SFF-8024

Specification for

SFF Module Management Reference Code Tables

Rev 4.6 February 14, 2019

SECRETARIAT: SFF TA TWG

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ABSTRACT:

This specification provides codes for module identifiers, encoding values, connector types, extended compliance codes, host electrical interfaces and module media interfaces.

This specification is the reference source for identifiers assigned to interpret the memory maps of self-identifying modules.

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Foreword

The development work on this specification was done by the SNIA SFF TWG, an industry group. Since its formation as the SFF Committee in August 1990, the membership has included a mix of companies which are leaders across the industry.

For those who wish to participate in the activities of the SFF TWG, the signup for membership can be found at http://www.snia.org/sff/join.

Revision History

Rev 0.7	-	Table 3-1 changed per comments received during ballot
	-	Figure 3-3 example added
Rev 0.8	-	As requested by Transceiver SSWG, added color to Figure 3-3
Rev 0.9	-	As requested, filled in more cells for SFP+ and CXP.
Rev 1.0	-	Corrected CXP 802.3ba as applicable to SFF-8647
Rev 1.1	-	Removed logo on connectors in Figure 3-1 and Figure 3-2
Rev 1.2	-	Changed '>' to 'and' in Table 3-1
	-	Added master table for Identifier Values as per Transceiver SSWG
	-	Added master table for Encoding Values
Rev 1.3	-	Added SFP+ 4 Gb/s to Table 3-1
Rev 1.4	-	Expanded the Identifier Values table
	-	Added master table for Specification Compliance Codes
	-	Added master table for Extended Specification Compliance Codes
Rev 1.5	-	Expanded single sentence about SFF-8063 to a paragraph with emphasis
Rev 1.6	-	Identified superseded specifications in Table 3-1
Rev 1.7	-	Expanded HD to include unshielded and add 24 Gb/s
Rev 1.8	-	Aligned SFP naming w/QSFP nomenclature
Rev 1.9	-	Added 0Bh to the Extended Specification Compliance Codes
Rev 2.0	-	Changed SFP Common Management Spec to SFF-8472
	-	Deleted 802.3bj from 28 Gb/s CXP
Rev 2.1	-	Aligned CXP and HD naming w/QSFP nomenclature
Rev 2.2	-	Replaced duplicated codes 08-0Ah in the Extended Specification Compliance Codes
	-	Clarified active cable and CWDM4 codes
Rev 2.3	-	Expanded 0Bh in Identifier Values to include SFP+
	-	Added 13-16h to the Extended Specification Compliance Codes
	-	The Encoding Values which were thought to be common between SFF-8472 and SFF-8636 are not. The table was deleted and restored to SFF-8636.
	-	The Specification Compliance Codes are not subject to change. The table was deleted and restored to SFF-8636.
Rev 2.4	-	Added 13h to Identifier Values
Rev 2.5	-	Restored the Encoding Values from SFF-8472 and SFF-8636
	-	Added Connector Types from SFF-8472 and SFF-8636
	-	Added 07h to Encoding Values
	-	Added 0Dh and 24h to Connector Types
	-	Split Table 3-1 Integrated Pluggable Solution specifications which were referenced by another Integrated Pluggable Solution: o SFF-8084 reference changed to SFF-8071 o SFF-8431 reference changed to SFF-8419 o SFF-8643 reference changed to SFF-8613 o SFF-8644 reference changed to SFF-8614 o SFF-8647 reference changed to SFF-8617
Rev 2.6	-	Added note in 4.1 about overlap with CFP MSA codes
	-	Removed IEEE references from CXP rows
Rev 2.7	-	Added 14-15h Fanouts to Identifier Values
Rev 2.8	-	Added specification numbers for QSFPx management

- Added SFF-8418 to Table 3-1

Rev 2.9 - Added 16h 10GBASE-T with SFI electrical interface to Extended Specification Compliance Codes

Rev 3.0 - Added 17h QSFP28 100G CLR4 to Extended Specification Compliance Codes

Rev 3.1 - Renamed Table 3-1 and added Table 3-2 Device Connectors

Rev 3.2 - Renamed Mini-SAS HD as Mini Multilane HD in Figure 3-2

- Updated Identifier Values with backward compatible cables and modules
- Added 25G Ethernet and AOC, ACC equivalents to Extended Specification Compliance Codes

Rev 3.3 - Added Extended SCC 17h microQSFP

Rev 3.4 - Added Extended SCC 1Ah 2 lambda DWDM 100G

- Added Encoding Value 08h PAM4

Rev 3.5 - Replaced Table 3-2

Rev 3.6 - Removed reference to SFF-8436 for Extended Compliance Codes in 4

Rev 3.7 - Corrected entries for CWDM4

Rev 3.8 - Added 25GBASE to 03h and 04h 100GBASE

Rev 3.9 - Changed 1Ah acronym to 100GE-DWDM2 and added description

Rev 4.0 - Added new codes 1Bh-20h in Extended compliance codes Table 4-4

Rev 4.2 Added new code 21h (100G PAM4 BiDi)in Extended compliance code Table 4-4

Rev 4.3 Added new code 19h for OSFP in Identifier values Table 4-1
Added new code 22h for 4WDM-10 MSA in Table 4-4
Added new code 23h for 4WDM-20 MSA in Table 4-4
Added new code 24h for 4WDM-40 MSA in Table 4-4

Rev 4.4 Incorporated changes from June 7 2017 meeting including:
Deleted all references to Seagate FTP site
Restructured Table 3-1
Updated Fig 3-3
Added multi-lane text to section 4.4
Changed ANSI reference to INCITS

Rev 4.5 Updated Tables 3-1, 3-2
Added new code 1Ah for SFP-DD in Table 4-1
Added new codes for CS and mini CS connectors to Table 4-3
Added new codes for 50G/lane and 100G PMDs in Table 4-4
Added new codes for 64GFC and 128GFC in Table 4-4
Added Module-Host Electrical Interface Codes as Table 4-5

