CL119 HI_SER and Link Status

IEEE P802.3bs Task Force

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Problem Description

- The FEC bypass indication option allows the FEC decoder to not mark uncorrectable codewords and save the associated latency.

- When FEC_bypass_indication_enable is asserted, additional error monitoring is performed: When the number of symbol errors in a block of 8192 codewords exceeds 5560, hi_ser is asserted.

- In CL119, when hi_ser is asserted, the PCS sends error block (EBLOCK_R) for 60ms-75ms which causes the data to be silently discarded without notifying the RS layer / AN layer or changing the link status.

- Due to the different statistics between hi_ser and align_loss, a link may remain up for hours, while silently discarding data.

- The behavior differs from CL82+CL91 (802.3cd / 802.3bj)
  - Where the error blocks trigger HI_BER.
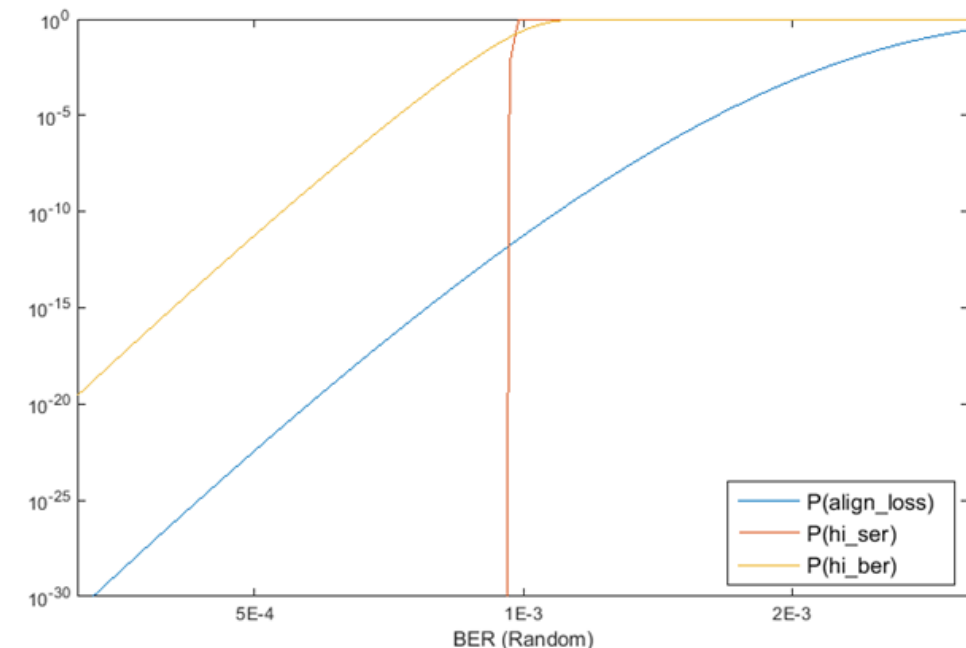
CL82 + CL91 Behavior

