
802.3cy coupling- and screening attenuation

August 3rd 2021

Thomas Müller (Rosenberger)

802.3cy screening and coupling attenuation

Scope

- To limit EMC emissions, ingress noise and crosstalk on a shielded automotive link segments, coupling- and screening attenuation requirements are the generally established parameter to specify.
- Annex 149A from 802.3ch describes the coupling- and screening attenuation test methodology to measure MultiGBASE-T1 link segments based on IEC 62153-4-7 triaxial tube in tube method.

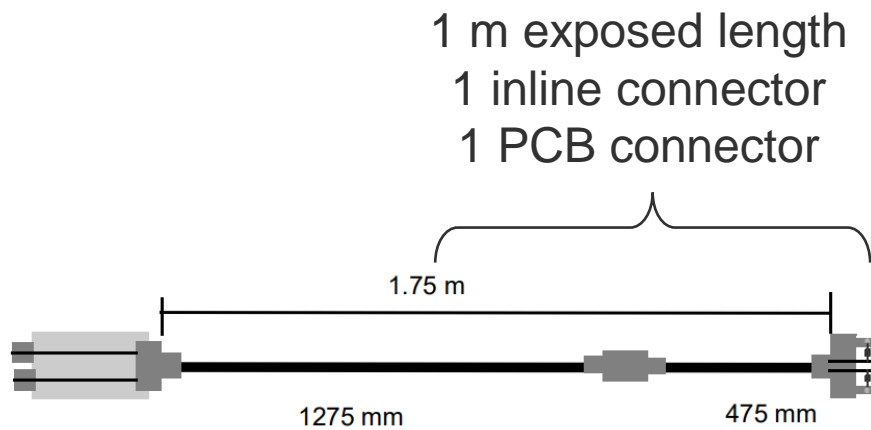


Figure 149A-1—Coupling attenuation reference cable assembly

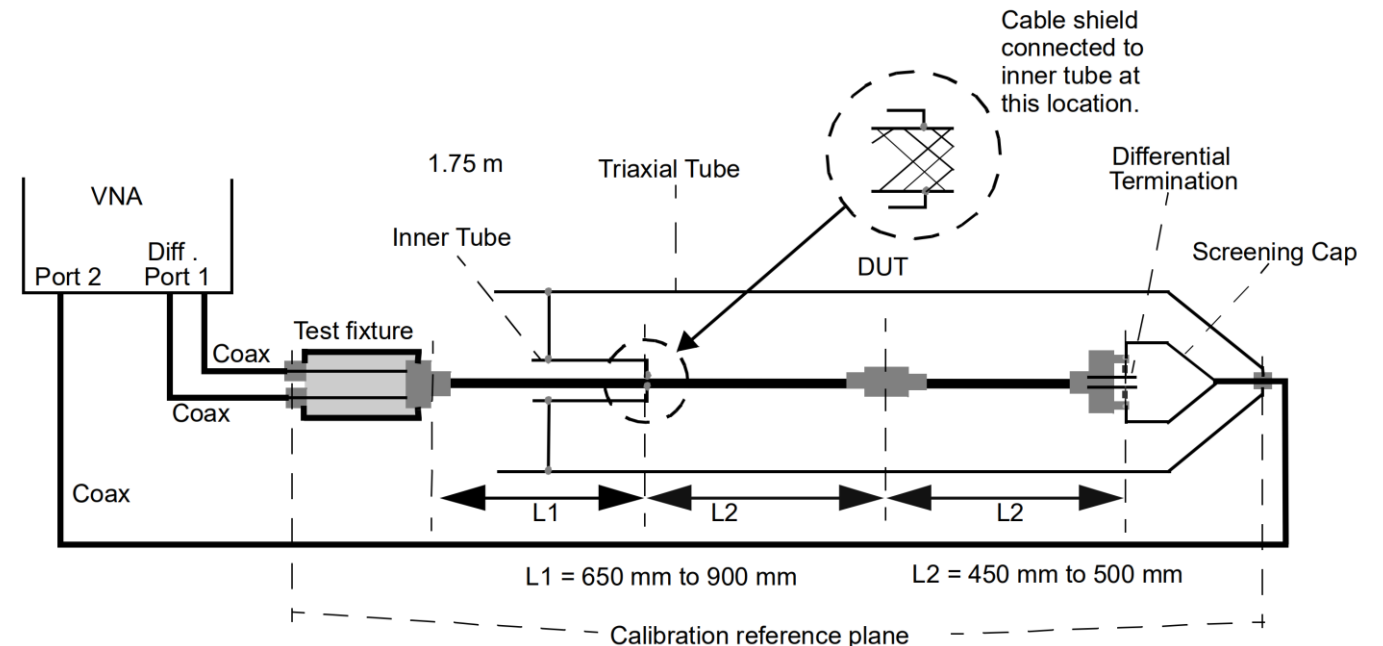


Figure 149A-2—Coupling attenuation reference cable assembly measurement setup

802.3cy screening and coupling attenuation

Additional information from previous presentations

Related to shielding measurement presented before

- [mueller_3ch_01a_1118.pdf](#)
- [DiBiaso_Bergner_3ch_01_1117.pdf](#)
- [180516_STP_cable_r1.pdf](#)
- [mueller_3ch_01_1117.pdf](#)
- [Measurement%20of%20Coupling%20Attenuation%20for%20NGAUTO.pdf](#)
- [ohni_3ch_01a_1118.pdf](#)
- [mueller_3ch_02a_0518.pdf](#)

Related to ingress noise and emissions

- [Cohen_Shirani_3ch_01_1108.pdf](#)
- [mueller_3ch_03_0518.pdf](#)
- [farjarad_3ch_01b_0918.pdf](#)

Information related to link segment crosstalk within wiring harness

- [mueller_3cy_01_03_15_21.pdf](#)

802.3cy screening and coupling attenuation

802.3ch limit review

- Coupling attenuation independent from data rate defined up to 4 GHz as below
- Screening attenuation defined to be ≥ 45 dB up to f_{\max} (1 / 2 / 4 GHz)

$$\text{Coupling Attenuation}(f) \geq \begin{cases} 70 & 30 \leq f < 750 \text{ MHz} \\ 50 - 20 \log_{10} \left(\frac{f}{7500} \right) & 750 \leq f \leq 4000 \text{ MHz} \end{cases} \text{ (dB)} \quad (149-24)$$

where

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

149.7.1.5 Screening attenuation

Where shielded balanced pair cabling is used, the minimum screening attenuation for a link segment is 45 dB for all frequencies between 30 MHz and F_{\max} 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.

