A First Look at Multi-Gig PHY TX-PSD Mask

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Overview

- PHY should meet both immunity as well as emission requirements
  - BCI test for immunity → make sure that PHY is robust under added noise
  - Stripline test for emission → make sure that PHY transmit signal do not interfere other devices
- Triaxial method (IEC 62153-4-7) gives screening and coupling attenuation
- Existing Triaxial measurement data available from cable and connector vendors
  - DiBiaso_3NGAUTO_01_0517.pdf
  - 2017-10-09 802.3ch screening measurement.pdf
- Use coupling attenuation to derive TX-PSD mask for Multi-Gig
- The contribution is based on Triaxial measurement data not the stripline!

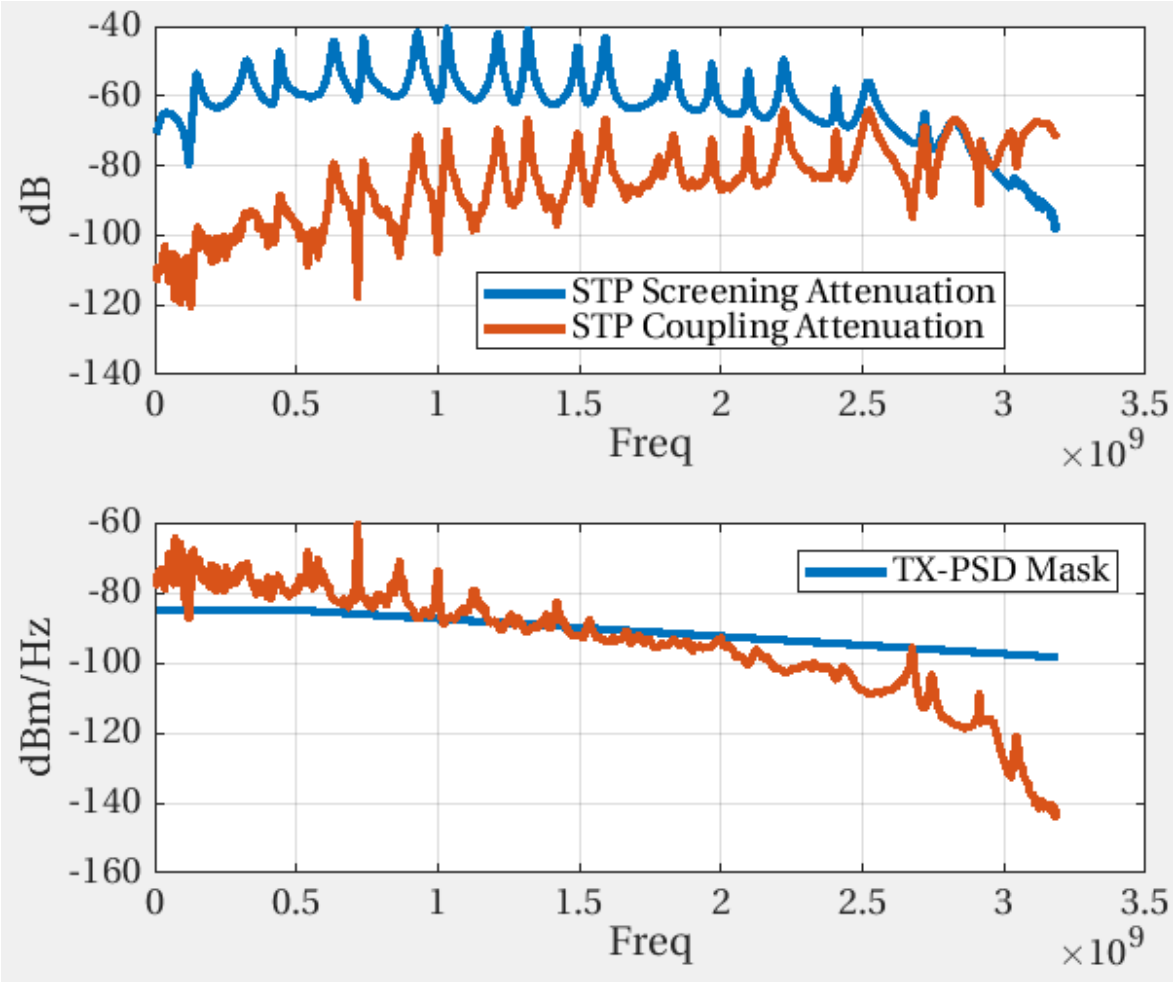
Definition

- While choosing the TX-PSD mask it shall meet the peak emission requirement that is set by the OEMs
- OEMs define 15dBuV peak radiated emission from DC to 1GHz
- *Common-Mode-Signal = TX-PSD Mask (dBuV) + Balance Pair (dB)
- Emission_STP_Cable = Common-Mode-Signal (dBuV) + Screening Attenuation (dB)
- Coupling attenuation
  - Screening attenuation (dB) + Balance Pair (dB)
- Mask is derived from balance of STP cable and use screening attenuation for additional margin

**http://www.ieee802.org/3/bp/public/jan13/tazebay_3bp_01a_0113.pdf*

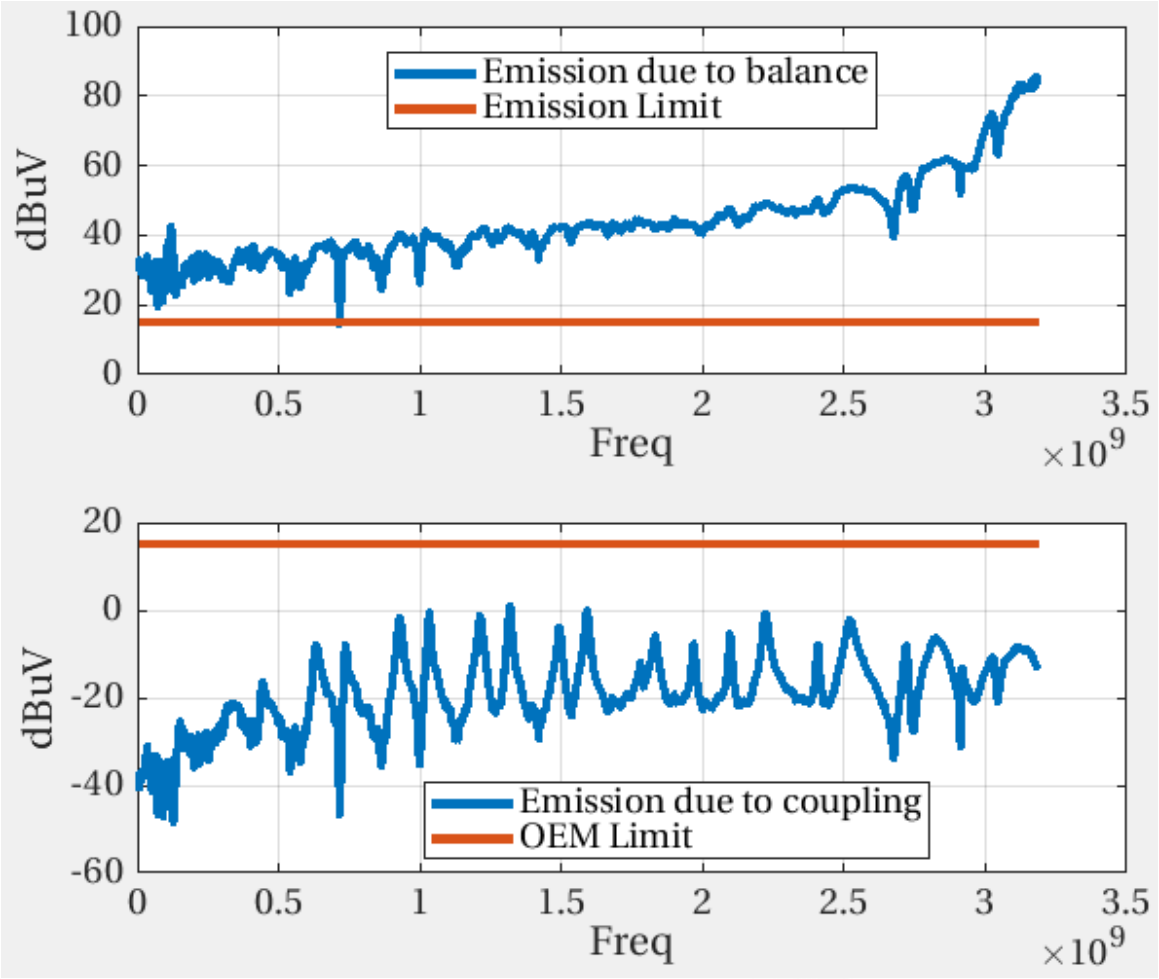
Case Study: TX-PSD (1/3)

