

# Inline Connector Evaluation for NGAUTO

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# Overview

- Many automotive Ethernet applications require inline connectors
- Proposals for a maximum of 2 and/or 4 inlines have been discussed
- Test results comparing 0,2, and 4 inlines are shown
  - J-UTP
  - Co-ax
- Motivation is to supply information to answer the following 2 questions:
  - How do the number of inlines impact the link segment?
  - Will the resulting performance affect the PHY design?

# Link Segments

Same topologies for both Co-ax & UTP

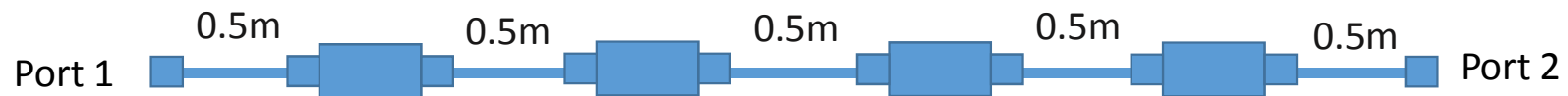
Topology 1: 0 Inlines



Topology 2: 2 Inlines

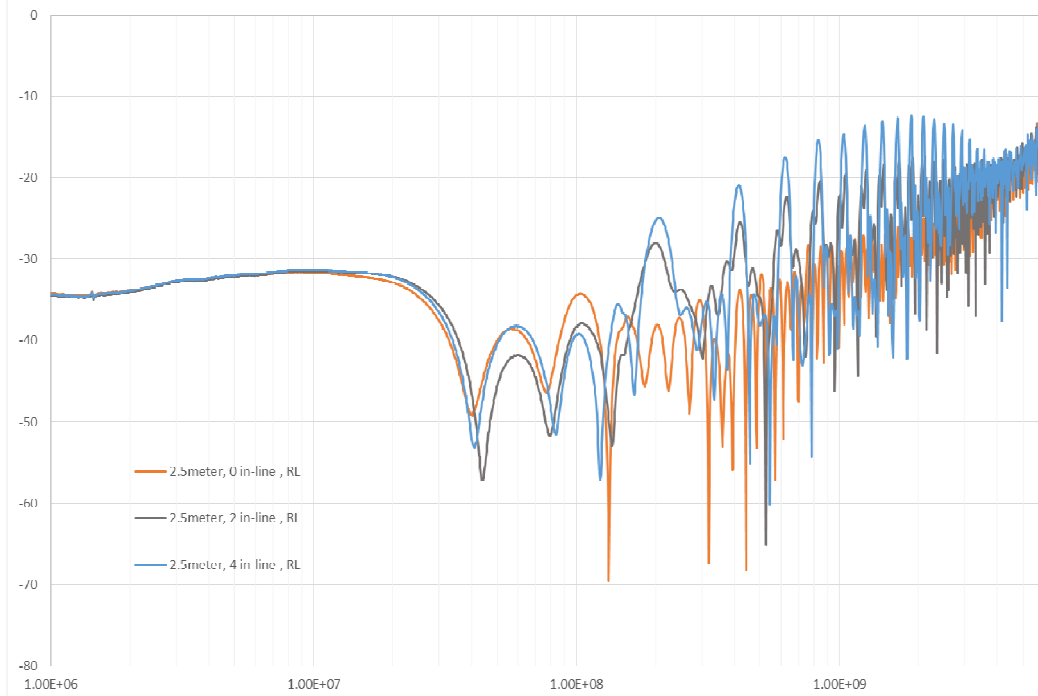


Topology 4: 4 Inlines

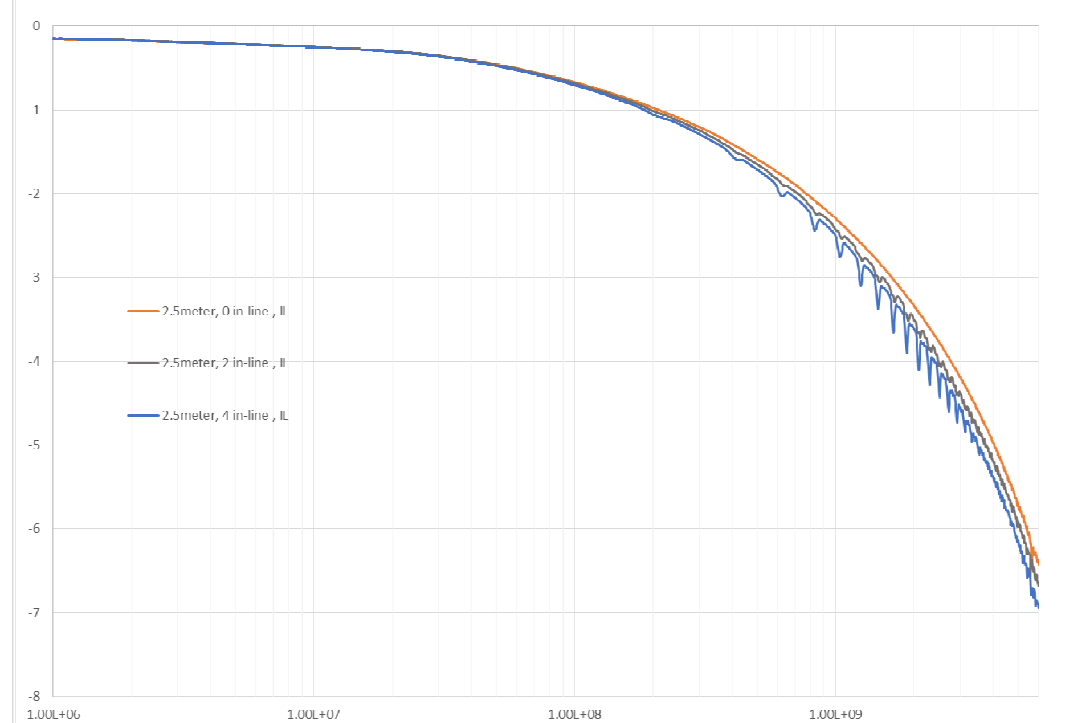


# Co-ax Test Results

Co-ax Comparison - 2.5m Link Segments - Return Loss

