

50Ge FEC codeword alignment with 16k AM spacing

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Supporters



Overview

- There is value in re-using 40Ge PCS IP for 50Ge
 - 50Ge can be achieved by a simple 25% speedup of 40Ge
- However the AM spacing used by 40G is not an integral number of RS-544 FEC blocks
 - This presentation will explain how this difficulty can be surmounted by changes to the “FEC alignment state diagram”

The Problem

- The Clause 82 PCS (for 40Ge) specifies an AM every 16384 64b66 word on each of 4 PCSLs
- An RS-544 FEC block carries 20 256b257 words
 - equivalent to 80 64b66 words
 - $(4 \cdot 16384) / 80 = 819.2$
 - So AMs are not an integral number of FEC blocks apart
 - However, $5 \cdot ((4 \cdot 16384) / 80) = 4096$
 - So one in five AM groups will fall on a FEC block boundary
- AM lock to the “wrong” AM group will result in uncorrectable FEC blocks - this will cause an immediate re-start of the AM lock SM
 - This may eventually result in lock to the correct AM boundary, but this is implementation dependent, and may be unbounded.
 - Instant lock parallel AM lock implementations will lock
 - Sub-sampled test-and-shift AM lock implementations may never lock

The solution

- Lock to Ams first, then determine FEC alignment
 - Validate FEC alignment after AM lock using existing “4 uncorrectable Frames” qualification
 - If 4 uncorrectable frames are seen set FEC block boundary to the next AM boundary and try again
 - After 4 unsuccessful retries, restart AM lock State machines

More Detail

- Modify existing Figure 91-8 “FEC Synchronization state diagram” (AM lock SM) to add signal indicating AM boundary

- Change Figure 91-9 “FEC alignment state diagram” :
 - Add a new variable “alignment retry counter”, and a new control loop to allow deskew to be retried
 - On Am Lock assertion set alignment retry counter to 4
 - If 4 un-correctable FEC blocks are received,
 - Invalidate FECL alignment, deskew to next AM boundary, and decrement alignment retry counter
 - If alignment retry counter is non-zero decrement it. If zero restart AM alignment SM

Conclusions

- The 40Ge PCs and AM spacing can be used for 50Ge with some simple modifications to the FEC alignment state diagrams