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# Rosenberger

## NGAuto channel options

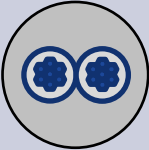
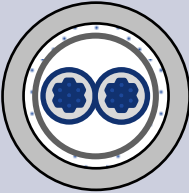
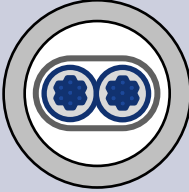

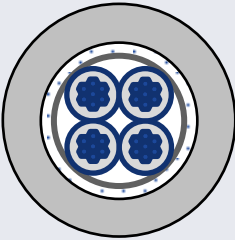
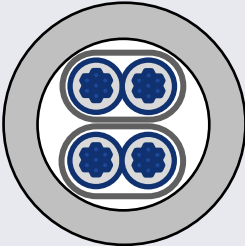
Thomas Müller

Supporters  
Amir Barniv (Aquantia)



- Channel options overview
  - Cable measurement results
    - Coaxial cables
    - Shielded differential cables
  - Channel measurement results
    - Coaxial 15 m with 4 Inlines
  - Summary
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- Channel options for automotive Multi-Gigabit Ethernet

Lanes	UTP	STP STQ	SPP (Parallel Pair)	Coaxial
One				
Two				

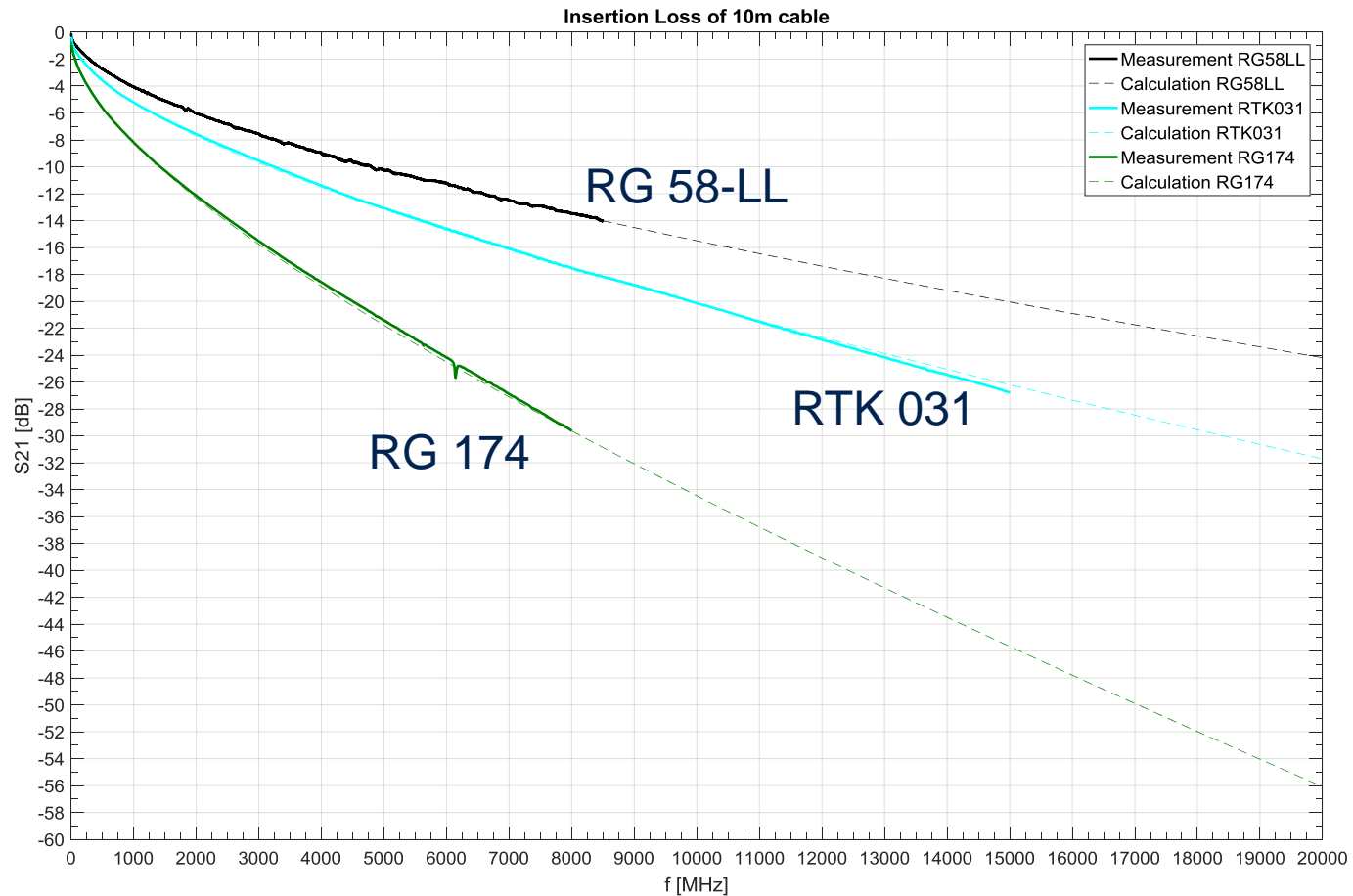
Notes:  
Typically conductors are stranded  
Typically air filled for shielded cables

