Vaden_02-06-13_Channel models

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DOCUMENT SUBMITTED TO: ***IEEE 802.3bp channel definitions adhoc***

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ABSTRACT: Single pair channel Return Loss model

Automotive link segment

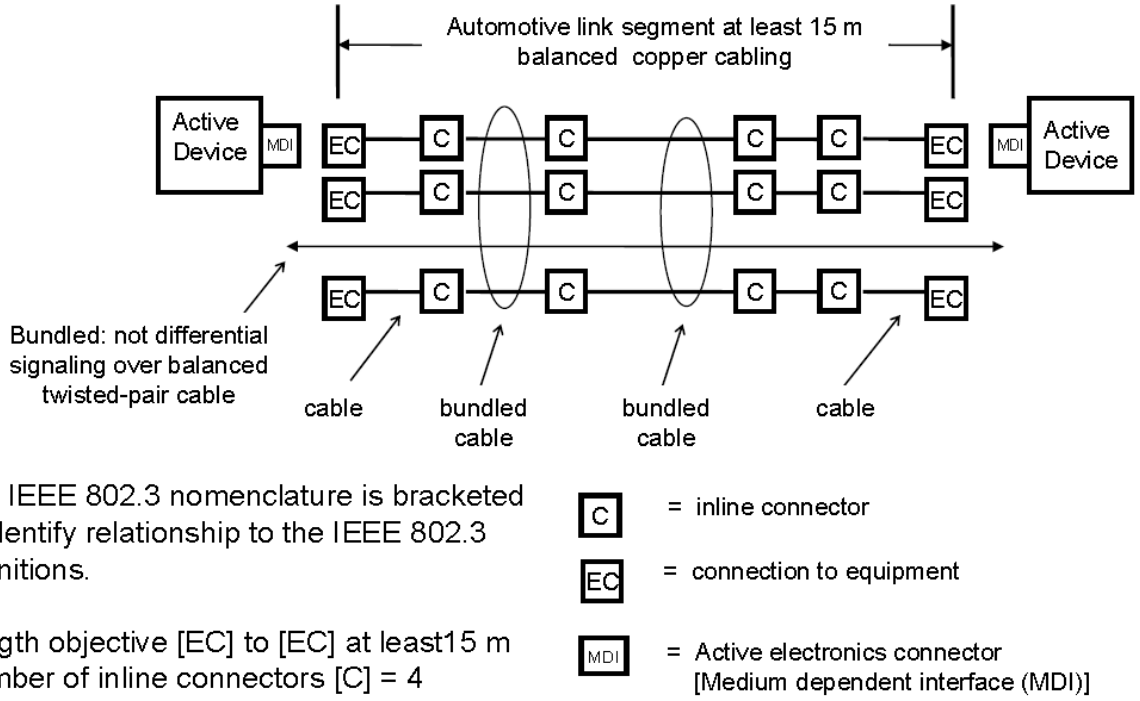

Figure 1 Link segment topology

For this model I have chosen a connector model that yields Cat6A compliant connector return loss and a cable model that yields Cat6A compliant cable return loss. For the link segment topology, I chose a symmetrical construction with 1m, 2m, 9m, 2m, 1m cable segment lengths. Other topologies could easily be chosen. The 1m and 2m cable segments are modeled with a single impedance offset. The 9m cable segment is modeled with structure.

First we will look at the connector return loss result

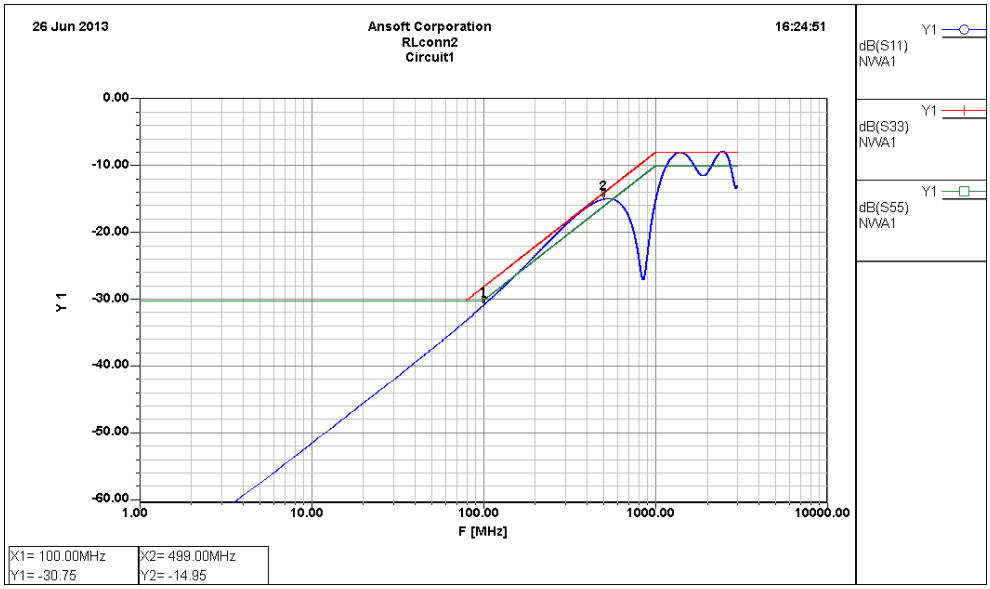

Figure 2 Cat6A compliant connector return loss modeled to 3 GHz

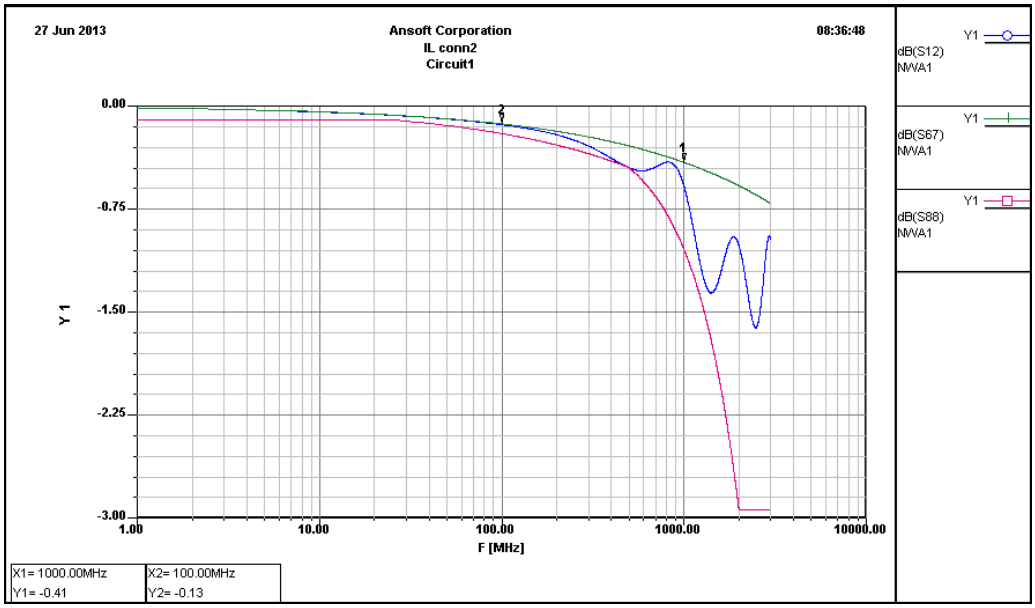

Figure 3 Connector insertion loss

Next we will look at the cable return loss profile (cable with structure)

