SFF Committee

SFF-8024

Specification for

SFF Committee Cross Reference to Industry Products

Rev 3.2   July 1, 2015

Secretariat: SFF Committee

Abstract: This specification defines the naming conventions for the various configurations of pluggable I/O solutions.

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

This specification provides a common reference for systems manufacturers, system integrators, and suppliers. This is an internal working specification of the SFF Committee, an industry ad hoc group.

This specification is made available for public review, and written comments are solicited from readers. Comments received by the members will be considered for inclusion in future revisions of this specification.

The description of a connector in this specification does not assure that the specific component is actually available from connector suppliers. If such a connector is supplied it must comply with this specification to achieve interoperability between suppliers.

Support: This specification is supported by the identified member companies of the SFF Committee.

POINTS OF CONTACT:

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EXPRESSION OF SUPPORT BY MANUFACTURERS

The members of the SFF Committee decided to treat this specification in the style of SFF-8000, and have it maintained by the Chair. Ballots to approve the content will be at the discretion of the Chair.

Update History:

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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Rev 1.6  - Identified superseded specifications in Table 3-1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
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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

Foreword

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

When 2 1/2" diameter disk drives were introduced, there was no commonality on external dimensions e.g. physical size, mounting locations, connector type, connector location, between vendors.

The first use of these disk drives was in specific applications such as laptop portable computers and system integrators worked individually with vendors to develop the packaging. The result was wide diversity, and incompatibility.

The problems faced by integrators, device suppliers, and component suppliers led to the formation of the SFF Committee as an industry ad hoc group to address the marketing and engineering considerations of the emerging new technology.

During the development of the form factor definitions, other activities were suggested because participants in the SFF Committee faced more problems than the physical form factors of disk drives. In November 1992, the charter was expanded to address any issues of general interest and concern to the storage industry. The SFF Committee became a forum for resolving industry issues that are either not addressed by the standards process or need an immediate solution.

Those companies which have agreed to support a specification are identified in the first pages of each SFF Specification. Industry consensus is not an essential requirement to publish an SFF Specification because it is recognized that in an emerging product area, there is room for more than one approach. By making the documentation on competing proposals available, an integrator can examine the alternatives available and select the product that is felt to be most suitable.

SFF Committee meetings are held during T10 weeks (see www.t10.org), and Specific Subject Working Groups are held at the convenience of the participants. Material presented at SFF Committee meetings becomes public domain, and there are no restrictions on the open mailing of material presented at committee meetings.

Most of the specifications developed by the SFF Committee have either been incorporated into standards or adopted as standards by EIA (Electronic Industries Association), ANSI (American National Standards Institute) and IEC (International Electrotechnical Commission).

If you are interested in participating or wish to follow the activities of the SFF Committee, the signup for membership and/or documentation can be found at:
                www.sffcommittee.com/ie/join.html

The complete list of SFF Specifications which have been completed or are currently being worked on by the SFF Committee can be found at:
                ftp://ftp.seagate.com/sff/SFF-8000.TXT

If you wish to know more about the SFF Committee, the principles which guide the activities can be found at:
                ftp://ftp.seagate.com/sff/SFF-8032.TXT

Suggestions for improvement of this specification will be welcome. They should be sent to the SFF Committee, 14426 Black Walnut Ct, Saratoga, CA 95070.

CONTENTS

FIGURES

TABLES

SFF Committee --

Cross Reference to Industry Products

1 Scope

This specification provides a cross reference between the industry use of terms to describe pluggable solutions and the SFF specifications which define them.

2 References

2.1 Industry Documents

- SFF-8436 QSFP+ 10 Gb/s 4X Pluggable Transceiver
- SFF-8472 SFP+ Management Interface - SFF-8636 QSFP+ Management Interface (Common)

2.2 SFF Specifications

There are several projects active within the SFF Committee. The complete list of specifications which have been completed or are still being worked on are listed in the specification at ftp://ftp.seagate.com/sff/SFF-8000.TXT

2.3 Sources

Those who join the SFF Committee as an Observer or Member receive electronic copies of the minutes and SFF specifications (http://www.sffcommittee.com/ie/join.html).

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

2.4 Conventions

The dimensioning conventions are described in ANSI-Y14.5M, Geometric Dimensioning and Tolerancing. All dimensions are in millimeters.

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

2.5 Glossary

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

3 General Description

This specification provides a tabular representation of pluggable I/O configurations along with the naming conventions that are used. The relationship between industry brand names or general usage and the SFF Specifications which define them is not obvious in many cases.

TABLE 3-1 PLUGGABLE CONNECTORS

Popular Name	Integrated Pluggable Solution	Per Lane Data Rate Gb/s	Low Speed and General Electrical Spec	Common Manage-ment Spec	Application Specific Manage-ment Spec	Single Card Module/ Plug Formfactor	Single Card Single SMT Connector	Single Card Single Cage	Single Card Ganged Cage
SFP	MSA	1	INF-8074				Superseded by SFP10, SFP16 et al		
SFP+	SFF-8084	4	SFF-8419 SFF-8418	SFF-8472	n/a	SFF-8432	SFF-8071	SFF-8432	SFF-8433
SFP10	SFF-8083	10	SFF-8419 SFF-8418	SFF-8472	n/a	SFF-8432	SFF-8071	SFF-8432	SFF-8433
SFP16	SFF-8081	16	SFF-8419	SFF-8472	n/a	SFF-8432	SFF-8071	SFF-8432	SFF-8433
SFP28	SFF-8402	28	SFF-8419	SFF-8472	n/a	SFF-8432	SFF-8071	SFF-8432	SFF-8433
XFP	MSA	10	INF-8077						
QSFP	MSA	4	INF-8438				Superseded by QSFP10, QSFP 14 et al		
QSFP+	SFF-8436	10	SFF-8436				Superseded by QSFP10, QSFP 14 et al		
QSFP10	SFF-8635	10	SFF-8679	SFF-8636	n/a	SFF-8661	SFF-8682	SFF-8683	
QSFP14	SFF-8685	14	SFF-8679	SFF-8636	n/a	SFF-8661	SFF-8682	SFF-8683	
QSFP28	SFF-8665	28	SFF-8679	SFF-8636	n/a	SFF-8661	SFF-8662 and SFF-8663 / SFF-8672 and SFF-8683	(Style A) / (Style B)	
						Dual Card Module/ Plug Formfactor	Dual Card Integrated Single PF Card/ Connector	Dual Card Integrated Ganged PF Cage/ Connector	
CXP10	EIA-965/ SFF-8642	10	IBTA QDR			EIA-965/ SFF-8642	EIA-965/ SFF-8642	EIA-965/ SFF-8642	
CXP14	SFF-8647	14	IBTA FDR			SFF-8617	SFF-8617	SFF-8617	
CXP28	SFF-8648	28	IBTA EDR			SFF-8617	SFF-8617	SFF-8617	
HD12un	SFF-8643	12	SAS 2.1/3	SFF-8636	SFF-8449	SFF-8613	SFF-8613	SFF-8613	
HD12sh	SFF-8644	12	SAS 2.1/3	SFF-8636	SFF-8449	SFF-8614	SFF-8614	SFF-8614	
HD24un	SFF-8673	24	SAS 4	SFF-8636	SFF-8449	SFF-8613	SFF-8613	SFF-8613	
HD24sh	SFF-8674	24	SAS 4	SFF-8636	SFF-8449	SFF-8614	SFF-8614	SFF-8614	

TABLE 3-2 DEVICE CONNECTORS

Integrated Pluggable Solution	Lane Data Rate Gb/s	Application	Common Management Spec	Application Specific Management Spec	Electrical Spec	Mechanical Spec
SFF-8678	3	SAS 1.1	SFF-8636	SFF-8449	SFF-8678	SFF-8482
SFF-8680	6	SAS-2	SFF-8636	SFF-8449	SFF-8680	SFF-8482
SFF-8680	12	SAS-3	SFF-8636	SFF-8449	SFF-8680	SFF-8482
SFF-8681	24	SAS-4	SFF-8636	SFF-8449	SFF-8681	SFF-8482