- Automotive connector interfaces for STP/SPP and coax up to 15 GHz RF bandwidth are under development and be available
- 10 Gbps will be supported from cable and connector side

- Common automotive coaxial cable types

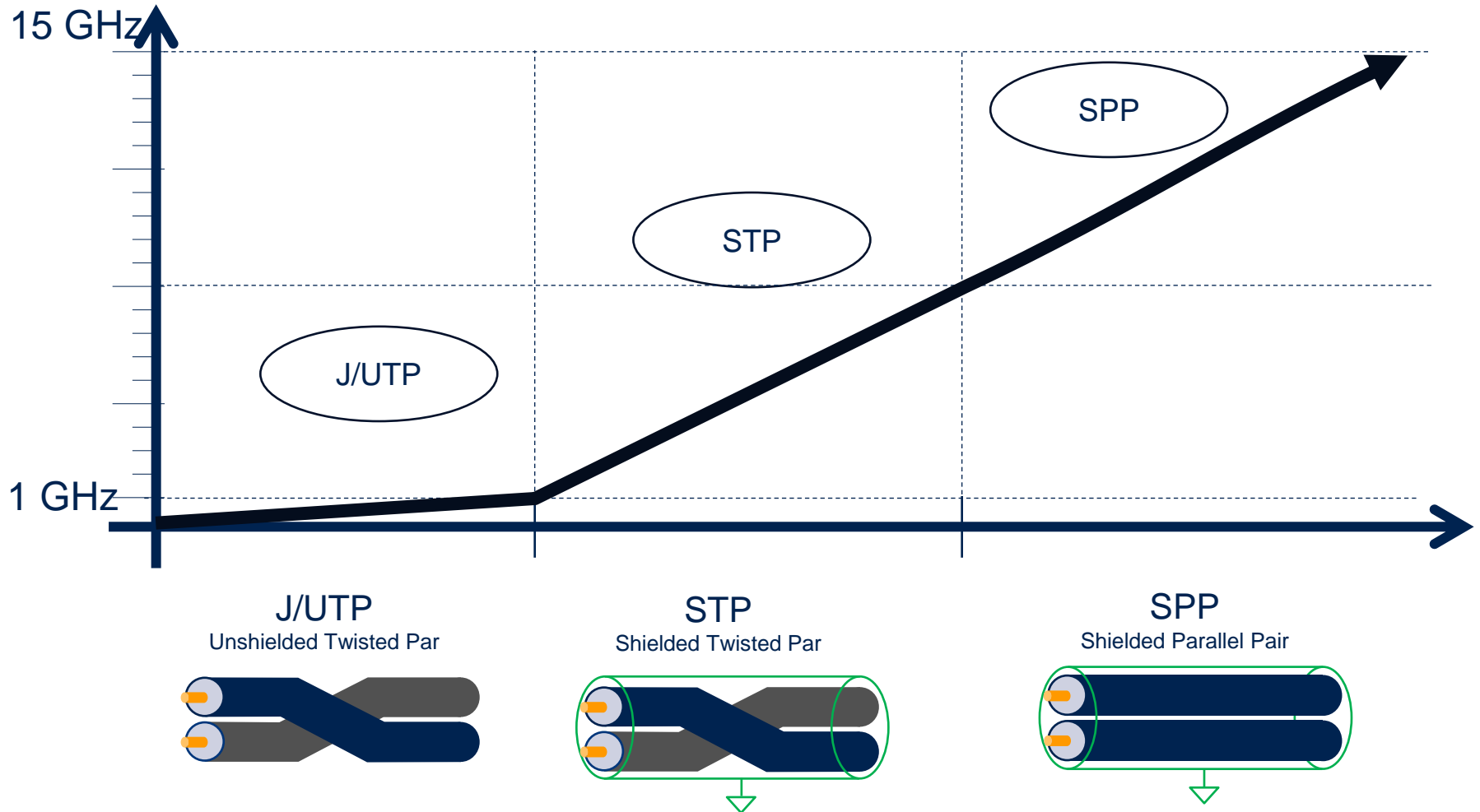
	RG 174 (1,5-2,8)	RTK 031 (2,1-3,3)	RG 58-LL (2,95-4,95)
IL @ 3 GHz [dB/m] (@ Room temp., new)	1.6	0.9 – 1.06	0.75 – 0.85
Inner Cond. CS [mm <sup>2</sup> ]	0.14 (~ AWG 26)	0.4 (~ AWG 22)	0.75 (~ AWG 18)
Outer Diameter [mm]	2.8	3.3	4.6 - 4.95
Dielectric	XPE / PP	PP / PP foam	PP foam
Screen	Foil + Braid	Foil + Braid	Foil + Braid
Weight [g/m]	13	19 - 20	35 - 40
Temp. range [°C]	-40 - +105	-40 - +105	-40 - +105

