PHY Analysis on Alien Crosstalk Proposal from May 2023 (rev a)

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IEEE P802.3dg telephonic Interim

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Introduction

- Discussion at the May interim suggested modifying the PSANEXT & PSAACR-F middle-range to a sliding scale:

IL (20 MHz)	Baseline	Withey (“dgMay”)	Straw Poll (“dg2May”)
IL(20 MHz) ≤ 16 dB	N=0	0	0
16 dB < IL(20 MHz)< 18 dB	N=1	N=0.4*(IL_20-16)	N=0.5*(IL_20-16)
18 dB ≤ IL(20 MHz)< 21 dB	N=1	N=0.4*(IL_20-16)	N=1
21 dB ≤ IL(20 MHz)< 23 dB	N=2	2	N=1 + 0.5*(IL_20-21)
IL(20 MHz) ≥ 23 dB	N=2	2	2

NOTE - This presentation provides preliminary PHY analysis to help consider those parameters, in line with analysis at March Interim

It is NOT a PHY baseline proposal at this time

Values of “N” for sliding scale

IL (20 MHz)	Baseline	Withey (“dgMay”)	Straw Poll (“dg2May”)
IL(20 MHz) ≤ 16 dB	N=0	0	0
16 dB < IL(20 MHz)< 18 dB	N=1	N=0.4*(IL_20-16)	N=0.5*(IL_20-16)
18 dB ≤ IL(20 MHz)< 21 dB	N=1	N=0.4*(IL_20-16)	N=1
21 dB ≤ IL(20 MHz)< 23 dB	N=2	2	N=1 + 0.5*(IL_20-21)
IL(20 MHz) ≥ 23 dB	N=2	2	2

PHY Modeling

- For consistency, modeling is as previously in zimmerman_3dg_01_11022022, zimmerman_3dg_01a_03152023
- Implementation independent – use theoretical limitations, established, proven technique for Salz modeling
- Model includes residual components from echo & receiver noise
  - Assume high degree of echo cancellation, good AFE
  - For this presentation use receiver parameters within technology, but high enough not to limit performance – focus on link segment - 50 dB echo, 12 bits ENOB (overkill)

Link Segment Transmission Models

- Insertion Loss: (graber_3dg_02_03152023 slide 4)

  $5.42*SQRT(f_{MHz})+0.044*f_{MHz}+1.76/SQRT(f_{MHz}) + 5*0.02*SQRT(f_{MHz})$

- Return Loss: (graber_01_03152023 slide 13)

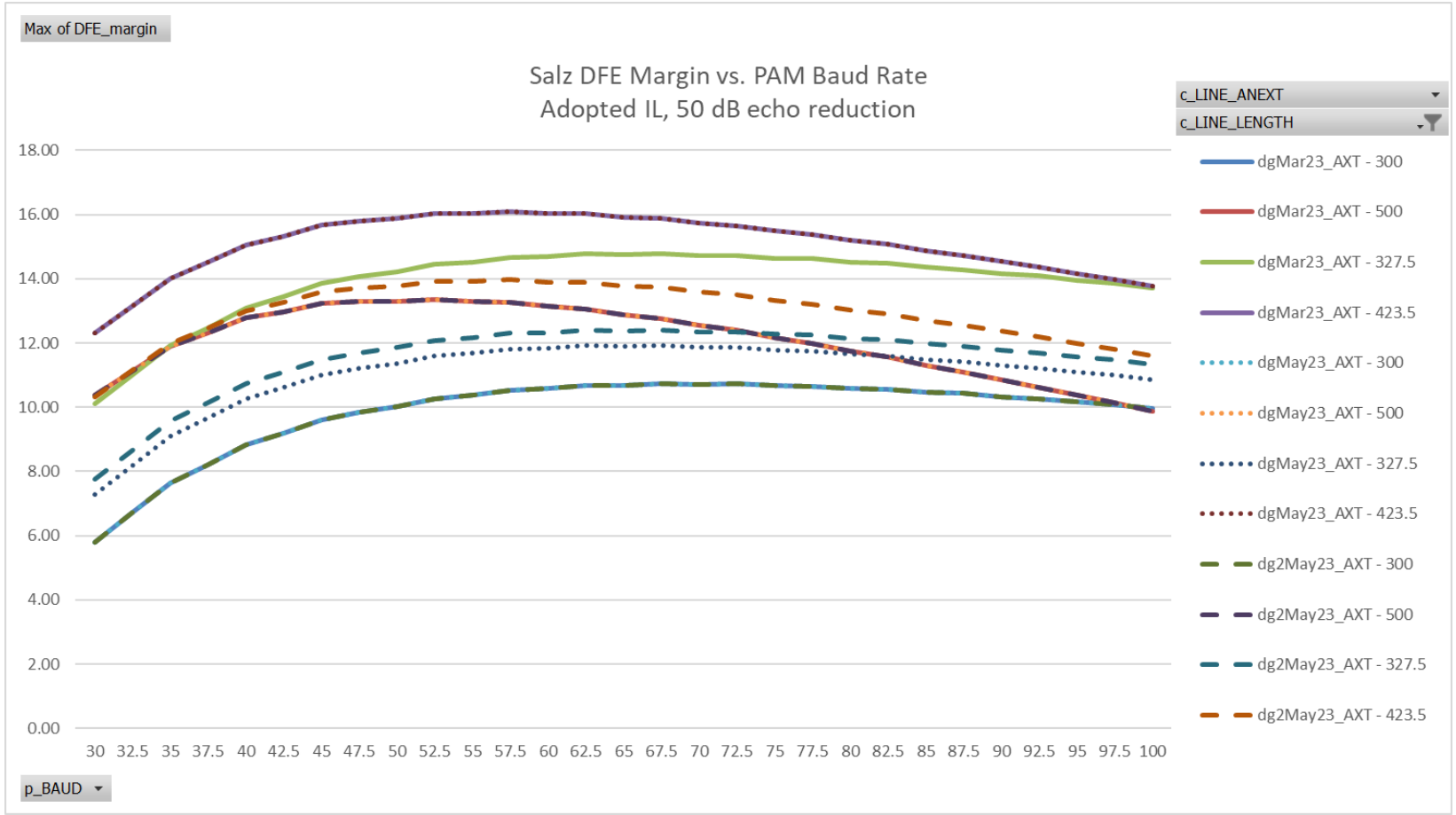
  $9+8* f_{MHz}$ dB ($f_{MHz} < 0.5$ MHz) , 13 dB ($0.5 \le f_{MHz} < 20$ MHz)
  $13-10*LOG10(f_{MHz}/20)$ ($20 \le f_{MHz} \le 100$ MHz)

- PSANEXT, PSAACR-F: (graber_03a_03152023.pdf slide 10)
  - PSANEXT: $50 + 5*N$ dB, ($f_{MHz} < 10$ MHz), $50 + 5*N - 15*LOG10(f_{MHz}/10)$ (10 MHz $\le f_{MHz}$)
    - N = 0 for *IL(20 MHz)* < 16 dB, N = 0.4*(for 16 dB ≤ *IL(20 MHz)* < 21 dB, N= 2 for 21 dB ≤ *IL(20 MHz)*
  - PSAACR-F: $50 + 5*N$ dB, ($f_{MHz} < 2$ MHz), $36 + 5*N - 20*LOG10(f_{MHz}/10)$ (2 MHz $\le f_{MHz}$)
    - N = 0 for *IL(20 MHz)* < 16 dB, N = 1 for 16 dB ≤ *IL(20 MHz)* < 21 dB, N= 2 for 21 dB ≤ *IL(20 MHz)*