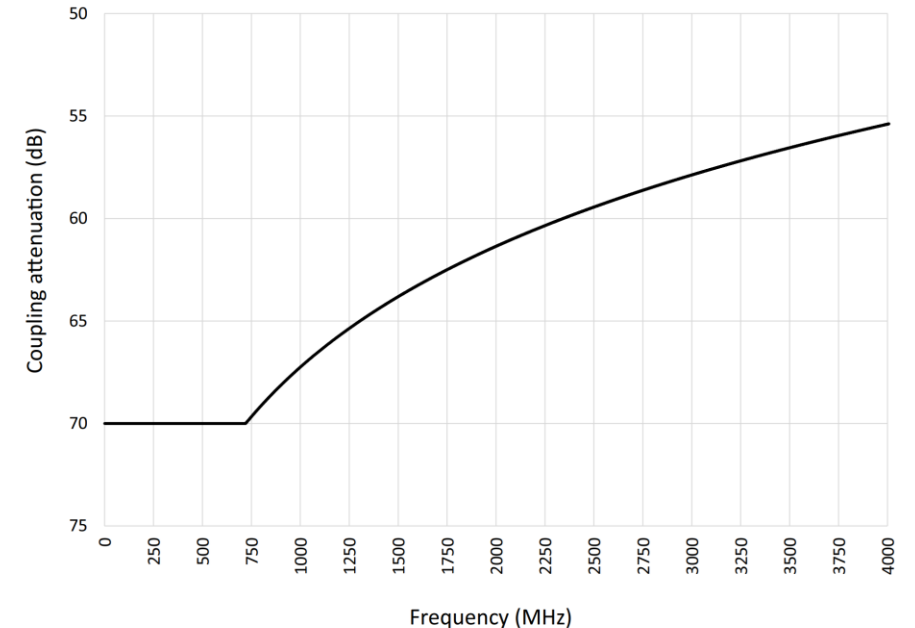


Figure 149-45—Coupling attenuation calculated using Equation (149-24)

802.3cy test fixture measurement results

Measurement setup

