

EMC ad hoc vehicle influence to channel parameters

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overview

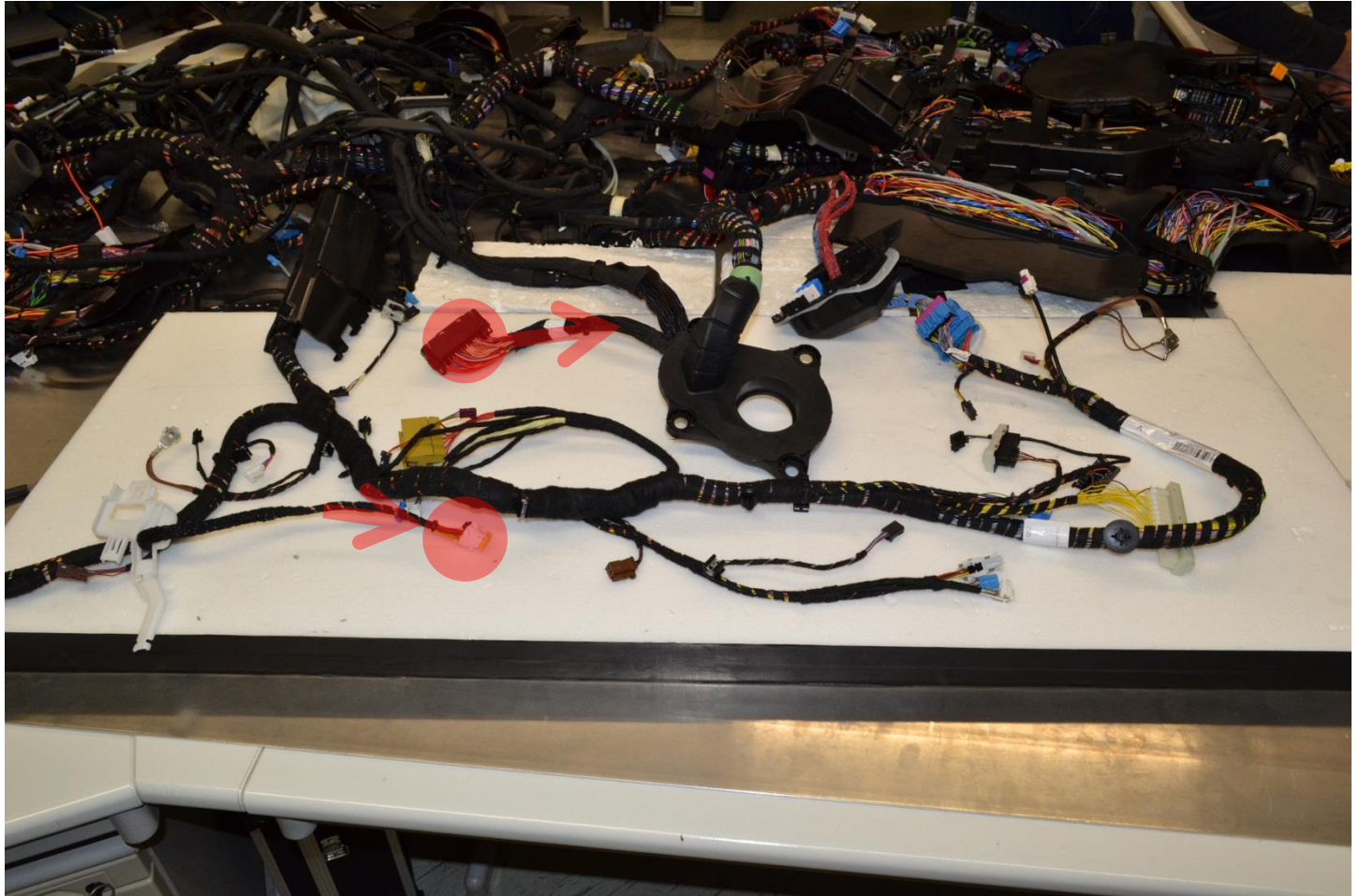
1. Balance measurements of a today's cable harness
2. Worst Case assumption: impedance of unjacketed cable

balance parameter of today's cable harness

- To get a first rough picture on the balance parameters of a vehicle harness some older measurement results within Daimler are shown here.
- Additional measurements of different OEMs and different **new** connector/cable systems (which are intended to be used for RTPGE) within a cable harness or a vehicle are necessary to provide a better data basis.

