

45. Management Data Input/Output (MDIO) Interface

45.2 ~~45.2~~ MDIO Interface ~~Registers~~ Registers

45.2.1 ~~45.2.1~~ PMA/PMD registers

45.2.1.6 PMA/PMD control 2 register (Register 1.7)

Change the description of bits 1.7.5:0 of Table 45-~~4~~7 to add the 1000BASE-RH as shown below, (publication editor will change “reserved” lines as appropriate for values defined by other approved amendments):

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

Bit(s)	Name	Description	R/W ^a
1.7.5:0	PMA/PMD type selection	5 4 3 2 1 0 1 1 0 1 0 1 = 1000BASE-RH PMA/PMD	R/W

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

45.2.3 PCS registers

Replace 3.420 through 3.1799 row with the following rows:

Table 45-119—PCS registers

Register address	Register name	Subclause
3.420 through 3.499	Reserved	
3.500	TXOAM_CTRL 1000BASE-H OAM transmit control	45.2.3.48
3.501 through 3.508	TXOAM_DATAx registers 1000BASE-H OAM transmit message	45.2.3.48
3.509	RXOAM_CTRL 1000BASE-H OAM receive control	45.2.3.48 45.2.3.49
3.510 through 3.517	RXOAM_DATAx registers 1000BASE-H OAM receive message	45.2.3.48 45.2.3.49
3.518	1000BASE-H PCS control	45.2.3.50
3.519	1000BASE-H PCS status register -1	45.2.3.51
3.520	1000BASE-H PCS status register -2	45.2.3.52
3.521	1000BASE-H PCS status register -3	45.2.3.53
3.522	1000BASE-H PCS status register -4	45.2.3.54
3.523 through 3.1799	Reserved	

Insert the below subclauses after 45.2.3.47 and renumber subsequent subclauses as required:

45.2.3.48 1000BASE-H OAM transmit registers (Registers 3.500 through 3.507)

These registers are used to provide an OAM channel between 1000BASE-H link partners. The OAM message is part of the physical header data (PHD) defined for 1000BASE-H (see Table 114-2).

~~These registers are used to provide a OAM channel between 1000BASE-H link partners. The OAM message is part of the physical header data subframe defined for 1000BASE-H (see Table 114-2). The transmit registers are used to compose an OAM message prior to requesting transmission to the link partner. An OAM TX control/status register Register 3.500 provides control, status, message identification and message header data information. Eight additional OAM TX registers hold the rest of the OAM message data. The OAM RX stores status and received OAM message header information. Eight additional OAM RX registers hold received OAM message data.~~

Table 45-120—OAM TX registers definitions

Bit(s)	Name	Description	R/W ^a
3.500.15	TXREQ	Transmission Request. It is raised by the ME to request the transmission of a new message. It is set to 0 by the local PHY to indicate that it has started the transmission of the message.	R/W
3.500.14	PHYT	PHY Toggle bit. Corresponds to the toggle bit of the last message received by the remote PHY.	RO
3.500.13	MERT	Management Entity Read Toggle bit. Toggle bit of the last message read by the Management Entity attached to the remote PHY.	RO
3.500.12	MSGT	Message Toggle Bit. Toggles with each successive transmitted message and is used for message identification.	RO
3.500.11:0	TXOAM_HDR	OAM message control information. Intended to be used by the ME to indicate the type or some information relevant about the content of OAM_DATA0 through OAM_DATA7 message for the proper processing of the OAM message by the remote ME. This information is not manipulated by the PHY and is transparently transmitted to the link partner together with the OAM message contained in OAM_DATA0 through OAM_DATA7 registers.	R/W
3.503.15:0	TXOAM_DATA1	OAM message 16-bit data word 1.	R/W
3.504.15:0	TXOAM_DATA2	OAM message 16-bit data word 2.	R/W
3.505.15:0	TXOAM_DATA3	OAM message 16-bit data word 3.	R/W
3.506.15:0	TXOAM_DATA4	OAM message 16-bit data word 4.	R/W
3.507.15:0	TXOAM_DATA5	OAM message 16-bit data word 5.	R/W

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Table 45–120—OAM TX registers definitions (continued)

Bit(s)	Name	Description	R/W ^a
3.507.15:0	TXOAM_DATA6	OAM message 16-bit data word 6.	R/W
3.508.15:0	TXOAM_DATA7	OAM message 16-bit data word 7.	R/W

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

[The assignment of bits in the 1000BASE-H OAM transmit registers is shown in Table 45–121.](#)

