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AMENDMENT 13
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**Telecommunications and exchange
between information technology
systems — Requirements for local and
metropolitan area networks —**

**Part 3:
Standard for Ethernet**

**AMENDMENT 13: Physical layers and
management parameters for 100 Gb/s
operation over DWDM systems**

*Télécommunications et échange entre systèmes informatiques —
Exigences pour les réseaux locaux et métropolitains —*

Partie 3: Norme pour Ethernet

*AMENDEMENT 13: Couches physiques et paramètres de gestion pour
un fonctionnement à 100 Gb/s sur réseaux DWDM*



Reference number
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IEEE Std 802.3ct™-2021

(Amendment to IEEE Std 802.3™-2018
as amended by IEEE Std 802.3cb™-2018,
IEEE Std 802.3bt™-2018,
IEEE Std 802.3cd™-2018,
IEEE Std 802.3cn™-2019,
IEEE Std 802.3cg™-2019,
IEEE Std 802.3cq™-2020,
IEEE Std 802.3cm™-2020,
IEEE Std 802.3ch™-2020,
IEEE Std 802.3ca™-2020,
IEEE Std 802.3cr™-2021,
IEEE Std 802.3cu™-2021,
and IEEE Std 802.3cv™-2021)

IEEE Standard for Ethernet

Amendment 13: Physical Layers and Management Parameters for 100 Gb/s Operation over DWDM Systems

Developed by the

LAN/MAN Standards Committee
of the
IEEE Computer Society

Approved 16 June 2021

IEEE SA Standards Board

Abstract: This amendment includes changes to IEEE Std 802.3-2018 and adds Clause 152 through Clause 154 and Annex 154A. This amendment adds 100 Gb/s Physical Layer specifications and management parameters for operation over DWDM systems using a combination of phase and amplitude modulation with coherent detection for reaches of at least 80 km.

Keywords: 100 Gb/s Ethernet, 100GBASE-ZR, DP-DQPSK, dense wavelength division multiplexing (DWDM), DWDM black link, Energy-Efficient Ethernet (EEE), Ethernet, forward error correction (FEC), IEEE 802.3™, IEEE 802.3ct™, Physical Medium Dependent (PMD) sublayer, single-mode fiber (SMF)

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Introduction

This introduction is not part of IEEE Std 802.3ct-2021, IEEE Standard for Ethernet—Amendment 13: Physical Layers and Management Parameters for 100 Gb/s Operation over DWDM Systems.

IEEE Std 802.3™ was first published in 1985. Since the initial publication, many projects have added functionality or provided maintenance updates to the specifications and text included in the standard. Each IEEE 802.3 project/amendment is identified with a suffix (e.g., IEEE Std 802.3ba™-2010).

The half duplex Media Access Control (MAC) protocol specified in IEEE Std 802.3-1985 is Carrier Sense Multiple Access with Collision Detection (CSMA/CD). This MAC protocol was key to the experimental Ethernet developed at Xerox Palo Alto Research Center, which had a 2.94 Mb/s data rate. Ethernet at 10 Mb/s was jointly released as a public specification by Digital Equipment Corporation (DEC), Intel and Xerox in 1980. Ethernet at 10 Mb/s was approved as an IEEE standard by the IEEE Standards Board in 1983 and subsequently published in 1985 as IEEE Std 802.3-1985. Since 1985, new media options, new speeds of operation, and new capabilities have been added to IEEE Std 802.3. A full duplex MAC protocol was added in 1997.

Some of the major additions to IEEE Std 802.3 are identified in the marketplace with their project number. This is most common for projects adding higher speeds of operation or new protocols. For example, IEEE Std 802.3u™ added 100 Mb/s operation (also called Fast Ethernet), IEEE Std 802.3z added 1000 Mb/s operation (also called Gigabit Ethernet), IEEE Std 802.3ae added 10 Gb/s operation (also called 10 Gigabit Ethernet), IEEE Std 802.3ah™ specified access network Ethernet (also called Ethernet in the First Mile) and IEEE Std 802.3ba added 40 Gb/s operation (also called 40 Gigabit Ethernet) and 100 Gb/s operation (also called 100 Gigabit Ethernet). These major additions are all now included in and are superseded by IEEE Std 802.3-2018 and are not maintained as separate documents.

At the date of IEEE Std 802.3ct-2021 publication, IEEE Std 802.3 was composed of the following documents:

IEEE Std 802.3-2018

Section One—Includes Clause 1 through Clause 20 and Annex A through Annex H and Annex 4A. Section One includes the specifications for 10 Mb/s operation and the MAC, frame formats and service interfaces used for all speeds of operation.

Section Two—Includes Clause 21 through Clause 33 and Annex 22A through Annex 33E. Section Two includes management attributes for multiple protocols and speed of operation as well as specifications for providing power over twisted pair cabling for multiple operational speeds. It also includes general information on 100 Mb/s operation as well as most of the 100 Mb/s Physical Layer specifications.

Section Three—Includes Clause 34 through Clause 43 and Annex 36A through Annex 43C. Section Three includes general information on 1000 Mb/s operation as well as most of the 1000 Mb/s Physical Layer specifications.

Section Four—Includes Clause 44 through Clause 55 and Annex 44A through Annex 55B. Section Four includes general information on 10 Gb/s operation as well as most of the 10 Gb/s Physical Layer specifications.

Section Five—Includes Clause 56 through Clause 77 and Annex 57A through Annex 76A. Clause 56 through Clause 67 and Clause 75 through Clause 77, as well as associated annexes, specify subscriber access and other Physical Layers and sublayers for operation from 512 kb/s to 10 Gb/s, and defines

services and protocol elements that enable the exchange of IEEE Std 802.3 format frames between stations in a subscriber access network. Clause 68 specifies a 10 Gb/s Physical Layer specification. Clause 69 through Clause 74 and associated annexes specify Ethernet operation over electrical backplanes at speeds of 1000 Mb/s and 10 Gb/s.

Section Six—Includes Clause 78 through Clause 95 and Annex 83A through Annex 93C. Clause 78 specifies Energy-Efficient Ethernet. Clause 79 specifies IEEE 802.3 Organizationally Specific Link Layer Discovery Protocol (LLDP) type, length, and value (TLV) information elements. Clause 80 through Clause 95 and associated annexes include general information on 40 Gb/s and 100 Gb/s operation as well the 40 Gb/s and 100 Gb/s Physical Layer specifications. Clause 90 specifies Ethernet support for time synchronization protocols.

Section Seven—Includes Clause 96 through Clause 115 and Annex 97A through Annex 115A. Clause 96 through Clause 98, Clause 104, and associated annexes, specify Physical Layers and optional features for 100 Mb/s and 1000 Mb/s operation over a single twisted pair. Clause 100 through Clause 103, as well as associated annexes, specify Physical Layers for the operation of the EPON protocol over coaxial distribution networks. Clause 105 through Clause 114 and associated annexes include general information on 25 Gb/s operation as well as 25 Gb/s Physical Layer specifications. Clause 99 specifies a MAC merge sublayer for the interspersing of express traffic. Clause 115 and its associated annex specify a Physical Layer for 1000 Mb/s operation over plastic optical fiber.

