147. Physical Coding Sublayer (PCS), Physical Medium Attachment (PMA) sublayer and baseband medium, type 10BASE-T1S

(edits only shown, and indicated in red)

147.2 Service primitives and interfaces

Change Figure 147-2 as shown (red dashed boxes indicate changes – these are not intended for the final figure):

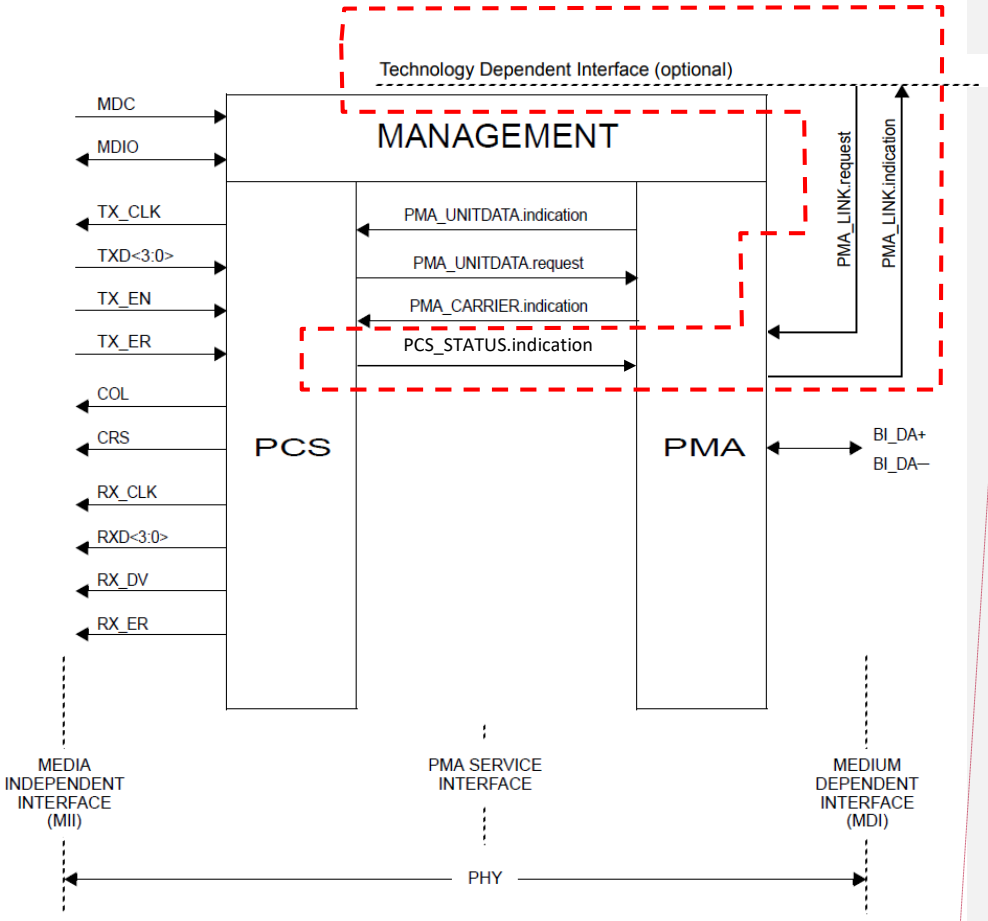

Figure 147–2—10BASE-T1S PHY interfaces

Commented [PB1]: Add PCS_STATUS.indication primitive (marked in red)
Add Technology Dependent Interface
Add PMA_LINK.request
Add PMA_LINK.indication

Change list in 3rd paragraph of 147.2 to add PMA_LINK.indication, PMA_LINK.request, and PCS_STATUS.indication as shown:

As shown in Figure 147–2, 10BASE-T1S uses the following service primitives to exchange symbol vectors, status indications, and control signals across the PMA service interface:

PMA_UNITDATA.indication (rx_sym)
PMA_UNITDATA.request (tx_sym)
PMA_CARRIER.indication(pma_crs)
PMA_LINK.indication(link_status)

PMA_LINK.request(link_control)
PCS_STATUS.indication(pcs_status)

Commented [PB2]: Add PCS_STATUS.indication and PMA_LINK.indication and request primitives

147.2.1 Mapping of PMA_CARRIER.indication

Reports whether a signal compatible with DME encoding rules specified in 147.4.2 is detected on the medium.