Table 45–121—1000BASE-H OAM transmit register bit definitions

Bit(s)	Name	Description	R/W ^a
3.500.15	TXO_REQ	Transmission request. It is set to one by the Management Entity to request the transmission of a new OAM Message. It shall be set to zero by the local PHY to indicate that the message has been accepted for transmission.	R/W, SC
3.500.14	TXO_PHYT	Transmit Message Phy Toggle bit. It corresponds to the toggle bit of the last message received by the remote PHY.	RO
3.500.13	TXO_MERT	Transmit Message Management Entity Read Toggle bit. It corresponds to the toggle bit of the last message read by the Management Entity attached to the remote PHY.	RO
3.500.12	TXO_MSGT	Transmit Message Toggle bit. This bit toggles with each new transmitted message and is used for message identification.	RO
3.500.11:0	TXO_TYPE	Transmit Message data type information. Together with TXO_DATA1 through TXO_DATA8, it contains the payload of the OAM message. This information is not manipulated by the PHY and it is transparently transmitted to the link partner.	R/W
3.501.15:0	TXO_DATA1	Transmit message 16-bit data word 1.	R/W
3.502.15:0	TXO_DATA2	Transmit message 16-bit data word 2.	R/W
3.503.15:0	TXO_DATA3	Transmit message 16-bit data word 3.	R/W
3.504.15:0	TXO_DATA4	Transmit message 16-bit data word 4.	R/W
3.505.15:0	TXO_DATA5	Transmit message 16-bit data word 5.	R/W
3.506.15:0	TXO_DATA6	Transmit message 16-bit data word 6.	R/W
3.507.15:0	TXO_DATA7	Transmit message 16-bit data word 7.	R/W
3.508.15:0	TXO_DATA8	Transmit message 16-bit data word 8.	R/W

^aR/W = Read/Write, RO = Read only, SC = Self-clearing

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45.2.3.48.1 ~~TXREQ~~ TXO_REQ (3.500.15)

~~This bit is set to request the transmission of a new OAM message. It is reset to 0 by the local PHY to indicate that the transmission of the last requested message has started and it is ready to accept a new request for transmission.~~

This bit is set to one by the Management Entity to request the transmission of the OAM message written to registers 3.500 through 3.508. It shall be set to zero by the local PHY to indicate that the message has been accepted for transmission, and that the registers are free to accept a new message.

45.2.3.48.2 ~~MSGT~~ TXO_PHYT (3.500.14)

~~This bit is used for OAM message identification. It is toggled by the local PHY whenever a new message is accepted for transmission.~~

45.2.3.48.3 ~~PHYT~~ (3.500.13)

~~This~~ The local PHY shall indicate in this bit is the ~~MSGT~~ TXO_MSGT bit of the last message received from by the remote PHY.

45.2.3.48.4 ~~MERT~~ TXO_MERT (3.500.4213)

~~This~~ The local PHY shall indicate in this bit corresponds to the ~~MSGT~~ TXO_MSGT bit of the last message read by the ~~ME~~ Management Entity attached to the remote PHY.

45.2.3.48.5 ~~TXOAM_HDR~~ TXO_MSGT (3.500.44:012)

~~These bits become the PHD.OAM.HDR bits upon transmission request.~~

This bit is used for message identification; it shall contain the toggle bit of the last message accepted by the local PHY for transmission. It shall be toggled by the local PHY when it accepts a new message for transmission (simultaneously with the falling of bit TXO_REQ)

Together with bits TXO_REQ, TXO_PHYT and TXO_MERT, this bit indicates the status of the OAM transmission channel. There can be up-to three outstanding messages in the transmission channel: message written in the OAM transmission registers that is waiting for transmission, the message being currently transmitted by the local PHY, and the message available in the OAM reception registers of the remote PHY which is waiting for processing of the remote Management Entity.

Table 45-122 shows all the possible values of the four control bits, and the corresponding status of the three possible outstanding OAM messages. The control bits can be either 0 or 1, the symbol ~ denotes logical not operator. Message K is the message currently being transmitted by the local PHY to the remote PHY, its associated toggle bit takes value 'a' as indicated by bit TXO_MSGT. Correspondingly, message K-1 denotes the previous message that was transmitted by the local PHY to the remote PHY. Its associated toggle bit takes value '~a'. Finally message K+1 corresponds to the OAM message being composed or yet to be requested for transmission by the local Management Entity. Its associated toggle bit will take value '~a'.

45.2.3.48.6 TXO_TYPE (3.500.11:0)

These bits contain the data type of the OAM message that will be transmitted by the local PHY. These bits are not manipulated in any way by the local or remote PHY and together with the TXO_DATAx bits carry the OAM message payload.

