# Physical Coding Sublayer (PCS), Physical Medium Attachment (PMA), type 1000BASE-H

## Management interfaces

1000BASE-H makes extensive use of the management functions that may be provided by the MDIO (Clause 45).

# Management Data Input/Output (MDIO) Interface

## MDIO Interface Registers

### PMA/PMD registers

#### BASE-H PMA Control Register

Table 45-XXX –BASE-H PMA Control register

|  |  |  |  |
| --- | --- | --- | --- |
| Bit(s) | Name | Description | R/W |
| PmaTBD0.15 | Reset | 1 = PMA reset  0 = Normal operation | R/W, SC |
| PmaTBD0.14:12 | Reserved | Write as 0, ignored on read | R/W |
| PmaTBD0.11 | Low power | 1 = Low-power mode  0 = Normal operations | R/W |
| PmaTBD0.10:4 | Reserved | Write as 0, ignored on read | R/W |
| PmaTBD0.3:0 | PHY Type | BASE-H PHY speed  0000 = Reserved  0001 = Reserved  0010 = 1000BASE-H  Else = Reserved |  |

##### BASE-H Reset (PmaTBD0.15)

Resetting a PMA is accomplished by setting bit PmaTBD0.15 to a one. This action shall set all PMA registers to their default states. As a consequence, this action may change the internal state of the PMA and the state of the physical link. This action may also initiate a reset in any other MMDs that are instantiated in the same package. This bit is self clearing, and a PMA shall return a value of one in bit PmaTBD0.15 when a reset is in progress; otherwise, it shall return a value of zero. A PMA is not required to accept a write transaction to any of its registers until the reset process is completed. The control and management interface shall be restored to operation within 100 ms from the setting of bit PmaTBD0.15.

During a reset, a PMA shall respond to reads from register bits PmaTBD0.15 and 1.8.15:14. All other register bits should be ignored.

NOTE—This operation may interrupt data communication.

##### BASE-H Low power (PmaTBD0.11)

A PMA may be placed into a low-power mode by setting bit PmaTBD0.11 to a one. This action may also initiate a low power mode in any other MMDs that are instantiated in the same package. The low-power mode is exited by resetting the PMA. The behavior of the PMA in transition to and from the low-power mode is implementation specific and any interface signals should not be relied upon. While in the low-power mode, the device shall, as a minimum, respond to management transactions necessary to exit the low-power mode. The default value of bit PmaTBD0.11 is zero.

NOTE—This operation interrupts data communication. The data path of a PMA, depending on type and temperature, may take many seconds to run at optimum error ratio after exiting from reset or low-power mode.

##### BASE-H PHY Type (PmaTBD0.3:0)

These bits are used to configure the PHY type.

### PCS registers

#### 1000BASE-H PCS Control Register

Table 45-XXX – 1000BASE-H PCS Control register

|  |  |  |  |
| --- | --- | --- | --- |
| Bit(s) | Name | Description | R/W |
| PcsTBD0.15:13 | 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 |
| PcsTBD0.12:10 | 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  Else = Reserved  Loopback modes are only operative in normal operation (no test mode is configured) | R/W |
| PcsTBD0.9:2 | Reserved | Write as 0, ignored on read | R/W |
| PcsTBD0.1 | OAM enable | 1 = Enable the PHY for OAM functionality  0 = Disable the PHY for OAM functionality | R/W |
| PcsTBD0.0 | EEE enable | 1 = Enable the PHY to use LPI mode  0 = Disable the PHY of using LPI mode | R/W |

##### PCS GMII level loopback

The PCS shall accept data on the transmit data path from GMII transmit path and return it on the receive path of the same GMII. In this mode, the PCS transmit and receive functions shall not be exercised.

##### PMS PMD interface level loopback

The PCS shall accept data on the transmit data path from the GMII interface and return it on the receive path of the same GMII, after being processed by PCS transmit and receive functions.

In this mode, the loopback shall be implemented at the PMD service interface. Therefore, the PCS and PMA functions shall be completely exercised. The PCS receive function shall not accept signals from the PMD.

##### Line loopback

When line loopback operation is enabled, the Ethernet frames shall be recovered from the optical signal received from PMD. The signal shall be equalized, decoded and de-encapsulated by PCS receive function. Then the received Ethernet frames shall be forwarded to the GMII received interface as well as to PCS transmit function to be sent back to the link partner. The Ethernet frames received from GMII transmit interface shall be ignored during line loopback operation. The line loopback operation is only operative when bidirectional link has been established. The PCS and PMA functions shall work as in normal operation. The data loopback shall be implemented between the output of the PCS 64B/65B decoder and the input of the encoder.

