Link segment requirements for 2.5Gbps operation

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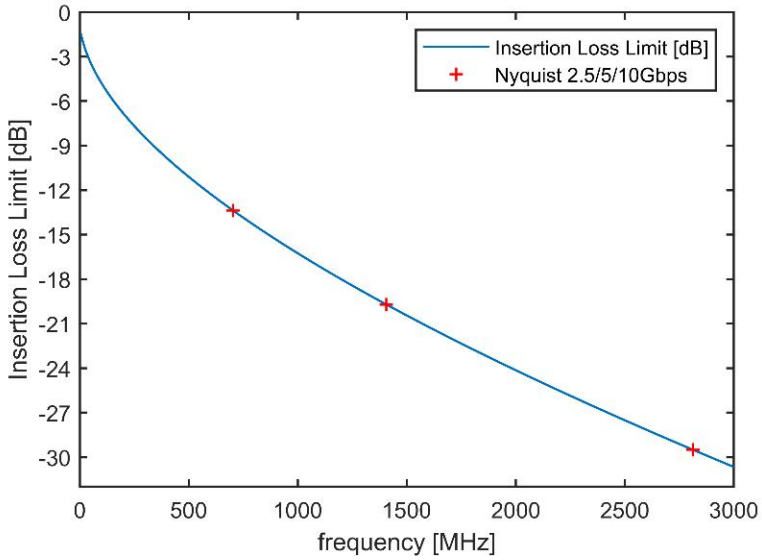
- Propose separate link segment specifications for 2.5Gbps
- Baseline proposal limits for
  - Insertion loss
  - Return loss
- Define way forward on
  - Mode-conversion
  - Shielding attenuation
  - Coupling attenuation

Rationale

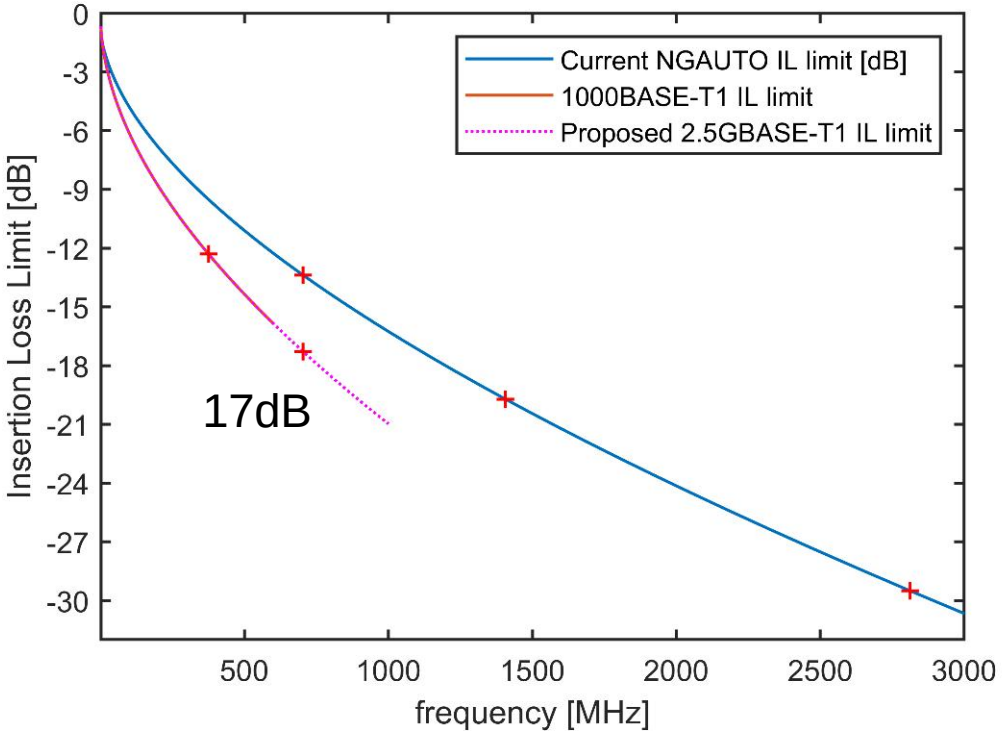
- A link operating at 2.5Gbps uses 4x less bandwidth
  - Nyquist frequency around 700MHz
- Nyquist insertion loss with current IL formula 13.4dB
- Note: this formula was set for 10Gbps capable high-quality shielded twisted-pair with braid