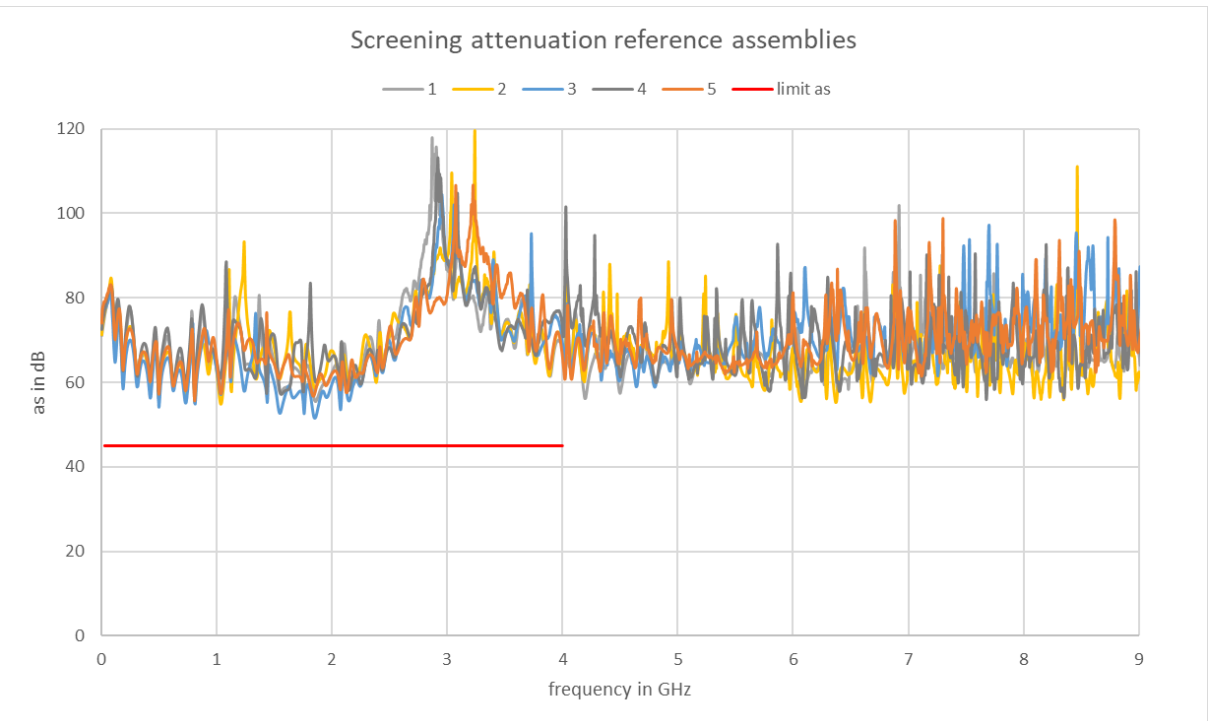
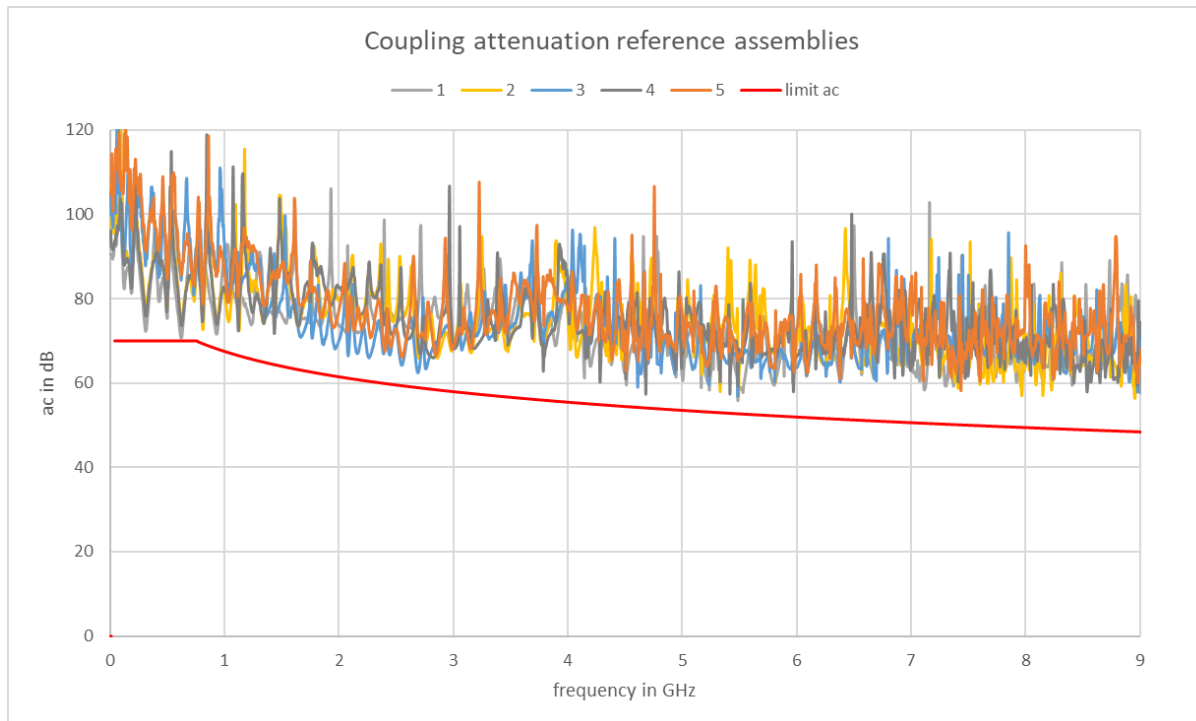
- Reference channel assembly with 1 m exposed cable length, 1 inline connector and PCB connector in IEC 62153-4-7 triaxial setup.



