Rosenberger

802.3ch channel options

Thomas Müller

802.3ch channel options

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- Estimated worst case bandwidth assumption for 10 Gbps (NRZ coding)

$$0.75 \times \text{bit rate}_{\text{[in bps]}} = \text{bandwidth}_{\text{[in Hz]}}$$

- 10 Gbps requires a bandwidth of 7.5 GHz maximum
- With more advanced modulation (e.g. PAMx*) the required bandwidth can be reduced (*x ≥3)

802.3ch channel options

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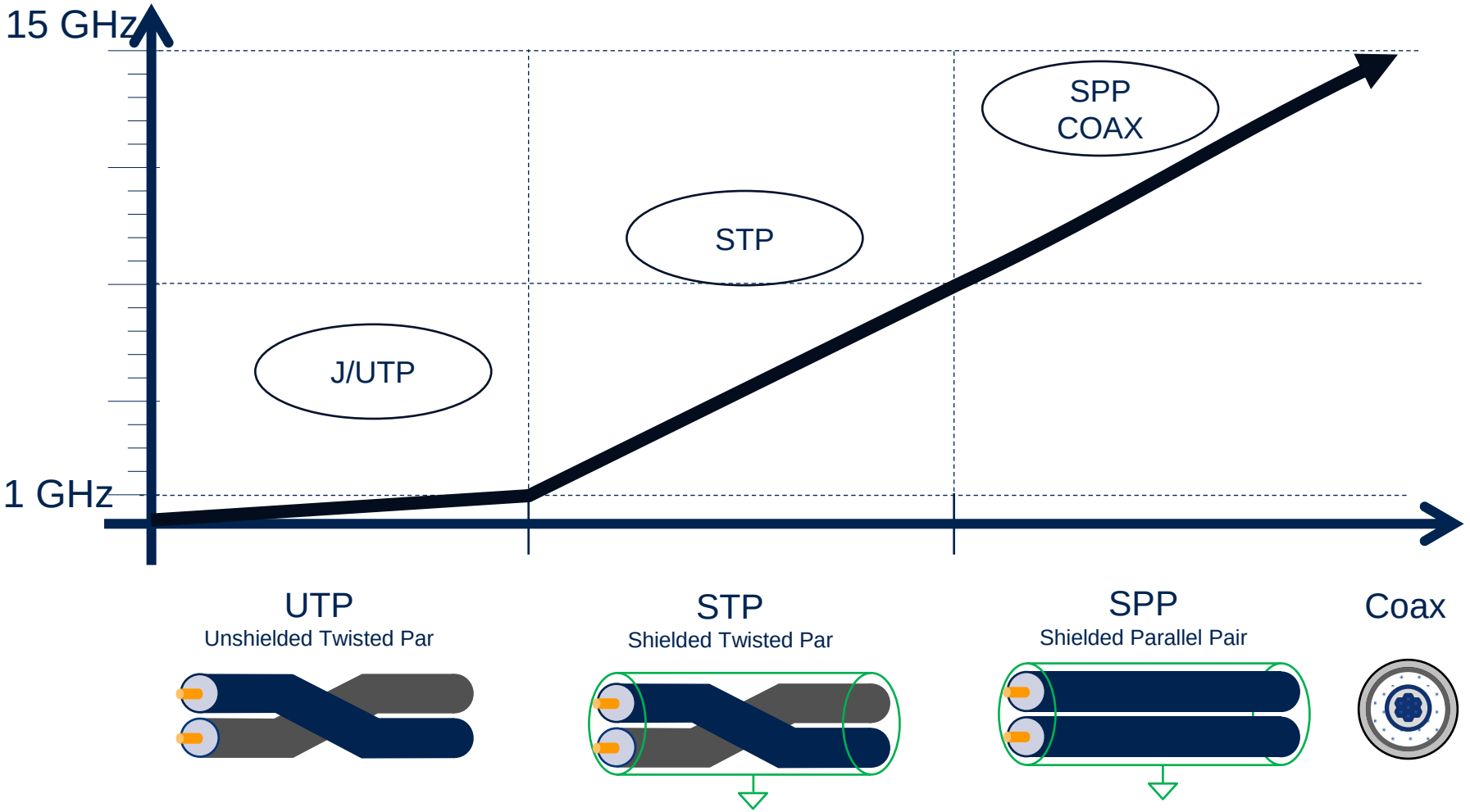
- Channel options for 802.3ch



802.3ch channel options

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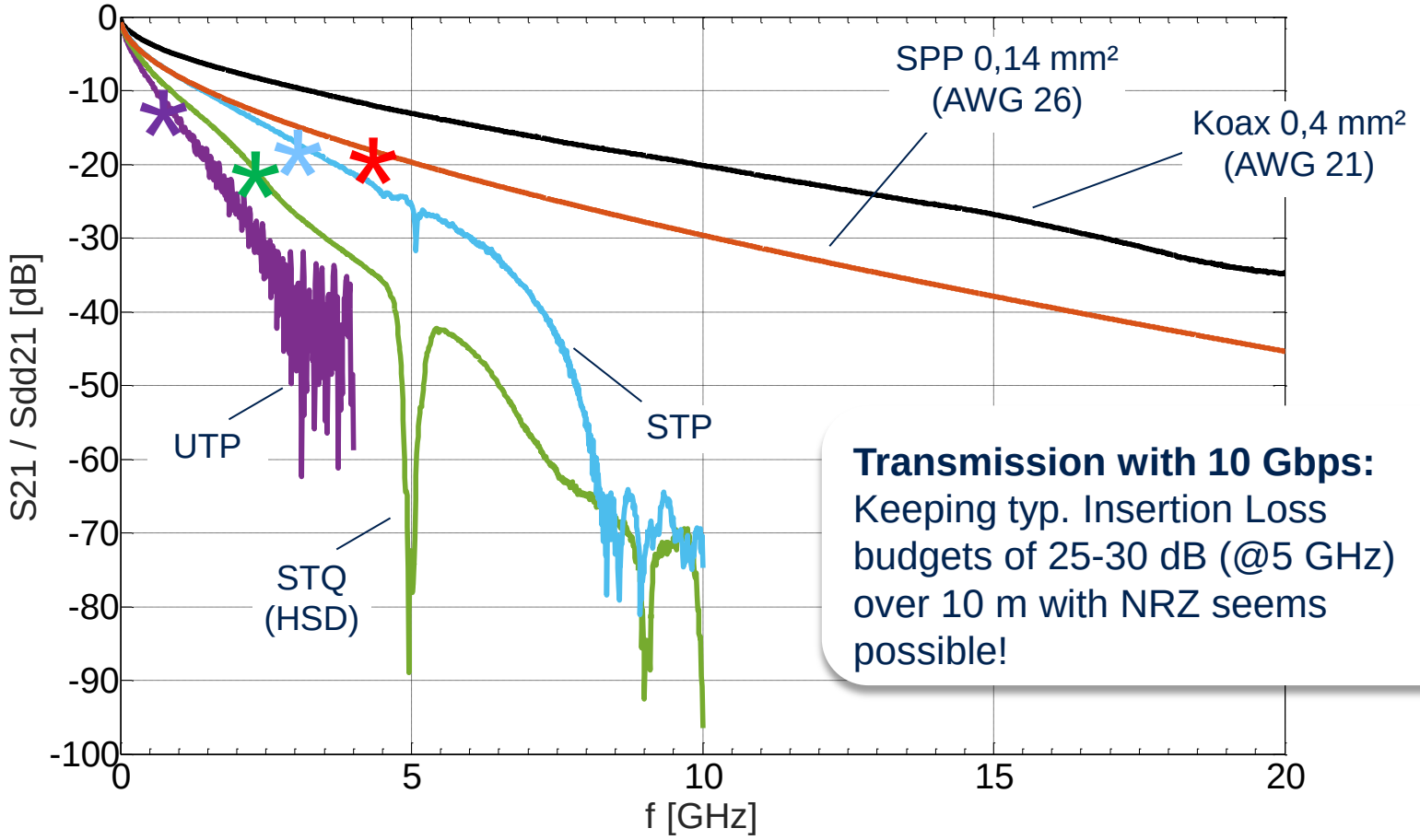
- Insertion loss of 10 m cable length at room temperature



Transmission with 10 Gbps: Keeping typ. Insertion Loss budgets of 25-30 dB (@5 GHz) over 10 m with NRZ seems possible!

* Highest frequency according to data sheet for each cable type

802.3ch channel options

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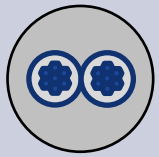
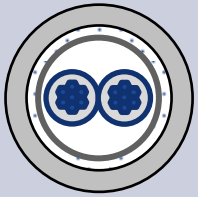
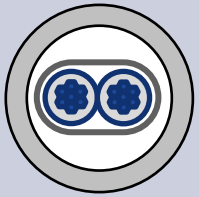
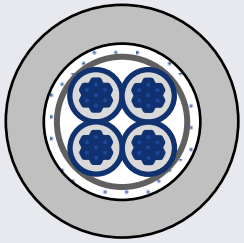
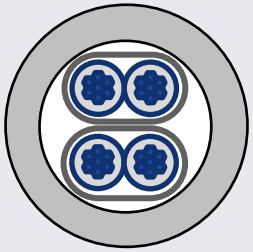
- Cabling options for 802.3ch

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

- Automotive cables to support 10 Gbps (≥ 7.5 GHz BW) are available for differential 1 pair, 2 pairs and coax

802.3ch channel options

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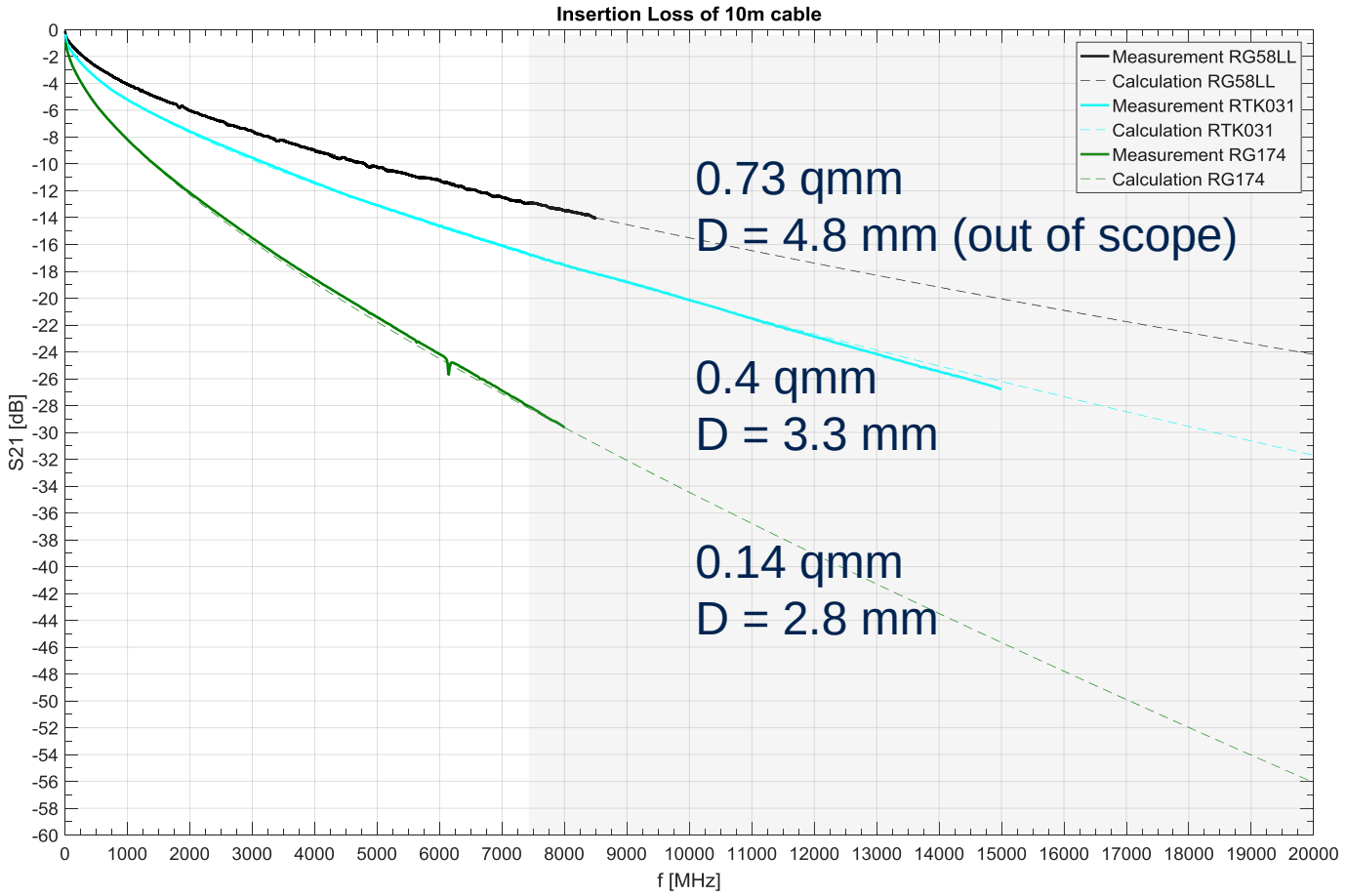
- Insertion loss of 10 m coaxial cable with different wire gauges at room temperature



802.3ch channel options

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- Channel insertion loss at room temperature
- 15 m coax channel with 4 Inlines (5 x 3m, AWG26)

Transmission with 10 Gbps: Keeping typ. Insertion Loss budgets of 25-30 dB (@5 GHz) over 10 m seems possible, 15 m could be challenging with NRZ and AWG26

- Smooth slope with low reflections (dips)

802.3ch channel options

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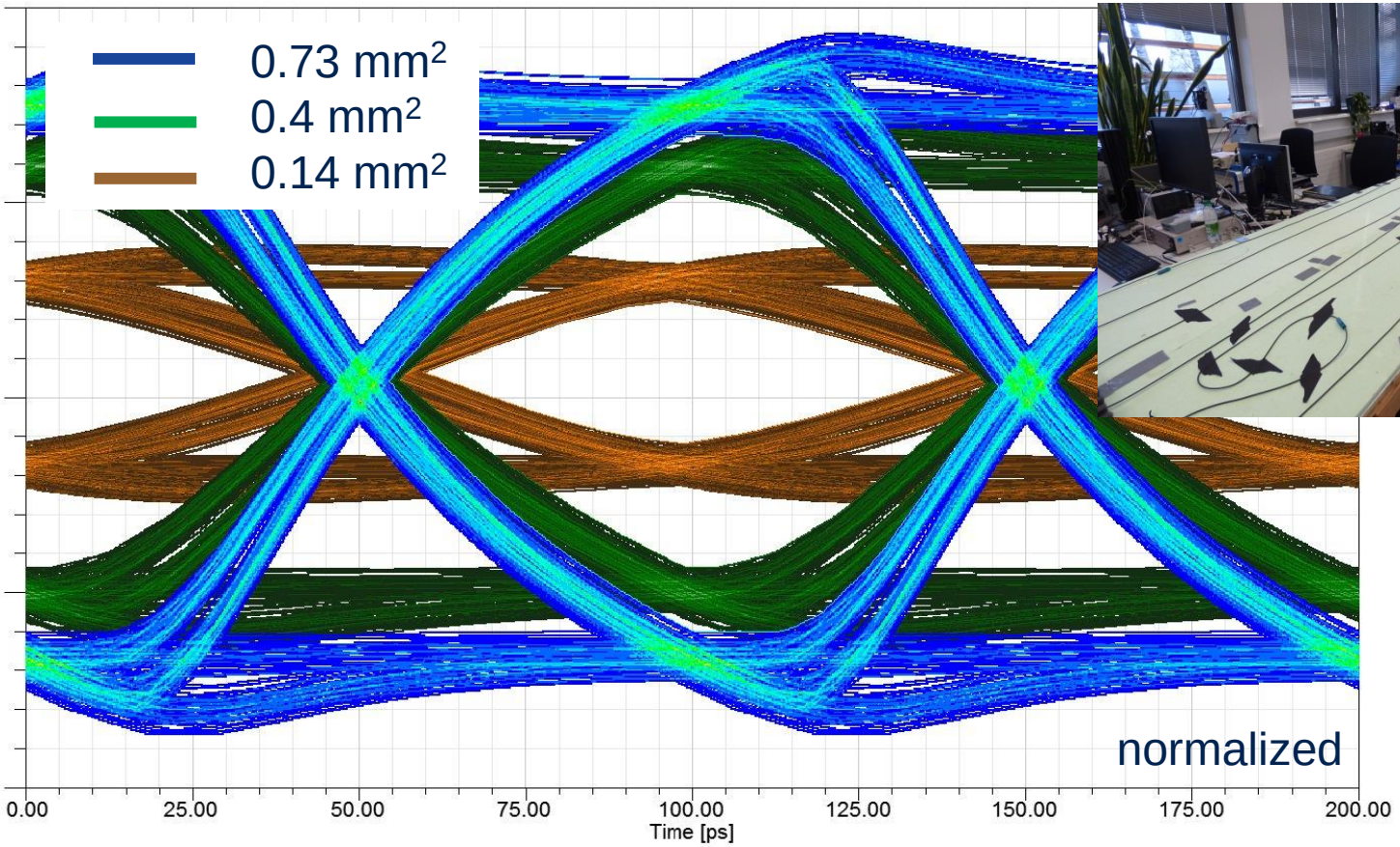
- Eye diagram 10 Gpbs with preemphasis and equalization
- 10 m coax channel with different wire gauges



- Transmission should be possible

802.3ch channel options

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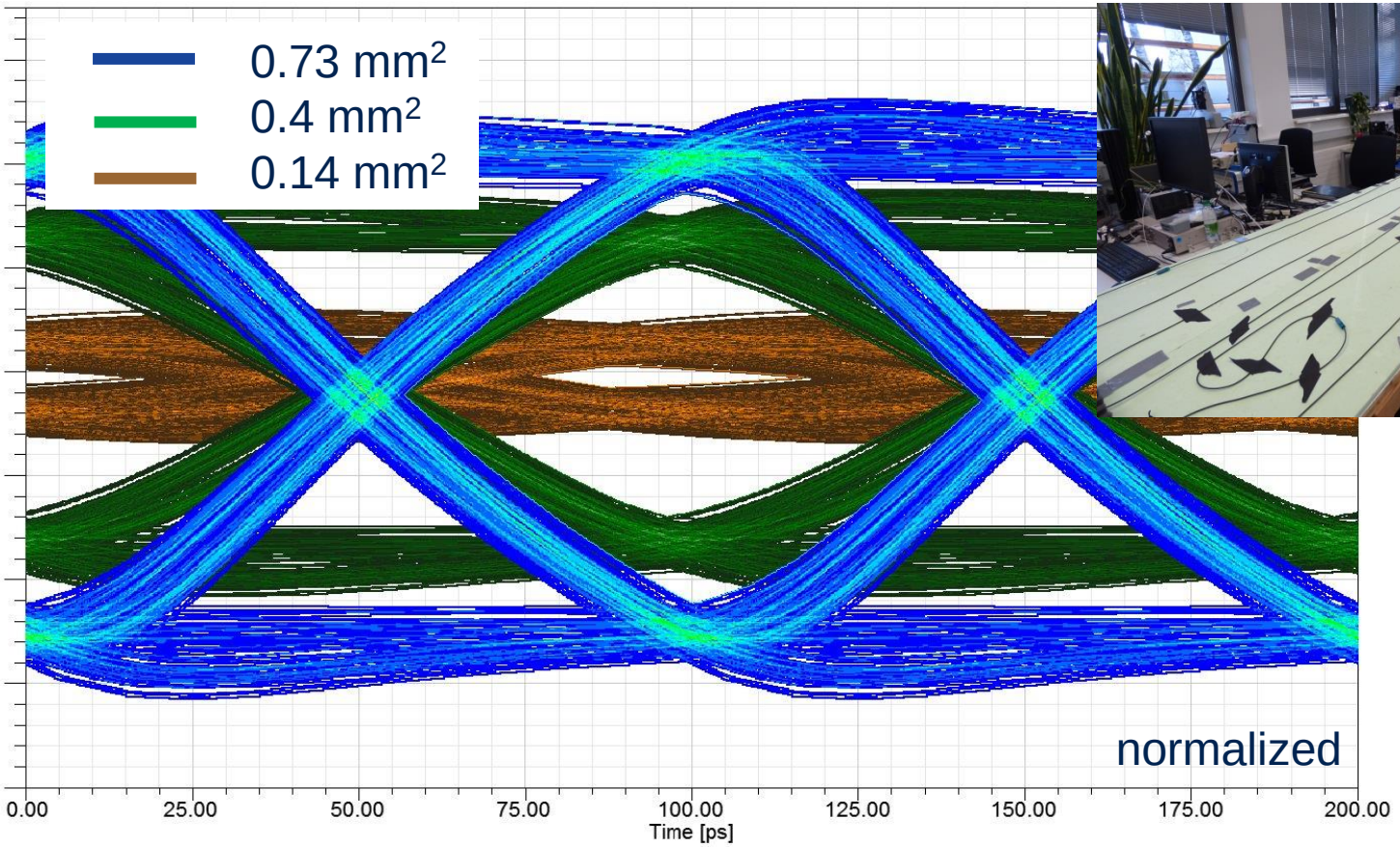
- Eye diagram 10 Gpbs with preemphasis and equalization
- 15 m coax channel with different wire gauges



- Achievable link length depends on the cable attenuation

802.3ch channel options

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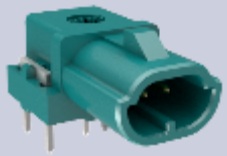
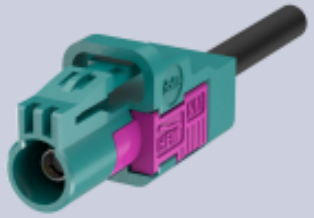
- Connector options for 802.3ch (examples)

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

- Automotive connector interfaces to support 10 Gbps (≥ 7.5 GHz BW) are available for differential 1 pair, 2 pairs and coax

802.3ch channel options

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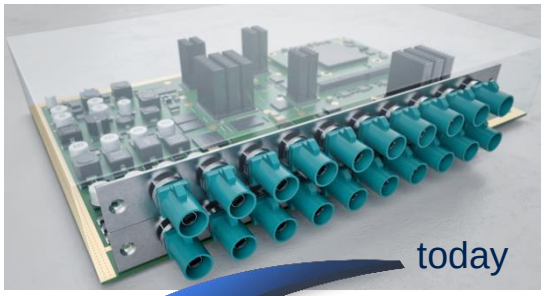
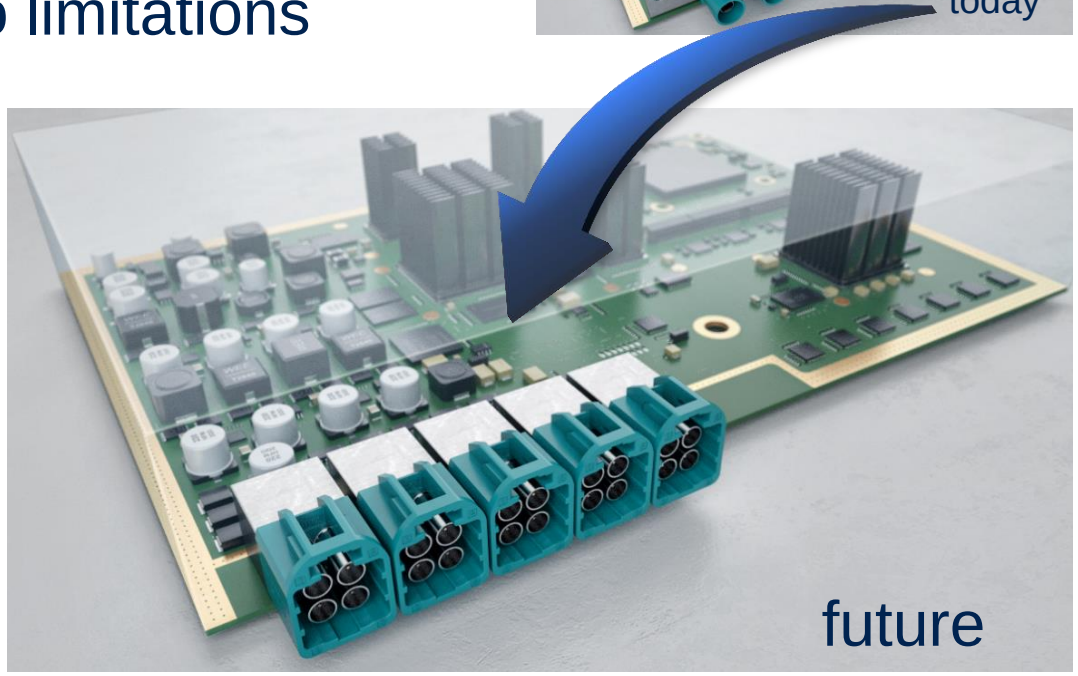
- Miniaturization of connector is the second driving force apart from improving bandwidth
- Miniaturization leads to limitations on the physical dimensions of the cables





- 802.3ch should target cables with D= 4.6 mm max. for differential links and D = 3.6 mm max. for coaxial links

802.3ch channel options

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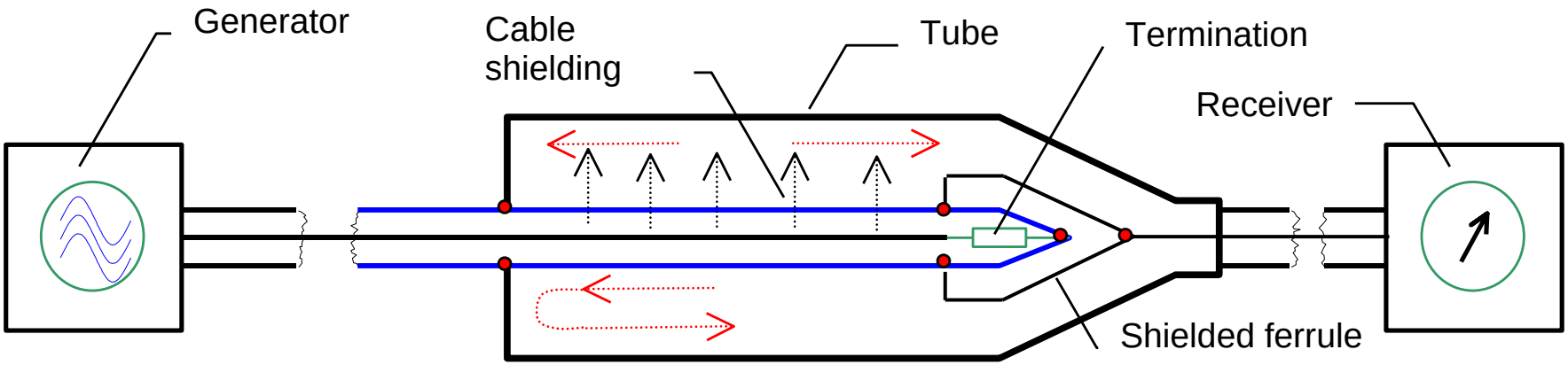
- Measuring transfer impedance and screening attenuation
- Differential and coaxial components

Component Tests	IEC 62153-4-4	IEC 62153-4-7	IEC 62153-4-10
	Cable	Inline connections	Feedthroughs



- Coupling attenuation measurement also possible with precise differential feed and termination (more challenging)

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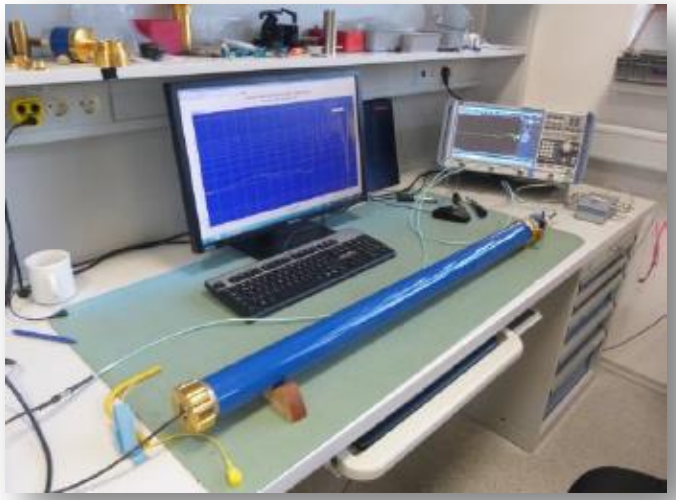
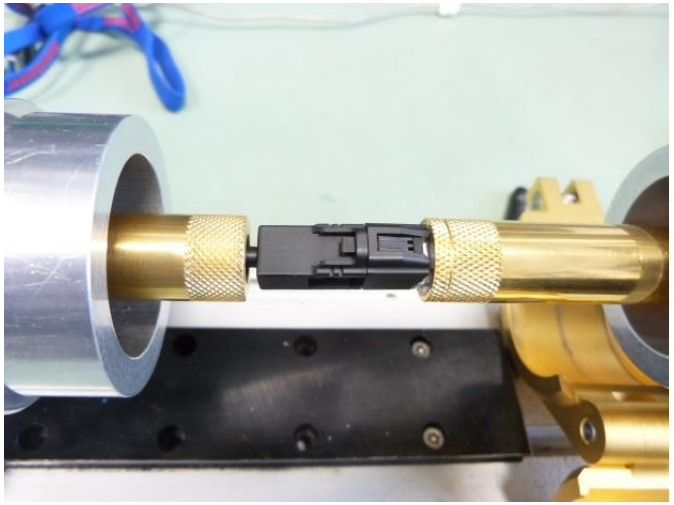
- Screening and coupling attenuation measurement with triaxial tube on component level
- Cable acc. to IEC 62153-4-4
- DUT cable length 1 m
  length exposed inside tube



- Connector acc. to IEC 62153-4-7 (tube-in-tube)



802.3ch channel options

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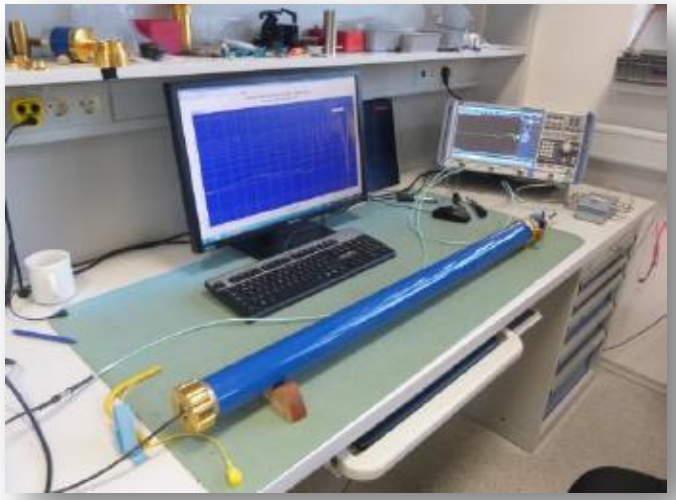

