Low Datarate EEE Mode

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March 13, 2019

Typical Automotive Sensor Use Case

- Sensor sending high speed data to ECU
- ECU sending configuration data to sensor

- Possible high speed transmission for initial configuration, firmware download etc from ECU to sensor.

- Afterwards ECU to sensor goes down to very low utilization and remains there.

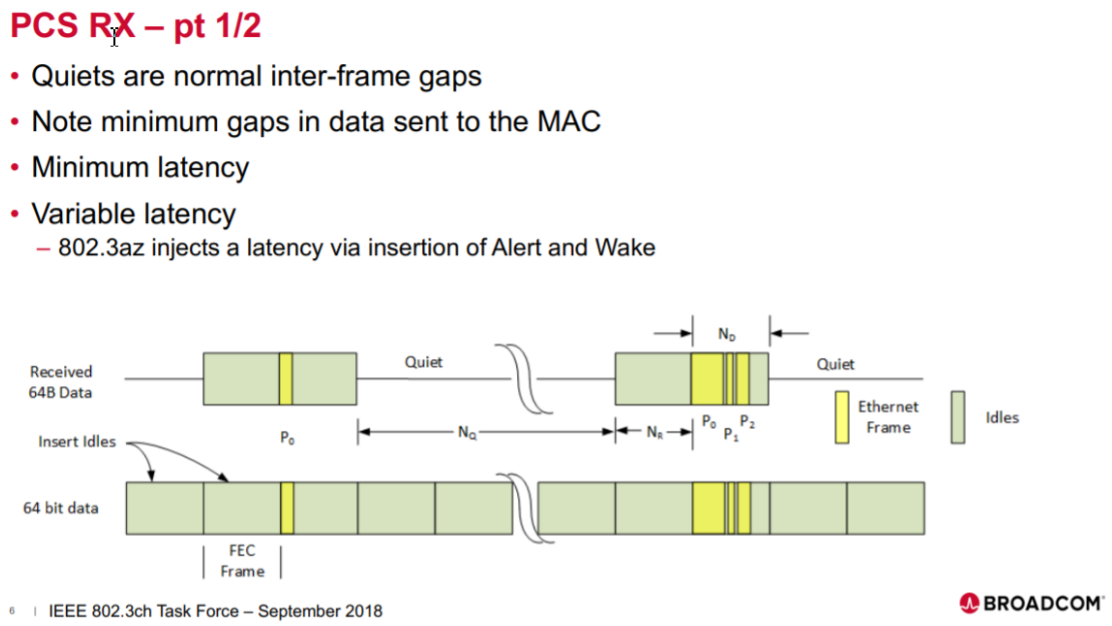
  i.e. some configuration updates once per second

- No need for ECU to transmit high speed for remaining duration of link

- Want to achieve very low power in this mode

Proposed Low Data Rate EEE Mode from September

- Transmit low data rate during EEE refreshes, variable data rate



http://www.ieee802.org/3/ch/public/sep18/souvignier_3ch_01_0918.pdf

- Another proposal (packing data differently) using EEE refreshes:
- http://www.ieee802.org/3/ch/public/adhoc/sedarat_3chah_01_013019.pdf

Expand on souvignier_3ch_01_0918.pdf with fixed latency

- Throttle XGMII interface at a fixed data rate instead of variable rate
- http://www.ieee802.org/3/ch/public/jan19/Lo_3ch_01_0119.pdf proposes 10Mb/s
- Using Option 3 of above, XGMII operates 1/1000 the speed of the XGMII in 10 Gb/s mode
- Fixed data rate ➔Fixed pipelining in PHY ➔ Fixed latency
- Known data rate ➔ More opportunities to save power

Quiet Refresh period not friendly to packing at 10Mb/s bit rate

- Quiet + Refresh time = multiple of 16 RS Frames to allow offset on super frame boundary
- One 10G RS frame equals to 3.2 (fractional) 10Mb/s bits ➔ multiple of 5 RS Frames gives integer number of bits.
- Currently Quiet + Refresh = 96 RS Frames – not multiple of 5.

