

# IEEE Standard for Ethernet

## Amendment 9: Physical Layer Specifications and Management Parameters for 1000 Mb/s Operation Over Plastic Optical Fiber

IEEE Computer Society

Sponsored by the  
LAN/MAN Standards Committee

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3 Park Avenue  
New York, NY 10016-5997  
USA

**IEEE Std 802.3bv™-2017**

(Amendment to  
IEEE Std 802.3™-2015  
as amended by  
IEEE Std 802.3bw™-2015,  
IEEE Std 802.3by™-2016,  
IEEE Std 802.3bq™-2016,  
IEEE Std 802.3bp™-2016,  
IEEE Std 802.3br™-2016,  
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## **Amendment 9: Physical Layer Specifications and Management Parameters for 1000 Mb/s Operation Over Plastic Optical Fiber**

**LAN/MAN Standards Committee**  
of the  
**IEEE Computer Society**

Approved 14 February 2017  
**IEEE-SA Standards Board**

**Abstract:** A family of three point-to-point physical layers (PHYs) for 1000 Mb/s operation over duplex plastic optical fiber (POF) and related management parameters are specified by this amendment to IEEE Std 802.3-2015.

**Keywords:** 1000BASE-H, 1000BASE-RHA, 1000BASE-RHB, 1000BASE-RXC, amendment, BASE-H, EEE, Energy Efficient Ethernet, IEEE 802.3™, IEEE 802.3bv™, PCS, Physical Coding Sublayer, Physical Medium Attachment sublayer, Physical Medium Dependent sublayer, plastic optical fiber, PMA, PMD, POF

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## Introduction

This introduction is not part of IEEE Std 802.3bv-2017, IEEE Standard for Ethernet—Amendment 9: Physical Layer Specifications and Management Parameters for 1000 Mb/s Operation Over Plastic Optical Fiber

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 802.3-2015 and are not maintained as separate documents.

At the date of IEEE Std 802.3bv-2017 publication, IEEE Std 802.3 is composed of the following documents:

### IEEE Std 802.3-2015

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 includes 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.

#### IEEE Std 802.3bw™-2015

Amendment 1—This amendment includes changes to IEEE Std 802.3-2015 and adds Clause 96. This amendment adds 100 Mb/s Physical Layer (PHY) specifications and management parameters for operation on a single balanced twisted-pair copper cable.

#### IEEE Std 802.3by™-2016

Amendment 2—This amendment includes changes to IEEE Std 802.3-2015 and adds Clause 105 through Clause 112, Annex 109A, Annex 109B, Annex 110A, Annex 110B, and Annex 110C. This amendment adds MAC parameters, Physical Layers, and management parameters for the transfer of IEEE 802.3 format frames at 25 Gb/s.

#### IEEE Std 802.3bq™-2016

Amendment 3—This amendment includes changes to IEEE Std 802.3-2015 and adds Clause 113 and Annex 113A. This amendment adds new Physical Layers for 25 Gb/s and 40 Gb/s operation over balanced twisted-pair structured cabling systems.

#### IEEE Std 802.3bp™-2016

Amendment 4—This amendment includes changes to IEEE Std 802.3-2015 and adds Clause 97 and Clause 98. This amendment adds point-to-point 1 Gb/s Physical Layer (PHY) specifications and management parameters for operation on a single balanced twisted-pair copper cable in automotive and other applications not utilizing the structured wiring plant.

#### IEEE Std 802.3br™-2016

Amendment 5—This amendment includes changes to IEEE Std 802.3-2015 and adds Clause 99. This amendment adds a MAC Merge sublayer and a MAC Merge Service Interface to support for Interspersing Express Traffic over a single link.

#### IEEE Std 802.3bn™-2016

Amendment 6—This amendment adds the Physical Layer specifications and management parameters for symmetric and/or asymmetric operation of up to 10 Gb/s on point-to-multipoint Radio Frequency (RF) distribution plants comprising either amplified or passive coaxial media. It also extends the operation of Ethernet Passive Optical Networks (EPON) protocols, such as Multipoint Control Protocol (MPCP) and Operation Administration and Management (OAM).

#### IEEE Std 802.3bz™-2016

Amendment 7—This amendment includes changes to IEEE Std 802.3-2015 and adds Clause 125 and Clause 126. This amendment adds new rates of 2.5 Gb/s and 5 Gb/s and new Physical Layers for operation at 2.5 Gb/s and 5 Gb/s over balanced twisted-pair structured cabling systems.

