IEEE 802.3CY – BEYOND 10G ELECTRICAL AUTOMOTIVE ETHERNET PHY TF

Link Segment Measurements

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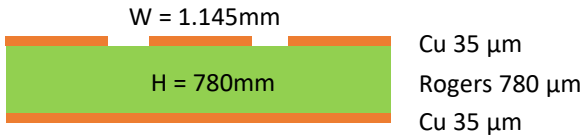
Purpose of the Analysis

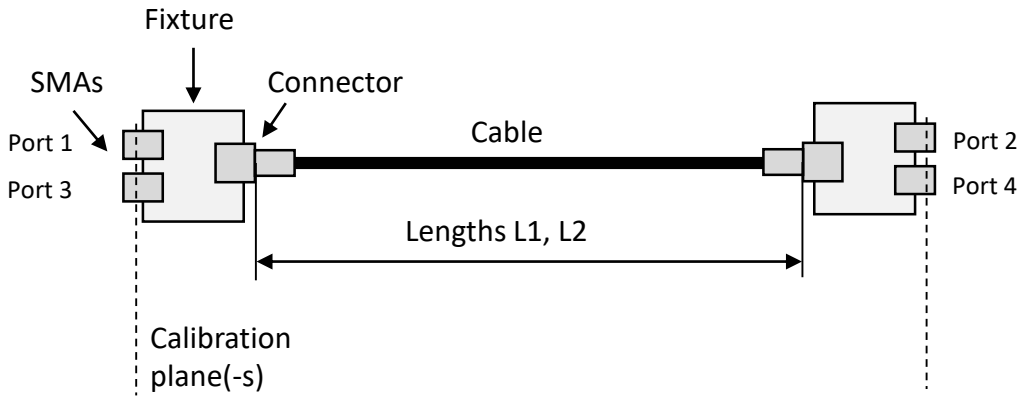
- Measure insertion loss of new automotive grade cable and consider various operating temperatures conditions
- Measure return loss of various cable segments with attached connectors up to 10 GHz
- Calculate Micro-Reflection response of the various cable segments

Fixture description and de-embedding

Same fixtures as in DiBiasoBergnerCuesta_3cy_3_0920

- PCB Trace length: 20mm
- PCB Stackup:





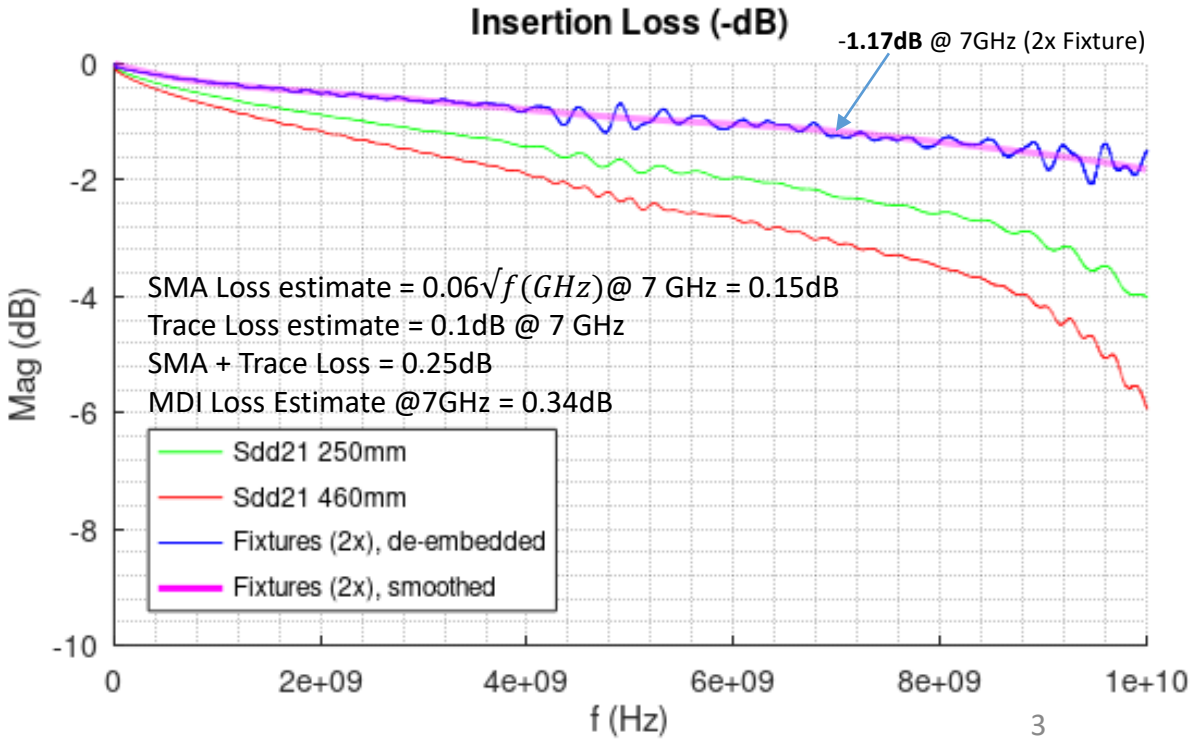
- PCB total loss (x2 to consider loss at both sides)

  - simple de-embedding by measuring 2 cable lengths incl. fixtures and subtraction of LogMag ILs:

$$IL_{2x\,Fixture} = IL_{Cable\,1+2xFix} - \frac{L1}{L2 - L1}\left(IL_{Cable\,2+2xFix} - IL_{Cable\,1+2xFix}\right)$$

  - smoothing to eliminate ripples

  → sufficient accuracy to consider the fixtures IL



Test Sequence and Samples

- S-parameters were captured at different temperatures in the following sequence (same cable assembly):
  - T1 = 20°C
  - T2 = -40°C
  - T3 =105°C
  - T4 = 20°C