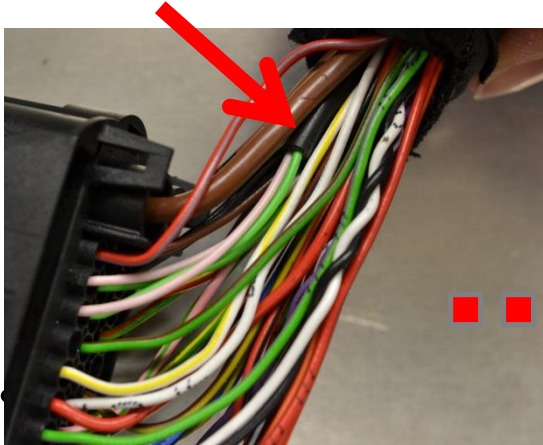
device under test/measurement setup

- 2x0,35mm² 100 ohm jacketed cable in harness (ca. 3600mm) with inline connector. (FlexRay)

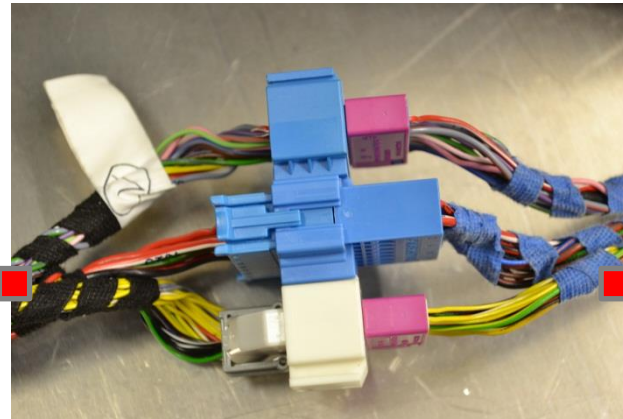


device under test/measurement setup

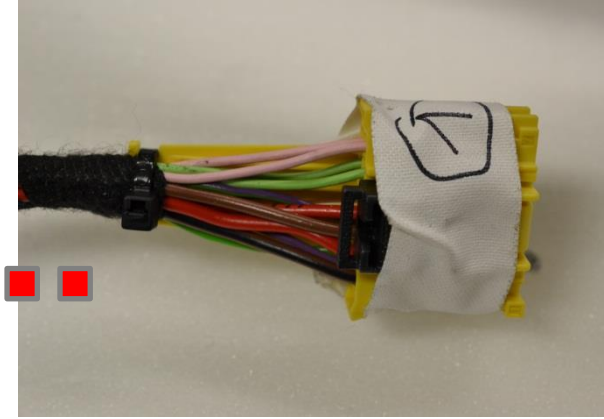
Connector1/jacketed cable



inline



Connector2



Test adapter

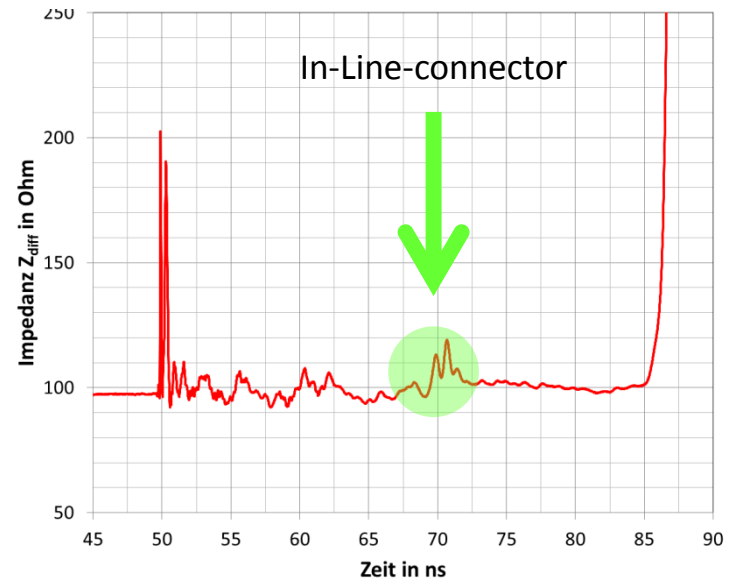
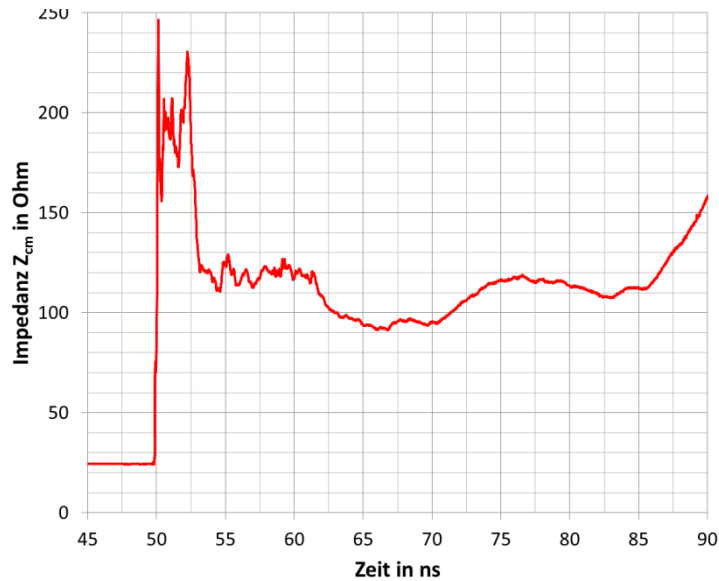
(as these were older measurements the test adapter is maybe not perfect...)

- Direct connection to GND plane.
- SMA heads soldered to Pins which are plugged into harness header.
- Complete harness on GND plane.
- No special treating of harness and assemblies to achieve high symmetry

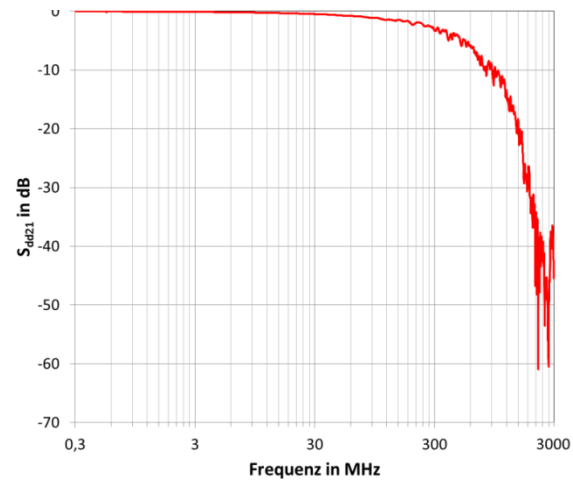
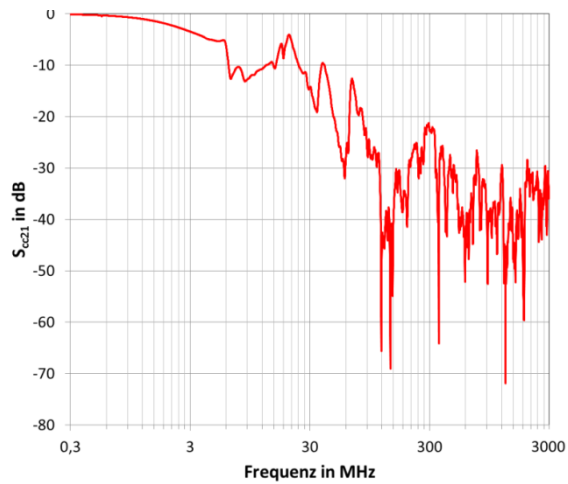
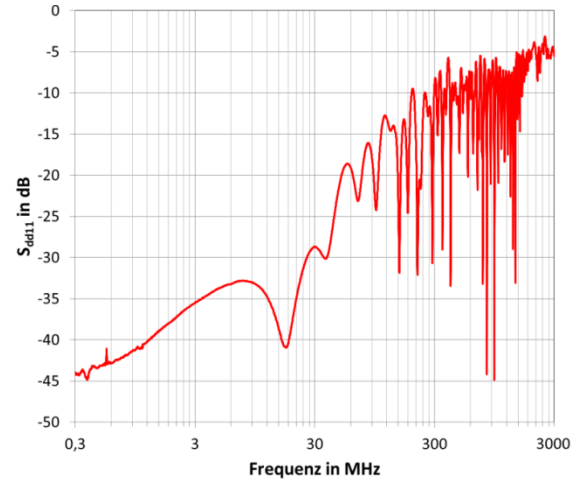
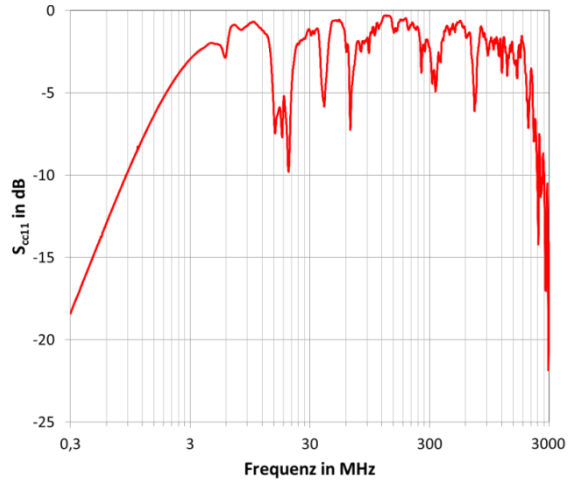