Section Eight—Includes Clause 116 through Clause 126 and Annex 119A through Annex 120E. Clause 116 through Clause 124 and associated annexes include general information on 200 Gb/s and 400 Gb/s operation as well the 200 Gb/s and 400 Gb/s Physical Layer specifications. Clause 125 and Clause 126 include general information on 2.5 Gb/s and 5 Gb/s operation as well as 2.5 Gb/s and 5 Gb/s Physical Layer specifications.

IEEE Std 802.3cb™-2018

Amendment 1—This amendment includes changes to IEEE Std 802.3-2018 and its amendments, and adds Clause 127 through Clause 130, Annex 127A, Annex 128A, Annex 128B, and Annex 130A. This amendment adds new Physical Layers for operation at 2.5 Gb/s and 5 Gb/s over electrical backplanes.

IEEE Std 802.3bt™-2018

Amendment 2—This amendment includes changes to IEEE Std 802.3-2018 and adds Clause 145, Annex 145A, Annex 145B, and Annex 145C. This amendment adds power delivery using all four pairs in the structured wiring plant, resulting in greater power being available to end devices. This amendment also allows for lower standby power consumption in end devices and adds a mechanism to better manage the available power budget.

IEEE Std 802.3cd™-2018

Amendment 3—This amendment includes changes to IEEE Std 802.3-2018 and adds Clause 131 through Clause 140 and Annex 135A through Annex 136D. This amendment adds MAC parameters, Physical Layers, and management parameters for the transfer of IEEE 802.3 format frames at 50 Gb/s, 100 Gb/s, and 200 Gb/s.

IEEE Std 802.3cn™-2019

Amendment 4—This amendment includes changes to IEEE Std 802.3-2018 and adds 50 Gb/s, 200 Gb/s, and 400 Gb/s Physical Layer specifications and management parameters for operation over single-mode fiber with reaches of at least 40 km.

IEEE Std 802.3cg™-2019

Amendment 5—This amendment includes changes to IEEE Std 802.3-2018 and its amendments and adds Clause 146 through Clause 148 and Annex 146A and Annex 146B. This amendment adds 10 Mb/s Physical Layer specifications and management parameters for operation on a single balanced pair of conductors.

IEEE Std 802.3cq™-2020

Amendment 6—This amendment includes editorial and technical corrections, refinements, and clarifications to Clause 33 and related portions of the standard.

IEEE Std 802.3cm™-2020

Amendment 7—This amendment includes changes to IEEE Std 802.3-2018 and adds Clause 150. This amendment adds Physical Layer (PHY) specifications and management parameters for 400 Gb/s operation on four pairs (400GBASE-SR4.2) and eight pairs (400GBASE-SR8) of multimode fiber, over reaches of at least 100 m.

IEEE Std 802.3ch™-2020

Amendment 8—This amendment includes changes to IEEE Std 802.3-2018 and adds Clause 149, Annex 149A, Annex 149B, and Annex 149C. This amendment adds physical layer specifications and management parameters for operation at 2.5 Gb/s, 5 Gb/s, and 10 Gb/s over a single balanced pair of conductors.

IEEE Std 802.3ca™-2020

Amendment 9—This amendment to IEEE Std 802.3-2018 extends the operation of Ethernet passive optical networks (EPONs) to multiple channels of 25 Gb/s providing both symmetric and asymmetric operation for the following data rates (downstream/upstream): 25/10 Gb/s, 25/25 Gb/s, 50/10 Gb/s, 50/25 Gb/s, and 50/50 Gb/s. This amendment specifies the 25 Gb/s EPON Multi-Channel Reconciliation Sublayer (MCRS), Nx25G-EPON Physical Coding Sublayers (PCSs), Physical Media Attachment (PMA) sublayers, and Physical Medium Dependent (PMD) sublayers that support both symmetric and asymmetric data rates while maintaining backward compatibility with already deployed 10 Gb/s EPON equipment. The EPON operation is defined for distances of at least 20 km, and for a split ratio of at least 1:32.

IEEE Std 802.3cr™-2021

Amendment 10—This amendment includes changes to IEEE Std 802.3-2018 and adds Annex J. This amendment replaces references to the IEC 60950 series of standards (including IEC 60950-1 “Information technology equipment—Safety—Part 1: General requirements”) with appropriate references to the IEC 62368 “Audio/video, information and communication technology equipment” series and makes appropriate changes to the standard corresponding to the new references.

IEEE Std 802.3cu™-2021

Amendment 11—This amendment includes changes to IEEE Std 802.3-2018 and adds Clause 151. This amendment adds Physical Layer (PHY) specifications and management parameters for 100 Gb/s and 400 Gb/s operation over single-mode fiber, based on 100 Gb/s per wavelength optical signaling.

IEEE Std 802.3cy™-2021

Amendment 12—This amendment includes editorial and technical corrections, refinements, and clarifications to Clause 145, Power over Ethernet, and related portions of the standard.

IEEE Std 802.3ct™-2021

Amendment 13—This amendment includes changes to IEEE Std 802.3-2018 and adds Clause 152 through Clause 154 and Annex 154A. This amendment adds 100 Gb/s Physical Layer specifications and management parameters for operation over DWDM systems with reaches of at least 80 km.

Two companion documents exist, IEEE Std 802.3.1 and IEEE Std 802.3.2. IEEE Std 802.3.1 describes Ethernet management information base (MIB) modules for use with the Simple Network Management Protocol (SNMP). IEEE Std 802.3.2 describes YANG data models for Ethernet. IEEE Std 802.3.1 and IEEE Std 802.3.2 are updated to add management capability for enhancements to IEEE Std 802.3 after approval of those enhancements.

IEEE Std 802.3 will continue to evolve. New Ethernet capabilities are anticipated to be added within the next few years as amendments to this standard.

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IEEE Standard for Ethernet

Amendment 13: Physical Layers and Management Parameters for 100 Gb/s Operation over DWDM Systems

(This amendment is based on IEEE Std 802.3™-2018 as amended by IEEE Std 802.3cb™-2018, IEEE Std 802.3bt™-2018, IEEE Std 802.3cd™-2018, IEEE Std 802.3cn™-2019, IEEE Std 802.3cg™-2019, IEEE Std 802.3cq™-2020, IEEE Std 802.3cm™-2020, IEEE Std 802.3ch™-2020, IEEE Std 802.3ca™-2020, IEEE Std 802.3cr™-2021, IEEE Std 802.3cu™-2021, and IEEE Std 802.3cv™-2021.)

NOTE—The editing instructions contained in this amendment define how to merge the material contained therein into the existing base standard and its amendments to form the comprehensive standard.

The editing instructions are shown in ***bold italic***. Four editing instructions are used: change, delete, insert, and replace. ***Change*** is used to make corrections in existing text or tables. The editing instruction specifies the location of the change and describes what is being changed by using strikethrough (to remove old material) and underscore (to add new material). ***Delete*** removes existing material. ***Insert*** adds new material without disturbing the existing material. Deletions and insertions may require renumbering. If so, ~~renumbering~~ instructions are given in the editing instruction. ***Replace*** is used to make changes in figures or equations by removing the existing figure or equation and replacing it with a new one. Editing instructions, change markings, and this NOTE will not be carried over into future editions because the changes will be incorporated into the base standard.