- *Proposal modifies N in the mid range, from about 310m to about 405m*

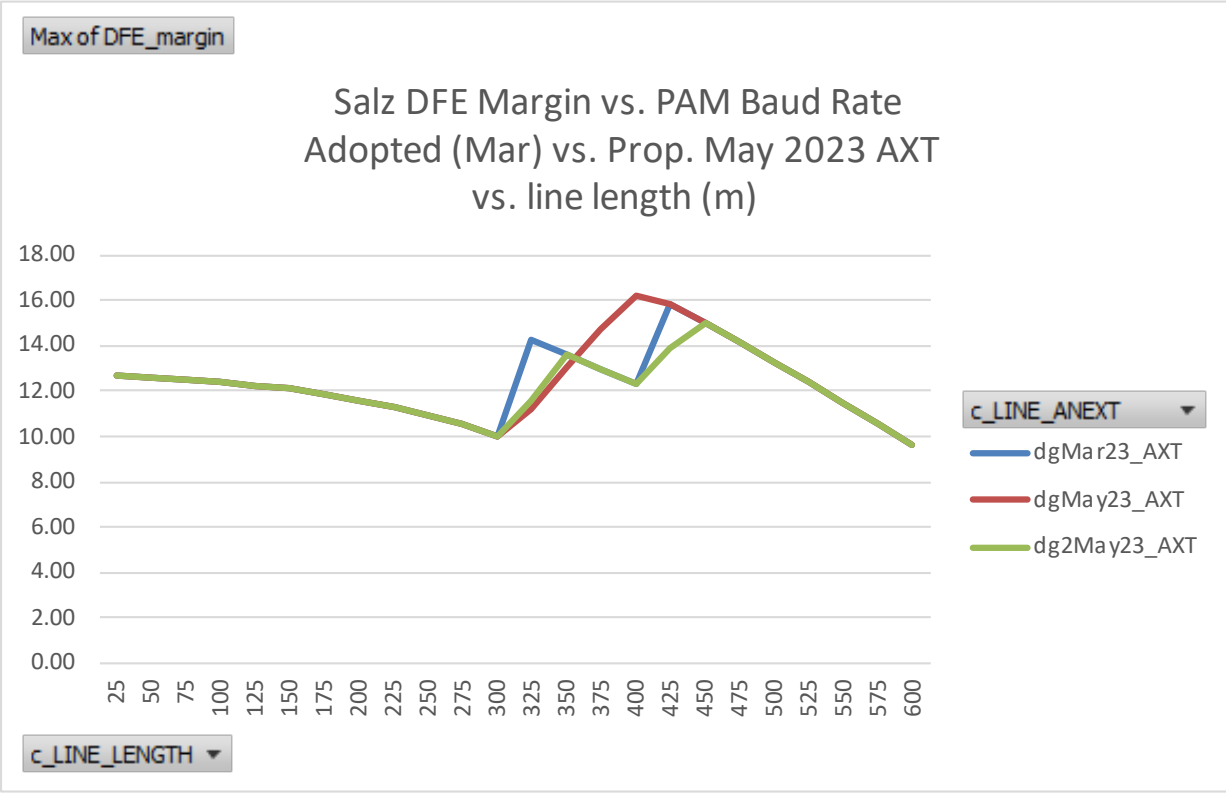
Optimal PHY bandwidth remains 20 to 30 MHz

- PAM3 to PAM5 all viable
- Results only shift shorter reach curves, which are less sensitive to baud rate
  - Ranges of approx. 308-347m & 404-443m are changed for the straw poll, and 308-404m for Withey
- Note that some longer reach margins (350m-400m) are improved



No change to minimum margin

- Worst case margin remains at the start of the relaxation (~305m) and is unchanged
- Minimum margin may be improved by lowering the IL_20 where the relaxation starts
  - **NOT suggesting this now**
  - Does not materially change margins
  - Increases # of links potentially needing mitigation



Conclusions

- May 2023 proposals seem acceptable from PHY point of view
  - Either sliding scale proposal seems reasonable
- Do not change expectations of minimum margins
- Do not change expectations for choices of symbol rate (baud)
  - PAM 3, 4, and 5 are all viable with the new proposal
- Do not change expectations for complexity
- May even improve margins on some longer links

THANK YOU