

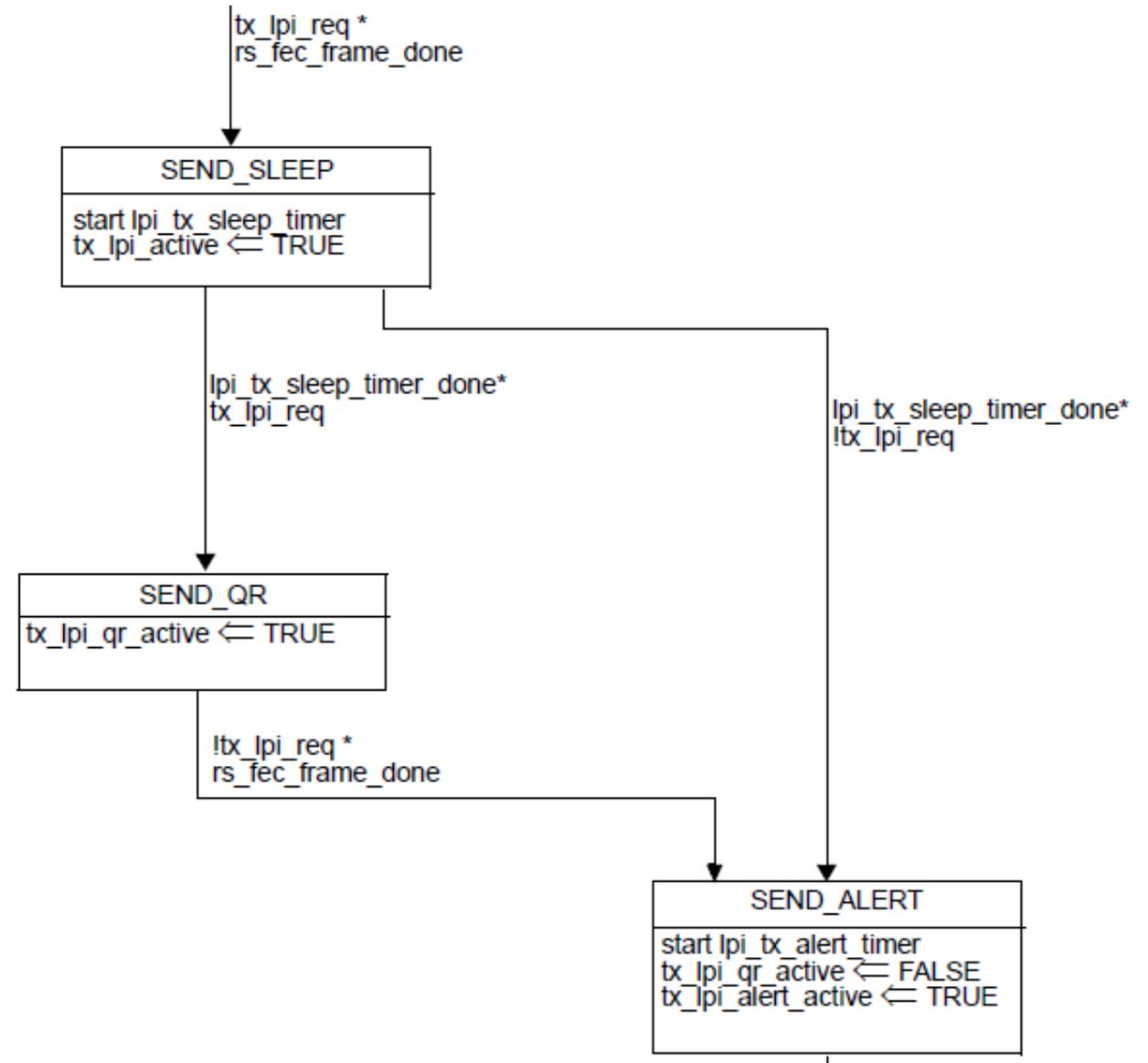
SEND_SLEEP to SEND_ALERT Problem

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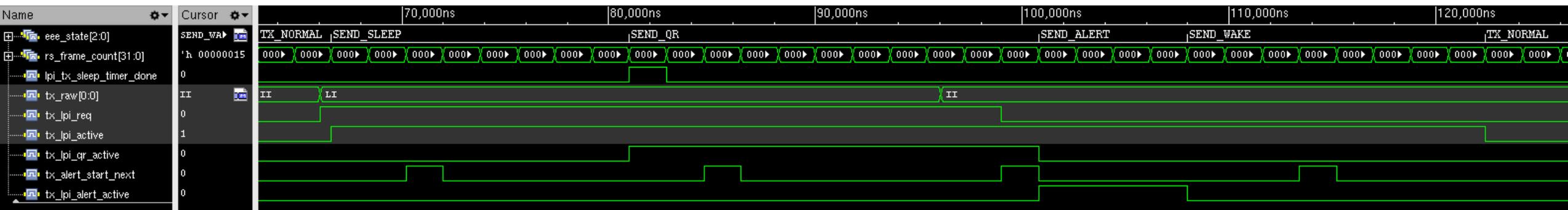
EEE transmit state diagram

- SEND_SLEEP is entered at any rs_fec_frame boundary
- Exit to SEND_QR is taken for long-term LPI – “normal” progression
- Exit to SEND_ALERT is taken for early exit from LPI
- Transition from SEND_QR to SEND_ALERT is aligned to tx_alert_start_next via removal of tx_lpi_req



