

Media Considerations - Insertion Loss and EMC

Eric DiBiaso (TE Connectivity), Bert Bergner (TE Connectivity)

Supporters:

Rainer Pöhmerer (Leoni)

IEEE 802.3 Multi-Gig Automotive Ethernet PHY Study Group

May-22, 2017 – Interim Meeting – New Orleans

Motivation – Discussion about NGAUTO Media

Cabling and PHY options

IEEE 802.3 Multigig Automotive Ethernet PHY
Study Group
George Zimmerman
CME Consulting, Inc / Aquantia

IEEE 802.3 MultiGigabit Automotive Ethernet PHY Study Group – May 3 2017 Ad Hoc

Page 1

Recommendation

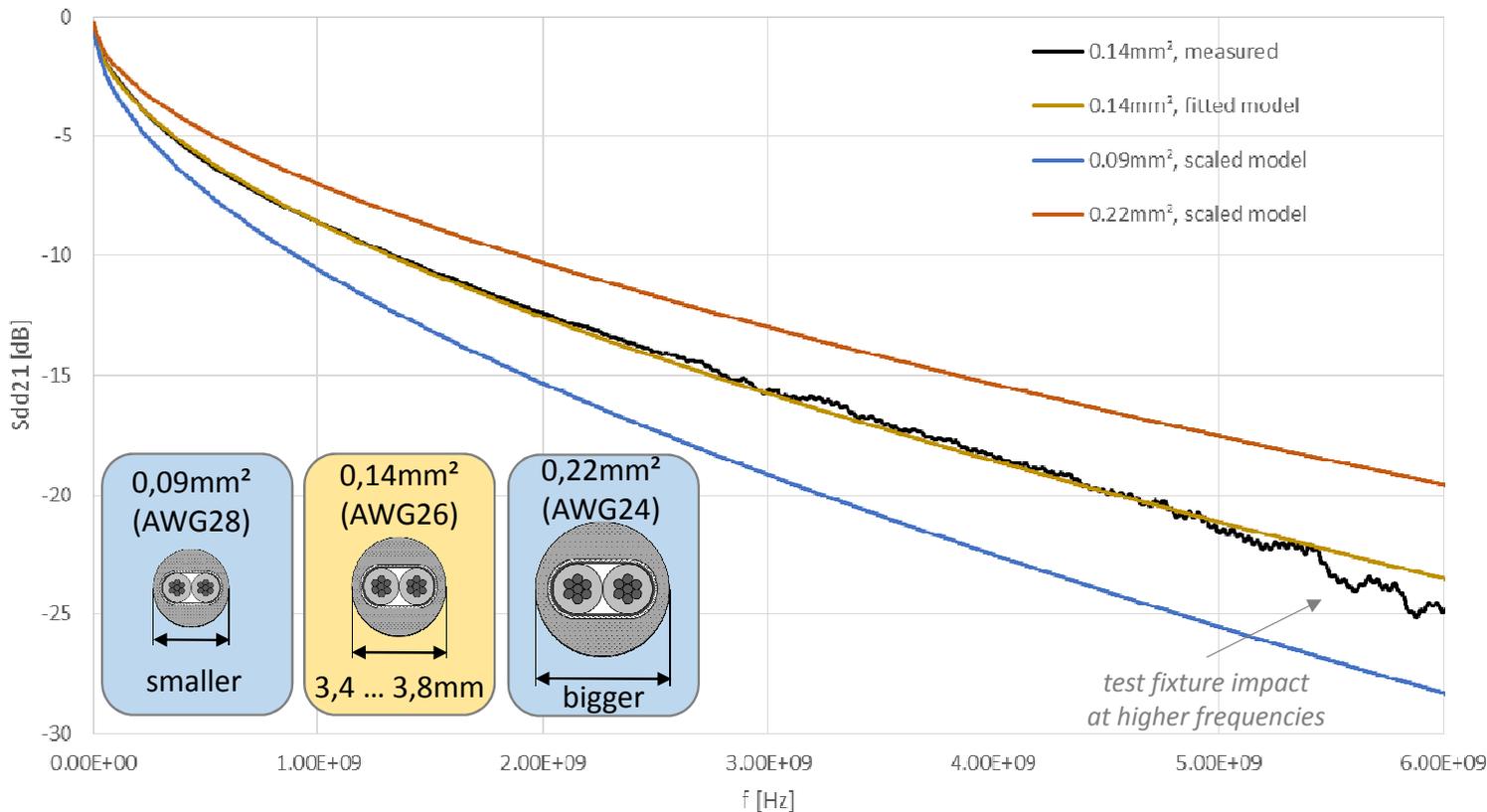
- Plan of attack:
 - Bring automotive media recommendations first (input from OEM's, Tier 1's)
 - Converge on a strawman link segment spec for each speed
 - Bandwidth, Shielding, IL
 - Recommend 10G first, as this can present a strawman for scaling to other rates
 - (either by baud or levels, TBD)

IEEE 802.3 MultiGigabit Automotive Ethernet PHY Study Group – May 3 2017 Ad Hoc

Page 8

Cable Insertion Loss – Shielded Differential Pair (SDP)

Insertion Loss [-dB] SDP, 10m Cable Length



Simple model for fitting (*):

$$|Sdd21|(dB) = K_1\sqrt{f} + K_2f$$

↑ Copper loss
 ↑ Dielectric loss

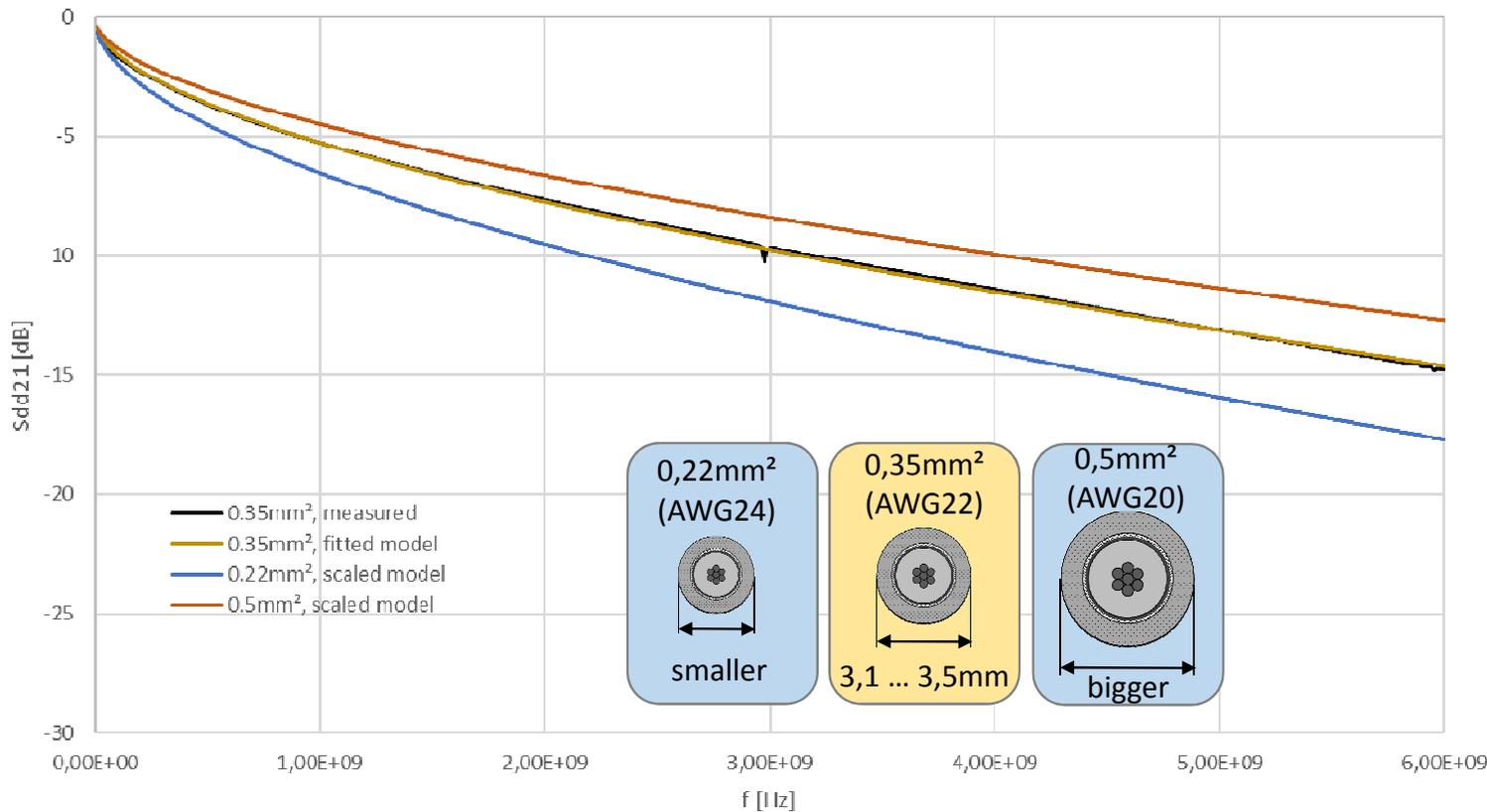
Scaling for other cross section (*):

$$|Sdd21|(dB) = \frac{\sqrt{0.14mm^2}}{\sqrt{A_x}} K_1\sqrt{f} + K_2f$$

(*). T. Herman et al., "RTPGE Channel Requirements Proposal for 1-Pair Ethernet," CommScope Inc., IEEE802.3 Plenary Meeting Geneva 07/2013, url: http://www.ieee802.org/3/bp/public/jul13/herman_3bp_01_0713.pdf, 2014-07-17

Cable Insertion Loss – Coax

Insertion Loss Coax (10m cable, -dB)



Simple model for fitting (*):

$$|S_{dd21}|(dB) = K_1\sqrt{f} + K_2f$$

↑ Copper loss
 ↑ Dielectric loss

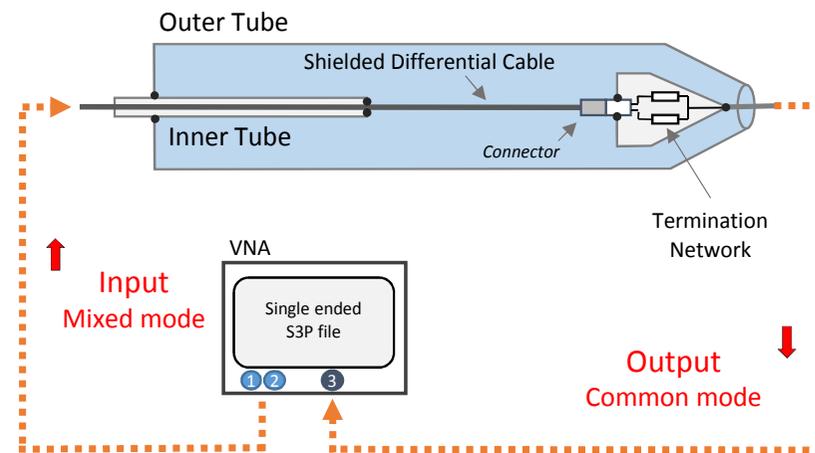
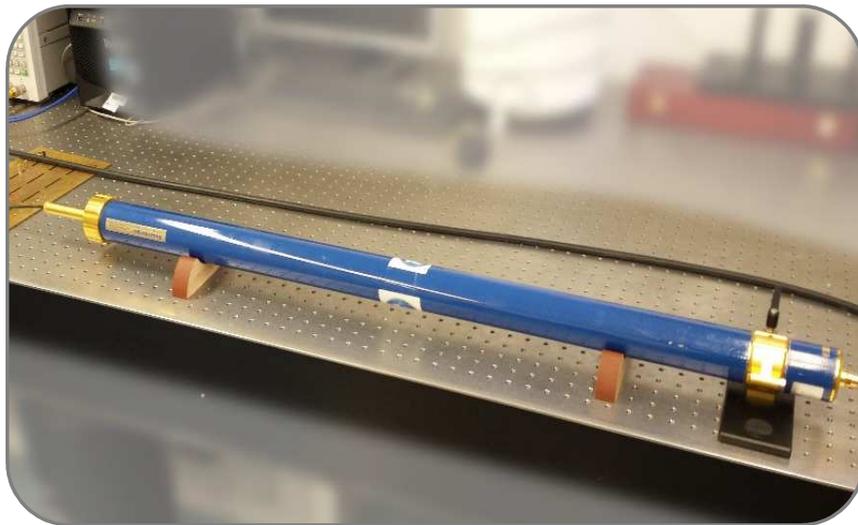
Scaling for other cross section (*):

$$|S_{dd21}|(dB) = \frac{\sqrt{0.35mm^2}}{\sqrt{A_x}} K_1\sqrt{f} + K_2f$$

(*). T. Herman et al., "RTPGE Channel Requirements Proposal for 1-Pair Ethernet," CommScope Inc., IEEE802.3 Plenary Meeting Geneva 07/2013, url: http://www.ieee802.org/3/bp/public/jul13/herman_3bp_01_0713.pdf, 2014-07-17

EMC – Differential vs. Common Mode (SDP)

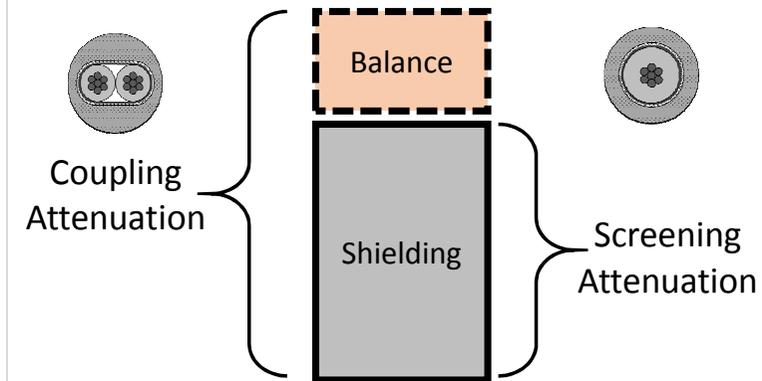
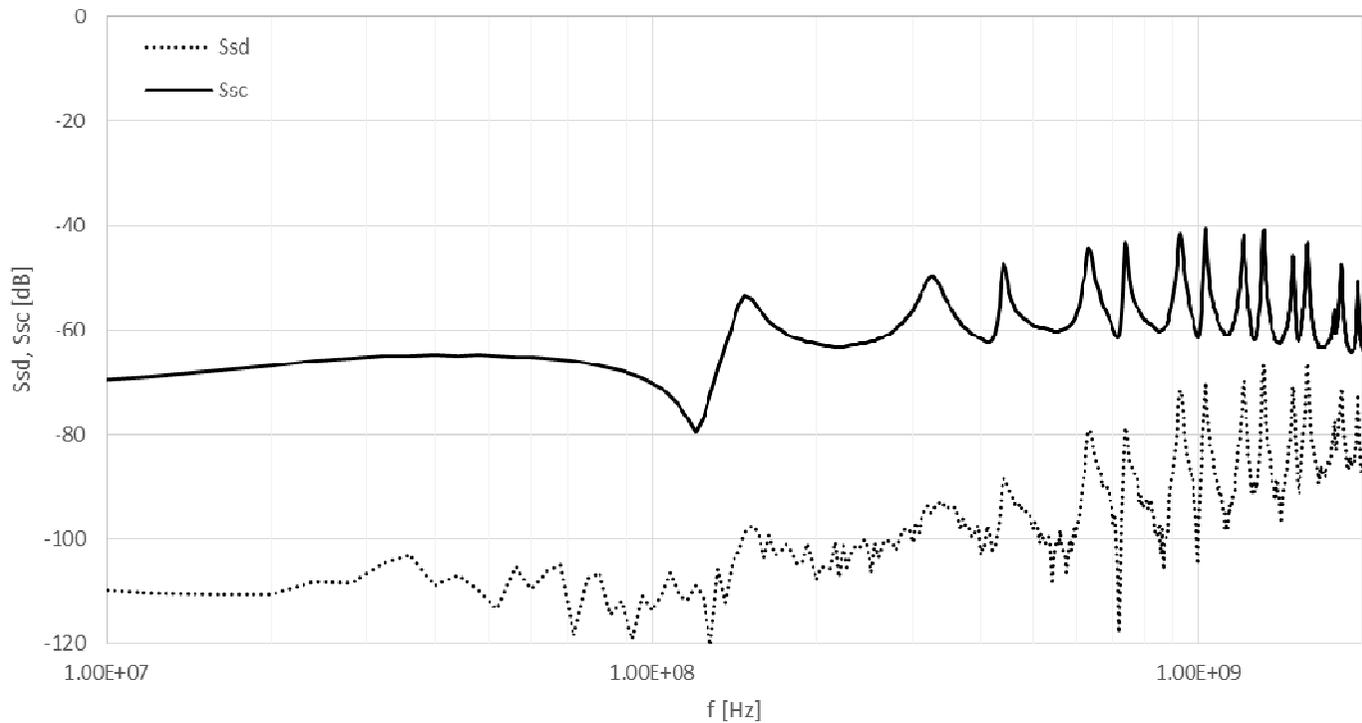
Setup (Tube-in-tube, IEC 62153-4-7):



Ssd ... differential mode, transfer function differential-to-single → coupling attenuation
Ssc ... common mode, transfer function common-to-single → screening attenuation

EMC – Differential vs. Common Mode (SDP)

Coupling and Screening Attenuation for same DUT (SDP)
Tube Setup (no renormalization)



- Same DUT / same shielding (SDP)
- Lower emission for differential mode compared to coax mode
- Depends on frequency

Conclusion

- Recommend to focus on “small size” cables with outer diameter $< 3,8$ mm as baseline for insertion loss and bandwidth definition, e.g. 0.14mm^2 (AWG26) SDP or 0.35mm^2 (AWG22) Coax
 - Smaller cable diameters support weight reduction
 - Smaller cable diameters would support high port density at switch devices, e.g. 4mm port pitch
- Considerations for environmental degradation versus frequency (temperature, humidity)
- SDP has higher insertion loss than coax (for similar cable sizes) but lower emissions due to differential signaling
 - Consider electromagnetic emission for sensitive services at higher frequencies (GPS, BT/WiFi, etc.)

Thank You!!!