Cross references that refer to clauses, tables, equations, or figures not covered by this amendment are highlighted in green.¹

¹ Notes in text, tables, and figures are given for information only and do not contain requirements needed to implement the standard.

1. Introduction

1.3 Normative references

Insert the following three references into 1.3 in alphanumeric order:

ITU-T Recommendation G.698.2—Amplified multichannel dense wavelength division multiplexing applications with single channel optical interfaces.²

ITU-T Recommendation G.709—Interfaces for the optical transport network.

ITU-T Recommendation G.709.2—OTU4 long-reach interface.

1.4 Definitions

Insert the following two new definitions after 1.4.35 “100GBASE-SR4”:

1.4.35a 100GBASE-Z: An IEEE 802.3 family of Physical Layer devices using 100GBASE-R encoding, a combination of phase and amplitude modulation, and coherent detection. (See IEEE Std 802.3, Clause 154.)

1.4.35b 100GBASE-ZR: IEEE 802.3 Physical Layer specification for a 100 Gb/s dense wavelength division multiplexing (DWDM) PHY using 100GBASE-R encoding, dual polarization differential quadrature phase shift keying (DP-DQPSK) modulation, and coherent detection with reach up to at least 80 km. (See IEEE Std 802.3, Clause 154.)

Insert the following new definition after 1.4.160 “bit time (BT)”:

1.4.160a black link approach: The specification of the input, output, and transfer characteristics of the unidirectional transmission path from TP2 to TP3 for a given dense wavelength division multiplexing (DWDM) channel within a DWDM black link, without specifying how the transmission path is implemented. (See, for example, IEEE Std 802.3, Clause 154, Figure 154–3.)

Insert the following new definition after 1.4.181 “Channel Operating Margin (COM)”:

1.4.181a channel spacing: The center-to-center difference in frequency or wavelength between adjacent channels in a WDM application. Dense wavelength division multiplexing (DWDM) channel spacings are based on the grid found in ITU-T G.694.1.

Insert the following new definition after 1.4.227 “defect”:

1.4.227a dense wavelength division multiplexing: An optical WDM technology where the frequency spacing is less than or equal to 1000 GHz.

Insert the following three new definitions after 1.4.237 “duplex channel”:

1.4.237a DWDM black link: An aggregate of pairs of dense wavelength division multiplexing (DWDM) channels, with each pair supporting one full duplex connection where the implementation of the transmission paths is not specified.

²ITU-T publications are available from the International Telecommunications Union (<https://www.itu.int/>).

1.4.237b DWDM channel: The transmission path from a transmitting DWDM PHY (TP2) to a receiving DWDM PHY (TP3).

1.4.237c DWDM PHY: An Ethernet PHY that transmits and receives on selected dense wavelength division multiplexing (DWDM) center frequencies for transmission over one selected DWDM channel in each direction.

Insert the following new definition after 1.4.400 “Point-to-point emulation (P2PE)” (renumbered from 1.4.401 due to the deletion of 1.4.294 by IEEE Std 802.3bt-2018):

1.4.400a polarization dependent loss: The variation of insertion loss due to a variation of the state of polarization of an optical signal over all states of polarization within the channel frequency or wavelength range.

1.5 Abbreviations

Insert the following new abbreviations into the list in 1.5, in alphanumeric order:

DP-DQPSK	dual polarization differential quadrature phase shift keying
DQPSK	differential quadrature phase shift keying
DWDM	dense wavelength division multiplexing
FAS	frame alignment signal
GMP	generic mapping procedure (see ITU-T G.709)
IFEC	inverse RS-FEC
MFAS	multi-frame alignment signal
OSNR	optical signal-to-noise ratio
SC-FEC	staircase FEC

30. Management

30.2 Managed Objects

30.2.5 Capabilities

Insert a new row for aSCFECLaneMapping in Table 30–1e after the row for “aRSFECLaneMapping” as follows (unchanged rows not shown):

Table 30–1e—Capabilities

			DTE	Repeater	MAU	
			Basic Package (mandatory)			
			Mandatory Package (mandatory)			
			Recommended Package (optional)			
			Optional Package (optional)			
			Array Package (optional)			
			Excessive Deferral Package (optional)			
			Multiple PHY Package (optional)			
			PHY Error Monitor Capability (optional)			
			Basic Control Capability (mandatory)			
			Performance Monitor Capability (optional)			
			Address Tracking Capability (optional)			
			100/1000 Mb/s Monitor Capability (optional)			
			1000 Mb/s Burst Monitor Capability (optional)			
			Basic Package (mandatory)			
			MAU Control Package (optional)			
			Media Loss Tracking Package (conditional)			
			Broadband DTE MAU Package (conditional)			
			MII Capability (conditional)			
			PHY Error Monitor Capability (optional)			
			MultiGBASE-T Operating Margin package (conditional)			
			Forward Error Correction Package (conditional)			
			Energy-Efficient Ethernet (optional)			
			Auto-Negotiation Package (mandatory)			
oMAU managed object class (30.5.1)						
...						
aSCFECLaneMapping	ATTRIBUTE	GET				X
...						

30.5 Layer management for medium attachment units (MAUs)

30.5.1 MAU managed object class

30.5.1.1 MAU attributes

30.5.1.1.2 aMAUType

Insert 100GBASE-ZR PHY type into the “APPROPRIATE SYNTAX” section of 30.5.1.1.2 after 100GBASE-ER4 (as inserted by IEEE Std 802.3cn-2019) as follows:

APPROPRIATE SYNTAX:

...
 100GBASE-ZR 100GBASE-R PCS/100GBASE-ZR PMA over a PMD with reach
 up to at least 80 km as specified in Clause 154
 ...

30.5.1.1.15 aFECAbility

Change 30.5.1.1.15 as follows:

ATTRIBUTE

APPROPRIATE SYNTAX:

An ENUMERATED VALUE that meets the requirement of the description below

unknown	initializing, true state not yet known
supported	FEC supported
not supported	FEC not supported

BEHAVIOUR DEFINED AS:

A read-only value that indicates if the PHY supports an optional FEC sublayer for forward error correction across the MDI (see 65.2, Clause 74, Clause 91, and Clause 108).

If a Clause 45 MDIO Interface is present, then this attribute maps to the FEC capability register (see 45.2.10.2 or 45.2.1.101).;

30.5.1.1.16 aFECmode

Change the first paragraph of the “BEHAVIOUR DEFINED AS” section of 30.5.1.1.16 as follows:

BEHAVIOUR DEFINED AS:

A read-write value for a PHY that supports an optional FEC sublayer that indicates the mode of operation of the FEC sublayer for forward error correction across the MDI (see 65.2, Clause 74, Clause 91, and Clause 108).

