Proposed TCL and Coupling Attenuation requirements: Technical presentation and analysis

Peter Fischer / BKS Kabel-Service AG

9/22/2021

Agenda

- Current limits in IEEE 802.3cg
- Changes in length and device number
- New proposed limits (all ffs)

New limits must be related to existing limits and a formula related to the suggested change.

Current limits in IEEE 802.3cg

Limits are given for information/ comparison:

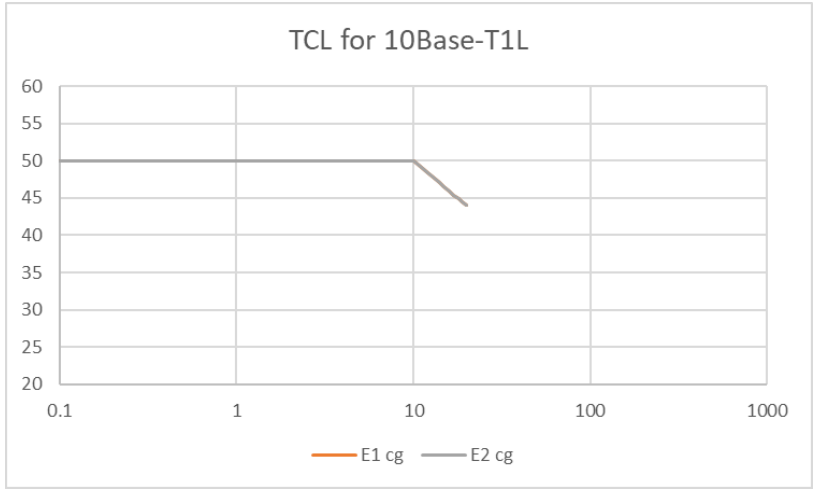
- 10Base-T1L

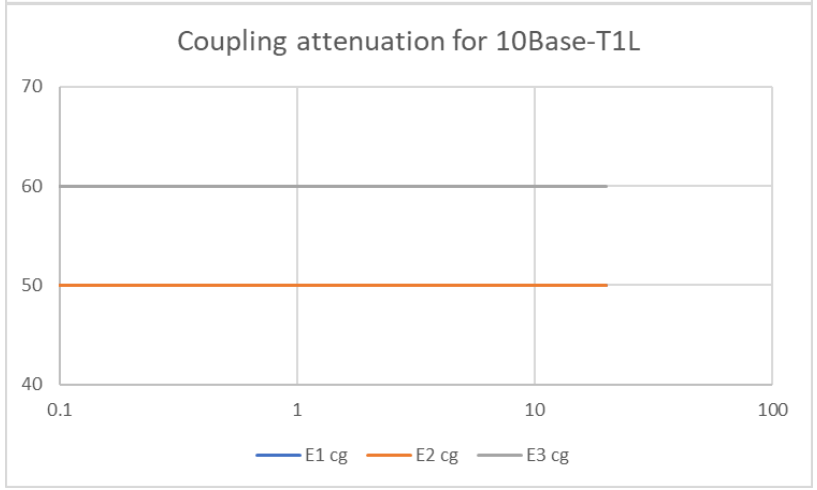
Table 146–5—Differential to common mode conversion

	Frequency (MHz)	E_1	E_2
TCL	$0.1 \le f \le 10$	≥ 50 dB	≥ 50 dB
TCL	$10 < f \le 20$	$\ge 50 - 20\log_{10}\left(\frac{f}{10}\right)$ dB	$\ge 50 - 20\log_{10}\left(\frac{f}{10}\right)$ dB

