



# Proposal to make Energy detect more robust in 10GBASE-KR EEE mode.

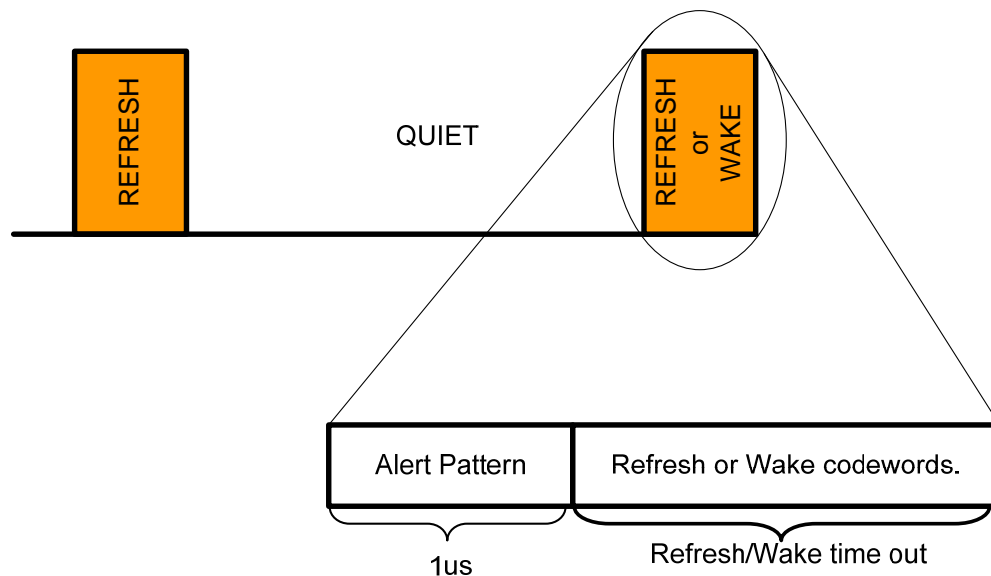
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17<sup>th</sup> November, 2009

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- David Koenen, HP
- Pat Thaler, Broadcom
- Matt Brown, AMCC

- Presently in CL49 LPI receive state machine, the transition from RX\_QUIET to RX\_WAKE is enabled by energy\_detect.
- Energy detect is more susceptible to noise and cross talks. This will unnecessarily make the LPI RX State machine transition out of the RX\_QUIET state.
- Several comments and concerns were put forward against Draft 2.0 during the September interim.
  - Changes were made to the CL49 LPI transmit and receive state diagrams to handle this appropriately during false energy detect.
- These changes still do not address the vulnerability of the Energy Detect.
- The proposal that is presented here is an elaborated version of the discussion that Adam Healey (LSI) had with Matt Brown (AMCC) and Velu Pillai (Broadcom).

- The proposal is for the Transmitter to send out a pattern as a prequel before the refresh or wake sequence.
- During EEE mode, signal detect function may use this alert pattern to detect electrical energy at the receiver.
- The proposed alert pattern is the output of a PRBS11 generator. Each output bit is transmitted as four 10.3125 GBd symbol for 1usec.
  - Reusing the PRBS11 generator defined in Clause 72. Running it at 1/4<sup>th</sup> the symbol rate during EEE.
  - CL49 LPI transmit state machine already has a 1us timer (one\_us\_timer) defined.
  - Reduce the transmitter wake and refresh timer values by 1us, hence it does not change the total time budgets.
  - The receiver signal detect activation time can be reduced to 500ns (Max).

- A pictorial view of the proposal is shown here.
- An alert pattern is send out whenever the transmitter comes out QUIET.



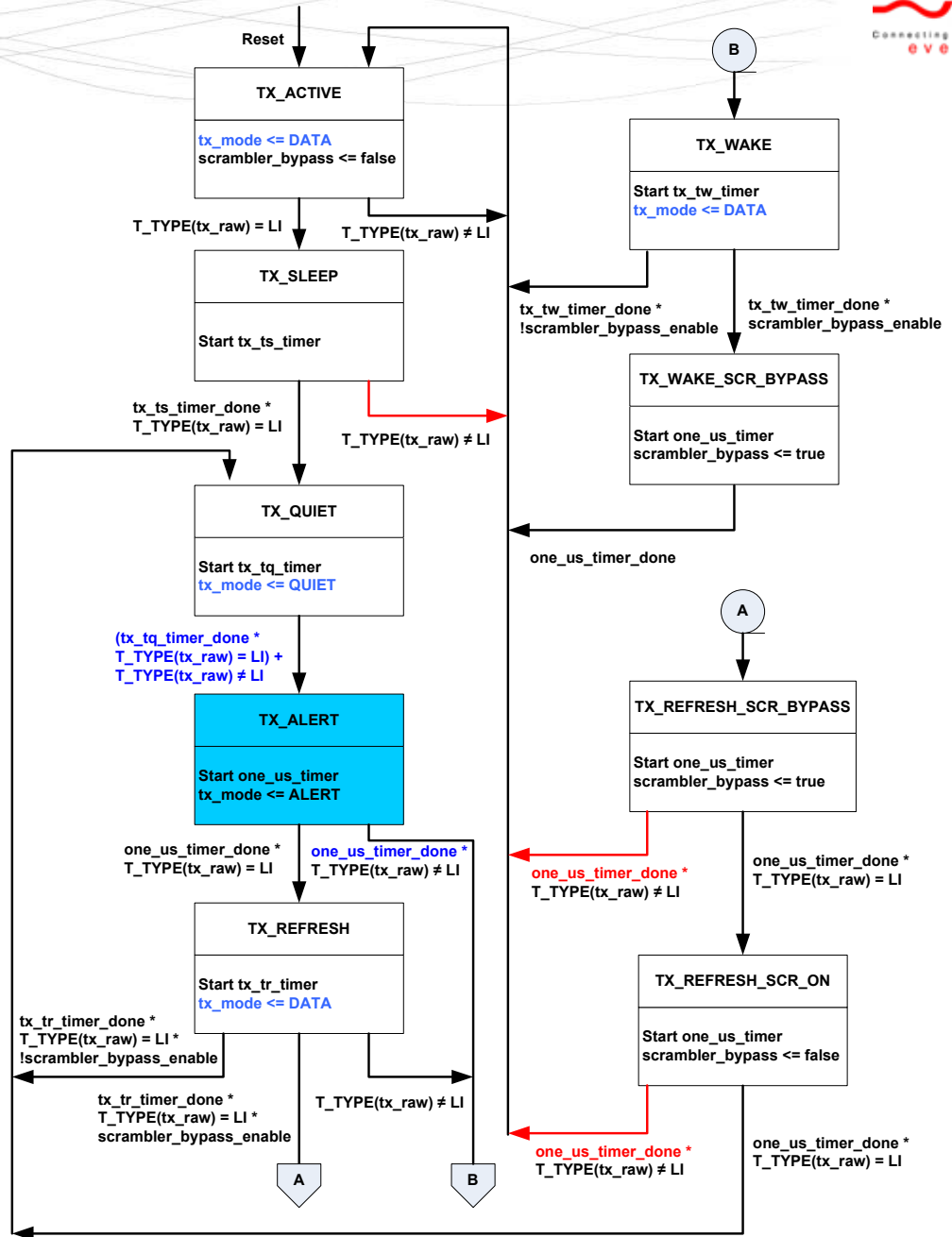
# CL49 LPI transmit state diagram changes (Fig 49-16)



- Solutions to the bugs in the Fig 49-16 (Draft 2.1). Comments are filed against these.



- Changes needed for alert pattern.



*Rename "tx\_quiet" to "tx\_mode". That way we can avoid adding a new variable and service interface.*

## 49.2.13.2.2 Variables

### tx\_mode

tx\_mode may assume a value from the set {QUIET, ALERT, DATA}. When set to QUIET, the PMD will disable the transmitter as described in 72.6.5. When set to ALERT, the PMD will transmit the PRBS11 pattern at 1/4<sup>th</sup> the symbol rate as described in 72.6.10.2.6. And PMD will pass Data, when this variable is set to DATA.