30.5.1.1.17 aFECCorrectedBlocks

Change 30.5.1.1.17 (as modified by IEEE Std 802.3cd-2018) as follows:

ATTRIBUTE

APPROPRIATE SYNTAX:

A SEQUENCE of generalized nonresettable counters. Each counter has a maximum increment rate of 1 200 000 counts per second for 1000 Mb/s implementations, 5 000 000 counts per second for 10 Gb/s, 25 Gb/s, and 40 Gb/s implementations, 10 000 000 counts per second for 50 Gb/s implementations, 2 500 000 counts per second for 100 Gb/s implementations, 40 000 000 counts per second for 200 Gb/s implementations, and 80 000 000 counts per second for 400 Gb/s implementations.

BEHAVIOUR DEFINED AS:

For 1000BASE-PX, 10/25/40/50/100/200/400GBASE-R, 100GBASE-P, 10GBASE-PR, or 10/1GBASE-PRX PHYs that support FEC across the MDI, an array of corrected FEC block counters. The counters do not increment for other PHY types. The indices of this array (0 to N – 1) denote the FEC sublayer instance number where N is the number of FEC sublayer instances in use. The number of FEC sublayer instances in use is set to one for PHYs that do not use PCS lanes or use a single FEC instance for all lanes. Each element of this array contains a count of corrected FEC blocks for that FEC sublayer instance.

Increment the counter by one for each ~~received FEC block~~ received across the MDI that is corrected by the FEC function in the PHY for the corresponding lane or FEC sublayer instance.

If a Clause 45 MDIO Interface is present, then this attribute maps to the FEC corrected blocks

counter(s) (see 45.2.10.5 and 45.2.1.103 for 10GBASE-R, 45.2.3.41 for 10GBASE-PR and 10/1GBASE-PRX, 45.2.1.125 for BASE-R, 45.2.1.112 for RS-FEC, ~~and 45.2.3.61 for PCS FEC~~, and 45.2.1.186al for SC-FEC).;

30.5.1.1.18 aFECUncorrectableBlocks

Change 30.5.1.1.18 (as modified by IEEE Std 802.3cd-2018) as follows:

ATTRIBUTE

APPROPRIATE SYNTAX:

A SEQUENCE of generalized nonresettable counters. Each counter has a maximum increment rate of 1 200 000 counts per second for 1000 Mb/s implementations, and 5 000 000 counts per second for 10 Gb/s, 25 Gb/s, and 40 Gb/s implementations, 10 000 000 counts per second for 50 Gb/s implementations, 2 500 000 counts per second for 100 Gb/s implementations, 40 000 000 counts per second for 200 Gb/s implementations, and 80 000 000 counts per second for 400 Gb/s implementations.

BEHAVIOUR DEFINED AS:

For 1000BASE-PX, 10/25/40/50/100/200/400GBASE-R, 100GBASE-P, 10GBASE-PR, or 10/1GBASE-PRX PHYs that support FEC across the MDI, an array of uncorrectable FEC block counters. The counters do not increment for other PHY types. The indices of this array (0 to N – 1) denote the FEC sublayer instance number where N is the number of FEC sublayer instances in use. The number of FEC sublayer instances in use is set to one for PHYs that do not use PCS lanes or use a single FEC instance for all lanes. Each element of this array contains a count of uncorrectable FEC blocks for that FEC sublayer instance.

Increment the counter by one for each FEC block received across the MDI that is determined to be uncorrectable by the FEC function in the PHY for the corresponding lane or FEC sublayer instance.

If a Clause 45 MDIO Interface is present, then this attribute maps to the FEC uncorrectable blocks counter(s) (see 45.2.10.6 and 45.2.1.104 for 10GBASE-R, 45.2.3.42 for 10GBASE-PR and 10/1GBASE-PRX, 45.2.1.133 for BASE-R, 45.2.1.113 for RS-FEC, ~~and 45.2.3.62 for PCS FEC~~, and 45.2.1.186am for SC-FEC).;

30.5.1.1.26 aRSFECBIPErrorCount

Change 30.5.1.1.26 (as modified by IEEE Std 802.3cd-2018) as follows:

ATTRIBUTE

APPROPRIATE SYNTAX:

A SEQUENCE of generalized nonresettable counters. Each counter has a maximum increment rate of 5 000 counts per second for 50 Gb/s and 100 Gb/s implementations.

BEHAVIOUR DEFINED AS:

For 50GBASE-R, 100GBASE-R, and 100GBASE-P PHYs that support RS-FEC across the MDI, an array of BIP error counters. The counters do not increment for other PHY types. The indices of this array (0 to N – 1) denote the PCS lane number where N is the number of PCS lanes in use. Each element of this array contains a count of BIP errors for that PCS lane.

Increment the counter by one for each BIP error across the MDI detected during alignment marker removal in the PCS for the corresponding lane.

If a Clause 45 MDIO Interface is present, then this attribute maps to the BIP error counters (see 45.2.1.117 and 45.2.1.118).;

30.5.1.1.27 aRSFECLaneMapping

Change 30.5.1.1.27 (as modified by IEEE Std 802.3cd-2018) as follows:

ATTRIBUTE

APPROPRIATE SYNTAX:

A SEQUENCE of INTEGERS.

BEHAVIOUR DEFINED AS:

For 50GBASE-R, 100GBASE-R, and 100GBASE-P PHYs that support RS-FEC across the MDI, an array of PCS lane identifiers. The indices of this array (0 to N – 1) denote the service interface lane number where N is the number of PCS lanes in use. Each element of this array contains the PCS lane number for the PCS lane across the MDI that has been detected in the corresponding service interface lane.

If a Clause 45 MDIO Interface is present, then this attribute maps to the Lane mapping registers (see 45.2.1.119 and 45.2.1.120).;

Insert new subclause 30.5.1.1.27a after 30.5.1.1.27 as follows:

30.5.1.1.27a aSCFECLaneMapping

ATTRIBUTE

APPROPRIATE SYNTAX:

A SEQUENCE of INTEGERS.

BEHAVIOUR DEFINED AS:

For a 100GBASE-R PHY that supports SC-FEC (see Clause 153) across the MDI, an array of PCS lane identifiers. The indices of this array (0 to N – 1) denote the service interface lane number where N is the number of PCS lanes in use. Each element of this array contains the PCS lane number for the PCS lane across the MDI that has been detected in the corresponding service interface lane.

If a Clause 45 MDIO Interface is present, then this attribute maps to the Lane mapping registers (see 45.2.1.186aj and 45.2.1.186ak).;

30.5.1.1.28 aRSFECBypassAbility

Change 30.5.1.1.28 as follows:

ATTRIBUTE

APPROPRIATE SYNTAX:

An ENUMERATED VALUE that meets the requirement of the following description:

unknown	initializing, true state not yet known
supported	FEC bypass ability supported
not supported	FEC bypass ability not supported

BEHAVIOUR DEFINED AS:

A read-only value that indicates if ~~the a~~ PHY that supports RS-FEC across the MDI supports an ~~the optional RS-FEC bypass ability (see 91.5.3.3).~~

For a PHY that does not support RS-FEC across the MDI, this attribute is not applicable.

If a Clause 45 MDIO Interface is present, then this attribute maps to the RS-FEC status register (see 45.2.1.111).;

30.5.1.1.29 aRSFECBypassIndicationAbility

Change 30.5.1.1.29 (as modified by IEEE Std 802.3cd-2018) as follows:

ATTRIBUTE

APPROPRIATE SYNTAX:

An ENUMERATED VALUE that meets the requirement of the following description:

unknown	initializing, true state not yet known
supported	FEC error indication bypass ability supported
not supported	FEC error indication bypass ability not supported

BEHAVIOUR DEFINED AS:

A read-only value that indicates if ~~the~~ a PHY that supports RS-FEC across the MDI supports ~~an~~ the optional RS-FEC error indication bypass ability.

For a PHY that does not support RS-FEC across the MDI, this attribute is not applicable.

If a Clause 45 MDIO Interface is present, then this attribute maps to the RS-FEC status register (see 45.2.1.111).;

30.5.1.1.32 aPCSFECBypassIndicationAbility

Change 30.5.1.1.32 as follows:

ATTRIBUTE

APPROPRIATE SYNTAX:

An ENUMERATED VALUE that meets the requirement of the following description:

unknown	initializing, true state not yet known
supported	PCS FEC error indication bypass ability supported
not supported	PCS FEC error indication bypass ability not supported

BEHAVIOUR DEFINED AS:

A read-only value that indicates if ~~the~~ a PHY that supports RS-FEC across the MDI supports ~~an~~ the optional PCS FEC error indication bypass ability (see 119.2.5.3).

For a PHY that does not support RS-FEC across the MDI, this attribute is not applicable.

If a Clause 45 MDIO Interface is present, then this attribute maps to the PCS FEC status register (see 45.2.3.60).;

45. Management Data Input/Output (MDIO) Interface

45.2 MDIO Interface Registers

45.2.1 PMA/PMD registers

Change the reserved rows for 1.740 through 1.899 and 1.203 through 1.2293 in Table 45–3 (as modified by IEEE Std 802.3cg-2019) as follows (unchanged rows not shown):

Table 45–3—PMA/PMD registers

Register address	Register name	Subclause
...		
1.740 through 1.899 <u>1.799</u>	Reserved	
<u>1.800</u>	<u>Tx optical channel control</u>	<u>45.2.1.133a</u>
<u>1.801</u>	<u>Tx optical channel ability 1</u>	<u>45.2.1.133b</u>
<u>1.802</u>	<u>Tx optical channel ability 2</u>	<u>45.2.1.133c</u>
<u>1.803</u>	<u>Tx optical channel ability 3</u>	<u>45.2.1.133d</u>
<u>1.804 through 1.819</u>	<u>Reserved</u>	
<u>1.820</u>	<u>Rx optical channel control</u>	<u>45.2.1.133e</u>
<u>1.821</u>	<u>Rx optical channel ability 1</u>	<u>45.2.1.133f</u>
<u>1.822</u>	<u>Rx optical channel ability 2</u>	<u>45.2.1.133g</u>
<u>1.823</u>	<u>Rx optical channel ability 3</u>	<u>45.2.1.133h</u>
<u>1.824 through 1.899</u>	<u>Reserved</u>	
...		
1.2103 through 1.2293 <u>1.2199</u>	Reserved	
<u>1.2200</u>	<u>IFEC control</u>	<u>45.2.1.186aa</u>
<u>1.2201</u>	<u>IFEC status</u>	<u>45.2.1.186ab</u>
<u>1.2202, 1.2203</u>	<u>IFEC corrected codewords counter</u>	<u>45.2.1.186ac</u>
<u>1.2204, 1.2205</u>	<u>IFEC uncorrected codewords counter</u>	<u>45.2.1.186ad</u>
<u>1.2206</u>	<u>IFEC lane mapping</u>	<u>45.2.1.186ae</u>
<u>1.2207 through 1.2209</u>	<u>Reserved</u>	
<u>1.2210 through 1.2217</u>	<u>IFEC symbol error counter, lane 0 to 3</u>	<u>45.2.1.186af</u> <u>45.2.1.186ag</u>
<u>1.2218 through 1.2245</u>	<u>Reserved</u>	
<u>1.2246</u>	<u>SC-FEC alignment status 1</u>	<u>45.2.1.186ah</u>
<u>1.2247</u>	<u>SC-FEC alignment status 2</u>	<u>45.2.1.186ai</u>
<u>1.2248, 1.2249</u>	<u>Reserved</u>	

Table 45–3—PMA/PMD registers (continued)

Register address	Register name	Subclause
<u>1.2250 through 1.2269</u>	<u>SC-FEC lane mapping, lane 0 through 19</u>	<u>45.2.1.186aj</u> , <u>45.2.1.186ak</u>
<u>1.2270 through 1.2275</u>	<u>Reserved</u>	
<u>1.2276, 1.2277</u>	<u>SC-FEC corrected codewords counter</u>	<u>45.2.1.186al</u>
<u>1.2278, 1.2279</u>	<u>SC-FEC uncorrected codewords counter</u>	<u>45.2.1.186am</u>
<u>1.2280 through 1.2283</u>	<u>SC-FEC total bits</u>	<u>45.2.1.186an</u>
<u>1.2284 through 1.2287</u>	<u>SC-FEC corrected bits</u>	<u>45.2.1.186ao</u>
<u>1.2288 through 1.2293</u>	<u>Reserved</u>	
...		

45.2.1.6 PMA/PMD control 2 register (Register 1.7)

Change the indicated reserved row of Table 45–7 (as inserted by IEEE Std 802.3cu-2021) as follows (unchanged rows not shown):

Table 45–7—PMA/PMD control 2 register bit definitions

Bit(s)	Name	Description	R/W ^a
...			
1.7.6:0	PMA/PMD type selection	6 5 4 3 2 1 0 ... 1 0 0 1 1 1 x = reserved 1 0 0 1 1 1 1 = reserved 1 0 0 1 1 1 0 = 100GBASE-ZR PMA/PMD ...	R/W

^a R/W = Read/Write, RO = Read only

45.2.1.7 PMA/PMD status 2 register (Register 1.8)**45.2.1.7.4 Transmit fault (1.8.11)**

Insert a row for 100GBASE-ZR in Table 45–9 after the row for “100GBASE-LR4, 100GBASE-ER4” as follows (unchanged rows not shown):

Table 45–9—Transmit fault description location

PMA/PMD	Description location
...	
100GBASE-ZR	154.5.8
...	

45.2.1.7.5 Receive fault (1.8.10)

Insert a row for 100GBASE-ZR in Table 45–10 after the row for “100GBASE-LR4, 100GBASE-ER4” as follows (unchanged rows not shown):

Table 45–10—Receive fault description location

PMA/PMD	Description location
...	
100GBASE-ZR	154.5.9
...	

45.2.1.8 PMD transmit disable register (Register 1.9)

Insert a row for 100GBASE-ZR in Table 45–12 after the row for “100GBASE-LR4 and 100GBASE-ER4” as follows (unchanged rows not shown):

Table 45–12—Transmit disable description location

PMA/PMD	Description location
...	
100GBASE-ZR	154.5.6
...	

45.2.1.21b 40G/100G PMA/PMD extended ability 2 register (Register 1.26)

Change the row for bit 1.26.6 in Table 45–24b (as modified by IEEE Std 802.3cu-2021) as follows (unchanged rows not shown):

Table 45–24b—40G/100G PMA/PMD extended ability 2 register bit definitions

Bit(s)	Name	Description	R/W ^a
...			
1.26.6	Reserved 100GBASE-ZR ability	Value always 0 1 = PMA/PMD is able to perform 100GBASE-ZR 0 = PMA/PMD is not able to perform 100GBASE-ZR	RO
...			

^aRO = Read only

Insert 45.2.1.21b.3aa before 45.2.1.21b.3a (as inserted by IEEE Std 802.3cu-2021) as follows:

45.2.1.21b.3aa 100GBASE-ZR ability (1.26.6)

When read as a one, bit 1.26.6 indicates that the PMA/PMD is able to operate as a 100GBASE-ZR PMA/PMD type. When read as a zero, bit 1.26.6 indicates that the PMA/PMD is not able to operate as a 100GBASE-ZR PMA/PMD type.

Insert 45.2.1.133a through 45.2.1.133h after 45.2.1.133 as follows:

45.2.1.133a Tx optical channel control register (Register 1.800)

The assignment of bits in the Tx optical channel control register is shown in Table 45–102k.

Table 45–102k—Tx optical channel control register bit definitions

Bit(s)	Name	Description	R/W ^a
1.800.15:6	Reserved	Value always 0	RO
1.800.5:0	Tx optical channel index	Integer value of the Tx optical channel index	R/W

^aR/W = Read/Write, RO = Read only

45.2.1.133a.1 Tx optical channel index (1.800.5:0)

Bits 1.800.5:0 set the value of the Tx optical channel index (which directly relates to the optical channel and transmitter center frequency) with bit 1.800.0 being the LSB and bit 1.800.5 being the MSB. The channel index number indicates the corresponding optical frequency. For 100GBASE-ZR the specific optical frequency corresponding to each channel index number is listed in Table 154–5.

45.2.1.133b Tx optical channel ability 1 register (Register 1.801)

The assignment of bits in the Tx optical channel ability 1 register is shown in Table 45–102l.

Table 45–102l—Tx optical channel ability 1 register bit definitions

Bit(s)	Name	Description	R/W ^a
1.801.15	Tx index ability 15	1 = PMD is able to operate with Tx optical channel index = 15 0 = PMD is not able to operate with Tx optical channel index = 15	RO
1.801.14	Tx index ability 14	1 = PMD is able to operate with Tx optical channel index = 14 0 = PMD is not able to operate with Tx optical channel index = 14	RO
1.801.13	Tx index ability 13	1 = PMD is able to operate with Tx optical channel index = 13 0 = PMD is not able to operate with Tx optical channel index = 13	RO
1.801.12	Tx index ability 12	1 = PMD is able to operate with Tx optical channel index = 12 0 = PMD is not able to operate with Tx optical channel index = 12	RO
1.801.11	Tx index ability 11	1 = PMD is able to operate with Tx optical channel index = 11 0 = PMD is not able to operate with Tx optical channel index = 11	RO
1.801.10	Tx index ability 10	1 = PMD is able to operate with Tx optical channel index = 10 0 = PMD is not able to operate with Tx optical channel index = 10	RO

Table 45–102l—Tx optical channel ability 1 register bit definitions (continued)

Bit(s)	Name	Description	R/W ^a
1.801.9	Tx index ability 9	1 = PMD is able to operate with Tx optical channel index = 9 0 = PMD is not able to operate with Tx optical channel index = 9	RO
1.801.8	Tx index ability 8	1 = PMD is able to operate with Tx optical channel index = 8 0 = PMD is not able to operate with Tx optical channel index = 8	RO
1.801.7	Tx index ability 7	1 = PMD is able to operate with Tx optical channel index = 7 0 = PMD is not able to operate with Tx optical channel index = 7	RO
1.801.6	Tx index ability 6	1 = PMD is able to operate with Tx optical channel index = 6 0 = PMD is not able to operate with Tx optical channel index = 6	RO
1.801.5	Tx index ability 5	1 = PMD is able to operate with Tx optical channel index = 5 0 = PMD is not able to operate with Tx optical channel index = 5	RO
1.801.4	Tx index ability 4	1 = PMD is able to operate with Tx optical channel index = 4 0 = PMD is not able to operate with Tx optical channel index = 4	RO
1.801.3	Tx index ability 3	1 = PMD is able to operate with Tx optical channel index = 3 0 = PMD is not able to operate with Tx optical channel index = 3	RO
1.801.2	Tx index ability 2	1 = PMD is able to operate with Tx optical channel index = 2 0 = PMD is not able to operate with Tx optical channel index = 2	RO
1.801.1	Tx index ability 1	1 = PMD is able to operate with Tx optical channel index = 1 0 = PMD is not able to operate with Tx optical channel index = 1	RO
1.801.0	Tx index ability 0	1 = PMD is able to operate with Tx optical channel index = 0 0 = PMD is not able to operate with Tx optical channel index = 0	RO

^aRO = Read only**45.2.1.133b.1 Tx index ability 0 through 15 (1.801.0 through 1.801.15)**

When read as a one, bit 1.801.0 indicates that the PMD selected by bits 1.7.6:0 is able to operate with a Tx optical channel index of 0. When read as a zero, bit 1.801.0 indicates that the PMD is not able to operate with a Tx optical channel index of 0. Bits 1.801.1 through 1.801.15 indicate the equivalent for index values 1 through 15, respectively. The optical frequencies that correspond to these index values are given in the appropriate PMD clause. For 100GBASE-ZR see Table 154–5.

45.2.1.133c Tx optical channel ability 2 register (Register 1.802)

The assignment of bits in the Tx optical channel ability 2 register is shown in Table 45–102m.

Table 45–102m—Tx optical channel ability 2 register bit definitions

Bit(s)	Name	Description	R/W ^a
1.802.15	Tx index ability 31	1 = PMD is able to operate with Tx optical channel index = 31 0 = PMD is not able to operate with Tx optical channel index = 31	RO
1.802.14	Tx index ability 30	1 = PMD is able to operate with Tx optical channel index = 30 0 = PMD is not able to operate with Tx optical channel index = 30	RO
1.802.13	Tx index ability 29	1 = PMD is able to operate with Tx optical channel index = 29 0 = PMD is not able to operate with Tx optical channel index = 29	RO

Table 45–102m—Tx optical channel ability 2 register bit definitions (continued)