802.3cy test fixture measurement results

Measurement results

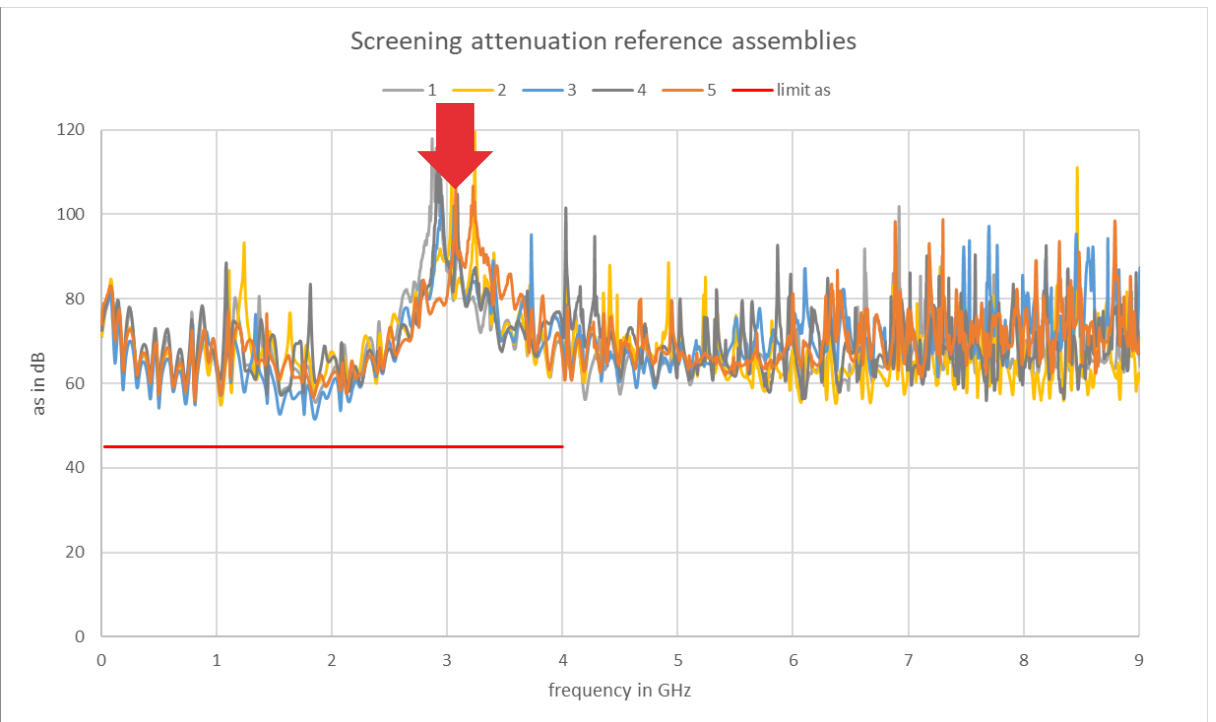
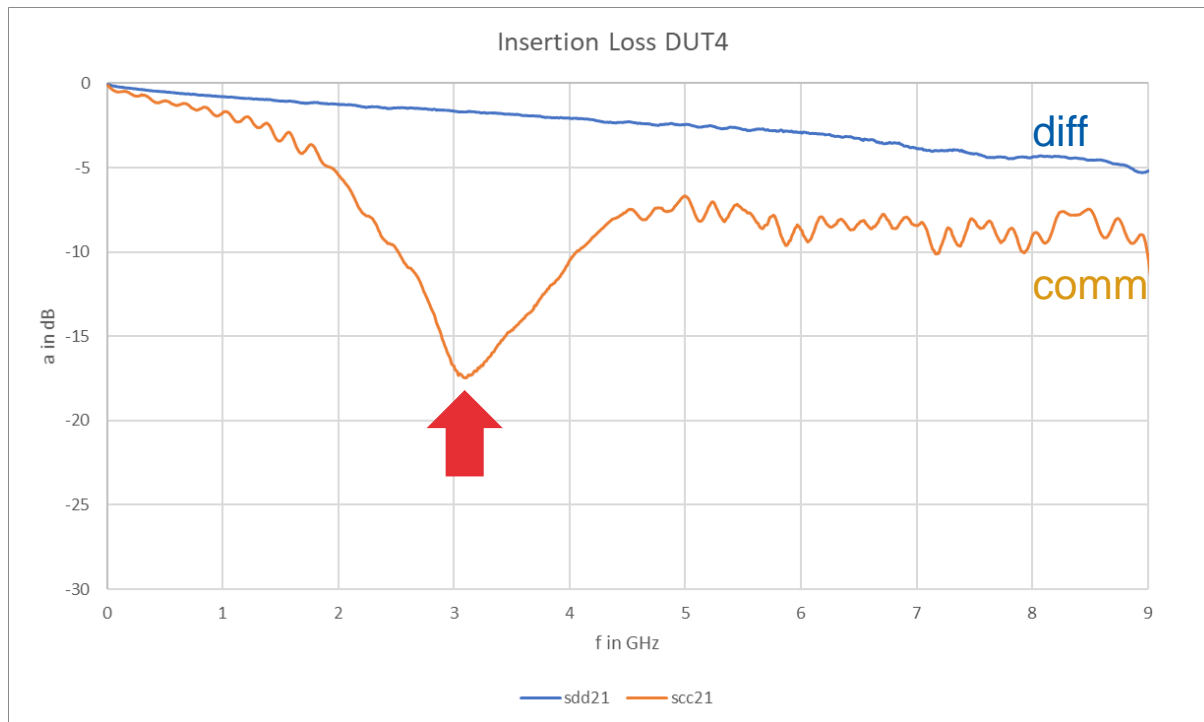
- Beyond 4 GHz screening- and coupling attenuation get very similar
- Balance deteriorates over frequency
- Common mode insertion loss higher than differential insertion loss causes better screening attenuation values compared to coupling attenuation