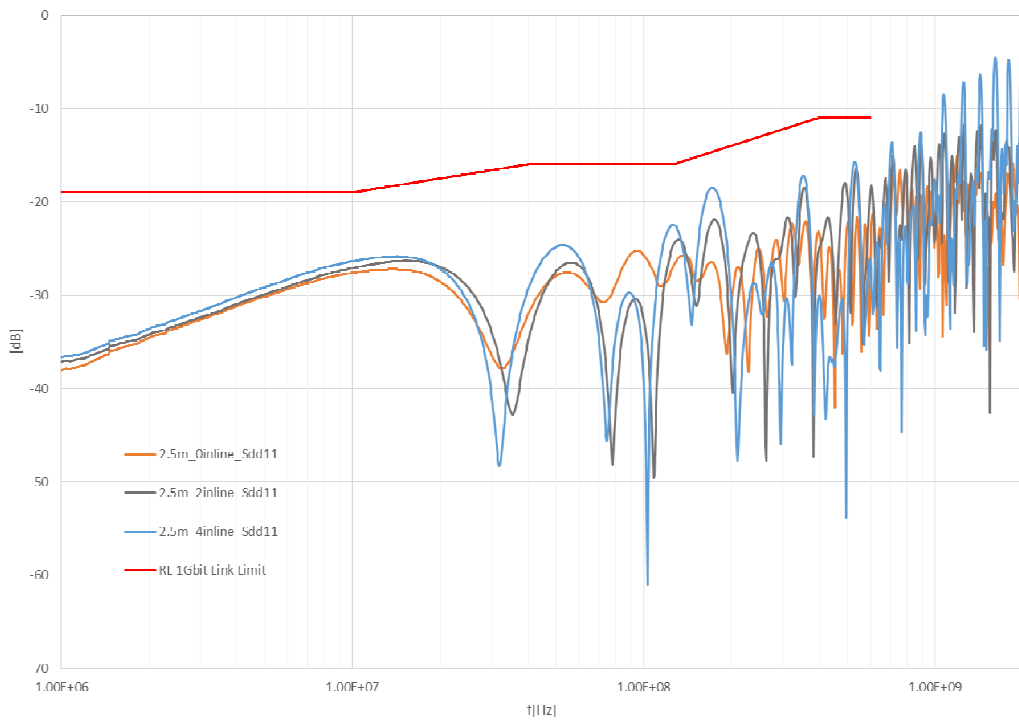


Co-ax Comparison - 2.5m Link Segments - Insertion Loss

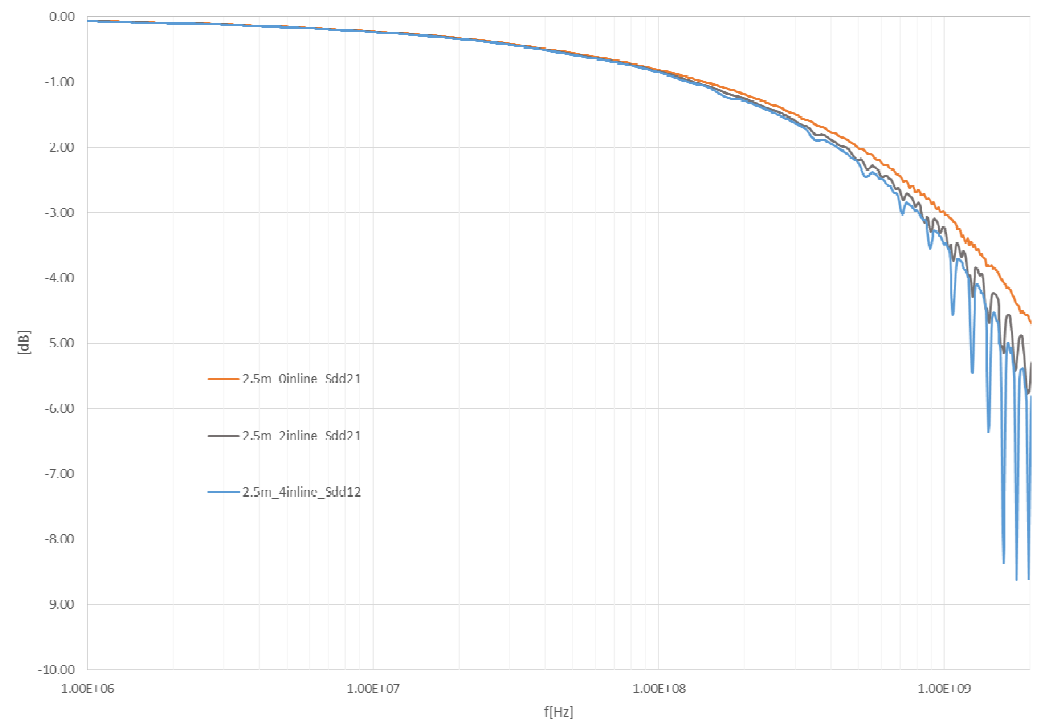


# UTP Test Results

Return Loss [-dB] - UTP Comparison - 2.5m Link - Thru



Insertion Loss [-dB] - UTP Comparison - 2.5m Link - Thru



# Conclusions

- Having identical 0.5m cable segments can be considered as a worst case scenario
  - Mismatch of characteristic impedance between cables and connectors will accumulate
- Cable impedance tolerances of +/- 5% vs +/- 10% will have impact on 2 vs. 4 inline connectors
- Future shielded solutions could be tested but performance is expected to be similar

Thank You

Extras



# Reasons for Reflections (Link)

- Topology: - number of segments  
- individual segment length  
(awareness of resonance effects for same segment lengths!)
- Segment (cable) attenuation
- Characteristic impedance mismatch cable:
  - mismatch to nominal impedance (100ohms)
  - segment to segment (different cable types)
- “Structural” reflections within cable (e.g. twist effects)
- Connector: - impedance mismatch  
(impedance profile)
  - length (including untwist area)

# Return Loss - Worst Case Scenario

- Topology: - max. number of inline connectors
  - short cable segments
  - same segment length (n\* shortest length, n=1, 3, 5, ...)
- Low cable attenuation (max cross section, -40°C)
- Alternating cable impedance segment to segment (Zmax-Zmin-Zmax-...)
- Max. impedance mismatch cable-to-connector (connector at Zmax, cable at Zmin or vice versa)
- Mated MDI connectors at both ends included