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Preliminary Feasibility Study for 25Gb/s over Coaxial Channels

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Preface

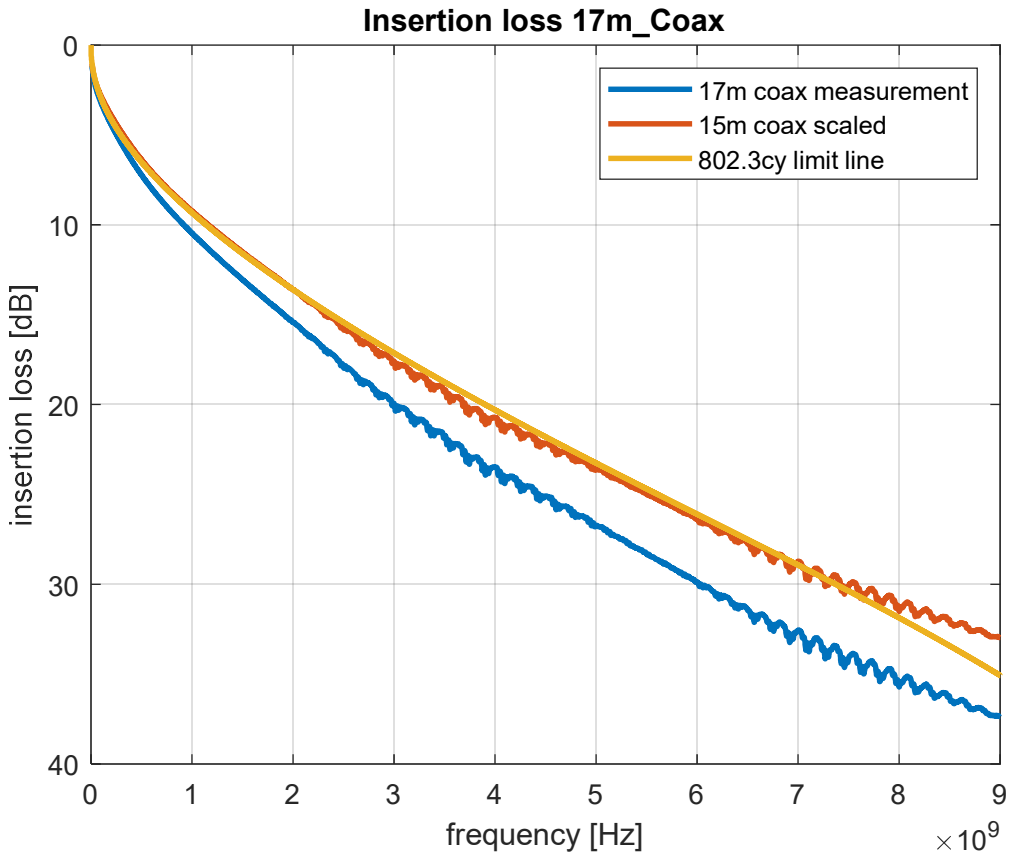
- Both STP and coaxial link segments are being considered for automotive image sensor applications in 802.3 ISAAC Study Group.
- The coaxial cabling and connectors are widely deployed for in-car camera applications. The relative lower cost power transfer and the volume shipment of coaxial link segments are known to provide an economic advantage over STP cables.
- In this study, the feasibility of 25Gb/s over a typical coaxial channel is analyzed using the well known Salz-SNR.
- Most critical in-car CW noise components are not included explicitly in this study in order to just show the attainable theoretical performance over a typical coaxial channel.

Outline

- Coaxial cable measurement
- Assumptions
- dpSNR
- Conclusions

IL Measurement

- 17m automotive rated coax (RTK 031 type)
  - Nominal temperature.
  - No aging effects.
  - 17m cable is used to model a 15m Coax which is a flexible cable.
- Scaled to 15m by linear cable length scaling in [dB].
- Comparison: 802.3cy limit line
  - 25G full duplex.
  - 11m differential twisted pair.



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Assumptions for the transmission 25Gb/s user data.

- Transmitter: zero-order hold and 0dBm transmit power.
- Receiver: brick wall filter.
- PCB trace from kadry_3cy_02_0820.
- Baud rate: 14.25GBd = 25G/s * (1/2) * (65/64) * (360/326) * 1.01645.
  - PAM4.
  - 64B/65B code.
  - FEC: Reed Solomon [360,326].
  - Time division and OAM overhead: 1.645% depends on:
    - Forward vs. backward information balance and baud rate.
    - Size of resynchronization fields.
    - Overhead vs. delay tradeoff.
- Coax single sided signal penalty: 6dB.
- Overall noise -145 dBm/Hz.
- Implementation loss: 5dB.
- Required slicer SNR for RS [360,326] and BER 1e-12: 17.2dB.

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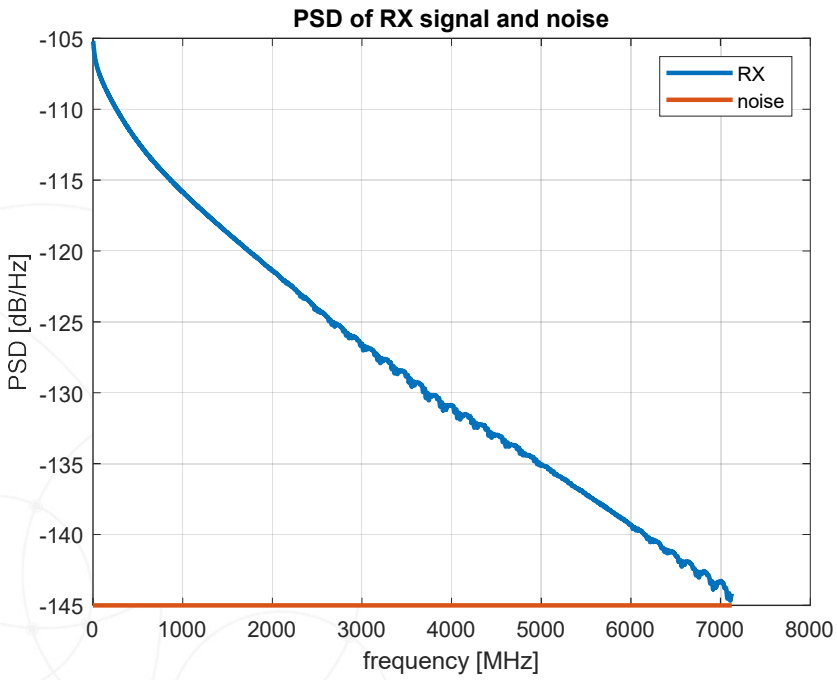
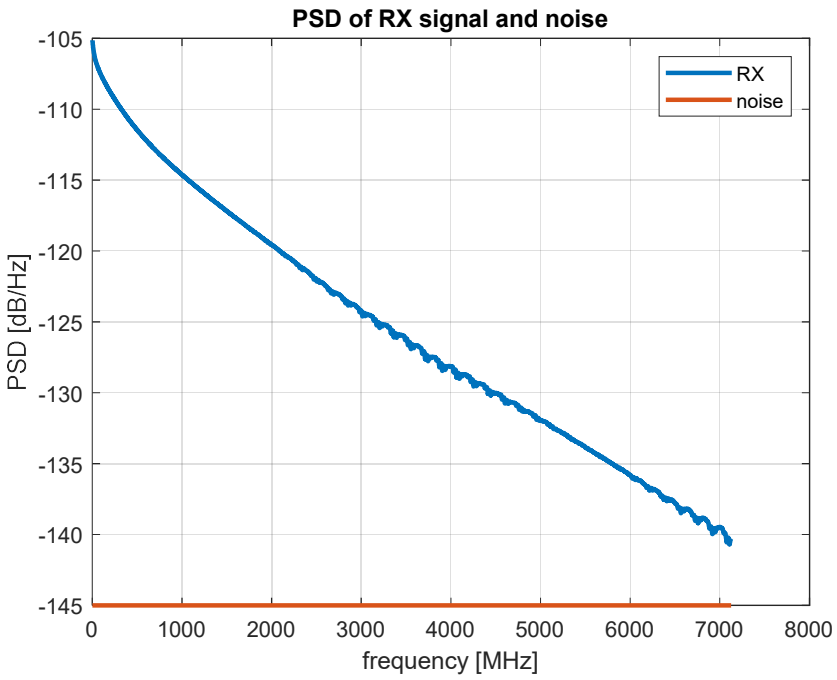
Decision point SNR

- Measured IL 17m coax cable
- dpSNR = -5.38dB



- Scaled IL 15m coax cable
- dpSNR = -2.93dB



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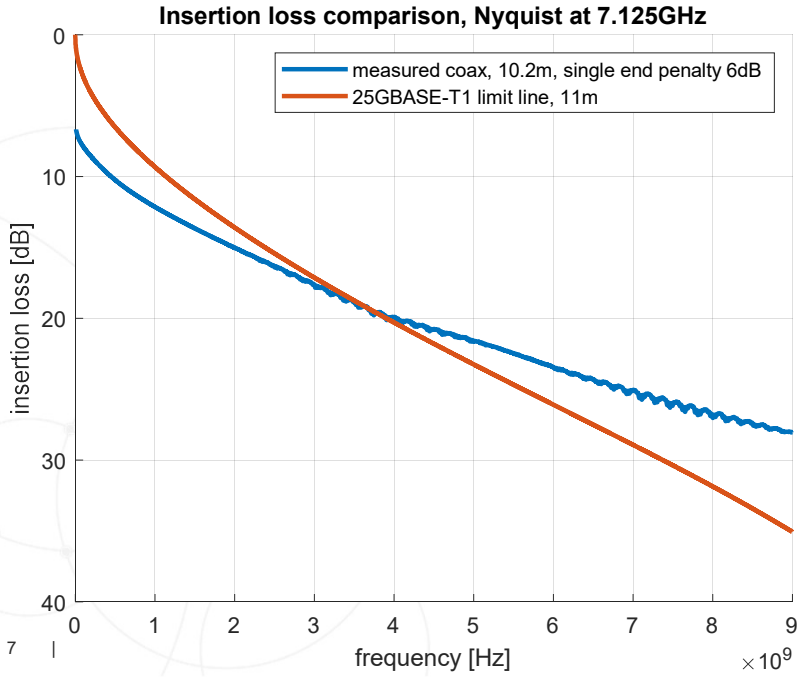
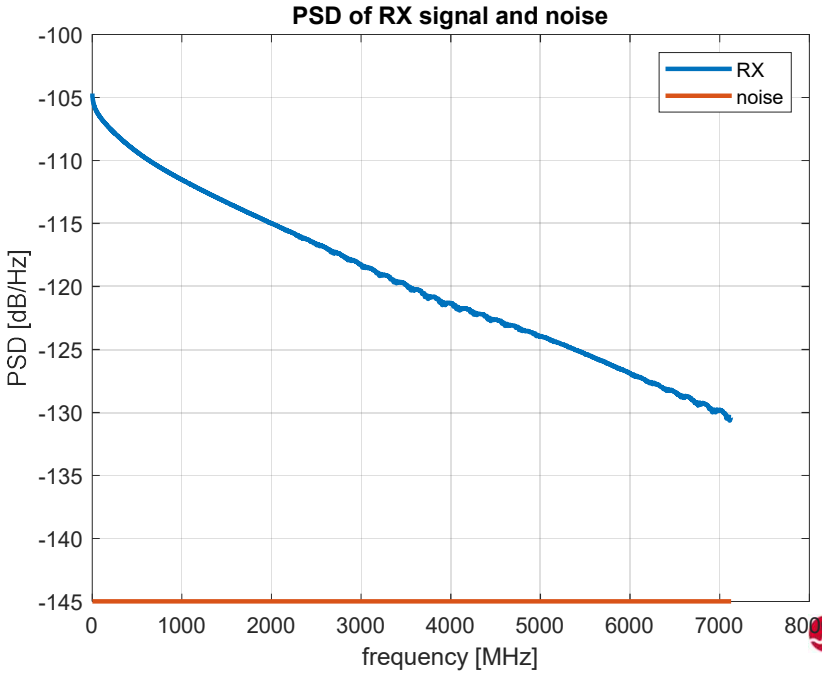
Decision point SNR 10.2m cable

- Insertion loss was measured for the 10.2m coax cable
- Coax single sided penalty of 6dB applied to insertion loss for easier comparison.
  - Mean of difference up to Nyquist of 7.125GHz: 25GBASE-T1 favored by 0.02dB.
- dpSNR = 3.27dB





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Conclusion

- Assumed without measurement:
  - Excellent suppression of external noise and CW signals by the coax cable and connectors.
- Scaled 15m coax, no aging or elevated temperature considered, has negative dpSNR.
- Measured 17m coax has negative dpSNR.
- Measured 10.2m coax has positive dpSNR.
- Future technical feasibility study is required:
  - Measurement and analysis for other automotive grade cables and connectors (if available)
  - Noise performance measurements (including component level and in-car EMC)

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Thank You


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