

OPTI-SFP-5.40 The XFP/SFP+ Module optical receive power Full Sensor SDR **shall** have the *Sensor Direction* field(byte 29) set to 01h(input sensor).

OPTI-SFP-5.41 If bit 4, address 92 of the Identity Block is set the IPM Controller **shall** convert XFP/SFP+ Module optical receive power sensor data to an IPMI sensor readings using the values in the Identity Block fields bytes 56 through 75.

OPTI-SFP-5.42 If bit 4, address 92 of the Identity Block is set, the XFP/SFP+ Module optical receive power Full Sensor SDR threshold values **shall** contain values calculated using the Identity Block field's bytes 56 through 75.

5.3.5 Optical Receive Loss of Signal Sensor

XFP/SFP+ Modules have an optional capability to detect optical Loss of Signal when the receive power falls below the modules ability to convert optical power to an electrical signal. This detects when a cable has been disconnected, the cable length exceeds the module capabilities or other faults.

There is a single Receive Loss of Single Sensor for an optical module. The sensor does not indicate which of the optical lanes is monitored.

The hardware implementing this specification may choose between monitoring the modules RX_LOS digital output pin or he SFF XFP Diagnostic TABLE 3.17: A/D Values and Status Bits (2 Wire Address A2h), byte 110, bit 1.

OPTI-SFP-5.43 If bit 6, address 92 of the Identity Block is set, the IPM Controller **shall** create a Compact Sensor Record for the XFP module containing the module Optical Receive Loss of Signal with an entity ID of E3h.

OPTI-SFP-5.44 If bit 3, address 92 of the Identify Block is set, the XFP/SFP+ Module Optical Receive Loss of Signal Compact Sensor SDR **shall** have the *Sensor Type* field set to D6h, Table 9: Sensor Type Codes, Optical Receive Loss of Signal.

OPTI-SFP-5.45 The XFP/SFP+ Module Optical Receive Loss of Signal Compact Sensor SDR **shall** have the *Sensor Direction* field(byte 29) set to 01h(input sensor).

OPTI-SFP-5.46 The XFP/SFP+ Module Optical Receive Loss of Signal Compact Sensor SDR **shall** contain an *Event/Reading Type* field set to 03h, State Deasserted/State Asserted.

OPTI-SFP-5.47 The XFP/SFP+ Module Optical Receive Loss of Signal Compact Sensor **shall** have a reading of State Deasserted when there is no optical receive signal.

OPTI-SFP-5.48 The XFP/SFP+ Module Optical Receive Loss of Signal Compact Sensor **shall** have a reading of State Asserted when a receive optical signal is present.

5.3.6 Laser Transmission Bias Sensor

Each XFP/SFP+ Module has a transmission bias current sensor. This document does not define how often the IPM Controller reads the XFP/SFP+ Module transmission bias current sensor.

OPTI-SFP-5.49 If bit 6, address 92 of the Identity Block is set the IPM Controller **shall** create a Full Sensor Record for the XFP module containing the module laser bias with an entity ID of E3h.

OPTI-SFP-5.50 The XFP/SFP+ Module temperature Full Sensor SDR **shall** have the *Sensor Type* field set to D4h, Table 9: Sensor Type Codes, Laser Transmission Bias,

OPTI-SFP-5.51 The XFP/SFP+ Module transmission bias current Full Sensor SDR **shall** contain an upper critical threshold created from the Diagnostic Block byte offsets 16 and 17.

OPTI-SFP-5.52 The XFP/SFP+ Module transmission bias current Full Sensor SDR **shall** contain lower critical threshold created from the Diagnostic Block byte offsets 18 and 19.

OPTI-SFP-5.53 The XFP/SFP+ Module transmission bias current Full Sensor SDR **shall** contain an upper non-critical threshold created from the Diagnostic Block byte offsets 20 and 21.

OPTI-SFP-5.54 The XFP/SFP+ Module transmission bias current Full Sensor SDR **shall** contain an upper non-critical threshold created from the Diagnostic Block byte offsets 22 and 23.

OPTI-SFP-5.55 The IPM Controller **shall** read the Diagnostic Block byte offsets 100 and 101 as when determining the XFP/SFP+ Module transmission bias current.