Bit(s)	Name	Description	R/W ^a
1.802.12	Tx index ability 28	1 = PMD is able to operate with Tx optical channel index = 28 0 = PMD is not able to operate with Tx optical channel index = 28	RO
1.802.11	Tx index ability 27	1 = PMD is able to operate with Tx optical channel index = 27 0 = PMD is not able to operate with Tx optical channel index = 27	RO
1.802.10	Tx index ability 26	1 = PMD is able to operate with Tx optical channel index = 26 0 = PMD is not able to operate with Tx optical channel index = 26	RO
1.802.9	Tx index ability 25	1 = PMD is able to operate with Tx optical channel index = 25 0 = PMD is not able to operate with Tx optical channel index = 25	RO
1.802.8	Tx index ability 24	1 = PMD is able to operate with Tx optical channel index = 24 0 = PMD is not able to operate with Tx optical channel index = 24	RO
1.802.7	Tx index ability 23	1 = PMD is able to operate with Tx optical channel index = 23 0 = PMD is not able to operate with Tx optical channel index = 23	RO
1.802.6	Tx index ability 22	1 = PMD is able to operate with Tx optical channel index = 22 0 = PMD is not able to operate with Tx optical channel index = 22	RO
1.802.5	Tx index ability 21	1 = PMD is able to operate with Tx optical channel index = 21 0 = PMD is not able to operate with Tx optical channel index = 21	RO
1.802.4	Tx index ability 20	1 = PMD is able to operate with Tx optical channel index = 20 0 = PMD is not able to operate with Tx optical channel index = 20	RO
1.802.3	Tx index ability 19	1 = PMD is able to operate with Tx optical channel index = 19 0 = PMD is not able to operate with Tx optical channel index = 19	RO
1.802.2	Tx index ability 18	1 = PMD is able to operate with Tx optical channel index = 18 0 = PMD is not able to operate with Tx optical channel index = 18	RO
1.802.1	Tx index ability 17	1 = PMD is able to operate with Tx optical channel index = 17 0 = PMD is not able to operate with Tx optical channel index = 17	RO
1.802.0	Tx index ability 16	1 = PMD is able to operate with Tx optical channel index = 16 0 = PMD is not able to operate with Tx optical channel index = 16	RO

^aRO = Read only**45.2.1.133c.1 Tx index ability 16 through 31 (1.802.0 through 1.802.15)**

When read as a one, bit 1.802.0 indicates that the PMD selected by bits 1.7.6:0 is able to operate with a Tx optical channel index of 16. When read as a zero, bit 1.802.0 indicates that the PMD is not able to operate with a Tx optical channel index of 16. Bits 1.802.1 through 1.802.15 indicate the equivalent for index values 17 through 31, respectively. The optical frequencies that correspond to these index values are given in the appropriate PMD clause. For 100GBASE-ZR see Table 154–5.

45.2.1.133d Tx optical channel ability 3 register (Register 1.803)

The assignment of bits in the Tx optical channel ability 3 register is shown in Table 45–102n.

Table 45–102n—Tx optical channel ability 3 register bit definitions

Bit(s)	Name	Description	R/W ^a
1.803.15	Tx index ability 47	1 = PMD is able to operate with Tx optical channel index = 47 0 = PMD is not able to operate with Tx optical channel index = 47	RO
1.803.14	Tx index ability 46	1 = PMD is able to operate with Tx optical channel index = 46 0 = PMD is not able to operate with Tx optical channel index = 46	RO
1.803.13	Tx index ability 45	1 = PMD is able to operate with Tx optical channel index = 45 0 = PMD is not able to operate with Tx optical channel index = 45	RO
1.803.12	Tx index ability 44	1 = PMD is able to operate with Tx optical channel index = 44 0 = PMD is not able to operate with Tx optical channel index = 44	RO
1.803.11	Tx index ability 43	1 = PMD is able to operate with Tx optical channel index = 43 0 = PMD is not able to operate with Tx optical channel index = 43	RO
1.803.10	Tx index ability 42	1 = PMD is able to operate with Tx optical channel index = 42 0 = PMD is not able to operate with Tx optical channel index = 42	RO
1.803.9	Tx index ability 41	1 = PMD is able to operate with Tx optical channel index = 41 0 = PMD is not able to operate with Tx optical channel index = 41	RO
1.803.8	Tx index ability 40	1 = PMD is able to operate with Tx optical channel index = 40 0 = PMD is not able to operate with Tx optical channel index = 40	RO
1.803.7	Tx index ability 39	1 = PMD is able to operate with Tx optical channel index = 39 0 = PMD is not able to operate with Tx optical channel index = 39	RO
1.803.6	Tx index ability 38	1 = PMD is able to operate with Tx optical channel index = 38 0 = PMD is not able to operate with Tx optical channel index = 38	RO
1.803.5	Tx index ability 37	1 = PMD is able to operate with Tx optical channel index = 37 0 = PMD is not able to operate with Tx optical channel index = 37	RO
1.803.4	Tx index ability 36	1 = PMD is able to operate with Tx optical channel index = 36 0 = PMD is not able to operate with Tx optical channel index = 36	RO
1.803.3	Tx index ability 35	1 = PMD is able to operate with Tx optical channel index = 35 0 = PMD is not able to operate with Tx optical channel index = 35	RO
1.803.2	Tx index ability 34	1 = PMD is able to operate with Tx optical channel index = 34 0 = PMD is not able to operate with Tx optical channel index = 34	RO
1.803.1	Tx index ability 33	1 = PMD is able to operate with Tx optical channel index = 33 0 = PMD is not able to operate with Tx optical channel index = 33	RO
1.803.0	Tx index ability 32	1 = PMD is able to operate with Tx optical channel index = 32 0 = PMD is not able to operate with Tx optical channel index = 32	RO

^aRO = Read only

45.2.1.133d.1 Tx index ability 32 through 47 (1.803.0 through 1.803.15)

When read as a one, bit 1.803.0 indicates that the PMD selected by bits 1.7.6:0 is able to operate with a Tx optical channel index of 32. When read as a zero, bit 1.803.0 indicates that the PMD is not able to operate with a Tx optical channel index of 32. Bits 1.803.1 through 1.803.15 indicate the equivalent for index values

33 through 47, respectively. The optical frequencies that correspond to these index values are given in the appropriate PMD clause. For 100GBASE-ZR see Table 154–5.

45.2.1.133e Rx optical channel control register (Register 1.820)

The assignment of bits in the Rx optical channel control register is shown in Table 45–102o.

Table 45–102o—Rx optical channel control register bit definitions

Bit(s)	Name	Description	R/W ^a
1.820.15	Tx Rx different optical channel ability	1 = PMD is able to operate with different Tx and Rx optical channels 0 = PMD is not able to operate with different Tx and Rx optical channels	RO
1.820.14:6	Reserved	Value always 0	RO
1.820.5:0	Rx optical channel index	Integer value of the Rx optical channel index	R/W

^aR/W = Read/Write, RO = Read only

45.2.1.133e.1 Tx Rx different optical channel ability (1.820.15)

When read as a one, bit 1.820.15 indicates that the PMD is able to operate with an Rx optical channel index that is different from the Tx optical channel index. When read as a zero, bit 1.820.15 indicates that the PMD is not able to operate with an Rx optical channel index that is different from the Tx optical channel index.

