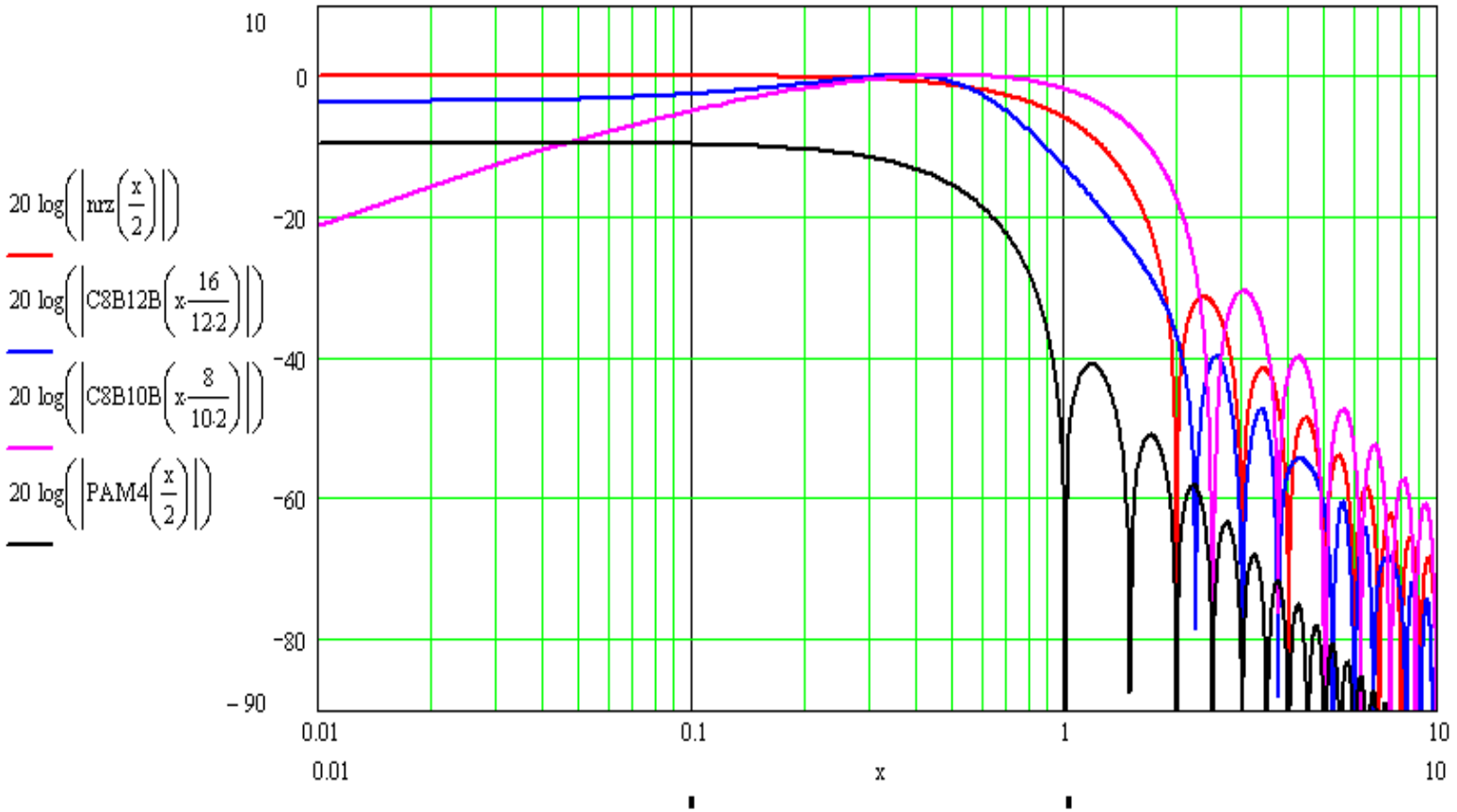
Acuid
BREAKING BARRIERS

Spectral coding for extended reach

Acuid Corporation
www.acuid.com

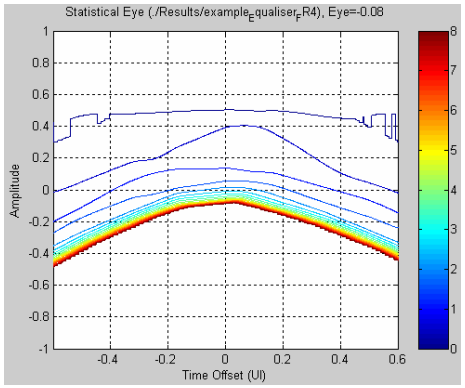
Spectral Changes from coding



Features of Spectral Codes

- Widely used in CD drives and disk drives (8b14b), but comms community seem ignorant of its huge advantages
- 8b12bRLL2 and 8b16bRLL3 are easier to apply than 8b10b
- 8b10b INCREASES data rate by 25%
- 8b16bRLL3 REDUCES apparent data rate to $^{2}/_{3}^{rds}$ that of uncoded data