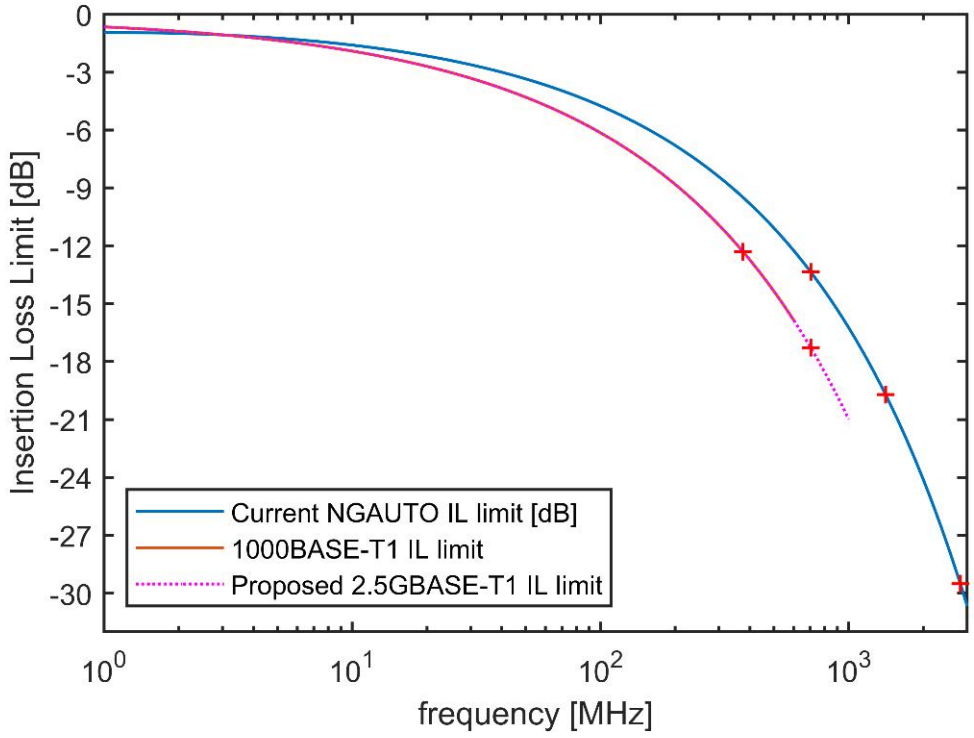


- At 2.5Gbps losses may be higher and shielding could be less ‘perfect’ = lower relative cost
- What if cables for 2.5Gbps could be an ‘enhanced 1Gbps cable’ instead of a downscaled 10Gbps cable?
- There will be 2.5Gbps transceivers that cannot do 10Gbps