45.2.1.133e.2 Rx optical channel index (1.820.5:0)

If the PMD is able to operate with an Rx optical channel index number that is different from the Tx optical channel index number (bit 1.820.15 is one), bits 1.820.5:0 set the value of the Rx optical channel index number (and hence the receiver optical frequency) with bit 1.820.0 being the LSB and bit 1.820.5 being the MSB. The channel index number indicates the corresponding optical frequency. For 100GBASE-ZR the specific optical frequency corresponding to each channel index number is listed in Table 154–5. If the PMD is not able to operate with an Rx optical channel index that is different from the Tx optical channel index (bit 1.820.15 is zero), bits 1.820.5:0 have no effect and the value of the Rx optical channel index is the same as the value of the Tx optical channel index as set by bits 1.800.5:0.

45.2.1.133f Rx optical channel ability 1 register (Register 1.821)

The assignment of bits in the Rx optical channel ability 1 register is shown in Table 45–102p.

Table 45–102p—Rx optical channel ability 1 register bit definitions

Bit(s)	Name	Description	R/W ^a
1.821.15	Rx index ability 15	1 = PMD is able to operate with Rx optical channel index = 15 0 = PMD is not able to operate with Rx optical channel index = 15	RO
1.821.14	Rx index ability 14	1 = PMD is able to operate with Rx optical channel index = 14 0 = PMD is not able to operate with Rx optical channel index = 14	RO
1.821.13	Rx index ability 13	1 = PMD is able to operate with Rx optical channel index = 13 0 = PMD is not able to operate with Rx optical channel index = 13	RO
1.821.12	Rx index ability 12	1 = PMD is able to operate with Rx optical channel index = 12 0 = PMD is not able to operate with Rx optical channel index = 12	RO
1.821.11	Rx index ability 11	1 = PMD is able to operate with Rx optical channel index = 11 0 = PMD is not able to operate with Rx optical channel index = 11	RO
1.821.10	Rx index ability 10	1 = PMD is able to operate with Rx optical channel index = 10 0 = PMD is not able to operate with Rx optical channel index = 10	RO
1.821.9	Rx index ability 9	1 = PMD is able to operate with Rx optical channel index = 9 0 = PMD is not able to operate with Rx optical channel index = 9	RO
1.821.8	Rx index ability 8	1 = PMD is able to operate with Rx optical channel index = 8 0 = PMD is not able to operate with Rx optical channel index = 8	RO
1.821.7	Rx index ability 7	1 = PMD is able to operate with Rx optical channel index = 7 0 = PMD is not able to operate with Rx optical channel index = 7	RO
1.821.6	Rx index ability 6	1 = PMD is able to operate with Rx optical channel index = 6 0 = PMD is not able to operate with Rx optical channel index = 6	RO
1.821.5	Rx index ability 5	1 = PMD is able to operate with Rx optical channel index = 5 0 = PMD is not able to operate with Rx optical channel index = 5	RO
1.821.4	Rx index ability 4	1 = PMD is able to operate with Rx optical channel index = 4 0 = PMD is not able to operate with Rx optical channel index = 4	RO
1.821.3	Rx index ability 3	1 = PMD is able to operate with Rx optical channel index = 3 0 = PMD is not able to operate with Rx optical channel index = 3	RO
1.821.2	Rx index ability 2	1 = PMD is able to operate with Rx optical channel index = 2 0 = PMD is not able to operate with Rx optical channel index = 2	RO
1.821.1	Rx index ability 1	1 = PMD is able to operate with Rx optical channel index = 1 0 = PMD is not able to operate with Rx optical channel index = 1	RO
1.821.0	Rx index ability 0	1 = PMD is able to operate with Rx optical channel index = 0 0 = PMD is not able to operate with Rx optical channel index = 0	RO

^aRO = Read only

45.2.1.133f.1 Rx index ability 0 through 15 (1.821.0 through 1.821.15)

When read as a one, bit 1.821.0 indicates that the PMD selected by bits 1.7.6:0 is able to operate with an Rx optical channel index of 0. When read as a zero, bit 1.821.0 indicates that the PMD is not able to operate with an Rx optical channel index of 0. Bits 1.821.1 through 1.821.15 indicate the equivalent for index values

1 through 15, respectively. The optical frequencies that correspond to these index values are given in the appropriate PMD clause. For 100GBASE-ZR see Table 154–5.

45.2.1.133g Rx optical channel ability 2 register (Register 1.822)

The assignment of bits in the Rx optical channel ability 2 register is shown in Table 45–102q.

Table 45–102q—Rx optical channel ability 2 register bit definitions

Bit(s)	Name	Description	R/W ^a
1.822.15	Rx index ability 31	1 = PMD is able to operate with Rx optical channel index = 31 0 = PMD is not able to operate with Rx optical channel index = 31	RO
1.822.14	Rx index ability 30	1 = PMD is able to operate with Rx optical channel index = 30 0 = PMD is not able to operate with Rx optical channel index = 30	RO
1.822.13	Rx index ability 29	1 = PMD is able to operate with Rx optical channel index = 29 0 = PMD is not able to operate with Rx optical channel index = 29	RO
1.822.12	Rx index ability 28	1 = PMD is able to operate with Rx optical channel index = 28 0 = PMD is not able to operate with Rx optical channel index = 28	RO
1.822.11	Rx index ability 27	1 = PMD is able to operate with Rx optical channel index = 27 0 = PMD is not able to operate with Rx optical channel index = 27	RO
1.822.10	Rx index ability 26	1 = PMD is able to operate with Rx optical channel index = 26 0 = PMD is not able to operate with Rx optical channel index = 26	RO
1.822.9	Rx index ability 25	1 = PMD is able to operate with Rx optical channel index = 25 0 = PMD is not able to operate with Rx optical channel index = 25	RO
1.822.8	Rx index ability 24	1 = PMD is able to operate with Rx optical channel index = 24 0 = PMD is not able to operate with Rx optical channel index = 24	RO
1.822.7	Rx index ability 23	1 = PMD is able to operate with Rx optical channel index = 23 0 = PMD is not able to operate with Rx optical channel index = 23	RO
1.822.6	Rx index ability 22	1 = PMD is able to operate with Rx optical channel index = 22 0 = PMD is not able to operate with Rx optical channel index = 22	RO
1.822.5	Rx index ability 21	1 = PMD is able to operate with Rx optical channel index = 21 0 = PMD is not able to operate with Rx optical channel index = 21	RO
1.822.4	Rx index ability 20	1 = PMD is able to operate with Rx optical channel index = 20 0 = PMD is not able to operate with Rx optical channel index = 20	RO
1.822.3	Rx index ability 19	1 = PMD is able to operate with Rx optical channel index = 19 0 = PMD is not able to operate with Rx optical channel index = 19	RO
1.822.2	Rx index ability 18	1 = PMD is able to operate with Rx optical channel index = 18 0 = PMD is not able to operate with Rx optical channel index = 18	RO
1.822.1	Rx index ability 17	1 = PMD is able to operate with Rx optical channel index = 17 0 = PMD is not able to operate with Rx optical channel index = 17	RO
1.822.0	Rx index ability 16	1 = PMD is able to operate with Rx optical channel index = 16 0 = PMD is not able to operate with Rx optical channel index = 16	RO

^aRO = Read only