

# Considerations on Return Loss and Insertion Loss

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Mathias Kleinwaechter, in-tech GmbH

# Supporters

- Ramanjit Ahuja (onsemi)
- Seven Bergdolt (Leoni)
- Bert Bergner (TE)
- Jamila Borda (in-tech)
- Kamal Dalmia (Aviva Links)
- Claude Gauthier (NXP)
- Stefan Giandorli (GG Group)
- Erwin Koeppendoerfer (Leoni)
- Tobias Kupka (GG Group)
- Kirsten Mattheus (BMW)
- Scott Muma (Microchip)
- Johannes Nachtrab (Leoni)
- Jonathan Silvano de Sousa (GG Group)
- Mehmet Tazebay (Broadcom)
- Conrad Zerna (Aviva Links)

# Motivation

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- This presentation analyzes the discussions about Insertion Loss (IL) & Return Loss (RL)
- This presentation compares the current discussion results to ASA transceiver specification
- This presentation reflects the statements of “bad connector” assumptions in [https://www.ieee802.org/3/dm/public/0924/jonsson\\_3dm\\_02\\_09\\_15\\_24.pdf](https://www.ieee802.org/3/dm/public/0924/jonsson_3dm_02_09_15_24.pdf)
- This presentation calls for leveraging the ASA transceiver specification

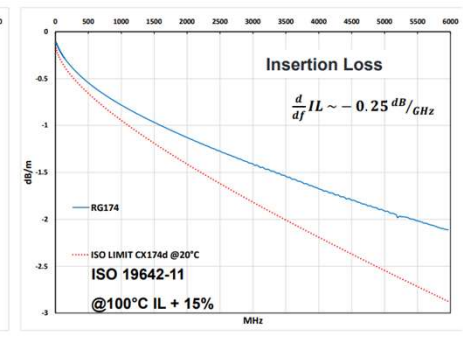
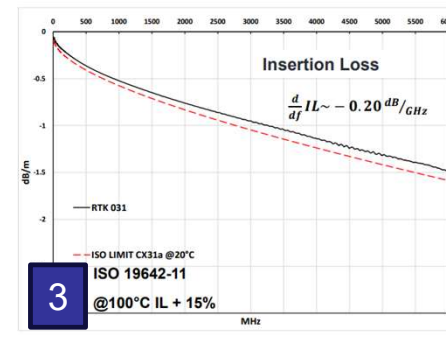
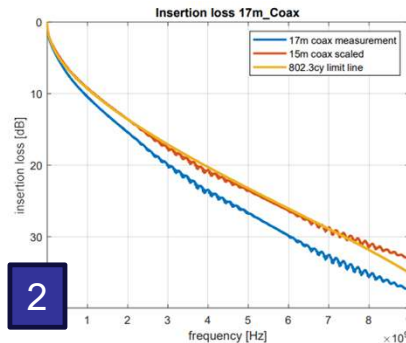
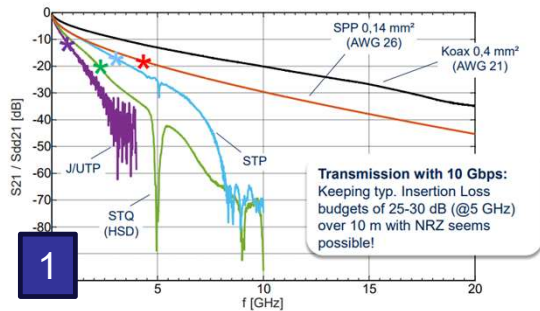
# Content

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- History of contributions regarding Insertion Loss
- Conclusion of Insertion Loss discussions
- Separate Insertion Loss limits for STP and Coax
- History of contributions regarding Return Loss
- Conclusion of Return Loss discussions
- History of discussion items in Ad Hocs
- Conclusion of discussion items
- Guide to applicable solutions
- Conclusion

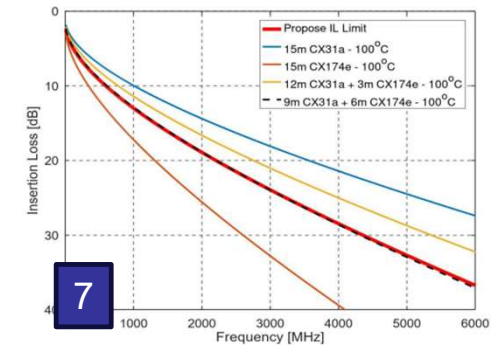
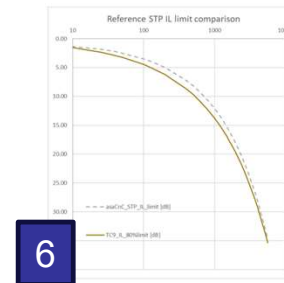
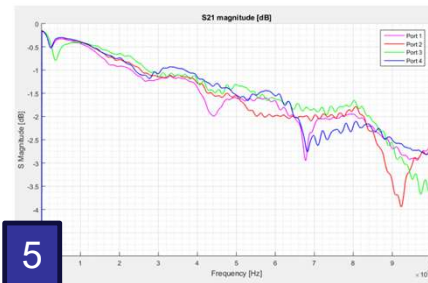
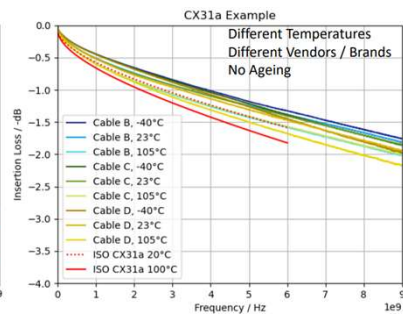
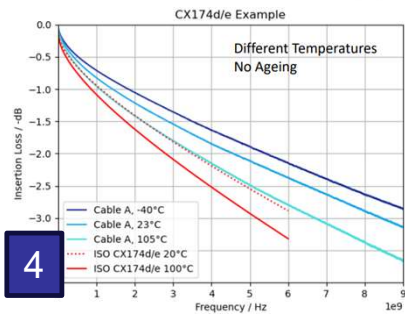
# Insertion Loss Contributions (1)

Insertion loss of 10 m cable length at room temperature



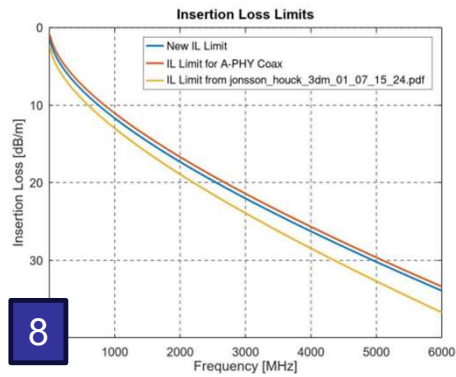
- (1) [https://www.ieee802.org/3/ch/public/jul17/mueller\\_channel\\_options\\_01a\\_0717.pdf](https://www.ieee802.org/3/ch/public/jul17/mueller_channel_options_01a_0717.pdf)
- (2) [https://www.ieee802.org/3/ISAAC/public/010924/Feyh\\_ISAAC\\_01A\\_01092024.pdf](https://www.ieee802.org/3/ISAAC/public/010924/Feyh_ISAAC_01A_01092024.pdf)
- (3) [https://www.ieee802.org/3/dm/public/0524/Coax\\_Cables\\_Silvano\\_de\\_Sousa\\_ISAAC\\_Interim\\_may\\_2024\(002\).pdf](https://www.ieee802.org/3/dm/public/0524/Coax_Cables_Silvano_de_Sousa_ISAAC_Interim_may_2024(002).pdf)

# Insertion Loss Contributions (2)

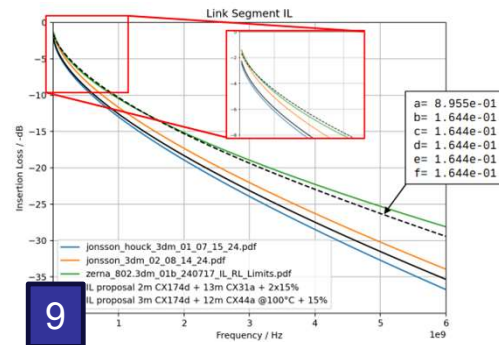


- (4) [https://www.ieee802.org/3/dm/public/0524/03May24\\_802.3dm\\_Cliber.pdf](https://www.ieee802.org/3/dm/public/0524/03May24_802.3dm_Cliber.pdf)
- (5) [https://www.ieee802.org/3/dm/public/0524/felso\\_3dm\\_01\\_2405.pdf](https://www.ieee802.org/3/dm/public/0524/felso_3dm_01_2405.pdf)
- (6) [https://www.ieee802.org/3/dm/public/0724/Zerna\\_802.3dm\\_01b\\_240717\\_IL\\_RL\\_Limits.pdf](https://www.ieee802.org/3/dm/public/0724/Zerna_802.3dm_01b_240717_IL_RL_Limits.pdf)
- (7) [https://www.ieee802.org/3/dm/public/0724/jonsson\\_houck\\_3dm\\_01\\_07\\_15\\_24.pdf](https://www.ieee802.org/3/dm/public/0724/jonsson_houck_3dm_01_07_15_24.pdf)

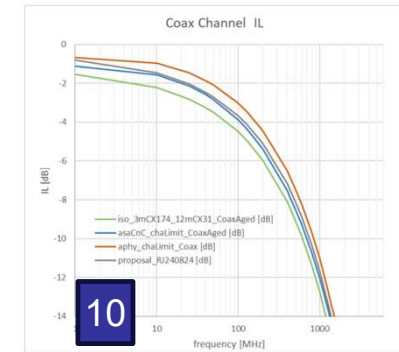
# Insertion Loss Contributions (3)



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- (8) [https://www.ieee802.org/3/dm/public/adhoc/081424/jonsson\\_3dm\\_02\\_08\\_14\\_24.pdf](https://www.ieee802.org/3/dm/public/adhoc/081424/jonsson_3dm_02_08_14_24.pdf)
- (9) [https://www.ieee802.org/3/dm/public/0924/bergner\\_3dm\\_01a\\_18\\_09\\_24.pdf](https://www.ieee802.org/3/dm/public/0924/bergner_3dm_01a_18_09_24.pdf)
- (10) [https://www.ieee802.org/3/dm/public/0924/Zerna\\_802.3dm\\_01\\_240918\\_IL\\_Limit\\_Proposal.pdf](https://www.ieee802.org/3/dm/public/0924/Zerna_802.3dm_01_240918_IL_Limit_Proposal.pdf)

# Separate IL Limits for STP and Coax

- The adoption of a single Insertion Loss limit for both STP and Coax cable-links has been discussed.
- This has also been discussed in ASA with the conclusion:
  - Coax & STP are different transmission media regarding construction, electrical specification and impact on (automotive) system design <sup>1</sup>
  - ASA Transceiver Specification defines separate harness insertion loss limit lines for STP cable and Coax cable
- Propose to differentiate electrical limits between STP and Coax

(1) [https://www.ieee802.org/3/dm/public/0724/Zerna\\_802.3dm\\_01b\\_240717\\_IL\\_RL\\_Limits.pdf](https://www.ieee802.org/3/dm/public/0724/Zerna_802.3dm_01b_240717_IL_RL_Limits.pdf)



# Insertion Loss Conclusions

- The proposed limits and the ASA limits are quite close 1
- Discussions about separate Insertion Loss limits for Coax and STP came to the solution: 802.3 dm should define separate limits (as ASA does) 2 3 4
- The proposed limit lines may have issues at lower frequencies: „ASA Channel and Component limit line is fixing the lower frequency range” 5 1
- ASA has done all these discussions regarding the OEMs needs
- ASA has a broad number of supporters and adopters

(1) [https://www.ieee802.org/3/dm/public/0924/Zerna\\_802.3dm\\_01\\_240918\\_IL\\_Limit\\_Proposal.pdf](https://www.ieee802.org/3/dm/public/0924/Zerna_802.3dm_01_240918_IL_Limit_Proposal.pdf)

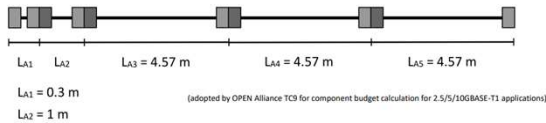
(2) [https://www.ieee802.org/3/dm/public/0724/Zerna\\_802.3dm\\_01b\\_240717\\_IL\\_RL\\_Limits.pdf](https://www.ieee802.org/3/dm/public/0724/Zerna_802.3dm_01b_240717_IL_RL_Limits.pdf)

(3) [https://www.ieee802.org/3/dm/public/0724/jonsson\\_houck\\_3dm\\_01\\_07\\_15\\_24.pdf](https://www.ieee802.org/3/dm/public/0724/jonsson_houck_3dm_01_07_15_24.pdf)

(4) [https://www.ieee802.org/3/dm/public/adhoc/081424/jonsson\\_3dm\\_02\\_08\\_14\\_24.pdf](https://www.ieee802.org/3/dm/public/adhoc/081424/jonsson_3dm_02_08_14_24.pdf)

(5) [https://www.ieee802.org/3/dm/public/0924/bergner\\_3dm\\_01a\\_18\\_09\\_24.pdf](https://www.ieee802.org/3/dm/public/0924/bergner_3dm_01a_18_09_24.pdf)

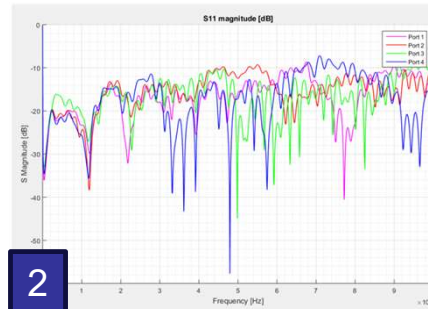
# Return Loss Contributions



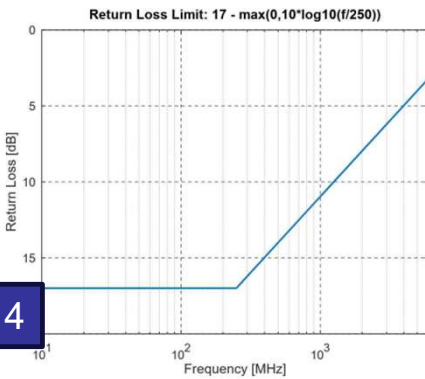
This reference link segment considers:

- Previous work in wienckowski\_3+105\_01a\_0519.pdf → segments 0.3 m and 1 m ("worst case" assumption for return loss)

1



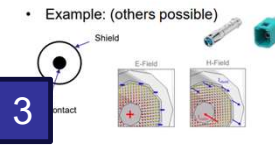
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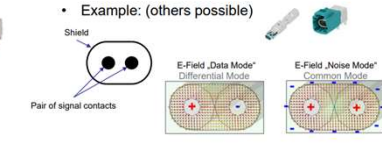
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- Coax
  - 50 Ohm nom. impedance
  - Insertion Loss
  - Return Loss
  - Screening attenuation (according IEC 62153-4-7)

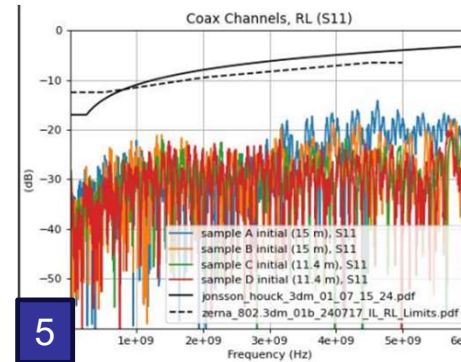
- STP
  - 100 Ohm nom. impedance differential mode
  - Insertion Loss
  - Return Loss
  - For multiport connectors: PSANEXT loss and PSAFEXT loss
  - Screening attenuation and coupling attenuation (according IEC 62153-4-7)



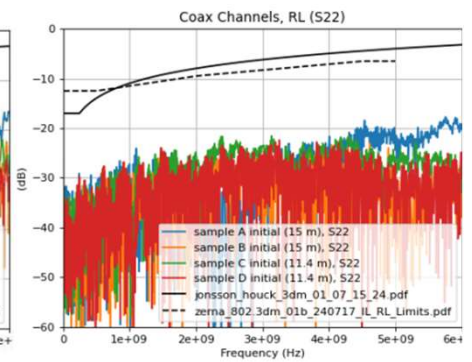
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Example: (others possible)



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- [https://www.ieee802.org/3/dm/public/0524/03May24\\_802.3dm\\_Cliber.pdf](https://www.ieee802.org/3/dm/public/0524/03May24_802.3dm_Cliber.pdf)
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- [https://www.ieee802.org/3/dm/public/0724/Zerna\\_802.3dm\\_01b\\_240717\\_IL\\_RL\\_Limits.pdf](https://www.ieee802.org/3/dm/public/0724/Zerna_802.3dm_01b_240717_IL_RL_Limits.pdf)
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# Return Loss Conclusion

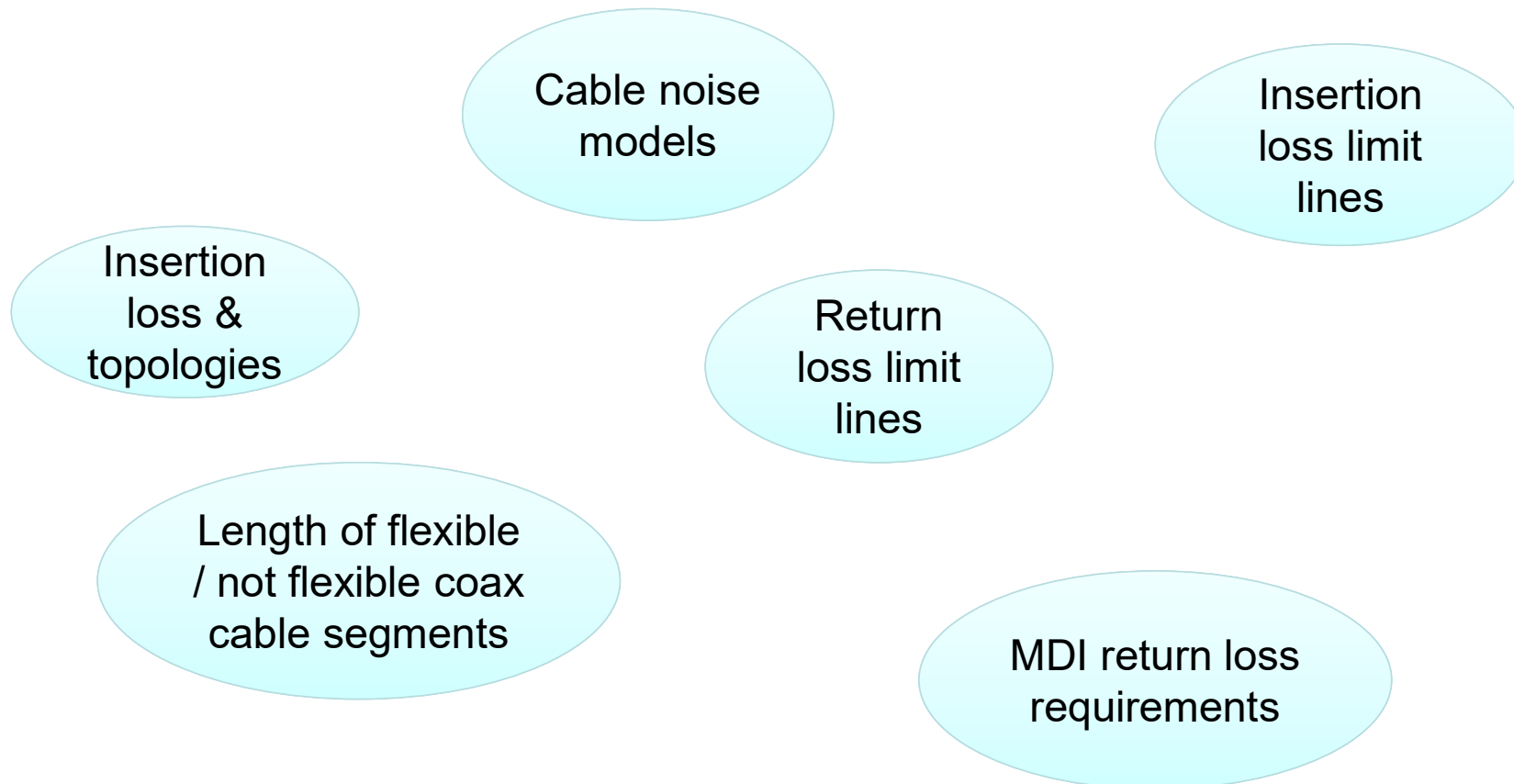
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- “Discussed limit proposals can typically be met with realistic connector assumptions” <sup>1</sup>
- Best practice experiences and OEMs needs should be considered in further discussions (as ASA has done)

(1) [https://www.ieee802.org/3/dm/public/0924/bergner\\_3dm\\_01a\\_18\\_09\\_24.pdf](https://www.ieee802.org/3/dm/public/0924/bergner_3dm_01a_18_09_24.pdf)

# Discussions in Ad Hocs

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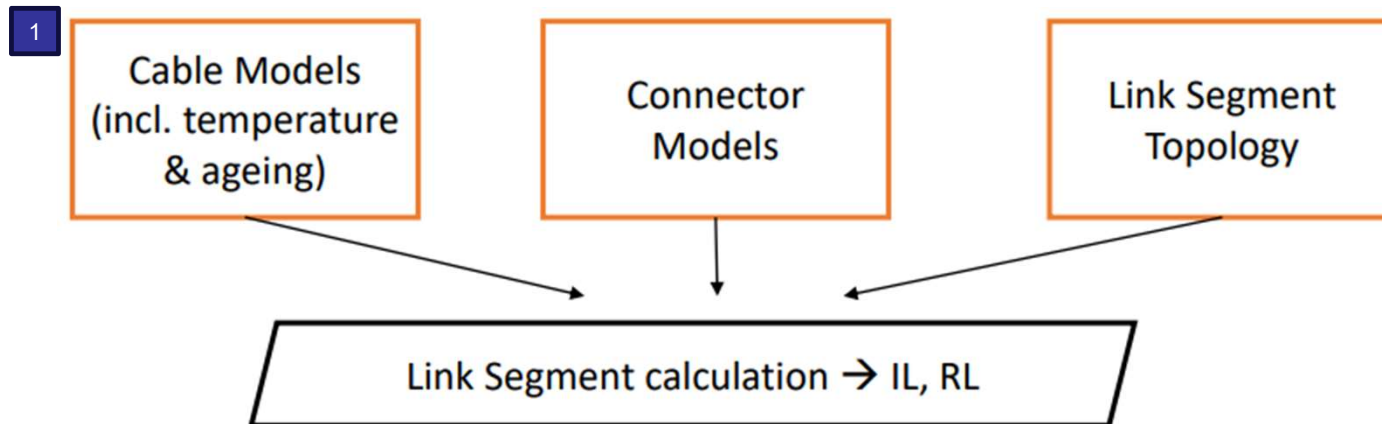


# Conclusion of discussion items

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- ASA has considered all discussion items in its working groups
- ASA has evaluated all discussion items
- ASA has regarded the considerations during spec development

# Guide to applicable solutions



- Connector models → realistic and considering OEM needs
- Link segment topology → realistic and considering OEM needs
- Model calculations proven by measurements **2**
- ASA has an improved coax channel limit line, that has undergone checks versus cable data of three independent measurements. It will be better suited in practice. **3**
- ASA has followed this guideline since 2019

(1) [https://www.ieee802.org/3/dm/public/0524/03May24\\_802.3dm\\_Cliber.pdf](https://www.ieee802.org/3/dm/public/0524/03May24_802.3dm_Cliber.pdf)

(2) [https://www.ieee802.org/3/dm/public/0924/bergner\\_3dm\\_01a\\_18\\_09\\_24.pdf](https://www.ieee802.org/3/dm/public/0924/bergner_3dm_01a_18_09_24.pdf)

(3) [https://www.ieee802.org/3/dm/public/0924/Zerna\\_802.3dm\\_01\\_240918\\_IL\\_Limit\\_Proposal.pdf](https://www.ieee802.org/3/dm/public/0924/Zerna_802.3dm_01_240918_IL_Limit_Proposal.pdf)

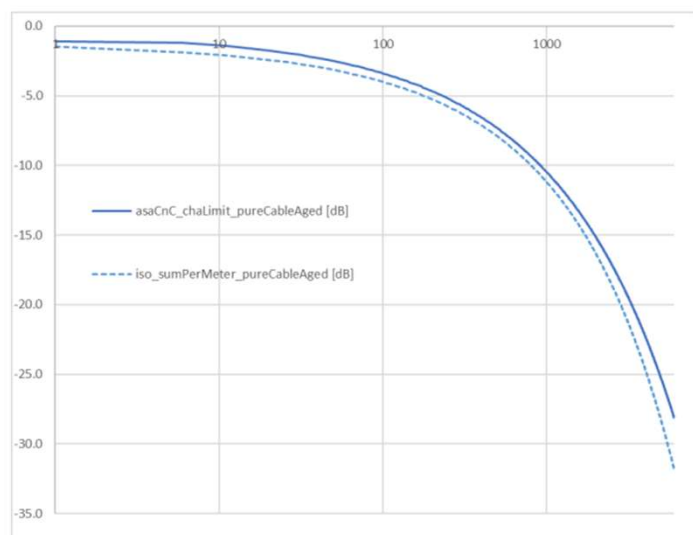
# Conclusion (1)

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- The example of discussions about IL show that the results and trade-offs match ASA specs very well
- For other discussion items, like RL, the ASA (test) specs are a very good starting point for leveraging
- ASA has proven to carefully consider automotive experience and OEM needs
- Leveraging ASA specs is recommended
- Proposal: differentiate electrical limits between STP and Coax

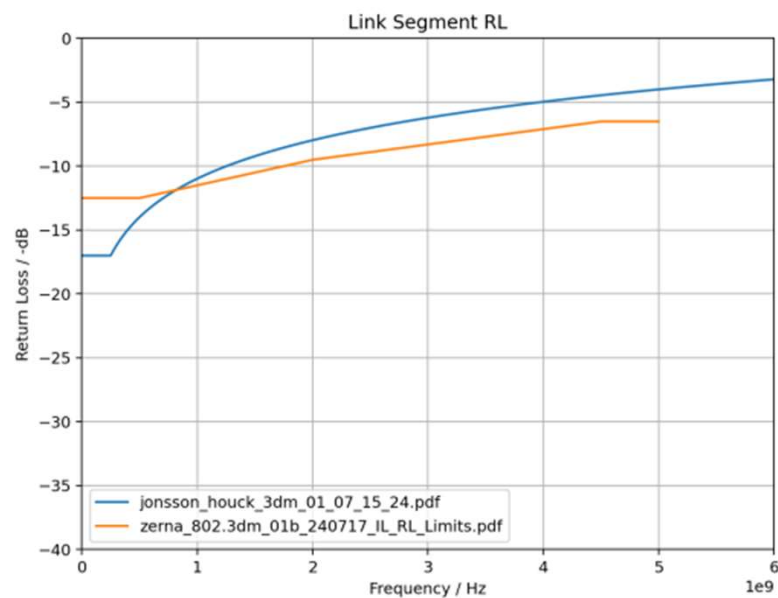
# Conclusion (2)

Proposal: accept IL limit line of ASA



[https://www.ieee802.org/3/dm/public/0724/Zerna\\_802.3dm\\_01b\\_240717\\_IL\\_RL\\_Limits.pdf](https://www.ieee802.org/3/dm/public/0724/Zerna_802.3dm_01b_240717_IL_RL_Limits.pdf)

Proposal: accept RL limit line of ASA



[https://www.ieee802.org/3/dm/public/0924/bergner\\_3dm\\_01a\\_18\\_09\\_24.pdf](https://www.ieee802.org/3/dm/public/0924/bergner_3dm_01a_18_09_24.pdf)



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# Thank You!