10 Mb/s Single Twisted Pair Ethernet

10BASE-T1L AWGN Noise Test

Steffen Graber

Pepperl+Fuchs

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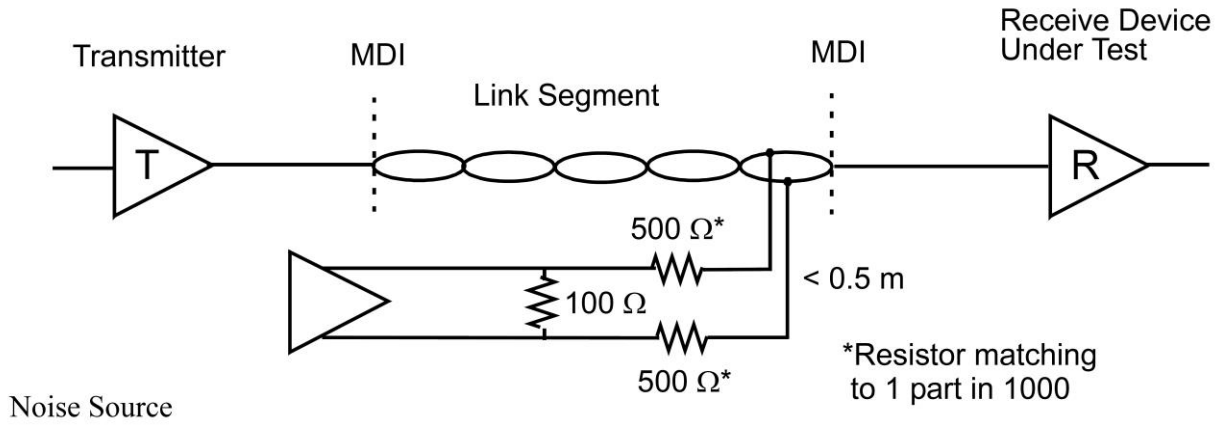
Alien Crosstalk Noise Rejection

- In Clause 146.5.5.3 (alien crosstalk noise rejection) of the actual PMA specification the AWGN noise level is defined to be -106 dBm/Hz with a bandwidth of 10 MHz using the following test setup:



- As the alien crosstalk (particularly the NEXT) is not influenced by the insertion loss of the victim‘s link segment or the victim‘s transmit level, the alien noise level should be kept independent from the victim‘s insertion loss and transmit level.
- Nevertheless the insertion loss level at which the DUT has to pass the noise test may be dependent on the transmit level of the DUT.
- Therefore the intention is to keep the noise test level the same for the 1.0 V_{pp} mode and the 2.4 V_{pp} mode of the PHY and to adjust the insertion loss limit of the link segment for the 1.0 V_{pp} transmit level.
- Assuming that the same cable and connectors are being used, the different maximum possible insertion loss will lead to a different maximum link segment length.

Insertion Loss for 1.0 V_{pp} Mode

- Using a transmit level of 1.0 V_{pp} instead of 2.4 V_{pp} leads to a reduction in the transmit PSD of 7.6 dB.
- To allow a similar alien noise tolerance for the 1.0 V_{pp} transmit mode compared to the 2.4 V_{pp} transmit mode, the insertion loss of the link segment needs to be reduced.

- Calculating the insertion loss according to the IL limits specified in 802.3cg D1.2 (using the mean square pulse loss, which can be approximately calculated at ½ Nyquist frequency or 1.875 MHz) leads to:

$$IL[dB] = 10 \cdot \left(1.23 \cdot \sqrt{1.875\ MHz} + 0.01 \cdot 1.875\ MHz + \frac{0.2}{\sqrt{1.875\ MHz}}\right) + 10 \cdot 0.02 \cdot \sqrt{1.875\ MHz} = 18.76\ dB$$

- Reducing the insertion loss limit by 7.6 dB and calculating the resulting link segment length leads to:

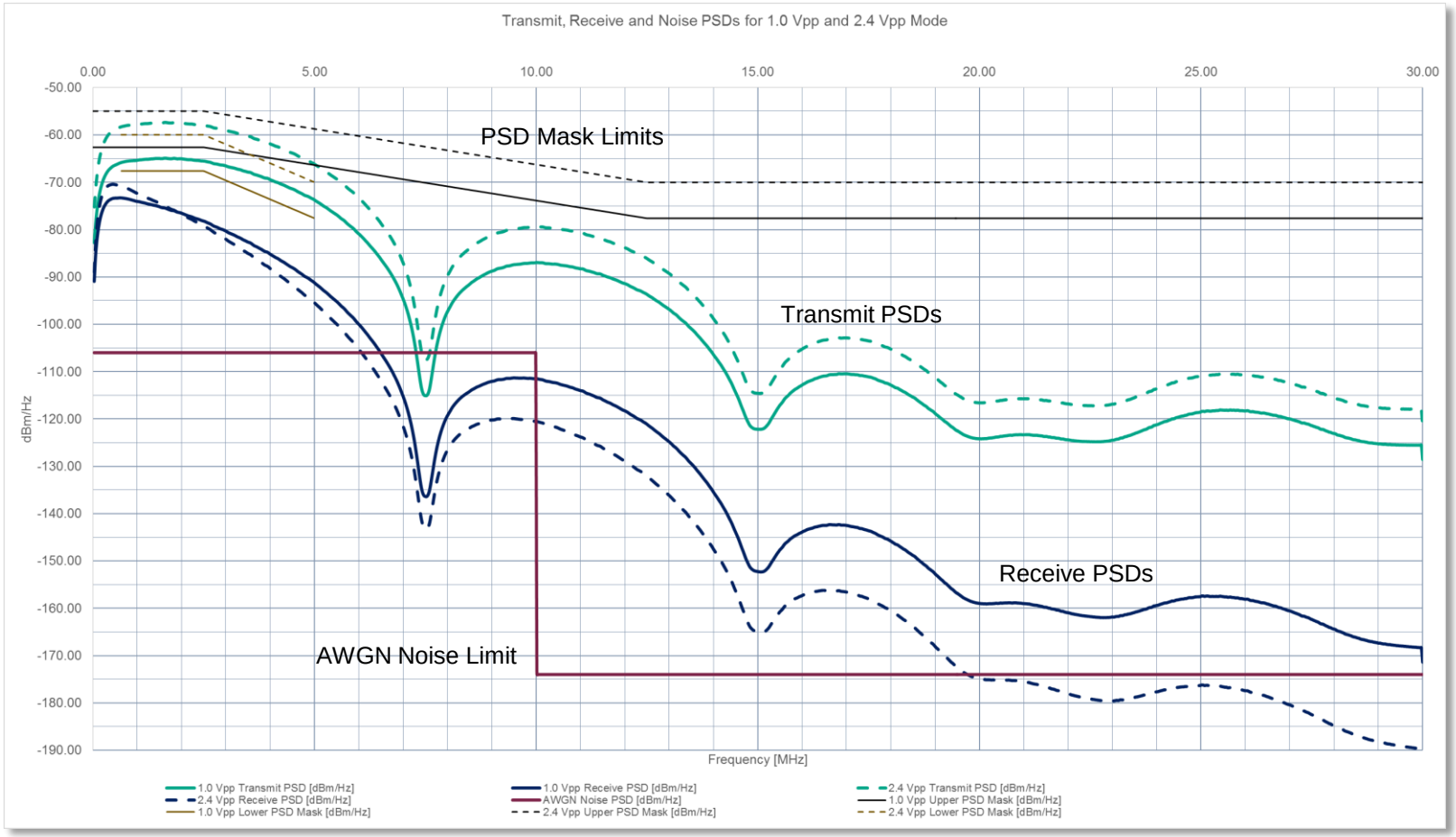
$$\frac{18.8\ dB - 7.6\ dB - 10 \cdot 0.02 \cdot \sqrt{1.875\ MHz}}{1.23 \cdot \sqrt{1.875\ MHz} + 0.01 \cdot 1.875\ MHz + \frac{0.2}{\sqrt{1.875\ MHz}}} \cdot 100\ m = 590\ m$$

- Therefore the suggestion is to add an additional insertion loss limit for the 1.0 V_{pp} transmit mode in the following way to Clause 146.7.1.1:

$$IL[dB] = 5.9 \cdot \left(1.23 \cdot \sqrt{f} + 0.01 \cdot f + \frac{0.2}{\sqrt{f}}\right) + 10 \cdot 0.02 \cdot \sqrt{f}\ with\ 0.1\ MHz \leq f \leq 20\ MHz$$

Transmit, Receive and Noise PSDs

- The green curves show the transmit PSDs (solid: 1.0 V_{pp} mode, dashed: 2.4 V_{pp} mode).
- The blue curves show the PSDs at the receiver side after running over the link segment with the frequency dependent insertion loss (solid: 1.0 V_{pp} mode - IL limit as defined on previous page, dashed: 2.4 V_{pp} mode - IL limit as defined in 802.3cg D1.2).
- The red curve shows the AWGN noise limit.



Thank You