- 8b12bRLL2 REDUCES apparent data rate to ¾ that of uncoded data
- No scrambling needed with spectrally coded data: they guarantee transitions every 11 bits (8b12b) to 15 bits (8b16b)
- 8b16b has DC balanced control codes and good DC wander properties

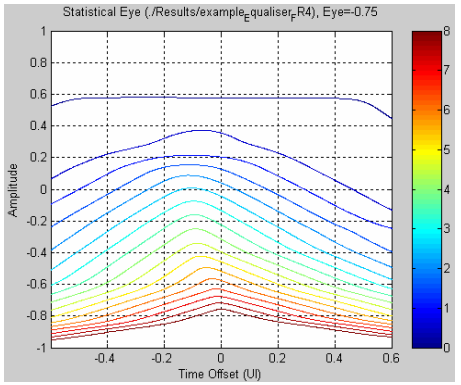
Effect on worst fibres



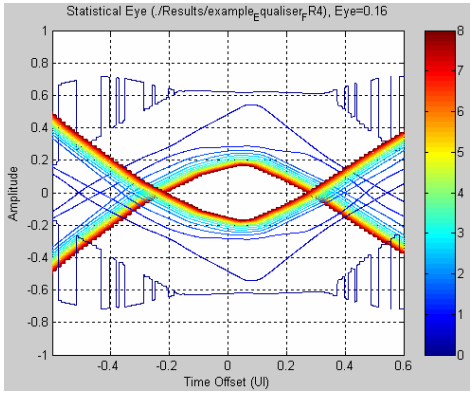
'MMF_Cambridge/CamMMF1p0f40o23f.w

Raw Channel
Uncoded data

10.3125Gbps

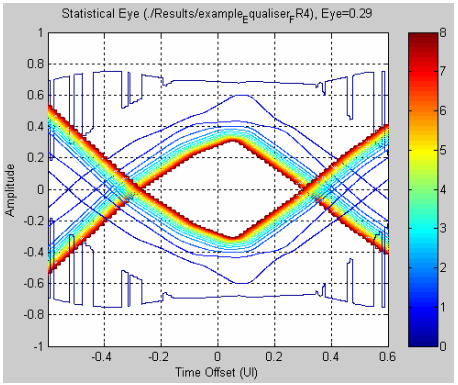


'MMF_Cambridge/CamMMF1p0f65o23f.w'



