30.16.1.1.4 aPLCALocalNodeID

Change text of BEHAVIOUR DEFINED AS section of 30.16.1.1.4 as shown:

This value is assigned to define the ID of the local node on the PLCA network. This attribute maps to the local_nodeID variable in 148.4.4.2. When D-PLCA is enabled, writes to this attribute are ignored. The default value is 255. Value range is 0 to 255, inclusive.;

Insert new subclauses 30.16.1.1.8 through 30.16.1.1.13 after 30.16.1.1.7 as follows:

~~**30.16.1.1.8 aDPLCASoftAgingCycles**~~

~~ATTRIBUTE~~

~~APPROPRIATE SYNTAX:~~
~~INTEGER~~

~~BEHAVIOUR DEFINED AS:~~
~~Controls the aging time in BEACON cycles of D-PLCA SOFT claims as defined by the soft_aging_cycles variable in 148.4.7.2.;~~

30.16.1.1.9 ~~aDPLCAHardAgingCycles~~ aDPLCAAgingCycles

ATTRIBUTE

APPROPRIATE SYNTAX:
INTEGER

BEHAVIOUR DEFINED AS:
Controls the aging time in BEACON cycles of D-PLCA ~~HARD~~ claims as defined by the ~~hard_aging_cycles~~ aging_cycles variable in 148.4.7.2.;

30.16.1.1.10 aDPLCACoordinatorRoleAllowed

ATTRIBUTE

APPROPRIATE SYNTAX:
BOOLEAN

BEHAVIOUR DEFINED AS:
Controls whether the D-PLCA enabled node is allowed to take the coordinator role, mapping to the coordinator_role_allowed variable defined in 148.4.7.2.;

30.16.1.1.11 aDPLCAAdminState

ATTRIBUTE

APPROPRIATE SYNTAX:
An ENUMERATED VALUE that has the following entries:
disabled
enabled

BEHAVIOUR DEFINED AS:
A read-only value that indicates whether the dynamic node ID allocation method for the PLCA Reconciliation Sublayer (D-PLCA) is enabled. When D-PLCA is enabled, PLCA node IDs are dynamically assigned as defined in 148.4.7.;

148. PLCA Reconciliation Sublayer (RS)

148.2 Overview

Change the first paragraph of 148.2 as shown:

~~The working principle of PLCA is that transmit opportunities on a mixing segment are granted in sequence based on a node ID unique to the local collision domain (set by the management entity). The method of determination of the node ID and to_timer by the management entity is beyond the scope of this standard. Proper operation of the Clause 148 functionality assumes that the assigned node ID is unique in the local collision domain.~~PLCA grants transmit opportunities on a mixing segment in sequence based on a node ID unique within the local collision domain. This defines a worst-case access time to each node and enables the mixing segment to operate collision free, which allows full utilization of the media. The node ID is not contained within the frames on the media. The node ID may be set by management or allocated using Dynamic PLCA (D-PLCA) (see 148.4.7).

148.4 PLCA Reconciliation Sublayer operation

148.4.4 PLCA Control

148.4.4.1 PLCA Control state diagram

Change the second paragraph of 148.4.4.1 as follows:

When D-PLCA is enabled, the PLCA nodeID and BEACON are automatically configured. For configuration when D-PLCA is enabled, see 148.4.7.1.~~To achieve error free operation the PLCA node should be configured appropriately before transmit functions are enabled.~~ When D-PLCA is not enabled, the PLCA node should be configured appropriately before transmit functions are enabled. Appropriate configuration includes the following:

Insert new paragraphs and numbered list at the end of 148.4.4.1 as follows:

When the optional Dynamic PLCA (D-PLCA) functionality is implemented, the PLCA control function also performs the detection of ~~hard and soft~~ commitment of other nodes to transmit opportunities for the purpose of identifying the availability of transmit opportunities within the PLCA cycle. ~~Soft commits are from nodes with PLCA disabled or not implemented and is simply the reception of a packet during a transmit opportunity. Nodes that are not operating with PLCA enabled do not have a specific transmit opportunity assigned to them.~~ A claim is made on a transmit opportunity simply by the reception of a packet during a transmit opportunity. Nodes that are not operating with PLCA enabled do not have a specific transmit opportunity assigned to them and should not be present in the collision domain. The existence of nodes with PLCA disabled will prevent D-PLCA enabled nodes from automatically selecting and converging on unique node IDs.

~~A hard commit is indicated by a sequence of COMMIT symbols that are appended or prepended to each packet. Hard commit sequences are transmitted in the following conditions:~~

- ~~in the COMMIT state when curID becomes equal to local_nodeID while the packetPending variable is TRUE, meaning this node now owns the transmit opportunity and has a packet to transmit.~~
- ~~in the BURST state following the transmission of a packet.~~

148.4.4.2 PLCA Control variables

Change entries for variables CRS, plca_node_count, RX_DV, and TX_EN as shown:

CRS

The MII signal CRS (see 22.2.2.11).
Values: TRUE or FALSE

plca_node_count

Maximum number of PLCA nodes on the mixing segment receiving transmit opportunities before the node with local_nodeID = 0 generates a new BEACON, reflecting the value of aPLCANodeCount. This parameter is meaningful only for the node with local_nodeID = 0; otherwise, it is ignored.
Values: integer number from ~~0~~1 to 255