Insertion loss

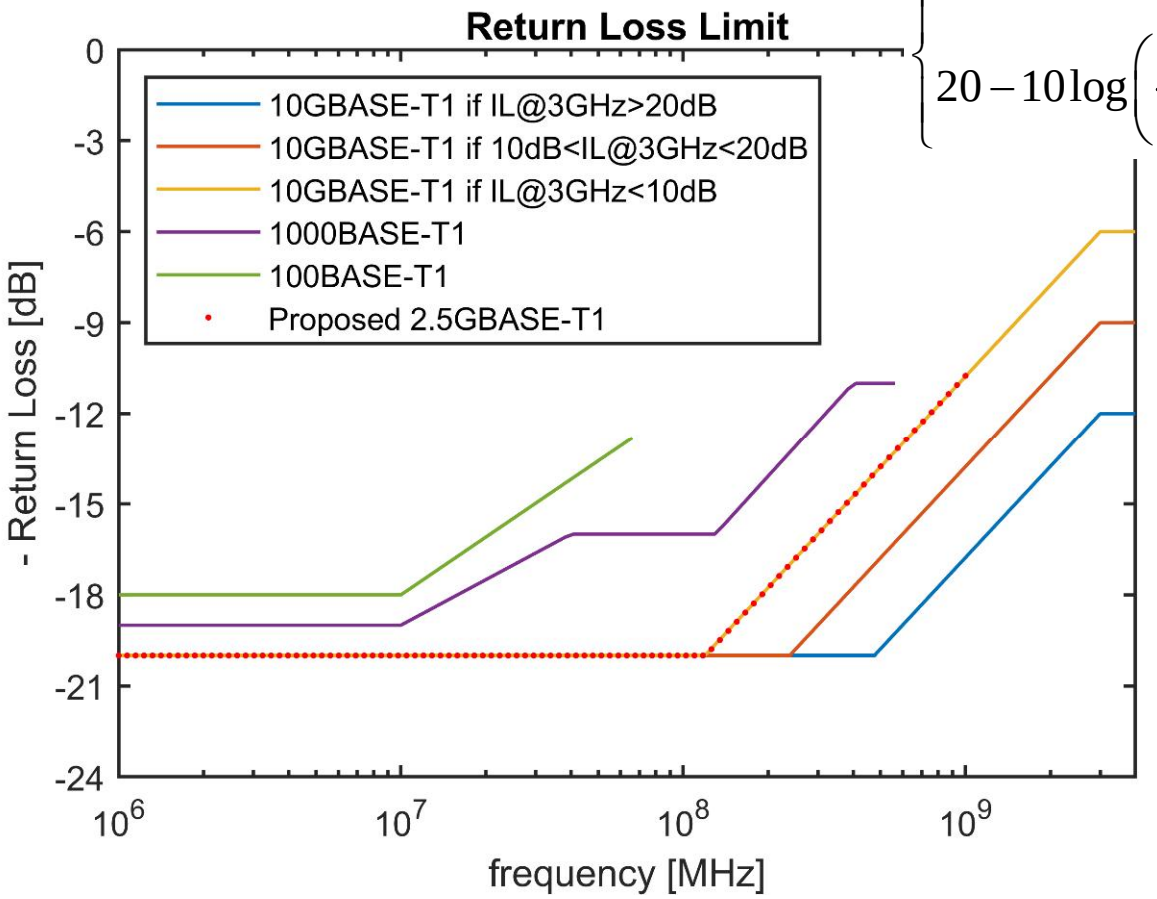
- 1000BASE-T1 IL limit: $IL < 0.0023 \cdot f + 0.5907 \cdot \sqrt{f} + \frac{0.0639}{\sqrt{f}}$
- Baseline proposal: extended curve for 2.5Gbps
- Freq=1-1000MHz





Return Loss

$$\begin{cases} 20dB & f = 1-120MHz \\ 20-10\log\left(\frac{f}{120}\right)dB & f = 120-1000MHz \end{cases}$$



- 10dB/dec roll-up for 2.5Gbps ~2x higher than for 1Gbps
- Freq=1-1000MHz
- Results in limit line close to the 10Gbps RL limit for IL<10dB

UTP or STP?

- Leave both options open
- Define mode-conversion for UTP
- or
- Define coupling and shielding attenuation for lower cost STP types
- Provide two options in spec to enable cable innovation

