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IEEE RTPGE information

Answers to PoE and Channel Model ad hoc

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additional/updated questions from RTPGE

Should be answered by the automotive OEMs, latest to the next IEEE meeting in San Diego (16th of July).

Channel Ad-hoc questionaire

Adobe Acrobat Document

http://www.ieee802.org/3/RTPGE/email/pdf0CEXtJtDjK.pdf

PoE Ad-hoc questionaire

Adobe Acrobat Document

http://www.ieee802.org/3/RTPGE/email/pdfVRBHUACjGc.pdf

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PoE answers

Question	Answer
1. Is PoE as defined in Clause 33 of the current standard adequate for RTPGE?	From our point of view no
2. Will vehicles use a mix of Clause 33 and non–clause 33 connections?	no
3. Will PSE ports be dedicated to a specific load or do they need to be “universal”?	
4. What line voltage should be used?	12V/24V, maybe 5V, for future also 48V
5. What power levels are required?	Arbitrary (1W to maybe 25W), but static power requirements
6. Will multiple power classes be required?	If this is an advantage, e.g. in cost (diameter
7. Will the power system need to support surge loads (motor start)?	Very unlikely

PoE answers

Question	Answer
8. What are the isolation requirements?	Not sure about?
9. What action should a PSE take if a power fault is detected?	Switch to save state and report to diagnosis (e.g. register)
10. Is a chassis ground always available?	No, e.g. in mirrors
11. Will we need to support adding/subtracting nodes to/from a live system (for example, a vehicle trailer or customer–installed equipment)?	Very unlikely
12. What is the maximum length of a PoE segment?	Same like others (15m / 40m)
13. Will PoE channels be treated differently (e.g., different wire gauge) than non– PoE channels?	If this is an advantage, e.g. in cost (diameter)

PoE answers

Question	Answer
14. Do we need to support daisy—chain configurations?	unlikely
15. What is the estimated ratio of powered to unpowered ports?	There will be more unpowered ports

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Answers to Automotive cabling survey

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2. Wire harness or assembly topology (see Figure 1).

2.1 Maximum length in meters of wire harness or assembly between active electronic devices – report current applications and lengths [EC] to [EC]. car/van:12m, truck/bus: 32m

2.2 Maximum length in meters of wire harness or assembly between active electronic devices – report future applications and lengths [EC] to [EC]. car/van:15m, truck/bus: 40m

2.3 Number and type of inline connectors [C] between active electronic devices – report current applications.

number of connectors 3 type of connector(s) typical connectors are Tyco (TE) MQS, nanoMQS, MLK, … different multi-pin connectors within one link are possible

2.4 Number and type of inline connectors [C] between active electronic devices– report future applications.

number of connectors 3 type of connector(s) typical connectors are Tyco (TE) MQS, nanoMQS, MLK, … different multi-pin connectors within one link are possible

2.5 Type of active electronic connectors [AEC] – report current applications.

type of connector(s) typical connectors are Tyco (TE) MQS, nanoMQS, MLK, …

2.6 Type of active electronic connectors [AEC] – report future applications.

type of connector(s) typical connectors are Tyco (TE) MQS, nanoMQS, MLK, …

Answers to Automotive cabling survey

2.7 Are there requirements for future applications to be mechanically compatible to existing connector systems?

not necessarily

2.8 Are there requirements for mechanically compatible connector systems between automobile manufacturers?

Not necessarily, however due to same requirements and cost aspects same connector is likely

3. Balanced twisted-pair cable used in wire harness or assembly (see Figure 1 and Figure 2.) report parameters and values.

3.1 Current automotive applications

- Gauge [AWG] [or conductor in mm]
- Impedance [ohm +/-]
- Shield [Y/N] [shield type]
- Copper conductors [Y/N] solid [Y/N] stranded [#strands]
- Direct current resistance [milliohm/meter]

3.2 Future automotive applications

- Gauge [AWG] [or conductor in mm]
- Impedance [ohm +/-]
- Shield [Y/N] [shield type]
- Copper conductors [Y/N] solid [Y/N] stranded [#strands]
- Direct current resistance [milliohm/meter]

→ See next slide

Answers to Automotive cabling survey

4. Bundled cable types in wire harnesses or assemblies (Figure 1)

4.1 Report data rates and signaling schemes for differential signaling applications in bundle [data rates and signaling].

→ See next slide

4.2 Report other data rates and signaling schemes not using differential signaling in bundle [data rates and signaling].

→ See next slide

4.3 Report voltage/power in bundle [ ]

12V (cars), 24V (trucks, busses) and 48V (future supply voltage)
currents are up to 150A@12V (e.g. steering, air condition, ...).

5. External noise sources → see following slides

5.1 Report steady state noise (including frequency content)

5.2 Report time variable noise (things that come and go)

5.3 Report impulse noise

5.4 Report radio frequency interference - modulated signals (i.e., cell phone type signals)

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Typical automotive bus systems and cabeling

- Overview over typical automotive bus systems, their voltage levels and cables and connectors

system	LIN	CAN(500 kbit/s*)	FlexRay	USB (HiSpeed)	HSVL („LVDS“)	RF-signals
Data rate	20 kbit/s	500 kbit/s	10 Mbit/s	480 Mbit/s	200…3000 Mbit/s	Antenna signals (AM, FM, ISM, WLAN, Bluetooth, …)
amplitude	12 V	2V	0,6V	0,4V	0,25…0,45V	different
differential?	single-ended	differential	differential	differential	differential	single-ended
typical cabling	Single wire, e.g. 0,35mm²	UTP 2x0,35mm²	UTP (e.g. FLR9Y 2x0,35 mm²-SN)	STQ 4x0,5mm² (e.g. Leoni Dacar566)	STQ 4x0,14mm² (e.g. Leoni Dacar535-2)	Coax (e.g. Leoni Dacar302)
Differential Cable impedance (Z_{diff} Ω)	-	120 (±12)	100 (±10)	90 (±15)	100 (±15)	50 (±3)
Shield?	no	no	no	yes (braid + foil)	yes (braid + foil)	yes (braid + foil)
conductor	stranded (e.g. 7)	Stranded (e.g. 7)	stranded (e.g. 7x0,26)	stranded (e.g. 19x0,182)	stranded (e.g. 7x0,16)	stranded (e.g. 7x0,27)
Jacketed?	-	no	no	yes	yes	yes
typical connector	different multi pin connectors (e.g. Tyco MQS)	different multi pin connectors (e.g. Tyco MQS)	different multi pin connectors (e.g. Tyco MQS)	Rosenberger HSD	Rosenberger HSD	FAKRA

*) different data rates are possible for CAN, typically are 125kbit/s or 500kbit/s

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Typical requirements MBN 10284-2:2011-04