Table 45–122—List of all possible 100BASE-H OAM message status

TXO_REQ	TXO_PHYT	TXO_MERT	TXO_MSGT	Message K+1 status	Message K status	Message K-1 status
0	a	a	a	Not written by local ME	Sent by local PHY ACK by remote PHY ACK by remote ME	Sent by local PHY ACK by remote PHY ACK by remote ME
0	~a	~a	a	Not written by local ME	Sent by local PHY No ACK by remote PHY No ACK by remote ME	Sent by local PHY ACK by remote PHY ACK by remote ME
0	a	~a	s	Not written by local ME	Sent by local PHY ACK by remote PHY No ACK by remote ME	Sent by local PHY ACK by remote PHY ACK by remote ME
0	~a	a	a	Not written by local ME	Sent by local PHY No ACK by remote PHY No ACK by remote ME	Sent by local PHY ACK by remote PHY No ACK by remote ME
1	a	a	a	Written by local ME Pending transmission by local PHY	Sent by local PHY ACK by remote PHY ACK by remote ME	Sent by local PHY ACK by remote PHY ACK by remote ME
1	~a	~a	a	Written by local ME Pending transmission by local PHY	Sent by local PHY No ACK by remote PHY No ACK by remote ME	Sent by local PHY ACK by remote PHY ACK by remote ME
1	a	~a	a	Written by local ME Pending transmission by local PHY	Sent by local PHY ACK by remote PHY No ACK by remote ME	Sent by local PHY ACK by remote PHY ACK by remote ME
1	~a	a	a	Written by local ME Pending transmission by local PHY	Sent by local PHY No ACK by remote PHY No ACK by remote ME	Sent by local PHY ACK by remote PHY No ACK by remote ME

45.2.3.48.7 ~~TXOAM_DATA~~ TXO_DATAx (Registers 3.501 through 3.508)

~~These registers contain the 128-bit OAM message data which become PHD.OAM.DATA upon transmission request. The first 16 transmitted bits (PHD.OAM.DATA0) and are stored in TXOAM_DATA1 (register 3.501) with subsequent bits stored sequentially in registers 3.502 through 3.508.~~

Table 45–123—100BASE-X OAM RX registers definitions

Bit(s)	Name	Description	R/W ^a
3.500.15	RXVAL	Reception Valid. The PHY sets to one to indicate that a new message has arrived and is ready for processing.	RO
3.510.14:13	Reserved	Ignore on read	RO

Table 45–123—1000BASE-X OAM RX registers definitions (continued)

Bit(s)	Name	Description	R/W ^a
3.510.12	RX_MSGT	Message Toggle Bit. Toggles with each successive transmitted message and is used for message identification.	RO
3.510.11:0	RX_OAM_HDR	OAM message control information. Intended to be used by the ME to indicate the type or some information relevant about the content of OAM_DATA0 through OAM_DATA7 message for the proper processing of the OAM message by the remote ME. This information is not manipulated by the PHY and is transparently transmitted to the link partner together with the OAM message contained in OAM_DATA0 through OAM_DATA7 registers.	RO
3.511.15:0	RX_OAM_DATA1	OAM message 16-bit data word 1.	RO
3.512.15:0	RX_OAM_DATA2	OAM message 16-bit data word 2.	RO
3.513.15:0	RX_OAM_DATA3	OAM message 16-bit data word 3.	RO
3.514.15:0	RX_OAM_DATA4	OAM message 16-bit data word 4.	RO
3.515.15:0	RX_OAM_DATA5	OAM message 16-bit data word 5.	RO
3.516.15:0	RX_OAM_DATA6	OAM message 16-bit data word 6.	RO
3.517.15:0	RX_OAM_DATA7	OAM message 16-bit data word 7.	RO

^aR/W = RO = Read only

[These registers contain the 128 data bits of the OAM message that will be transmitted by the local PHY](#)

45.2.3.49 1000BASE-H OAM ~~control/status~~ receive registers (Registers 3.509 through 3.517)

~~These register are used to control and monitor the transmission of an OAM message stored in OAM_DATA 0:7. It includes 4 bits related to OAM message transmission and 12 user control bits for use as a header to the OAM message.~~

[These registers are used to provide an OAM channel between 1000BASE-H link partners. The OAM message is part of the physical header data defined for 1000BASE-H \(see Table 114–2\).](#)

[The receive registers hold the OAM messages received from the link partner. Register 3.509 provides status information, message identification and message data information. Eight additional registers hold the rest of the received OAM message data](#)

[The assignment of bits in the 1000BASE-H OAM receive registers is shown in Table 45–124.](#)

Table 45–124—1000BASE-H OAM receive register bit definitions

Bit(s)	Name	Description	R/W ^a
3.509.15	RXO_VAL	Reception valid. The PHY sets this bit to one to indicate that a new message has arrived and it is ready for processing.	RO
3.509.14:13	Reserved	Ignore on read	RO