147.2.1.1 Function

Maps the primitive PMA_CARRIER.indication to the MII CRS sign.

147.2.1.2 Semantic of the service primitive

PMA_CARRIER.indication(pma_crs)

The pma_crs parameter can take one of two values: CARRIER_ON or CARRIER_OFF.

The pma_crs parameter is set to CARRIER_ON if a signal compatible with DME encoding rules specified in 147.4.2 is present on the medium. Otherwise the pma_crs parameter is set to CARRIER_OFF.

147.2.1.3 When generated

The PMA_CARRIER.indication primitive is generated continuously by the PMA sublayer.

Insert 147.2.2 through 147.2.4 PMA_LINK.request, PMA_LINK.indication, and PCS_STATUS.indication after 147.2.1.3 (PMA_CARRIER.indication When generated) and renumber as shown

147.2.2 PMA_LINK.request

Commented [PB3]: Add PMA_LINK.indication primitive description

This primitive allows the Auto-Negotiation to enable and disable operation of the PMA, as specified in 98.4.2, respectively.

147.2.2.1 Semantics of the primitive

PMA_LINK.request (link_control)

The link_control parameter can take on one of the following two values:
DISABLE: Used by the Auto-Negotiation function to disable the PHY.
ENABLE: Used by the Auto-Negotiation function to enable the PHY.

147.2.2.2 When generated

Auto-Negotiation generates this primitive to indicate a change in link_control as described in 98.4.

147.2.3 PMA_LINK.indication

Commented [PB4]: Add PMA_LINK.indication primitive description

This primitive is generated by the PMA to indicate the status of the underlying medium as specified in 98.4.1. This primitive informs the Auto-Negotiation functions about the status of the underlying link.

147.2.3.1 Semantics of the primitive

PMA_LINK.indication (link_status)
The link_status parameter can take on the following two values:

FAIL	No valid link established.
OK	The Link Monitor function indicates that a valid 10BASE-T1S link is established. Reliable reception of signals transmitted from the remote PHY is possible.

147.2.3.2 When generated

The PMA generates this primitive to indicate a change in link_status in compliance with the state diagram given in Figure TBD.

Commented [PB5]: Link to link monitor state diagram

147.2.3.3 Effect of receipt

The effect of receipt of this primitive is specified in 98.4.1.

147.2.4 PCS_STATUS.indication

Commented [PB6]: Add PCS_STATUS.indication primitive description

This primitive is generated by the PMA to retrieve the status of the PCS.

147.2.4.1 Semantics of the primitive

PCS_STATUS.indication (pcs_status)

The pcs_status parameter can take on the following two values:

FALSE	PCS is not receiving valid packets or heartbeat signals from the remote PHY.
TRUE	PCS is actively receiving valid packets and/or heartbeat signals from the remote PHY.

147.2.4.2 When generated

The PCS generates this primitive continuously. The pcs_status parameter is set according to the state diagram in Figure TBD.

Commented [PB7]: Link to HB Receive State Diagram

147.2.4.3 Effect of receipt

The effect of receipt of this primitive is specified in TBD.

Commented [PB8]: Link to link monitor state diagram subclause

147.3 Physical Coding Sublayer (PCS) functions

Change Figure 147-3 to add PCS_STATUS.indication primitive as shown (changes in red):