#### 1000BASE-H PCS Status Register 1

Table 45-XXX – 1000BASE-H PCS Status register 1

|  |  |  |  |
| --- | --- | --- | --- |
| Bit(s) | Name | Description | R/W |
| PcsTBD1.15 | Local receiver status | It returns the value of state variable loc\_rcvr\_status  1 = The local receive operation is reliable  0 = The local receive operation is unreliable | RO |
| PcsTBD1.14 | Remote receiver status | It returns the value of state variable rem\_rcvr\_status  1 = The receive operation of remote PHY is reliable  0 = The receive operation of remote PHY is unreliable | RO |
| PcsTBD1.13 | Link status | It returns the value of state variable link\_status  1 = Bidirectional reliable link is established  0 = Bidirectional reliable link is not established | RO, LL |
| PcsTBD1.12 | Local PHD reception status | It 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 |
| PcsTBD1.11 | Remote PHD reception status | It returns the value of 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 |
| PcsTBD1.10 | PHD lock status | It returns the value of state variable rcvr\_hdr\_lock  1 = PHD transmission and reception are reliable  0 = PHD transmission or reception are unreliable | RO |
| PcsTBD1.9 | THP lock status | It returns the value of state variable rcvr\_thp\_lock  1 = THP is initialized; payload data is received with TH precoding  0 = THP is not initialized | RO |
| PcsTBD1.8 | Tx LPI received | 1 = Tx PCS has received LPI  0 = LPI not received | RO, LH |
| PcsTBD1.7 | Rx LPI received | 1 = Rx PCS has received LPI  0 = LPI not received | RO, LH |
| PcsTBD1.6 | Tx LPI indication | 1 = Tx PCS is currently receiving LPI  0 = PCS is not currently receiving LPI | RO |
| PcsTBD1.5 | Rx LPI indication | 1 = Rx PCS is currently receiving LPI  0 = PCS is not currently receiving LPI | RO |
| PcsTBD1.4 | Reserved | Ignored when read | RO |
| PcsTBD1.3 | Remote OAM ability | 1 = The remote PHY has OAM ability and it is enable  0 = The PHY does not have OAM ability or it is disable | RO |
| PcsTBD1.2 | Remote EEE ability | 1 = The remote PHY has EEE ability and it is enable  0 = The PHY does not have EEE ability or it is disable | RO |
| PcsTBD1.1 | OAM ability | 1 = The PHY has OAM ability  0 = The PHY does not have OAM ability | RO |
| PcsTBD1.0 | EEE ability | 1 = The PHY has EEE ability  0 = The PHY does not have EEE ability | RO |

#### 1000BASE-H PCS Status Register 2

Table 45-XXX – 1000BASE-H PCS Status register 2

|  |  |  |  |
| --- | --- | --- | --- |
| Bit(s) | Name | Description | R/W |
| PcsTBD2.15:14 | Reserved | Ignored when read | RO |
| PcsTBD2.13:0 | Local link margin | This field reports the local link margin measured as extra SNR available in decoding with respect to min SNR needed to provide loc\_rcvr\_status = OK.  This field is fixed-point formatted (14,6) and is provided in log2(⋅) units e.g. LM = 3.5 dB is equivalent to log2(100.35) = 1.1627 in log2 units, which is equal to 0x012A in (14,6) format | RO |

#### 1000BASE-H PCS Status Register 3

Table 45-XXX – 1000BASE-H PCS Status register 3

|  |  |  |  |
| --- | --- | --- | --- |
| Bit(s) | Name | Description | R/W |
| PcsTBD3.15:14 | Reserved | Ignored when read | RO |
| PcsTBD3.13:0 | Remote link margin | 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. | RO |

#### 1000BASE-H PCS Status Register 4

Table 45-XXX – 1000BASE-H PCS Status register 4

|  |  |  |  |
| --- | --- | --- | --- |
| Bit(s) | Name | Description | R/W |
| PcsTBD3.15 | BER test mode counter reset | 1 = reset the BER test mode counter PcsTBD3.14:0  0 = ignored | R/W,  SC |
| PcsTBD3.14:0 | BER test mode counter | This is a 15-bit counter used to count the number of bits received with value 1 at the output of the binary descrambler, when PHY receiver is operating in test mode 1.  The counter is reset always that the PHY receiver enters in test mode 1 by indication of the link partner (see 114.8.2) or when reset is instructed by writing 1 in register PcsTBD3.15 | RO |