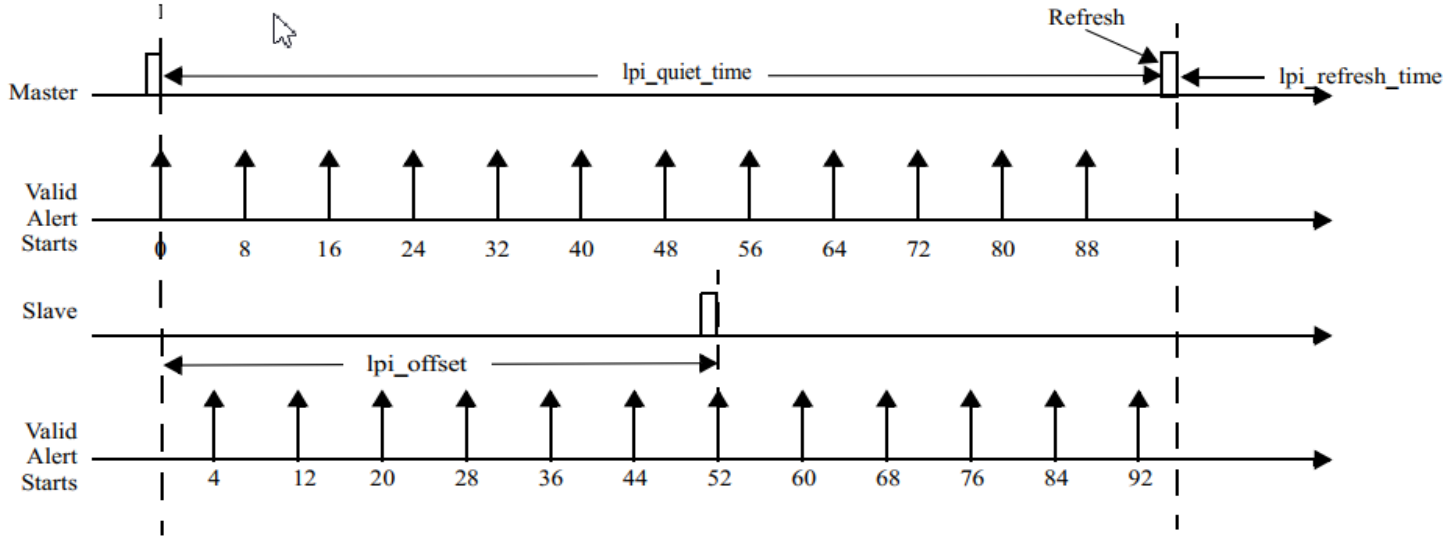
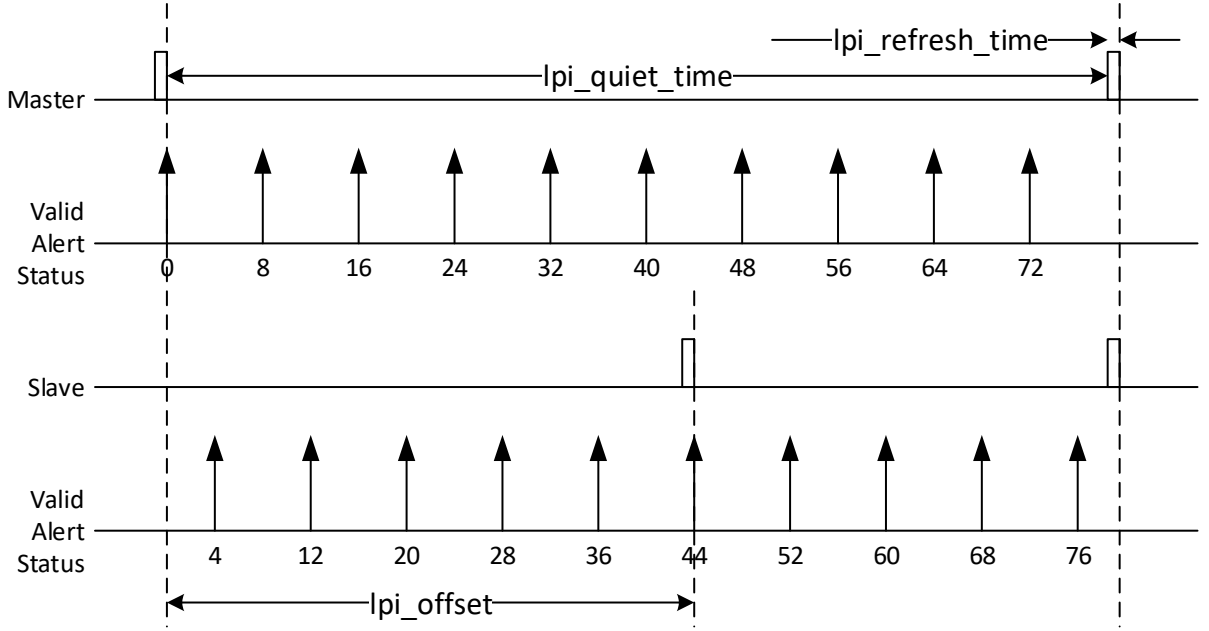


Figure 149–12—Timing periods for LPI signals

Step 1: Make Quiet Refresh Duration Friendly

- Quiet + Refresh time = 80 RS Frames
- Spacing sets up option to pack integer number of 10Mb/s bytes in EEE refresh.
- Pack exactly four 64/65 Frames into refresh