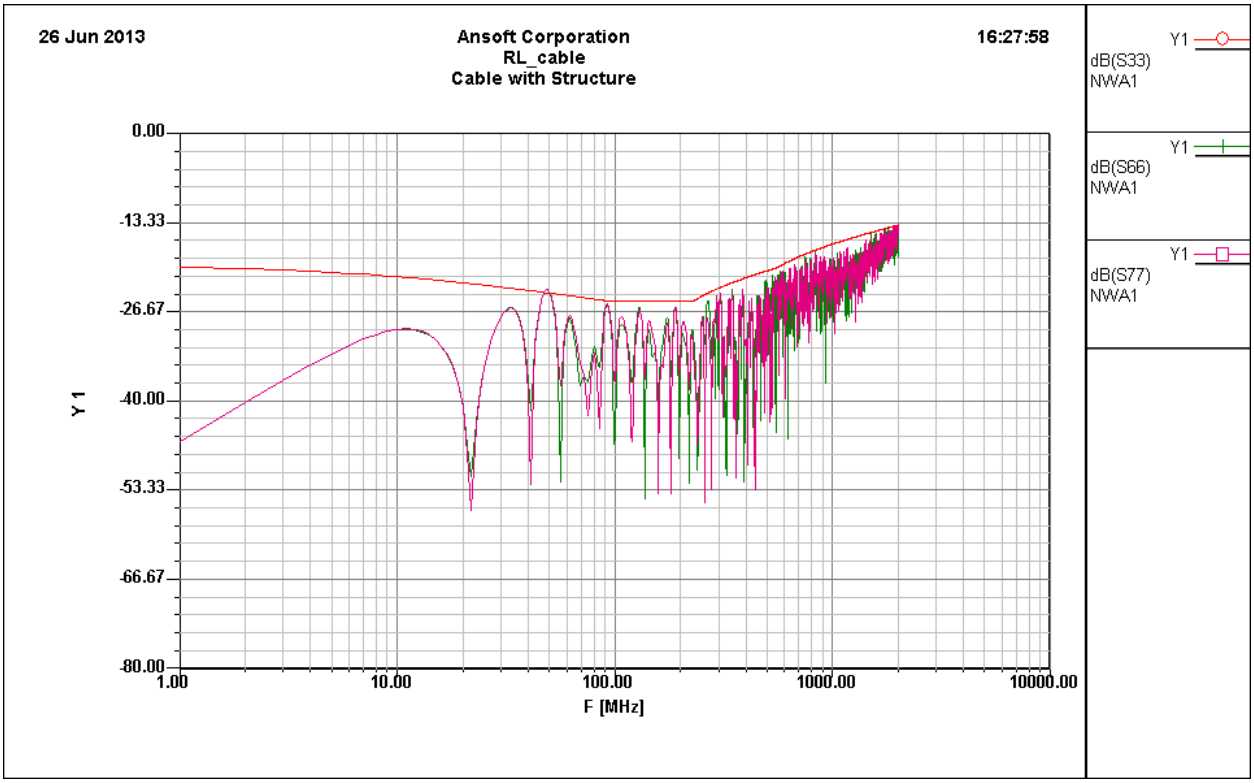

Figure 4 Return loss model result for cable with structure

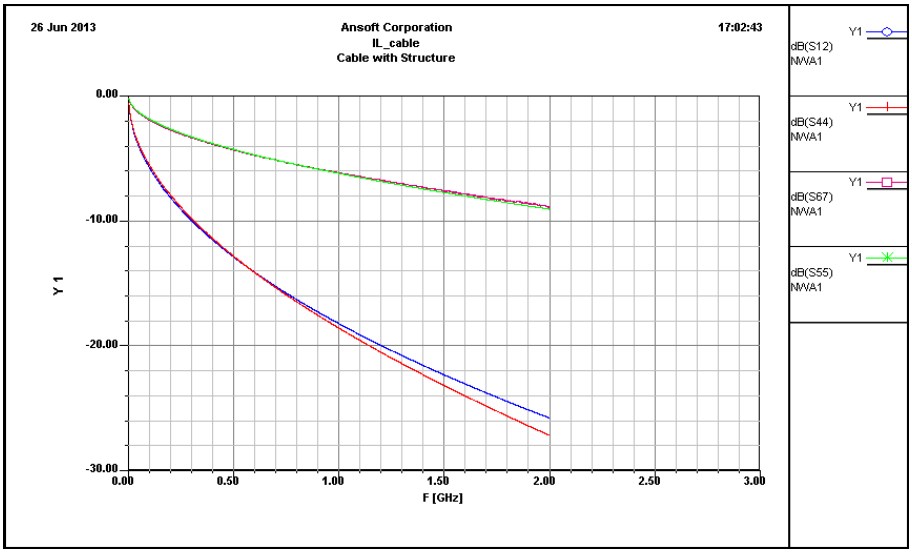

Figure 5 30m and 10m cable insertion loss

These combine in the model to yield the link segment result. The results shown represent three different selections of cable impedance offsets.

