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# **Supporting material for Clause 85 comments submitted**

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# Objective

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- **Technical completion of Clause 85**
- **Provide TBD values**

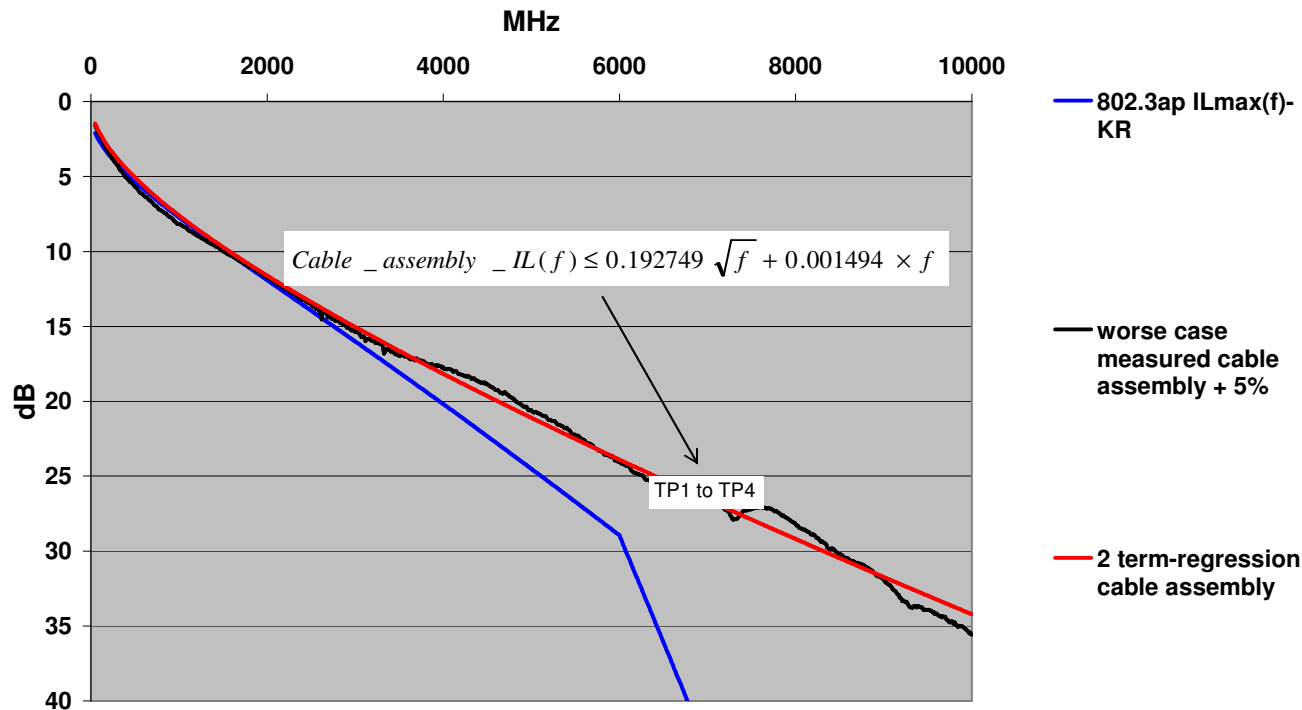


# Comment #458 – Cable assembly insertion loss

## Comment # 458

Provide values for TBDs in cable assembly insertion loss (85-1) for  $\sqrt{f}$  and  $f$ . Remove  $1/\sqrt{f}$  term. Add TBD cable assembly insertion loss equation as contributions from IL and power sum crosstalk to ICR are still under study.

CR4 and CR10 cable assembly IL specifications



Insertion Loss (f) =  $0.192749 \cdot \sqrt{f} + 0.001494 \cdot f$  TBD dB. Remove  $1/\sqrt{f}$  term. Given the CR4 and CR10 bandwidth compared to CX4 the  $1/\sqrt{f}$  loss function term is not necessary as a regression term.