Table 146–6—Coupling attenuation

Frequency (MHz)	(dB)		
	E_1	E_2	E_3
0.1 to 20	≥ 50	≥ 50	≥ 60





Current limits in IEEE 802.3cg

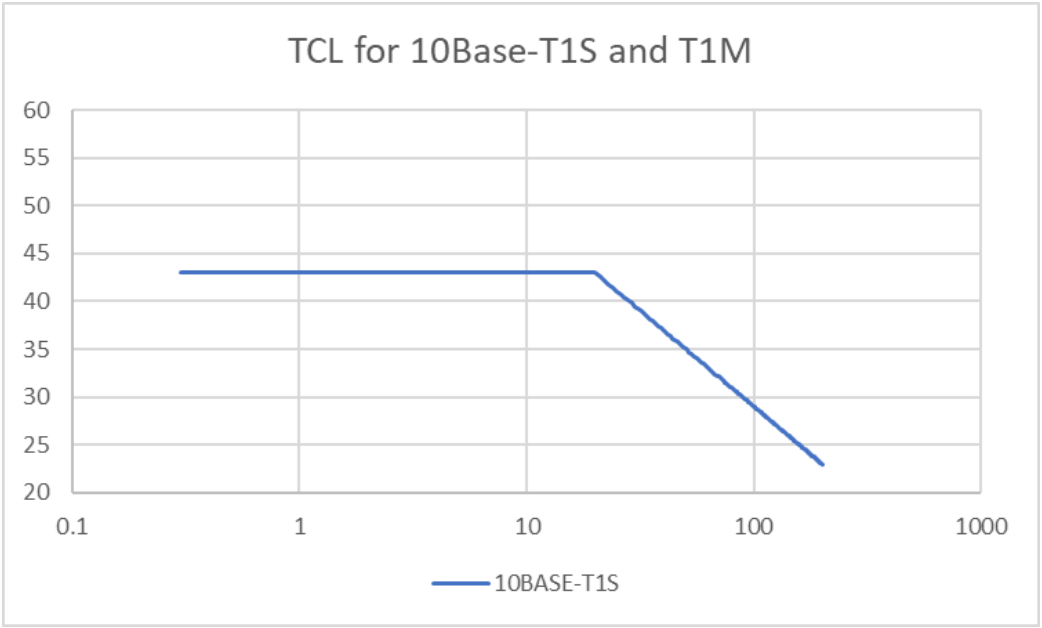
Limits are given for information/ comparison:

- 10Base-T1S

$$\text{Mode conversion loss}(f) > \begin{cases} 43 & 0.3 \le f < 20 \\ 43 - 20\log_{10}\left(\frac{f}{20}\right) & 20 \le f \le 200 \end{cases} \text{ dB} \qquad (147\text{–}5)$$

where

f is the frequency in MHz; $0.3 \le f \le 200$



- 10Base-T1M: Same as 10Base-T1S

147.8.3 Mode conversion loss

The mixing segment shall meet the mode conversion loss characteristics specified for link segments in 147.7.3 between any two MDI attachment points.

Changes in length and device number

- The length will change from IEEE 802.3cg to IEEE 802.3da from 25m to 50m or 75m.
- This change shall be covered by the following formula:

$$Value_{new} = Value_{old} + 20 \cdot log\left(\frac{length\_new}{length\_old}\right)$$

Change in length: 50m: +6dB; 75m: +9.5dB

Changes in length and device number

- The number of devices will change from IEEE 802.3cg to IEEE 802.3da from 8 to 16.
- This change shall be covered by the following formula:

$$Value_{new} = Value_{old} + 20 \cdot log\left(\frac{number\_new}{number\_old}\right)$$

- Change in number: +6dB
- Total change: Change in length + Change in number

→ 50m, 16 devices : +12dB; 75m, 16 devices: +15.5dB

New proposed limits (all ffs)

For IEEE 802.3da the following limits are proposed for TCL:

E1_50m: $55 - 20 * \log\left(\frac{f}{20}\right), Plateau\ 50dB,\ 0.3\ to\ 200MHz$