Step 2: Agree on a way to pack data onto refresh frame

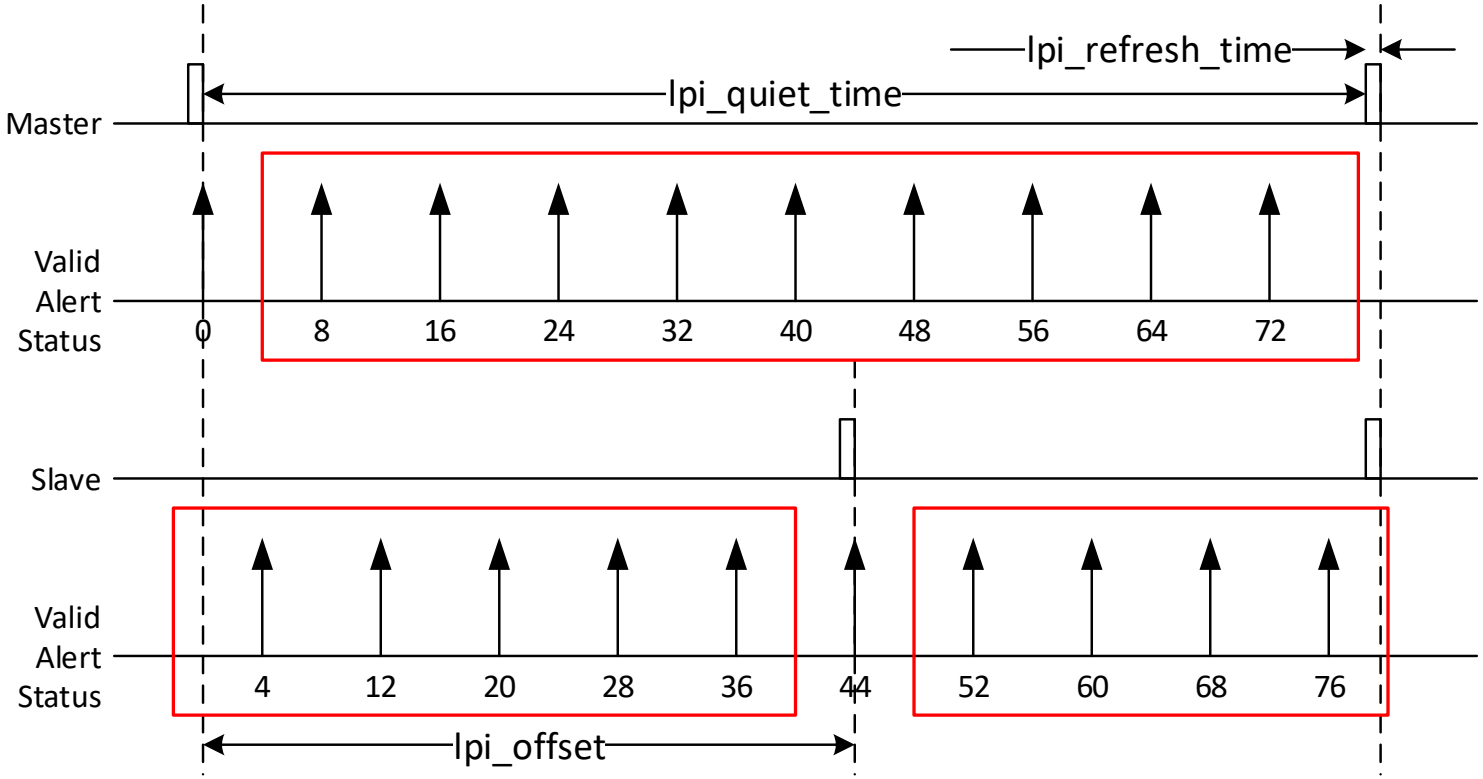
- Agree on a way to pack data – plenty of space available in refresh frame
- This is EEE mode 2

- Does not preclude regular EEE (call it EEE mode 1)

- Like to unify quiet/refresh for both EEE modes

EEE mode 2

- Known fixed data rate – eliminates need to prepare for alert/wake between refreshes
- Additional power saving to fully shut down between refreshes
- Longer latency to exit EEE mode 2



EEE Mode 2

- Change the Quiet/Refresh Ratio to set the framework
- Agree on a way to pack data
- Does not preclude regular EEE (call it EEE mode 1)
- Works within existing EEE framework

Recommendations of the upcoming draft

- Change in Clause 149.3.5
  - lpi_quiet_time equal to 79 RS-FEC frame periods.
  - lpi_qr_time equal to 80 RS-FEC frame periods
  - lpi_offset is a fixed value equal to lpi_qr_time / 2 + 4
    (44 RS-FEC frame periods)
  - Change figure 149-12 to one in slide 6

THANK YOU