# Comment #459 – Return loss

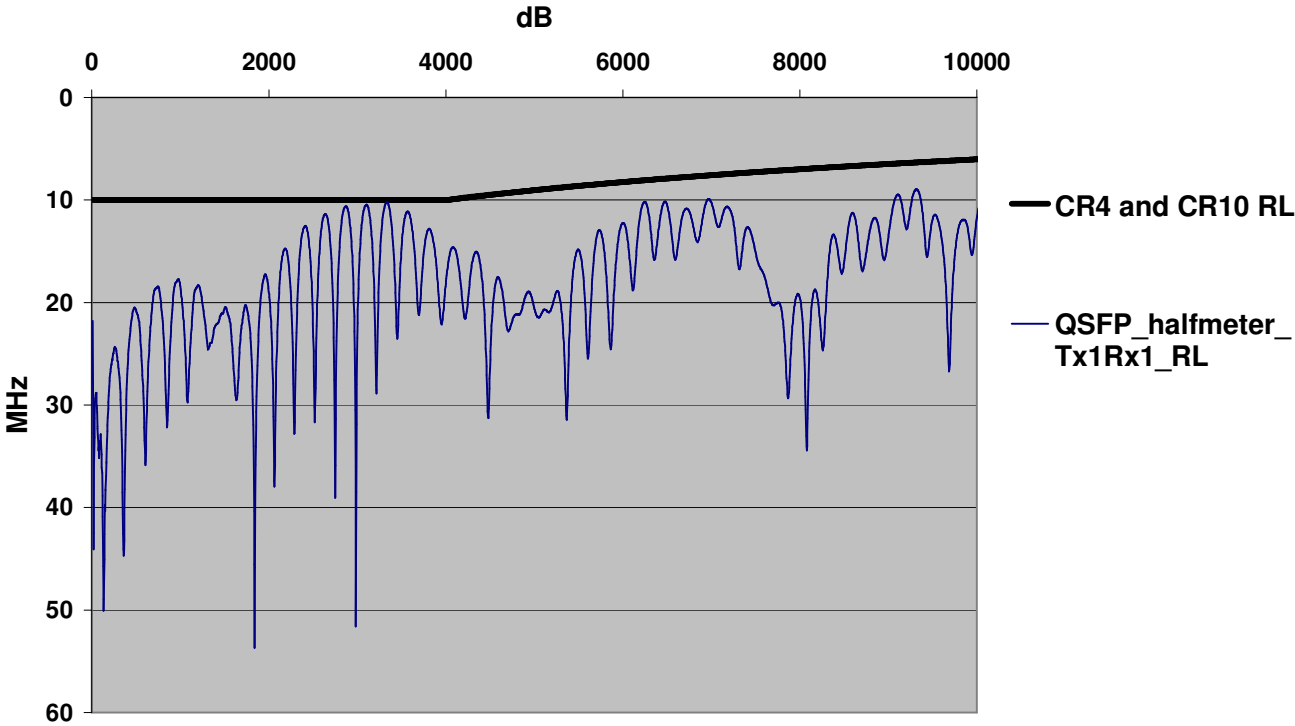
## Comment # 459

The return loss (in dB with f in MHz) of each pair of the 40GBASE-CR4 and 100GBASE-CR10 Cable assembly shall be:

Return\_loss(f)= 10 dB for 100 MHz <= f < 4000 MHz

Return\_loss(f)=10-10\*log(f/4000) for 4000 MHz <= f <= 10000 MHz

### CR4 and CR10 cable assembly RL specification



# Comment #453-#454- Crosstalk

## *Comment #453*

Define NEXT and MDNEXT to be used in the ICR calculation (PSXT) and remove individual limit specifications. The use of independent limit lines for each disturber is unnecessary as the individual impairments are not uniquely distinguished i.e., they are combined on a power sum basis to limit crosstalk in relation to insertion loss.