Table 45–124—1000BASE-H OAM receive register bit definitions

Bit(s)	Name	Description	R/W ^a
3.509.12	RXO_MSGT	Receive Message Toggle bit. This bit toggles with each new received message and is used for message identification.	RO
3.509.11:0	RXO_TYPE	Receive Message data type information. Together with RXO_DATA1 through RXO_DATA8, it contains the payload of the OAM message.	RO
3.510.15:0	RXO_DATA1	Receive message 16-bit data word 1.	RO
3.511.15:0	RXO_DATA2	Receive message 16-bit data word 2.	RO
3.512.15:0	RXO_DATA3	Receive message 16-bit data word 3.	RO
3.513.15:0	RXO_DATA4	Receive message 16-bit data word 4.	RO
3.514.15:0	RXO_DATA5	Receive message 16-bit data word 5.	RO
3.515.15:0	RXO_DATA6	Receive message 16-bit data word 6.	RO
3.516.15:0	RXO_DATA7	Receive message 16-bit data word 7.	RO
3.517.15:0	RXO_DATA8	Receive message 16-bit data word 8.	RO

^aRO = Read only

45.2.3.49.1 ~~RXVAL~~ RXO_VAL (3.509.15)

~~The PHY sets this bit to one to indicate the reception of an OAM message. It is set to zero when register 3.517 is read. (This supports reading all nine registers with OAM message content without the registers changing.)~~

The local PHY shall set this bit to one to indicate the reception of a new OAM message. It shall be set to zero when the message is processed by the Management Entity. The PHY shall not update the reception message registers with a new message until the previous message is processed by the Management Entity.

The Management Entity signals that it has finished processing the message by first reading register 3.509 having RXO_VAL bit set to one, and then reading register 3.517. It is not required that the two accesses are contiguous; the Management Entity can access any other management register in between.

45.2.3.49.2 ~~Reserved~~ RXO_MSGT (3.509.44:43:12)

~~The corresponding two bits of the received OAM message are not to be written to the register.~~

This bit contains the toggle identifier of the received message. It shall toggle with every new received message.

45.2.3.49.3 ~~RXMSGT~~ RXO_TYPE (3.509.42:11:10)

~~This bit is the received PHD.OAM.MSGT bit.~~

These bits contain the data type of the OAM message. These bits are not manipulated in any way by the PHY, and together with the RXO_DATAx bits carry the received OAM message payload.

45.2.3.49.4 ~~RXOAM_HDR_RXO_DATAx (3.509.44:012)~~

These ~~registers contain the 128 data~~ bits ~~are of~~ the received ~~PHD.OAM.HDR bits~~ ~~OAM message~~.

45.2.3.49.5 ~~RXOAM_DATA (Registers 3.510 through 3.517)~~

~~These registers contain the received 128-bit PHD.OAM.DATA. The first 16 received bits are PHD.OAM.DATA0 and are stored in RXOAM_DATA1 (register 3.510) with subsequent bits stored sequentially in registers 3.511 through 3.517.~~

45.2.3.50 1000BASE-H PCS control register (Register 3.518)~~1~~

Table 45–125—1000BASE-H PCS control register bit definitions

Bit(s)	Name	Description	R/W ^a
3.518.15:13	Operation mode	15 14 13 0 0 0 = Normal operation 0 0 1 = Test mode 1 0 1 0 = Test mode 2 0 1 1 = Test mode 3 1 0 0 = Test mode 4 1 0 1 = Test mode 5 1 1 x = Reserved	R/W
3.518.12:10	Loopback mode	12 11 10 0 0 0 = No loopback 0 0 1 = PCS GMII level loopback 0 1 0 = PCS PMD interface level loopback 0 1 1 = Line loopback 1 x x = Reserved Loopback modes are only operative in normal operation (no test mode is configured)	R/W
3.518.9:2	Reserved	Ignore on read	RO
3.518.1	OAM enable	1 = Enable OAM functionality 0 = Disable OAM functionality	R/W
3.518.0	EEE enable	1 = Enable LPI mode 0 = Disable LPI mode	R/W

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

[The assignment of bits in the 1000BASE-H PCS control register is shown in Table 45–126.](#)

45.2.3.50.1 Operation mode (3.518.15:13)

These bits have a default value of 000, selecting normal 1000BASE-H operation. The various test modes are defined in 114.8.

45.2.3.50.2 Loopback mode (3.518.12:10)

These bits have a default value of ~~0000 0 0~~, selecting ~~normal 1000BASE-H~~ ~~no loopback~~ operation~~-~~.