#### IEEE Std 802.3bu™-2016

Amendment 8—This amendment includes changes to IEEE Std 802.3-2015 to define a methodology for the provision of power via a single twisted pair to connected Data Terminal Equipment (DTE) with IEEE 802.3 single twisted-pair interfaces.

#### IEEE Std 802.3bv-2017

Amendment 9—This amendment includes changes to IEEE Std 802.3-2015 and adds Clause 115 and Annex 115A. This amendment adds point-to-point 1000 Mb/s Physical Layer (PHY) specifications and management parameters for operation on duplex plastic optical fiber (POF) targeting use in automotive, industrial, home-network, and other applications.

A companion document IEEE Std 802.3.1 describes Ethernet management information base (MIB) modules for use with the Simple Network Management Protocol (SNMP). IEEE Std 802.3.1 is updated to add management capability for enhancements to IEEE Std 802.3 after approval of the 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.

# Contents

1. Introduction.....	18
1.3 Normative references.....	18
1.4 Definitions .....	18
1.5 Abbreviations.....	20
30. Management.....	21
30.3.2.1.2 aPhyType.....	21
30.3.2.1.3 aPhyTypeList.....	21
30.5.1.1.2 aMAUType.....	21
30.5.1.1.4 aMediaAvailable.....	21
45. Management Data Input/Output (MDIO) Interface.....	22
45.2 MDIO Interface Registers.....	22
45.2.1 PMA/PMD registers .....	22
45.2.1.6 PMA/PMD control 2 register (Register 1.7).....	23
45.2.1.10 PMA/PMD extended ability register (Register 1.11) .....	23
45.2.1.10.aaaa BASE-H extended abilities (1.11.15) .....	23
45.2.1.14d BASE-H PMA/PMD extended ability register (Register 1.22).....	24
45.2.1.117a BASE-H PMA/PMD control register (Register 1.900).....	24
45.2.1.117a.1 Type selection (1.900.3:0).....	24
45.2.3 PCS registers.....	25
45.2.3.47a 1000BASE-H OAM transmit registers (Registers 3.500 through 3.508).....	25
45.2.3.47a.1 TXO_REQ (3.500.15).....	25
45.2.3.47a.2 TXO_PHYT (3.500.14).....	26
45.2.3.47a.3 TXO_MERT (3.500.13) .....	26
45.2.3.47a.4 TXO_MSGT (3.500.12) .....	26
45.2.3.47a.5 TXO_DATAx (Bits 3.500.11:0 and Registers 3.501 through 3.508).....	26
45.2.3.47b 1000BASE-H OAM receive registers (Registers 3.509 through 3.517).....	27
45.2.3.47b.1 RXO_VAL (3.509.15).....	27
45.2.3.47b.2 RXO_MSGT (3.509.12).....	28
45.2.3.47b.3 RXO_DATAx (Bits 3.509.11:0 and Registers 3.510 through 3.517).....	28
45.2.3.47c 1000BASE-H PCS control register (Register 3.518).....	28
45.2.3.47c.1 Operation mode (3.518.15:13).....	28
45.2.3.47c.2 Loopback mode (3.518.12:10).....	28
45.2.3.47c.3 1000BASE-H OAM enable (3.518.1).....	29
45.2.3.47c.4 EEE enable (3.518.0).....	29
45.2.3.47d 1000BASE-H PCS status 1 register (Register 3.519).....	29
45.2.3.47d.1 Local receiver status (3.519.15).....	30
45.2.3.47d.2 Remote receiver status (3.519.14) .....	30
45.2.3.47d.3 Link status (3.519.13) .....	30
45.2.3.47d.4 Local PHD reception status (3.519.12).....	30
45.2.3.47d.5 Remote PHD reception status (3.519.11) .....	30
45.2.3.47d.6 PHD lock status (3.519.10).....	30
45.2.3.47d.7 THP lock status (3.519.9).....	30
45.2.3.47d.8 Tx Assert LPI received (3.519.8).....	31
45.2.3.47d.9 Rx Assert LPI generated (3.519.7) .....	31
45.2.3.47d.10 Tx LPI indication (3.519.6) .....	31
45.2.3.47d.11 Rx LPI indication (3.519.5).....	31