## *Comment #454*

Define FEXT and MDFEXT to be used in the ICR calculation (PSXT) and remove individual limit specifications; remove ELFEXT. The use of independent limit lines for each disturber is unnecessary as the individual impairments are not uniquely distinguished i.e., they are combined on a power sum basis to limit crosstalk in relation to insertion loss. In addition, ELFEXT is unnecessary as ICR enables crosstalk to insertion loss tradeoff.

$$\text{Cable Assembly\_PSXT}(f) = -10 \log(10^{-MDNEXT(f)/10} + 10^{-MDFEXT(f)/10}) \quad \text{dB}$$

# Comments #457 – Cable assembly ILD

## Comment # 457

Add cable assembly ILD specifications to limit cable assembly ILD. Add TBD to equation as contributions from IL and power sum crosstalk to ICR under consideration.

The cable assembly insertion loss deviation is the difference between the cable insertion loss and the fitted insertion loss determined using Equation (85-x).

$$ILD(f) = IL(f) - IL_{fitted}(f) \quad (85-x)$$

The ILD shall be within the region bounded by the following equations:

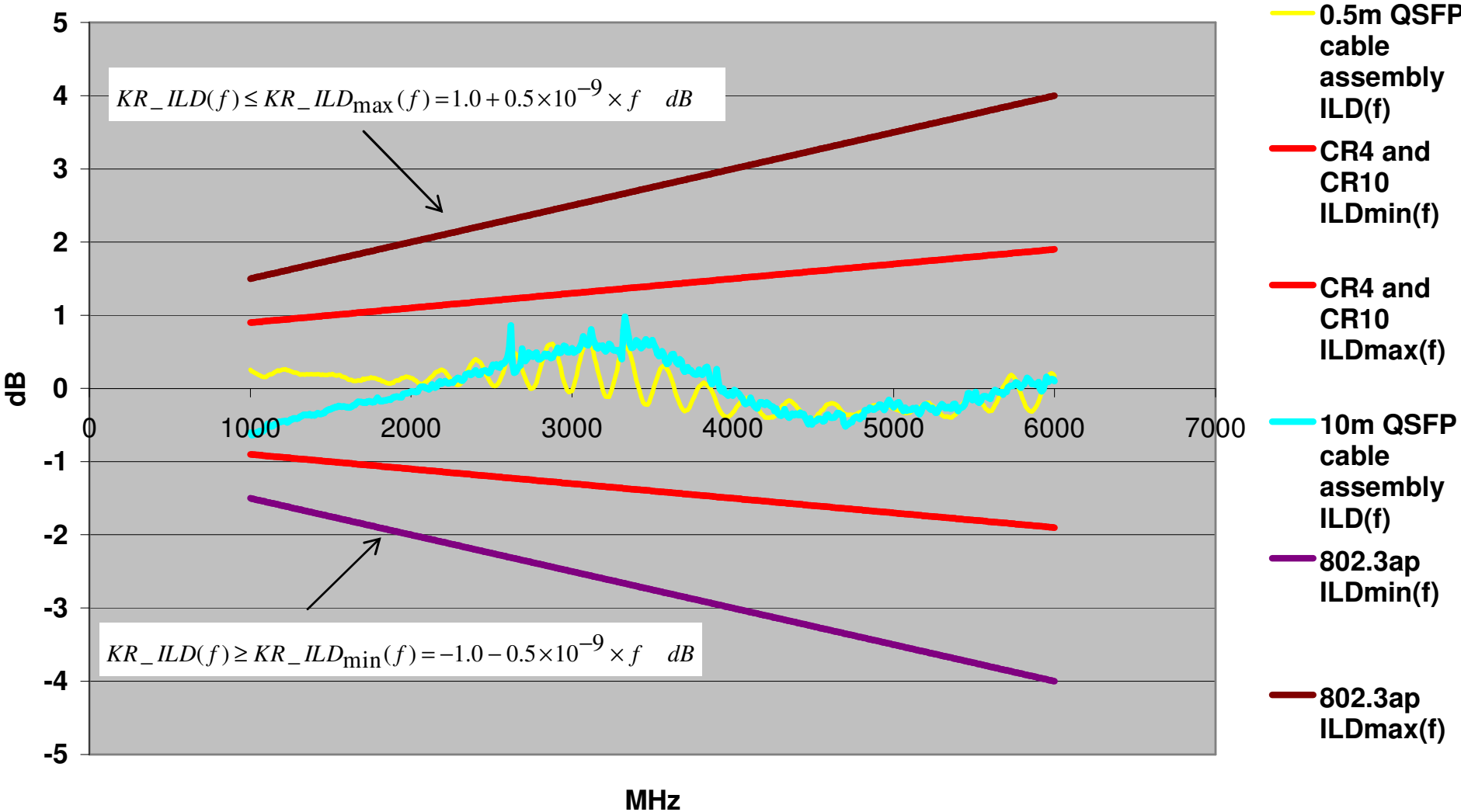
$$ILD_{max} = 0.7(TBD) + 0.2(TBD) \cdot 10^{-9} \cdot (f \cdot 10^6) \quad TBD \text{ dB}$$