Table 45–126—1000BASE-H PCS control register bit definitions

Bit(s)	Name	Description	R/W ^a
3.518.15:13	Operation mode	15 14 13 0 0 0 = Normal operation 0 0 1 = Test mode 1 0 1 0 = Test mode 2 0 1 1 = Test mode 3 1 0 0 = Test mode 4 1 0 1 = Test mode 5 1 1 x = Reserved	R/W
3.518.12:10	Loopback mode	12 11 10 0 0 0 = No loopback 0 0 1 = PCS GMII level loopback 0 1 0 = PCS PMD interface level loopback 0 1 1 = Line loopback 1 x x = Reserved Loopback modes are only operative in normal operation (no test mode is configured)	R/W
3.518.9:2	Reserved	Ignore on read	RO
3.518.1	OAM enable	1 = Enable OAM functionality 0 = Disable OAM functionality	R/W
3.518.0	EEE enable	1 = Enable LPI mode 0 = Disable LPI mode	R/W

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

In PCS GMII level loopback, the 1000BASE-H PCS shall accept data on the transmit data path from the ~~GMII~~GMII, looping the data back to the receive path ~~of on~~ the ~~PCS~~GMII. In this mode, the PCS ~~transmit transmitter~~ and ~~receive functions shall~~receiver may not be exercised.

In PCS PMD interface level loopback, the loopback shall be implemented at the PMD service interface, completely exercising the PCS and ~~PMA functionality~~PMA. The PCS ~~receive function~~receiver shall not accept signals from the ~~PMD~~PMD receive function.

When line loopback operation is selected, received data shall be processed and looped back near the GMII interface toward the link partner with data going back through the PCS transmission path. Received signal is equalized, decoded and de-encapsulated by PCS. Then the received data stream is forwarded to the GMII ~~received~~receive interface as well as to the PCS ~~transmit function~~transmitter. The Ethernet frames received from the GMII transmit interface are ignored during line loopback operation. The line loopback is only operative when a bidirectional link has been established. The PCS and PMA functions work as in normal operation. The data loopback is implemented between the output of the PCS 64B/65B decoder and the input of the encoder.

45.2.3.50.3 OAM enable (3.518.1)

~~OAM mode is enabled when the local device is capable of running an OAM protocol. Setting this bit to one (enable) causes the PHD.CAP.OAM bit to be transmitted as one. Setting to zero (disable) cause the PHD.CAP.OAM bit to be transmitted as zero (see Table 114–2).~~

OAM capability is advertised to the link partner in field PHD.CAP.OAM as one (see Table 114–2) when the local PHY implementation is able to run the OAM protocol (as indicated in OAM ability bit 3.519.1) and

this bit is set. Otherwise, PHD.CAP.OAM field is transmitted as zero. The value of this bit is reflected in field PHD.CAP.OAM only after a PMA reset.

45.2.3.50.4 EEE enable (3.518.0)

~~EEE capability of the local PHY is controlled with this bit. Setting this bit to one (enable) causes the PHD.CAP.LPI bit to be transmitted as one. Setting to zero (disable) cause the PHD.CAP.LPI bit to be transmitted as zero (see Table 114-2).~~

EEE capability is advertised to the link partner in field PHD.CAP.LPI as one (see Table 114-2) when the local PHY implements EEE (as indicated in EEE ability bit 3.519.0) and this bit is set. Otherwise, PHD.CAP.LPI field is transmitted as zero. The value of this bit is reflected in field PHD.CAP.LPI only after a PMA reset.

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45.2.3.51 1000BASE-H PCS status 1 register ~~4~~ (Register 3.519)~~4~~