Examples are: SFP+, QSFP+

Single Card / Single Port / SMT Connector

Single Card / Ganged Ports / SMT Connector

FIGURE 3-1 SINGLE CARD CONFIGURATIONS

Examples are: CXP, Mini Multilane HD
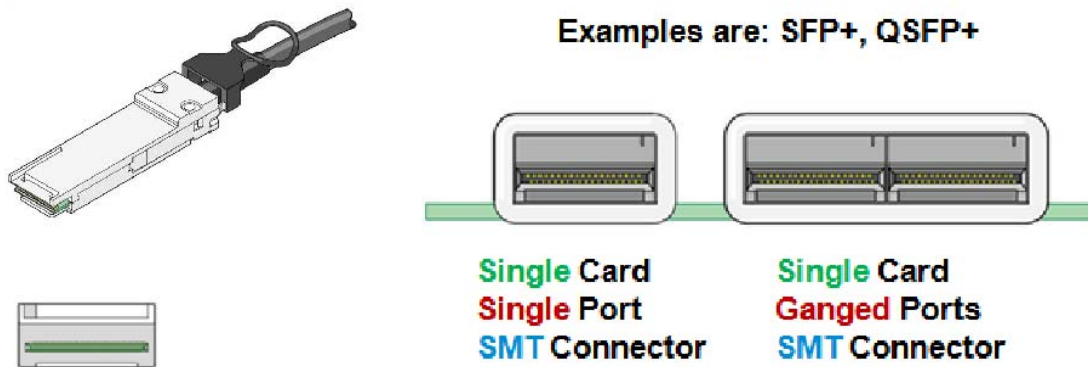
Dual Card / Single Port / PF Connector

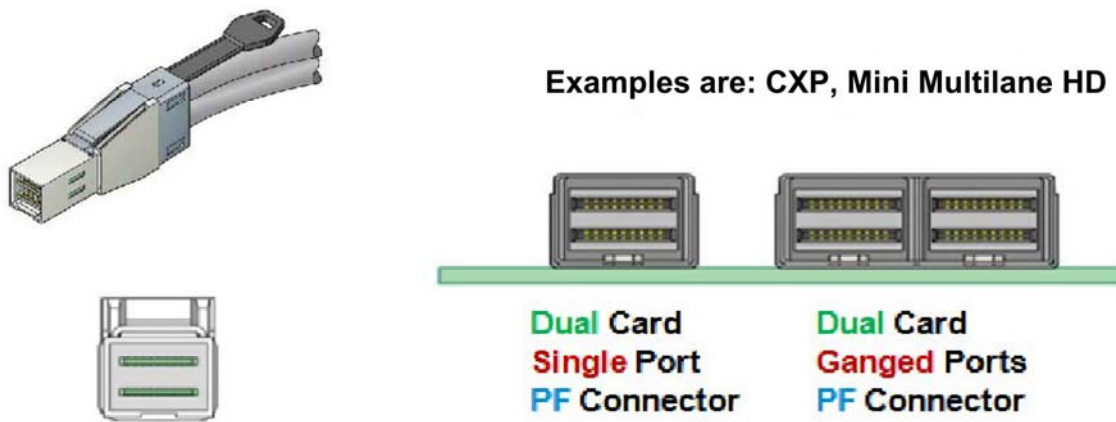**Dual Card / Ganged Ports / PF Connector**

FIGURE 3-2 DUAL CARD CONFIGURATIONS

SFF-8635 QSFP+ 10 Gb/s 4X Pluggable Transceiver Solution (QSFP10)
SFF-8665 QSFP+ 28 Gb/s 4X Pluggable Transceiver Solution (QSFP28)
SFF-8685 QSFP+ 14 Gb/s 4X Pluggable Transceiver Solution (QSFP14)

SFF-8636 Management Interface
(common to all 3 specs)

SFF-8661 QSFP+ Module/Plug Form-factor
(common to all 3 specs)

SFF-8682 10G QSFP+ Connector
- same component as what is in the original MSA
  and the current SFF-8436 all-in-one spec
- picked up in the restructured SFF-8436 and in the
  SFF-8685 14G QSFP+ spec

SFF-8683 10G QSFP+ Cage
- same component as what is in the original MSA
  and the current SFF-8436 all-in-one spec
- picked up in the restructured SFF-8436 and in the
  SFF-8685 14G QSFP+ spec

SFF-8679 Base Electrical Spec
(common to all 3 specs)
- collected all that remained after the management,
  Plug FF, connector and cage were removed from
  the original MSA/SFF-8436 all-in-one spec

