Fmax for Coupling & Screening Attenuation

Eric DiBiaso

Sept 18, 2019

What's in Draft 2.1?

149.7.1.4 Coupling attenuation

In order to limit the noise at the receiver as well as emissions, when tested using the IEC 62153-4-7 triaxial tube in tube method as specified in Annex 149A, the MultiGBASE-T1 link segment shall meet the coupling attenuation values determined by using Equation (149–24).

$$Coupling\ Attenuation(f) \geq \begin{cases} 70 & 30 \leq f \leq 750\ \text{MHz} \\ 50 - 20\log_{10}\left(\frac{f}{7500}\right) & 750 \leq f \leq \text{Fmax MHz} \end{cases} (\text{dB}) \qquad (149\text{–}24)$$

where

f is the frequency in MHz; $30 \leq f \leq$ Fmax

$$\text{Fmax} = 4000 \times S$$

PHY type	*S*
10GBASE-T1	1
5GBASE-T1	0.5
2.5GBASE-T1	0.25

The coupling attenuation is illustrated in Figure 149–44.

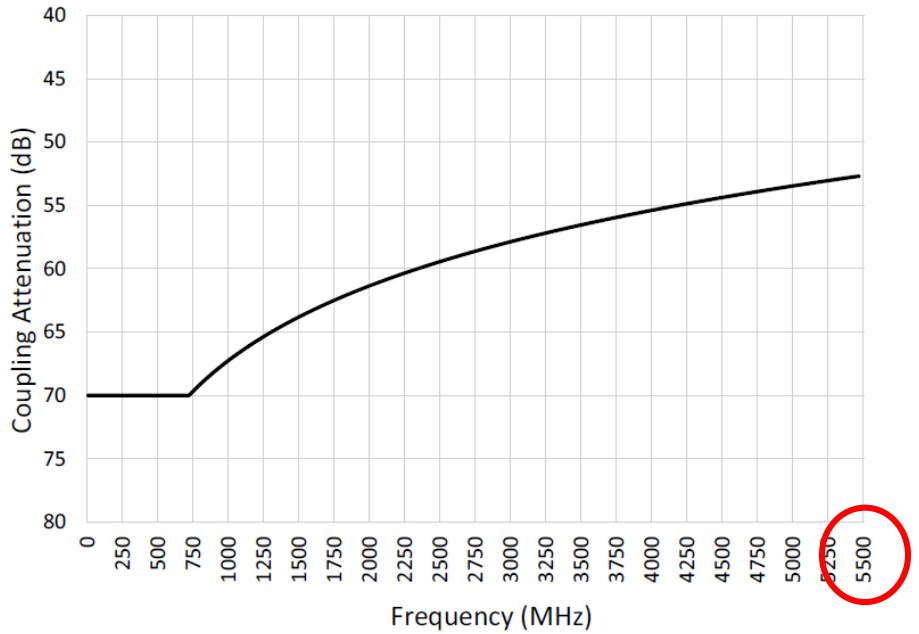

Figure 149–44—Coupling attenuation calculated using Equation (149–24)

149.7.1.5 Screening attenuation

The minimum screening attenuation for a link segment is 45 dB for all frequencies between 30 MHz and Fmax MHz. Screening attenuation is tested as specified in IEC 62153-4-7 using triaxial tube-in-tube method. Additional screening attenuation test methodologies are defined in Annex 149A.

Option 1: Equation (149-24) is correct

The coupling attenuation is illustrated in Figure 149–44.

