Rosenberger

802.3dg Thoughts on Cable AWG

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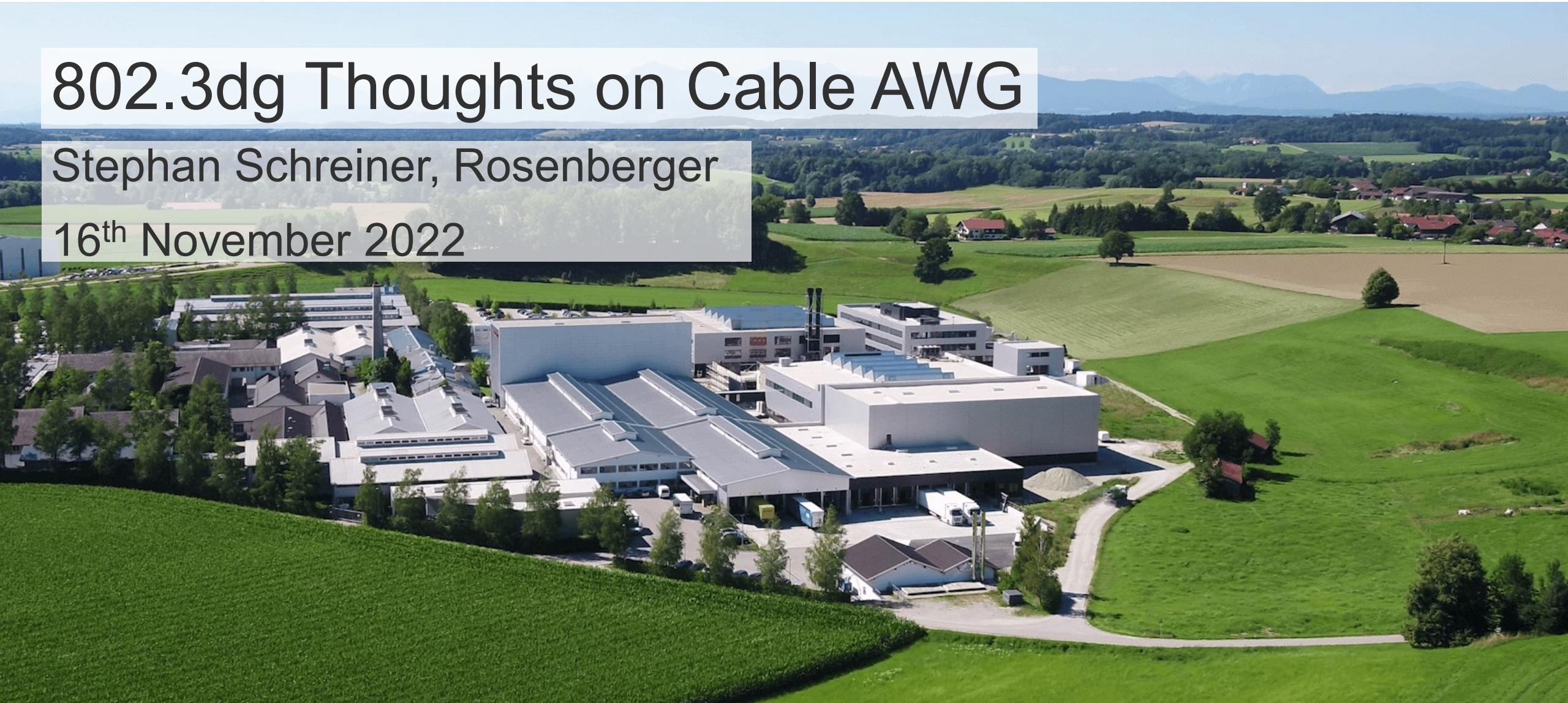


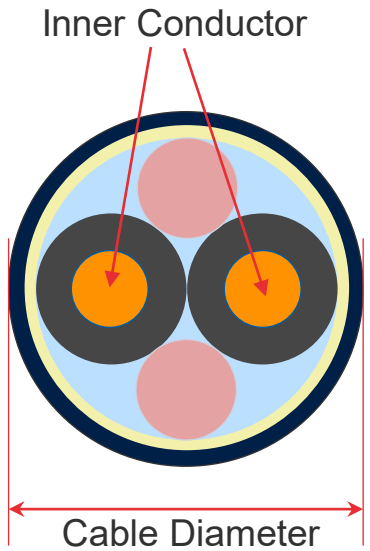
Purpose

- For long reach links, the cable characteristic becomes very important
- Additionally, the cable costs become very important for long links
- Choosing appropriate AWG for the inner conductors have to balance electrical characteristics and costs and can be a good starting point to derive the channel specification
- The following slides will evaluate this contradictory behaviour on a very general basis

Estimation copper in inner conductors

Copper is calculated for inner wires only (shield excluded)

AWG	Diameter [mm]	Cross Section [mm²]	Approx. Cable Diameter [mm]	Copper Weight 500m [kg]	Copper Weight 500m [lbs]	Copper Weight relative to AWG18
16	1,3	1,33	8,6	11,92	26,27	162 %
18	1,02	0,82	7,2	7,34	16,20	100 %
20	0,81	0,52	6,5	4,66	10,27	63 %
22	0,643	0,32	5	2,87	6,32	39 %
24	0,511	0,21	4	1,88	4,15	26 %
26	0,404	0,13	3,6	1,16	2,57	16 %



- Amount of copper is not negligible for long reach links and contributes to the cable costs
- Thinner cables typically have lower bending radius and are easier to install
- Insertion Loss will be higher on thinner cables

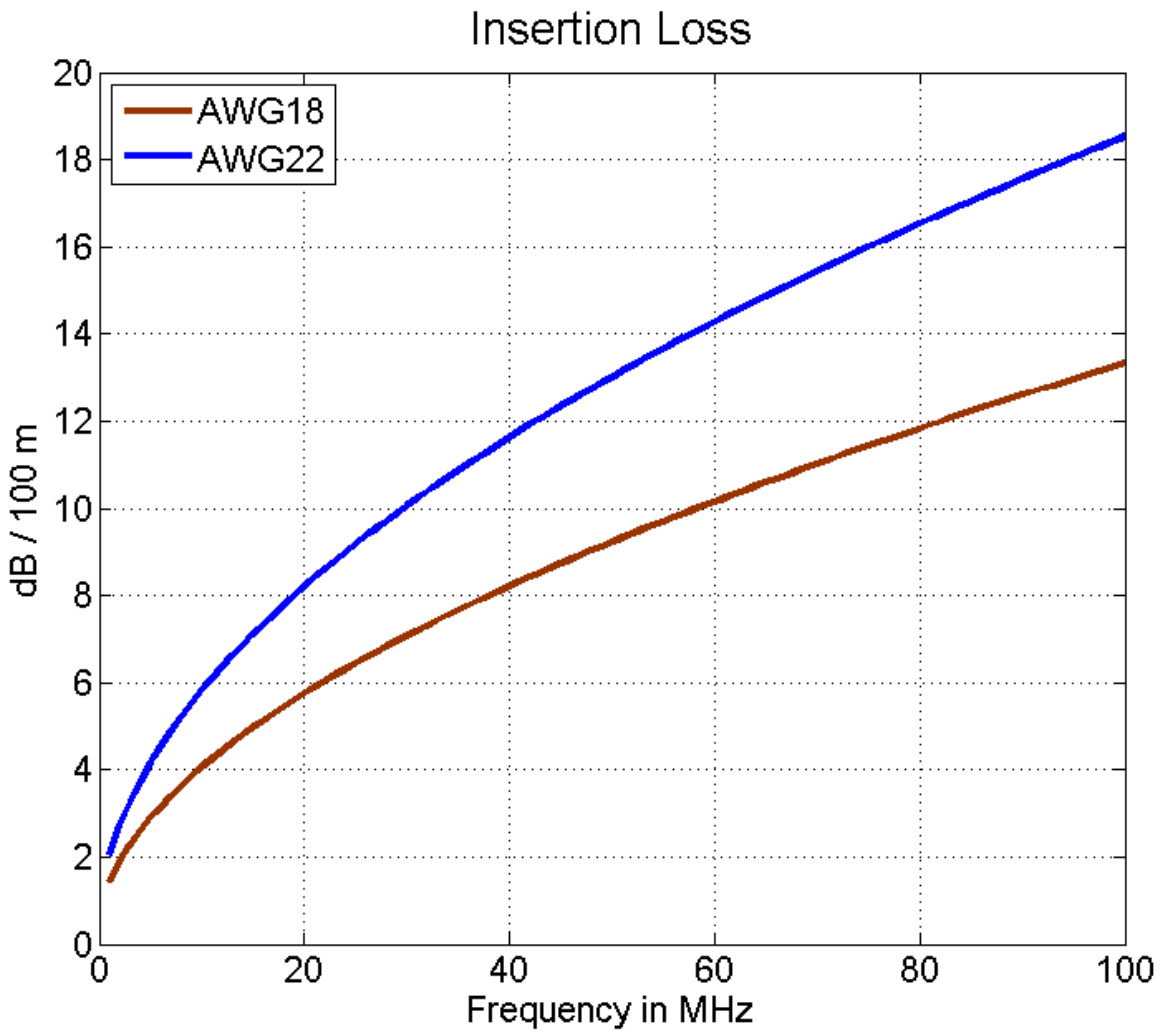
Estimation of Insertion Loss

- Estimation of insertion loss based on estimation equation

$$\alpha = a \cdot \sqrt{f} + b \cdot f + \frac{c}{\sqrt{(f)}}$$

AWG	a	b	c
18	1,23	0,01	0,2
22	1,8	0,005	0,25

- Graph shows estimation for 100m cable length
- Attenuation at 66 MHz
  - AWG18: 10.68 dB / 100 m
  - AWG22: 14.98 dB / 100 m



PoDL

DC Loop Resistance

AWG	Diameter [mm]	Cross Section [mm²]	Approx. Cable Diameter [mm]	Copper Weight 500m [kg]	Copper Weight 500m [lbs]	Copper Weight relative to AWG18	DC Loop Resistance 500m [Ω]	PoDL Classes	Max Range for PoDL Class 12 & 15 [m]
16	1,3	1,33	8,6	11,92	26,27	162 %	13,2	11; 14	360
18	1,02	0,82	7,2	7,34	16,20	100 %	21	11; 14	226
20	0,81	0,52	6,5	4,66	10,27	63 %	33	10; 13	144
22	0,643	0,32	5	2,87	6,32	39 %	53	10; 13	90
24	0,511	0,21	4	1,88	4,15	26 %	84	--	57
26	0,404	0,13	3,6	1,16	2,57	16 %	134	--	35

- Not every link will use PoDL
- AWG18 will support Clause 104 classes 11 & 14 at 500 m
- AWG22 will support Clause 104 classes 10 & 13 at 500 m
- Neither AWG18 nor AWG22 nor AWG16 will support Clause 104 classes 12 & 15 at 500 m

Conclusion

- Using AWG22 instead of AWG18 cable will reduce copper weight of inner conductors by 60%
- Additional copper reduction will be achieved due to thinner cables which requires less copper within the shield
- Some PoDL classes will work on AWG22 even on 500m link length
- Highest PoDL classes will not work on 500m link length with AWG16, AWG18 and AWG22
- Using lower cable cross section is able to reduce cable costs and will be easier to install
- AWG22 would be a good compromise
- Thus, it would be beneficial to derive required channel limits based on the AWG22 cables

Questions

Thank you for your attention!

Questions?