#### 1000BASE-H OAM Transmit Register

Table 45-XXX – 1000BASE-H OAM Transmit register

|  |  |  |  |
| --- | --- | --- | --- |
| Bit(s) | Name | Description | R/W |
| OamTxTBD0.15 | TXREQ | Transmission Request. It is raised by the OAM Management Entity 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 |
| OamTxTBD0.14 | PHYT | PHY Toggle bit. Corresponds to the toggle bit of the last message received by the remote PHY. | RO |
| OamTxTBD0.13 | MERT | Management Entity Read Toggle bit. Toggle bit of the last message read by the Management Entity attached to the remote PHY. | RO |
| OamTxTBD0.12 | MSGT | Message Toggle Bit. Toggles with each successive transmitted message and is used for message identification. | RO |
| OamTxTBD0.11:0 | OAM\_CTRL | OAM message control information. Intended to be used by the Management Entity to indicate the type or some information relevant about the content of OAM\_DATA0..7 message for the proper processing of the OAM message by the remote Management Entity.  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..7 registers. | R/W |

#### 1000BASE-H OAM Message Registers

Table 45-XXX – 1000BASE-H Transmit OAM Message registers

|  |  |  |  |
| --- | --- | --- | --- |
| Bit(s) | Name | Description | R/W |
| OamTxTBD1.15:0 | OAM\_DATA0 | OAM message 16-bit data word 0. | R/W |
| OamTxTBD2.15:0 | OAM\_DATA1 | OAM message 16-bit data word 1. | R/W |
| OamTxTBD3.15:0 | OAM\_DATA2 | OAM message 16-bit data word 2. | R/W |
| OamTxTBD4.15:0 | OAM\_DATA3 | OAM message 16-bit data word 3. | R/W |
| OamTxTBD5.15:0 | OAM\_DATA4 | OAM message 16-bit data word 4. | R/W |
| OamTxTBD6.15:0 | OAM\_DATA5 | OAM message 16-bit data word 5. | R/W |
| OamTxTBD7.15:0 | OAM\_DATA6 | OAM message 16-bit data word 6. | R/W |
| OamTxTBD8.15:0 | OAM\_DATA7 | OAM message 16-bit data word 7. | R/W |

#### 1000BASE-H OAM Receive Register

Table 45-XXX – 1000BASE-H OAM Receive register

|  |  |  |  |
| --- | --- | --- | --- |
| Bit(s) | Name | Description | R/W |
| OamRxTBD0.15 | RXVAL | Reception Valid. It is raised by the PHY to indicate to the Management Entity that a new message has arrived and is ready for processing. The message will be locked in the Rx Registers until the Management Entity access register RxTBD8, at which point the PHY will clear bit RXVAL and will also acknowledge the message processing to the link partner (see 2.4) | RO |
| OamRxTBD0.14:13 | Reserved |  |  |
| OamRxTBD0.12 | MSGT | Message Toggle bit. Indicates the toggle bit associated with the received message, and serves as message identification. It will toggle with every new received message. | RO |
| OamRxTBD0.11:0 | OAM\_CTRL | 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..7 message. | RO |

Table 45-XXX – 1000BASE-H Receive OAM Message registers

|  |  |  |  |
| --- | --- | --- | --- |
| Bit(s) | Name | Description | R/W |
| OamRxTBD1.15:0 | OAM\_DATA0 | OAM message 16-bit data word 0. | RO |
| OamRxTBD2.15:0 | OAM\_DATA1 | OAM message 16-bit data word 1. | RO |
| OamRxTBD3.15:0 | OAM\_DATA2 | OAM message 16-bit data word 2. | RO |
| OamRxTBD4.15:0 | OAM\_DATA3 | OAM message 16-bit data word 3. | RO |
| OamRxTBD5.15:0 | OAM\_DATA4 | OAM message 16-bit data word 4. | RO |
| OamRxTBD6.15:0 | OAM\_DATA5 | OAM message 16-bit data word 5. | RO |
| OamRxTBD7.15:0 | OAM\_DATA6 | OAM message 16-bit data word 6. | RO |
| OamRxTBD8.15:0 | OAM\_DATA7 | OAM message 16-bit data word 7. | RO |