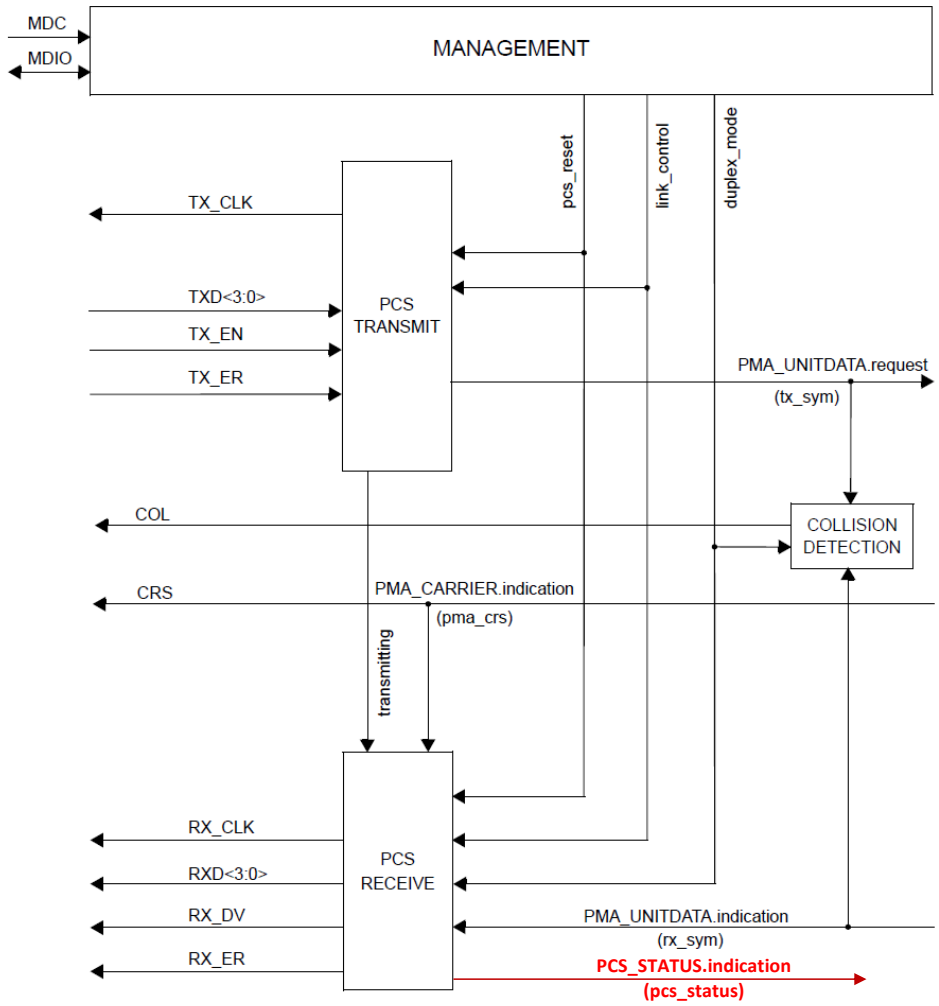

Figure 147–3—PCS reference diagram

Commented [PB9]: Add PCS_STATUS primitive (marked in red)

147.3.2 PCS Transmit

147.3.2.2 Variables

Change description of tx_cmd as shown:

tx_cmd

5B symbol to be transmitted when the PCS Transmit function is in ~~SILENT~~ COMMAND state. The tx_cmd variable is assigned according to the ~~PLCA~~ RS signaling over MII interface, as defined in 22.2.2.4, ~~148.4.3.1.1, and 148.4.3.1.2.~~ in conjunction with value of the hb_cmd variable, defined in 147.3.8.2.
The following mapping shall be used:

- tx_cmd <= 'N' when a BEACON request is asserted,
- tx_cmd <= 'J' when a COMMIT request is asserted,
- tx_cmd <= 'T' when hb_cmd variable is set to HEARTBEAT and none of the previous requests is asserted,
- tx_cmd <= 'I' otherwise.
  ~~When PLCA capabilities are not supported or disabled, tx_cmd shall be set to the special 5B symbol 'I' (binary vector of 1,1,1,1,1) representing SILENCE~~

Commented [PB10]: change the definition of tx_cmd to accommodate the HB functions

[GZ] Cleanup – the RS signaling is defined in clause 22, and is independent of PLCA – see strikeout at end of tx_cmd – behavior is now generic.

147.3.2.3 Function

Change Special Function in 19th body row for 'T' (5B value 01101) as shown (unchanged rows not shown):

Table 147–1—4B/5B Encoding

Name	4B	5B	Special function
. . .	. . .	. . .	. . .
T	N/A	01101	ESD / HB
. . .	. . .	. . .	. . .

Commented [PB11]: Use symbol 'T' as a Heartbeat indication, shared with 'ESD' as they can't occur simultaneously

Insert 147.3.8 Optional support for PCS status generation and subclauses, after 147.3.7 Optional Support for PLCA Reconciliation Sublayer.

147.3.8 Optional support for PCS status generation

If Clause 98 auto-negotiation functions are implemented and enabled, the PCS shall conform to the Heartbeat (HB) transmit and receive state diagrams in Figure TBD, Figure TBD and the associated state variables, functions, timers, messages and constants. Otherwise all of the HB functions shall be disabled.

Commented [PB12]: reference to HB transmit state diagram

Commented [PB13]: reference to HB receive state diagram

Commented [PB14]: Heartbeat functions only works in conjunction with AN (they depend on each other).