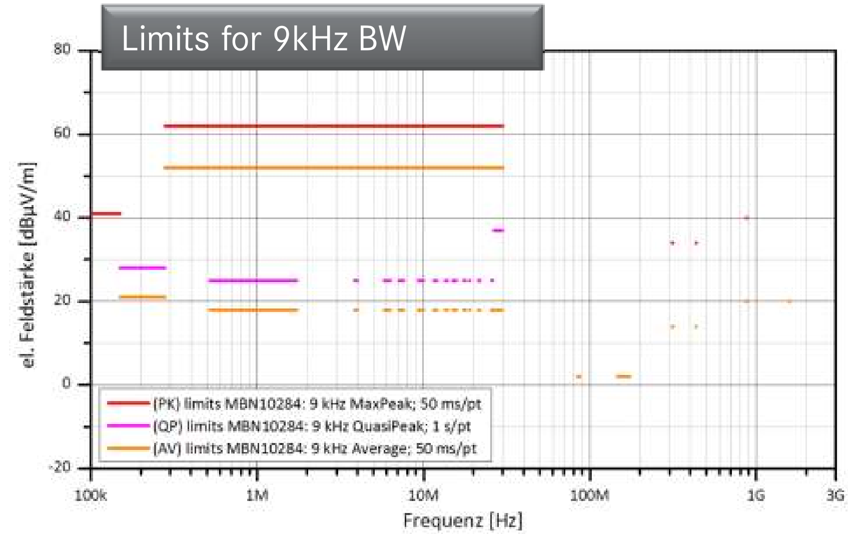
- Overall requirements (Step size, measurement time, BW)

BW (kHz)	PK		QP		AV	
	Max. frequency step size	Min. measurement time (ms)	Max. frequency step size	Min. measurement time (ms)	Max. frequency step size	Min. measurement time (ms)
9	≤0,5 x BW	50	≤5 x BW	1000	≤0,5 x BW	50
120	≤0,5 x BW	5	≤5 x BW	1000	≤0,5 x BW	5
1000	≤0,5 x BW	50	-	-	≤0,5 x BW	50

- RF Emissions – antenna test
  according to CISPR25, section 6.4
  →limit diagrams for different BW/detectors (see next slide)

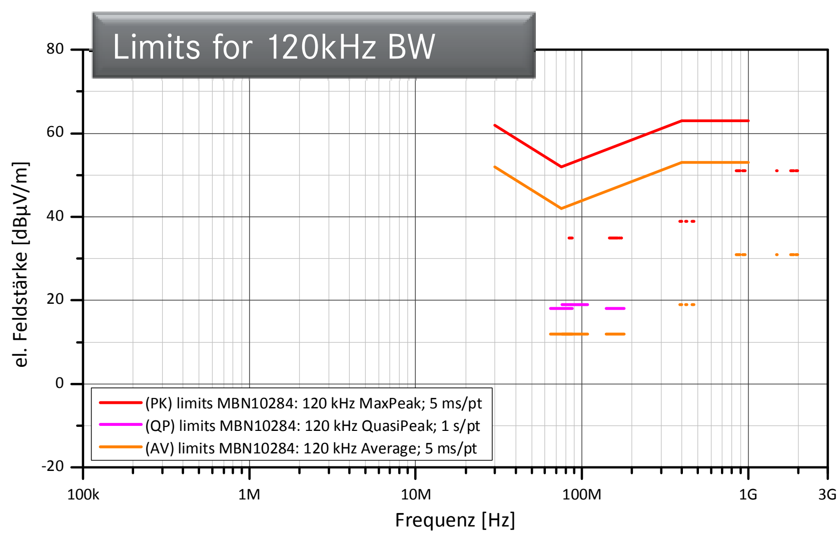
Typical requirements MBN10284-2:2011-04

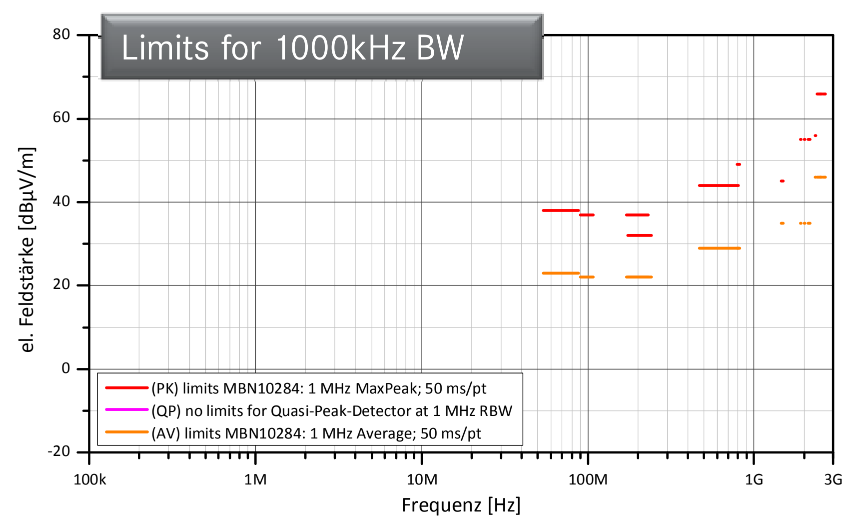
limit diagrams for different BW/detectors



antenna test, according to CISPR25, section 6.4 (~1,7m cable, 1m in front of antenna)

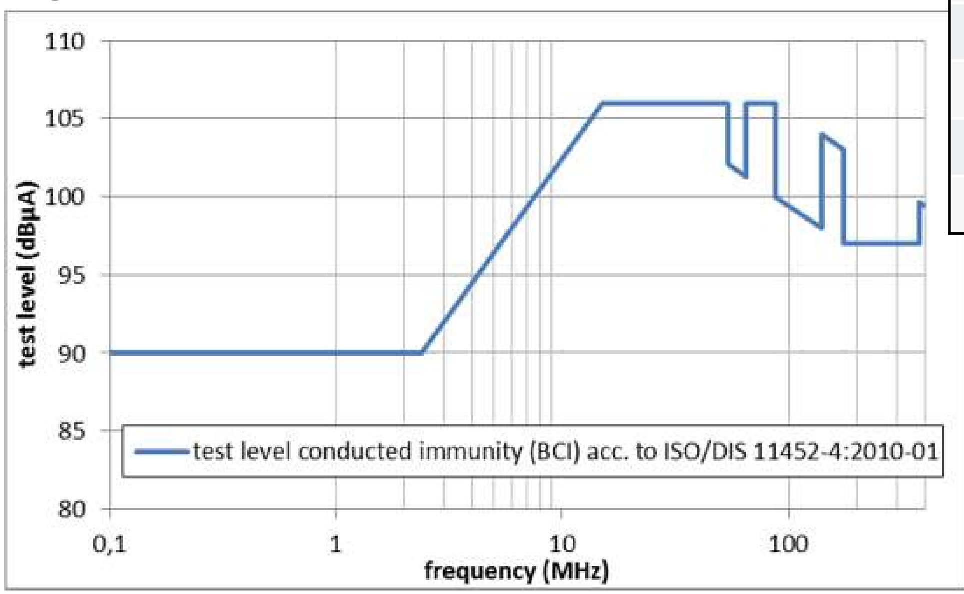
always lowest limit is valid.