Rev 4.6 *March 8, 2019*
Changed name from 'SFF Cross Reference to Industry Products' to 'SFF Module Management Reference Code Tables'
Deleted Tables 3-1, 3-2 (See REF-TA-1011)
Added new Module Media code Tables 4-6,7,8,9,10
Updated Module-Host Electrical Interface Codes Table 4-5
Added codes for DSFP, x4 MiniLink/OCuLink, x8 MiniLink, QSFP with CMIS (Table 4-1)
Reworded description of 0Dh code in Table 4-1
Added text to note 2 in Table 4-1
Added note 1 in Table 4-5
Corrected BER from $2.4x10^{-6}$ to $2.6x10^{-6}$ in Table 4-9
Added code for active cable with BER <10-6 in Table 4-9

Contents

Figures

Tables

1. Scope

This specification defines the SFF Module Management Reference Codes. This specification provides codes for module identifiers, encoding values, connector types, extended compliance codes, host electrical interface and module media interface. These codes are used to advertise module capabilities in a module memory map.

2. References, Conventions, Keywords, Definitions

2.1 Industry Documents

- InfiniBand Architecture Specification Volume 2

- CPRI V7.0
- ITU-T G.709/Y.1331
- IEEE Std 802.3
- ITU-T G.Sup58

- INCITS FC-PI-4,5,6,6p,7
- INCITS 417 SAS-1.1 (Serial Attached SCSI - 1.1)
- INCITS 457 SAS-2 (Serial Attached SCSI - 2)
- INCITS 478 SAS-2.1 (Serial Attached SCSI - 2.1)
- INCITS 519 SAS-3 (Serial Attached SCSI - 3)
- INCITS 534 SAS-4 (Serial Attached SCSI - 4)

- SFF-8071 SFP+ 1X 0.8mm Card Edge Connector
- INF-8077 XFP 1X 10 Gb/s Pluggable Module
- SFF-8081 SFP+ 1X 16 Gb/s Pluggable Transceiver Solution (SFP16)
- SFF-8083 SFP+ 1X 10 Gb/s Pluggable Transceiver Solution (SFP10)
- SFF-8084 SFP+ 1X 4 Gb/s Pluggable Transceiver Solution
- SFF-8402 SFP+ 1X 28 Gb/s Pluggable Transceiver Solution (SFP28)
- SFF-8418 SFP+ 10 Gb/s Electrical Interface
- SFF-8419 SFP+ Power and Low Speed Interface
- SFF-8432 SFP+ Module and Cage
- SFF-8433 SFP+ Ganged Cage
- SFF-8436 QSFP+ 4X 10 Gb/s Pluggable Transceiver
- INF-8438 QSFP 4X 4 Gb/s Transceiver (Quad SFP)
- SFF-8449 Management Interface for SAS Shielded Cables
- SFF-8472 Management Interface for SFP+
- SFF-8482 Serial Attachment 2X Unshielded Connector
- SFF-8613 Mini Multilane 4/8X Unshielded Connector (HDun)
- SFF-8614 Mini Multilane 4/8X Shielded Cage/Connector (HDsh)
- SFF-8617 Mini Multilane 12X Shielded Cage/Connector (CXP)
- SFF-8630 Serial Attachment 4X 12 Gb/s Unshielded Connector
- SFF-8635 QSFP+ 4X 10 Gb/s Pluggable Transceiver Solution (QSFP10)
- SFF-8636 Management Interface for Cabled Environments
- SFF-8639 Multifunction 6X Unshielded Connector
- SFF-8640 Serial Attachment 4X 24 Gb/s Unshielded Connector
- SFF-8642 Mini Multilane 12X 10 Gb/s Shielded Connector (CXP10)
- SFF-8643 Mini Multilane 4/8X 12 Gb/s Unshielded Connector (HD12un)
- SFF-8644 Mini Multilane 4/8X 12 Gb/s Shielded Cage/Connector (HD12sh)
- SFF-8647 Mini Multilane 12X 14 Gb/s Shielded Cage/Connector (CXP14)
- SFF-8648 Mini Multilane 12X 28 Gb/s Shielded Cage/Connector (CXP28)
- SFF-8661 QSFP+ 4X Pluggable Module
- SFF-8662 QSFP+ 4X Connector (Style A)
- SFF-8663 QSFP+ Cage (Style A)

- SFF-8665 QSFP+ 4X 28 Gb/s Pluggable Transceiver Solution (QSFP28)
- SFF-8672 QSFP+ 4X Connector (Style B)
- SFF-8678 Serial Attachment 2X 6 Gb/s Unshielded Connector
- SFF-8679 QSFP+ 4X Base Electrical Specification
- SFF-8680 Serial Attachment 2X 12 Gb/s Unshielded Connector
- SFF-8681 Serial Attachment 2X 24 Gb/s Unshielded Connector
- SFF-8682 QSFP+ 4X Connector
- SFF-8683 QSFP+ Cage
- SFF-8685 QSFP+ 4X 14 Gb/s Pluggable Transceiver Solution (QSFP14)
- REF-TA-1011 Cross Reference to Select SFF Connectors and Modules

- QSFP-DD	www.qsfp-dd.com	
- SFP-DD	www.sfp-dd.com	
- OSFP	www.osfpmsa.org	
- DSFP	www.dsfpmsa.org	
- QSFP-DD	Common Management Interface Specification (CMIS)	www.qsfp-dd.com
- DSFP	Management Interface Specification (ACMIS)	www.dsfpmsa.org
- CLR4		
- SWDM	www.SWDM.org	
- 4WDM	www.4wdm-msa.org	

2.2 Sources

The complete list of SFF documents which have been completed, are currently being worked on, or that have been expired by the SFF Committee can be found at http://www.snia.org/sff/specifications. Suggestions for improvement of this specification will be welcome, they should be submitted to http://www.snia.org/feedback.

Copies of INCITS standards may be obtained from the InterNational Committee for Information Technology Standards (http://www.techstreet.com/incitsgate.tmpl).

Copies of PCIe standards may be obtained from the PCI-SIG (http://pcisig.com).