If Clause 98 auto-negotiation functions are not implemented or disabled, the PCS_STATUS.indication primitive shall convey FALSE.

The pcs_status parameter of PCS_STATUS.indication primitive is set after the reception of HB signals and valid data reception (RX_DV) according to the logic described in the HB receive state diagram.

The HB generation is disabled when the PHY is configured for operation over a mixing-segment network or a PLCA BEACON indication is detected on the line.

147.3.8.1 Heartbeat transmit overview

HB signals are sent unsolicited by the PHY that negotiated the master role during auto-negotiation, while the slave PHY replies back to received HB signals.

147.3.8.2 Heartbeat transmit variables

pcs_reset
: See 147.3.2.2.

mr_autoneg_enable
: See 98.3.1.

an_link_good
: See 98.3.1.

multidrop
: If MDIO is implemented, this variable is set according to bit 1.2299.10. If MDIO is not implemented, multidrop should be set by equivalent means.

master
: result of the role negotiated using method in 98.2.1.5 and Table 98-4.
Values: TRUE (negotiated role is master) or FALSE (negotiated role is slave)

hb_cmd
: enumerated variable that conveys the command to send an HB message to the PCS transmit function. This command is ignored or interrupted by the PCS transmit function when normal data is being sent or an higher priority request is in effect, as specified in 147.3.2.2
Values: HEARTBEAT or NONE

rx_cmd
: enumerated value set to:
- 'BEACON' when a BEACON indication is generated as specified in 147.3.7.1.
- 'COMMIT' when a COMMIT indication is generated as specified in 147.3.7.2.
- 'HEARTBEAT' when a HB is detected on the line.
- 'NONE' otherwise
Values: BEACON, COMMIT, HEARTBEAT or NONE

COL
: the MII signal COL
Values: TRUE or FALSE

CRS
: the MII signal CRS
Values: TRUE or FALSE

RX_DV
: the MII signal RX_DV
Values: TRUE or FALSE

147.3.8.3 Heartbeat transmit timers

HB_SEND_TIMER
: Times the duration of the HB signal on the line.
Duration: 20 bit times

HB_TIMER
: Period between the transmission of two consecutive HB signals.
Duration: 50 ms

Insert Figure 147-TBD Heartbeat transmit state diagram with editorial license to combine parts a & b below into a single diagram and according to IEEE style.