Typical requirements MBN10284-2:2011-04

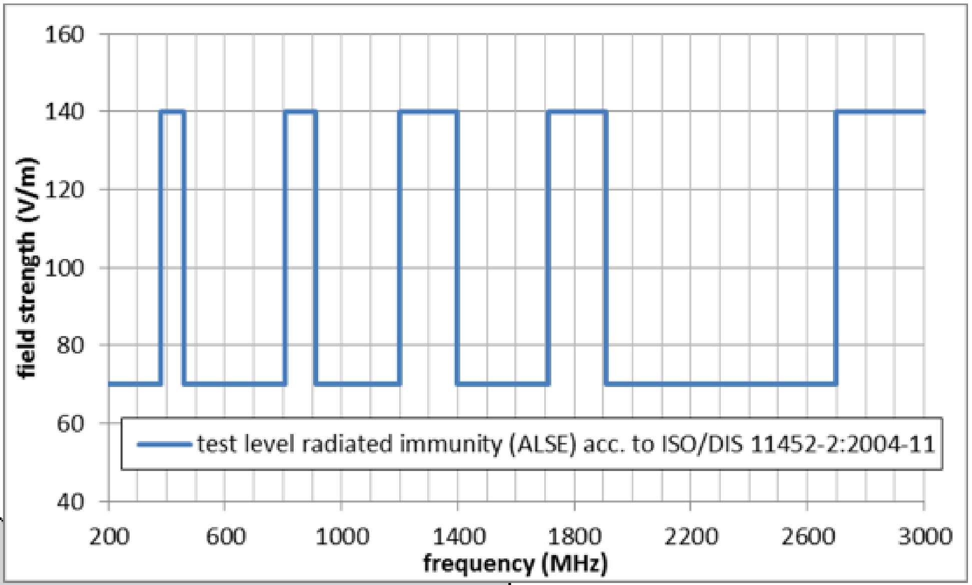
- Bulk Current injection (BCI) acc. to ISO/DIS11452-4:2010-1 test currents → see table on the right.
  In the formulas, f is the frequency in MHZ and lg denotes the logarithm to the base 10



Frequency Range (MHz)	Test Current (dBµA)	Modulation
0,1 … 2,38	90	CW and AM (1 kHz, 80%)
2,38 … 15	106 – 20 lg (15/f)	
15 … 30	106	
30 … 54	106	
54 … 65	100 – 10 lg (f/88)	
65 … 88	106	
88 … 140	100 – 10 lg (f/88)	
140 … 174	106 – 10 lg (f/88)	
174 … 380	97	
380 … 400	106 – 10 lg (f/88)	

Typical requirements MBN 10284-2:2011-04

- RF radiated immunity (ALSE test) acc. to ISO/DIS 11452-2:2004-11

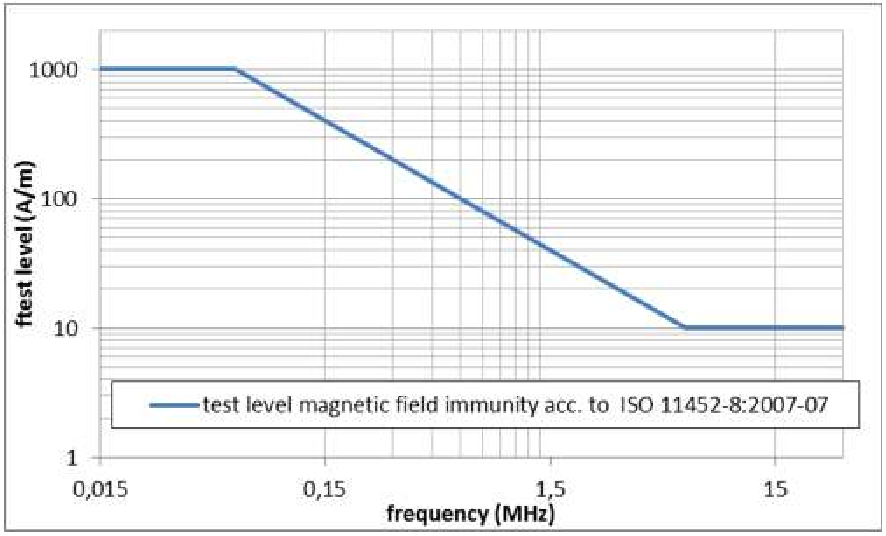


Frequency Range (MHz)	Test level (V/m)	Polarisation	Modulations
200 ... 380	70	vert + hor	CW and AM (1kHz, 80%)
380 ... 460	140	vert + hor	CW and AM (1kHz, 80%)
460 ... 806	70	vert + hor	CW and AM (1kHz, 80%)
806 ... 915	140	vert + hor	CW and pulse modulation (577µs duration, 217Hz repetition rate)
915 ... 1200	70	vert + hor	CW
1200 ... 1400	140	vert + hor	CW and pulse modulation (3µs duration, 300Hz repetition rate)
1400 ... 1710	70	vert + hor	CW
1710 ... 1910	140	vert + hor	CW and pulse modulation (577µs duration, 217Hz repetition rate)
1910 ... 2700	70	vert + hor	CW
2700 ... 3000	140	vert + hor	CW and pulse modulation (3µs duration, 300Hz repetition rate)

Typical requirements MBN10284-2:2011-04

- Magnetic field immunity acc. to ISO 11452-8:2007-07

Frequency Range (MHz)	Test level (A/m)	Modulation
0 (DC)	1000	DC
0,015 … 0,06	1000	CW
0,06 … 6	60/f	CW
6 … 30	10	CW



- transient pulses on data lines acc. to ISO7637-3:
  - Slow transient with inductive coupling (ICC), requirement: ±6V,
  - Fast Transient with capacitive coupling (CCC), requirement: -75V/+60V

Typical requirements MBN 10284-2:2011-04

- ESD requirements
  - ESD Handling Test acc. to ISO 10605:2008-07, section 9 (150pF, 330Ω)

Discharge type	pins	Housing	
		Discharge points Plastics	Discharge points Plastics
Air discharge	-	10 discharges ±4kV, ±8kV and ±15kV	10 discharges ±15kV
Contact discharge	3 discharges ±2kV, ±4kV and ±6kV	-	5 discharges ±4kV and ±8kV

  - ESD Direct Discharge acc. to ISO 10605:2008-07, Annex F (330pF, 330Ω)

Discharge type	pins	Housing, periphery, switches, displays, …	
		Discharge points Plastics	Discharge points Plastics
Air discharge	-	10 discharges ±4kV, ±8kV and ±15kV	10 discharges ±15kV
Contact discharge	3 discharges ±2kV, ±4kV and ±6kV	-	10 discharges ±4kV and ±8kV

- ESD Indirect Discharge acc. to ISO 10605:2008-07, Annex F (330pF, 330Ω)

Discharge type	Discharge islands
Air discharge	-
Contact discharge	10 discharges ±4kV, ±8kV and ±15kV

Open questions/issues

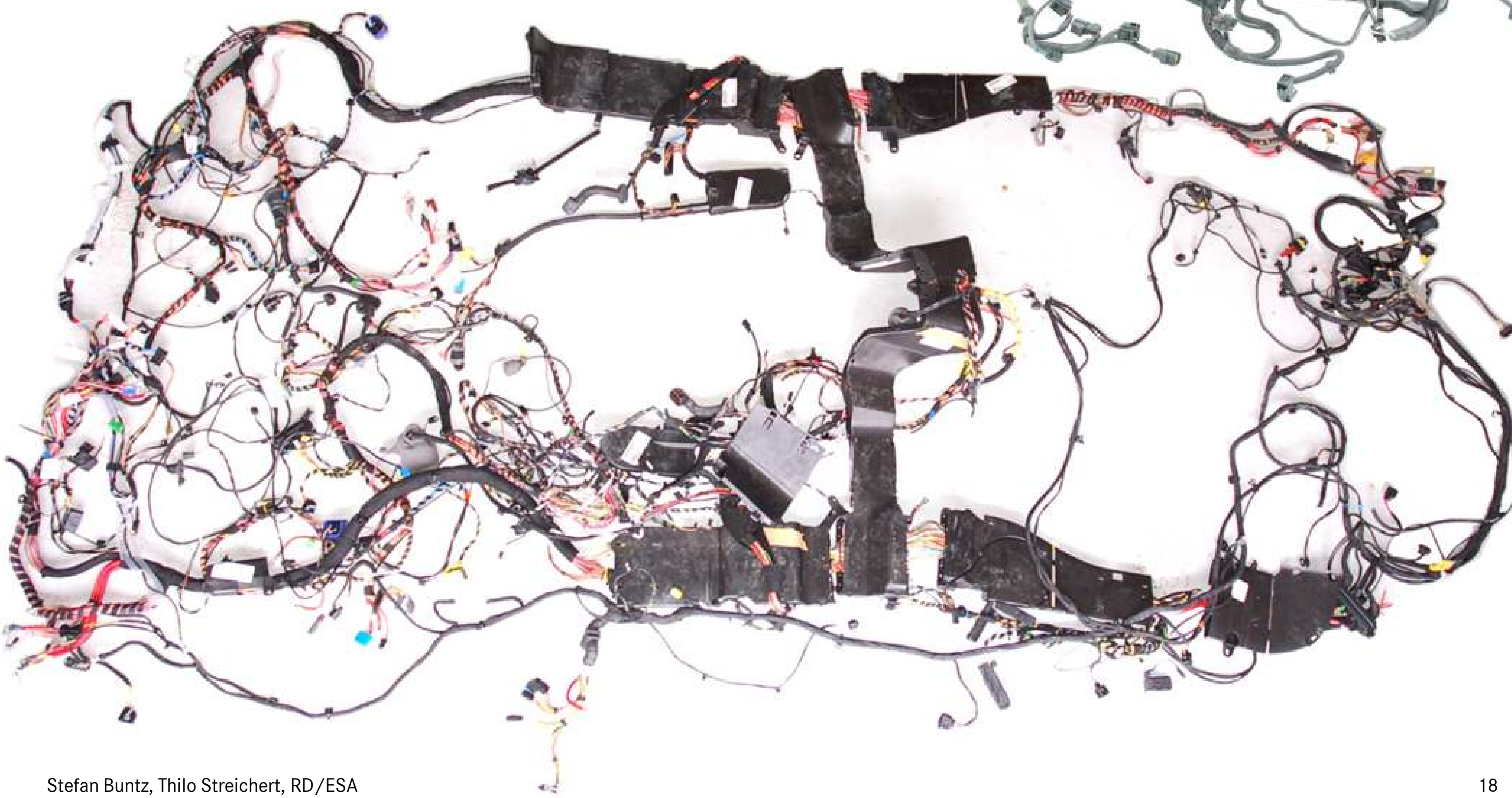
- The above shown EMC requirements describe the overall performance. For the individual System Components (PHY/Filtering/PCB/Connectors/Cables) dedicated requirements must be derived.
- Therefore we see the need that chip designers derive the respective requirements for the other system components out of their solution.
  → e.g. How much unsymmetry (TLC, TLTC) does the (planned) chip/system allow in order to still fullfill the shown requirements?

exemplary automotive cable harness

- **overview / parts of the cable harness**
  - engine harness
  - cockpit-harness
  - Powertrain harness
- **examples of connectors**
- **TDR measurements (impedance)**
- **S-parameter measurements**

Mercedes-Benz S-Class (2006) complete cable harness

- about 38kg, following slides show details of this harness (parts of some dedicated harnesses)



engine harness (e.g. headlights)

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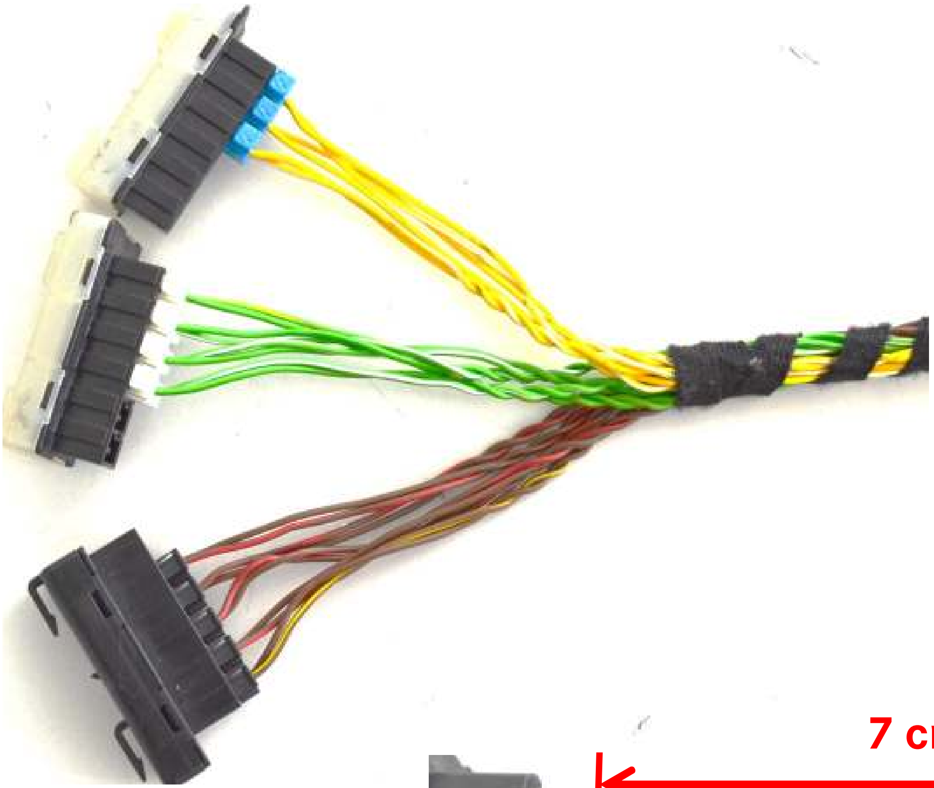
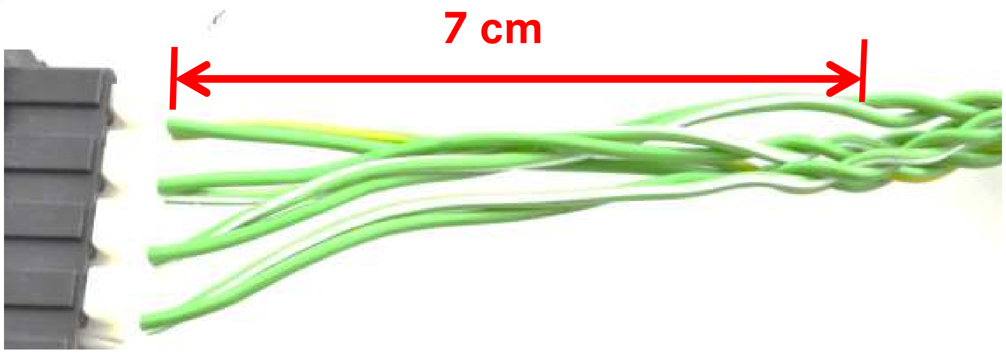
cockpit harness

body harness (part)

