Feasibility of 1-UTP for RTPGE : Impacts of Gauge, Temperature, and Modulation

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Agenda

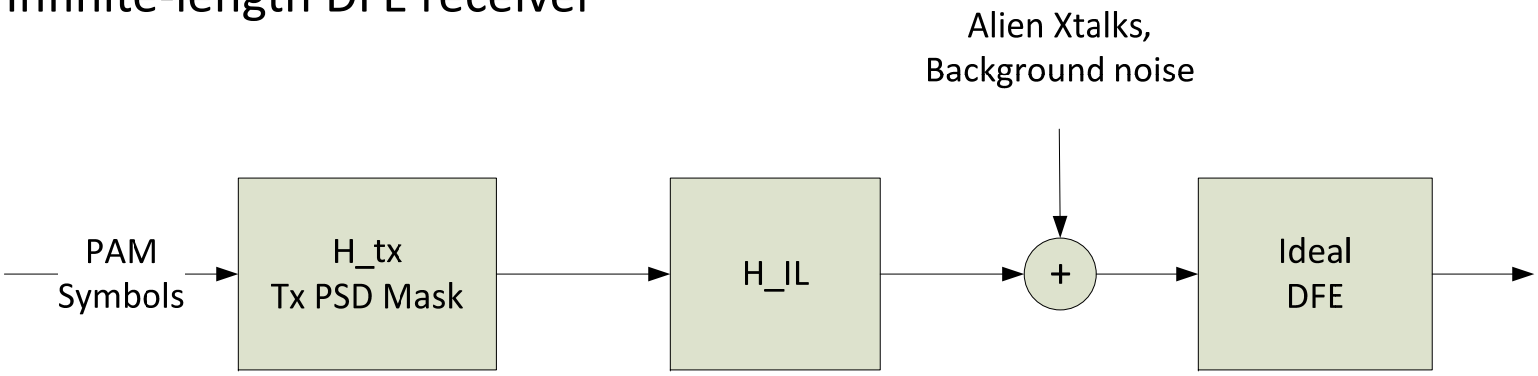
- Objectives
- System Model and Assumptions
- Salz SNR Results
- Susceptibility to NI
- Conclusions & Recommendations

Objectives

- **Study the feasibility of one UTP for RTPGE and investigate the impacts of gauge and temperature with ideal DFE implementation.**
- **Compare different PAM-M schemes in terms of achievable SNRs, susceptibility to narrowband interference and implementation loss.**
- **Provide recommendations to channel definition.**

System Model & Assumptions

- Infinite-length DFE receiver



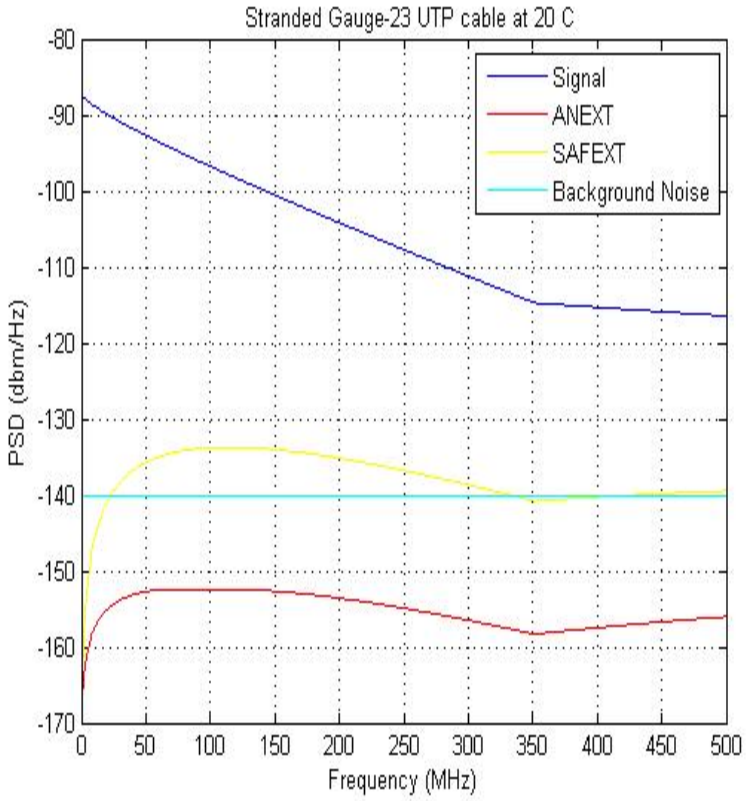
- Tx PSD Mask from [Tazebay_3bp_01_0113] with 10 db margin for Tx filter implementation and connector imbalance.