no aging, just ~60 min dwell time to allow temperature adaptation

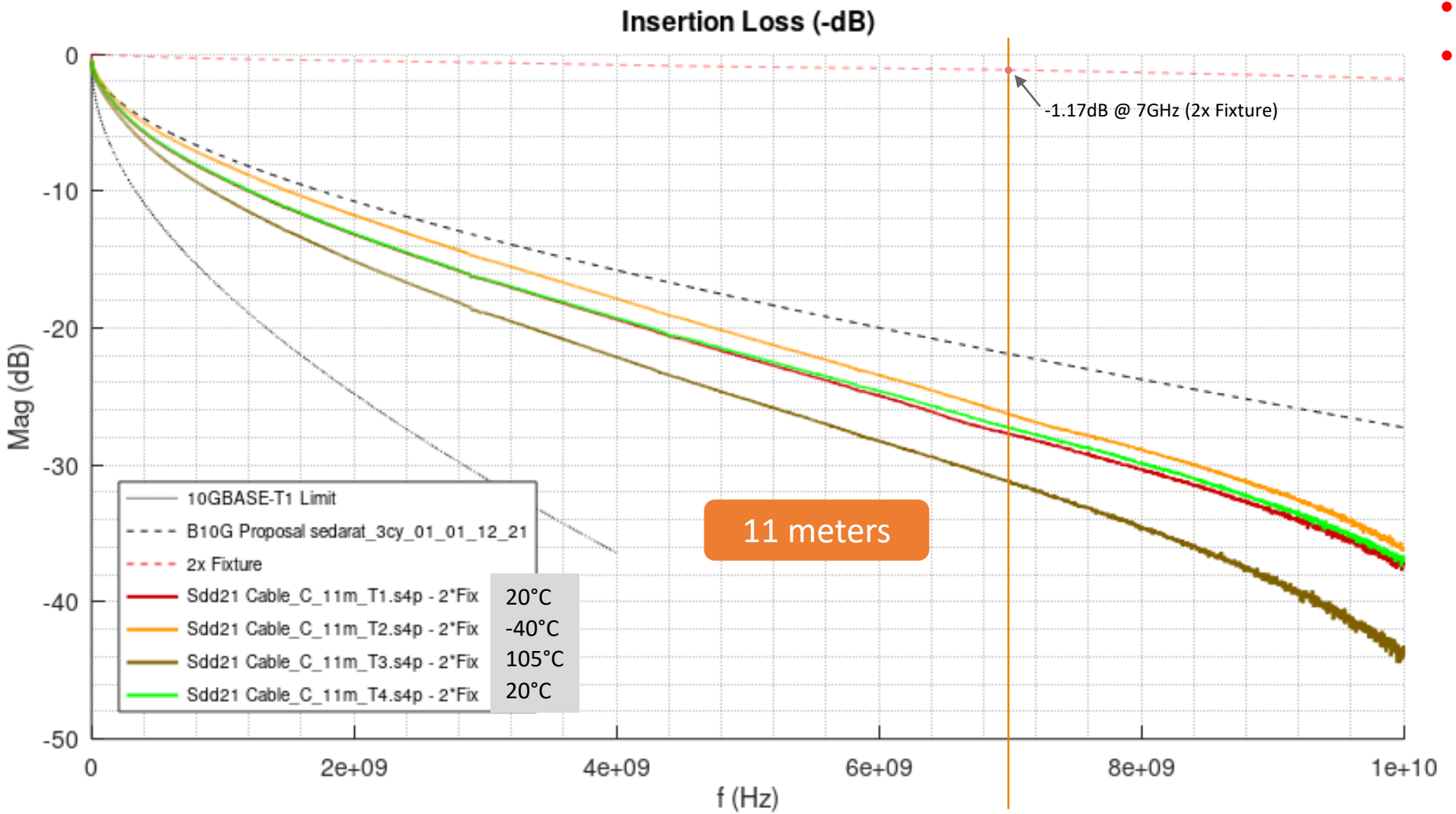
- Samples:

Cable C
- construction (SDP)
- 10 GHz type
- 2x 0.14mm²
  (AWG 26)
  stranded

Same arrangement as in DiBiasoBergnerCuesta_3cy_3_0920

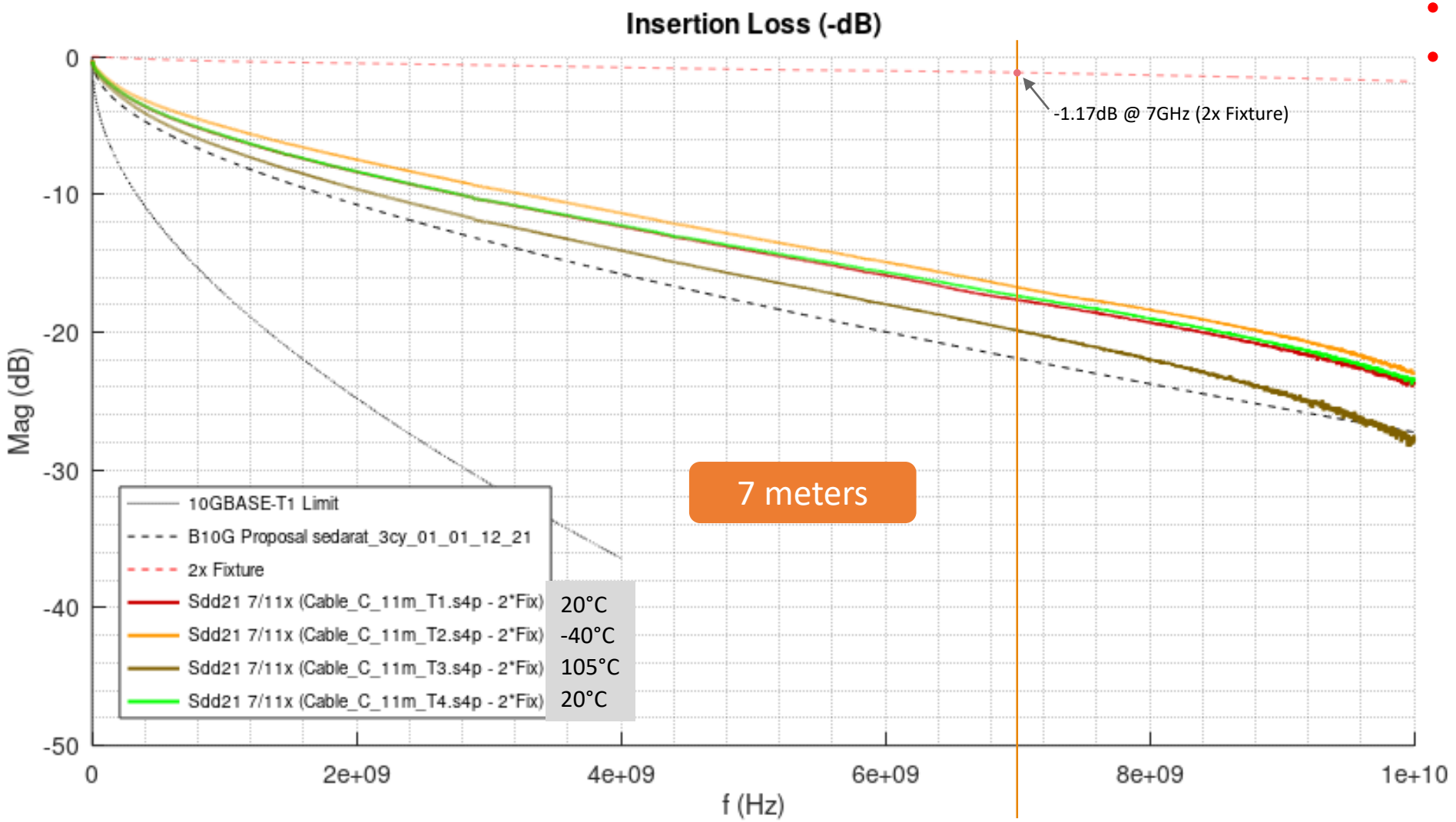
Insertion Loss – Sample C (fixtures removed)

- 11m as measured
- No inline connectors



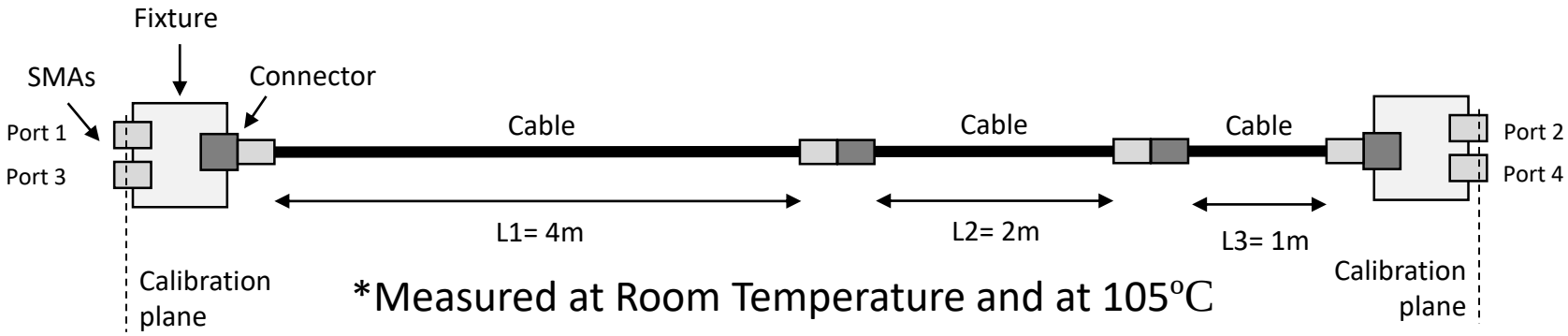
Insertion Loss – Sample C (fixtures removed)