Copies of InfiniBand standards may be obtained from the InfiniBand Trade Association (IBTA) (http://www.infinibandta.org).

Copies of IEEE standards may be obtained from the Institute of Electrical and Electronics Engineers (IEEE) (https://www.ieee.org).

Copies of SAS standards may be obtained from the International Committee for Information Technology Standards (INCITS) (http://www.incits.org).

Copies of OIF Implementation Agreements may be obtained from the Optical Internetworking Forum (http://www.oiforum.com).

Copies of Electronic Industries Alliance (EIA) standards may be obtained from the Electronic Components Industry Association (ECIA) (https://www.ecianow.org).

Copies of SFP-DD specifications may be obtained from the SFP-DD MSA group (https://www.sfp-dd-msa.org).

Copies of QSFP-DD specifications may be obtained from the QSFP-DD MSA group (https://www.qsfp-dd.com)

Copies of CMIS (Common Management Interface Specification) may be obtained from the QSFP-DD MSA group (https://www.qsfp-dd.com)

Copies of DSFP specification may be obtained from the DSFP MSA group (https://www.dsfpmsa.org).

Copies of the microQSFP specification may be obtained from the microQSFP MSA group (https://www.microqsfpmsa.com).

2.3 Conventions

The following conventions are used throughout this document:

DEFINITIONS
Fanout Cable: A single connector cable assembly which splits into a number of connectors at the other end.

NUMBERING CONVENTIONS
The ISO convention of numbering is used i.e., the thousands and higher multiples are separated by a space and a period is used as the decimal point. This is equivalent to the English/American convention of a comma and a period.

American	**French**	**ISO**
0.6	0,6	0.6
1,000	1 000	1 000
1,323,462.9	1 323 462,9	1 323 462.9

2.4 Keywords, Acronyms, and Definitions

For the purposes of this document, the following keywords, acronyms, and definitions apply.

2.4.1 Keywords

May/may not: A keyword that indicates flexibility of choice with no implied preference.

Obsolete: A keyword indicating that an item was defined in prior specifications but has been removed from this specification.

Optional: A keyword that describes features which are not required by the SFF specification. However, if any feature defined by the SFF specification is implemented, it shall be done in the same way as defined by the specification. Describing a feature as optional in the text is done to assist the reader.

Reserved: A keyword used for defining the signal on a connector contact [when] its actual function is set aside for future standardization. It is not available for vendor specific use. Where this term is used for bits, bytes, fields, and code values; the bits, bytes, fields, and code values are set aside for future standardization. The default value shall be zero. The originator is required to define a Reserved field or bit as zero, but the receiver should not check Reserved fields or bits for zero.

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.

Should: A keyword indicating flexibility of choice with a strongly preferred alternative.

Vendor specific: A keyword indicating something (e.g., a bit, field, code value) that is not defined by this specification. Specification of the referenced item is determined by the manufacturer and may be used differently in various implementations.

2.4.2 Acronyms and Abbreviations

4WDM
AOC: Active Optical Cable
BNC: Bayonet Neill-Concelman
CAUI: 100G Attachment Unit Interface
CDFP: 16 Lane Form factor Pluggable Module
CLR4
CMIS: Common Management Interface Specification
CS: Corning/Senko
CXP: 100G 12 lane Pluggable Module
DAC: Direct Attach Copper (passive)
ACC: Active Copper Cable
DSFP: Dual Small Form Factor Pluggable
DWDM: Dense Wavelength Division Multiplexing
GBIC: Giga Bit Interface Converter
HSSDC: High Speed Serial Data Connector
LC: Lucent Connector

MPO: Multi-fiber Push-On connector
MT-RJ
MU
MXC: Multi-media eXtension Connector
OSFP: Octal Small Form Factor Pluggable
PAM4: Pulse Amplitude Modulation 4 levels
PSM4: Parallel Single Mode 4 lane

QSFP: Quad Small Form Factor Pluggable
QSFP-DD: Quad Small Form Factor Pluggable Double Density
RJ45
SC
SFI: SFP+ high speed electrical interface
SFP: Small Form Factor Pluggable
SFP-DD: Small Form Factor Pluggable Double Density
SG
SWDM
TNC: Threaded Neill-Concelman

X2: 10G form factor pluggable
XAUI: 10 lane Attachment Unit Interface
XENPAK: 10Gbit Ethernet transceiver Package
XFF
XFF-E
XFI: XFP high speed electrical Interface
XFP: 10G Form factor Pluggable
XPAK: 10G form factor pluggable

2.4.3 Definitions

Connector: Each half of an interface that, when joined together, establish electrical contact and mechanical retention between two components. In this specification, the term connector does not apply to any specific gender; it is used to describe the receptacle, the plug or the card edge, or the union of receptacle to plug or card edge. Other common terms include: connector interface, mating interface, and separable interface.

Module: In this specification, module refers to:
1) an assembly that is terminated with a plug (See Figure 2-1) at the end of a direct attach copper (DAC), an active copper cable (ACC) or an active optical cable(AOC) intended to mate to a receptacle .
or
2) an optical transceiver typically inserted into a front panel socket that connects to the electrical interface of the system with a plug (See Figure 2-1) and the optical interface of the outside world

Plug: A term used to describe the connector that contains the penetrating contacts of the connector interface as shown in Figure 2-1. Plugs typically contain stationary contacts. Other common terms include male, pin connector, and card edge.

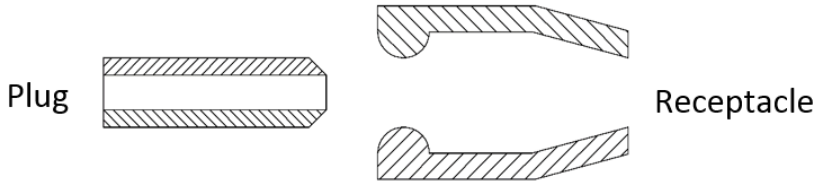

Figure 2-1 Plug and Receptacle Definition

Receptacle: A term used to describe the connector that contains the contacts that accept the plug contacts as shown in Figure 2-1. Receptacles typically contain spring contacts. Other common terms include female and socket connector.

