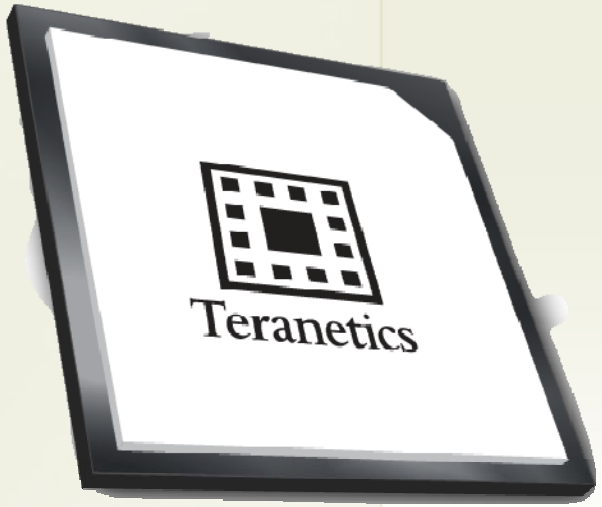

Alert signal Comments for 10GBASE-T EEE

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Nov, 2008

Teranetics

Supporters

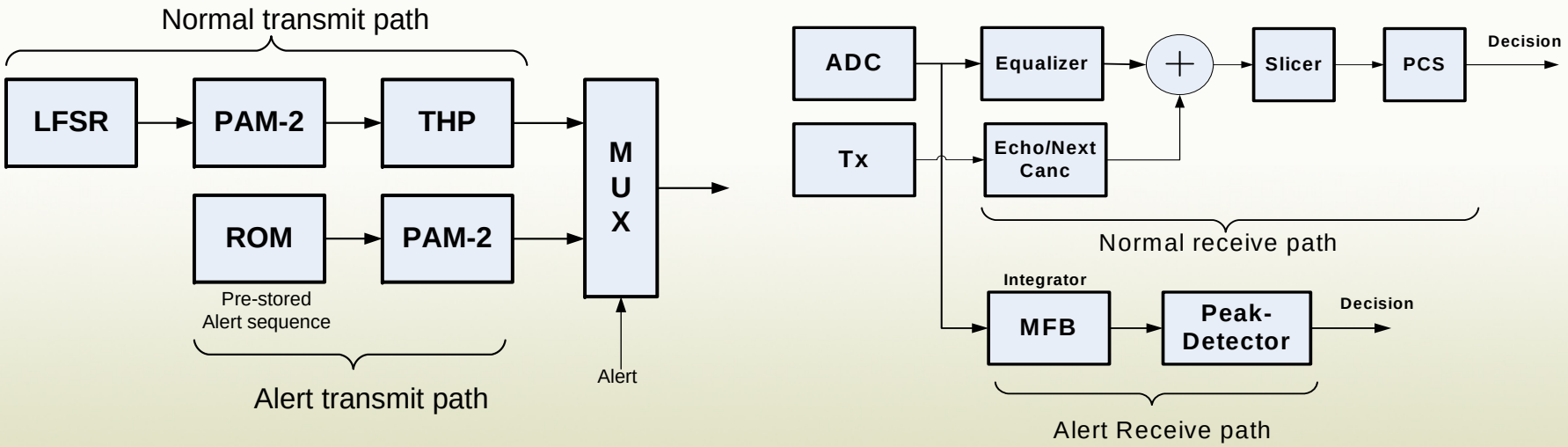
Alert Recap I

- Definition: Signal transmitted to inform the link partner that the local transmitter is returning to the active state

- Features:
  - Easily detectable signal with low miss-detection probability
  - Short enough to ensure fast recovery time
  - Listening mechanism will be active all the time
    - could be implemented with very low power consumption as possible
  - Low-latency detection

Alert Recap II

- PBO identical to data mode
- PAM2 constellation (LFSR and THP are bypassed)
- Based on Matched filter bound (only 1 bit of information)
  - About 13dB more processing gain than PAM2+THP+Ideal Equalizer structure.
    - SNR_mfb ~ 10*log10(mean(S(f)) / mean(N(f)))
    - SNR_eq ~ mean(log(SNR(f))