Normal LPI exit (while in SEND_QR)

- The SEND_ALERT state is normally entered from SEND_QR with when tx_lpi_req transitions false
- tx_lpi_req is set false in the PCS 64B/65B state diagram using tx_alert_start_next so that the EEE state diagram will transition at the start of an ALERT window
- Note that tx_alert_start_next occurs before tx_lpi_alert_active



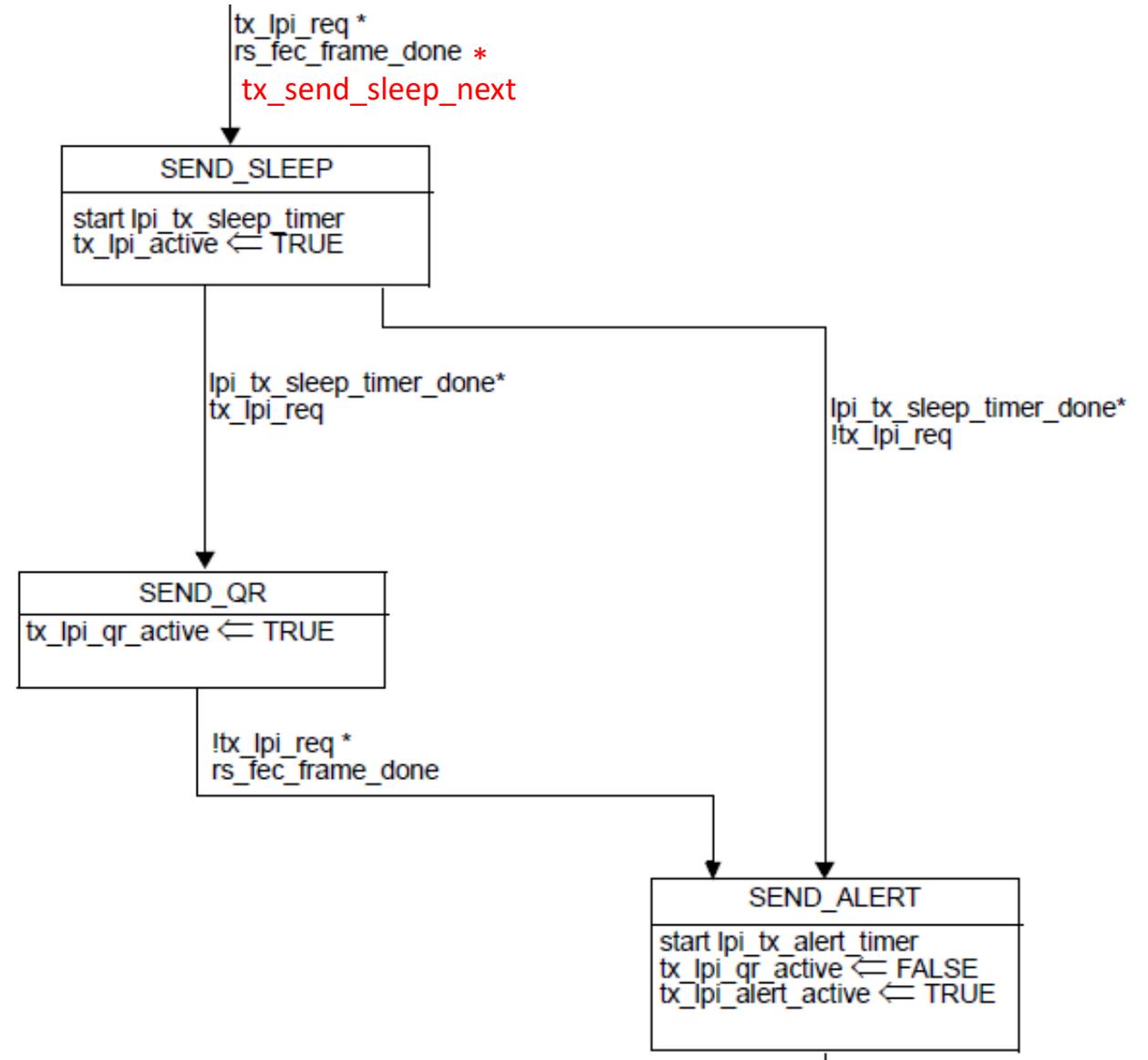
Early exit from LPI (while in SEND_SLEEP)

