Some of the Problems With PMA Specifications (Clause 55, 802.3an Draft 1.2)

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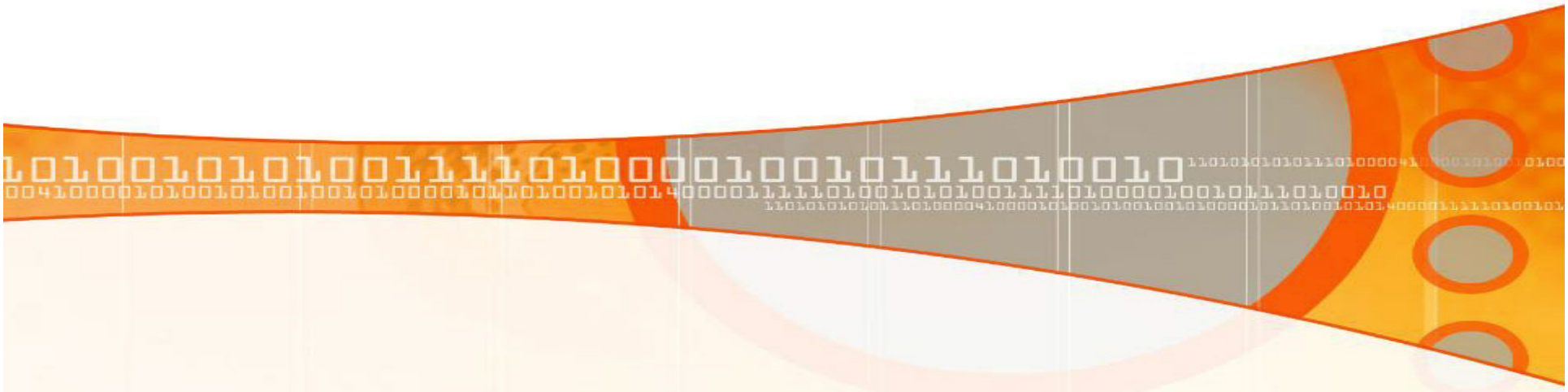


IEEE 802.3an: 10BASE-T Task Force

Areas of Concern

Some of the technical specifications in Clause 55 of draft D1.2 (802.3an-D1.2.pdf) are inadequate for practical implementation

In particular,

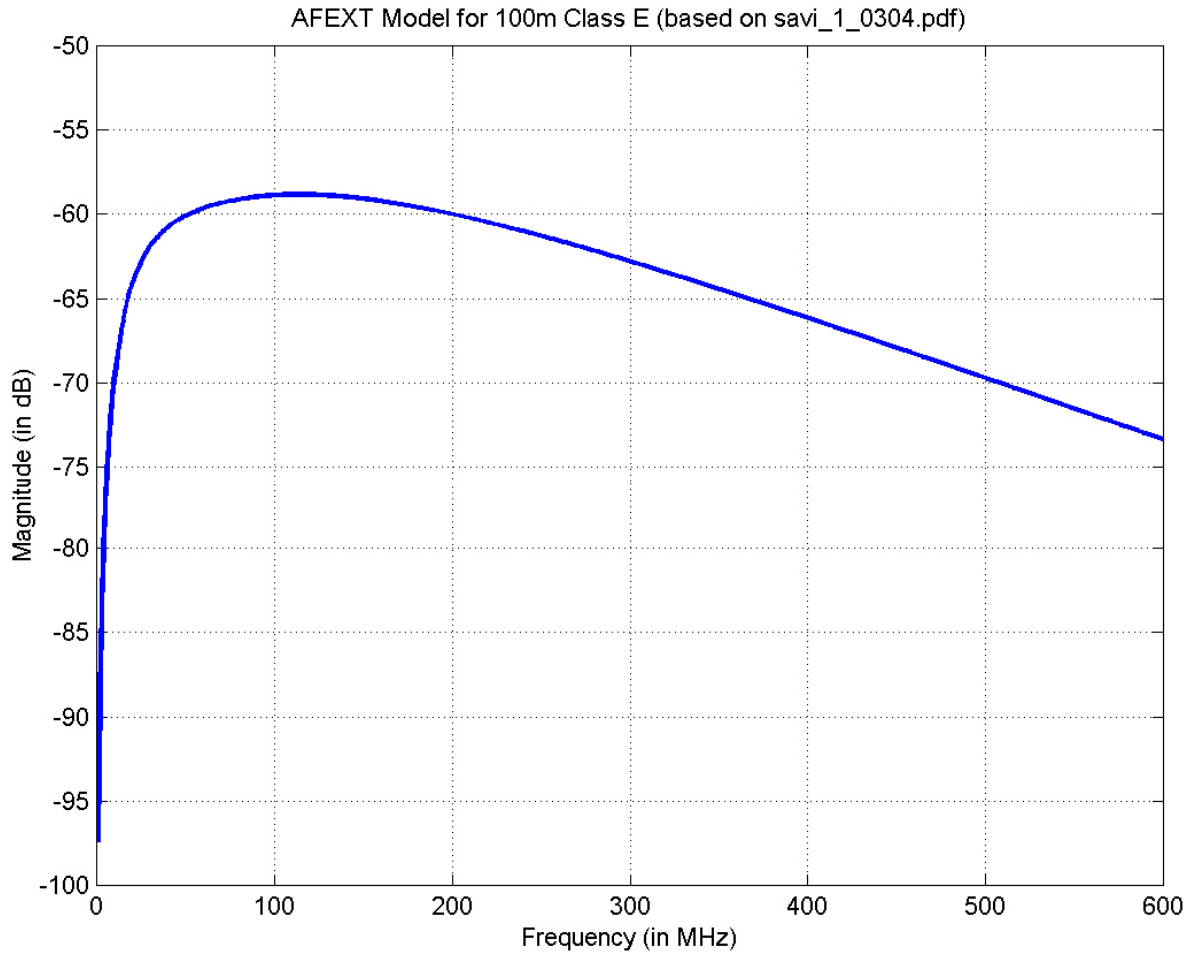
- No margin in the presence of AFEXT
- No fixed THP defined for 55m CAT6 cable
- Transmit PSD, average power, and peak-to-peak voltage specifications are too stringent

System Margin: 100m Class E

- Required SNR: 23.3 dB, ungerboeck_1_1104.pdf
- 100m of Class E cable, ANEXT, -140dBm/Hz
  - Best achievable SNR with infinite equalizer: 26.4 dB
  - Best achievable SNR With a realistic system:
    - 24.5 dB, vareljian_1_1104.pdf
    - Implementation loss: 1.9 dB
- Margin: 3.2 dB (Theory), 1.2 dB (Finite EQ)

- Problem 1: The margin is too small
- Problem 2: No AFEXT!

PSAFEXT Model: 100m Class E



The Effect of AFEXT

- Example model is based on savi_1_0304.pdf
  - The group is yet to agree on AFEXT model
- 100m Class E cable with AFEXT
  - Best achievable SNR: 25 dB (infinite equalizer)
  - With 1.9 dB implementation loss: 23.1 dB (finite EQ)
- There is no or little margin with AFEXT

- AFEXT increases with decreased length
- Power back off adds to the problem for shorter cable

Fixed THP: The Problem

- The Problem: The fixed THP specification in 55.4.3.1 does not cover the 55m of CAT 6 cable
  - 55m of CAT6 is part of the objective
- The number of fixed THP were decided based on two presentations in the Nov'04 meetings
  - Ungerboeck_1_1104.pdf
  - Golden_1_1104.pdf
- None of them considered the 55m CAT6 cable
- Purely frequency domain analysis

Fixed THP: Ungerboeck

- Conclusions were based on shielded CAT6 cable: Model #3, ClassEs
- 55m CAT6 cable: Model #2, ClassEu
  - Same IL curve as 55m ClassEs
  - ANEXT is 15dB higher
  - Suggested power back off 7dB
  - Achievable SNR for 55m of ClassEs is 28dB
  - Achievable SNR for 55m CAT 6 is 22 dB
  - Less than then required SNR 23.3dB
- The fixed THP and power back off do not work for 55m of CAT6

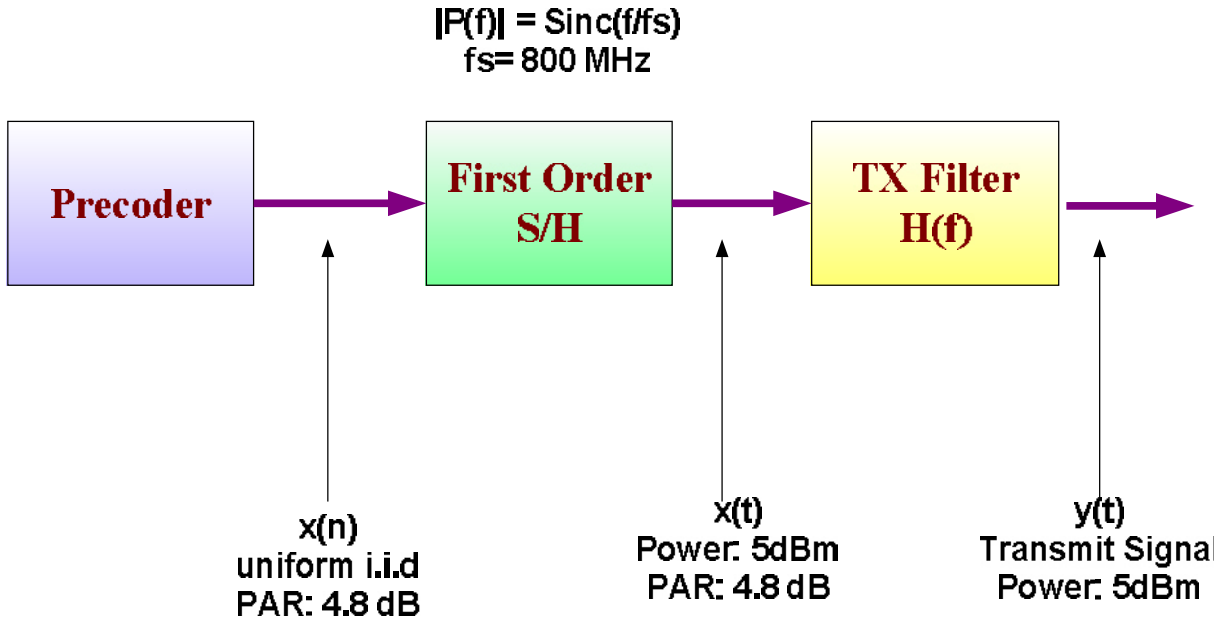
Fixed THP: Golden

- Conclusions were based on Model 3
- 55m CAT6 cable
  - Suggested power back off for 65m is 5dB
  - Achievable SNR for 55m CAT6 is 23.9 dB
  - Suggested power back off for 35m is 7.5 dB
  - Achievable SNR for 55m CAT6 is 21.5 dB
- The fixed THP and power back off do not work for 55m of CAT6

Transmit Signal: Specifications

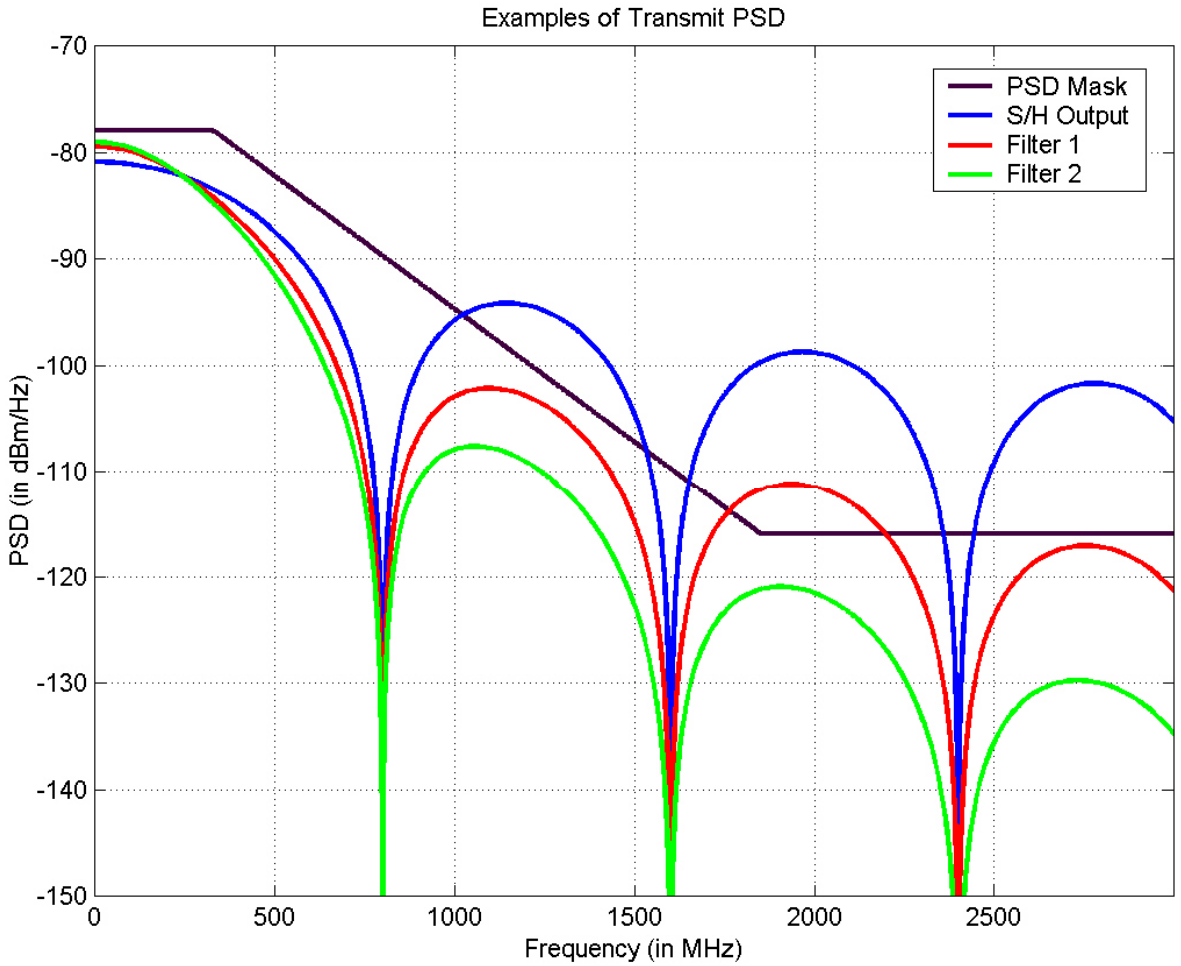
- Transmit PSD specification in Section 55.5.6 was based on pagnanelli_2_1104.pdf
  - Assumes PAR no more than 3.42dB
- Section 55.5.3.1: The peak-to-peak voltage is between 2.0 and 2.5 V
  - Peak transmit power with 2.5V (100 Ohm): 11.9 dB
- Average transmit power: 5dBm
  - Used in most presentations
- Available PAR: 11.9-5 = 6.9 dB

Model For Calculating TX PSD



- Filter 1: $|H(f)|^2 = a1/[1+(f/fc)^2]$, fc=400 MHz
- Filter 2: $|H(f)|^2 = a2/[1+(f/fc)^2]^2$, fc=500 MHz

Examples of Transmit PSD



Transmit Signal: Problem

- Filter 1: First order filter with fc=400MHZ
  - 6.35 dB PAR is lower than the limit 6.9 dB
  - Does not meet the PSD mask
- Filter 2: Second order filter with fc=500MHZ
  - Does meet the PSD mask
  - 6.74 dB PAR; too close to the limit 6.9 dB
  - Would cross the limit if fc is lowered to 450MHz

- Problem: Not enough margin for PAR
- We should allow for enough tolerance

Q&A

Thanks!