- Insertion loss at room temperature
- 10 m cable length

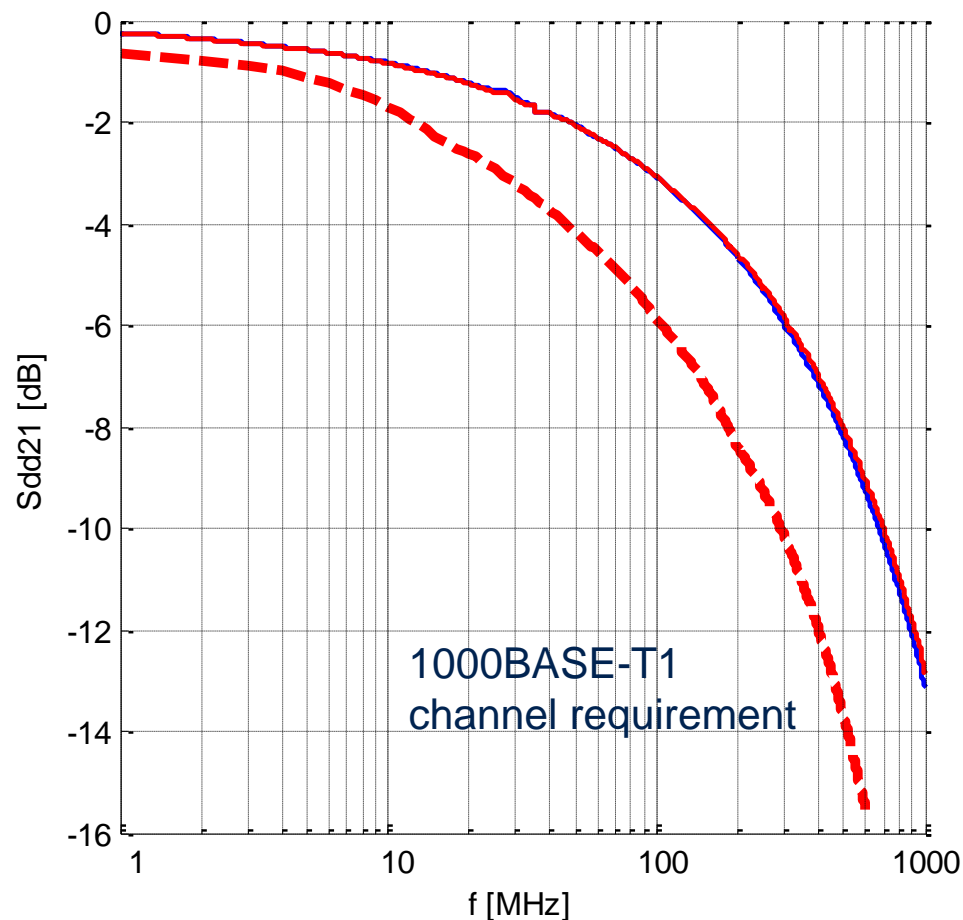


## Overview

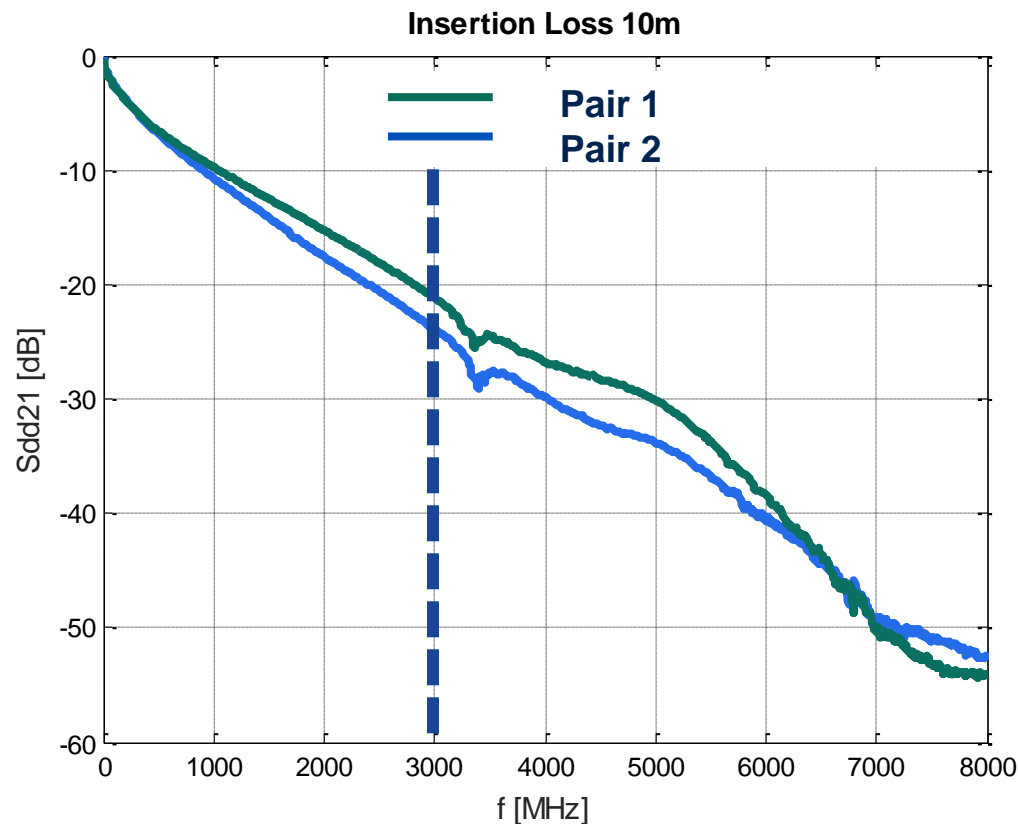
- Cable types for differential signaling



- Insertion loss at room temperature
- J/UTP cable 10 m length, 1000BASE-T1 type, AWG26



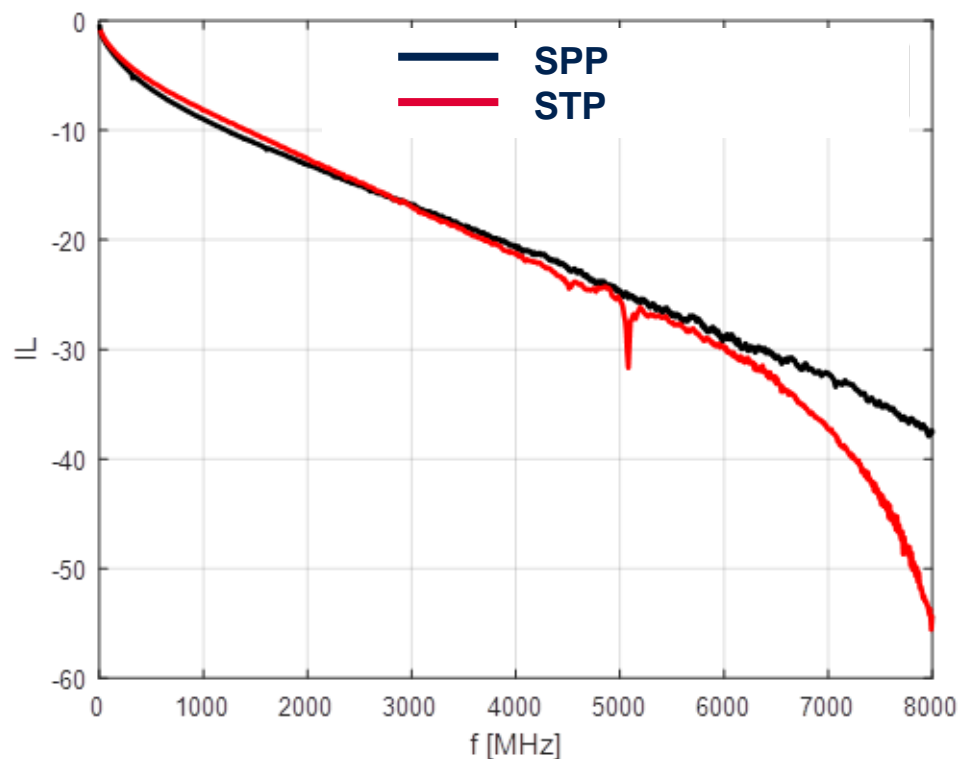
- Insertion loss at room temperature
- STQ cable 10 m length (AWG26), specified to max. 3 GHz



- 2 x 3 GHz bandwidth is realistic with good STQ cables



- Insertion loss at room temperature
- STP and SPP cable 10 m length (AWG26)



- Insertion loss very similar but SPP without dip

- Measuring transfer impedance and screening attenuation
- some kHz up to more than 4 GHz with only one test set-up