- Clause 82
  - block_lock_loss – set upon reception of 65 invalidate sync headers on a lane out of 1024.
    - block_lock_loss triggers align_loss
  - hi_ber – set upon reception of 97 invalidate sync headers within 500usec
    - hi_ber resets the RX State machine to RX_INIT (LBLOCK_R)
    - hi_ber triggers PCS_status down. (Restarts auto-negotiation)
- Clause 91
  - Invalidates 48 66b-blocks out of 80 for uncorrectable codewords.
  - When FEC Indication_bypass is enabled:
    - hi_ser – set upon reception of 417 RS-symbols with errors out of 8192 codewords.
    - hi_ser invalidates the sync headers for all 66b-blocks for 60-75msec.
- CL82 + CL91:
  - 3 uncorrectable codewords out of 9765 → 144 error 66b-block within 500usec → hi_ber → RX_INIT (LBLOCK_R), PCS_status down
  - 22 uncorrectable codewords out of 256 → 66 error 66b-block out of 1024 → block_lock_loss & PCS align loss.
  - FEC hi_ser → 60-75msec of invalid sync headers → block_lock_loss, PCS align loss, PCS_status down
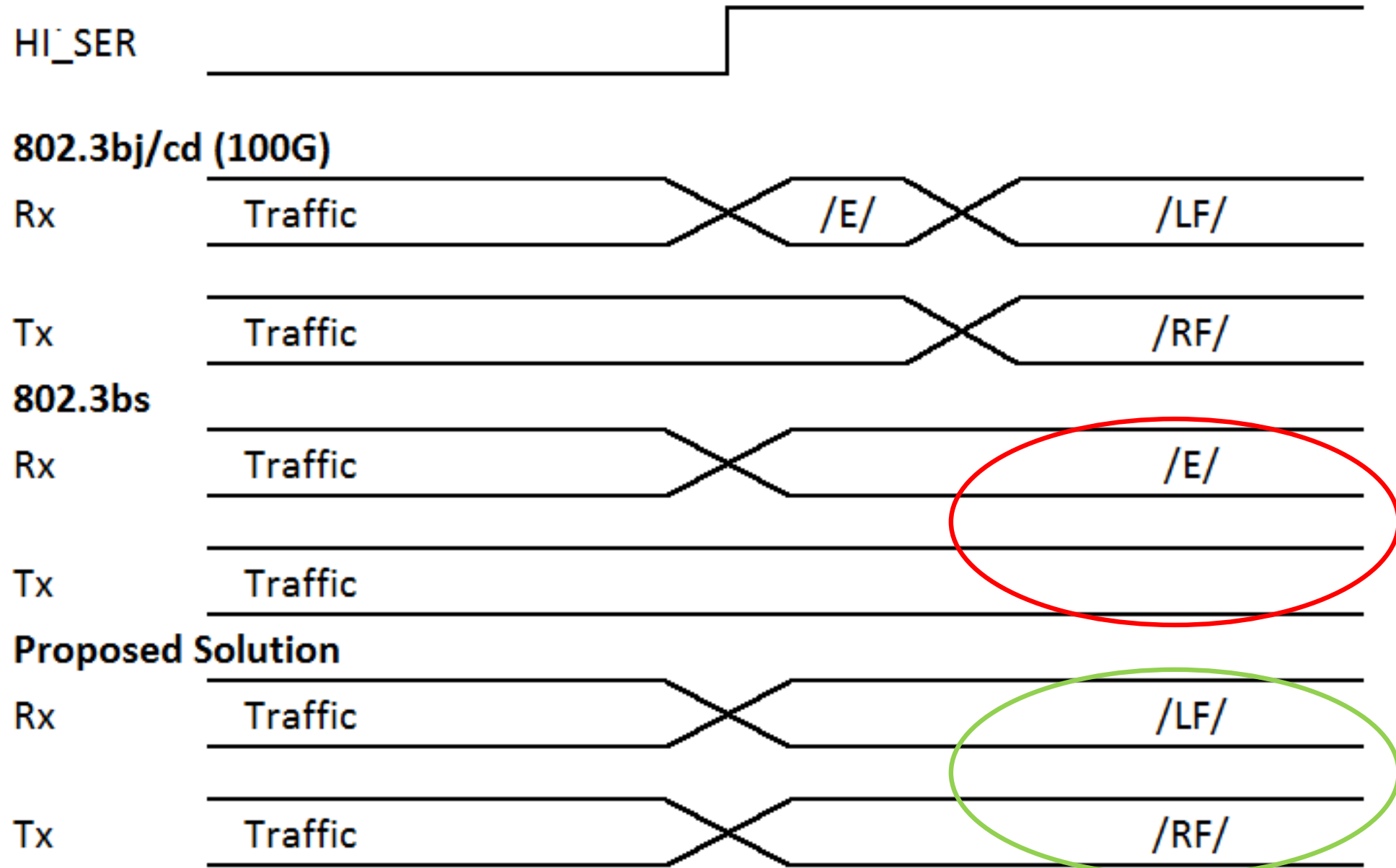
Proposal #1: RX_INIT on hi_ser

- Add hi_ser to the RX state machine RX_INIT condition
  - reset + !align_status + hi_ser

- Update hi_ser variable definition

  When FEC_bypass_indication_enable is set to zero, hi_ser is set to zero.

- Update the FEC indication bypass definition

  the Reed-Solomon decoder shall set hi_ser causing the PCS receive function to return to RX_INIT (setting the received blocks to LBLOCK_R) for a period of 60 ms to 75 ms.

- Define PCS_status
  - A Boolean variable that is true when align_status is true and hi_ser is zero.