45.2.3.47d.12	Remote 1000BASE-H OAM ability (3.519.3)	31
45.2.3.47d.13	Remote EEE ability (3.519.2)	31
45.2.3.47d.14	1000BASE-H OAM ability (3.519.1)	31
45.2.3.47d.15	EEE ability (3.519.0)	32
45.2.3.47e	1000BASE-H PCS status 2 register (Register 3.520)	32
45.2.3.47e.1	Local link margin (3.520.7:0)	32
45.2.3.47f	1000BASE-H PCS status 3 register (Register 3.521)	32
45.2.3.47f.1	Remote link margin (3.521.7:0)	32
45.2.3.47g	1000BASE-H PCS status 4 register (Register 3.522)	32
45.5	Protocol implementation conformance statement (PICS) proforma for Clause 45, Management Data Input/Output (MDIO) interface	34
45.5.3	PICS proforma tables for the Management Data Input Output (MDIO) interface	34
45.5.3.2	PMA/PMD MMD options	34
45.5.3.3	PMA/PMD management functions	34
45.5.3.6	PCS options	35
45.5.3.7	PCS management functions	35
78.	Energy-Efficient Ethernet (EEE)	37
78.1.4	PHY types optionally supporting EEE	37
78.2	LPI mode timing parameters descriptions	37
78.5	Communication link access latency	37
115.	Physical Coding Sublayer (PCS), Physical Medium Attachment (PMA) sublayer, and Physical Medium Dependent (PMD) sublayer, types 1000BASE-RHA, 1000BASE-RHB, and 1000BASE- RHC	38
115.1	Overview	38
115.1.1	Features	38
115.1.2	Conventions	38
115.1.3	Relationship of 1000BASE-RHx to other standards	38
115.1.4	Relationship to other Gigabit Ethernet PHY types	39
115.1.5	Operation of 1000BASE-RHx	39
115.1.6	Functional block diagram	41
115.2	Physical Coding Sublayer (PCS)	42
115.2.1	Transmit Block	42
115.2.2	Pilots data path	44
115.2.2.1	Pilot S1 generator	44
115.2.2.2	Pilot S2 generator	45
115.2.3	Physical header encoding and scrambling	46
115.2.3.1	Physical header CRC16	46
115.2.3.2	Physical header binary scrambler	47
115.2.3.3	Physical header BCH encoder	47
115.2.3.4	Physical header modulation	47
115.2.3.5	Physical header ordering	48
115.2.4	Payload data encoding and scrambling	48
115.2.4.1	GMII data stream encoding	48
115.2.4.1.1	64B/65B encoding	48
115.2.4.1.2	64B/65B encoding formal definition	51
115.2.4.1.3	PDB alignment with Transmit Block	52
115.2.4.2	Payload data binary scrambler	52
115.2.4.3	PAM16 encoder	53
115.2.4.3.1	MLCC demultiplexer	54
115.2.4.3.2	Payload BCH encoder	54