Component  
Tests

IEC 62153-4-4

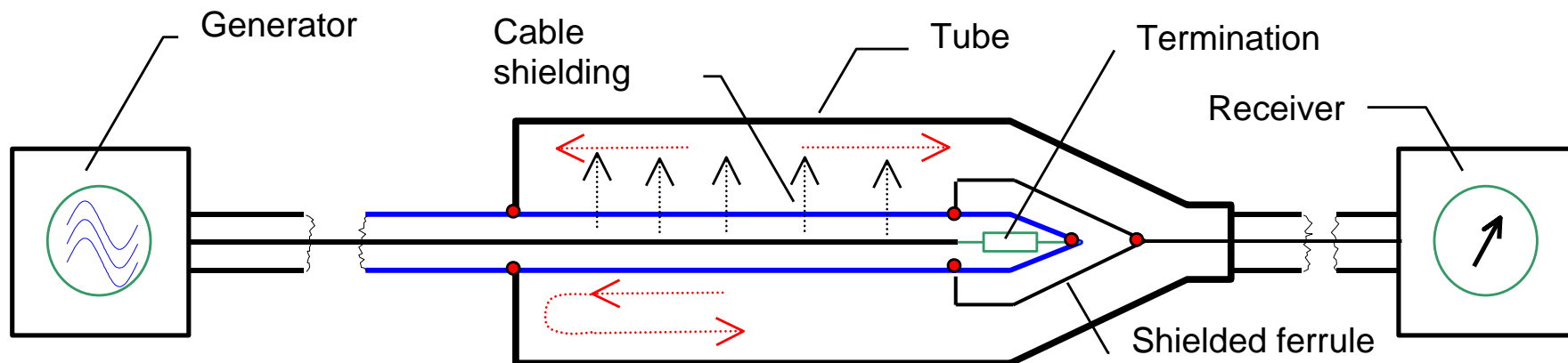
Cable

IEC 62153-4-7

Inline connections

IEC 62153-4-10

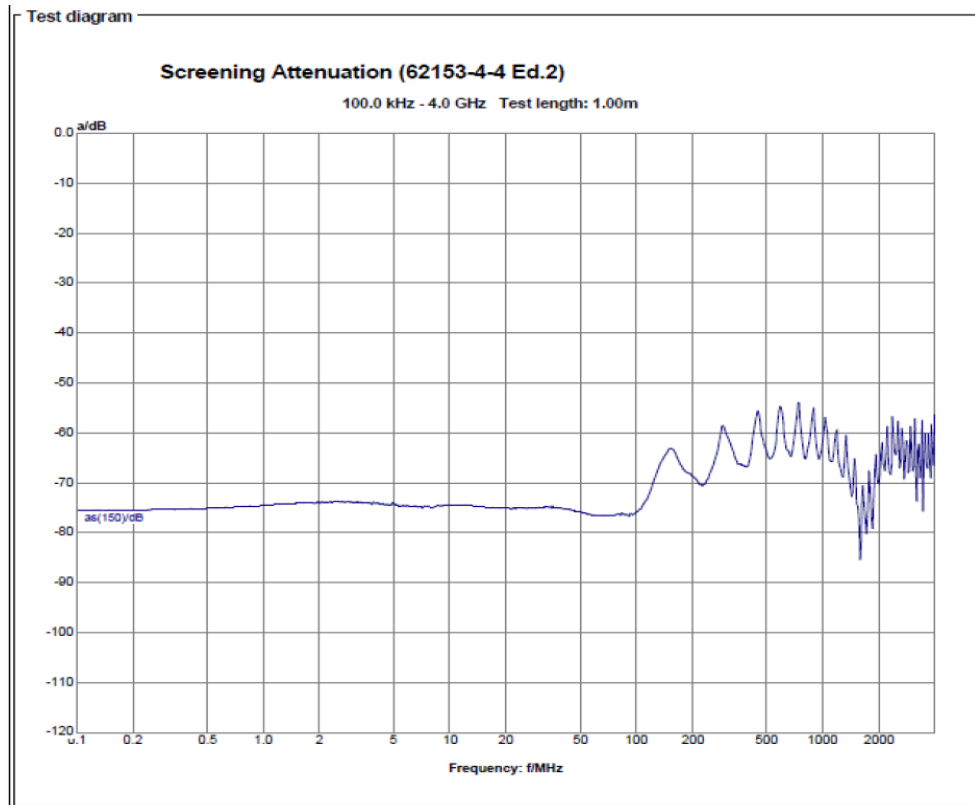