- Scaled to 7m
- No inline connectors



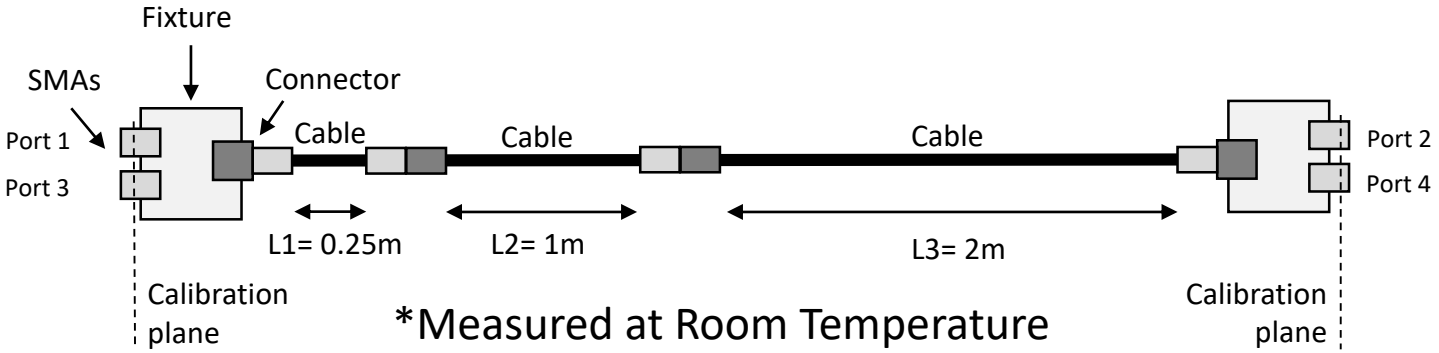
Link segment configuration for RL measurements

Link 1



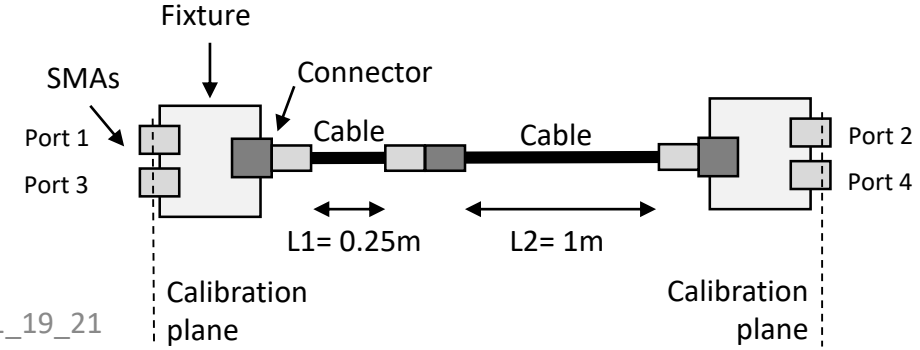
*Measured at Room Temperature and at 105°C

Link 2



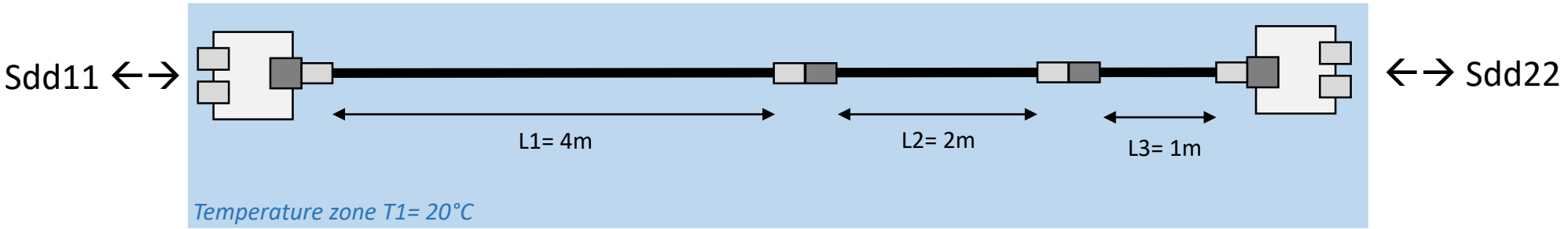
*Measured at Room Temperature

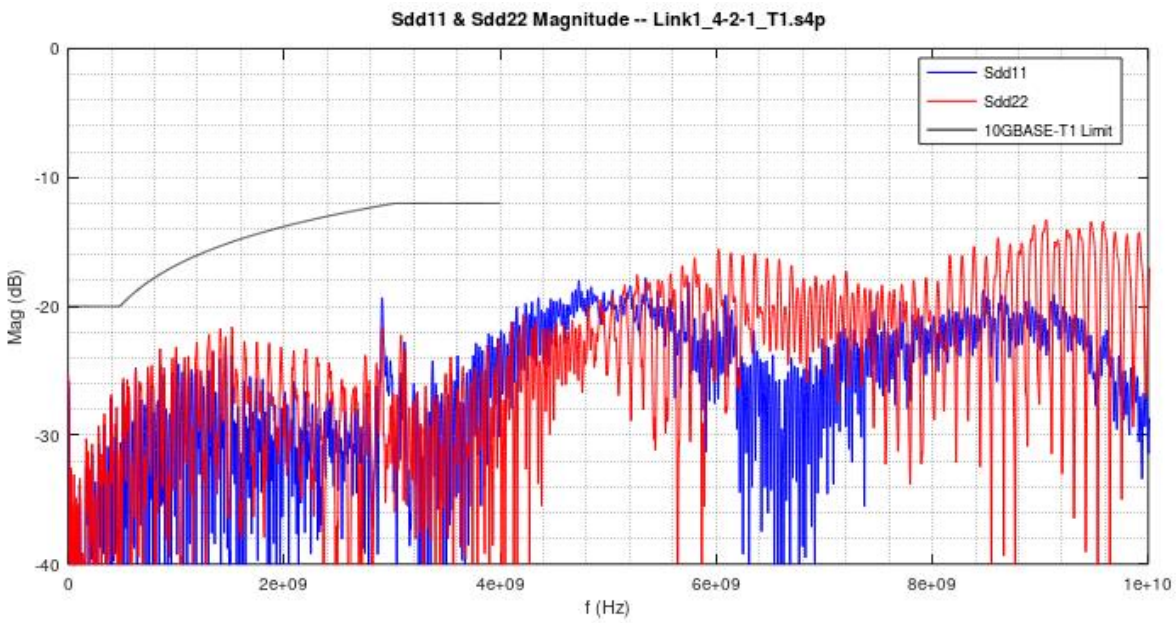
Link 3

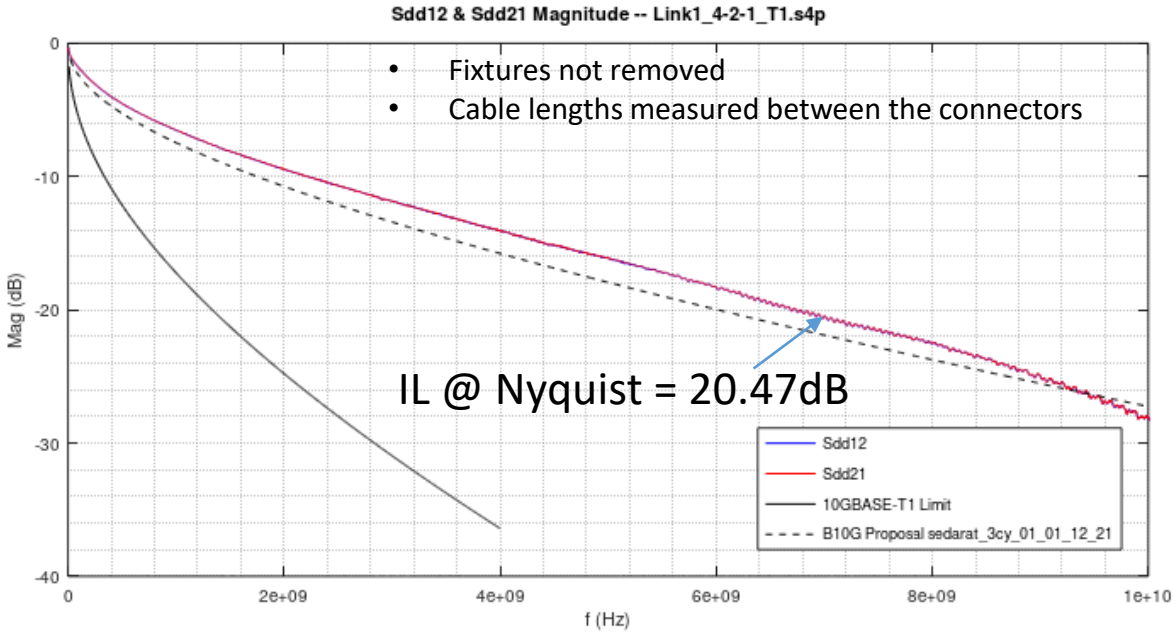


*Measured at Room Temperature

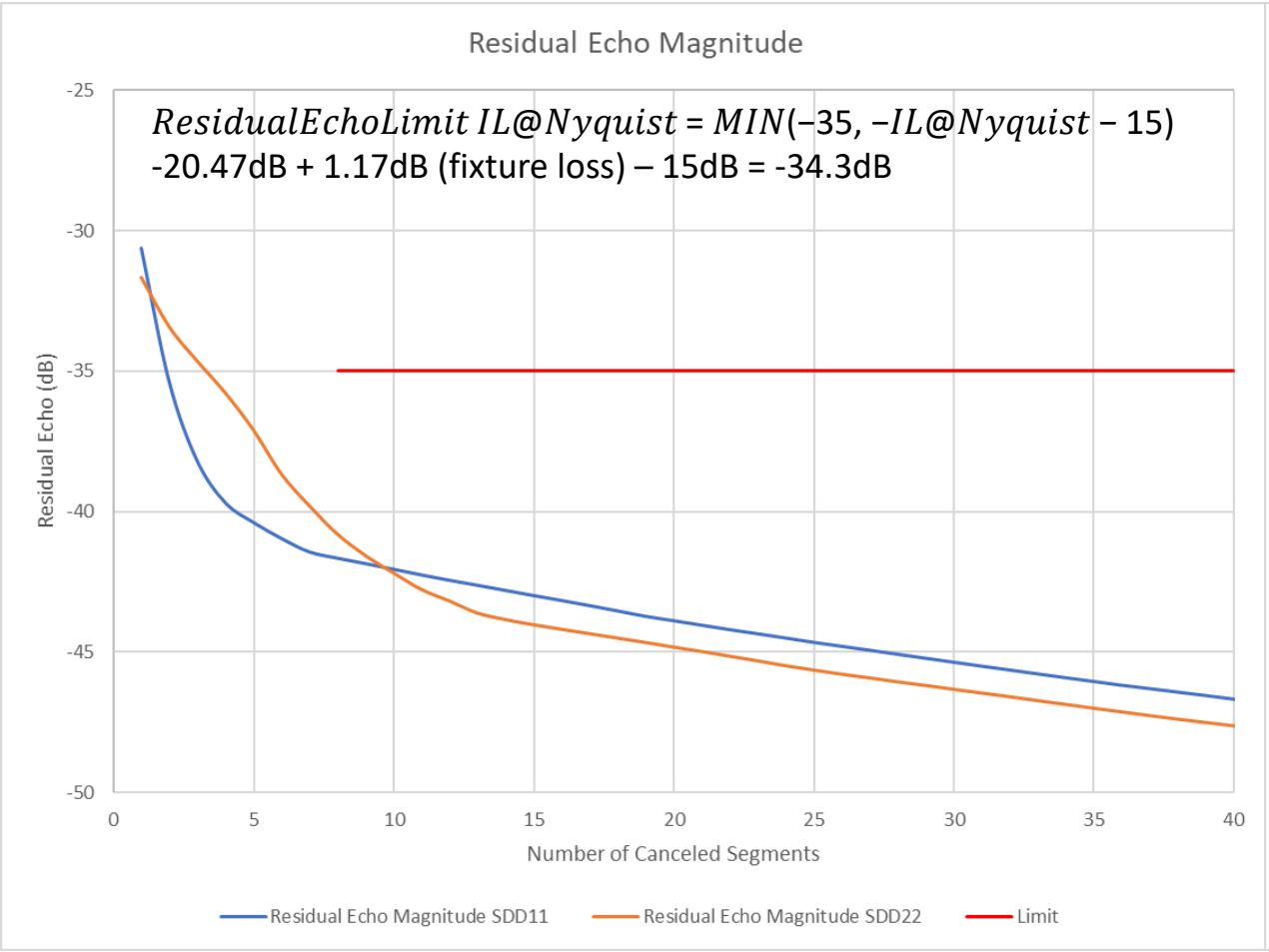
Link Segment with Inliner – Link 1 (4-2-1) @ T1=20°C