- Cable model by [diminico_3bp_01a_0313].
  - Temperature correction factor for 60^0C to 125^0C is 1% per degree (compare to [mei_3bp_01a_0313]).

System Model & Assumptions (Cont'd)

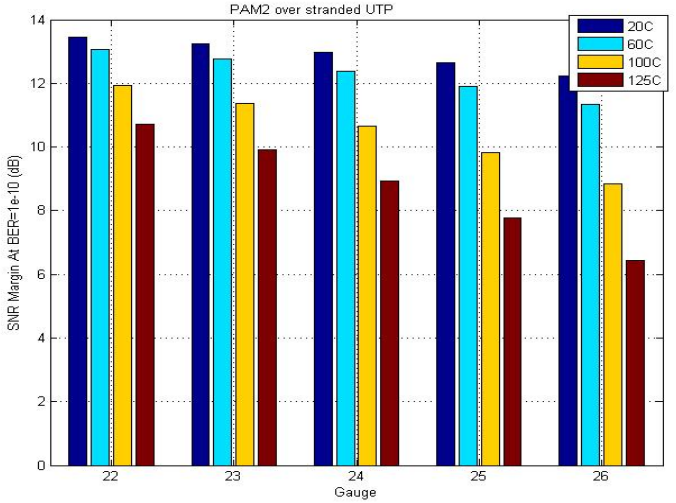
- 802.3an cat6a PSAELFEXT and PSANEXT losses without temperature correction.

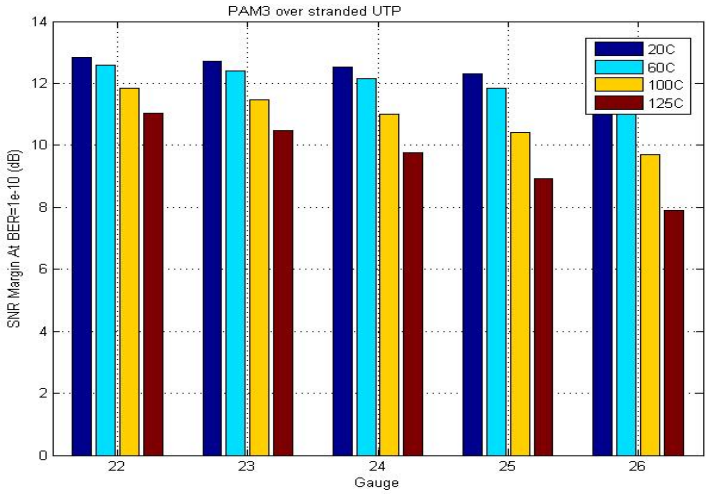
- Differential background noise at -140dbm/Hz.
  - Common-mode background noise at -107 to -105dbm/Hz in the range 100M to 500 M ([buntz_3bp_01a_0313]).
  - Assuming about 35db TCL for frequency in the range 100M to 500M.
  - Assuming receiver (including transformer) CMRR >35 db.
  - It is not strictly flat with larger PSD at higher frequency.

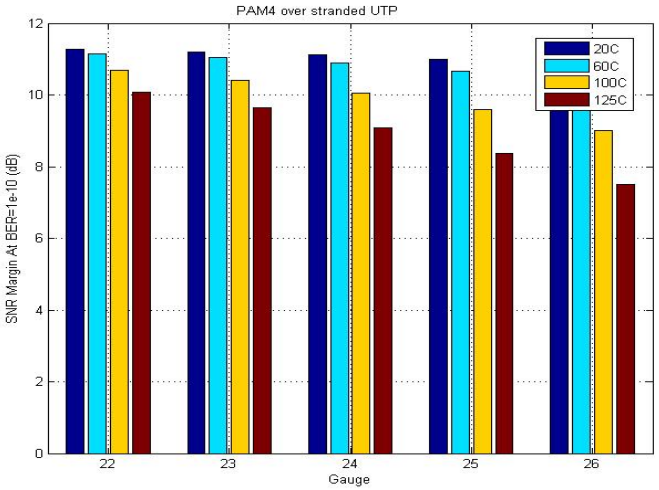


Salz SNR Results

- All cases show decent margin.
- PAM2 tends to have higher margin than PAM-M with M>2 does at lower temperature .
- Temperature affects performance more than gauge does.