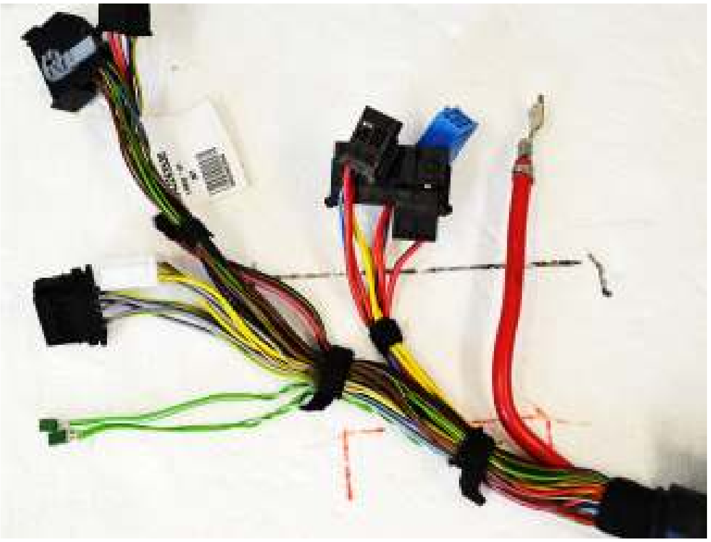
connector examples (CAN star coupler)

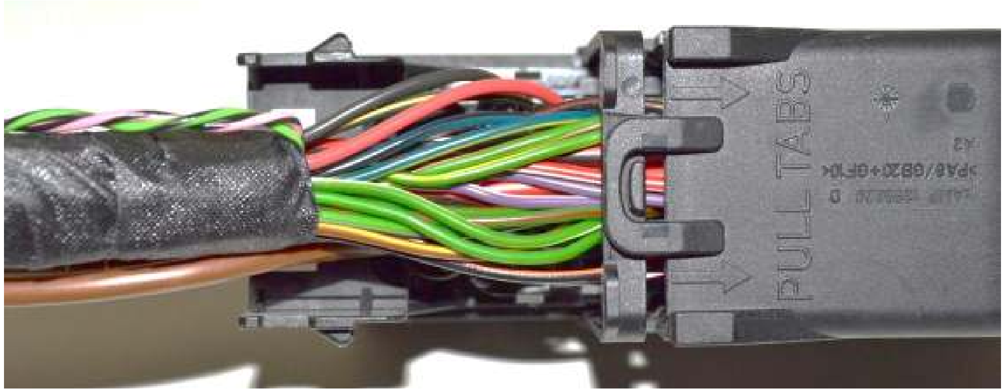


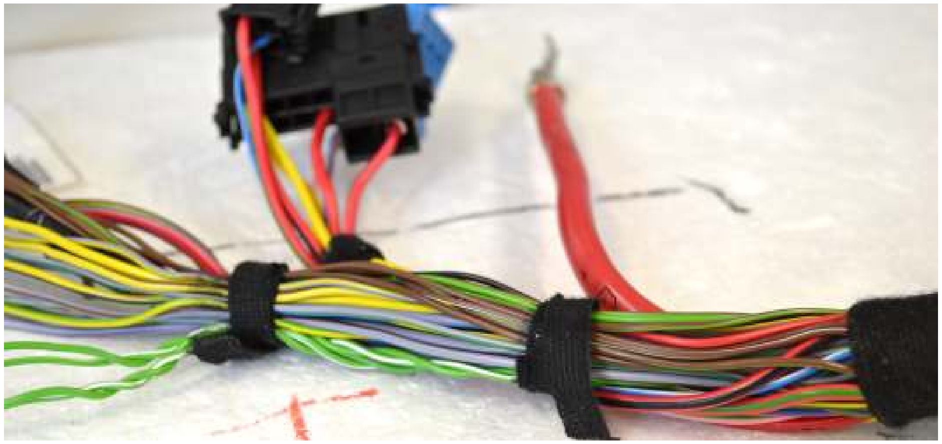


- CAN cables:
  70mm of untwisted cable

connector examples







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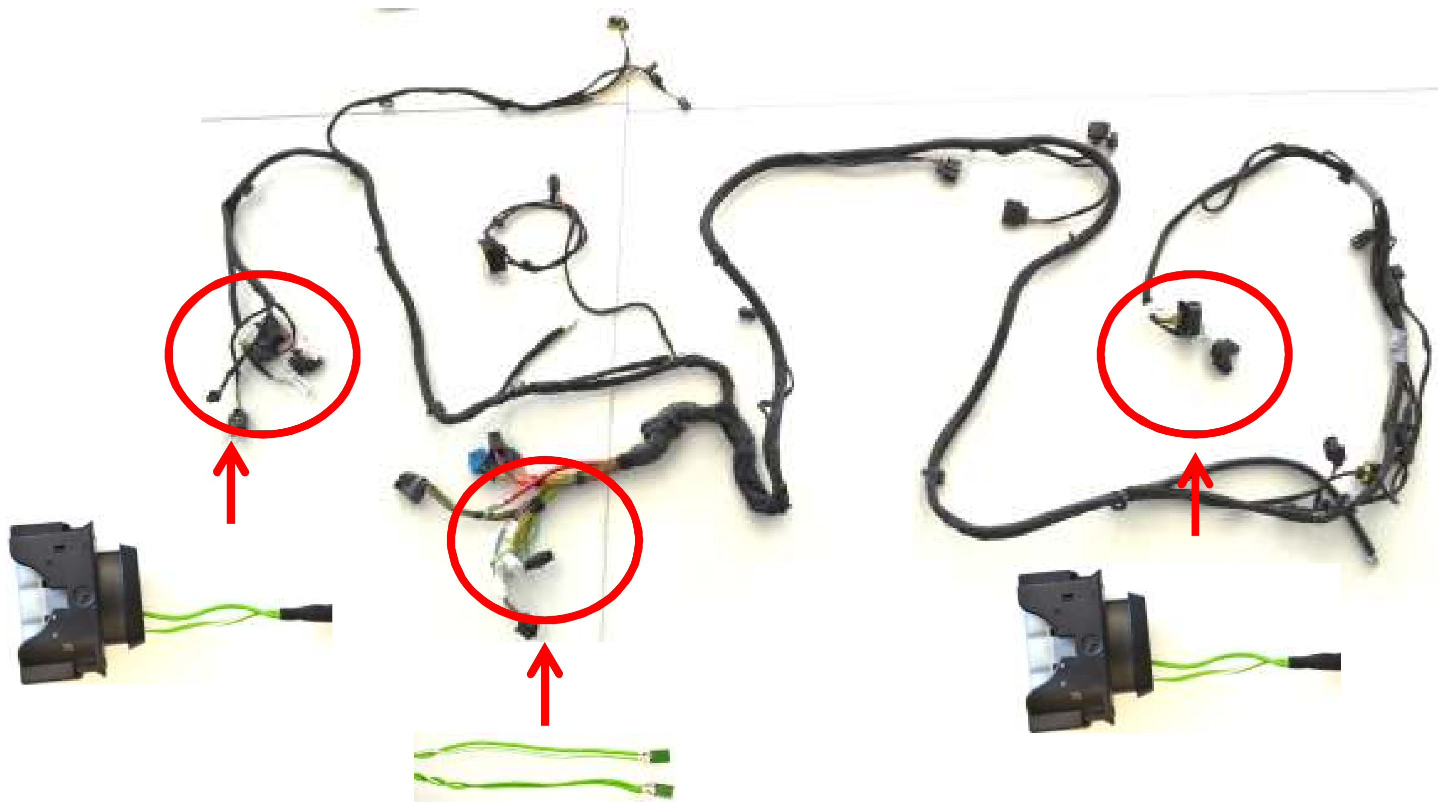
TDR measurements