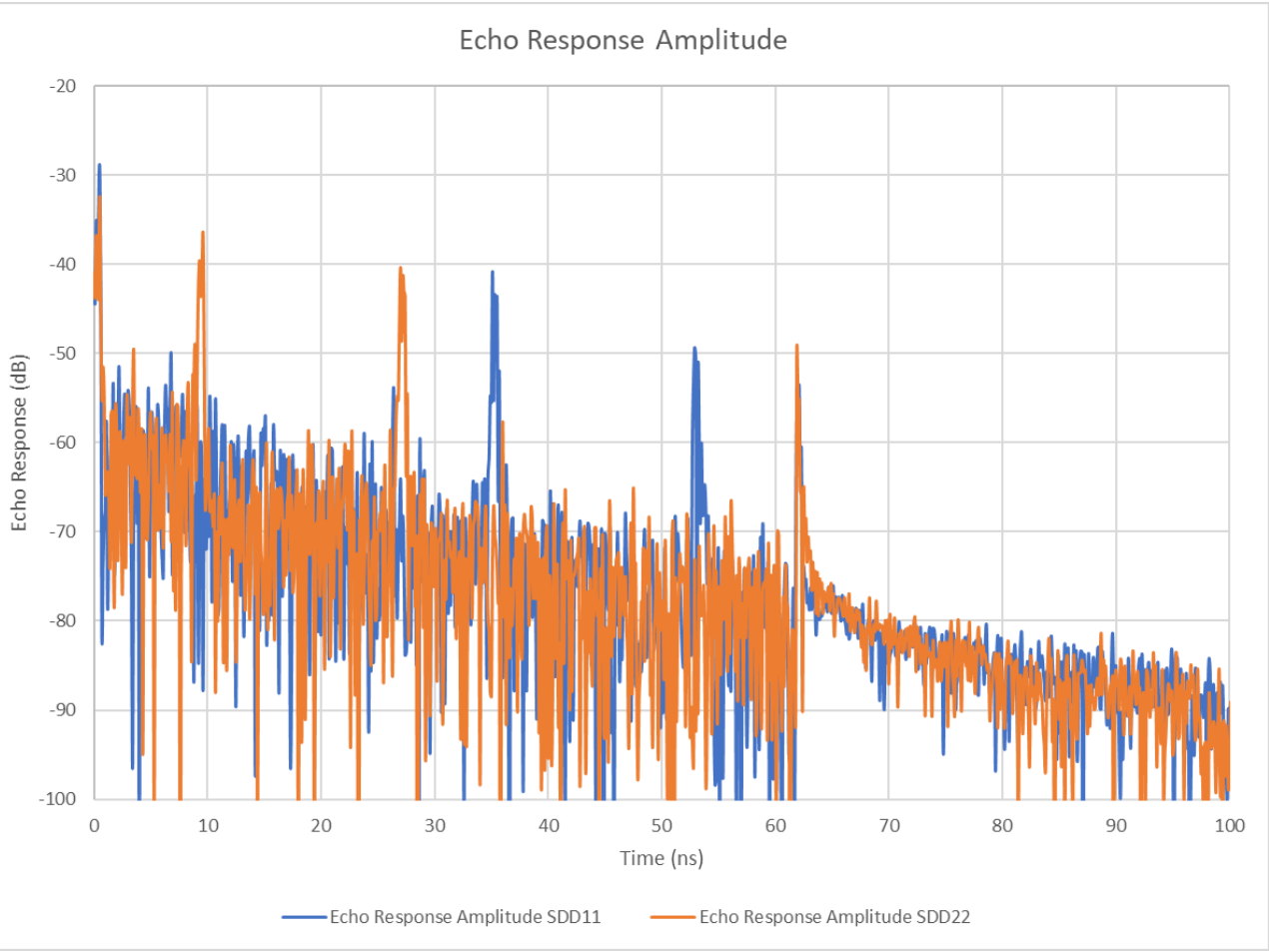






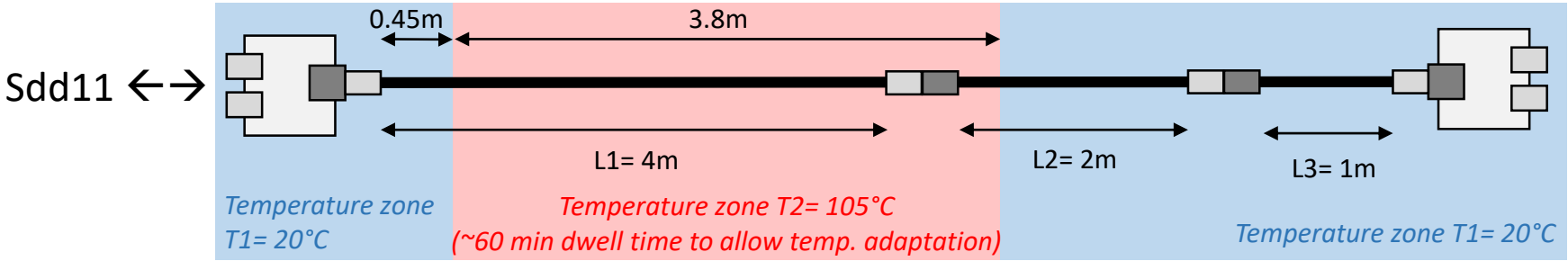
Micro-Reflection Response Link 1 (4-2-1) @ T1=20 °C