OPTI-SFP-5.56 The XFP/SFP+ Module transmission bias current Full Sensor SDR **shall** have the *Sensor Direction* field(byte 29) set to 10h(output sensor).

OPTI-SFP-5.57 The XFP/SFP+ Module transmission bias current Full Sensor SDR **shall** have the measure units in milliamperes. **Question:** There is no Milliamps in IPMI 2.0 table 45-13 only Amps.

OPTI-SFP-5.58 If bit 4, address 92 of the Identity Block is set, the IPM Controller **shall** convert XFP/SFP+ Module transmission bias current sensor data to IPMI sensor readings using the values in the Identity Block fields bytes 76 through 79.

OPTI-SFP-5.59 If bit 4, address 92 of the Identity Block is set, the XFP/SFP+ Module transmission bias current Full Sensor SDR threshold values **shall** contain values calculated using the Identity Block field's bytes 76 through 79.

6 QFSP/QFSP+ Modules

The QFSP/QFSP+ optical modules are documented in the SFF 8636 CMI specification which supports a 40 Gig link spread over four lanes. Each lane has an optical transmission power and receive power sensors. The maximum power draw by a QSFP/QSFP+ optical module is 4.5 Watts.

6.1 QFSP/QFSP+ Memory Map

The SFF 8636 CMI specification, Table 19 - SERIAL ID: DATA FIELDS is identified in this specification as the Serial ID Block. It contains 128 bytes of read only data and contains information that identify the optical compatibility and vendor identification information.

This specification has no requirements on the protocol interface between the IPM Controller and the QFP/QSFP+ module. It may be proprietary or use the interface defined in SFF 8636 CMI specification.

Question: Is there any vendor independent way to set/get the wavelength of the QSFP+? The ITU-T defines the wavelength and frequency but that usually involves a vendor defined ID written to a I2C address.

6.2 Module Identification

An IPM Controller maps the SFF 8636 CMI optical module's 's Serial ID Block's data bytes to a FRU ID's FRU Information area as SDR Multi Record. An IPM Controller is not required to read the Identify data until it receives an IPMI Read FRU Info command for the FRU ID. Once the IPM Controller or the System Manager has read the Identity Block data no changes are allowed to the data until the IPM Controller is rebooted or the optical module is removed.

Table 4. SFF 8636 Module Description Record

Offset	Field Length	Field Name
0	1	*Record Type ID*. For all records defined in this specification a value of D0h (OEM) is used.
1	1	End of List/Version [7:7]- End of List. Set to one for the last record. [6:4]- Reserved. Write as 0h. [3:0]- Record Format Version. For this specification 0h.
2	1	Record Length
3	1	*Record Checksum*. The zero Checksum of the record.
4	1	*Header Checksum.* The zero Checksum of the header.
5	3	*Manufacturer ID*. The Private Enterprise number assigned to OCP. Write as 42623 (A67Fh) . Least significant byte first.
8	1	*OCP Record ID*. 06h
9	1	*Record Format Version*. [7:4] Reserved. Write as 0h. [3:0] Format Version ID. Use 0h to identify this table.
10	128	*Quad Module Description*. The block of 128 byes identified in the

Offset	Field Length	Field Name
		SFF 8636 CMI as Table 19, - SERIAL ID: DATA FIELDS.

OPTI-QSF-6.1 For each QSFP/QSFP+ Optical Module detected the IPM Controller **shall** validate the Serial ID Block CRC values at offset 191 is valid for bytes 128 through 190 and the CRC value at offset 223 is valid for bytes offset 192 through 222 before creating the QSFP Module's Mutli record containing a single SFF 8636 Module Description Record.

Question: Should a second sensor Event Reading code 8h(enabled/disabled) be added to indicate the QSFP/QSFP+ is present but CRC did validate or there is some other problem?

TODO: add FRU Device locator record requirement. Add requirement that all SDR records for the module contain the same Entity Instance as in the FRU Device locator record.

6.3 Sensors

The SFF 8636 CMI specification defines input voltage and temperature sensors for the module. Each of the four optical channels within the module have sensors for optical transmission receive and transmit power.

If the optical modules lower page field name Status (byte 2, bit 2) is not set the sensor thresholds are mandatory and 14 (3 Module Sensors+4 channels * 3 sensors) IPMI Full sensor records are created for the module.

When the IPM Controller detects a QSFP/QSFP+ module has been inserted into the bay, it creates the Compact and Full Sensor records and inserts them into the Device SDR Repository of the LUN ID that monitors the optical bay.

TODO: add that Device SDR is on the LUN

6.3.1 Module Sensors

A QSFP/QSFP+ optical module contains three sensors indicating the state of the entire module.

6.3.2 Far Side Module Sensor

A Compact Sensor Record indicates if the optical module is connected to a SFF 8636 CMI compatible module on the far side of the optical links.

OPTI-QSF-6.2 The IPM Controller **shall** create a Compact Sensor Record with the Entity ID Field set to E4h with the QSFP/QSFP+module Far Side state from the SFF 8636 CMI Table 18 Free Side Device Properties byte 110, bit 3

OPTI-QSF-6.3 The Compact Sensor for the Far Side State **shall** contain an *Event/Reading Type* field set to 08h, The Device Removed / Device Absent and Device Inserted / Device Present.

OPTI-QSF-6.4 The IPM Controller **shall** reflect within ten seconds a change in the state of the SFF 8636 CMI Table 18 Free Side Device Properties byte 110, bit 3 in the state of the sensor defined in the Compact Sensor Record for the Far Side

State.

6.3.2.1 Module Temperature Sensor

This document does not define how often the IPM Controller reads the QSFP/QSFP+ Module's channels temperature sensor.

OPTI-QSF-6.5 For each of the QSFP/QSFP+ module's channels, the IPM Controller **shall** create a Full Sensor Record an Entity ID of E4h.

OPTI-QSF-6.6 The Full Sensor Record for an QSFP/QSFP+ module channel's temperature **shall** have the *Sensor Type* field set to 01h, temperature.

6.3.2.2 Module Input Voltage Sensor

This document does not define how often the IPM Controller reads the QSFP/QSFP+ Module's channel input voltage sensor.

OPTI-QSF-6.7 For each of the QSFP/QSFP+ module's channels, the IPM Controller **shall** create a Full Sensor Record for the channel input voltage with an Entity ID of E4h.

OPTI-QSF-6.8 The Full Sensor Record for an QSFP/QSFP+ module channel's input voltage **shall** have the *Sensor Type* field set to 02h, Voltage.

OPTI-QSF-6.9 The QSFP/QSFP+ module channel's input voltage Full Sensor SDR **shall** have the *Sensor Direction* field(byte 24) set to 01h(input sensor).

6.3.3 Channel Sensors

A QSFP/QSFP+ module contains four optical links each with it's own set of three sensors. The optical transmit and receive power.

A QSFP/QSFP+ optical module contains four optical links, called channels by the SFF 8636 CMI specification and they are numbered one through four. Each channel contains it's own set of sensors for temperature, receive optical power, transmit optical power and transmit bias. The sensors thresholds are optional.

The channels are differentiated in the Compact and Full sensor records by the sensor name. The QSFP/QSFP+ Channel 1 has an IPMI Sensor name of "1".

6.3.3.1 Optical Transmit Power Sensor

This document does not define how often the IPM Controller reads the QSFP/QSFP+ Module's channel optical transmit power sensor.

OPTI-QSF-6.10 For each of the QSFP/QSFP+ module's channels the IPM Controller **shall** create a Full Sensor Record for the channel's optical transmit power with an Entity ID of E4h.

OPTI-QSF-6.11 The Full Sensor Record for an QSFP/QSFP+ module channel's optical transmit power **shall** have the *Sensor Type* field set to D3h, Table 9: Sensor Type Codes, Optical Transmit Power.

OPTI-QSF-6.12 The QSFP/QSFP+ module channel's optical transmit power Full Sensor SDR

shall have the *Sensor Direction* field(byte 29) set to 02h(output sensor).

OPTI-QSF-6.13 The QSFP/QSFP+ Module optical transmit power Full Sensor SDR **shall** have the *ID String Bytes* Field(byte 49) set to a single ASCII character of either 1,2,3 or 4 indicating the QSFP/QSFP optical channel number.

6.3.3.2 Optical Receive Power Sensor

The optical received power is measured in Milliwatts as an received power average or as receive modulation amplitude. The received power can range between 0 to 6.5535 Milliwatts.

This document does not define how often the IPM Controller reads the QSFP/QSFP+ Module's channel optical receive power sensor.

OPTI-QSF-6.14 For each of the QSFP/QSFP+ module's channels the IPM Controller **shall** create a Full Sensor Record for the channel's optical receive power with an Entity ID of E4h.

OPTI-QSF-6.15 If the Serial ID Block. byte 220, bit 3 is set the the Full Sensor Record for an QSFP/QSFP+ module channel's optical receive power **shall** have the *Sensor Type* field set to D1h, Table 9: Sensor Type Codes, Optical Receive Power Average.

OPTI-QSF-6.16 If the Serial ID Block. byte 220, bit 3 is not set the Full Sensor Record for an QSFP/QSFP+ module channel's optical receive power **shall** have the *Sensor Type* field set to D2h, Table 9: Sensor Type Codes, Optical Receive Power Modulation Amplitude.

OPTI-QSF-6.17 The QSFP/QSFP+ Module optical receive power Full Sensor SDR **shall** have the *Sensor Direction* Field(byte 24) set to 01h(input sensor).

OPTI-QSF-6.18 The QSFP/QSFP+ Module optical receive power Full Sensor SDR **shall** have the *ID String Bytes* Field(byte 49) set to a single ASCII character of either 1,2,3 or 4 indicating the QSFP/QSFP optical channel number.

6.3.3.3 Optical Receive Loss of Signal Sensor

QSFP/QSFP+ Modules have the capability to detect optical Loss of Signal when the receive power falls below the modules ability to convert optical power to an electrical signal. This detects when a cable has been disconnected, the cable length exceeds the module capabilities or other faults.

Each channel in the module has it's own Optical Receive Loss of Signal Sensor.

OPTI-SFP-6.19 For each of the QSFP/QSFP+ module's channels the IPM Controller **shall** create a Compact Sensor Record for the channel's Optical Receive Loss of Signal with an Entity ID of E4h.

OPTI-SFP-6.20 The QSFP/QSFP+ module's Optical Receive Loss of Signal Compact Sensor SDR **shall** have the *Sensor Type* field set to D6h, Table 9: Sensor Type Codes, Optical Receive Loss of Signal.

OPTI-SFP-6.21 The QSFP/QSFP+ Module Optical Receive Loss of Signal Compact Sensor SDR **shall** have the *Sensor Direction* Field(byte 24) set to 01h(input sensor).

OPTI-SFP-6.22 The QSFP/QSFP+ Module Optical Receive Loss of Signal Compact Sensor

	SDR **shall** contain an *Event/Reading Type* field set to 03h, State Deasserted /State Asserted.
OPTI-SFP-6.23	The QSFP/QSFP+ Module Optical Receive Loss of Signal Compact Sensor **shall** have a reading of State Deasserted when there is no optical receive signal on the channel
OPTI-SFP-6.24	The QSFP/QSFP+ Module Optical Receive Loss of Signal Compact Sensor **shall** have a reading of State Asserted when a receive optical signal is present on the channel.
OPTI-SFP-6.25	The QSFP/QSFP+ Module Optical Receive Loss of Signal Compact Sensor SDR **shall** have the *ID String Bytes* Field(byte 49) set to a single ASCII character of either 1,2,3 or 4 indicating the QSFP/QSFP optical channel number.

6.3.3.4 Laser Transmission Bias Sensor

The laser transmission bias has a measurement range of 0 to 131 milliamp with a resolution of 2 microamps.

This document does not define how often the IPM Controller reads the QSFP/QSFP+ Module's channel laser transmission bias sensor.