Alert Structure Refinement

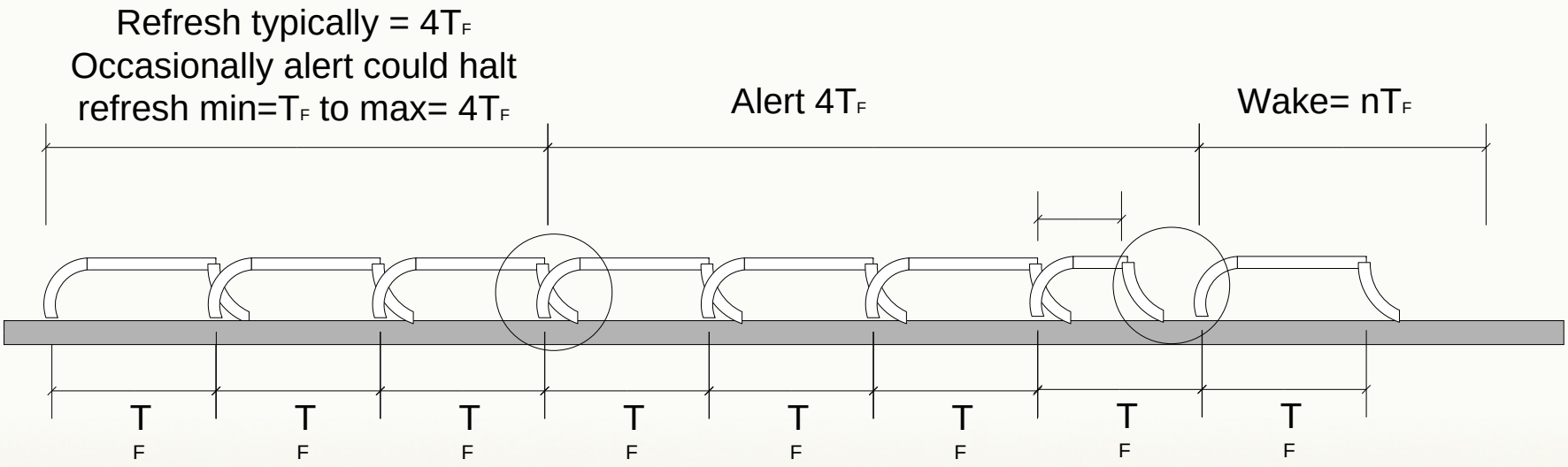
- Different PAM2 patterns for Master and Slave with low cross-correlation peak value
  - To prevent false-alarm when Mas/Slv transmit Alert simultaneously
- Constructed by repeating a 128 PAM2 symbol sequence with Good Auto-correlation features
  - Allows simple peak detection
  - Low latency detection possible (in the order of 128 symbols, ~160nsec)
  - Seamless fit into 256 symbols LDPC frame boundaries
- $T_A = 4xT_F$ (total span is 4x256 symbols)

- *Refinement*
  - *Composed of 7 repetitions of the 128 PAM2 sequence followed by 128 zeros (NEW)*
    - *Eliminates residual ISI to subsequent Wake frames*
  - *Receiver can combine multiple 128 sequences for additional processing gain*
    - *Total processing gain is 10*log10(7x128) = 29.5dB (current draft is 30dB)*

Alert, Refresh, Quiet and Wake co-existence (I)

- Alert is always transmitted on the same lane
  - Master transmits on lane A
  - Slave transmits on lane C
- *Clarification:*
  - *Alert is allowed at any stage – Quiet or Refresh*
    - *Minimizes Latency*
  - *If Alert is transmitted during refresh cycle, refresh transmission shall be halted (on all lanes)*
    - *Alert detection is reliable with very low latency so adaptation easy to halt*
- Simplifies transmitter and receiver operation
  - Generation, detection, state machines, etc.

Alert, Refresh, Quiet and Wake co-existence (II)



Alert, Refresh, Quiet and Wake co-existence (III)

- Worst case “Edge” conditions:
  - Refresh followed by Alert
    - For a Master this case only happens if Alert must interrupt a refresh in progress in lane A
    - For Slave same as above for lane C
    - The total residual ISI energy from PAM2+THP Refresh frame “leaking” into following Alert is
      - Uncorrelated to the Alert signal
      - Has negligible power compared to residual Echo, NEXT, etc
      - About ~30dB smaller than S matched filter level
  - Alert followed by Wake
    - By setting last 128 Alert samples to zero the residual ISI “leaking” from Alert to the first Wake LDPC frame is about -40dB below the signal for the worst case (100m cat6a).
    - The worst case (100m) ISI degradation is about 0.1dB for the first Wake frame and nothing for subsequent

Summary

- Simple refinement to alert scheme has been presented
  - Reduces residual ISI from Alert into first Wake frame
- Proposal integrates well into Quiet/Refresh/Wake framing structure
  - Alert can be transmitted any time
  - No lane or link partner synchronization issues