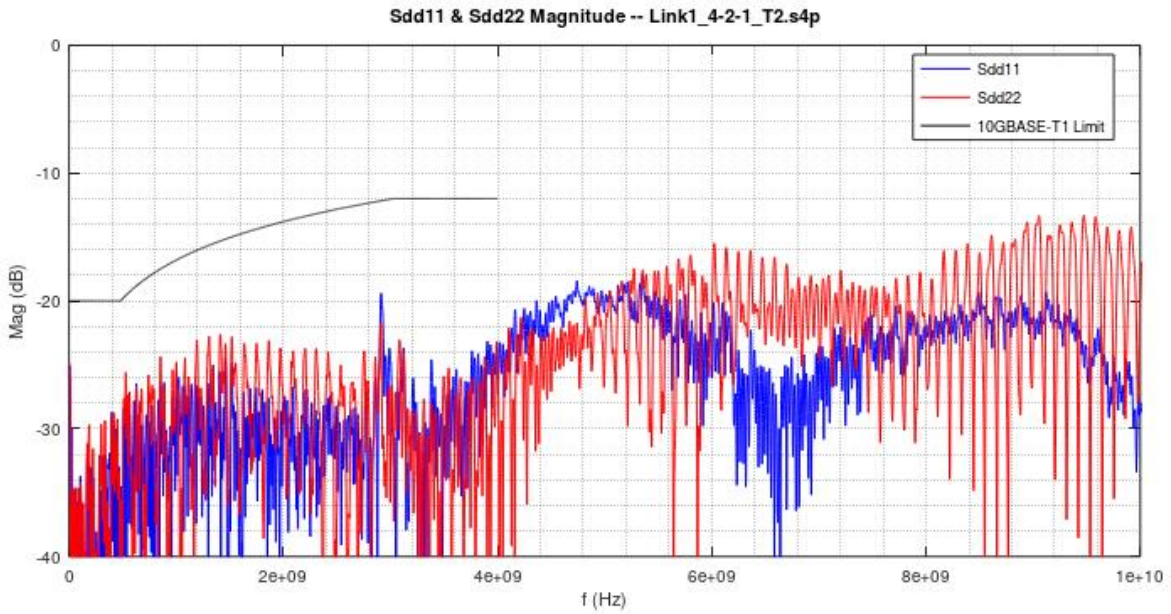


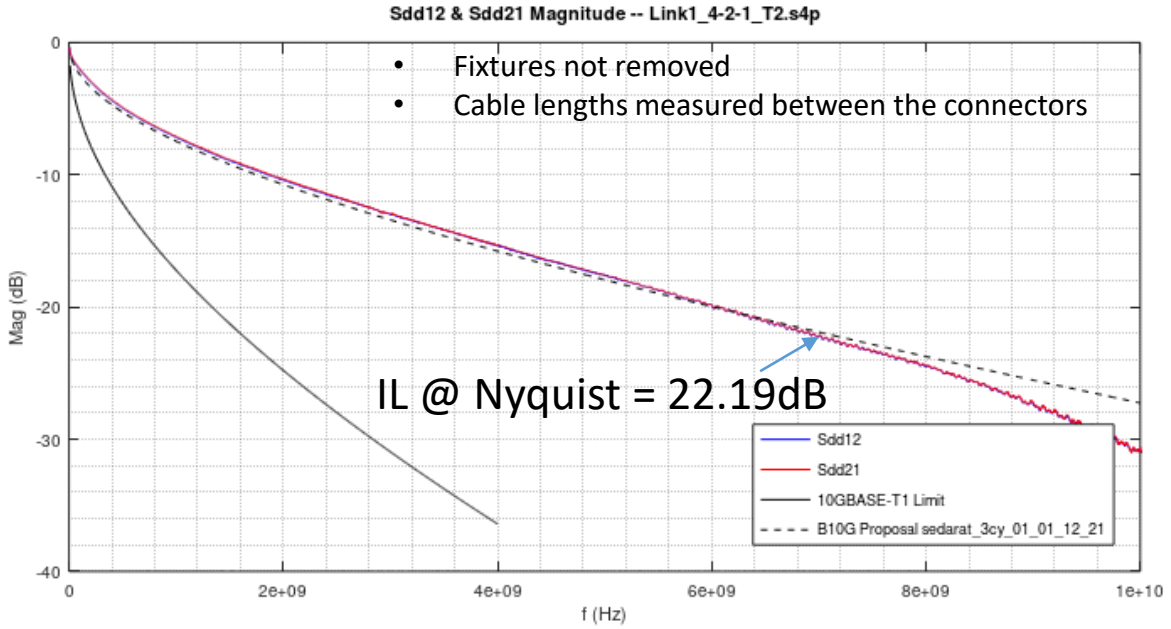


Residual Echo Limit Referencing jonsson_3cy_01_12_08_20

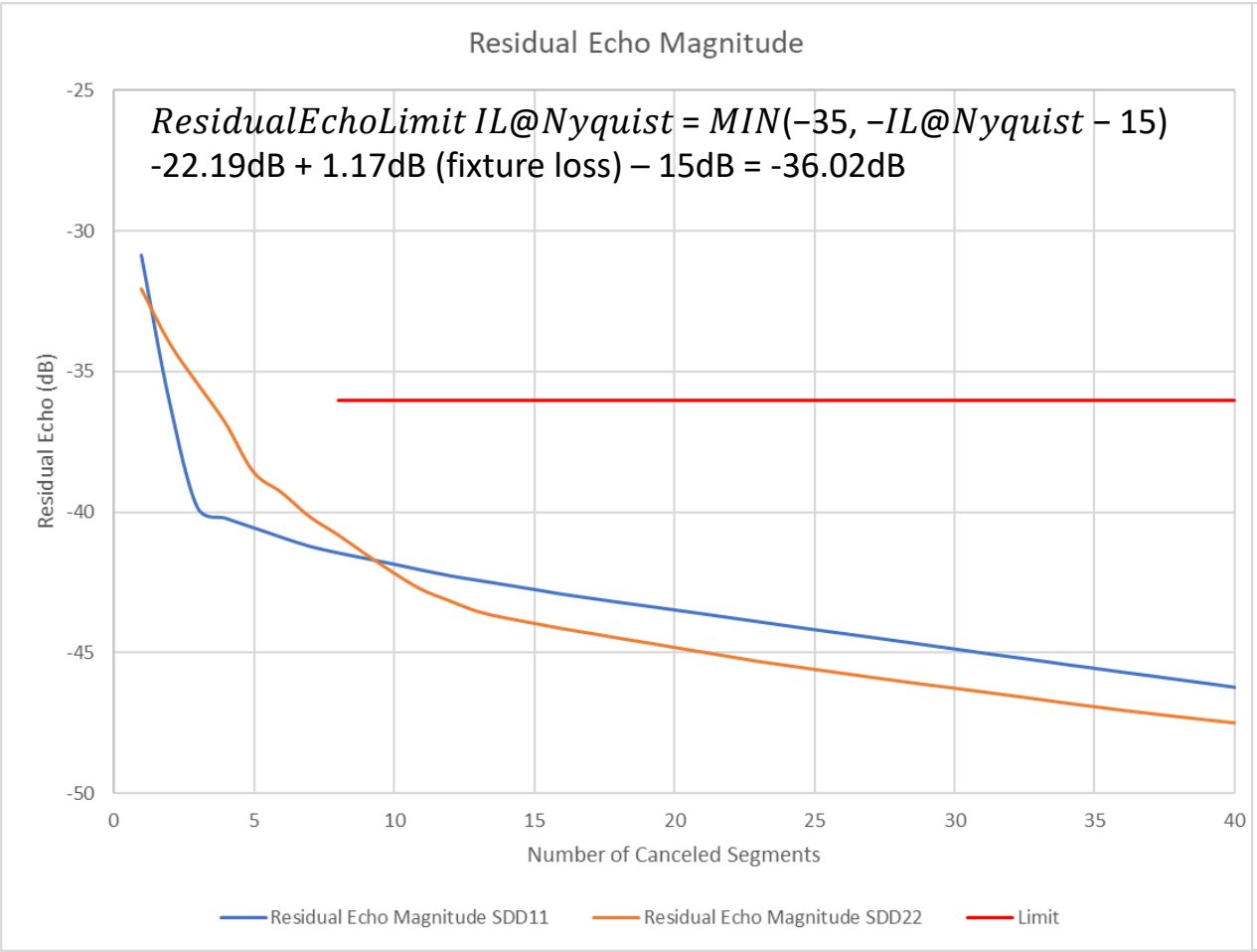
Link Segment with Inliner – Link 1 (4-2-1) @ T2=105°C