OPTI-QSF-6.26	For each of the QSFP/QSFP+ module's channels the IPM Controller **shall** create a Full Sensor Record for the channel's optical transmit bias with an Entity ID of E4h.
OPTI-QSF-6.27	The Full Sensor Record for an QSFP/QSFP+ module channel's optical transmit power **shall** have the *Sensor Type* field set to D4h, Table 9: Sensor Type Codes, Laser Transmission Bias.
OPTI-QSF-6.28	The QSFP/QSFP+ Module transmission bias current Full Sensor SDR **shall** have the *Sensor Direction* field(byte 29) set to 10h(output sensor).
OPTI-QSF-6.29	The QSFP/QSFP+ Module transmission bias Full Sensor SDR **shall** have the *ID String Bytes* Field(byte 49) set to a single ASCII character of either 1,2,3 or 4 indicating the QSFP/QSFP optical channel number.

6.3.3.5 **Optical Output Sensor**

The optical output sensor indicates if a single optical channel has been enabled for output or disabled.

OPTI-QSF-6.30	For each of the QSFP/QSFP+ module's channels, the IPM Controller **shall** create a Compact Sensor Record for the channel's optical transmit state with an Entity ID of E4h.
OPTI-QSF-6.31	The Compact Sensor for the optical transmit state **shall** contain an *Event/Reading Type* field set to 03h, State Asserted.
OPTI-QSF-6.32	The Compact Sensor for the optical transmit state **shall** contain a *Sensor Type* field set to D5h(Table 9: Sensor Type Codes, Optical Transmit State).
OPTI-QSF-6.33	The QSFP/QSFP+ Module transmission output state Compact Sensor SDR **shall** have the *Sensor Direction* field(byte 29) set to 10h(output sensor).
OPTI-QSF-6.34	The Compact Sensor for the optical transmit state **shall** contain a *ID String*

Bytes field with a single character of either 1,2,3 or 4 indicating the QSFP/QSFP optical channel number.

Question: Should TX and TX optical squelch have sensors ?

7 Optical Output Control

If the IPM Controllers at both ends of the fiber optic cable implement this specification a System Manager can validate that the cable is connected to the correct port by toggling the laser state and reading the optical receive power. Each IPM Controller creates an IPMI Compact Sensor record for both the transmit and receive state of each optical modules laser.

7.1 Optical Transmit Command

The IPM Controller enables or disables the optical transmitter when it receives a Set Optical Transmit State Command command.

Table 5: Set Optical Transmit State Command

	Byte	Data Field
Request Data	0:2	*OCP Private Enterprise Number*. The Private Enterprise number assigned to OCP. The value 42623 (A67Fh) . Least significant byte first.
	3	*FRU ID*. The FRU ID of the Optical Module Bay within the IPMB and LUN ID the command is sent to.
	4	Optical Channel Number. [7:6] Reserved. Write as zero. [5:0] Channel number. The optical channel number to change. 0h Reserved.
	4	Laser Output Flags. [7:1] Reserved. Write as zero. [0:0] Laser Transmit State. If set the laser output will be enabled. If not set the laser output will be disabled.
Response Data	0	*Completion Code*.

441 # 8 ID Assignment

442 **Table 6: IPMI Command ID Assignment**

Command Name	Table Number	Command ID	Minimum Privilege Level
Set Optical Transmit State Command	5	4h	Administrator

443 **Table 7: FRU Information Record ID Assignments**

FRU Record Name	Table Number	Record ID	Chassis Manager	Node Manager
Optical Module Bay Address Record	1	4h	Yes	Yes
XFP/SFP+ Module Description Record	3	5h	Yes	Yes
SFF 8636 Module Description Record	4	6h	Yes	Yes

444 **Table 8: Entity ID Assignments**

Entity ID	Entity Name
E2h	Optical Module Bay
E3h	XFP/SFP+ Optical Transceiver Module
E4h	QSFP/QSFP+ Optical Transceiver Module

445 **Table 9: Sensor Type Codes**

Sensor Type Code	Sensor Name
D1h	Optical Receive Power Average
D2h	Optical Receive Power Modulation Amplitude
D3h	Optical Transmit Power
D4h	Laser Transmission Bias
D5h	Optical Transmit State
D6h	Optical Receive Loss of Signal

446 The OEM values for the IPM 2.0, Table 43-1, PMB/I2C Device Type Codes.

447 **Table 10: IPMB/I2C Device Type Codes**

Sensor Type Code	Sensor Name
C2h	XFP/SFP+ Module Bay
C3h	QSFP/QSFP+ Module Bay