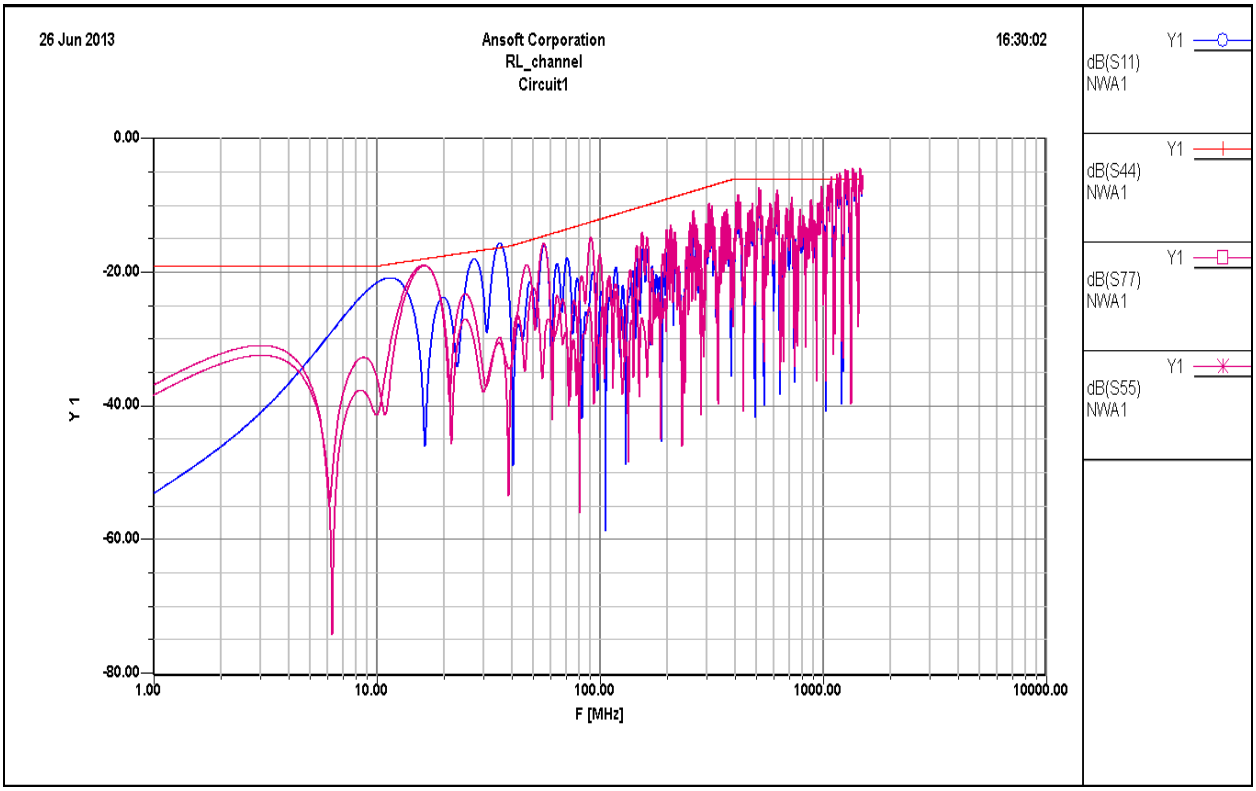

Figure 6 Link segment return loss result, 1-2-9-2-1 channel

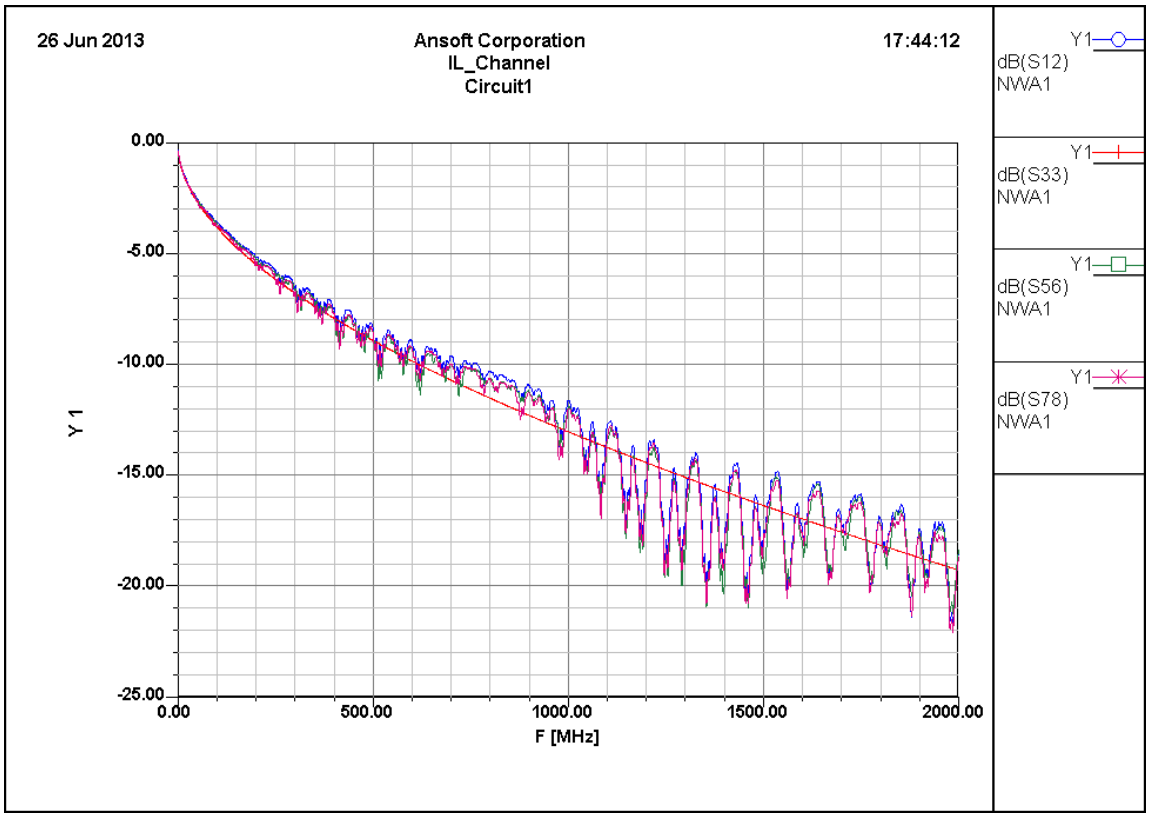

Figure 7 15m link segment insertion loss

Well how about that. This points out (in my estimation) a failing of the Category 6A specification that did not include insertion loss deviation in the calculation of the channel insertion loss. Also, for a 15m channel, the return loss is going to play a larger part in the overall insertion loss profile than for a 100m channel. This would require some modeling and curve fitting, as neither the Category 6 nor Category 8 ILD estimates are accurate for this channel. Category 8 ILD = -0.0324*sqrt(f)

Table 6 - Channel insertion loss

	Frequency (MHz)	Insertion loss (dB)
Category 3	$1 \le f \le 16$	$1.02(2.32\sqrt{f} + 0.238f) + 4 \cdot 0.1\sqrt{f}$
Category 5e	$1 \le f \le 100$	$1.02(1.967\sqrt{f} + 0.023f + \frac{0.05}{\sqrt{f}}) + 4 \cdot 0.04\sqrt{f}$
Category 6	$1 \le f \le 250$	$1.02(1.808\sqrt{f} + 0.017f + \frac{0.2}{\sqrt{f}}) + 4 \cdot 0.02\sqrt{f} + 0.0003 \cdot f^{1.5}$
Category 6A	$1 \le f \le 500$	$1.05(1.82\sqrt{f} + 0.0091f + \frac{0.25}{\sqrt{f}}) + 4 \cdot 0.02\sqrt{f}$