- Screening and coupling attenuation data is from DiBiaso_3NGAUTO_01_0517.pdf
- TX-PSD Mask = Emission (dBuV) – Balance Pair (dB)
- RBW = 100kHz



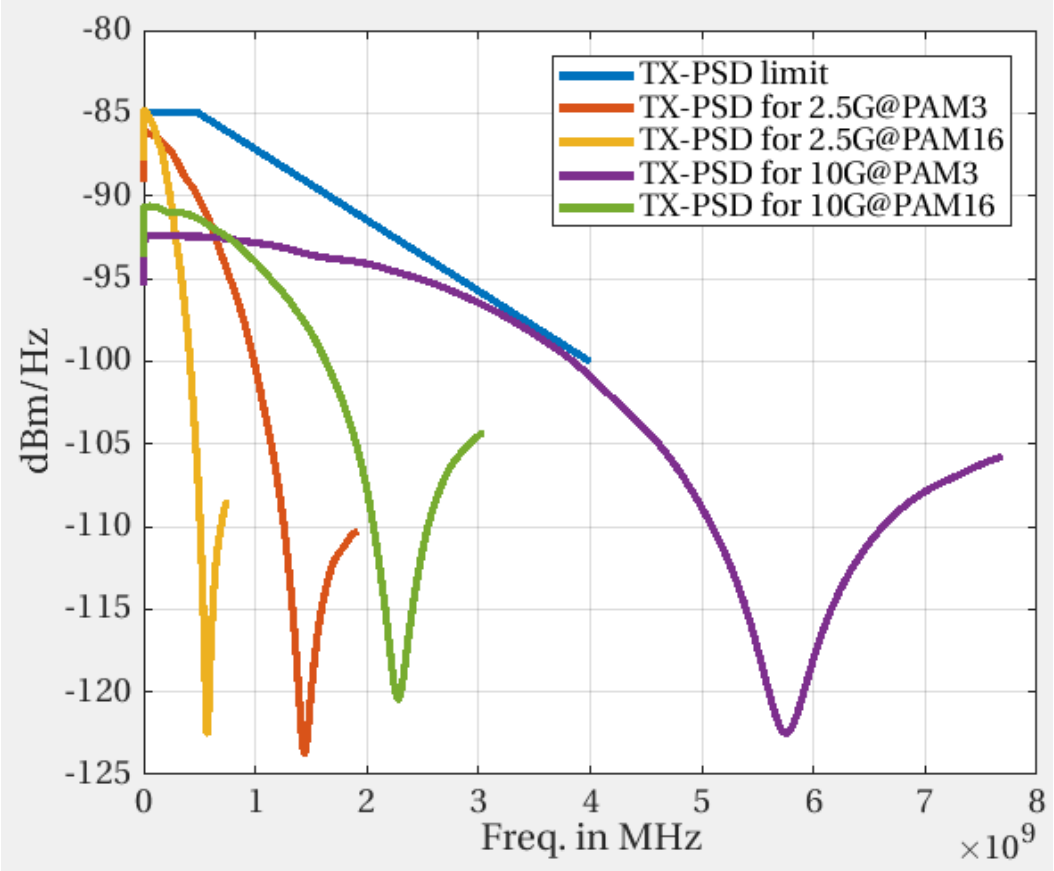
Case Study: TX-PSD (2/3)

- Mode conversion of cable violates the emission limit
- Screening attenuation gives about 15dB margin
- Question
  - Do all cable types maintain screening and coupling attenuation limit?
  - 15dBuV is for all OEMs and for >1GHz?