Feedthroughs



IEC 62153-4-3/-4-4 Metallic communication cable test methods, EMC

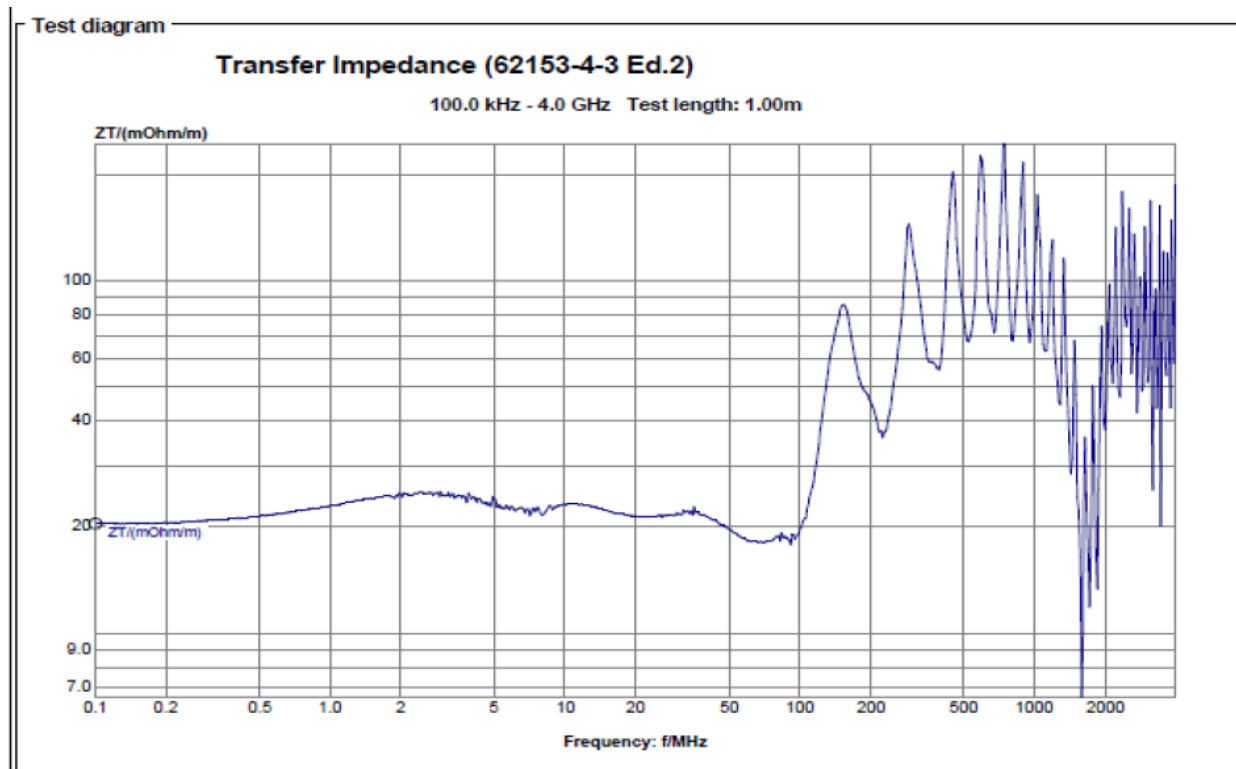
EN 50289-1-6 Communication cable, Electromagnetic performance