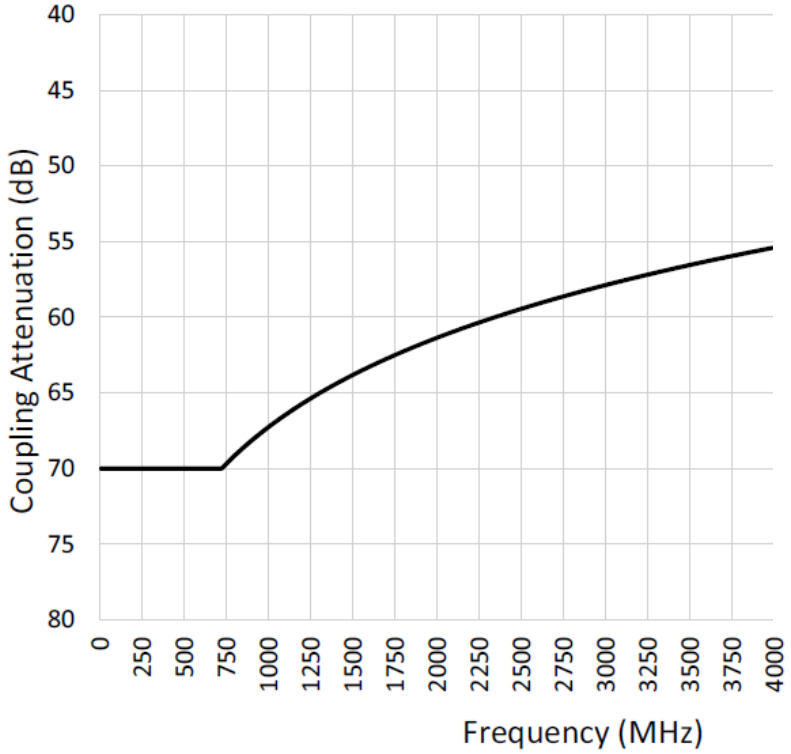

Figure 149–44—Coupling attenuation calculated using Equation (149–24)

Only need to modify Figure 149-44 by removing all frequencies above 4000MHz.

Or is Figure 149-44 correct?

Original Motion

http://www.ieee802.org/3/ch/public/may18/motions_3ch_01_0518.pdf

Motion #8

Move to adopt Coupling Attenuation Reference Test Limit given by the equation:

$$\begin{cases} 70 & 30 \le f \le 750 \text{ MHz} \\ 50 - 20\log(f / 7500) & 750 \le f \le 5500 \text{ MHz} \end{cases} \text{ dB}$$

30 MHz ≤ f ≤ 5500 MHz frequency f in MHz as shown on page 9 of mueller_3ch_02a_0518.pdf for all 3 speeds for frequencies from 30 MHz to 5500 MHz.

- M: Thomas Müller
- S: Masood Sharif
- (Technical >= 75%)
- Y: 19 N: 0 A: 17
- Motion Passes

Change occurred between Draft 1.1 and 1.2

Or is Figure 149-44 correct?

2nd Motion

http://www.ieee802.org/3/ch/public/mar19/motions_3ch_01a_0319.pdf

Motion # 11

Replace subclause 149.7.1.5 Shielding attenuation with subclause 149.7.1.5 Screening attenuation, title and content, as shown on page 1 of mueller_3ch_04_0319.pdf and grant editorial license to implement the proposal.

M: Thomas Mueller

S: Gerrit den Besten

(Technical >= 75%)

Y 31 N 0 A 12

Motion Passes

http://www.ieee802.org/3/ch/public/mar19/mueller_3ch_04_0319.pdf

149.7.1.4 Coupling Attenuation

In order to limit the noise at the receiver as well as emissions, the 2.5G/5G/10GBASE-T1link segment shall meet the coupling attenuation values determined by using Equation (149-26). The coupling attenuation is tested as specified in IEC 62153-4-7 using triaxial tube-in-tube method. Additional coupling attenuation test methodologies are defined in Annex 149A.

$$\text{Coupling attenuation (f)} \geq \begin{pmatrix} 70 & 30 \leq f < 750 \\ 50 - 20\log({}^{f}/_{7500}) & 750 \leq f \leq 4000 * S \end{pmatrix} \text{ (dB)} \qquad \text{(149-26)}$$

where

f is the frequency in MHz; $30 \leq f \leq 4000 * S$

The coupling attenuation is illustrated in Figure 149–31.

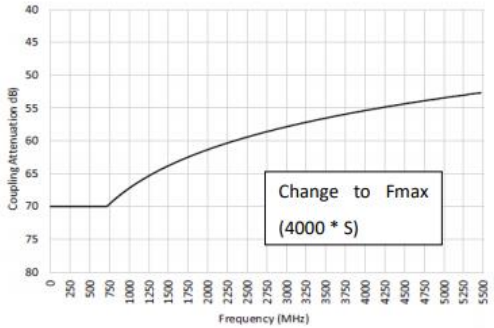

Figure 149-31: Coupling attenuation calculated using equation (149-26)

149.8.2.2 MDI coupling attenuation

149.7.1.5 Screening Attenuation

The minimum screening attenuation for a link segment is 45 dB for all frequencies between 30 MHz and Fmax MHz. Screening attenuation is tested as specified in IEC 62153-4-7 using triaxial tube-in-tube method. Additional screening attenuation test methodologies are defined in Annex 149A.