RX_DV

The MII signal RX_DV (see 22.2.2.7).
Values: TRUE or FALSE

TX_EN

The MII signal TX_EN (see 22.2.2.3).
Values: TRUE or FALSE

Insert new variables COL, dplca_en, dplca_txop_claim, dplca_txop_end, dplca_txop_id, dplca_txop_node_count, and dplca_txop_table_upd into the list, in alphabetical order:

COL

The MII signal COL (see 22.2.2.12).
Values: TRUE or FALSE

dplca_aging

See 148.4.7.2.

dplca_en

The dplca_en signal controls the operation of the optional D-PLCA function when D-PLCA is implemented. When the optional D-PLCA function is not implemented, the dplca_en variable is set to FALSE. When Clause 30 management is present, this variable maps to TRUE when the aDPLCASupported attribute is set to TRUE and the aDPLCAAdminState is set to enabled, and maps to FALSE when the aDPLCASupported attribute is set to FALSE or the aDPLCAAdminState is set to disabled.
Values:
TRUE: The D-PLCA function is enabled
FALSE: The D-PLCA function is disabled or not present

dplca_txop_claim

Notifies the D-PLCA state diagrams whether the transmit opportunity indicated by dplca_txop_id was claimed by a node. ~~Additionally, it specifies the type of claim~~. See 148.4.7.2 definitions at txop_claim_table.
Values:
~~SOFT: A packet not including a COMMIT indication was received; SOFT claims may be issued implicitly by nodes not supporting D-PLCA~~
CLAIMED: A packet ~~including a COMMIT indication~~ was received; ~~HARD claims may be issue by D-PLCA enabled nodes, and occasionally by statically configured PLCA enabled nodes~~
UNCLAIMED: The transmit opportunity is available to be claimed

dplca_txop_end
: Notifies the D-PLCA state diagrams that the transmit opportunity indicated by the dplca_txop_id variable has expired.
Values: TRUE or FALSE

dplca_txop_id
: Copy of the curID variable, synchronized with dplca_txop_end.
Values: integer from 0 to 255

dplca_txop_node_count
: Copy of PLCA node count synchronized with PLCA SYNCING cycle.
Values: integer from 1 to 255

dplca_txop_table_upd
: See 148.4.7.2.

148.4.4.4 Timers

~~***Insert new timer append_commit_timer in the list, in alphabetical order:***~~

~~append_commit_timer~~
: ~~Timer used by D-PLCA to append a COMMIT to each transmitted packet.~~
~~Duration: 22 bit times.~~
~~Tolerance: ± 1 bit time.~~

148.4.4.6 State diagram

Replace the arc from BURST to TRANSMIT in Figure 148-4 with tag F, replace the arc and the text "ELSE" from NEXT_TX_OPPORTUNITY to WAIT_TO in Figure 148-4 with tag G, and change Figure 148–3 and Figure 148–4 as shown:

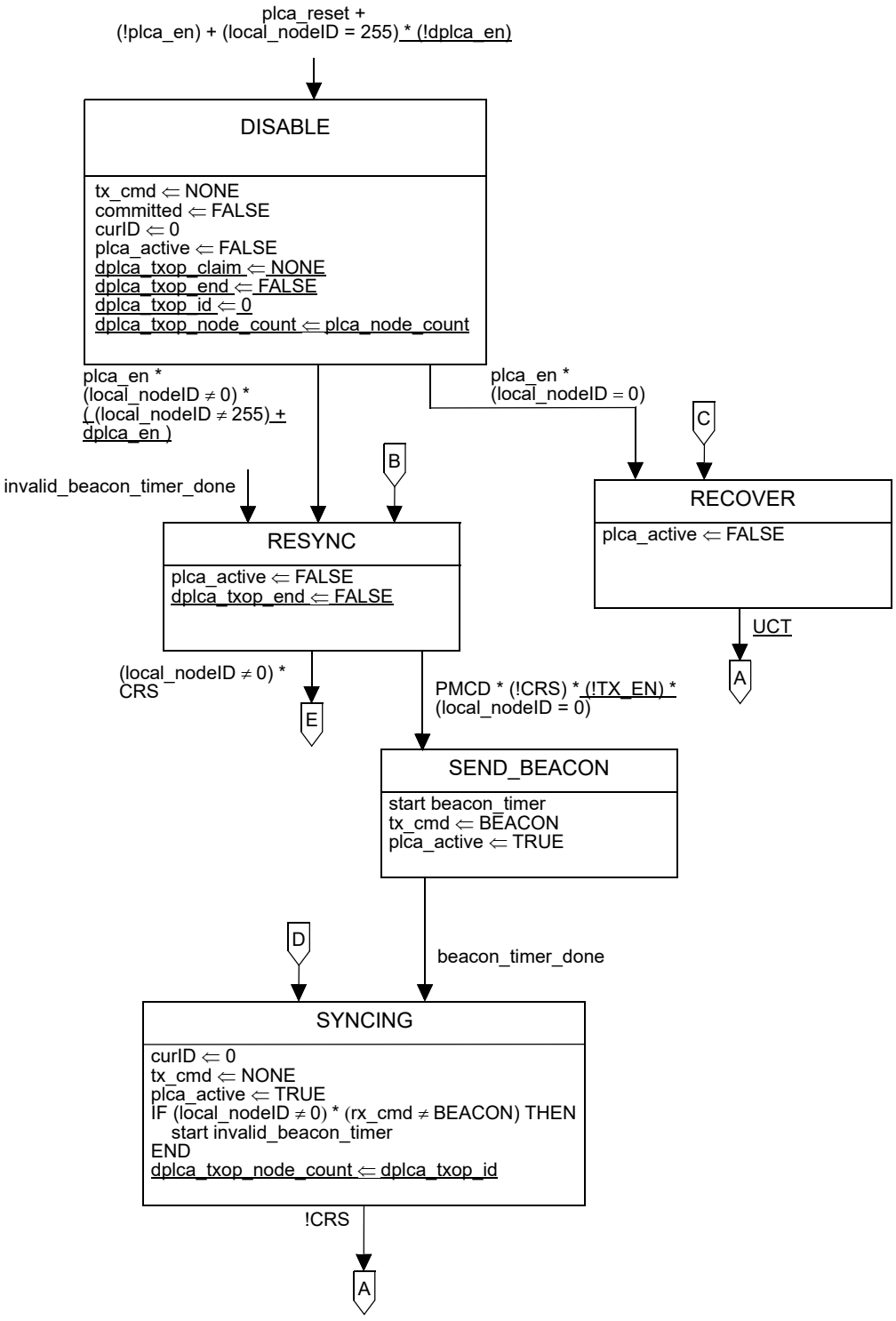

Figure 148–3—PLCA Control state diagram, part a

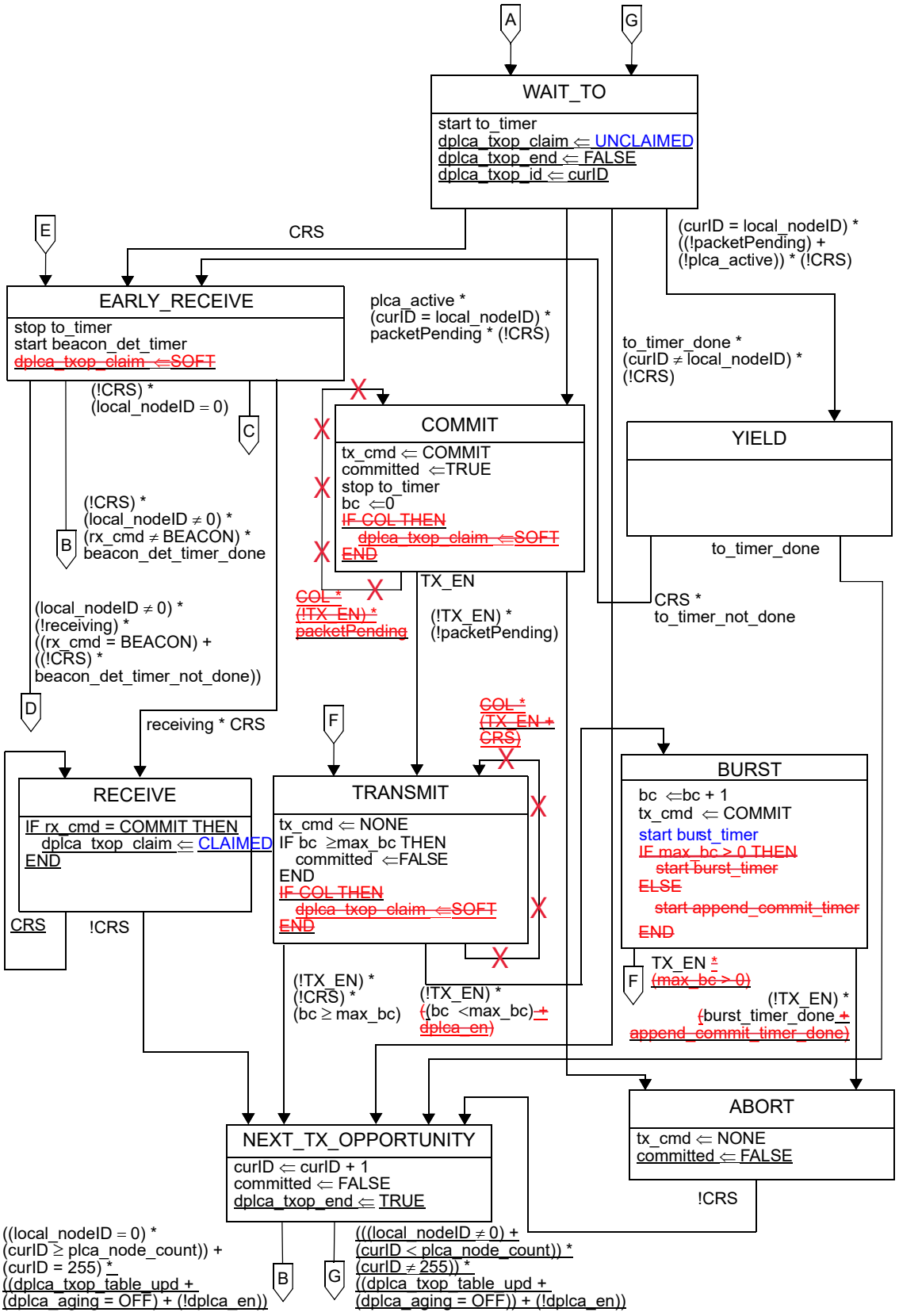

Figure 148–4—PLCA Control state diagram, part b

148.4.5 PLCA DATA state diagram

148.4.5.2 Variables

Change entries for variables COL, CRS, TX TX_EN, and TX_ER as shown:

COL

The MII signal COL ~~specified in~~(see 22.2.2.12).
Values: TRUE or FALSE

CRS

The MII signal CRS (see 22.2.2.11).
Values: TRUE or FALSE

TXD

The MII signals TXD<3:0> ~~specified in~~(see 22.2.2.4).