- Tx_lpi_req can become false at any point in SEND_SLEEP
- Exit from SEND_SLEEP is controlled by lpi_tx_sleep_timer_done, which is not aligned to the ALERT window
- This allows the transition to SEND_ALERT and the transmission of ALERT to have an arbitrary alignment to the ALERT window
- Note that tx_alert_start_next occurs during tx_lpi_alert_active



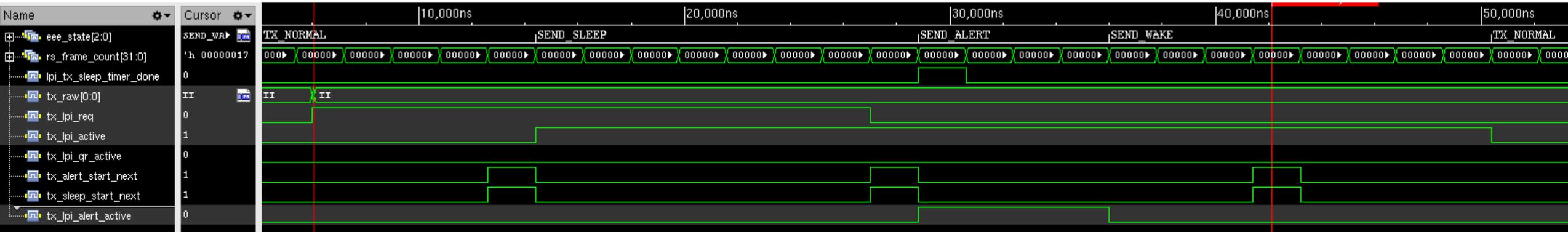
Solution

- One solution is to align the entry to SEND_SLEEP to the ALERT window
- This ensures that the exit of SEND_SLEEP 8 RS-FEC frames later will also be aligned to the ALERT window
- tx_alert_start_next could be used to align entry to SEND_SLEEP but will delay entry to SEND_SLEEP in slow-wake mode
- Introduce tx_send_sleep_next variable for alignment
- tx_send_sleep_next has same timing as tx_send_alert_next in fast-wake mode