Page 1

Should Fmax be aligned to Transmitter PSD?

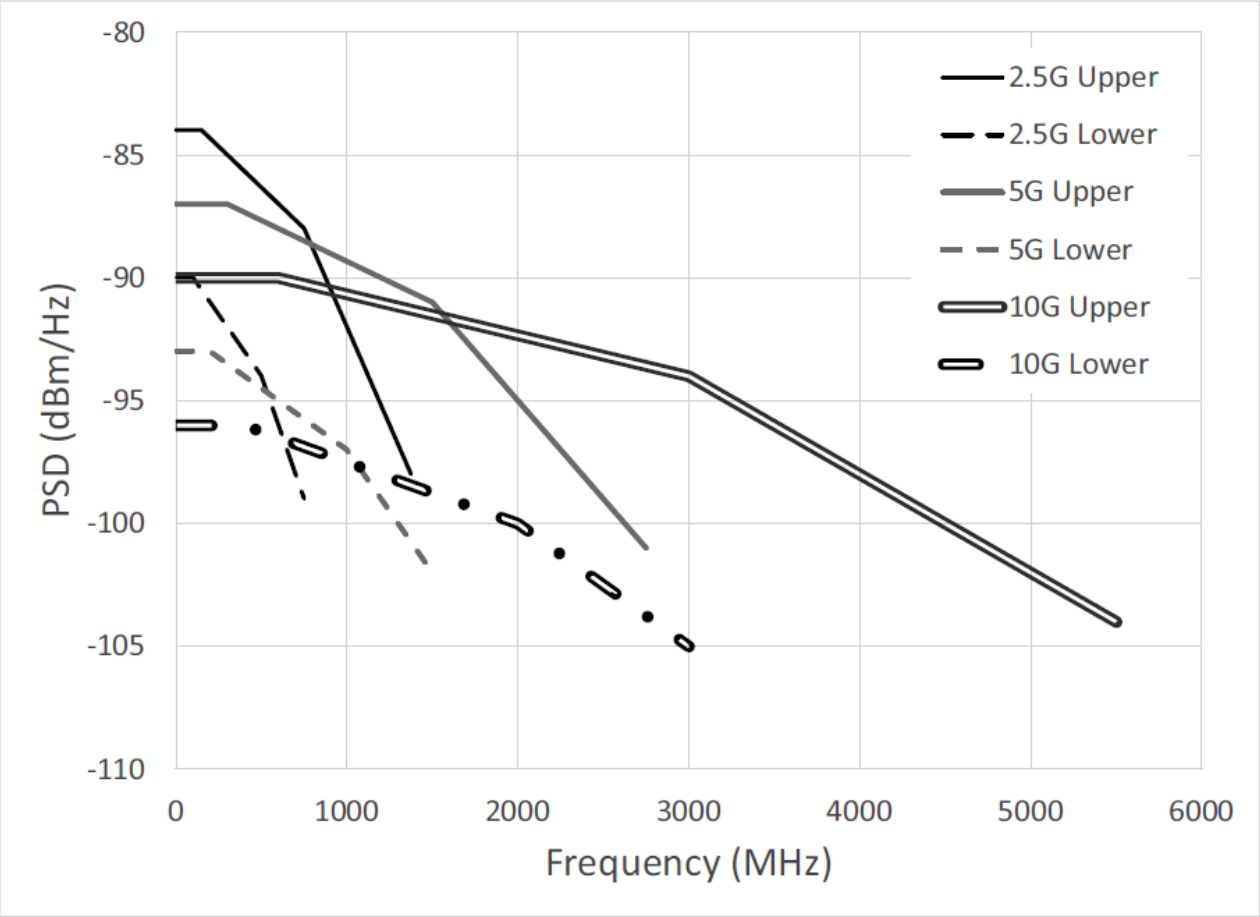

Figure 149–40—Transmitter Power Spectral Density, upper and lower masks

$$UPSD(f) = \begin{cases} -90 - K & \text{dBm/Hz} \quad 0 < f \le 600 \times S \\ -89 - K - \dfrac{f}{600 \times S} & \text{dBm/Hz} \quad 600 \times S < f \le 3000 \times S \\ -82 - K - \dfrac{f}{250 \times S} & \text{dBm/Hz} \quad 3000 \times S < f \le 5500 \times S \end{cases}$$