115.2.4.3.3	QAM16 mapper .....	55
115.2.4.3.4	QAM8 mapper .....	56
115.2.4.3.5	First lattice transformation .....	56
115.2.4.3.6	Lattice addition .....	56
115.2.4.3.7	Second lattice transformation .....	57
115.2.4.3.8	QAM to PAM multiplexer .....	57
115.2.4.4	Payload data symbol scrambler .....	57
115.2.5	PCS receive function .....	58
115.3	Physical Medium Attachment (PMA) sublayer .....	60
115.3.1	PMA transmit function .....	60
115.3.1.1	Payload data Tomlinson-Harashima precoding .....	60
115.3.1.2	Transmit power scaling .....	61
115.3.2	PMA receive function .....	61
115.3.3	Interface to the PMD .....	62
115.3.3.1	Signals transmitted to the PMD .....	62
115.3.3.2	Signals received from PMD .....	62
115.3.4	Physical Header Data (PHD) .....	63
115.3.5	PHY control .....	66
115.3.5.1	PHY control state variables .....	66
115.3.5.2	PHY TX control state diagram .....	68
115.3.5.3	PHY RX control state diagram .....	69
115.3.5.4	Link monitor state diagram .....	71
115.3.5.5	PHD monitor state diagrams .....	72
115.3.6	Adaptive THP protocol .....	74
115.3.6.1	Adaptive THP state variables .....	74
115.3.6.2	Adaptive THP TX state diagram .....	75
115.3.6.3	Adaptive THP REQ state diagram .....	77
115.3.7	PHY quality monitor .....	78
115.3.7.1	PHY quality criterion .....	78
115.3.7.2	PHY quality assessment .....	78
115.3.7.3	PHY quality monitor state variables .....	79
115.3.7.4	PHY quality monitor state diagram .....	79
115.3.8	Fixed-point format formal definition .....	81
115.3.8.1	Fixed-point encoding .....	81
115.3.8.2	Fixed-point decoding .....	81
115.4	Energy-Efficient Ethernet (EEE) .....	81
115.4.1	LPI mode transmit operation .....	83
115.4.2	LPI mode receive operation .....	83
115.4.3	PMD power control state variables .....	84
115.4.4	PMD power control state diagrams .....	84
115.5	Test modes .....	86
115.5.1	Test mode 1 .....	87
115.5.2	Test mode 2 .....	87
115.5.3	Test mode 3 .....	87
115.5.4	Test mode 4 .....	87
115.5.5	Test mode 5 .....	87
115.5.6	Test mode 6 .....	87
115.6	Physical Medium Dependent (PMD) sublayer .....	89
115.6.1	PMD service interface .....	89
115.6.1.1	PMD_COMSIGNAL.request .....	89
115.6.1.1.1	Semantics of the primitive .....	89
115.6.1.1.2	When generated .....	89
115.6.1.1.3	Effect of receipt .....	89
115.6.1.2	PMD_COMSIGNAL.indication .....	89

115.6.1.2.1	Semantics of the primitive .....	89
115.6.1.2.2	When generated .....	90
115.6.1.2.3	Effect of receipt .....	90
115.6.1.3	PMD_TXPWR.request .....	90
115.6.1.3.1	Semantics of the primitive .....	90
115.6.1.3.2	When generated .....	90
115.6.1.3.3	Effect of receipt .....	90
115.6.1.4	PMD_RXPWR.request .....	90
115.6.1.4.1	Semantics of the primitive .....	90
115.6.1.4.2	When generated .....	91
115.6.1.4.3	Effect of receipt .....	91
115.6.1.5	PMD_RXDETECT.indication .....	91
115.6.1.5.1	Semantics of the primitive .....	91
115.6.1.5.2	When generated .....	91
115.6.1.5.3	Effect of receipt .....	91
115.6.1.6	PMD_SDINH.request .....	91
115.6.1.6.1	Semantics of the primitive .....	92
115.6.1.6.2	When generated .....	92
115.6.1.6.3	Effect of receipt .....	92
115.6.2	PMD functional specifications .....	92
115.6.2.1	PMD block diagram .....	92
115.6.2.2	PMD transmit function .....	93
115.6.2.3	PMD receive function .....	93
115.6.2.4	PMD signal detect function .....	93
115.6.3	PMD to MDI optical specifications .....	94
115.6.3.1	Transmitter optical specifications .....	94
115.6.3.2	Transmit clock frequency .....	96
115.6.3.3	Receiver optical specifications .....	96
115.6.3.4	Receiver boundary condition tests .....	97
115.6.3.4.1	Receiver minimum AOP test .....	97
115.6.3.4.2	Receiver maximum AOP test .....	97
115.6.4	Optical measurement requirements .....	98
115.6.4.1	Center wavelength measurement .....	98
115.6.4.2	Spectral width measurement .....	98
115.6.4.3	Average Optical Power (AOP) measurement .....	99
115.6.4.4	Transmitter rise and fall time measurements .....	99
115.6.4.5	Transmitter extinction ratio (ER) measurement .....	99
115.6.4.6	Transmitter overshoot measurements .....	99
115.6.4.7	Transmitter output droop measurements .....	100
115.6.4.8	Transmitter distortion measurement .....	100
115.6.4.9	Transmitter timing jitter measurement .....	103
115.6.4.10	Transmitter relative intensity noise (RIN) measurement .....	103
115.6.4.11	Transmitter modal power distribution measurement .....	104
115.7	Characteristics of the fiber optic cabling (channel) .....	104
115.7.1	Transfer function of fiber optic channel type I .....	106
115.7.2	Transfer function of fiber optic channel type II .....	107
115.7.3	Transfer function of fiber optic channel type III .....	108
115.7.4	Fiber optic channel insertion loss measurement .....	109
115.7.5	Fiber optic channel transfer function measurement .....	109
115.7.6	Worst-case 1000BASE-RHx link power budget .....	109
115.8	Medium Dependent Interface (MDI) .....	109
115.8.1	MDI mechanical interface for 1000BASE-RHA .....	109
115.9	1000BASE-H Operations, Administration, and Maintenance (1000BASE-H OAM) channel .....	111