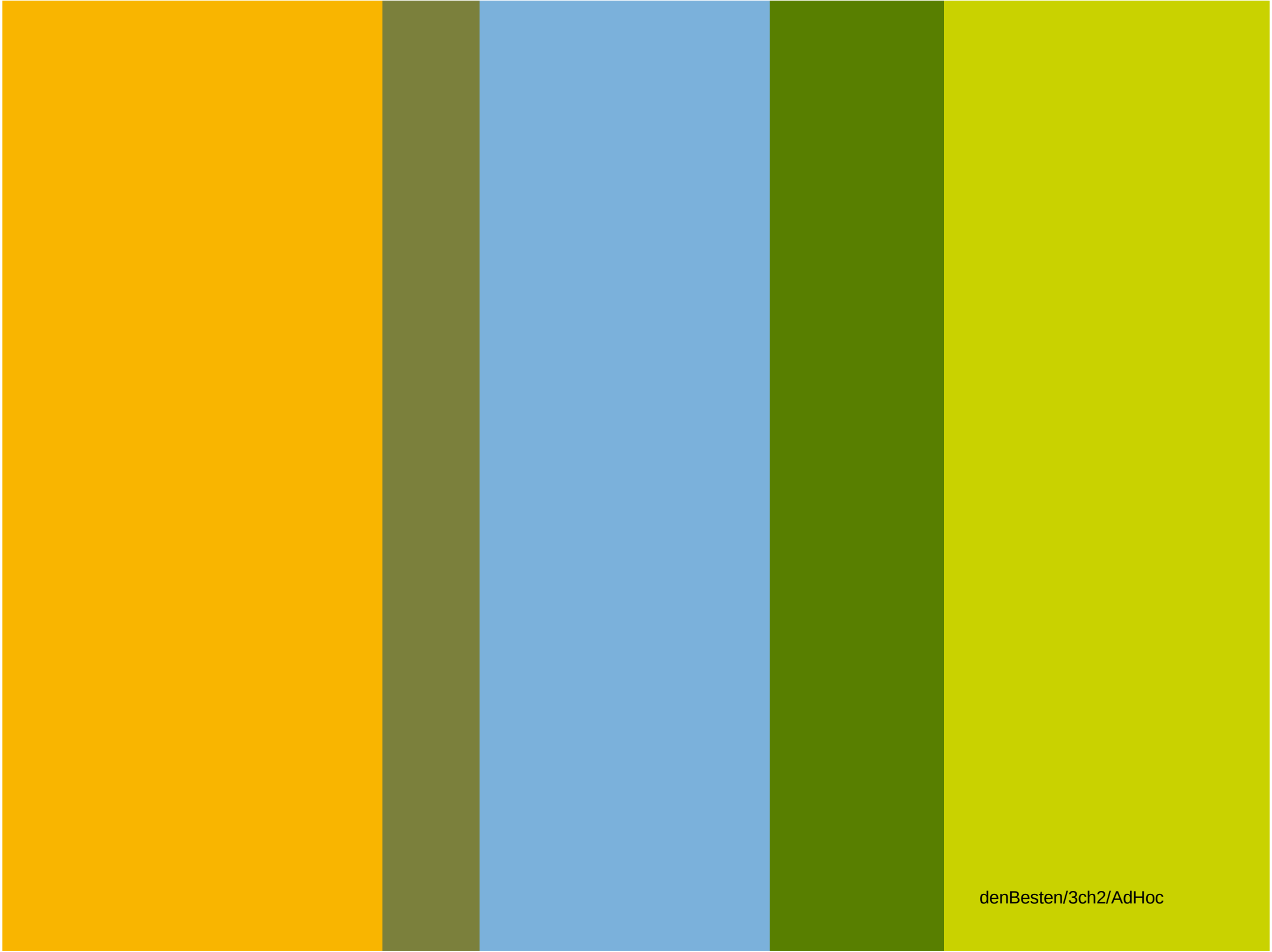
Additional suggestions

- Consider to simplify 2.5Gbps IL formula to:
  - Impact of last term is very small anyway

$$IL < 0.0023 \cdot f + 0.59 \cdot \sqrt{f} + \frac{0.064}{\sqrt{f}}$$

- Update low-frequency correction factor 5/10G
  - Consistency with low-frequency 1000BASE-T1 IL shape

$$IL < 0.002 \cdot f + 0.45 \cdot \sqrt{f} + \frac{\beta}{\sqrt{1+\alpha f}}$$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