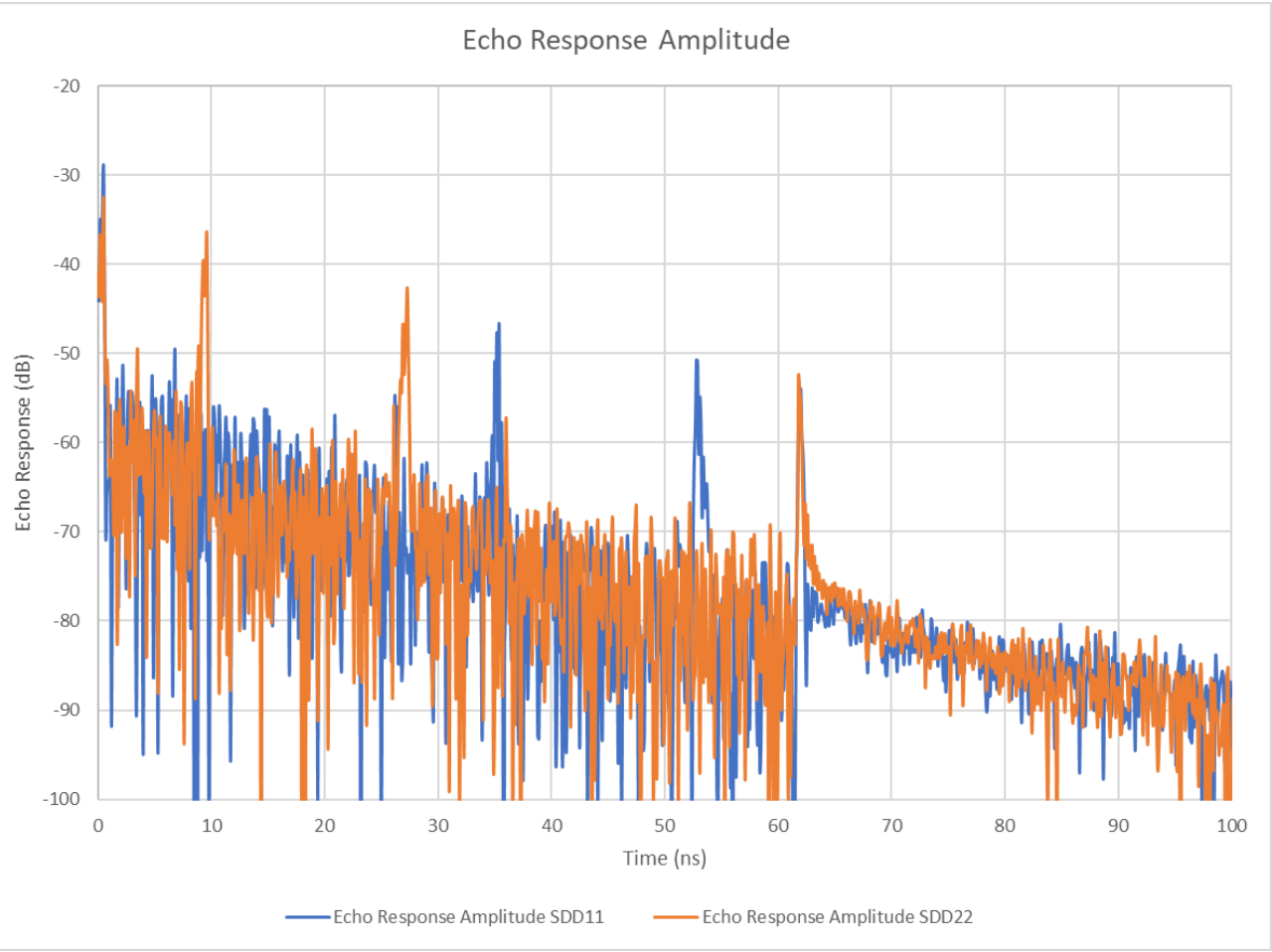






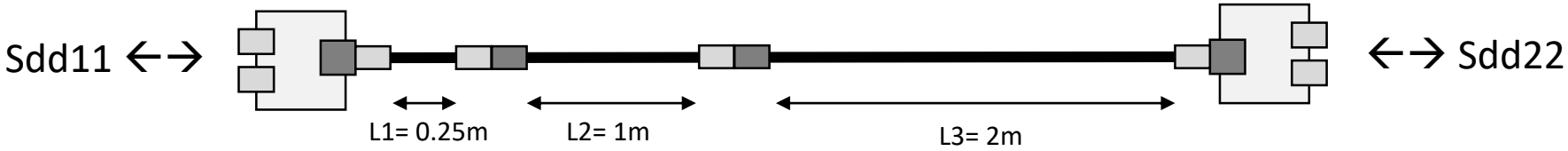
Micro-Reflection Response Link 1 (4-2-1) @ T2=105 °C

