IEEE 802.3dg Task Force

100BASE-T1L MDI RL

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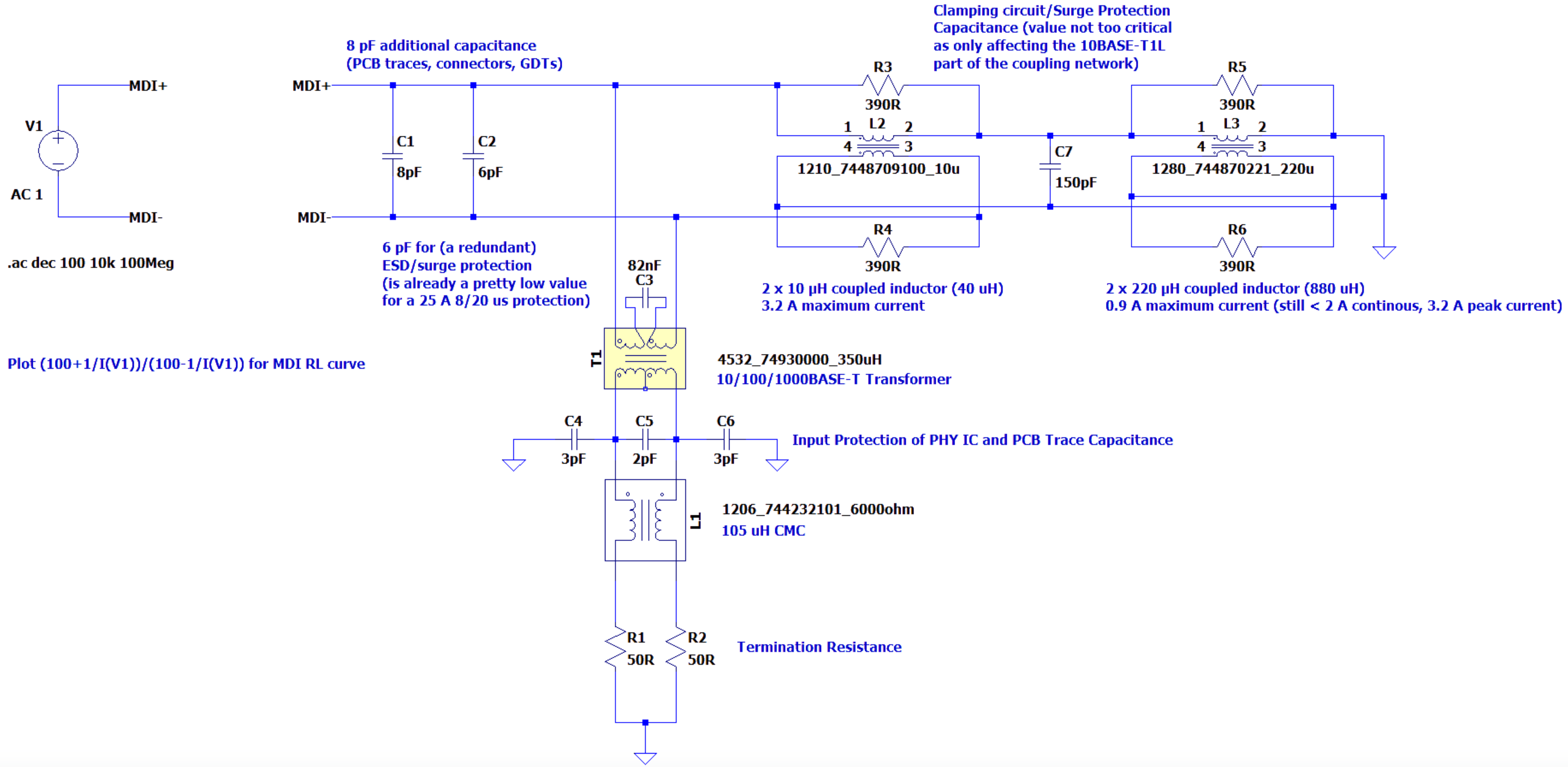
Current MDI RL Specification

- Currently the MDI RL defined in Clause 190.8.2.1 is:

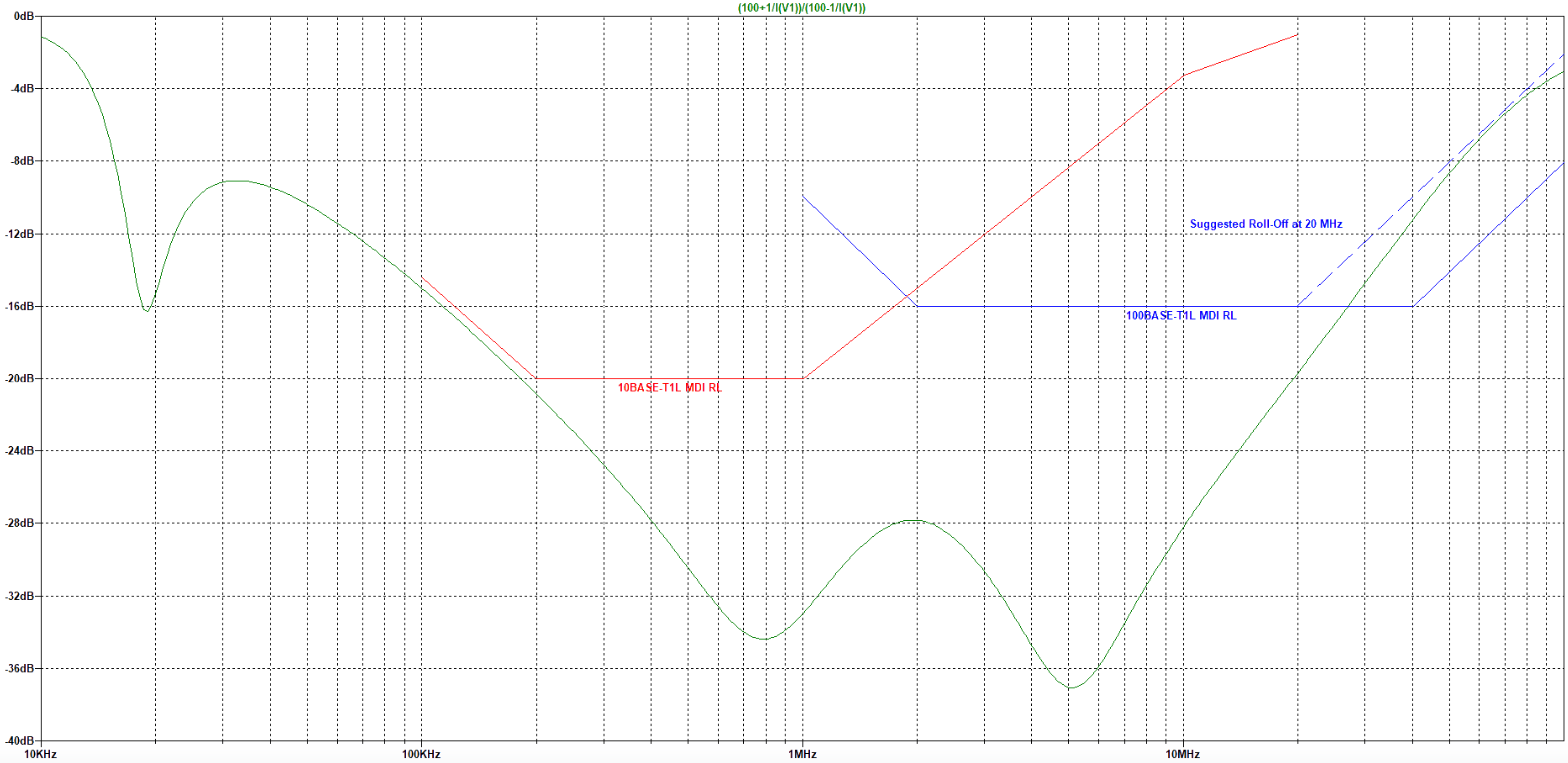
$$MDI\ Return\ Loss \geq \begin{cases} 16\ dB - 20\ dB \cdot log_{10}\left(\frac{2\ MHz}{f_{MHz}}\right) & for\ 1\ MHz \leq f < 2\ MHz \\ 16\ dB & for\ 2\ MHz \leq f \leq 40\ MHz \\ 10\ dB - 20\ dB \cdot log_{10}\left(\frac{f_{MHz}}{80\ MHz}\right) & for\ 40\ MHz \leq f \leq 100\ MHz \end{cases}$$

- The MDI RL has been defined based on the 1000BASE-T MDI RL specification, as appropriate isolation transformers are commonly available.
- In powered systems additionally to the isolation transformer further inductors and likely also a common mode choke for the power coupling network are necessary.
- These inductors have relatively high internal parasitic intra- and interwinding capacitances, which influence the MDI RL, especially in the higher frequency range.
- Due to the high current, e.g. flowing on an Ethernet-APL trunk, a significant amount of energy can be stored in the power coupling inductors, which needs to be dissipated in the clamping/EMC protection circuit in case of a freewheeling event.
- This causes the need for larger protection elements, providing a higher parasitic capacitance.

MDI RL Simulation (Trunk Port, simplified Circuit)



MDI RL Simulation Result



MDI RL Specification

- As it can be seen on the previous slide, even when trying to minimize the capacitive load, for a practical implementation the 40 MHz corner frequency of the MDI RL specification is expected to be too high.
- Therefore, it is suggested to reduce the corner frequency from 40 MHz to 20 MHz.
- This leads to higher reflections at the MDI and thus a reduced signal energy at the receiver.
- Nevertheless, changing the corner frequency from 40 MHz to 20 MHz, still would lead to a similar MDI RL at Nyquist frequency as for 10BASE-T1L (10.4 dB @ 3.75 MHz for 10BASE-T1L and 10 dB @ 40 MHz for 100BASE-T1L).

- The new suggested MDI RL limit would be:

$$MDI\ Return\ Loss \geq \begin{cases} 16\ dB - 20\ dB \cdot log_{10}\left(\frac{2\ MHz}{f_{MHz}}\right) & for\ 1\ MHz \leq f < 2\ MHz \\ 16\ dB & for\ 2\ MHz \leq f \leq 20\ MHz \\ 16\ dB - 20\ dB \cdot log_{10}\left(\frac{f_{MHz}}{20\ MHz}\right) & for\ 20\ MHz \leq f \leq 100\ MHz \end{cases}$$

- Needs discussion about the impact on a PHY IC implementation (e.g., input voltage range, EC length) and if a change of the link segment would be required (e.g., reduced IL limits for a powered system due to a reduced signal energy at the receiver).
- It would be good to also get further input from powering experts related to their view on (10)/100BASE-T1L powering circuits.

Thank you!