$$ILD_{min} = -0.7(TBD) - 0.2(TBD) \cdot 10^{-9} \cdot (f \cdot 10^6) \quad TBD \text{ dB}$$

$$1000 \text{ MHz} \leq f \leq 6000 \text{ MHz}$$

# Comments #457 – Cable assembly ILD

## 802.3ap ILD vs CR4 and CR10 ILD 0.5m and 10m cable assembly





# Comments #456 – ICR

*Please note the comment #456 equation is for channel ICR and incorrectly submitted for cable assembly ICR.*

## **Comment # 456**

**Add cable assembly ICR specification to limit the total multi-disturber cable assembly crosstalk noise. Add TBD to equation as contributions from IL and power sum crosstalk to ICR under consideration.**

**The cable assembly insertion loss to crosstalk ratio (ICR) is the ratio of the cable assembly insertion loss to the total cable assembly crosstalk loss determined using Equation (89.xx).**

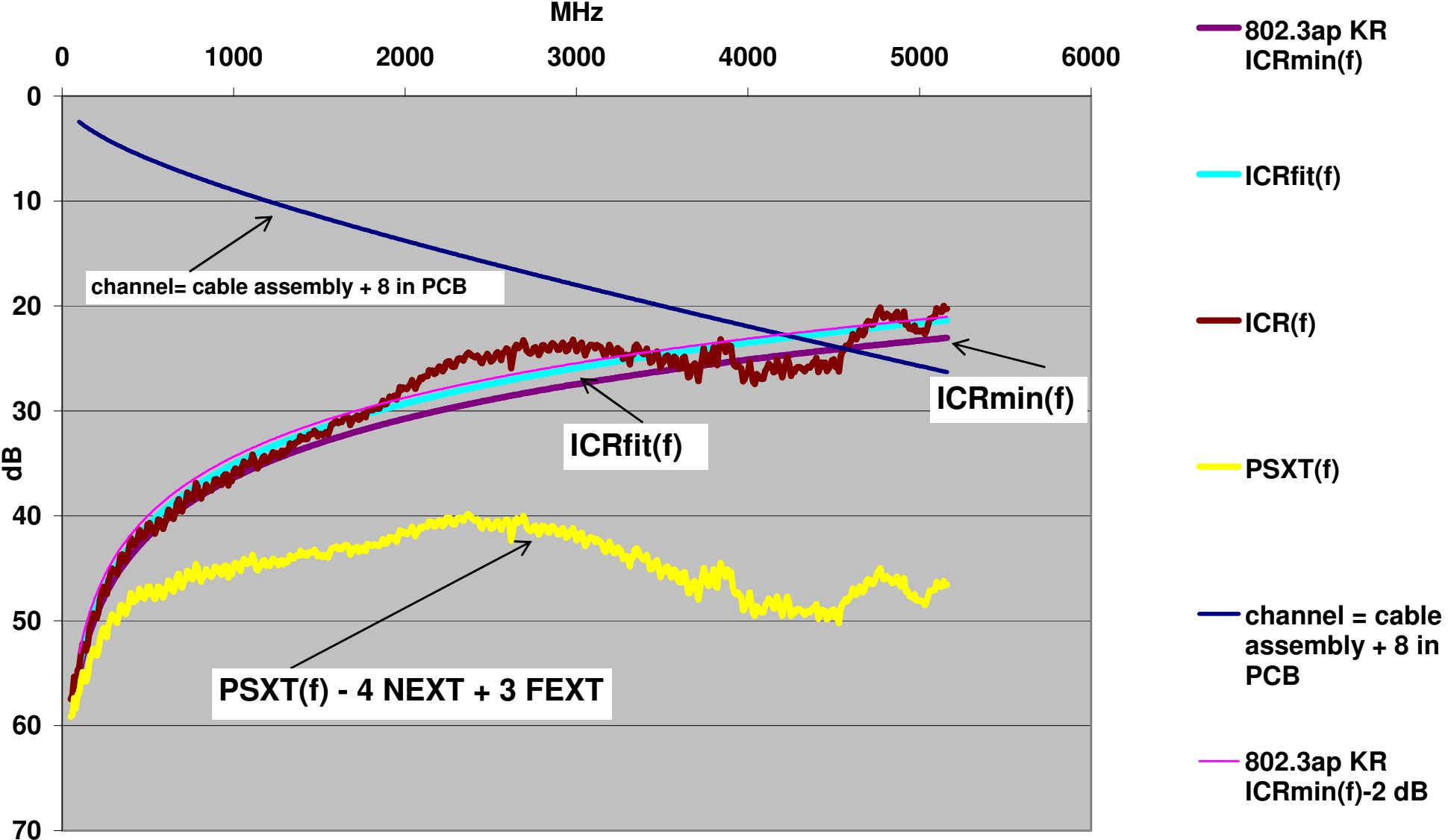
$$\text{ICR}(f) = -\text{IL}(f) + \text{PSXT}(f) \text{ (TBD) dB}$$

**100MHz ≤ f ≤ 5156.25 MHz**

**Add equation:  $\text{ICR}_{\text{fit}}(f) \geq \text{ICR}_{\text{min}}(f) = 23.3 - 18.7 \cdot \text{LOG}((f \cdot 10^6) / (5 \cdot 10^9)) - 2.5$  (TBD) dB**

**Note: 2.5 dB of the 3 dB signal-to-noise ratio penalty related to insertion loss deviation embodied in 802.3ap  $\text{ICR}_{\text{min}}$  is applied as 2.5 dB  $\text{ICR}_{\text{min}}$  margin to account for reduction in ILD penalty for CR4 and CR10**

# Insertion to crosstalk ratio Channel = 10m cable assembly + 8 inches of PCB differential trace loss



# Comments #xxx – ICR

## *Comment # xxx*

Add cable assembly ICR specification to limit the total multi-disturber cable assembly crosstalk noise. Add TBD to equation as contributions from IL and power sum crosstalk to ICR under consideration.

The cable assembly insertion loss to crosstalk ratio (ICR) is the ratio of the cable assembly insertion loss to the total cable assembly crosstalk loss determined using Equation (89.xx).

$$\text{ICR}(f) = -\text{IL}(f) + \text{PSXT}(f) \text{ (TBD) dB}$$
$$100\text{MHz} \leq f \leq 5156.25 \text{ MHz}$$

Add equation:  $\text{ICR}_{\text{fit}}(f) \geq \text{ICR}_{\text{min}}(f) = 23.3 - 18.7 * \text{LOG}((f * 10^6) / (5 * 10^9)) + \text{scale factor}$  (TBD) dB