- Update CL118, CL119 PICS RF5

  When the number of symbol errors in a block of 8192 codewords exceeds 5560, reset the receive state machine to RX_INIT.
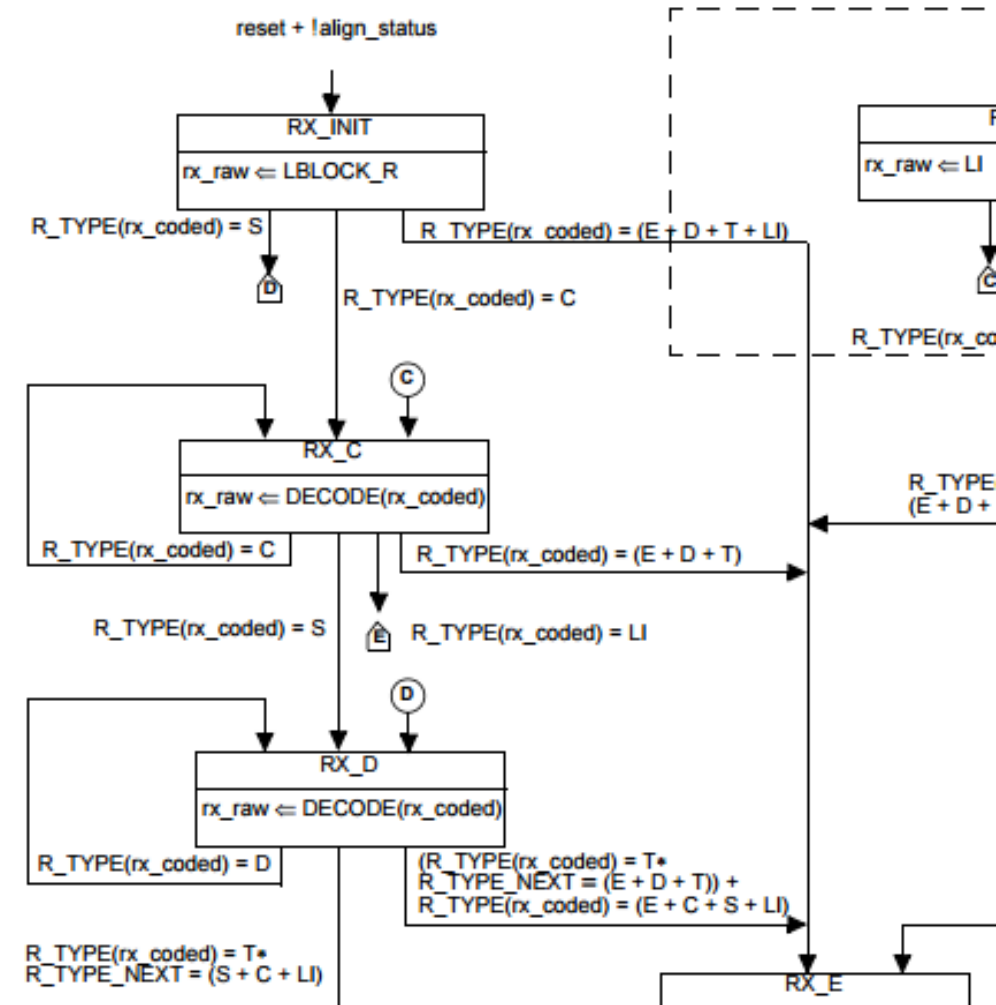

Figure 119–15—Receive state diagram

Proposal #2: Lose align_status on hi_ser

- Add hi_ser to the LOSS_OF_ALIGNMENT condition
  - reset + !all_locked + hi_ser

- Update hi_ser variable definition
  When FEC_bypass_indication_enable is set to zero, hi_ser is set to zero.

- Define PCS_status
  - A Boolean variable that is true when align_status is true

- Update the FEC indication bypass definition
  the Reed-Solomon decoder shall set hi_ser causing the PCS synchronization function to return to LOSS_OF_ALIGNMENT, setting align_status = FALSE and remain in LOSS_OF_ALIGNMENT for a period of 60 ms to 75 ms.