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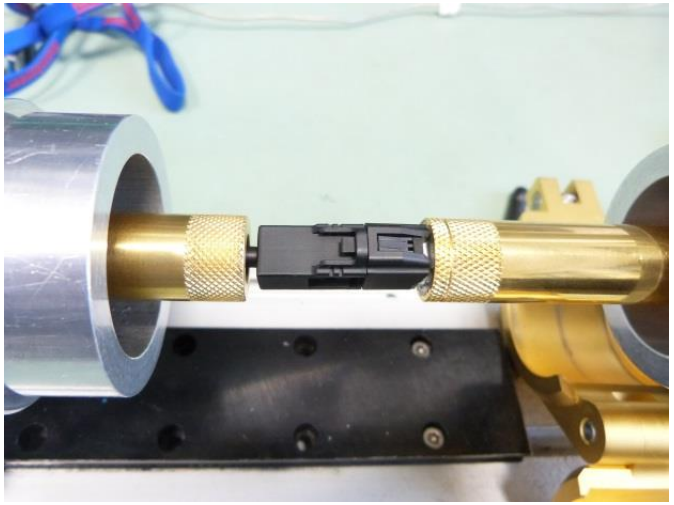

802.3ch channel options

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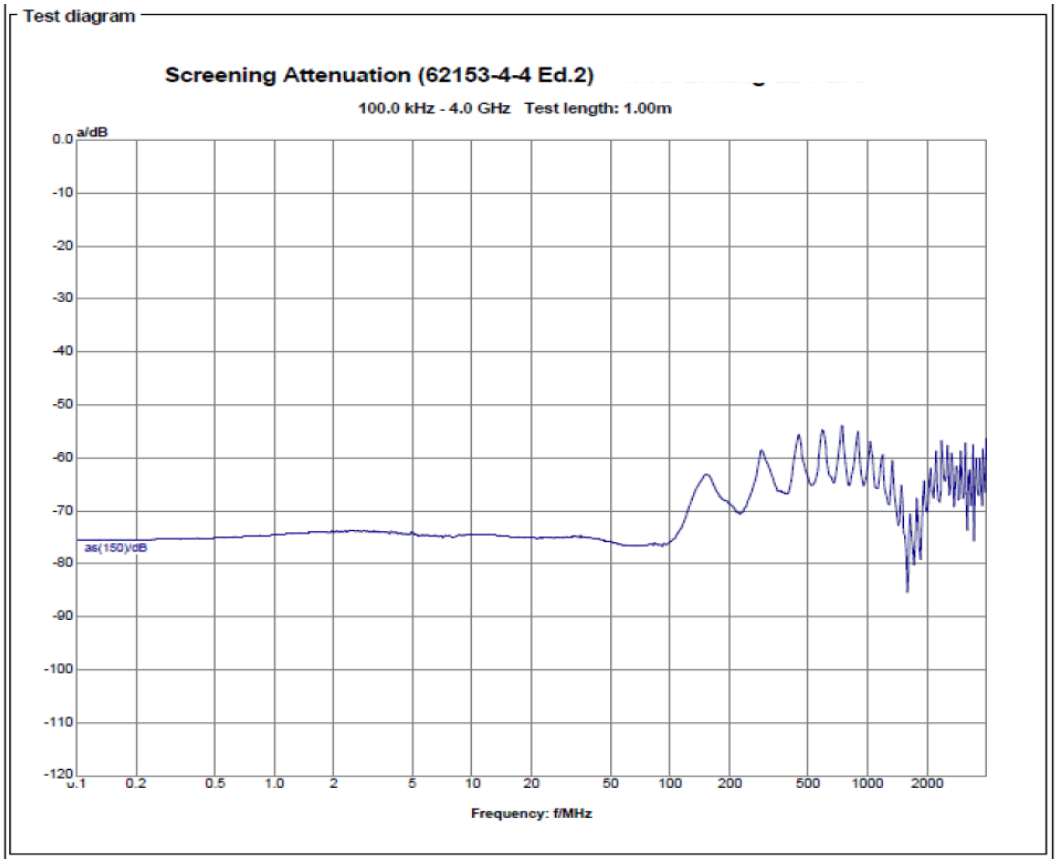
- Shielding attenuation of typical STP cable (AWG26)
- Foil and braid shield



-50
-60
-70

- Can be measured up to 9 GHz depending on setup

802.3ch channel options

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- Automotive connector and cables up to ≥7.5 GHz RF bandwidth are under development for differential 1 pair, 2 pairs and coax
- 10 Gbps are supported from cable and connector side
- Wire gauge for differential cables should not exceed 0.21 qmm to keep cable diameter ≤ 4.6 mm. Preferred wire gauge is 0.14 qmm. 0.35 qmm cables should be out of scope as the cable diameter is ≥ 5.4 mm
- Wire gauge for coaxial cables should not exceed 0.4 qmm to keep cable diameter ≤ 3.6 mm