Table 45–127— 1000BASE-H PCS status register bit definitions

Bit(s)	Name	Description	R/W ^a
3.519.15	Local receiver status	Returns the value of the state variable loc_rcvr_status 1 = The local receive operation is reliable 0 = The local receive operation is unreliable	RO
3.519.14	Remote receiver status	Returns the value of the state variable rem_rcvr_status 1 = The receive operation of the remote PHY is reliable 0 = The receive operation of the remote PHY is unreliable	RO
3.519.13	Link status	Returns the value of the state variable link_status 1 = Bidirectional reliable link is established 0 = Bidirectional reliable link is not established	RO, LL
3.519.12	Local PHD reception status	Returns the value of state variable loc_rcvr_hdr_lock 1 = PHD reception is reliable for the local PHY 0 = PHD reception is unreliable for the local PHY	RO
3.519.11	Remote PHD reception status	Returns the value of the state variable rem_rcvr_hdr_lock 1 = PHD reception is reliable for the remote PHY 0 = PHD reception is unreliable for the remote PHY	RO
3.519.10	PHD lock status	Returns the value of the state variable rcvr_hdr_lock 1 = PHD transmission and reception are reliable 0 = PHD transmission or reception are unreliable	RO
3.519.9	THP lock status	Returns the value of the state variable rcvr_thp_lock 1 = THP is initialized; payload data is received with TH precoding 0 = THP is not initialized	RO
3.519.8	Tx LPI received	1 = Tx PCS has received LPI 0 = LPI not received	RO, LH
3.519.7	Rx LPI received	1 = Rx PCS has received LPI 0 = LPI not received	RO, LH
3.519.6	Tx LPI indication	1 = Tx PCS is currently transmitting LPI 0 = PCS is not currently transmitting LPI	RO
3.519.5	Rx LPI indication	1 = Rx PCS is currently receiving LPI 0 = PCS is not currently receiving LPI	RO
3.519.4	Reserved	Ignored when read	RO
3.519.3	Remote OAM ability	1 = The remote PHY has OAM ability and it is enabled 0 = The PHY does not have OAM ability or it is disable	RO
3.519.2	Remote EEE ability	1 = The remote PHY has EEE ability and it is enabled 0 = The PHY does not have EEE ability or it is disable	RO
3.519.1	OAM ability	1 = The PHY has OAM ability 0 = The PHY does not have OAM ability	RO
3.519.0	EEE ability	1 = The PHY has OAM ability 0 = The PHY does not have OAM ability	RO

^aR/W = RO = Read only, LH = Latching high, LL = Latching low

The assignment of bits in the 1000BASE-H PCS status 1 register is shown in Table 45–128.

Table 45–128— 1000BASE-H PCS status 1 register bit definitions

Bit(s)	Name	Description	R/W ^a
3.519.15	Local receiver status	Returns the value of the state variable <code>loc_rcvr_status</code> 1 = The local receive operation is reliable 0 = The local receive operation is unreliable	RO
3.519.14	Remote receiver status	Returns the value of the state variable <code>rem_rcvr_status</code> 1 = The receive operation of the remote PHY is reliable 0 = The receive operation of the remote PHY is unreliable	RO
3.519.13	Link status	Returns the value of the state variable <code>link_status</code> 1 = Bidirectional reliable link is established 0 = Bidirectional reliable link is not established	RO, LL
3.519.12	Local PHD reception status	Returns the value of the state variable <code>loc_rcvr_hdr_lock</code> 1 = PHD reception is reliable for the local PHY 0 = PHD reception is unreliable for the local PHY	RO
3.519.11	Remote PHD reception status	Returns the value of the state variable <code>rem_rcvr_hdr_lock</code> 1 = PHD reception is reliable for the remote PHY 0 = PHD reception is unreliable for the remote PHY	RO
3.519.10	PHD lock status	Returns the value of the state variable <code>rcvr_hdr_lock</code> 1 = PHD transmission and reception are reliable 0 = PHD transmission or reception are unreliable	RO
3.519.9	THP lock status	Returns the value of the state variable <code>rcvr_thp_lock</code> 1 = THP is initialized; payload data is received with TH precoding 0 = THP is not initialized	RO
3.519.8	Tx LPI received	1 = Tx PCS has received LPI 0 = LPI not received by Tx PCS	RO, LH
3.519.7	Rx LPI received	1 = Rx PCS has received LPI 0 = LPI not received by Rx PCS	RO, LH
3.519.6	Tx LPI indication	1 = Tx PCS is currently receiving LPI 0 = Tx PCS is not currently receiving LPI	RO
3.519.5	Rx LPI indication	1 = Rx PCS is currently receiving LPI 0 = Rx PCS is not currently receiving LPI	RO
3.519.4	Reserved	Ignored when read	RO
3.519.3	Remote OAM ability	1 = The remote PHY has OAM ability and it is enabled 0 = The PHY does not have OAM ability or it is disabled	RO
3.519.2	Remote EEE ability	1 = The remote PHY has EEE ability and it is enabled 0 = The PHY does not have EEE ability or it is disabled	RO
3.519.1	OAM ability	1 = The PHY has OAM ability 0 = The PHY does not have OAM ability	RO
3.519.0	EEE ability	1 = The PHY has EEE ability 0 = The PHY does not have EEE ability	RO

^aRO = Read only, LH = Latching high, LL = Latching low

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45.2.3.51.1 Local receiver status (3.519.15)

This bit indicates the value of the state variable ~~loc_rcvr_hdr_lock~~ loc_rcvr_status as determined by the ~~local PHD reception~~ PHY quality monitor state diagram (see 114.3.2.1.5).

45.2.3.51.2 Remote receiver status (3.519.14)

This bit indicates the value of the state variable rem_rcvr_status which reflects the link status reported by the link partner (see 114.3.2.1.5).