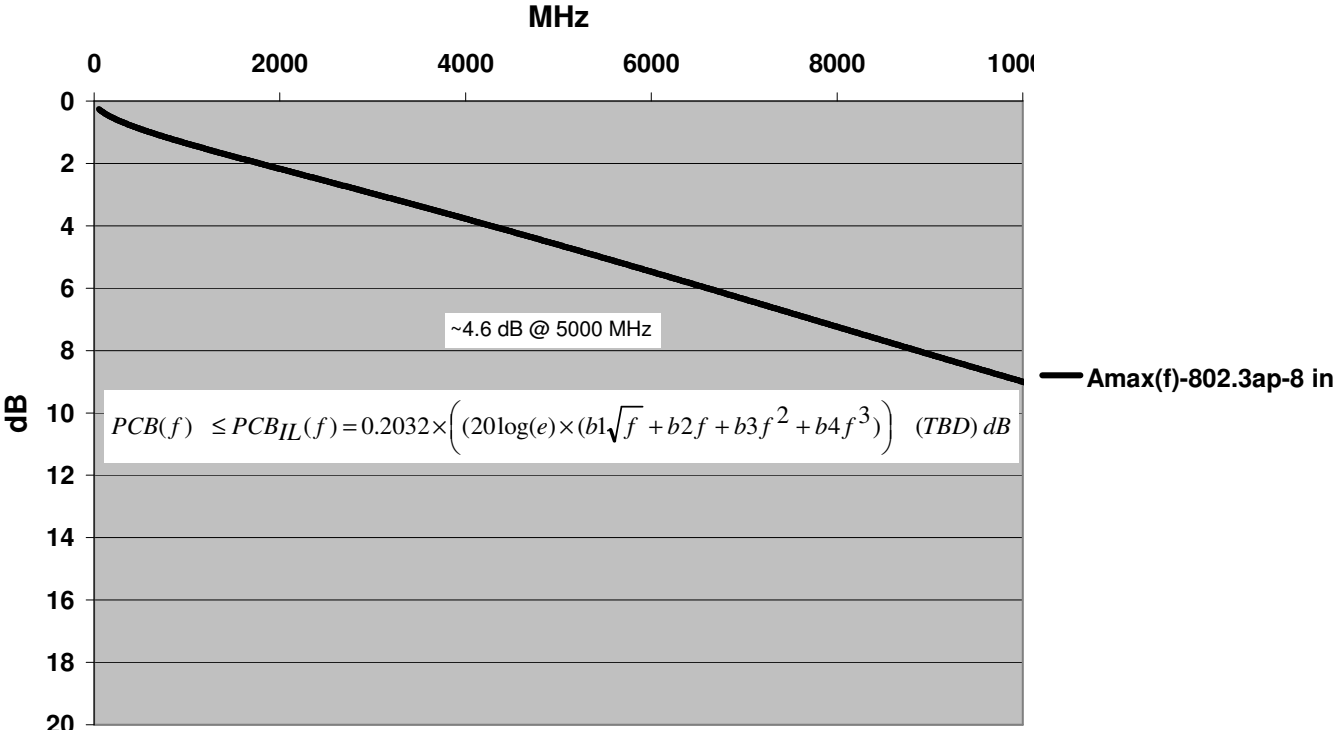
# Comments #458 – PCB trace loss equation

**Comment # 448**

The maximum insertion loss (in dB with f in MHz) for the transmitter and receiver differential controlled impedance printed circuit boards for each differential lane shall be:

Insertion Loss(f) ≤ (0.2032) \* [20 \* log(e) \* (2.00E-05 \* sqrt(f \* 10^6) + 1.1E-10 \* (f \* 10^6) + 3.2E-20 \* ((f \* 10^6)^2 + 1.2E-30 \* (f \* 10^6)^3)] TBD dB for all frequencies from 100 MHz to 6000 MHz.

## Differential PCB trace loss 8 inches (Amax)



Insertion Loss(f) represents 8 inches (0.2032 m) of the maximum fitted attenuation (Amax) due to trace skin effect and dielectric properties as defined in Annex 69B.4.2.