115.9.1	1000BASE-H OAM message transmission protocol.....	111
115.9.2	1000BASE-H OAM channel status .....	112
115.9.3	1000BASE-H OAM message reception protocol .....	113
115.9.4	1000BASE-H OAM channel state diagrams descriptions .....	114
115.9.4.1	1000BASE-H OAM control state variables.....	114
115.9.4.2	1000BASE-H OAM transmit control state diagram .....	116
115.9.4.3	1000BASE-H OAM receive control state diagram .....	116
115.10	Loopback modes .....	119
115.11	Management interface.....	119
115.12	Environmental specifications.....	119
115.12.1	Temperature classes .....	119
115.12.2	General safety .....	120
115.12.3	Environmental safety .....	120
115.12.4	Electromagnetic compatibility .....	121
115.12.5	Optical safety .....	121
115.13	Delay constraints.....	121
115.14	Protocol implementation conformance statement (PICS) proforma for Clause 115, Physical Coding Sublayer (PCS), Physical Medium Attachment (PMA) sublayer, and Physical Medium Dependent (PMD) sublayer, types 1000BASE-RHA, 1000BASE-RHB, and 1000BASE-RHC .....	122
115.14.1	Introduction.....	122
115.14.2	Identification.....	122
115.14.2.1	Implementation identification.....	122
115.14.2.2	Protocol summary .....	122
115.14.3	Major capabilities/options.....	123
115.14.4	Physical Coding Sublayer (PCS) .....	124
115.14.5	Physical Medium Attachment (PMA) .....	126
115.14.6	Energy-Efficient Ethernet (EEE) .....	128
115.14.7	Test modes .....	129
115.14.8	Physical Medium Dependent (PMD).....	130
115.14.9	PMD to MDI optical specifications .....	131
115.14.10	Optical measurement requirements .....	132
115.14.11	Characteristics of the fiber optic cabling (channel) .....	133
115.14.12	Medium dependent interface (MDI) .....	133
115.14.13	1000BASE-H Operations, Administration, and Maintenance (1000BASE-H OAM) channel .....	134
115.14.14	Loopback modes .....	135
115.14.15	Management Interface .....	135
115.14.16	Environmental specifications .....	135
115.14.17	Delay constraints.....	136
Annex 115A (informative) BCH codeword examples .....		137
115A.1	Output of the BCH(896, 720) encoder.....	137
115A.2	Output of the BCH(1976, 1668) encoder.....	137

# IEEE Standard for Ethernet

## Amendment 9: Physical Layer Specifications and Management Parameters for 1000 Mb/s Operation Over Plastic Optical Fiber

### 1. Introduction

#### 1.3 Normative references

*Insert the following references in alphanumeric order:*

IEC 60793-1-41:2010, Optical fibres—Part 1-41: Measurement methods and test procedures—Bandwidth.

IEC 60793-2-40:2009, Optical fibres—Part 2-40: Product specifications—Sectional specification for category A4 multimode fibres.

IEC 61300-2-4, Fibre optic interconnecting devices and passive components—Basic test and measurement procedures—Part 2-4: Tests—Fibre/cable retention.

IEC 61300-3-53, Fibre optic interconnecting devices and passive components—Basic test and measurement procedures—Part 3-53: Examinations and measurements—Encircled angular flux (EAF) measurement method based on two-dimensional far field data from step index multimode waveguide (including fibre).

ISO/IEC 14763-3:2014, Information technology—Implementation and operation of customer premises cabling—Part 3: Testing of optical fibre cabling.

#### 1.4 Definitions

*Insert the following new definition after 1.4.22 “1000BASE-CX”:*

**1.4.22a 1000BASE-H:** IEEE 802.3 PCS and PMA sublayers for 1000 Mb/s Ethernet that support PMDs using duplex plastic optical fiber. (See IEEE Std 802.3, Clause 115.)