45.2.3.51.3 Link status (3.519.13)

This bit indicates the value of the state variable link_status as determined by the link status monitor state diagrams (see 114.3.2.1.5).

45.2.3.51.4 Local PHD reception status (3.519.12)

This bit indicates the value of the state variable loc_rcvr_hdr_lock as determined by the local PHD reception monitor state diagram (see 114.3.2.1.5).

45.2.3.51.5 Remote PHD reception status (3.519.11)

This bit indicates the value of the state variable rem_rcvr_hdr_lock ~~as which reflects as determined by the remote~~ PHD reception ~~status reported by the link partner~~ monitor state diagram (see 114.3.2.1.5).

45.2.3.51.6 PHD lock status (3.519.10)

This bit indicates the value of the state variable rcvr_hdr_lock as determined by the ~~local~~ PHD reception monitor state diagram (see 114.3.2.1.5).

45.2.3.51.7 THP lock status (3.519.9)

This bit indicates the value of the state variable rcvr_thp_lock as determined by the adaptive THP REQ state diagram (see ~~114.3.2.1.5~~ 114.3.2.2.3).

45.2.3.51.8 Tx LPI received (3.519.8)

~~This bit indicates that the local PHY has received LPI in the transmit path from the GMII. The bit is reset to zero when read (see 114.5).~~

When read as a one, this bit indicates that the transmit 1000BASE-H PCS has received LPI signaling from GMII one or more times since the register was last read. When read as a zero, this bit indicates that the 1000BASE-H PCS transmitter has not received LPI signaling. This bit shall be implemented with latching high behavior.

45.2.3.51.9 Rx LPI received (3.519.7)

~~This bit indicates that the local PHY has received LPI in the transmit path from the GMII. The bit is reset to zero when read (see 114.5).~~

When read as a one, this bit indicates that the receive 1000BASE-H PCS has received LPI signaling from PMD service interface one or more times since the register was last read. When read as a zero, this bit indicates that the 1000BASE-H PCS receiver has not received LPI signaling. This bit shall be implemented with latching high behavior.

45.2.3.51.10 Tx LPI indication (3.519.6)

~~This bit indicates the current LPI mode status of the local PHY transmit path. When read as zero, the PHY transmitter is in normal mode, when read as one, the PHY transmitter is in LPI mode (see 114.5).~~

When read as a one, this bit indicates that the transmit 1000BASE-H PCS is currently receiving LPI signals from GMII. When read as a zero, this bit indicates that the 1000BASE-H PCS transmitter is not currently receiving LPI signals. The behavior if read during a state transition is undefined.

45.2.3.51.11 Rx LPI indication (3.519.5)

~~This bit indicates the current LPI mode status of the local PHY receive path. When read as zero, the PHY is receiving normal Transmit Blocks, when read as one, the PHY is receiving is in LPI Transmit Blocks (see 114.5).~~

When read as a one, this bit indicates that the receive 1000BASE-H PCS is currently receiving LPI signals from PMD service interface. When read as a zero, this bit indicates that the 1000BASE-H PCS receiver is not currently receiving LPI signals. The behavior if read during a state transition is undefined.

45.2.3.51.12 Remote OAM ability (3.519.3)

This bit indicates the OAM ability ~~reported by~~ of the remote PHY received in the PHD field PHD.CAP.OAM (see ~~Table 114-2~~ Table 114-2). When read as one, this bit indicates the remote PHY implementation is able to run the OAM protocol and it is enabled. When read as zero, this bit indicates that the remote PHY implementation is not able for OAM protocol or it is disabled.

45.2.3.51.13 Remote EEE ability(3.519.2)

This bit indicates the EEE ability ~~reported by~~ of the remote PHY received in the PHD field PHD.CAP.~~OAM~~ LPI (see ~~Table 114-2~~ Table 114-2). When read as one, this bit indicates the remote PHY implements EEE and it is enabled. When read as zero, this bit indicates that the remote PHY does not implement EEE or it is disabled.

45.2.3.51.14 OAM ability (3.519.1)

This bit indicates the OAM ability of the local PHY. When read as one, this bit indicates that the local PHY is to run the OAM protocol. When read as zero, it indicates the local PHY is not able to run OAM protocol.

45.2.3.51.15 EEE ability (3.519.0)

This bit indicates the EEE ability of the local PHY. When read as one, this bit indicates that the local PHY implements EEE, hence the local PHY is able to enter the transmit PCS in LPI mode asserted from GMII and also to accept the PCS receiver LPI signaling from PMD service interface. When read as zero, it indicates the local PHY does not implement EEE operation in either transmission or reception.