3. General Description

3.1 Configuration Overview/Descriptions

This specification provides reference tables for pluggable modules. These tables are updated with additional codes reflecting industry developments.

Revisions 4.5 and earlier of this specification provided a tabular representation of pluggable I/O configurations along with the naming conventions that were used. This content is now provided in REF-TA-1011 "Cross Reference to Select SFF Connectors and Modules".

To request the addition of a code send the following information to the contacts on page 1 of this document. The request should include the following:
1) Relevant table
2) Recommended information (Form factor name, Management interface name) to include in table
3) Publically available reference specification e.g. data sheet or MSA specification

The relation between module form factors and management interface specifications is shown in Table 3-1.

Table 3-1 Module form factors and management interface specifications

Form factor	Management interface specification
SFP+/SFP28	SFF-8472
QSFP+	SFF-8436
QSFP+	SFF-8636
QSFP28	SFF-8636
QSFP-DD	CMIS
OSFP	CMIS

4. Transceiver or Cable Management

4.1 Overview

Self-identifying information is provided by modules or cables that use the 2-wire interface based management interfaces listed in Table 3-1.

The information will only be current if the developers of new modules and the standards incorporating new speeds and technologies request updates to the tables.

The tables below are not static. They have been removed from the subject specifications (listed below) to prevent multi-revisions with no new technical content.

To request a new identifier (Table 4-1), connector type (Table 4-3), compliance code (Table 4-4) or compliance code (Tables 4-5 to 4-10) please send an email request to points of contact listed on title page.

The tables below are referenced by the using specifications because either the content is common, or the contents are regularly updated. Maintaining the tables in SFF-8024 avoids having to revise specifications for non-technical changes. The registers for each table are:

Table 4-1 Identifier Values
- SFF-8472 A0h, Byte 0
- SFF-8636 and CMIS Page 00h Byte 0 and Page 00h Byte 128

Table 4-2 Encoding Values
- SFF-8436, SFF-8636 and CMIS Page 00h Byte 139
- SFF-8472 A0h Byte 11

Table 4-3 Connector Types
- SFF-8436, SFF-8636 and CMIS Page 00h Byte 130
- SFF-8472 A0h Byte 2

Table 4-4 Extended Specification Compliance Codes
- SFF-8636 and CMIS Page 00h Byte 192
- SFF-8472 A0h Byte 36

4.2 Host Electrical and Media Interface Codes

The following tables provide codes for the various electrical interface and optical or media interface specifications that may apply to pluggable modules. Separate codes for the electrical and media interfaces enable modules to identify the specific combination of electrical and media specifications that the module supports. Codes for all publically available networking industry specifications should be included.

Table 4-5 Host Electrical Interface Codes
- CMIS lower page, bytes 86, 90, 94, 98, 102, 106, 110, and 114

Table 4-6 to Table 4-10 Module-Media Interface Codes
- CMIS lower page, bytes 87, 91, 95, 99, 103, 107, 111, and 115

4.3 Transceiver References

The Identifier Value assigned to the module is essential to interpreting the contents of the memory map.

Table 4-1 Identifier Values

Value	Description of Module
00h	Unknown or unspecified
01h	GBIC
02h	Module/connector soldered to motherboard (using SFF-8472)
03h	SFP/SFP+/SFP28
04h	300 pin XBI
05h	XENPAK
06h	XFP
07h	XFF
08h	XFP-E
09h	XPAK
0Ah	X2
0Bh	DWDM-SFP/SFP+ (not using SFF-8472)
0Ch	QSFP (INF-8438)
0Dh	QSFP+ or later with SFF-8636 or SFF-8436 management interface (SFF-8436, SFF-8635, SFF-8665, SFF-8685 et al.) *1
0Eh	CXP or later
0Fh	Shielded Mini Multilane HD 4X
10h	Shielded Mini Multilane HD 8X
11h	QSFP28 or later with SFF-8636 management interface (SFF-8665 et al.) *2
12h	CXP2 (aka CXP28) or later
13h	CDFP (Style 1/Style2)
14h	Shielded Mini Multilane HD 4X Fanout Cable
15h	Shielded Mini Multilane HD 8X Fanout Cable
16h	CDFP (Style 3)
17h	microQSFP
18h	QSFP-DD Double Density 8X Pluggable Transceiver (INF-8628)
19h	OSFP 8X Pluggable Transceiver
1Ah	SFP-DD Double Density 2X Pluggable Transceiver
1Bh	DSFP Dual Small Form Factor Pluggable Transceiver
1Ch	x4 MiniLink/OcuLink
1Dh	x8 MiniLink
1Eh	QSFP+ or later with Common Management Interface Specification (CMIS)
1FH	
20h	
21h-7Fh	Reserved
80-FFh	Vendor Specific
*1 0Dh is the preferred coding, it supports multi-speed implementations and provides backward compatibility *2 11h may prevent the use of new 25G-class modules on old hosts. Not recommended for new designs	

NOTE: The Identifier Values assigned by the CFP MSA overlap with the above, and this should not be an issue because CFP does not use I2C for the management protocol, it uses MDIO. Software which bases actions on Identifier Values needs to recognize that synonyms exist and qualify the values by the management protocol.

4.4 Encoding References

The values established by SFF-8436 and SFF-8636 are similar but not identical to those assigned by SFF-8472. Maintaining a single reference will prevent further divergence.

Table 4-2 Encoding Values

Description of Encoding mechanism	Modules		
	8472	**Common**	**8436/8636**
Unspecified		00h	
8B/10B		01h	
4B/5B		02h	
NRZ		03h	
Manchester	04h		06h
SONET Scrambled	05h		04h
64B/66B	06h		05h
256B/257B (transcoded FEC-enabled data)		07h	
PAM4		08h	
Reserved		09h-FFh	
Note: For modules supporting multiple encoding types, the primary product application dictates the value chosen e.g. for Fibre Channel 16G/8G/4G or Ethernet 10G/1G, the value of 64B/66B should be chosen. In case of a conflict between modulation and coding, use the code for modulation. I.e. for 200GAUI-4 use code for PAM4.			

4.5 Connector References

The Connector Types are common between SFF-8436, SFF-8472 and SFF-8636. Maintaining a single reference will prevent divergence.

Table 4-3 Connector Types

Value	Description of Media Connector
00h	Unknown or unspecified
01h	SC (Subscriber Connector)
02h	Fibre Channel Style 1 copper connector
03h	Fibre Channel Style 2 copper connector
04h	BNC/TNC (Bayonet/Threaded Neill-Concelman)
05h	Fibre Channel coax headers
06h	Fiber Jack
07h	LC (Lucent Connector)
08h	MT-RJ (Mechanical Transfer - Registered Jack)
09h	MU (Multiple Optical)
0Ah	SG
0Bh	Optical Pigtail
0Ch	MPO 1x12 (Multifiber Parallel Optic)
0Dh	MPO 2x16
0Eh-1Fh	Reserved
20h	HSSDC II (High Speed Serial Data Connector)
21h	Copper pigtail
22h	RJ45 (Registered Jack)
23h	No separable connector
24h	MXC 2x16
25h	CS optical connector
26h	Mini CS optical connector
27h	MPO 2x12
28h	MPO 1x16
29h-7Fh	Reserved
80h-FFh	Vendor specific

4.6 Extended Specification Compliance References

The Extended Specification Compliance Codes identify the electronic or optical interfaces which are not included in SFF-8472 Optical and Cable Variants Specification Compliance or SFF-8636 Specification Compliance Codes. A multi-

lane pluggable module may support more than a single instantiation of the specified compliance code.

Table 4-4 Extended Specification Compliance Codes

Code	Description of Module Capability
00h	Unspecified
01h	100G AOC (Active Optical Cable) or 25GAUI C2M AOC. Providing a worst BER of 5×10^{-5}
02h	100GBASE-SR4 or 25GBASE-SR
03h	100GBASE-LR4 or 25GBASE-LR
04h	100GBASE-ER4 or 25GBASE-ER
05h	100GBASE-SR10
06h	100G CWDM4
07h	100G PSM4 Parallel SMF
08h	100G ACC (Active Copper Cable) or 25GAUI C2M ACC. Providing a worst BER of 5×10^{-5}
09h	Obsolete (assigned before 100G CWDM4 MSA required FEC)
0Ah	Reserved
0Bh	100GBASE-CR4 or 25GBASE-CR CA-25G-L
0Ch	25GBASE-CR CA-25G-S
0Dh	25GBASE-CR CA-25G-N
0Eh-0Fh	Reserved
10h	40GBASE-ER4
11h	4 x 10GBASE-SR
12h	40G PSM4 Parallel SMF
13h	G959.1 profile P1I1-2D1 (10709 MBd, 2km, 1310 nm SM)
14h	G959.1 profile P1S1-2D2 (10709 MBd, 40km, 1550 nm SM)
15h	G959.1 profile P1L1-2D2 (10709 MBd, 80km, 1550 nm SM)
16h	10GBASE-T with SFI electrical interface
17h	100G CLR4
18h	100G AOC or 25GAUI C2M AOC. Providing a worst BER of 10^{-12} or below
19h	100G ACC or 25GAUI C2M ACC. Providing a worst BER of 10^{-12} or below
1Ah	100GE-DWDM2 (DWDM transceiver using 2 wavelengths on a 1550 nm DWDM grid with a reach up to 80 km)
1Bh	100G 1550nm WDM (4 wavelengths)
1Ch	10GBASE-T Short Reach (30 meters)
1Dh	5GBASE-T
1Eh	2.5GBASE-T
1Fh	40G SWDM4
20h	100G SWDM4
21h	100G PAM4 BiDi
22h	4WDM-10 MSA (10km version of 100G CWDM4 with same RS(528,514) FEC in host system)
23h	4WDM-20 MSA (20km version of 100GBASE-LR4 with RS(528,514) FEC in host system)
24h	4WDM-40 MSA (40km reach with APD receiver and RS(528,514) FEC in host system)
25h	100GBASE-DR, with CAUI-4 without FEC
26h	100G-FR, with CAUI-4 without FEC
27h	100G-LR, with CAUI-4 without FEC
28h – 2Fh	Reserved
30h	Active Copper Cable with 50GAUI, 100GAUI-2 or 200GAUI-4 C2M. Providing a worst BER of 10^{-6} or below
31h	Active Optical Cable with 50GAUI, 100GAUI-2 or 200GAUI-4 C2M. Providing a worst BER of 10^{-6} or below
32h	Active Copper Cable with 50GAUI, 100GAUI-2 or 200GAUI-4 C2M. Providing a worst BER of 2.6×10^{-4} for ACC, 10^{-5} for AUI, or below
33h	Active Optical Cable with 50GAUI, 100GAUI-2 or 200GAUI-4 C2M. Providing a worst BER of 2.6×10^{-4} for AOC, 10^{-5} for AUI, or below
34h – 3Fh	Reserved

Code	Description of Module Capability
40h	50GBASE-CR, 100GBASE-CR2, or 200GBASE-CR4
41h	50GBASE-SR, 100GBASE-SR2, or 200GBASE-SR4
42h	50GBASE-FR or 200GBASE-DR4
43h	200GBASE-FR4
44h	200G 1550 nm PSM4
45h	50GBASE-LR
46h	200GBASE-LR4
47h – 4Fh	Reserved
50h	64GFC EA
51h	64GFC SW
52h	64GFC LW
53h	128GFC EA
54h	128GFC SW
55h	128GFC LW
56h - FFh	Reserved

4.7 Host Electrical and Media Interface Codes

The following tables provide codes for the various electrical interface and optical or media interface specifications that may apply to pluggable modules. Separate codes for the electrical and media interfaces enable modules to identify the specific combination of electrical and media specifications that the module supports. Codes for all publically available networking industry specifications should be included.

Table 4-5 Host Electrical Interface Codes

ID	Code (Hex)	Application Name	Application Data Rate, Gb/s	Lane Count	Lane Signaling Rate, GBd	Modul-ation	b/sym
0	0	Undefined					
		Ethernet					
1	1	1000BASE -CX (Clause 39)	1.25	1	1.25	NRZ	1
2	2	XAUI (Clause 47)	12.50	4	3.125	NRZ	1
3	3	XFI (SFF INF-8071i)	9.95-11.18	1	9.95-11.18	NRZ	1
4	4	SFI (SFF-8431)	9.95-11.18	1	9.95-11.18	NRZ	1
5	5	25GAUI C2M (Annex 109B)	25.78	1	25.78125	NRZ	1
6	6	XLAUI C2M (Annex 83B)	41.25	4	10.3125	NRZ	1
7	7	XLPPI (Annex 86A)	41.25	4	10.3125	NRZ	1
8	8	LAUI-2 C2M (Annex 135C)	51.56	2	25.78125	NRZ	1
9	9	50GAUI-2 C2M (Annex 135E)	53.13	2	26.5625	NRZ	1
10	A	50GAUI-1 C2M (Annex 135G)	53.13	1	26.5625	PAM4	2
11	B	CAUI-4 C2M (Annex 83E)[1]	103.13	4	25.78125	NRZ	1
12	C	100GAUI-4 C2M (Annex 135E)	106.25	4	26.5625	NRZ	1
13	D	100GAUI-2 C2M (Annex 135G)	106.25	2	26.5625	PAM4	2
14	E	200GAUI-8 C2M (Annex 120C)	212.50	8	26.5625	NRZ	1
15	F	200GAUI-4 C2M (Annex 120E)	212.50	4	26.5625	PAM4	2
16	10	400GAUI-16 C2M (Annex 120C)	425.00	16	26.5625	NRZ	1
17	11	400GAUI-8 C2M (Annex 120E)	425.00	8	26.5625	PAM4	2
18	12	Reserved					
19	13	10GBASE-CX4 (Clause 54)	12.50	4	3.125	NRZ	1
20	14	25GBASE-CR CA-L (Clause 110)	25.78	1	25.78125	NRZ	1
21	15	25GBASE-CR CA-S (Clause 110)	25.78	1	25.78125	NRZ	1
22	16	25GBASE-CR CA-N (Clause 110)	25.78	1	25.78125	NRZ	1
23	17	40GBASE-CR4 (Clause 85)	41.25	4	10.3125	NRZ	1
24	18	50GBASE-CR (Clause 126)	53.13	1	26.5625	PAM4	2
25	19	100GBASE-CR10 (Clause 85)	103.13	10	10.3125	NRZ	1
26	1A	100GBASE-CR4 (Clause 92)	103.13	4	25.78125	NRZ	1
27	1B	100GBASE-CR2 (Clause 136)	106.25	2	26.5625	PAM4	2
28	1C	200GBASE-CR4 (Clause 136)	212.50	4	26.5625	PAM4	2
29	1D	400G CR8 ()	425.00	8	26.5625	PAM4	2
30	1E	1000BASE -T (Clause 40)	1.12	4	0.125	PAM5	2.236068
31	1F	2.5GBASE-T (Clause 126)	2.50	4	0.200	PAM16	3.125
32	20	5GBASE-T (Clause 126)	5.00	4	0.400	PAM16	3.125
33	21	10GBASE-T (Clause 55)	10.00	4	0.800	PAM16	3.125
34	22	25GBASE-T (Clause 113)	25	4	2.000	PAM16	3.125
35	23	40GBASE-T (Clause 113)	40	4	3.200	PAM16	3.125
36	24	50GBASE-T ()					
		Fibre Channel					

ID	Code (Hex)	Application Name	Application Data Rate, Gb/s	Lane Count	Lane Signaling Rate, GBd	Modul-ation	b/sym
37	25	8GFC (FC-PI-4)	8.50	1	8.500	NRZ	1
38	26	10GFC (10GFC)	10.52	1	10.51875	NRZ	1
39	27	16GFC (FC-PI-5)	14.03	1	14.025	NRZ	1
40	28	32GFC (FC-PI-6)	28.05	1	28.050	NRZ	1
41	29	64GFC (FC-PI-7)	57.80	1	28.900	PAM4	2
42	2A	128GFC (FC-PI-6P)	112.20	4	28.050	NRZ	1
43	2B	256GFC (FC-PI-7P)	231.20	4	28.900	PAM4	2
		InfiniBand					
44	2C	IB SDR (Arch.Spec.Vol.2 R.1.3.1)	2.5 - 30	1, 2, 4, 8, 12	2.5	NRZ	1
45	2D	IB DDR (Arch.Spec.Vol.2 R.1.3.1)	5.0 - 60	1, 2, 4, 8, 12	5.0	NRZ	1
46	2E	IB QDR (Arch.Spec.Vol.2 R.1.3.1)	10 - 120	1, 2, 4, 8, 12	10.0	NRZ	1
47	2F	IB FDR (Arch.Spec.Vol.2 R.1.3.1)	14 - 169	1, 2, 4, 8, 12	14.0625	NRZ	1
48	30	IB EDR (Arch.Spec.Vol.2 R.1.3.1)	26 - 309	1, 2, 4, 8, 12	25.78125	NRZ	1
49	31	IB HDR (Arch.Spec.Vol.2 R.1.3.1)	52 - 618	1, 2, 4, 8, 12	26.5625	PAM4	2
50	32	IB NDR	Nx100G				
		CIPRI					
51	33	E.96 (CPRI Specification V7.0)	9.83	1	9.8304	NRZ	1
52	34	E.99 (CPRI Specification V7.0)	10.14	1	10.1376	NRZ	1
53	35	E.119 (CPRI Specification V7.0)	12.17	1	12.16512	NRZ	1
54	36	E.238 (CPRI Specification V7.0)	24.33	1	24.33024	NRZ	1
		OTN					
55	37	OTL3.4 (ITU-T G.709/Y.1331 G.Sup58) See XLAUI (overclocked)	43	4	10.7546	NRZ	1
56	38	OTL4.10 (ITU-T G.709/Y.1331 G.Sup58) See CAUI-10 (overclocked)	112	10	11.1810	NRZ	1
57	39	OTL4.4 (ITU-T G.709/Y.1331 G.Sup58) See CEI-28G-VSR	112	4	27.9525	NRZ	1
58	3A	OTLC.4 (ITU-T G.709/Y.1331 G.Sup58) See CEI-28G-VSR	112	4	28.0762	NRZ	1
59	3B	FOIC1.4 (ITU-T G.709/Y.1331 G.Sup58) See CEI-28G-VSR	112	4	27.9524	NRZ	1
60	3C	FOIC1.2 (ITU-T G.709/Y.1331 G.Sup58) See CEI-56G-VSR-PAM4	112	2	27.9524	PAM4	2
61	3D	FOIC2.8 (ITU-T G.709/Y.1331 G.Sup58	224	8	27.9523	NRZ	1
62	3E	FOIC2.8 (ITU-T G.709/Y.1331 G.Sup58	224	4	27.9523	PAM4	2

ID	Code (Hex)	Application Name	Application Data Rate, Gb/s	Lane Count	Lane Signaling Rate, GBd	Modul-ation	b/sym
63	3F	FOIC2.8 (ITU-T G.709/Y.1331 G.Sup58	447	16	27.9523	NRZ	1
64	40	FOIC2.8 (ITU-T G.709/Y.1331 G.Sup58	447	8	27.9523	PAM4	2
65-191	41-BF	Reserved					
192-254	C0-FE	Vendor Specific/Custom					
255	FF	End of list					
Notes: 1. a proposal to change this code is under discussion							

Table 4-6 850 nm MM media interface codes

ID	Code (Hex)	Application Name	Application Data Rate, Gb/s	Lane Count	Lane Signaling Rate, GBd	Modul-ation	b/sym
0	0	Undefined					
		Ethernet					
1	1	10GBASE-SW (Clause 52)	9.95	1	9.95328	NRZ	1
2	2	10GBASE-SR (Clause 52)	10.31	1	10.3125	NRZ	1
3	3	25GBASE-SR (Clause 112)	25.78	1	25.78125	NRZ	1
4	4	40GBASE-SR4 (Clause 86)	41.25	4	10.3125	NRZ	1
5	5	40GE SWDM4 MSA Spec	41.25	4	10.3125	NRZ	1
6	6	40GE BiDi	41.25	2	20.625	NRZ	1
7	7	50GBASE-SR (Clause 138)	53.13	1	26.5625	PAM4	2
8	8	100GBASE-SR10 (Clause 86)	103.13	10	10.3125	NRZ	1
9	9	100GBASE-SR4 (Clause 95)	103.13	4	25.78125	NRZ	1
10	A	100GE SWDM4 MSA Spec	103.13	4	25.78125	NRZ	1
11	B	100GE BiDi	106.25	2	25.5625	PAM4	2
12	C	100GBASE-SR2 (Clause 138)	106.25	2	26.5625	PAM4	2
13	D	100G-SR					
14	E	200GBASE-SR4 (Clause 138)	212.50	4	26.5625	PAM4	2
15	F	400GBASE-SR16 (Clause 123)	425.00	16	26.5625	NRZ	1
16	10	400G-SR8					
17	11	400G-SR4					
18	12	800G-SR8					
26	1A	400GE BiDI	425.00	8	26.5625	PAM4	2
		Fibre Channel					
19	13	8GFC-MM (FC-PI -4)	8.50	1	8.500	NRZ	1
20	14	10GFC-MM (10GFC)	10.52	1	10.51875	NRZ	1
21	15	16GFC-MM (FC-PI -5)	14.03	1	14.025	NRZ	1
22	16	32GFC-MM (FC-PI -6)	28.05	1	28.050	NRZ	1
23	17	64GFC-MM (FC-PI -7)	57.80	1	28.900	PAM4	2
24	18	128GFC-MM4 (FC-PI -6P)	112.20	4	28.050	NRZ	1
25	19	256GFC-MM4 (FC-PI -7P)	231.20	4	28.900	PAM4	2
27-191	1B-BF	Reserved					
192-255	C0-FF	Vendor Specific/Custom					