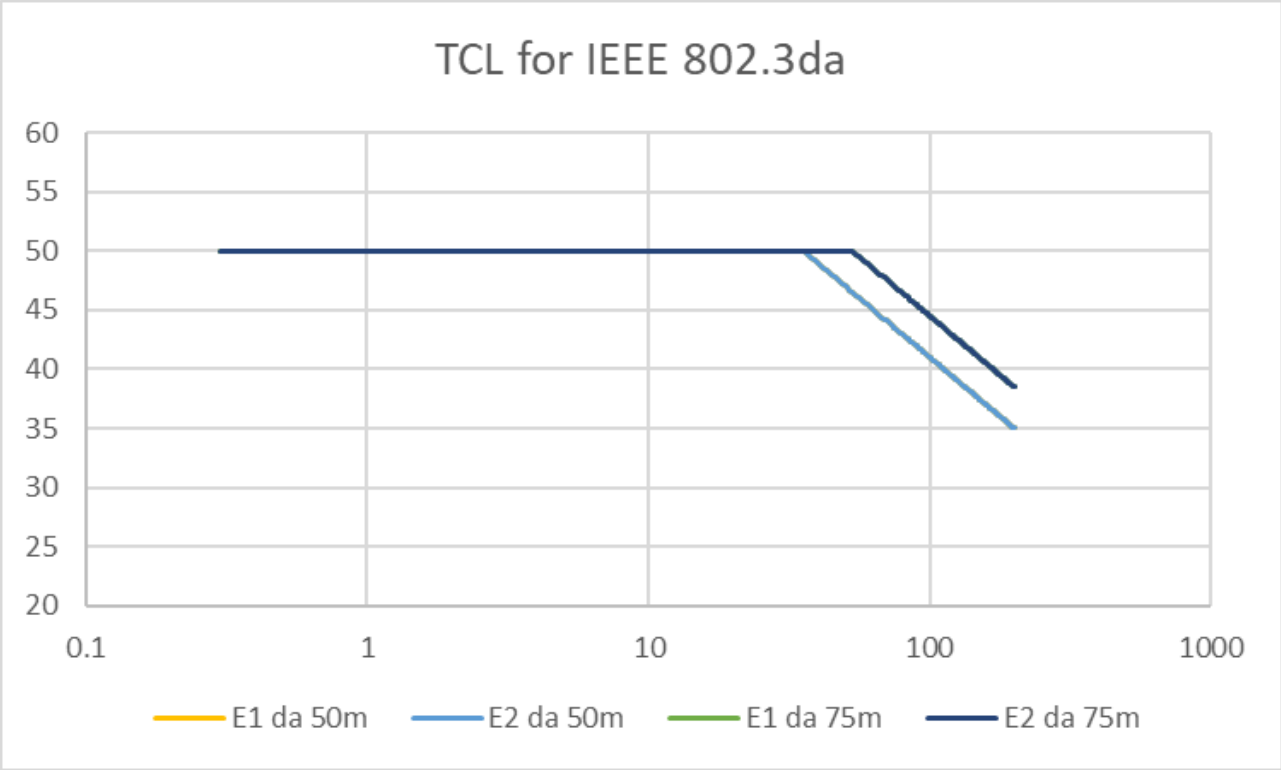
E2_50m: $55 - 20 * \log\left(\frac{f}{20}\right), Plateau\ 50dB,\ 0.3\ to\ 200MHz$

E1_75m: $58.5 - 20 * \log\left(\frac{f}{20}\right), Plateau\ 50dB,\ 0.3\ to\ 200MHz$

E2_75m: $58.5 - 20 * \log\left(\frac{f}{20}\right), Plateau\ 50dB,\ 0.3\ to\ 200MHz$

New proposed limits (all ffs)

For IEEE 802.3da the following limits are proposed for TCL:



The limits are based on IEEE 802.3cg and the formulas shown above.

New proposed limits (all ffs)

For IEEE 802.3da the following limits are proposed for Coupling Attenuation:

Based on the formula $TCL + AS = AC$, values between the 2 parameters shall be better aligned. The E levels for Coupling Attenuation shall be aligned with table 146-7 Link segment electromagnetic classifications (ISO/IEC 11801-1). For AS a minimum value of 20dB shall be taken into consideration.

New proposed limits (all ffs)

For IEEE 802.3da the following limits are proposed for Coupling Attenuation:

E1: $75 - 20 * \log\left(\frac{f}{20}\right), Plateau\ 70dB,\ 0.3MHz\ to\ 200MHz$

E2: $75 - 20 * \log\left(\frac{f}{20}\right), Plateau\ 70dB,\ 0.3MHz\ to\ 200MHz$

E3: $85 - 20 * \log\left(\frac{f}{20}\right), Plateau\ 70dB,\ 0.3MHz\ to\ 200MHz$

New proposed limits (all ffs)

For IEEE 802.3da the following limits are proposed for Coupling Attenuation: