Coax Shielding Effectiveness and Derating

Erwin Köppendörfer
affiliated with LEONI

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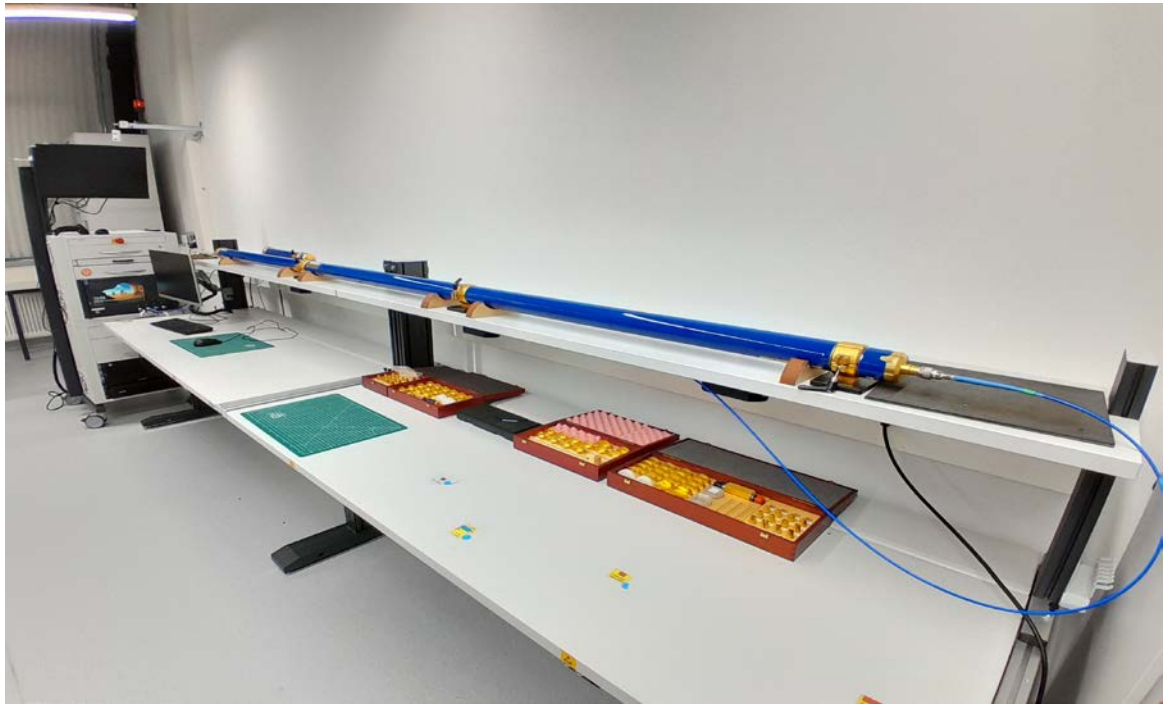
Parameter & Measurement Procedure

Screening attenuation is the main parameter for describing the EMC compatibility of an coaxial data cable for its operational frequency bandwidth (GHz domain).

- Quantification of attenuation of parasitic radiated and/or absorbed signal power of the cable
- Reliable, established and easy measurement by the triaxial method described in IEC 62153-4-4:2015-04



Screening attenuation is defined only at high frequencies, where the coupling length l_c is electrically long compared to the electrical wave length λ.
Therefore the screening attenuation is defined only for frequencies f, where

$$f > \frac{c_0}{2 \cdot l_c \left| \sqrt{\varepsilon_{r1}} - \sqrt{\varepsilon_{r2}} \right|}$$

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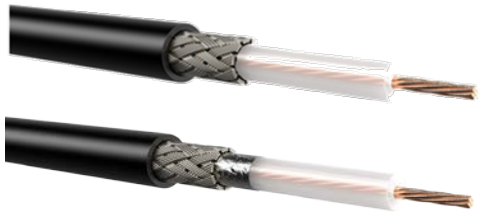
C- / BC-Shielding and Cable Types

Types of Shielding

Coaxial data cables exhibit verious types of shielding designs. Most commonly used are

- single braid shield (C-Shield)
- combination of foil and braid shield (BC-Shield)



Considered types of bulk cable based on ISO 19642-11

	Impedance	Conductor	Ø Dielectric	Shielding Type	Ø Jacket
ISO Type CX174a (RG174 size)	50 Ω	0,14 mm²	1,5 mm	C	2,8 mm
ISO Type CX174d/e (RG 174 size)	50 Ω	0,14 mm²	1,5 mm	BC	2,8 mm
ISO Type CX31a (RTK031 size)	50 Ω	0,35 mm²	2,1 mm	BC	3,3 mm

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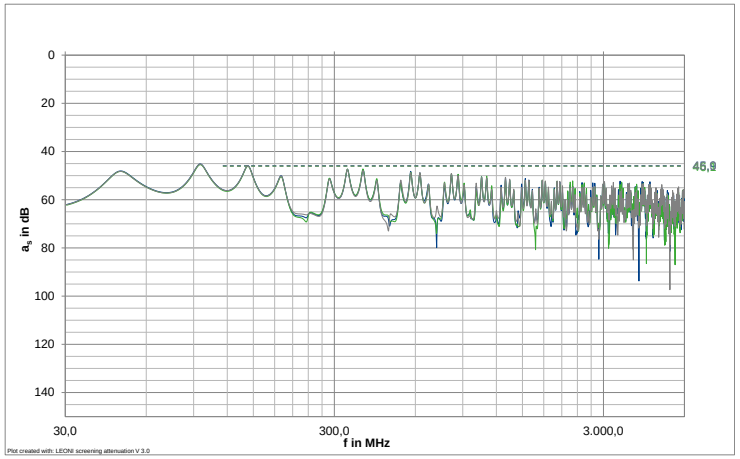
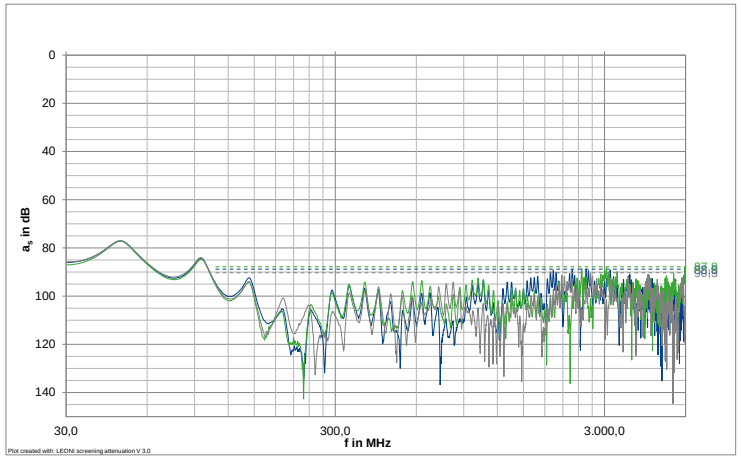
Measurements Screening Attenuation bulk cables (ISO 19642-11 Types)

Cable Type CX174a
single braid shielded



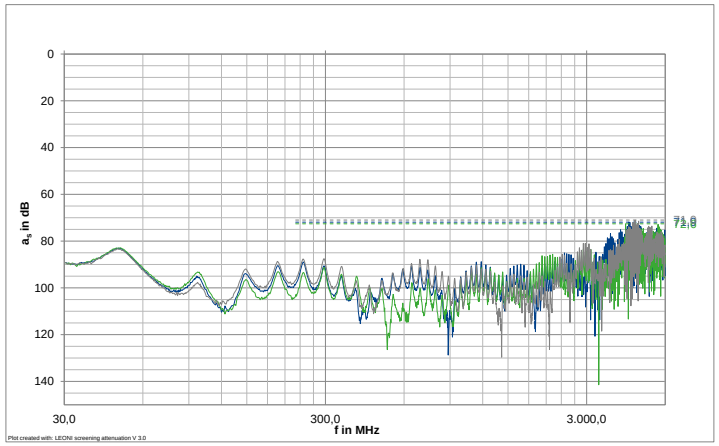
cut-off frequency: 115,9 MHz
screening attenuation: ~ 46 dB

Cable Type CX174d / e
foil + braid shielded



cut-off frequency: 108,0 MHz
screening attenuation: ~ 89 dB

Cable Type CX31a
foil + braid shielded



cut-off frequency: 230,8 MHz
screening attenuation: ~ 72 dB

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Measurement results

	Impedance	Conductor	Ø Dielectric	Shielding Type	Ø Jacket	Frequency Range	Screening attenuation (ISO 19642-11)
ISO Type CX174a (RG174 size)	50 Ω	0,14 mm²	1,5 mm	C	2,8 mm	~ 116 MHz … 6 GHz	min. 45 dB
ISO Type CX174d/e (RG 174 size)	50 Ω	0,14 mm²	1,5 mm	BC	2,8 mm	~ 108 MHz … 6 GHz	min. 75 dB
ISO Type CX31a (RTK031 size)	50 Ω	0,35 mm²	2,1 mm	BC	3,3 mm	~ 231 MHz … 6 GHz	min. 65 dB

Summary and prospect

- screening attenuation of main coaxial data cable types are already considered in ISO 19642-11.
- consideration of the lower cut-off frequency for the screening attenuation requirement recommended.
- environmental treatment (mechanic, thermal) can influence the level of screening attenuation.
  → provided values represent only the untreated delivery condition of the cables.
- ISO 19642-11 defines the well know and in common use Coax-Construction and Materials
- But there is new, cost reduced stuff upcoming. So have a look on these on the next pages.

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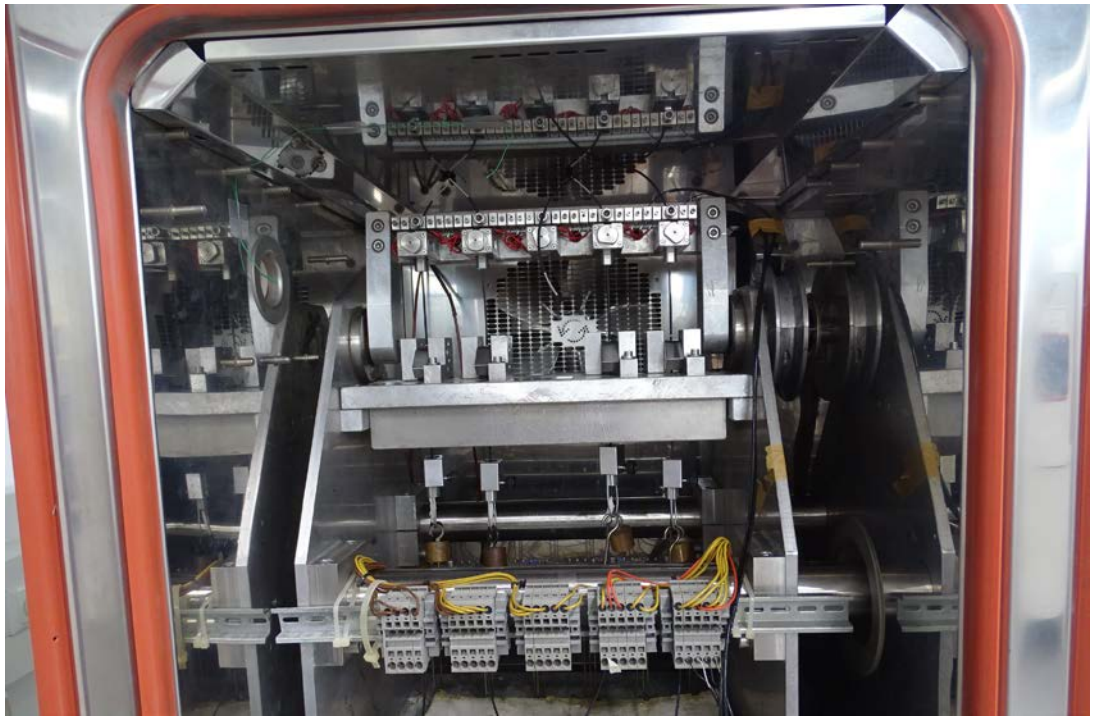
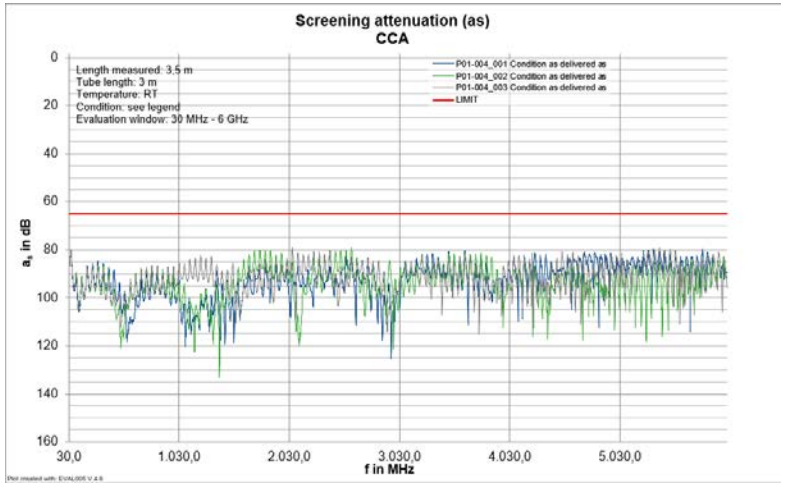
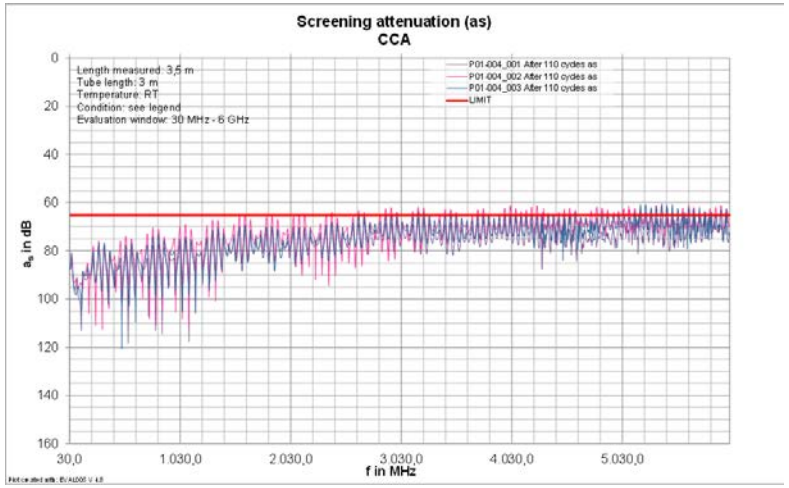
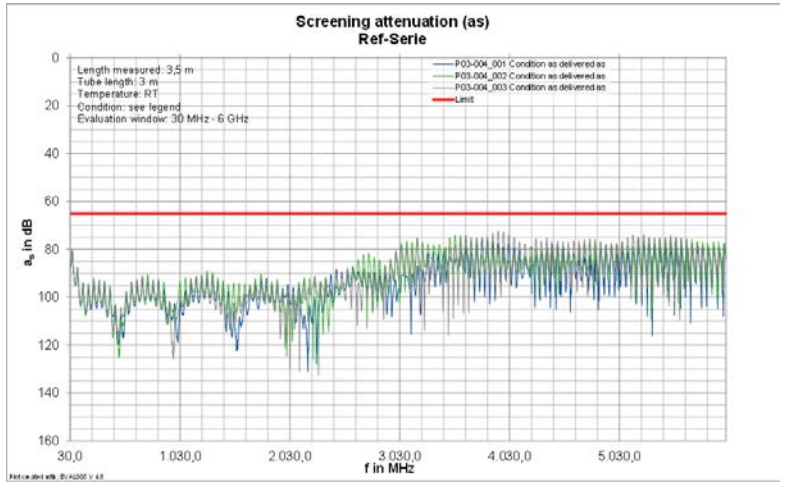
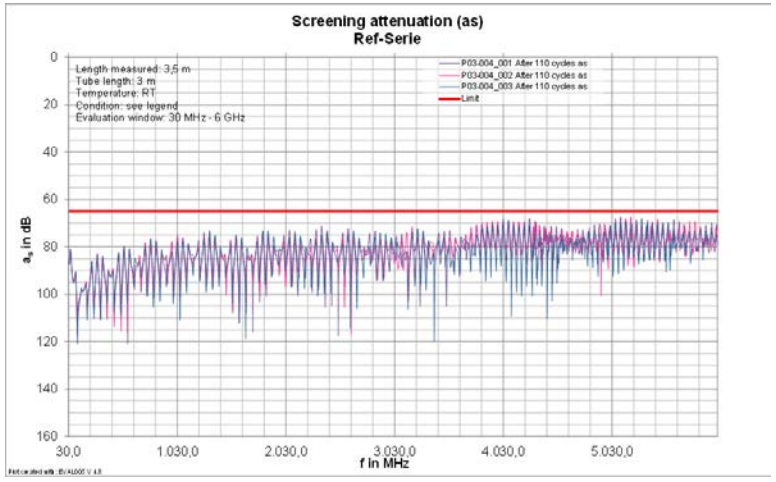
Basics

- For the well-known cable dimension RTK031 are new Materials upcoming. The copper braid material is substituted by copper cladded aluminum (CCA). This is a material with aluminum inside surrounded by a thin copper layer.
- Some big OEM request a standard bending test. The test based on the ISO 14572 bending test and require a ±90° bending for 100 cycles in room temperature and 10 cycles @-40°C.
- The test represent the mechanical load in the harness making and the installing of the harness.



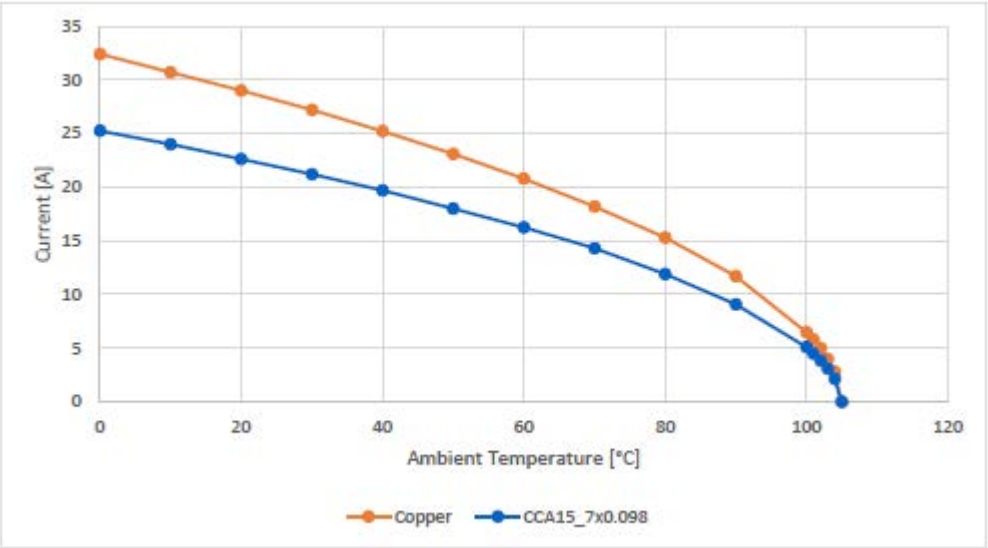
- ±90° at a rate of 15 cycles/min

Comparison: Standard vs CCA

	New condition	After bending
CCA		
CX31a		

Derating – Simulation results

- An additional deviation is in the derating behavior. CCA has more resistance, and this leads to less power delivery capabilities.



Copper	
T_amb	Current Braid
0	32.4
10	30.7
20	29
30	27.2
40	25.2
50	23.1
60	20.8
70	18.2
80	15.3
90	11.7
100	6.5
101	5.8
102	5
103	4
104	2.8
105	0

CCA15 7x0.098	
T_amb	Current Braid
0	25.25
10	24
20	22.6
30	21.2
40	19.7
50	18
60	16.25
70	14.3
80	11.9
90	9.1
100	5.1
101	4.5
102	3.85
103	3.1
104	2.15
105	0

Conclusion

- The Coax types descripted in the ISO 19642-11 are well known and in overall use in the automotive marked.
- Double screened cables show a high level of screening attenuation.
- Single screened cable could problematic based on the lower screening attenuation level.
- New cost reduced Version have the same dimensions as the normative in ISO 19642-11 defined cables but in some attributes less performance. Problems after installing or by power delivery could come up.
- I expect that double screened ISO Types will be able for Ethernet use.

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Thank you

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