SFF-8662 28G QSFP+ Connector

SFF-8672 28G QSFP+ Connector

SFF-8663 28G QSFP+ Cage

	Manage ment	Plug FF	Conn	Cage	Base spec

QSFP10

8635

- InfiniBand
  Arch Vol 2
- IEEE 802.3ba
- SAS 2.1
- FC-PI-4

8636 | 8661 | 8682 | 8683 | 8679

QSFP14

8685

- InfiniBand
  Arch Vol 2
- SAS-3
- FC-PI-5

8636 | 8661 | 8682 | 8683 | 8679

QSFP28

8665

- InfiniBand
  Arch Vol 2
- IEEE 802.3bj
- FC-PI-6

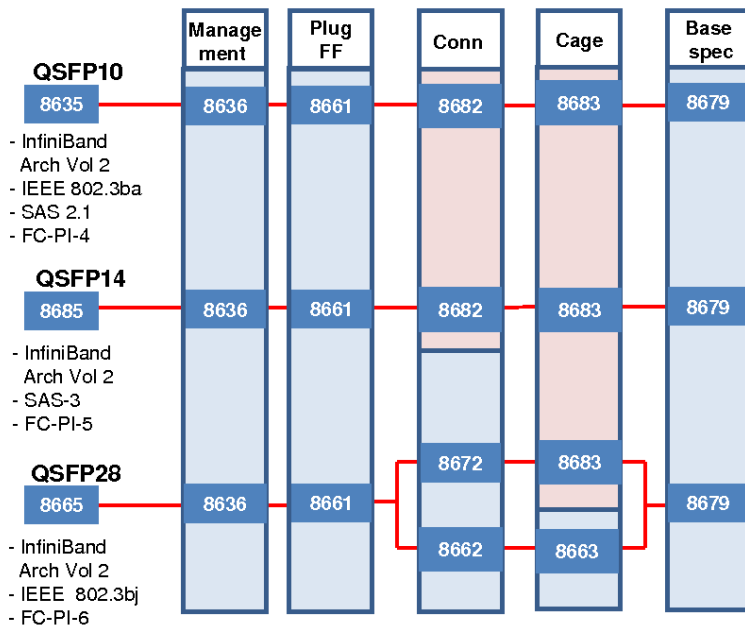8636 | 8661 | 8672 / 8662 | 8683 / 8663 | 8679

FIGURE 3-3 EXAMPLE OF SFF-8436 QSFP+ RESTRUCTURING

4 Transceiver or Cable Management

Self-identifying information is provided by modules or cables that use the 2-wire interface as described in SFF-8436, SFF-8472 and SFF-8636.

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 to prevent multi-revisions with no new technical content.

Use the SFF-8063 SFF Committee Request Template to request an addition.

ftp.seagate.com/sff/SFF-8063.PDF

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 Page 00h Byte 0 and Page 00h Byte 128
Table 4-2 Encoding Values
        SFF-8436 Page 00h Byte 139
        SFF-8472 A0h Byte 11
        SFF-8636 Page 00h Byte 139
Table 4-3 Connector Types
        SFF-8436 Page 00h Byte 130
        SFF-8472 A0h Byte 2
        SFF-8636 Page 00h Byte 130
Table 4-4 Extended Specification Compliance Codes
        SFF-8436 Page 00h Byte 192
        SFF-8472 A0h Byte 36
        SFF-8436/8636 Page 00h Byte 192
```

4.1 Transceiver References

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

TABLE 4-1 IDENTIFIER VALUES

Value	Description of Physical Device
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 (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 (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)
-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	

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.

4.2 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	8x36
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	
Reserved		-FFh	
Note: For devices 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.			

4.3 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
-1Fh	Reserved
20h	HSSDC II (High Speed Serial Data Connector)
21h	Copper pigtail
22h	RJ45 (Registered Jack)
23h	No separable connector
24h	MXC 2x16
-7Fh	Reserved
80h-FFh	Vendor specific
Note: 01h to 05h are not SFP-compatible, and are included for compatibility with GBIC standards.	

4.4 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.

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
04h	100GBASE-ER4
05h	100GBASE-SR10
06h	100G CWDM4 MSA with FEC
07h	100G PSM4 Parallel SMF
08h	100G ACC (Active Copper Cable) or 25GAUI C2M ACC. Providing a worst BER of 5×10^{-5}
09h	100G CWDM4 MSA without FEC
0Ah	Reserved
0Bh	100GBASE-CR4 or 25GBASE-CR CA-L
0Ch	25GBASE-CR CA-S
0Dh	25GBASE-CR CA-N
-0Fh	Reserved
10h	40GBASE-ER4
11h	4 x 10GBASE-SR
12h	40G PSM4 Parallel SMF
13h	G959.1 profile P1I1-2D1 (10709 MBd, 2km, 1310nm SM)
14h	G959.1 profile P1S1-2D2 (10709 MBd, 40km, 1550nm SM)
15h	G959.1 profile P1L1-2D2 (10709 MBd, 80km, 1550nm 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
-FFh	Reserved