Table 4-7 SM media interface codes

ID	Code (Hex)	Application Name	Application Data Rate, Gb/s	Lane Count	Lane Signaling Rate, GBd	Modul-ation	b/sym
0	0	Undefined					
		Ethernet					
1	1	10GBASE-LW (Cl 52)	9.95	1	9.95328	NRZ	1
2	2	10GBASE-EW (Cl 52)	9.95	1	9.953	NRZ	1
3	3	10G-ZW	9.95	1	9.953	NRZ	1
4	4	10GBASE-LR (Cl 52)	10.31	1	10.3125	NRZ	1
5	5	10GBASE-ER (Cl 52)	10.31	1	10.3125	NRZ	1
6	6	10G-ZR	10.31	1	10.3125	NRZ	1
7	7	25GBASE-LR (Cl 114)	25.78	1	25.78125	NRZ	1
8	8	25GBASE-ER (Cl 114)	25.78	1	25.78125	NRZ	1
9	9	40GBASE-LR4 (Cl 87)	41.25	4	10.3125	NRZ	1
10	A	40GBASE-FR (Cl 89)	41.25	1	41.25	NRZ	1
11	B	50GBASE-FR (Cl 139)	53.13	1	26.5625	PAM4	2
12	C	50GBASE-LR (Cl 139)	53.13	1	26.5625	PAM4	2
13	D	100GBASE-LR4 (Cl 88)	103.13	4	25.78125	NRZ	1
14	E	100GBASE-ER4 (Cl 88)	103.13	4	25.78125	NRZ	1
15	F	100G PSM4 MSA Spec	103.13	4	25.78125	NRZ	1
52	34	100G CWDM4-OCP	103.13	4	25.78125	NRZ	1
16	10	100G CWDM4 MSA Spec	103.13	4	25.78125	NRZ	1
17	11	100G 4WDM-10 MSA Spec	103.13	4	25.78125	NRZ	1
18	12	100G 4WDM-20 MSA Spec	103.13	4	25.78125	NRZ	1
19	13	100G 4WDM-40 MSA Spec	103.13	4	25.78125	NRZ	1
20	14	100GBASE-DR (Cl 140)	106.25	1	53.125	PAM4	2
21	15	100G-FR	106.25	1	53.125	PAM4	2
22	16	100G-LR	106.25	1	53.125	PAM4	2
23	17	200GBASE-DR4 (Cl 121)	212.50	4	26.5625	PAM4	2
24	18	200GBASE-FR4 (Cl 122)	212.50	4	26.5625	PAM4	2
25	19	200GBASE-LR4 (Cl 122)	212.50	4	26.5625	PAM4	2
26	1A	400GBASE-FR8 (Cl 122)	425.00	8	26.5625	PAM4	2
27	1B	400GBASE-LR8 (Cl 122)	425.00	8	26.5625	PAM4	2
28	1C	400GBASE-DR4 (Cl 124)	425.00	4	53.125	PAM4	2
29	1D	400G-FR4	425.00	4	53.125	PAM4	2
30	1E	400G-LR4	425.00	4	53.125	PAM4	2
		Fibre Channel					
31	1F	8GFC-SM (FC-PI -4)	8.50	1	8.500	NRZ	1
32	20	10GFC-SM (10GFC)	10.52	1	10.51875	NRZ	1
33	21	16GFC-SM (FC-PI-5)	14.03	1	14.025	NRZ	1
34	22	32GFC-SM (FC-PI-6)	28.05	1	28.050	NRZ	1
35	23	64GFC-SM (FC-PI-7)	57.80	1	28.900	PAM4	2
36	24	128GFC-PSM4 (FC-PI-6P)	112.20	4	28.050	NRZ	1

ID	Code (Hex)	Application Name	Application Data Rate, Gb/s	Lane Count	Lane Signaling Rate, GBd	Modul-ation	b/sym
37	25	256GFC-PSM4 (FC-PI-7P)	231.20	4	28.900	PAM4	2
38	26	128GFC-CWDM4 (FC-PI-6P)	112.20	4	28.050	NRZ	1
39	27	256GFC-CWDM4 (FC-PI-7P)	231.20	4	28.900	PAM4	2
40-43	28-2B	Reserved					
		OTN					
44	2C	4I1-9D1F	112	4	28	NRZ	1
45	2D	4L1-9C1F	112	4	28	NRZ	1
46	2E	4L1-9D1F	112	4	28	NRZ	1
47	2F	C4S1-9D1F	112	4	28	NRZ	1
48	30	C4S1-4D1F	224	4	27.9523	PAM4	2
49	31	4I1-4D1F	224	4	27.9523	PAM4	2
50	32	8R1-4D1F	447	8	27.9523	PAM4	2
51	33	8I1-4D1F	447	8	27.9523	PAM4	2
53-55	35-37	Reserved					
		CPRI					
56	38	10G-SR	9.8304	1	9.8304	NRZ	1
57	39	10G-LR	9.8304	1	9.8304	NRZ	1
58	3A	25G-SR	24.33024	1	24.33024	NRZ	1
59	3B	25G-LR	24.33024	1	24.33024	NRZ	1
60	3C	10G-LR-BiDi	9.8304	1	9.8304	NRZ	1
61	3D	25G-LR-BiDi	24.33024	1	24.33024	NRZ	1
62-191	3E-BF	Reserved					
192-255	C0-FF	Vendor Specific/Custom					

Table 4-8 Passive Copper Cable interface codes

ID	Code (Hex)	Application Name
0	0	Undefined
1	1	Copper cable,
2-191	2-BF	Reserved
192-255	C0-FF	Vendor Specific/Custom

4.8 Note: Details for the cable assembly interface are defined using the host electrical interface codes in Host Electrical and Media Interface Codes

The following tables provide codes for the various electrical interface and optical or media interface specifications that may apply to pluggable modules. Separate codes for the electrical and media interfaces enable modules to identify the specific combination of electrical and media specifications that the module supports. Codes for all

publically available networking industry specifications should be included.
Table 4-5**Error! Reference source not found.**

Table 4-9 Active Cable assembly media interface codes

ID	Code (Hex)	Application Name
0	0	Undefined
1	1	Active Cable assembly with BER < 10^{-12}
2	2	Active Cable assembly with BER < $5x10^{-5}$
3	3	Active Cable assembly with BER < $2.6x10^{-4}$
4	4	Active Cable assembly with BER < 10^{-6}
5-191	5-BF	Reserved
192-255	C0-FF	Vendor Specific/Custom

4.9 Note: Details for the cable assembly interface are defined using the host electrical interface codes in Host Electrical and Media Interface Codes

The following tables provide codes for the various electrical interface and optical or media interface specifications that may apply to pluggable modules. Separate codes for the electrical and media interfaces enable modules to identify the specific combination of electrical and media specifications that the module supports. Codes for all publically available networking industry specifications should be included.
Table 4-5.

Table 4-10 BASE-T media interface advertising codes

ID	Code (Hex)	Application Name	Application Data Rate, Gb/s	Lane Count	Lane Signaling Rate, GBd	Modul-ation	
0	0	Undefined					
		Ethernet Applications					
1	1	1000BASE-T (Clause 40)	1.12	4	0.125	PAM5	2.236068
2	2	2.5GBASE-T (Clause 126)	2.50	4	0.200	PAM16	3.125
3	3	5GBASE-T (Clause 126)	5.00	4	0.400	PAM16	3.125
4	4	10GBASE-T (Clause 55)	10.00	4	0.800	PAM16	3.125
5-191	5-BF	Reserved					
192-255	C0-FF	Custom					