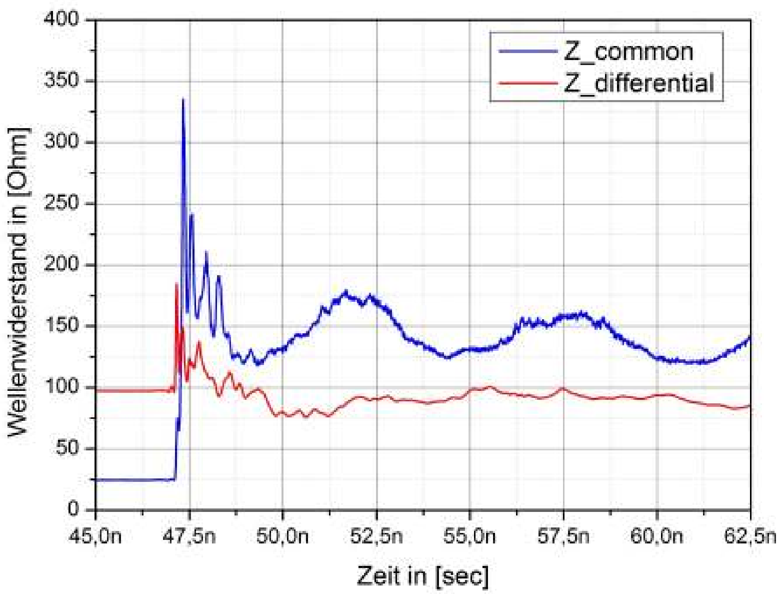
- CAN connection of headlights (engine compartment, no inline connectors)
- cable harness 50mm above GND, no inline connectors