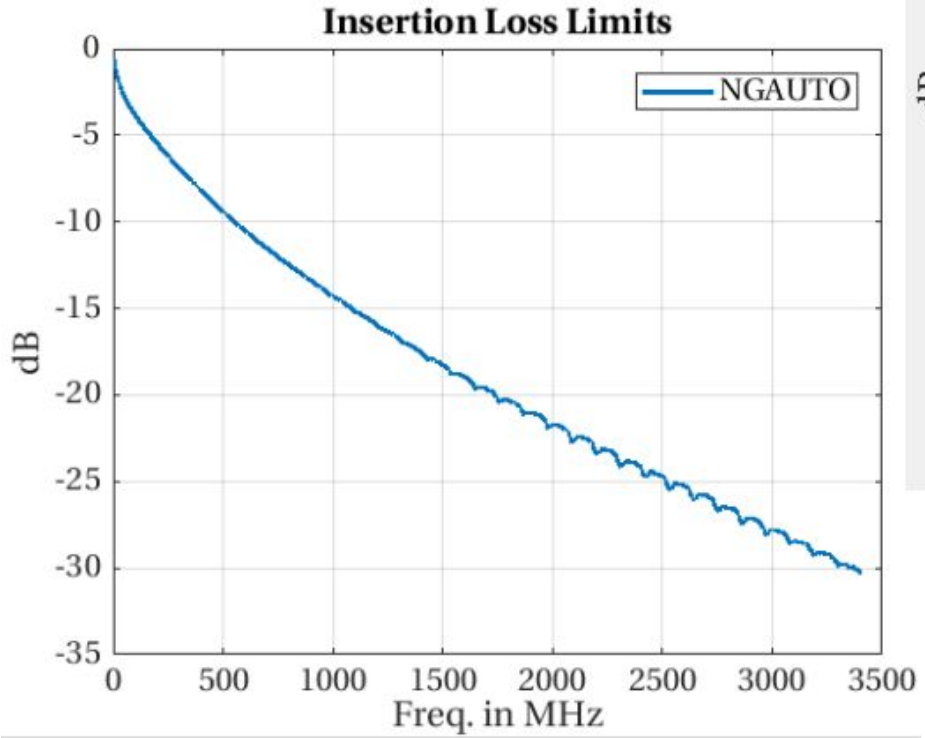


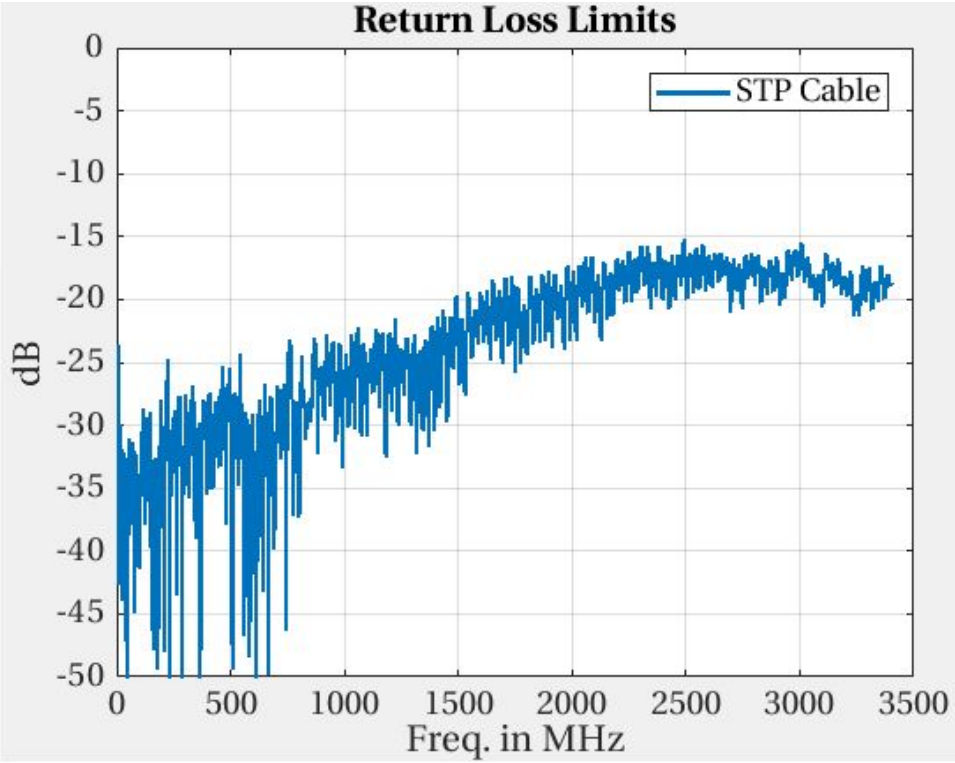
Case Study: TX-PSD (3/3)