802.3cy test fixture measurement results

Measurement results

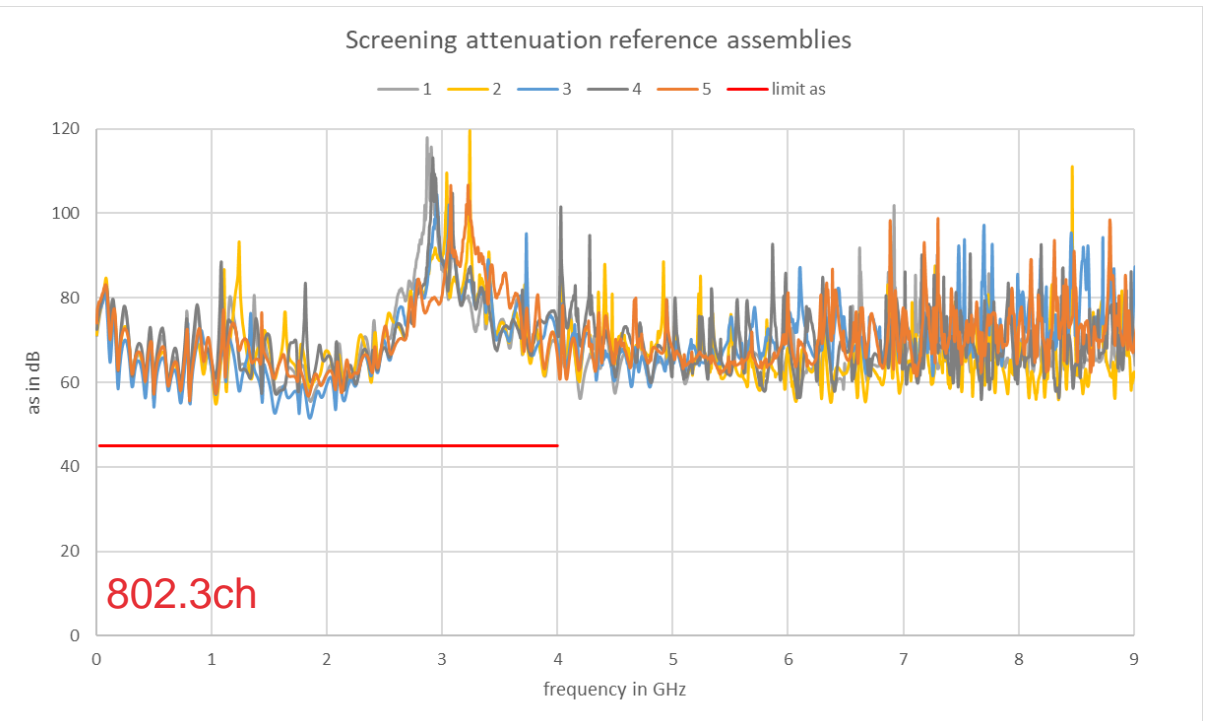
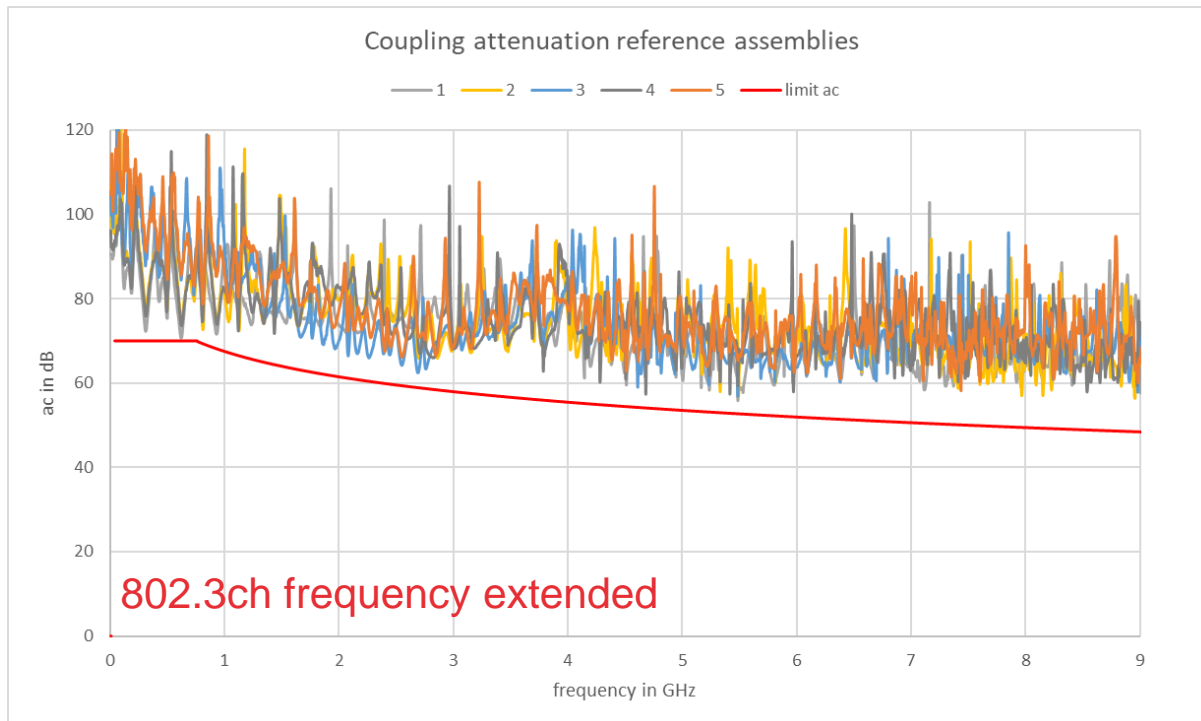
- High common mode IL causes better measured screening attenuation
- Common mode IL not specified and relatively unpredictable
- Differential IL must have a defined slope without resonances to fulfil link segment IL



802.3cy test fixture measurement results

Measurement results

- Proposal: coupling attenuation up to 9 GHz and end screening attenuation at 4 GHz



802.3cy test fixture measurement results

Summary

- Propose to the group to consider the coupling- and screening attenuation requirements for the 802.3cy link segment in the measurement setup defined in Annex 149A.

$$\text{Coupling Attenuation}(f) \geq \begin{cases} 70 & 30 \leq f < 750 \text{ MHz} \\ 50 - 20 \log_{10} \left(\frac{f}{7500} \right) & 750 \leq f \leq 9000 \text{ MHz} \end{cases} \text{ (dB)}$$

$$\text{Screening Attenuation}(f) \geq 45 \text{ dB} \quad 30 \leq f < 4000 \text{ MHz}$$