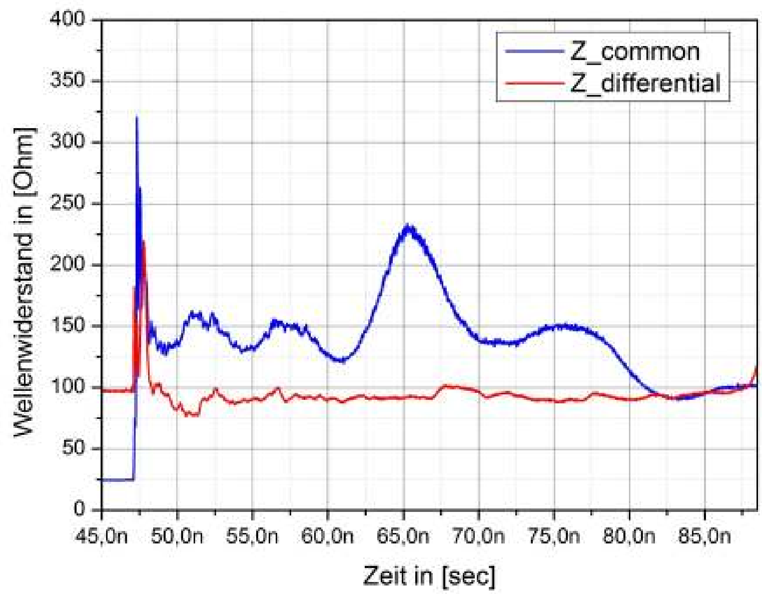


TDR measurements

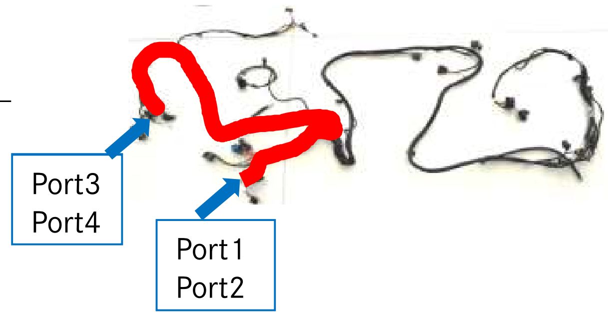
ca. 1.80m

ca. 4.00m

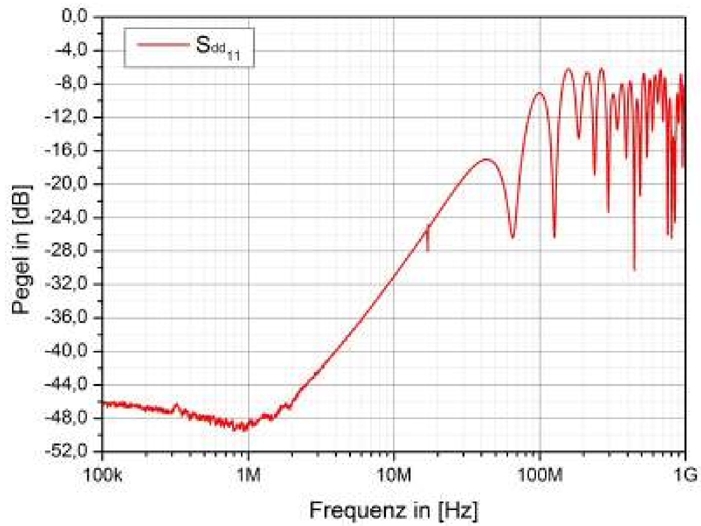


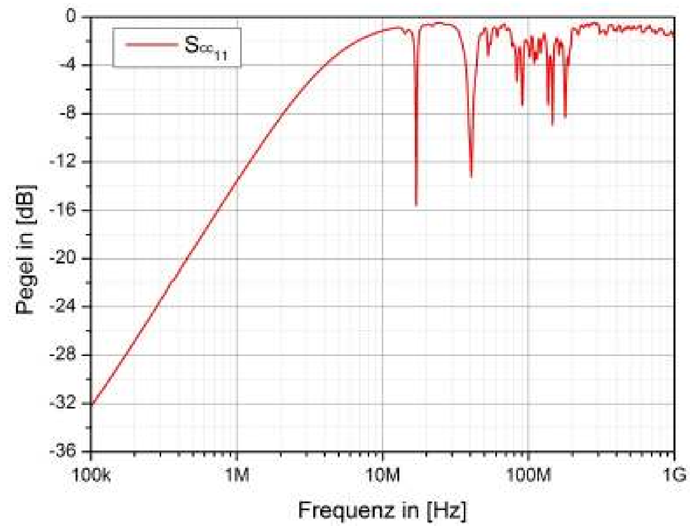


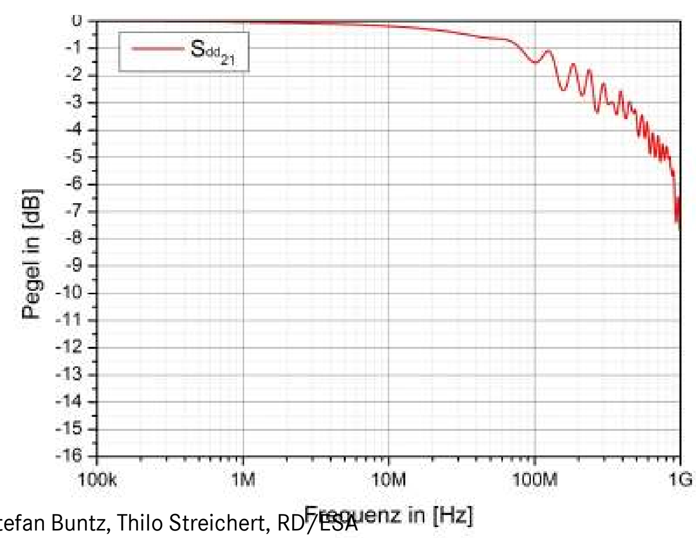
S-Parameter

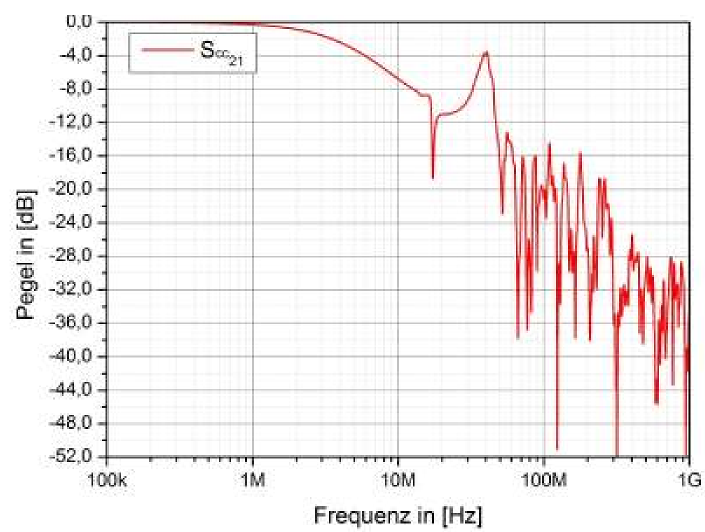


ca. 1.80m

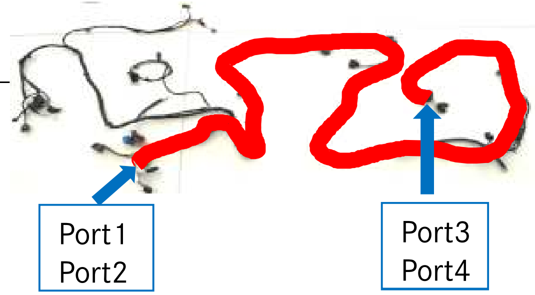




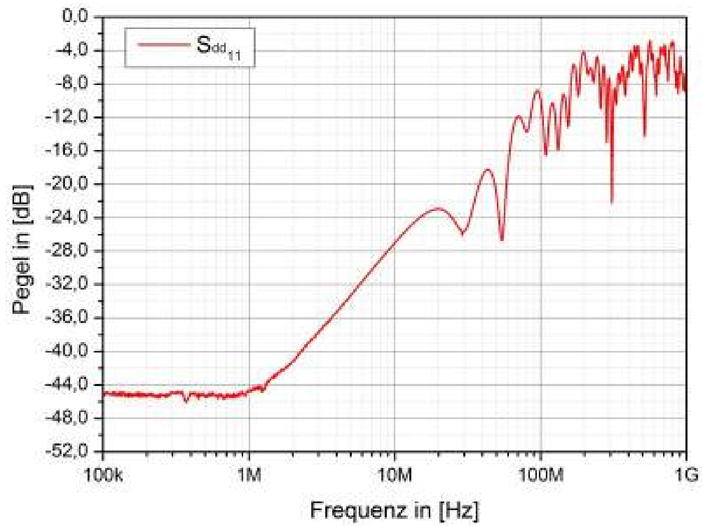


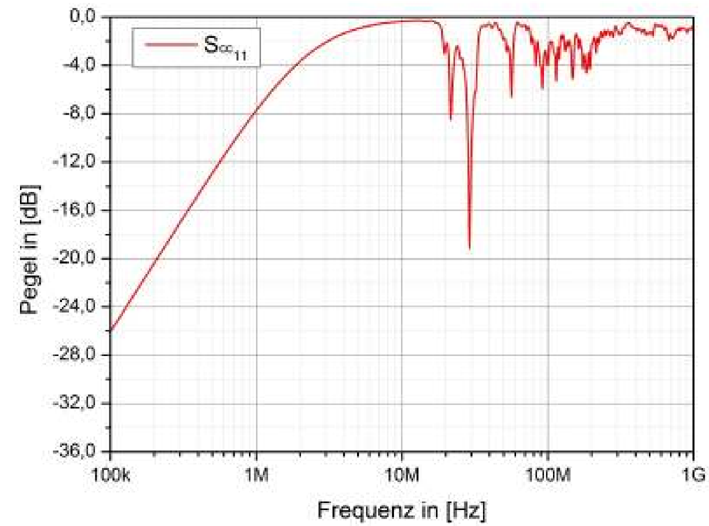


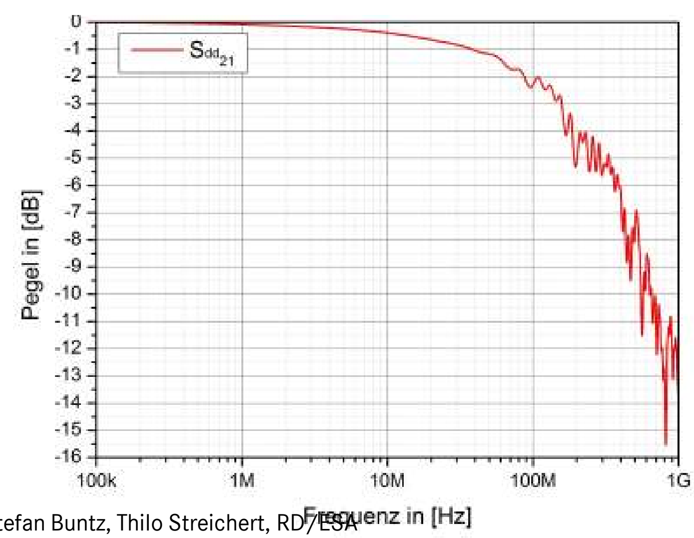
S-Parameter

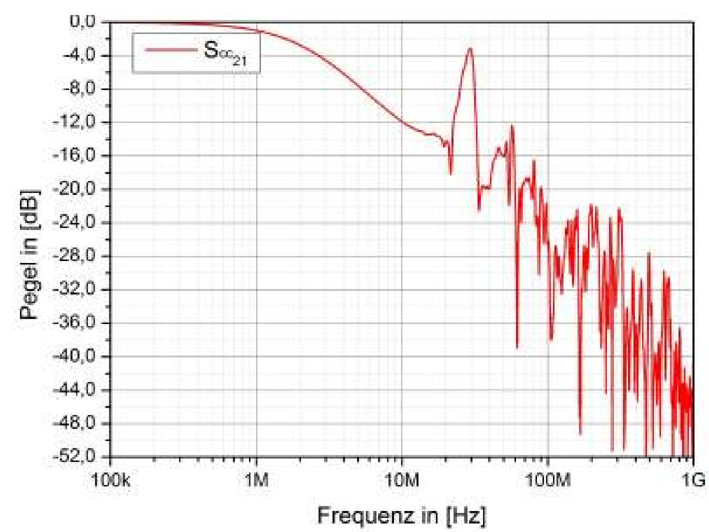


ca. 4.00m





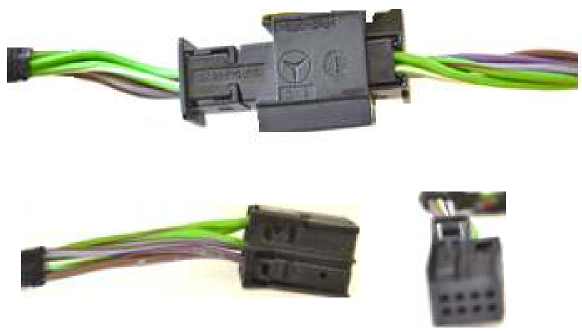




S-parameter with (simple) in-line-connector

Port 1

ca. 5.60m



In-Line-Stecker