8b16b RLL Coded

Acts like 6.875Gbps



Spectral Coding in Silicon

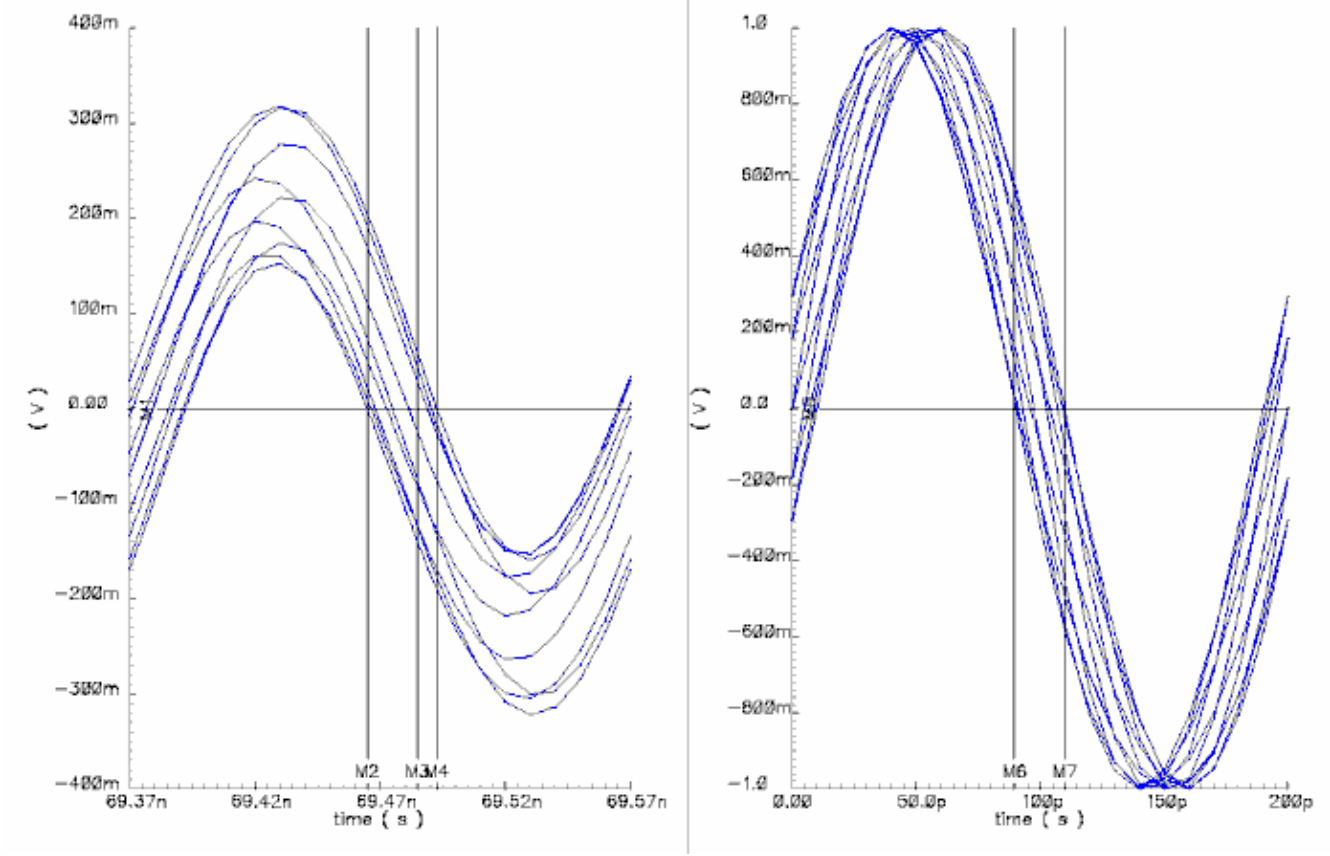
- The TX and RX buffers can have a lower bandwidth than without coding
- The TX VCO and serialiser operates faster
- The RX VCO can operate at same speed as before, dual sampling
- Spectral codes are easy to apply, taking less space than 8b10b, and are low latency

Reduced Distortion, especially PNA

- Spectral Coding reduces the effective baud rate travelling across the channel
- Reduced baud rate means that Phase Noise Amplification of the DJ is reduced
- This means that the received eye has less ISI, as well as better amplitude and less distortion
- Phase Noise Amplification, is effectively Jitter Amplification
- Occurs when the baud rate is a lot higher than the channel bandwidth. This is the case for poor MMF
- The greater the amplitude loss, the greater the Phase Noise Amplification (PNA). Detailed papers on UXPi postings and White Papers on www.acuid.com
- PNA could be called HF Jitter Amplification because that is what it does
- 5ps of DJ at a TX can be amplified by PNA to be 20ps of DJ at RX
- PNA is by far the primary factor closing the eye width
- Cross talk is another factor, generally less than PNA
- Maximum PNA is 1.8 for a 11Gbps link over a channel with 6dB loss

Eye width = 1 – RJ - DJ*PNA^(d/8) – Xtalk – Reflection budget

Phase Noise Amplification



Input on right with 0.2UI jitter, channel output on left, frequency 3.5GHz

Summary

- Spectral Coding can greatly reduce the problems of achieving the 300m reach
- Propose that the EDC standard include an option for Spectral Coding
- Propose that the 8b16b RLL 3 code is the preferred option