- Screening attenuation of typical STP cable (AWG26)
- Foil and braid shield



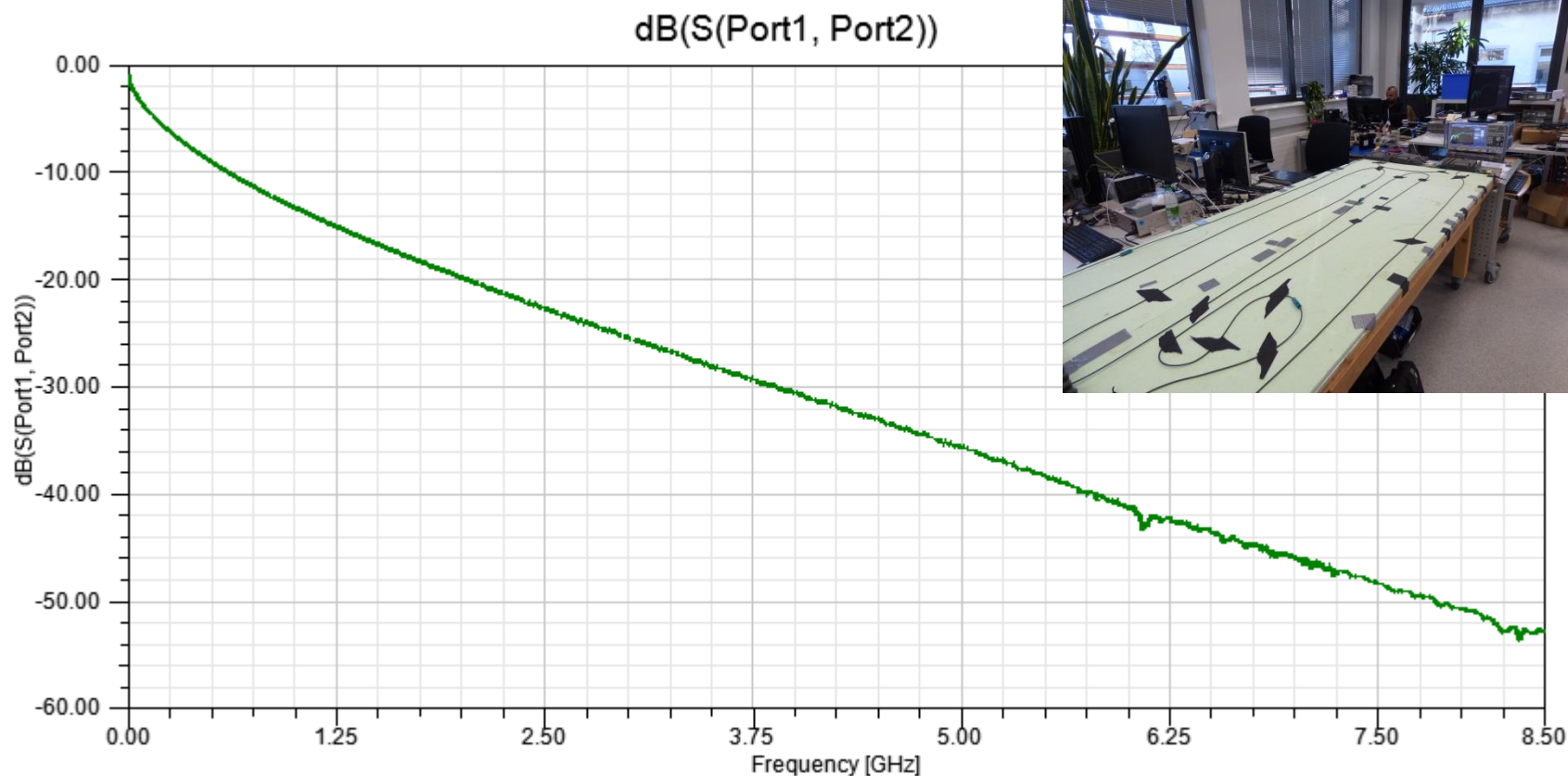
- Can be measured up to 9 GHz depending on setup