- Update CL118, CL119 PICS RF5
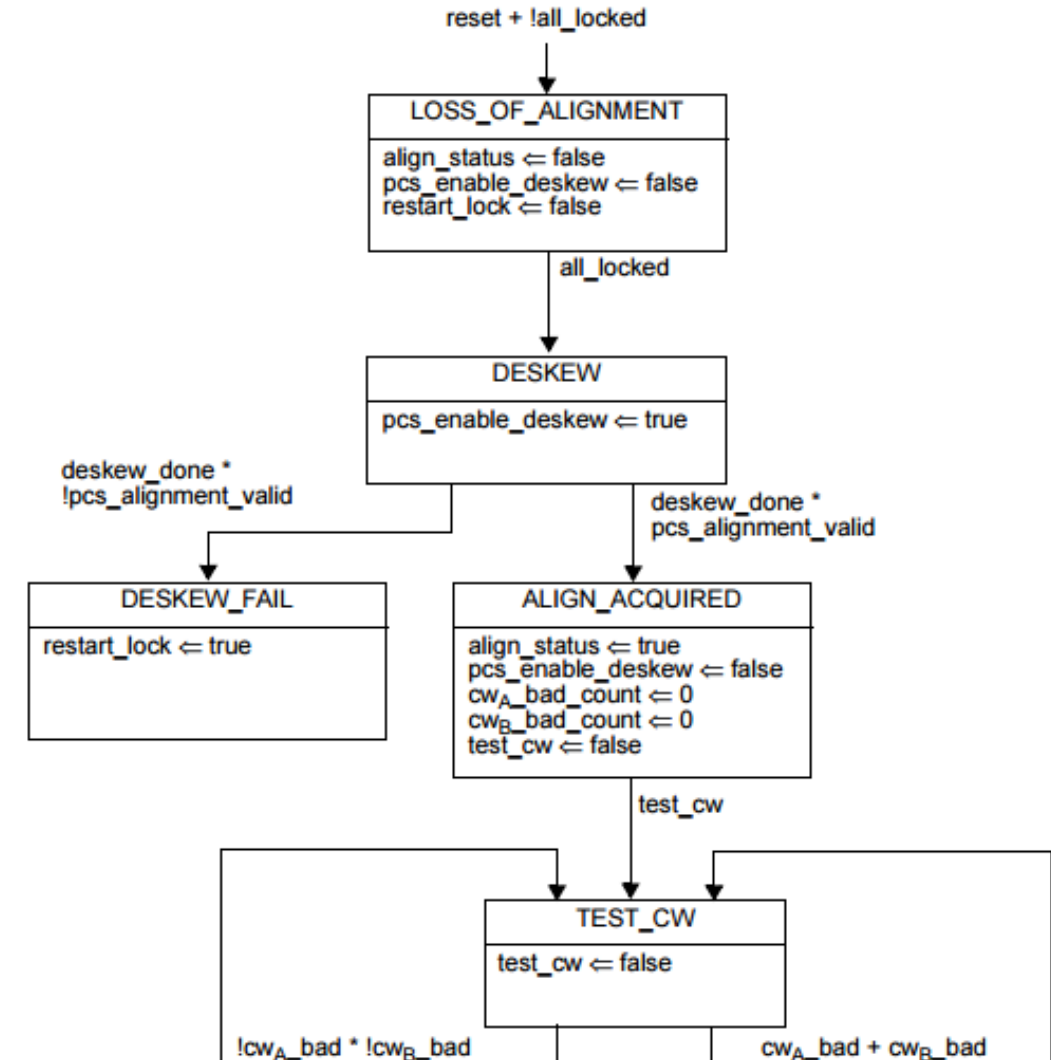 When the number of symbol errors in a block of 8192 codewords exceeds 5560, reset align_status.

Figure 119–13—PCS synchronization state diagram

Proposed Solutions Summary

- In both proposals the PCS sends local faults and reset the PCS status on hi_ser.
- The main difference between the proposals is the PCS alignment state on hi_ser.

	100GE (802.3cd / 802.3bj)	#1 – RX_INIT on hi_ser	#2 - Lose alignment on hi_ser
RS Indication on hi_ser	~ 96 EBLOCK_R then Local faults (LBLOCK_R)	Local faults (LBLOCK_R)	Local faults (LBLOCK_R)
PCS_Status on hi_ser (Trigger also AN reset)	FALSE	FALSE	FALSE
Alignment status on hi_ser	PCS Alignment loss FEC alignment maintained	Alignment maintained	Alignment loss

Thank You