$$LPSD(f) = \begin{cases} -96 - K & \text{dBm/Hz} \quad 5 < f \le 400 \times S \\ -95 - K - \dfrac{f}{400 \times S} & \text{dBm/Hz} \quad 400 \times S < f \le 2000 \times S \\ -90 - K - \dfrac{f}{200 \times S} & \text{dBm/Hz} \quad 2000 \times S < f \le 3000 \times S \end{cases}$$

Option 2: Change Fmax to 5500 x S

149.7.1.4 Coupling attenuation

In order to limit the noise at the receiver as well as emissions, when tested using the IEC 62153-4-7 triaxial tube in tube method as specified in Annex 149A, the MultiGBASE-T1 link segment shall meet the coupling attenuation values determined by using Equation (149–24).

$$Coupling\ Attenuation(f) \geq \begin{cases} 70 & 30 \leq f \leq 750\ \text{MHz} \\ 50 - 20\log_{10}\left(\frac{f}{7500}\right) & 750 \leq f \leq \text{Fmax MHz} \end{cases} (\text{dB}) \qquad (149\text{–}24)$$

where

f is the frequency in MHz; $30 \leq f \leq$ Fmax

The coupling attenuation is illustrated in Figure 149–44.

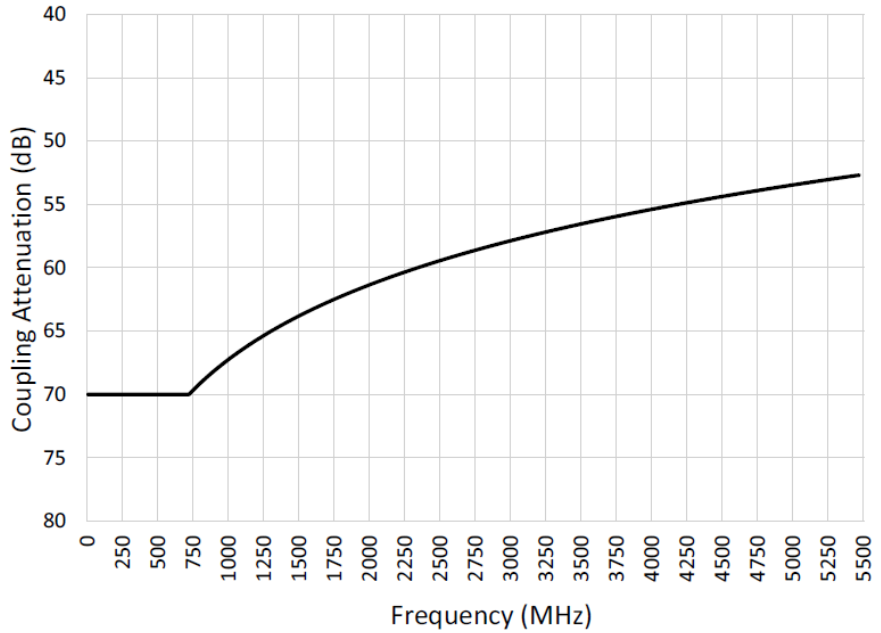

Figure 149–44—Coupling attenuation calculated using Equation (149–24)

149.7.1.5 Screening attenuation

The minimum screening attenuation for a link segment is 45 dB for all frequencies between 30 MHz and Fmax MHz. Screening attenuation is tested as specified in IEC 62153-4-7 using triaxial tube-in-tube method. Additional screening attenuation test methodologies are defined in Annex 149A.

Conclusions

- Two solutions were given to resolve the Fmax discrepancy between equation 149-24 and Figure 149-44.
- My recommendation is that Coupling and Screening attenuation should be aligned with upper frequency limit of Transmitter PSD

Thank You!!!