- PAM3 and PAM16 modulations schemes were chosen arbitrarily



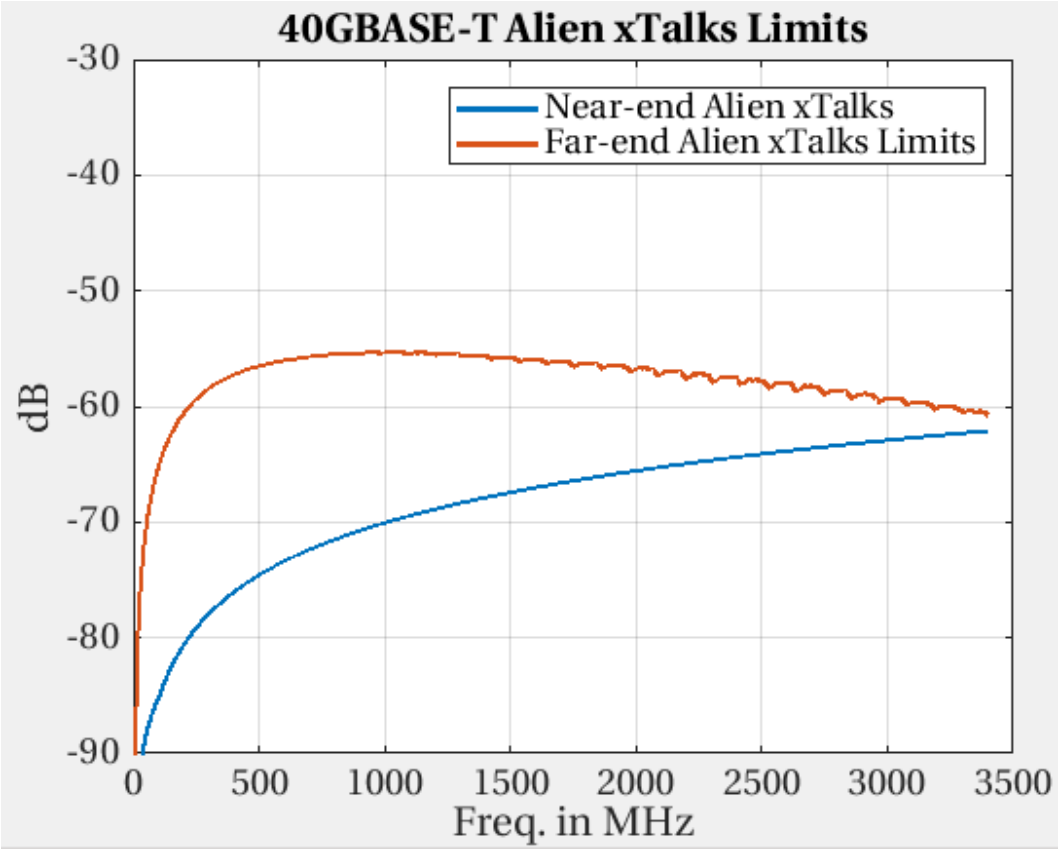
Insertion Loss and Return Loss





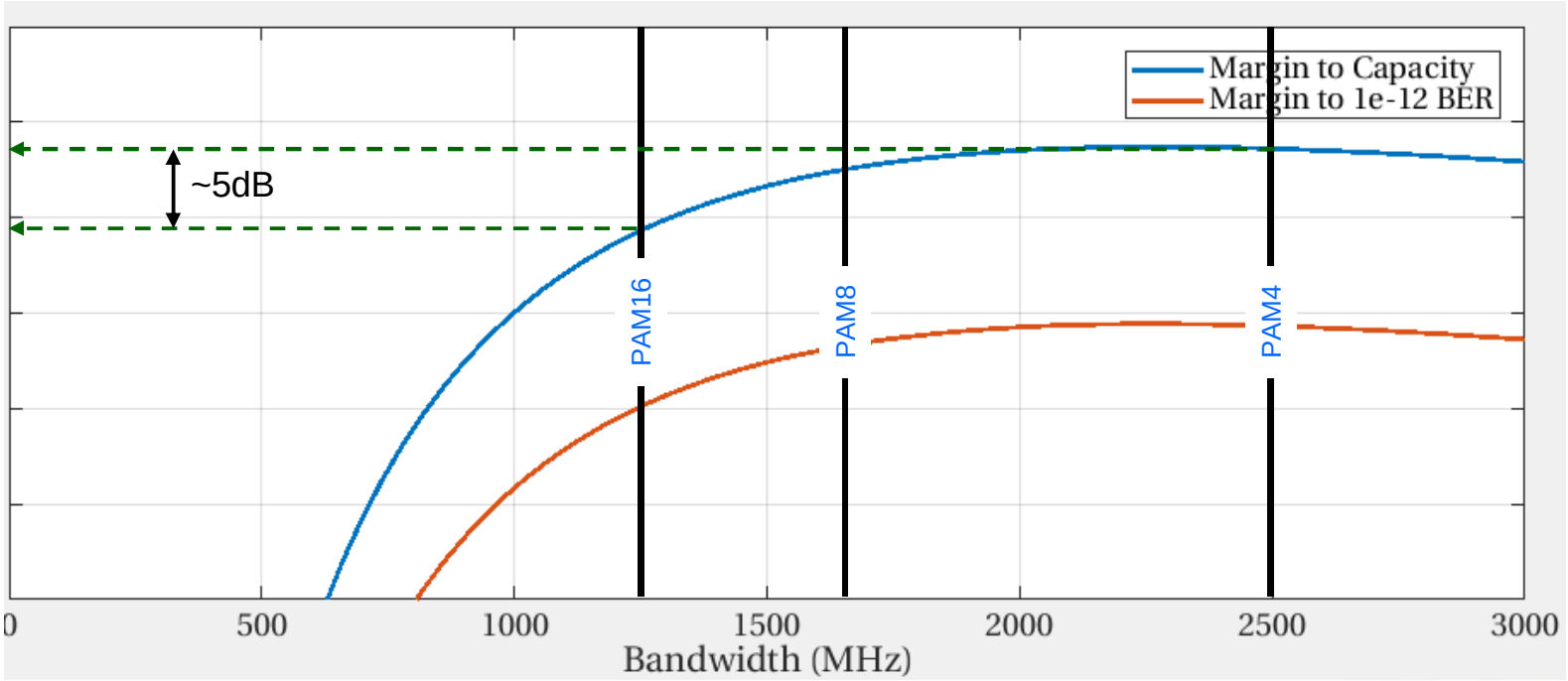
Alien Crosstalks

- CAT6 cable Alien xTalks limit



Infinite Length DFE SNR Analysis for 10GBASE-T1

- Uncoded data
- Choosing PAM16 would lose ~5dB SNR



Discussion

- Based on the existing measurement data 1Vpp launch voltage can be achieved for all Multi-Gig PHYs and meets the emission requirement
- >>1Vpp (e.g., 2Vpp) launch voltage seems to violate the emission
- 15dB margin is considered for unknowns and can be adjusted based on future measurement data
- 10G PHY: PAM16 seems not optimal from SNR point of view
  - Also vulnerable to BCI noise
- Recommendations
  - Need more measurement results to agree on limits for screening attenuation and coupling attenuation
  - Data of Stripline measurement results of STP cable
  - In-depth understanding of BCI differential noise for all use cases

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