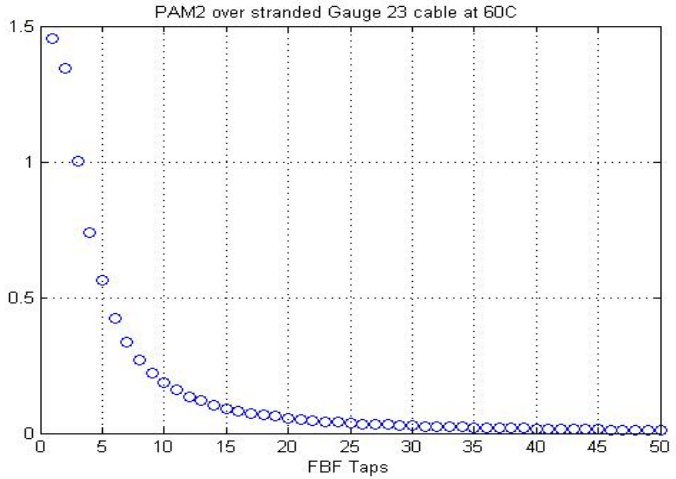


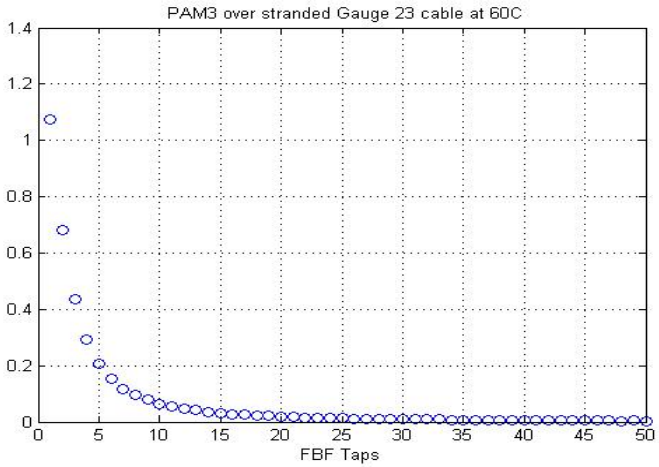


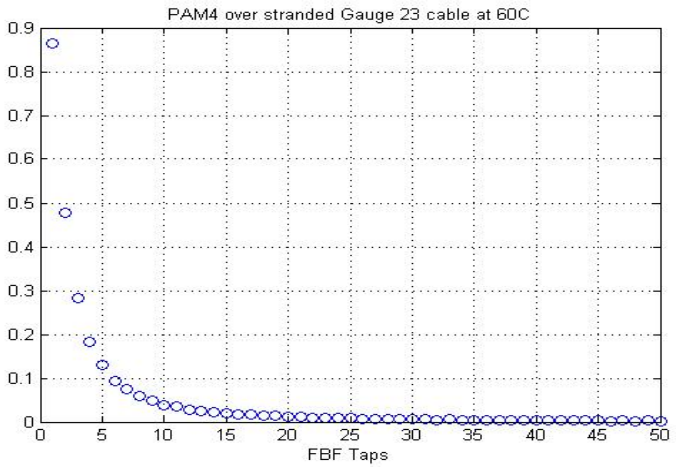


FeedBack Taps

- Very large feedback coefficients. If DFE-based implementation, some peaking gain is needed to avoid serious error propagation, which in turn will cause some loss in SNR.
- Lower modulation size has larger feedback coefficients.

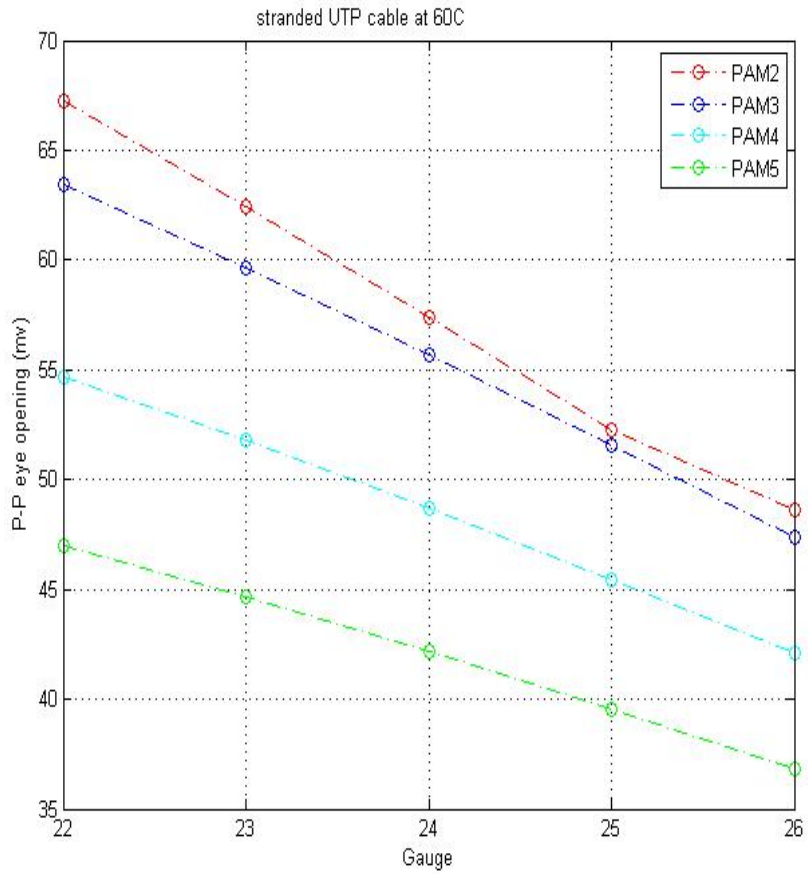






Susceptibility To NI

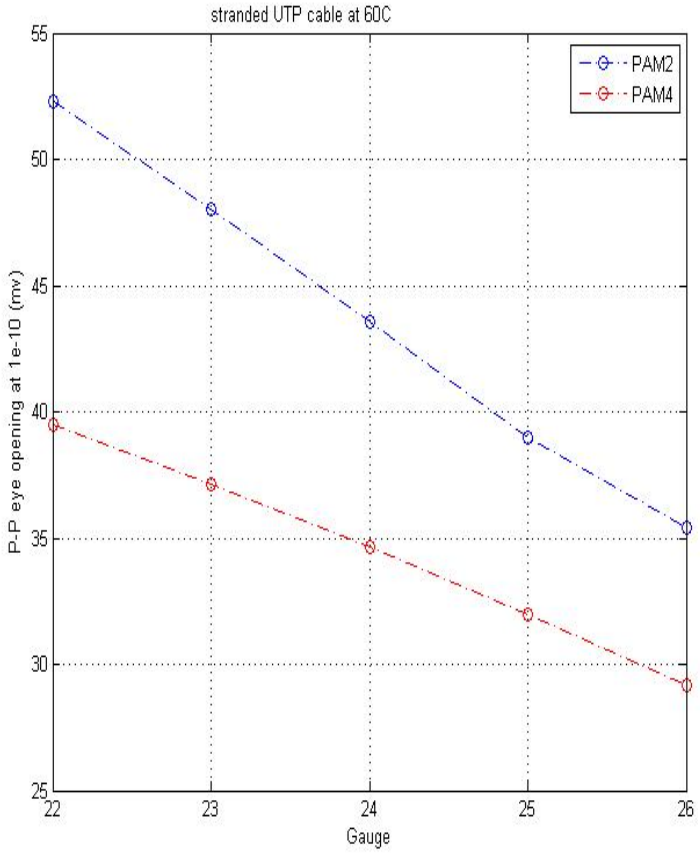
- The eye-opening with unit-gain filtering can be a measure of immunity to NI.
- The lower modulation size, the better the immunity.
- PAM2 has about 2 to 2.3 db advantage over PAM-4 in immunity.



Susceptibility to NI (Cont'd)

- Another measure of the susceptibility could be the eye opening at BER=1e-10. This can be roughly considered as maximal allowed P-P amplitude of DM narrow-band interference.

- In a finite DFE implementation, the tolerable maximal P-P amplitude will be smaller for higher frequency NI due to filtering.



Conclusions & Recommendations

- With only cat6a Alien Xtalks and background noise (with at least 35db TCL), there exist reasonable SNR margins for all cable sizes and temperature range considered.
- Temperature has significant impact on SNR margin.
- Define TCL better than 30-10*log10(f/100) to reduce background noise and increase NI immunity.
- PAM-2 shows better immunity to NI and can tolerate about 3v CM NI with 35db TCL. Need maximal amplitude of NI to determine if NI canceller is required.
- Need model of impulse noise to determine coding scheme.
- Need to evaluate measured channels with realistic equalization schemes.