*To be consistent the proposal is to rename rx\_quiet to rx\_mode too. The value set will be {QUIET, DATA}. The LPI Receive state diagram needs modification.*

Fig 49-4 and Fig 74-2: Functional block diagram:

*Rename tx\_quiet and rx\_quiet to tx\_mode and rx\_mode, respectively. And modify the appropriate service interface text for tx\_mode.request and rx\_mode.request.*

Table 49-2 – Transmitter LPI timing parameters

Parameter	Description	Value	Units
TSL	Local Sleep Time from entering TX_SLEEP state to transmit disable	5 ±1%	us
TQL	Local Quiet Time from Transmitter disabled to start of TX_REFRESH state	1.7 ±1%	ms
TUL	Local Refresh Time while in TX_REFRESH state, when scrambler_bypass_enable = FALSE	16 ±1%	us
TUL	Local Refresh Time while in TX_REFRESH state, when scrambler_bypass_enable = TRUE	14 ±1%	us
TWL	Local Wake Time from LPI de-asserted to TX_ACTIVE state	11 ±1%	us

## 51 Physical Medium Attachment (PMA)

*Rename tx\_quiet and rx\_quiet to tx\_mode and rx\_mode, respectively. Add rx\_lpi\_active service interface. And modify the appropriate service interface text.*

## 72.2 Physical Medium Dependent (PMD) service interface and 72.6.11. PMD LPI function

*Rename tx\_quiet and rx\_quiet to tx\_mode and rx\_mode, respectively. Add rx\_lpi\_active service interface. And modify the appropriate service interface text.*

### 72.6.2 PMD transmit function

If the optional Energy Efficient Ethernet (EEE) capability is supported (see Clause 78) then when tx\_mode is set to ALERT, PMD will transmit the PRBS11 output bit as four 10.3125 GBd symbol as described in 72.6.10.2.6.

### 72.6.4 PMD signal detect function

The value of the SIGNAL\_DETECT is defined by the training state diagram shown in Figure 72–5 when rx\_lpi\_active is set to FALSE. If EEE is supported and rx\_mode = QUIET, a local PMD signal detect function shall report to the PMD service interface using the message PMD\_SIGNAL.indication(SIGNAL\_DETECT). During the transition from Quiet to Active, the link partner transmitter is expected to transmit the output of the PRBS11 pattern generator as described in 72.6.10.2.6, for 1 usec. PMD signal detect function may use this pattern to detect electrical energy at the receiver. For EEE, the SIGNAL\_DETECT parameter can take on one of two values: OK or FAIL, indicating whether the PMD is detecting electrical energy at the receiver (OK) or not (FAIL). When SIGNAL\_DETECT = FAIL, PMD\_UNITDATA.indication(rx\_bit) is undefined.

## 72.6.5 PMD transmit disable function

d) For EEE capability, the PMD\_transmit\_disable function shall turn off the transmitter after **tx\_mode is set to QUIET** within a time and voltage level specified in 72.7.1.4. The PMD\_transmit\_disable function shall turn on the transmitter after **tx\_mode is set to DATA or ALERT** within the time and voltage level specified in 72.7.1.4.

### 72.6.10.2.6 Training pattern

If the optional Energy Efficient Ethernet (EEE) capability is supported (see Clause 78) then when **tx\_mode is set to ALERT**, PMD will transmit the PRBS11 pattern generator output bit as four 10.3125 GBd symbol.

Table 72–9—Receiver characteristics for 10GBASE-KR

EEE Signal Detect deactivation time ( $T_{SD}$ ) from active to LPI quiet	72.6.5	500	ns
EEE Signal Detect activation time ( $T_{SA}$ ) from LPI quiet to active	72.6.5	500	ns

### 72.10.4.2 PMD functional specifications

*Modify the appropriate service interface text for tx\_mode.request and rx\_mode.request.*





Thank You