TDR results Z_{cm} and Z_{diff}

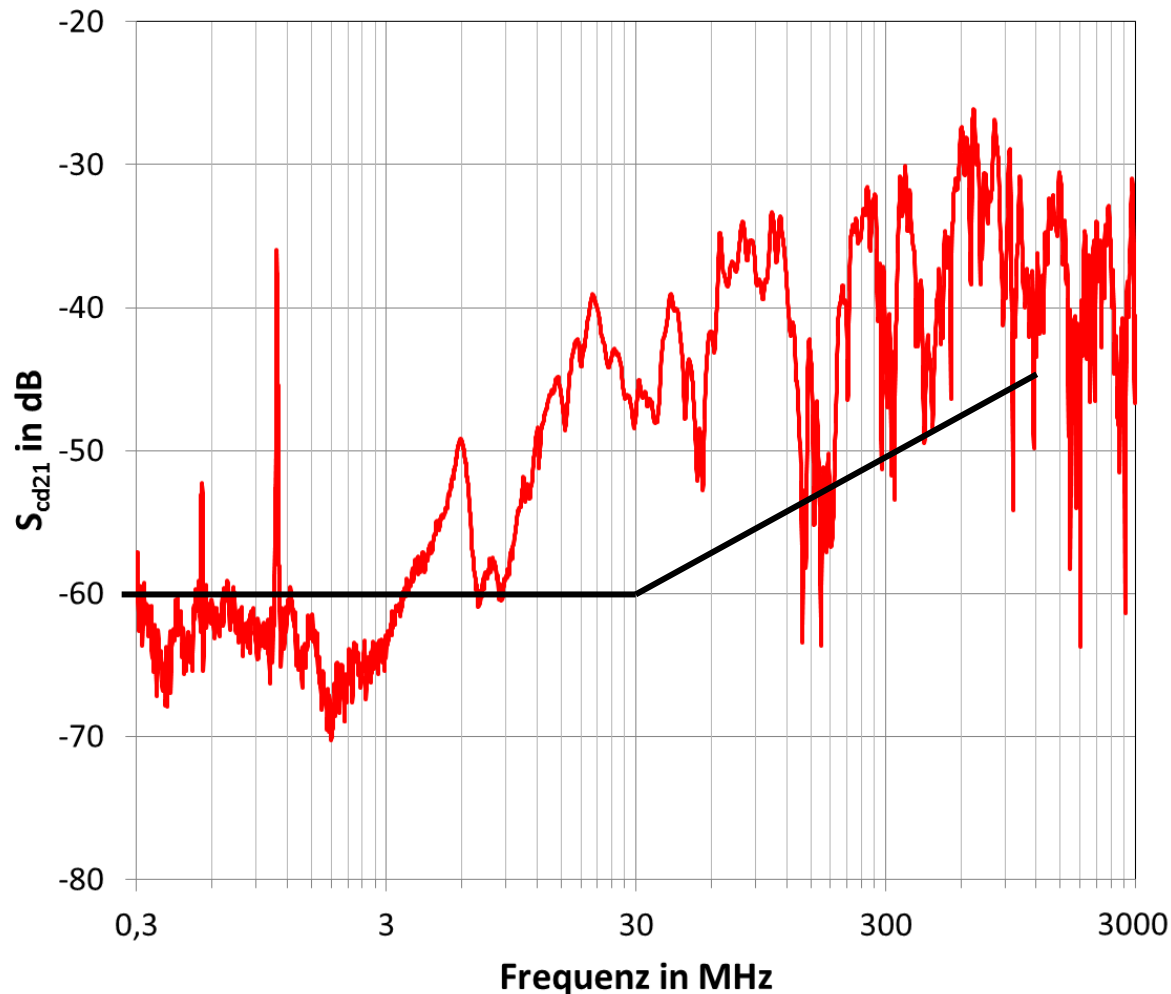
- as harness is placed 50mm above GND plane Z_{CM} is nearly constant



S_{cc11} , S_{dd11} , S_{cc21} , S_{dd21}



S_{cd21} (TCTL)



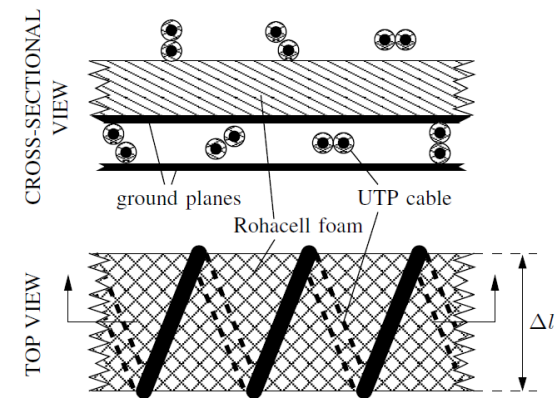
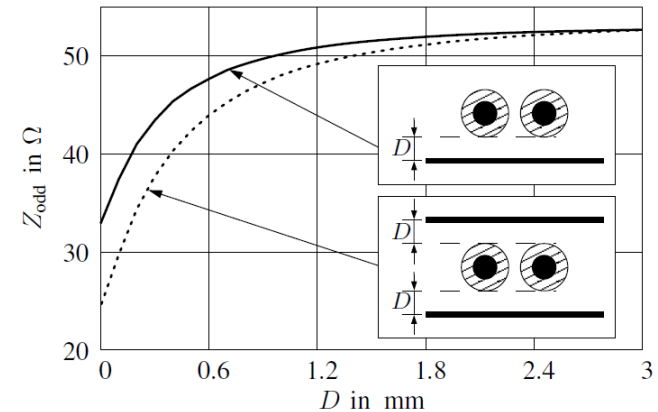
- Compared to the proposed limit state-of-the-art UTP channels in an automotive environment do NOT fulfill the required balance parameters (as expected)
- Measurements with proposed connector technologies have to be done!