ca. 2.10m

Port 2

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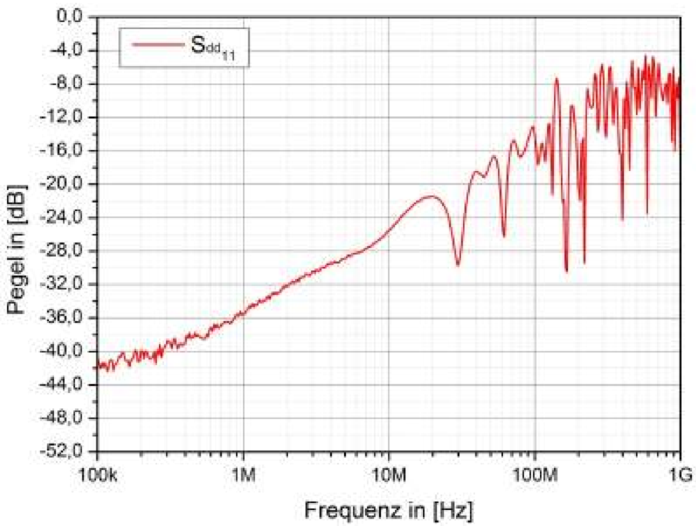
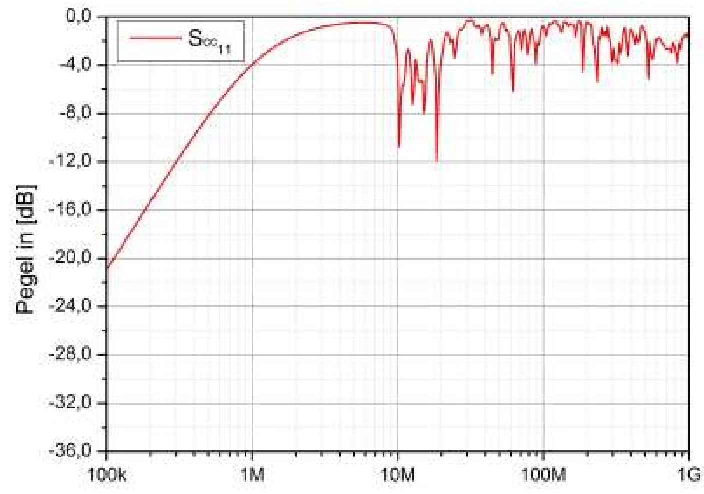
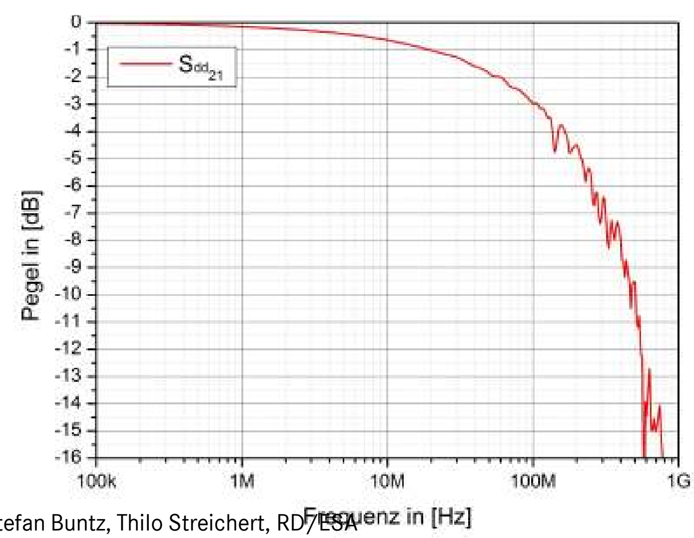
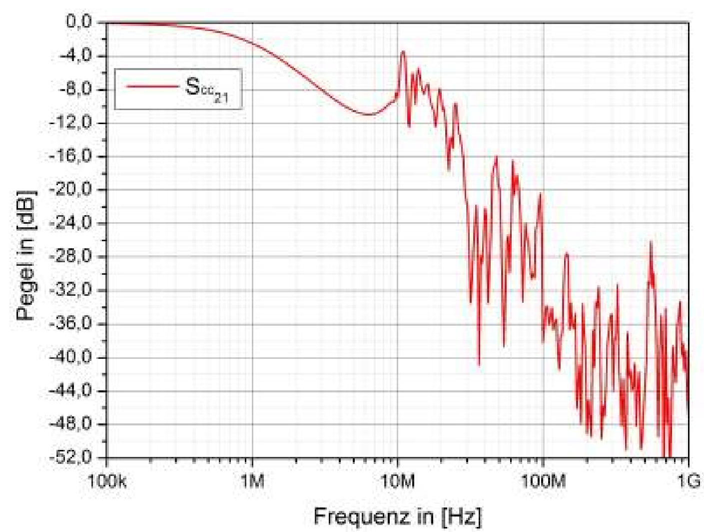
S-Parameter with In-line-connector









summary

- The shown pictures are just examples of an automotive cable harness
- The shown s-Parameter measurements are also just examples (and by way not the „worst case“) of how an automotive channel coul look like.

Automotive requirements for Connector

- a multi-pin connector must be possible (e.g. similar to MQS)
- A possibility for contacting shielded cables must be possible inside the multi-pin connector