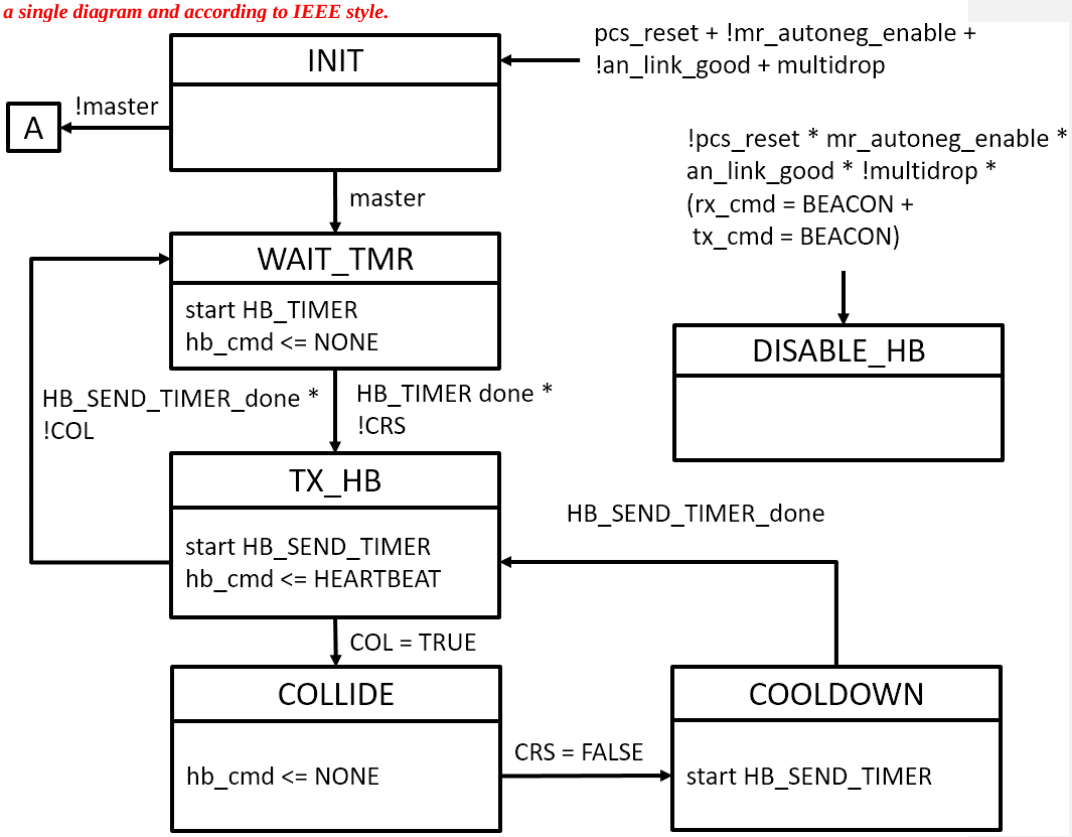

Figure 147-TBD: HB Transmit State Diagram (part a)

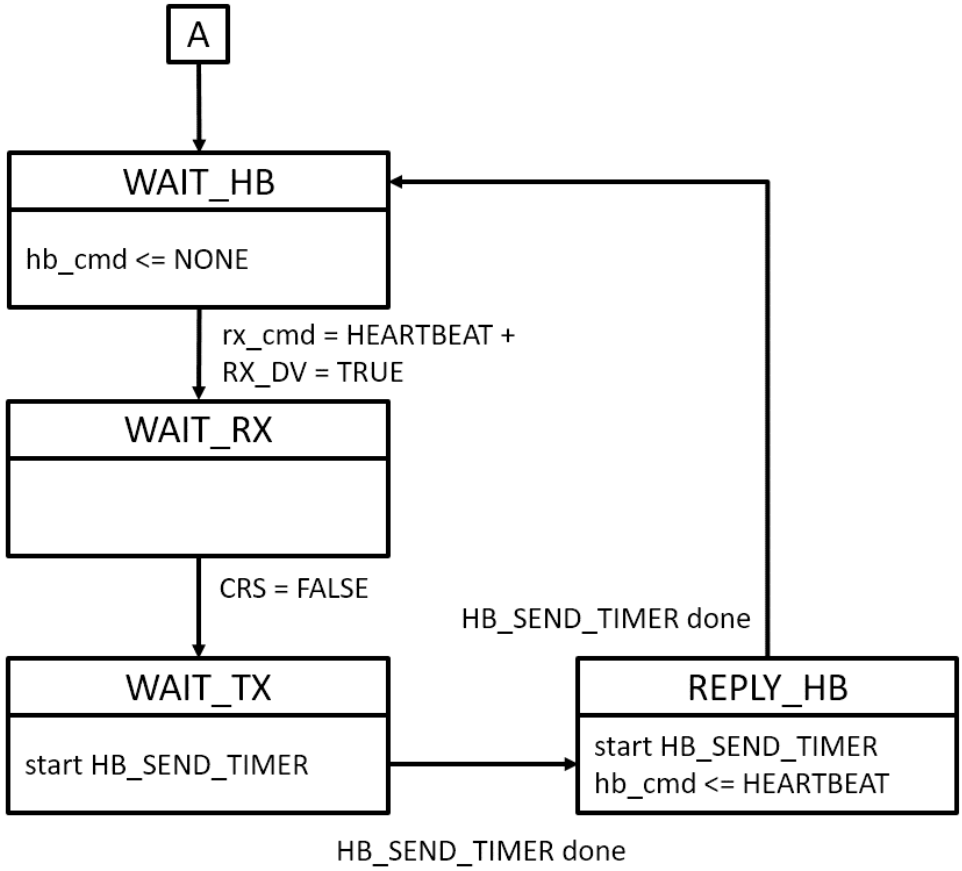

Figure 147-TBD: HB Transmit State Diagram (part b)

147.3.8.4 Heartbeat receive overview

The HB receive state diagram generates the pcs_status parameter of the PCS_STATUS.indication primitive based on the reception of valid data packets and HB signals from the remote PHY.

The pcs_status is reported as TRUE when at least ACTIVE_CNT valid packets or HB messages, separated at max by LINK_HOLD_TIMER ms, are received.

The pcs_status is reported as FALSE when PCS is reset or when no valid packets nor HB messages are received within LINK_HOLD_TIMER ms for INACTIVE_CNT times in a row.

147.3.8.5 Heartbeat receive variables

pcs_reset
: See 147.3.2.2.

pcs_status
: parameter of the PCS_STATUS.indication primitive.
Values: TRUE or FALSE

mr_autoneg_enable
: See 98.3.1.

an_link_good
: See 98.3.1.

multidrop
: See 147.3.8.2.

rx_cmd
: See 147.3.8.2.

cnt_l
: counter of HB when pcs_status is TRUE.
Values: integer number between 0 and 7

cnt_h
: counter of HB when pcs_status is FALSE.
Values: integer number between 0 and 7

COL
: the MII signal COL
Values: TRUE or FALSE

CRS
: the MII signal CRS
Values: TRUE or FALSE

RX_DV
: the MII signal RX_DV
Values: TRUE or FALSE

147.3.8.6 Heartbeat receive constants

ACTIVE_CNT
: number of HB required to signal pcs_status = TRUE
Value: 2

INACTIVE_CNT
: number of HB required to signal pcs_status = FALSE
Value: 5

147.3.8.7 Heartbeat receive timers

LINK_HOLD_TIMER
: Time after which the count of HB is updated.
Duration: 50 ms

Insert Figure 147-TBD Heartbeat receive state diagram with editorial license to redraw according to IEEE style.

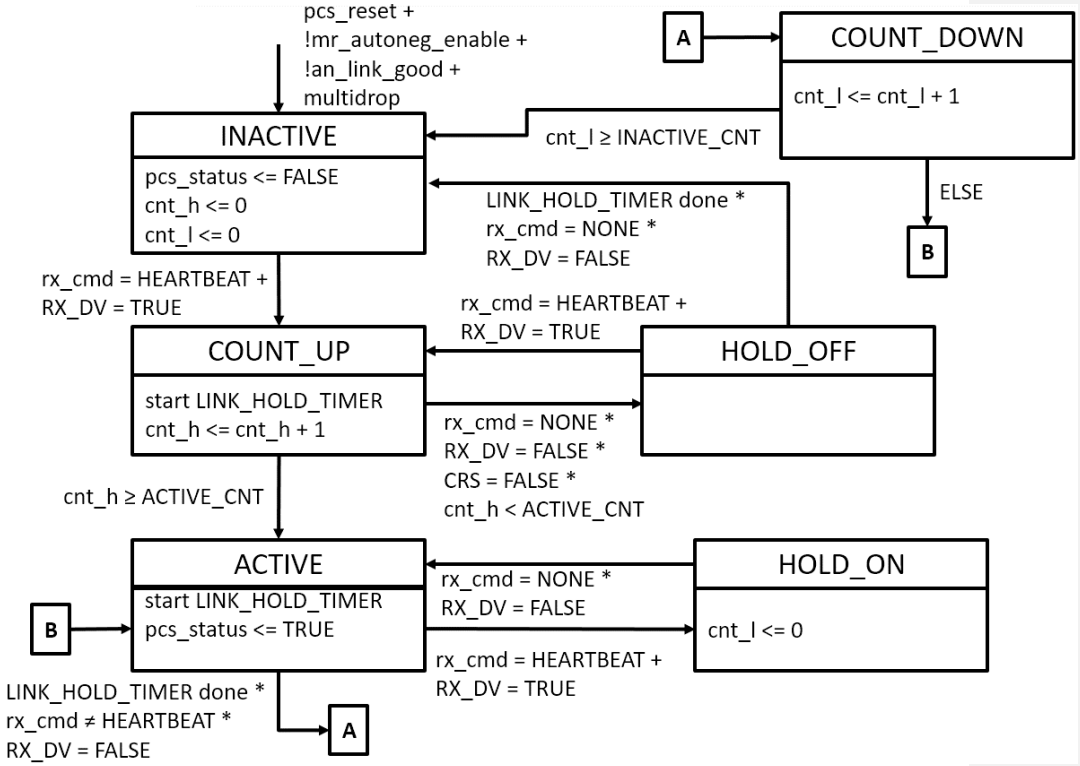

Figure 147-TBD: HB Receive State Diagram

147.4 Physical Medium Attachment (PMA) Sublayer

Change Figure 147-10 to add LINK MONITOR and primitives as shown (changes in red):

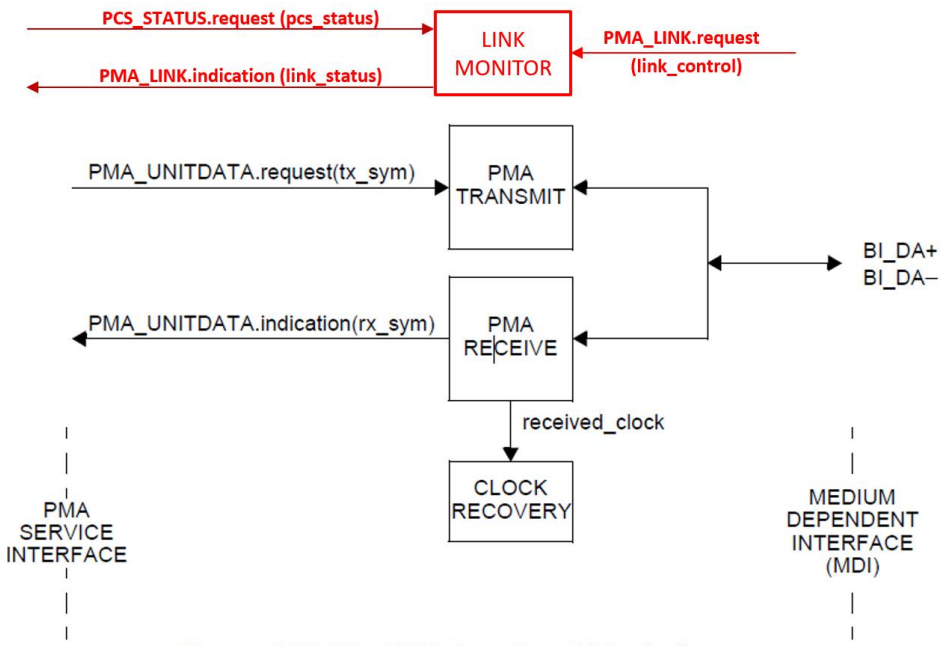

Figure 147–10—PMA functional block diagram

Insert 147.4.5 Link Monitor function (and subclauses) after 147.4.4 PMA clock recovery

147.4.5 Link Monitor function

The PMA shall conform to the Link Monitor State diagram in Figure 147-TBD and associated variables.

147.4.5.1 Link Monitor overview

The link monitor function generates the link_status parameter of the PMA_LINK.indication primitive for the Clause 98 auto-negotiation function.

The link_status parameter is set after the result of the PCS_STATUS.indication primitive and the implementation defined variable loc_rcv_status.

Commented [PB15]: Add Link Monitor block and related primitives in the figure

Commented [PB16]: Add Link Monitor function in the PMA

Commented [PB17]: reference to link monitor state diagram

147.4.5.2 Link Monitor variables

pma_reset

Allows reset of all PMA functions.
Values: TRUE or FALSE.
Set by: PMA Reset function.

link_control

See 147.3.2.2.

loc_rcv_status

Implementation defined variable set to TRUE when the PMA is ready to decode valid data from the line, FALSE otherwise.
Values: TRUE or FALSE

link_status

The link_status parameter set by PMA Link Monitor and passed to the PCS via the PMA_LINK.indication primitive.
Values: OK or FAIL

pcs_status

See 147.3.8.5.

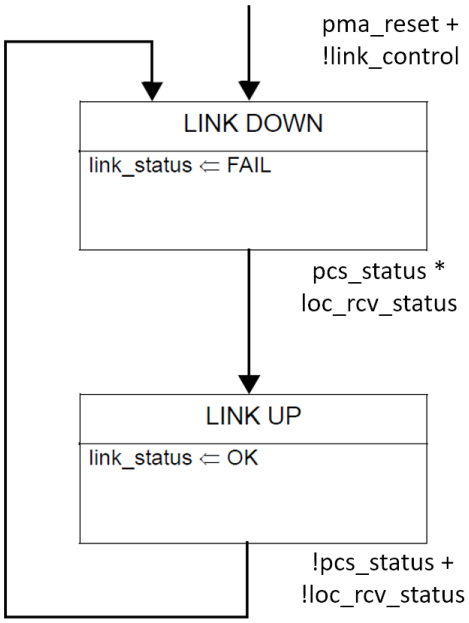

Figure 147-TBD: Link Monitor State Diagram

147.12 Protocol implementation conformance statement (PICS) proforma for Clause 147, Physical Coding Sublayer (PCS), Physical Medium Attachment (PMA) sublayer and baseband medium, type 10BASE-T1S[1]

Grant editorial license to adjust PICS for added requirements.

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