TX_EN

The MII signal TX_EN ~~specified in~~(see 22.2.2.3).
Values: TRUE or FALSE

TX_ER

The MII signal TX_ER ~~specified in~~(see 22.2.2.5).
Values: TRUE or FALSE

148.4.5.7 State diagram

Change Figure 148-5 and Figure 148-6 as shown:

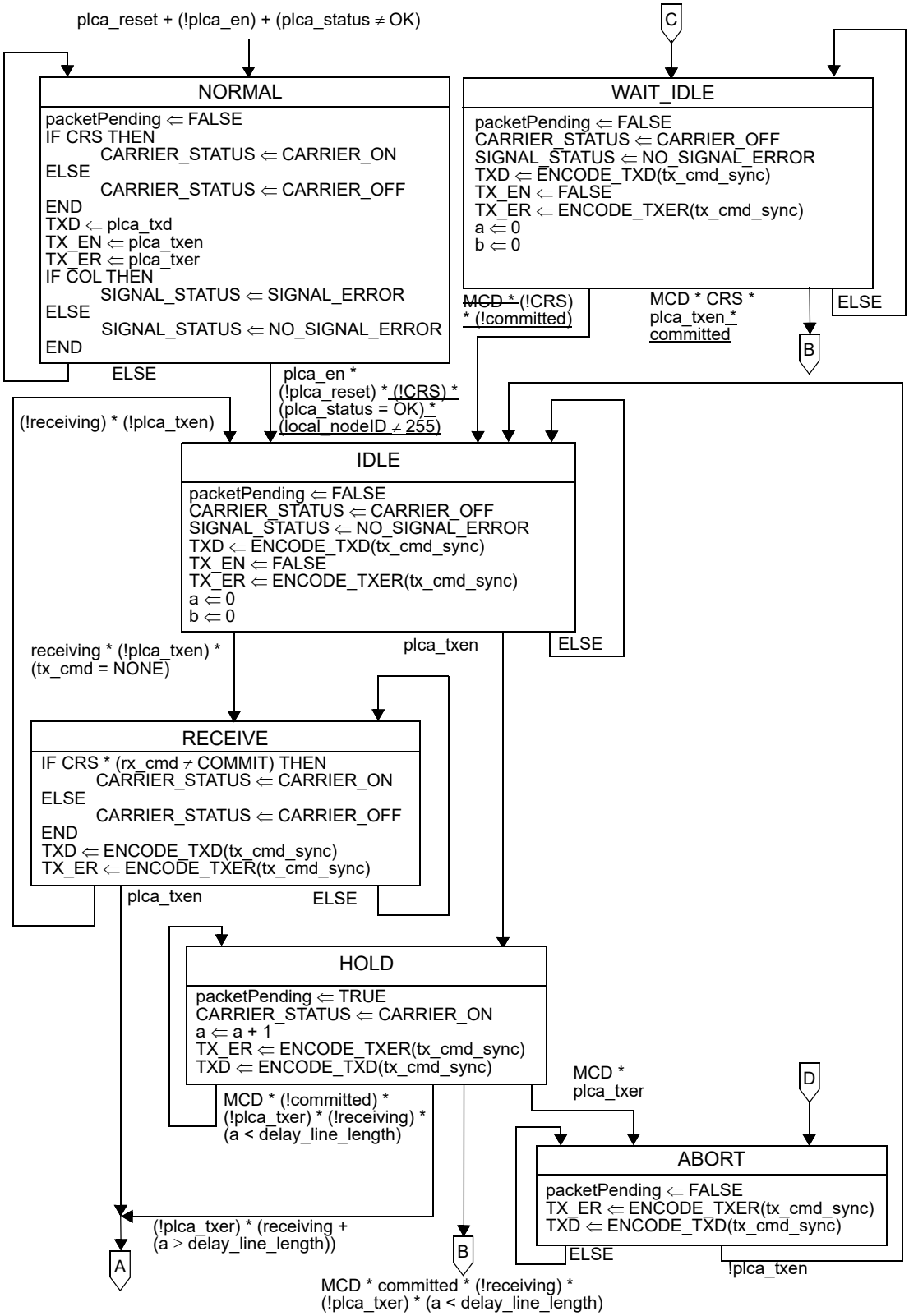

Figure 148–5—PLCA Data state diagram, part a

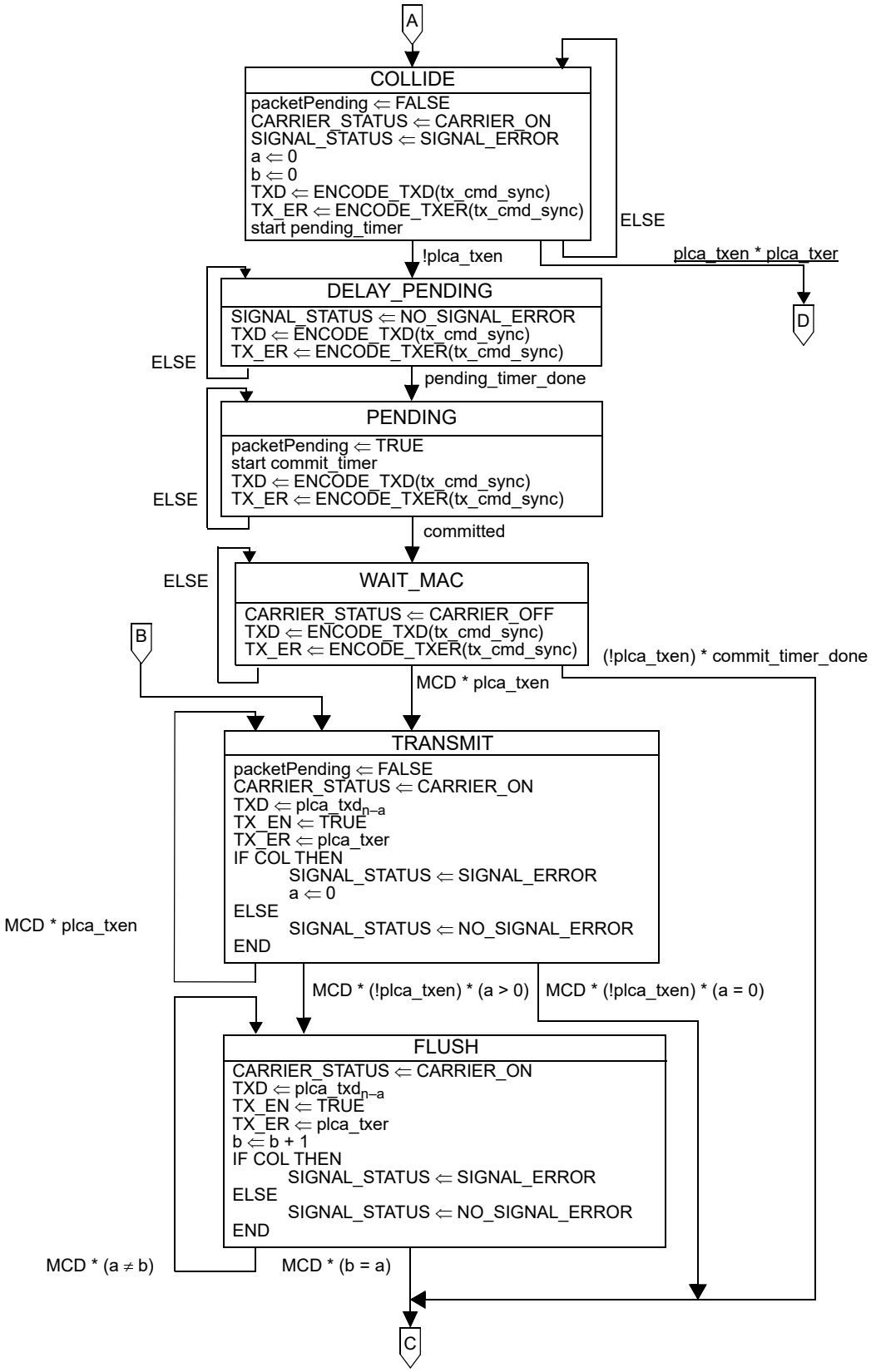

Figure 148–6—PLCA Data state diagram, part b

Insert new subclause 148.4.7 (and Figures 148-8 and 148-9) after 148.4.6 (and its subclauses) as follows:

148.4.7 Dynamic PLCA (D-PLCA)

148.4.7.1 D-PLCA state diagram overview

D-PLCA is an optional feature of the PLCA RS that reduces the amount of configuration required to use PLCA. D-PLCA enables nodes to select unique node IDs automatically and defines a method to designate a single node with ID = 0 (coordinator). If the D-PLCA option is implemented, it shall comply with the state diagrams in Figure 148–8 and Figure 148–9.

D-PLCA adjusts plca_node_count and local_nodeID based on transmit opportunity claims observed on a mixing segment. When a mixing segment contains a mixture of nodes with D-PLCA active and not active, the D-PLCA nodes select IDs outside the space of the statically assigned IDs. When using D-PLCA with statically assigned IDs, values in the range of 0 to 7 should be assigned first. When D-PLCA is active, PHYs detect collisions as part of the local_nodeId assignment process.

See replacement text on final page of this document

~~D-PLCA keeps track of claimed transmit opportunities, distinguishing between HARD claims (with COMMIT requests) and SOFT claims (without explicit COMMITs). The aging algorithm assigns two different aging times for HARD and SOFT claims to avoid the case where non-PLCA-enabled nodes may prevent D-PLCA from converging. The variables hard_aging_cycles and soft_aging_cycles can be configured to optimize convergence time and stability over time in different situations. Soft claims are removed from the claim table, txop_claim_table, if they are older than soft_aging_cycles. Similarly, stale hard claims are removed every hard_aging_cycles. The value of hard_aging_cycles should be sufficiently greater than the value of soft_aging_cycles to maintain stability of the D-PLCA process as well as interoperability with statically configured PLCA nodes.~~

When D-PLCA functionality is enabled, the node transitions to the WAIT_BEACON state and waits for the reception of a BEACON. If no BEACON is detected before wait_beacon_timer_done and the coordinator role is allowed, the node promotes itself as the D-PLCA coordinator by transitioning to the COORDINATOR state.

The D-PLCA coordinator always maintains the plca_node_count such that transmit opportunity plca_node_count-1 is always unused. This allows new D-PLCA nodes to be added to the mixing segment by claiming this unused transmit opportunity. Upon detecting a node performing a ~~hard~~ claim on this transmit opportunity, the D-PLCA coordinator transitions to the INCREASE_NODE_COUNT state and increase plca_node_count by one to create a new unused transmit opportunity.

The D-PLCA coordinator also reduces plca_node_count to accommodate D-PLCA nodes being removed from the network. When the coordinator detects that no node has a ~~hard~~ claim on the last ~~two~~ transmit opportunitie~~s~~ of the cycle, it transitions to the REDUCE_NODE_COUNT state. In this state, the coordinator will reduce plca_node_count to the highest ~~hard~~ claimed transmit opportunity plus ~~one~~ two to maintain an unused transmit opportunity at the end of the PLCA cycle.

Detection of a BEACON or a ~~hard~~ claim on transmit opportunity zero by the D-PLCA coordinator indicates the existence of another coordinator on the mixing segment. In this case, the D-PLCA coordinator switches to the LEARNING state where it demotes itself as a D-PLCA follower and begins identifying a transmit opportunity that it may claim.

Upon detection of a BEACON, new D-PLCA followers transition to the LEARNING state where they monitor the mixing segment for one PLCA cycle to identify transmit opportunities that have a ~~hard~~ claim. At the end of the PLCA cycle, the D-PLCA follower will select a free transmit opportunity that does not have a ~~hard~~ claim. The follower will continue to monitor all transmit opportunities maintaining a table of transmit opportunities that are claimed by other followers. Once the follower has selected a transmit opportunity, if it

later detects another follower perform a ~~hard~~ claim on the same transmit opportunity, it will select a new transmit opportunity that does not have a ~~hard~~ claim.

If BEACONs cease to be regularly detected and plca_status fails, followers transition back to the WAIT_BEACON state through DISABLED.

148.4.7.2 D-PLCA variables

COL
: The MII signal COL (see 22.2.2.12).
Values: TRUE or FALSE

coordinator_role_allowed
: This variable controls whether the local node is allowed to take the coordinator role (local_nodeID = 0) during the D-PLCA node assignment procedure. This variable maps on the aDPLCACoordinatorRoleAllowed attribute in 30.16.1.1.10.
Values: TRUE or FALSE

CRS
: The MII signal CRS (see 22.2.2.11).
Values: TRUE or FALSE

dplca_aging
: This variable controls the state of the D-PLCA aging state diagram.
Values: ON or OFF

dplca_en
: See 148.4.4.2.

dplca_new_age
: Internal variable used to synchronize the D-PLCA Control State Diagram with the D-PLCA Aging State Diagram so that changes in the node ID allocation occur at the end of a cycle of transmit opportunities.
Values: TRUE or FALSE

dplca_txop_claim
: See 148.4.4.2.

dplca_txop_end
: See 148.4.4.2.

dplca_txop_id
: See 148.4.4.2.

dplca_txop_node_count
: See 148.4.4.2.

dplca_txop_table_upd
: Synchronization variable set by the D-PLCA aging state diagram to notify the D-PLCA control state diagram that the table of transmit opportunity has been updated.
Values: TRUE or FALSE

~~hard_aging_cycles~~ aging_cycles
: Defines the number of BEACON cycles before the ~~HARD~~ claims over the transmit opportunities expire. When Clause 30 management is implemented, this variable maps to the ~~aDPLCAHardAgingCycles~~ aDPLCAAgingCycles attribute defined in 30.16.1.1.9.
Values: integer from 1 to 65535
Default: 1000

local_nodeID
See 148.4.4.2.

~~long_cnt~~ aging_cnt
Counter of BEACON cycles for the ~~long~~ aging time ~~(HARD claims)~~.
Values: positive integer number

plca_en
See 148.4.4.2.

plca_node_count
See 148.4.4.2.

plca_reset
See 148.4.4.2

plca_status
See 148.4.6.2.

rx_cmd
See 148.4.4.2.

~~short_cnt~~
~~Counter of BEACON cycles for the short aging time (SOFT claims).~~
~~Values: positive integer number~~

~~soft_aging_cycle~~s
~~Defines the number of BEACON cycles before the SOFT claims over the transmit opportunities expire. When Clause 30 management is implemented, this variable maps to the aDPLCASoftAgingCycles attribute defined in 30.16.1.1.8.~~
~~Values: integer from 1 to 65535~~
~~Default: 50~~

tx_cmd
See 148.4.4.2.

txop_claim_table
This variable contains the claim state of the 255 transmit opportunities IDs. The claim state of each ID can be:

~~NONE~~ UNCLAIMED, meaning that the transmit opportunity ID is available to be returned by the PICK_FREE_TXOP function.

~~SOFT, meaning the ID is currently claimed by a node transmissionthatdidnotincludea COMMIT indication.~~

~~HARD~~ CLAIMED, meaning the ID is currently claimed by a node transmission ~~that included a COMMIT indication at the beginning or at the end of the carrier event~~.

The transmit opportunity table is maintained by the D-PLCA aging state diagram defined in Figure 148–9.
Values: Array of 255 elements, each having a value of ~~NONE, SOFT or HARD~~.
UNCLAIMED or CLAIMED.

txop_claim_table_new
Copy of txop_claim_table used by the D-PLCA Aging State Diagram to handle the expiration of ~~HARD~~ claims.
Values: same as txop_claim_table

148.4.7.3 Functions

~~CLEAR_SOFT_CLAIMS~~

~~This function takes as an argument either the txop_claim_table or the txop_claim_table_new variable. When invoked, it reverts all of the array elements that have been marked as SOFT claims to NONE.~~

CLEAR_TXOP_TABLE

This function takes as an argument either the txop_claim_table or the txop_claim_table_new variable. When invoked, it sets all of the 255 elements of the specified table to the ~~NONE~~ UNCLAIMED claim state.

~~HARD_CLAIMING~~ CLAIMING

This function takes as parameter "ID", a transmit opportunity integer number in the range of 0 to 254. It returns the result of the following boolean expression:
dplca_txop_end * (dplca_txop_claim = ~~HARD~~ CLAIMED) * (dplca_txop_id = ID)

~~MAX_HARD_CLAIM~~ MAX_CLAIM

This function takes as parameter the txop_claim_table defined in 148.4.7.2.
It returns the highest ID in the table which is marked as ~~HARD claimed~~ CLAIMED. Note that the ID claimed by the local node does not count as ~~claimed~~ CLAIMED.

PICK_FREE_TXOP

This function takes as parameter the txop_claim_table defined in 148.4.7.2.
It returns any ID that is not marked as ~~HARD or SOFT claimed~~ CLAIMED in the table, with the following exceptions:

a. it shall not return zero, which is reserved for the PLCA coordinator

b. it returns an available ID less than the highest ~~HARD claimed~~ CLAIMED ID if possible. If there is no available ID less than the highest ~~HARD claimed~~ CLAIMED ID, it returns the next ID after the highest ~~HARD claimed~~ CLAIMED ID.

c. it shall return 255 if all IDs in the table are marked ~~HARD or SOFT~~ CLAIMED

Note that it is allowed for this function to return the ID currently being claimed by the local node, unless it is claimed by another node. The actual criteria for choosing among the available, allowed IDs is implementation defined.

~~SOFT_CLAIMING~~

~~This function takes as parameter "ID", a transmit opportunity integer number in the range of 0 to 254. It returns the result of the following boolean expression:~~
~~dplca_txop_end * (dplca_txop_claim = SOFT) * (dplca_txop_id = ID)~~

148.4.7.4 Timers

wait_beacon_timer

Represents the time the D-PLCA state diagram waits for a BEACON indication.
Duration: the duration of this timer is four times a random integer uniformly distributed ranging from 40 and 295 inclusive, in bit times, selected upon entering the DISABLED state.
Tolerance: 1 BT

148.4.7.5 D-PLCA Control state diagram

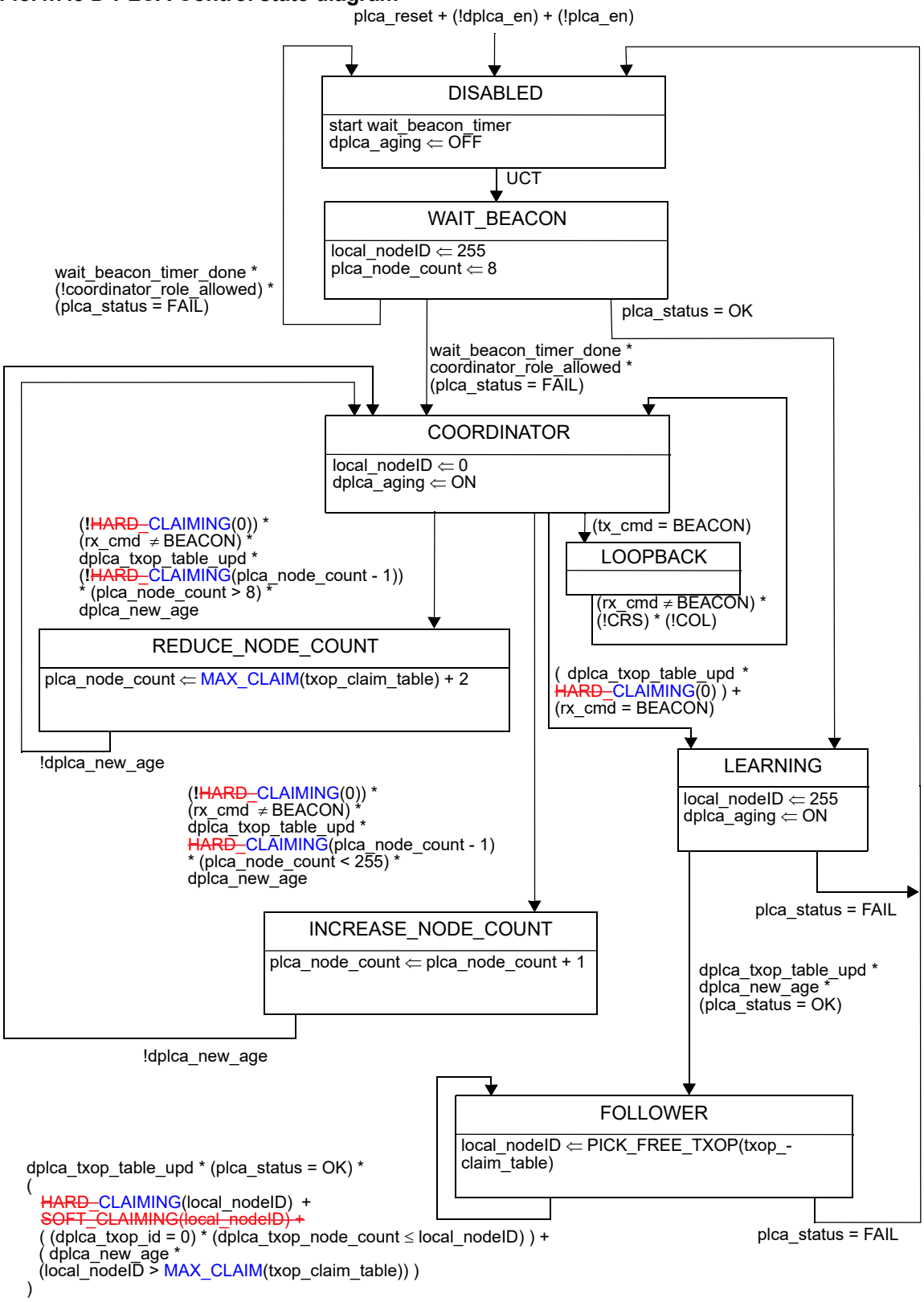

Figure 148–8—D-PLCA Control State Diagram

148.4.7.6 D-PLCA Aging state diagram

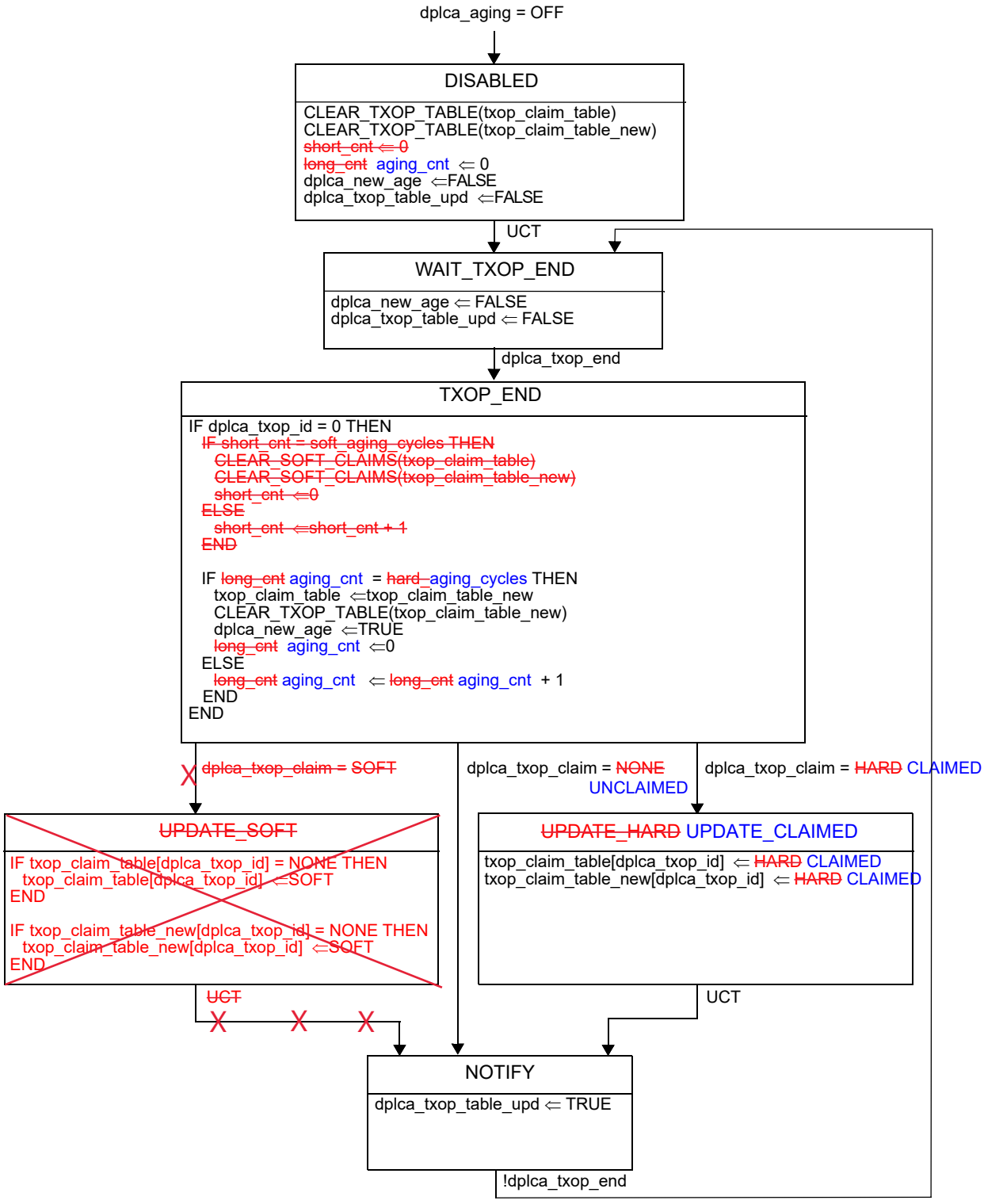

Figure 148–9—D-PLCA Aging State Diagram

Replace third paragraph of section 148.4.7.1 (P75 L18-26) with the following:

D-PLCA keeps track of claimed transmit opportunities by detecting the reception of packets within transmit opportunities. An aging algorithm is used to allow D-PLCA-enabled nodes to drop off, freeing their transmit opportunity after some time. The variable aging_cycles is configured to optimize convergence time and stability.