- Transfer impedance of typical STP cable (AWG26)
- Foil and braid shield



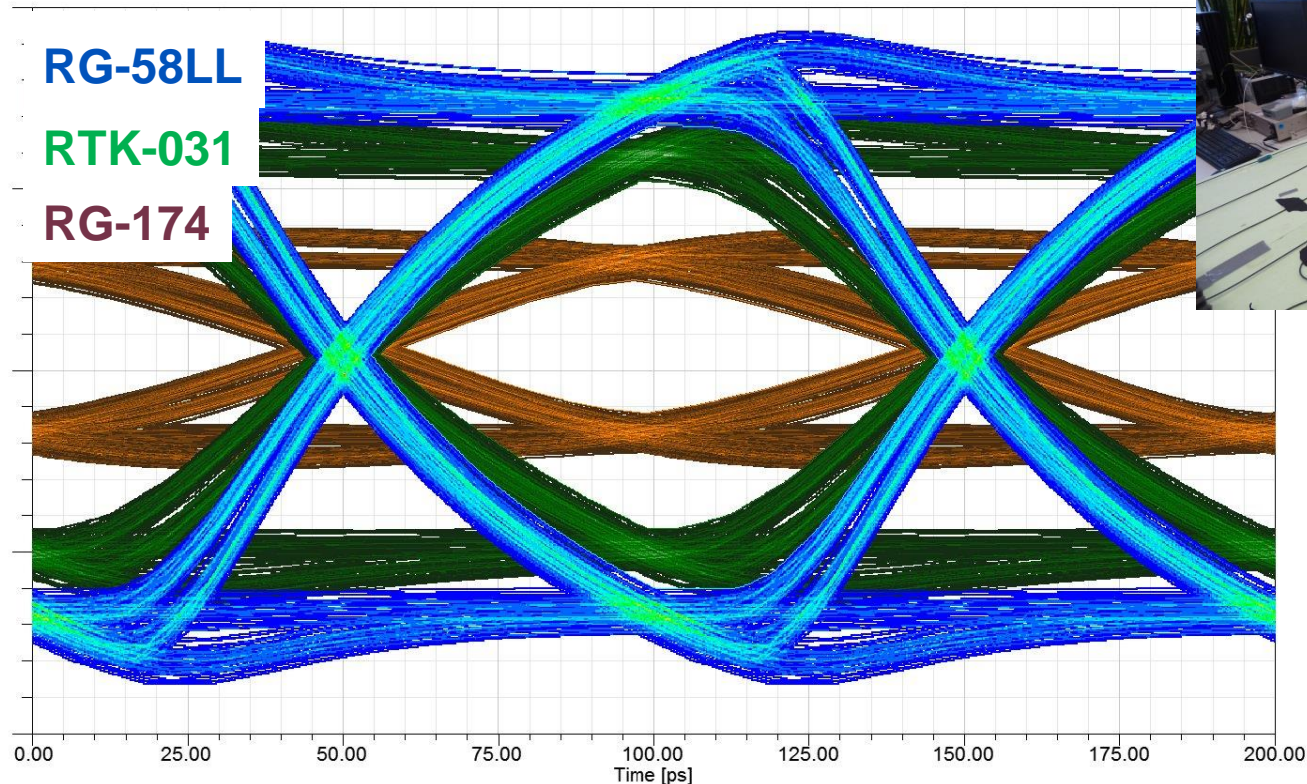
- Mainly determined by DC resistance

- Insertion loss at room temperature
- 15 m coax channel with 4 Inlines (RG174 style, AWG26)



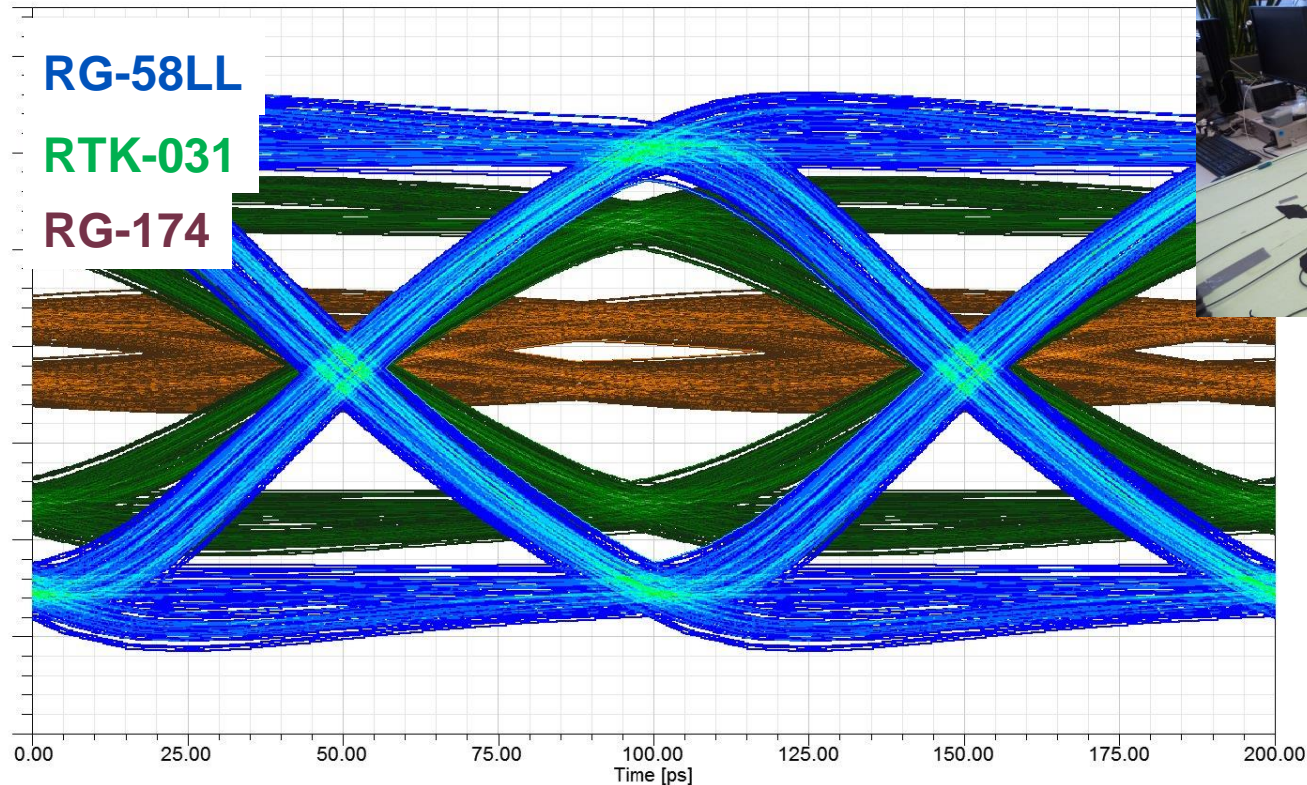
- Smooth slope with low reflections (dips)

- Eye diagram 10 Gbps (with preemphasis and equalization)
- PAM 2
- 10 m coax channel with 3 cable types



- Transmission should be possible

- Eye diagram 10 Gbps (with preemphasis and equalization)
- PAM 2
- 15 m coax channel with 3 cable types



- Reachable channel length depends on the cable attenuation

- Automotive connector and cables up to 15 GHz RF bandwidth are under development for STP/SPP and coax and will be available soon
  - 10 Gbps will be supported from cable and connector side
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