45.2.3.52 1000BASE-H PCS status 2 register ~~2~~ (Register 3.520) ~~!~~

The assignment of bits in the 1000BASE-H PCS status 2 register is shown in Table 45-130.!

45.2.3.52.1 Local link margin (3.520.13:0)

These bits are set by the local 1000BASE-H PHY to indicate the link margin of receiver. Link margin is defined as the extra signal-to-noise ratio that is available in decoding with respect to the minimum one needed by the receiver to assert loc_rcvr_status = OK.

Table 45–129— 1000BASE-H PCS status register 2 bit definitions

Bit(s)	Name	Description	R/W ^a
3.520.15:14	Reserved	Ignore when read	RO
3.520.13:0	Local link margin	Reports the local link margin	RO

^aR/W = RO = Read only

Table 45–130— 1000BASE-H PCS status 2 register bit definitions

Bit(s)	Name	Description	R/W ^a
3.520.15:14	Reserved	Ignore when read	RO
3.520.13:0	Local link margin	Reports the local link margin	RO

^aRO = Read only

This local link Link margin is ~~measured as extra SNR available in decoding with respect to min SNR needed to provide loc_rev_r_status = OK. It is fixed~~ provided fix-point formatted (14,6) ~~and is provided~~ in log₂ (–) ~~units e.g. units. LM =~~ For example, a link margin of 3.5 dB is equivalent to log₂(10^{0.35}) = 1.1627 ~~in~~ log₂ units, which is ~~equal~~ equivalent to hexadecimal 0x012A in (14,6) fixed-point format. The formal description for converting fixed point numbers to floating point and viceversa is in 114.3.3.

45.2.3.53 1000BASE-H PCS status 3 register ~~3~~ (Register 3.521)!

Table 45–131— 1000BASE-H PCS status register 3 bit definitions

Bit(s)	Name	Description	R/W ^a
3.521.15:14	Reserved	Ignore when read	RO
3.521.13:0	Remote link margin	The detected link margin reported by the link partner	RO

^aRO = Read only

The assignment of bits in the 1000BASE-H PCS status 3 register is shown in Table 45–132.!

Table 45–132— 1000BASE-H PCS status 3 register bit definitions

Bit(s)	Name	Description	R/W ^a
3.521.15:14	Reserved	Ignore when read	RO
3.521.13:0	Remote link margin	The detected link margin reported by the link partner	RO

^aRO = Read only

45.2.3.53.1 Remote link margin (3.521.13:0)

~~This field reports the remote link margin measured as extra SNR available in decoding with respect to min SNR needed to provide rem_rcvr_status = OK.~~

These bits reports the link margin of the remote PHY receiver as it is received in the PHD field PHD.RX.LINKMARGIN (see Table 114–2). Remote link margin is the extra signal-to-noise ratio available in the remote receiver with respect to the minimum one needed to assert rem_rcvr_status = OK. This register has the same fixed-point format than register 3.520.13:0 (see 45.2.3.52.1).

45.2.3.54 1000BASE-H PCS status 4 register 4 (Register 3.522) ~~!~~

Table 45–133— PCS status register 4 register bit definitions

Bit(s)	Name	Description	R/W ^a
3.522.15	BER test mode counter reset	1 = reset the BER test mode counter PcsTBD3.14:0 0 = ignored	R/W
3.521.14:0	BER test mode counter	A 15-bit counter used when operating in test mode 1.	RO

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

The assignment of bits in the 1000BASE-H PCS status 4 register is shown in Table 45–134. !

Table 45–134— 1000BASE-H PCS status 4 register bit definitions

Bit(s)	Name	Description	R/W ^a
3.522.15	BER test mode counter reset	1 = reset the BER test mode counter 3.522.14:0 0 = ignored	R/W, SC
3.522.14:0	BER test mode counter	A 15-bit counter used when operating in test mode 1.	RO, NR

^aR/W = Read/Write, RO = Read only, SC = Self-clearing, NR = Non Roll-over

45.2.3.54.1 BER test mode counter reset (3.522.15)

This bit is set to one to reset the BER test mode counter to zero. The bit is self clearing, returning to zero when reset is complete.

45.2.3.54.2 BER test mode counter (3.522.14:0)

~~This~~ These bits are a 15-bit counter that counts the number of bits received with value 1 at the output of the binary descrambler, when the PHY receiver is operating in test mode 1. The counter is ~~These bits shall be reset to all zeroes when entering the PCS receiver enters test mode 1 as indicated by indication of the link partner (see 114.8.1) or when reset is performed-instructed by writing a one to 3.522.15 BER test mode counter reset. These bits shall be held at all ones in the case of overflow.~~