impedance of unjacketed cable

- Impedance of unjacketed cable is significantly influenced by it's environment.
- The following slides show a worst case assumption for IL of unjacketed cables in a worst case environment (periodic metallic structure)
- This part of the presentation is based on the paper „Worst Case Signal Integrity Analysis for In-Vehicle Data Transmission via UTP Cables” published by Volker Zwillich in the “18th International Zurich Symposium on Electromagnetic Compatibility”, 2007. EMC Zurich 2007.

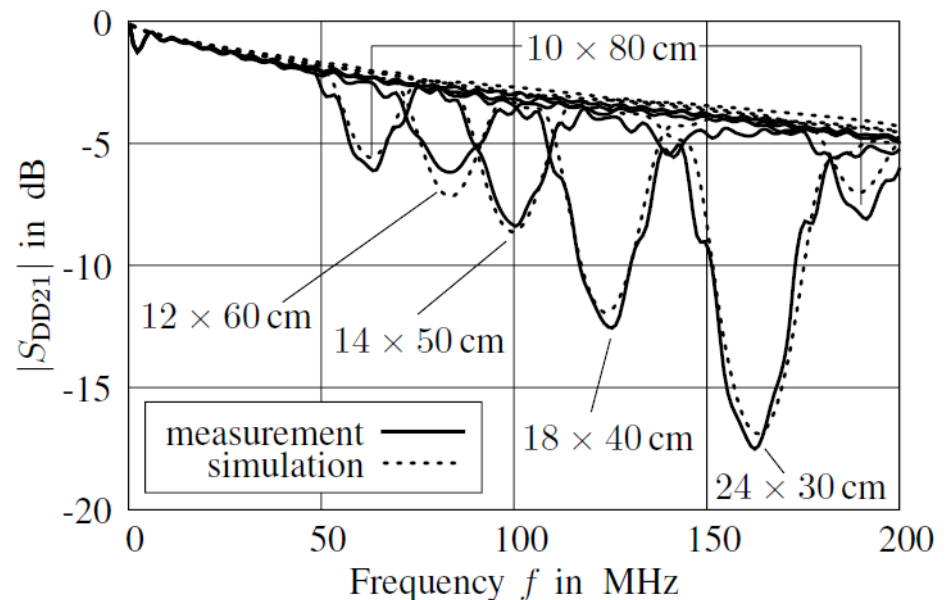
impedance of unjacketed cable

- Differential mode impedance (odd-mode impedance) is influenced by nearby metallic GND-plane.
- If the UTP is unjacketed the worst case is an distance D between GND and the UTP of $D=0\text{mm}$
- A worst case assumption of the metallic environment is a periodic change of the distance D . This means e.g. for a length of $\Delta l=400\text{mm}$ the distance $D=0\text{mm}$ and for the next $\Delta l=400\text{mm}$ the distance is $D=50\text{mm}$ and so on...



impedance of unjacketed cable

- Using the above mentioned worst case scenario for an unjacketed cable the insertion loss of this channel (s_{dd21}) is influenced significantly by the environment. On the figure below different periodic structures with unjacketed UTP are simulated and measured and it shows that above 50MHz there are significant changes in the insertion loss
- Investigations for jacketed cables had not been made so far.



conclusion

- both points above show that the influence of the vehicle environment can not be neglected.
- Up to now only a few measurements of vehicle environments are conducted.
- Therefore to improve the data basis for balance parameter assumptions a wider range of measurement is necessary.
- Additional measurements of different OEMs and different connector/cable systems (which are intended to be used for RTPGE) within a cable harness or a vehicle are necessary to provide a better data basis.