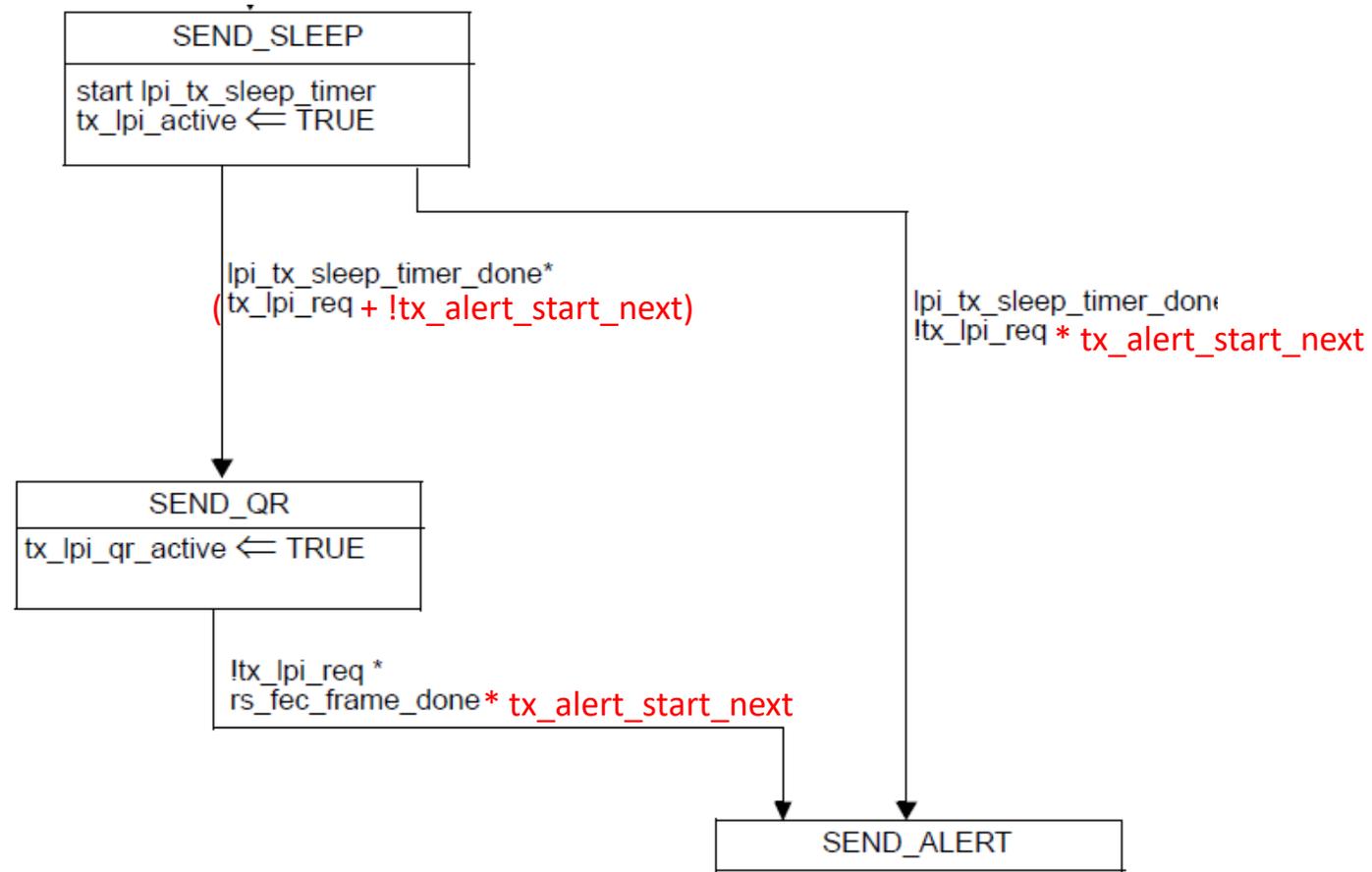
Timing with fix

- SEND_SLEEP state is not entered until alignment of ALERT window
- Note that now tx_lpi_active is delayed until after tx_alert_start_next



Alternate Solutions

- Force SEND_SLEEP to SEND_QR with if !tx_alert_start_next
 - SEND_QR will immediately transition to SEND_ALERT
 - Would need to further qualify transition to SEND_ALERT with tx_alert_start_next



Related Issue

- What is the definition of “superframe” in the following:

149.3.2.2.22 EEE capability

The optional 2.5GBASE-T1, 5GBASE-T1, or 10GBASE-T1 EEE capability allows compliant PHYs to transition to an LPI mode of operation when link utilization is low in either direction of transmission.

PHYs that support EEE shall conform to the EEE transmit state diagram, shown in Figure 149–20, within the PCS.

In the transmit direction, the transition to the LPI transmit mode begins when the PCS transmit function detects an LPI control character in the last 64B/65B block of a Reed-Solomon frame. Following this event, the PMA transmits the sleep signal starting at the beginning of the next superframe to indicate to the link partner that it is transitioning to the LPI transmit mode. The sleep signal is composed of eight Reed-Solomon frames that contain only LP_IDLE 64B/65B blocks. Once initiated, the complete sleep signal consisting of 8 RS-FEC frames of LP_IDLE shall be transmitted.