

Alert signal proposal for 10GBASE-T EEE

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Sept 11, 2008

Alert – Definition and Discussion

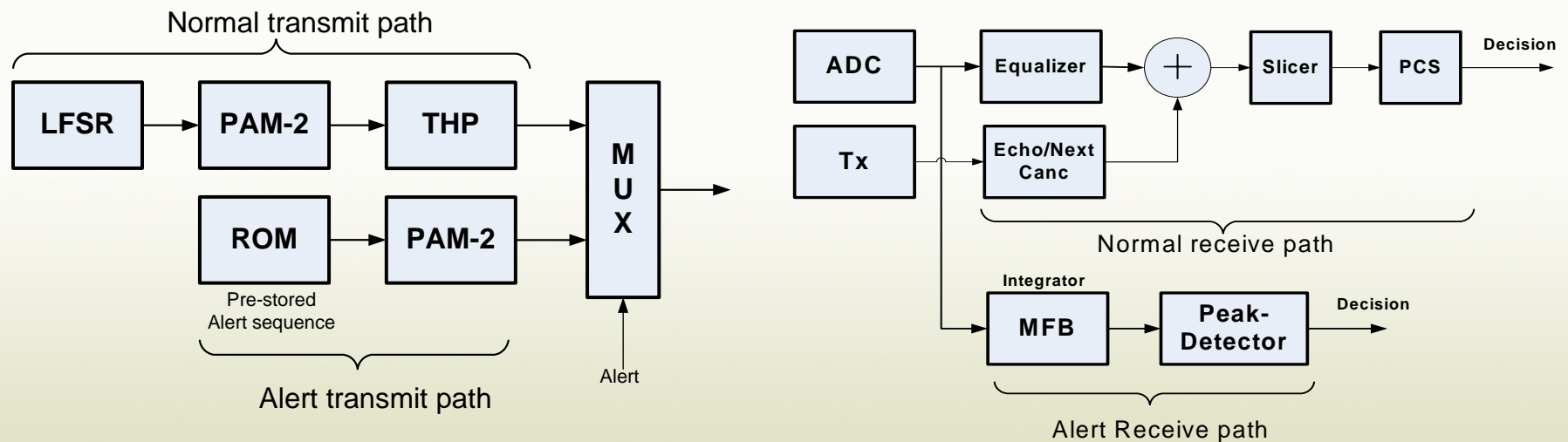
- ▶ Definition: Signal transmitted to inform the link partner that the local transmitter is returning to the active state

- ▶ Requirements:
 - Needs to be easily detectable signal with low miss-detection probability
 - Short enough to ensure fast recovery time
 - Listening mechanism will be active all the time – hence should be implemented with as low power consumption as possible

- ▶ Low-latency detection is bug plus

Advantages of using Pre-defined pseudo random sequence as alert signal

- ▶ Very low power transmit and receive path implementation is possible
- ▶ Provides significant SNR margin comparing to randomly-scrambled bits equalization and detection – proportional to difference between Matched filter bound vs equalized (Saltz) SNR
- ▶ Allows simple peak-detection implementation in the receiver with Very low latency detection (less than 1 LDPC frame)
- ▶ No Transmit/Receive Equalization required



Alert Structure

- ▶ PBO identical to normal mode, PAM-2 constellation
- ▶ LFSR and THP are bypassed
- ▶ Different PR patterns for Master and Slave with low cross-correlation peak value
 - To prevent false-alarm when both link partners transmit Alert simultaneously
- ▶ 128-bits PR 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
 - Receiver can combine multiple 128 sequences for additional processing gain

Alert structure - Con't

▶ xPR_Master =

▶	1	1	-1	-1	-1	-1	-1	-1	1	1	-1	-1	1	1	1	1
▶	1	1	1	1	-1	-1	1	1	1	1	-1	-1	1	1	-1	-1
▶	-1	-1	-1	-1	-1	-1	1	1	-1	-1	-1	-1	-1	-1	1	1
▶	-1	-1	-1	-1	-1	-1	-1	-1	1	1	-1	-1	1	1	-1	-1
▶	-1	-1	1	1	1	1	1	1	1	1	1	1	-1	-1	-1	-1
▶	1	1	-1	-1	-1	-1	1	1	1	1	-1	-1	1	1	-1	-1
▶	-1	-1	-1	-1	-1	-1	-1	-1	1	1	1	1	-1	-1	1	1
▶	1	1	-1	-1	1	1	-1	-1	1	1	1	1	-1	-1	-1	-1

▶ xPR_Slave is time reversed of Master

▶ Example of Matlab code for Alert pattern generation:

- N=128
- randn('state',105)
- xhalf = sign(randn(1, N/2));
- x = kron(xhalf,[1 1]);

Alert incorporation into Refresh/Quite staggering scheme

- ▶ Only one transmitter channel is enabled at a time. Rest of the channels are disabled and cannot send Alert Signal
- ▶ Alert is allowed at any stage – Quiet or Refresh
- ▶ Switching between Normal and Alert path is only allowed on the LDPC frame boundary
 - No synchronization issue
- ▶ An alert at the end of the Enabled interval may be split between 2 channels
- ▶ See [sedarat_x_0908.pdf](#) proposal on Refresh/Quite cycle for more details on Staggering scheme

Summary

- ▶ Simple alert scheme has been presented
 - Very low power transmit and receive path implementation
 - Well-known low-risk technique - pseudo-random pattern transmission with following matched filter bound detection
 - low-latency (~160nsec) detections allows additional time for receiver's circuits activation; multiple sequences detection can be applied in parallel to reduce false-alarm probability

- ▶ MFB detections provides additional SNR margin comparing to the Equalization technique

- ▶ Proposed algorithm integrates well into staggering Quite/Refresh scheme
 - Alert can be transmitted any time
 - No synchronization issue