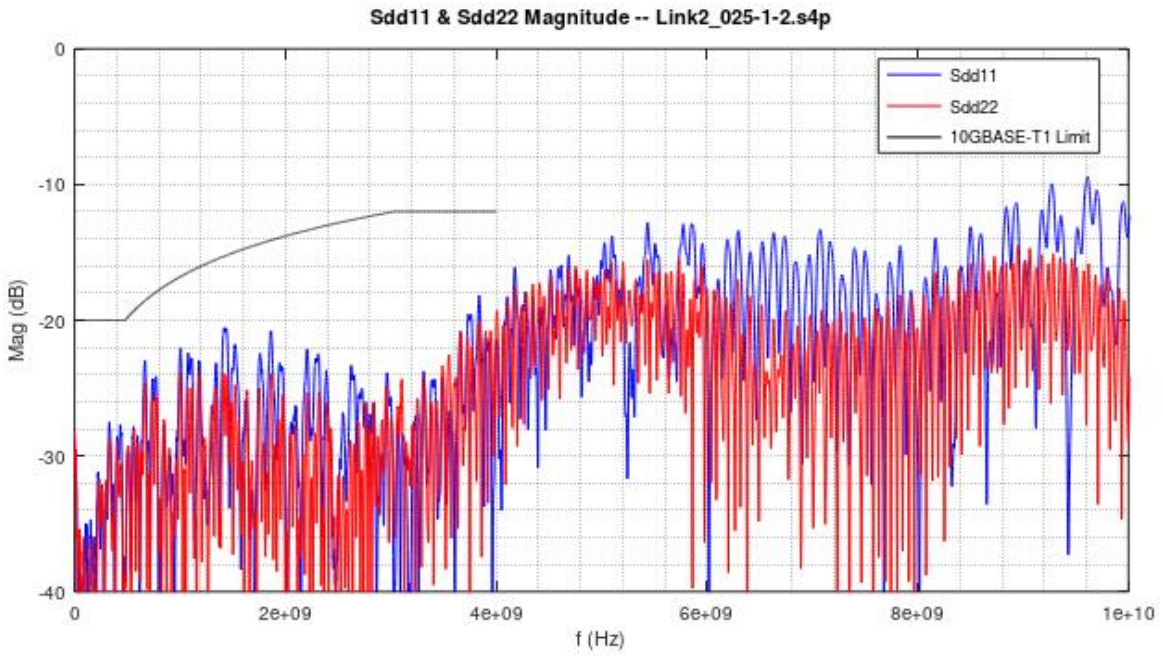


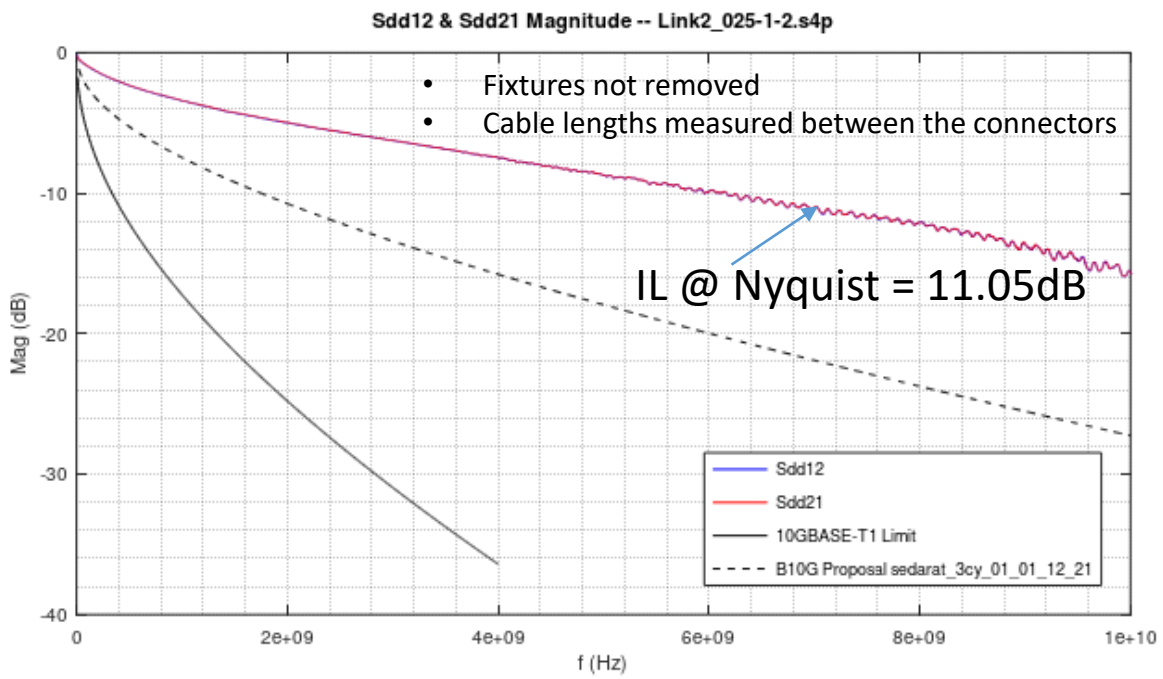


Residual Echo Limit Referencing jonsson_3cy_01_12_08_20

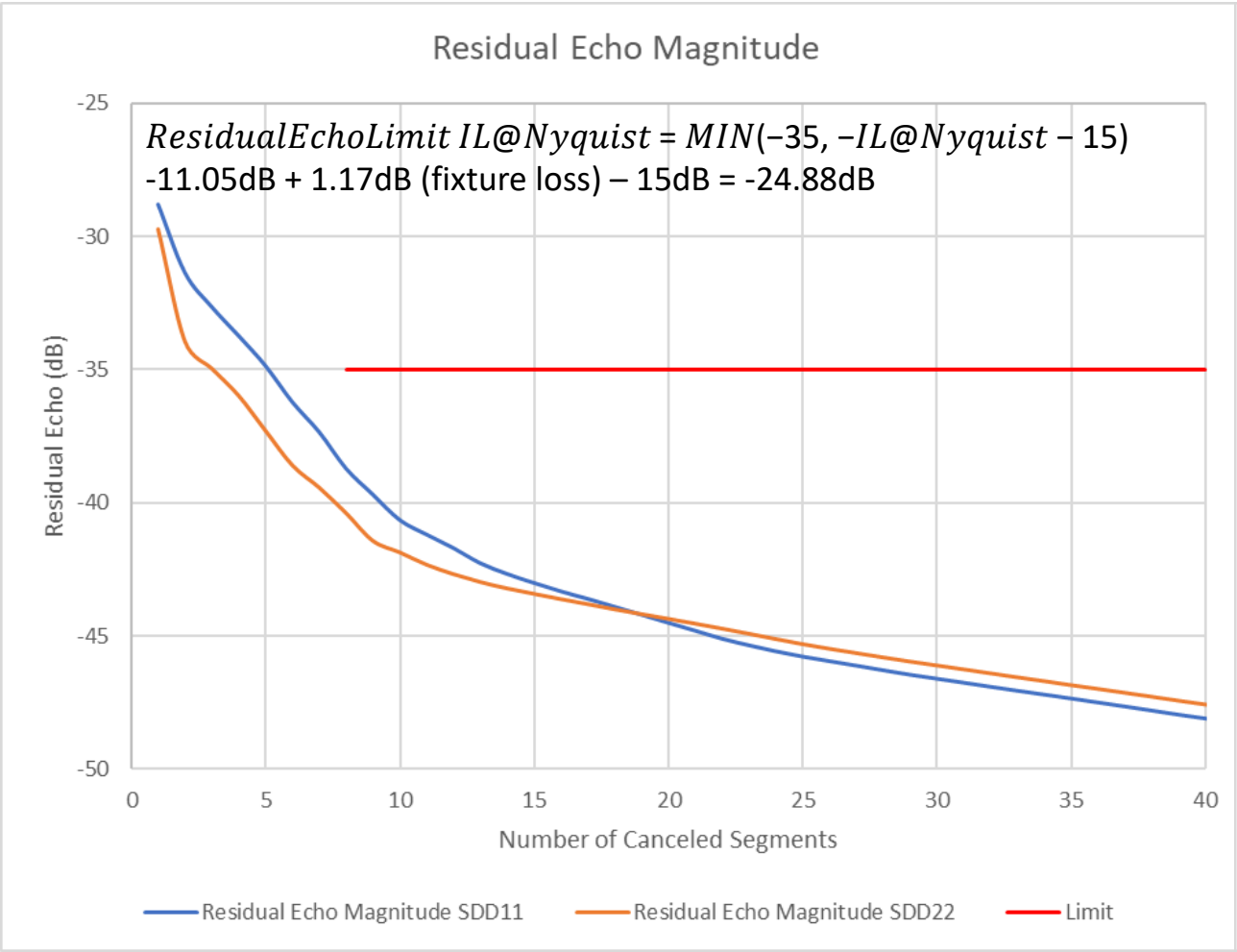
Link Segment with Inliner – Link 2 (0.25-1-2) @ T=20 °C

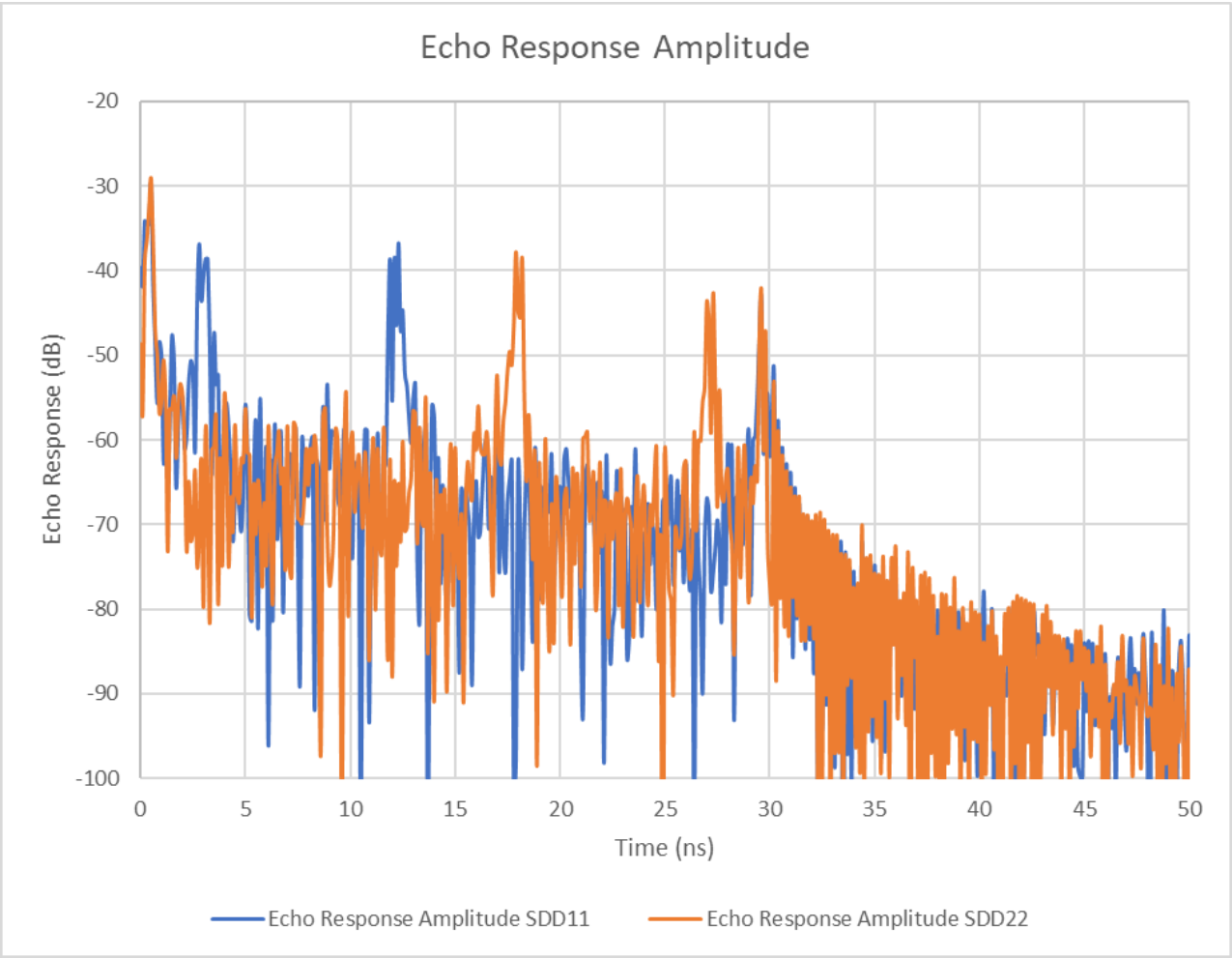






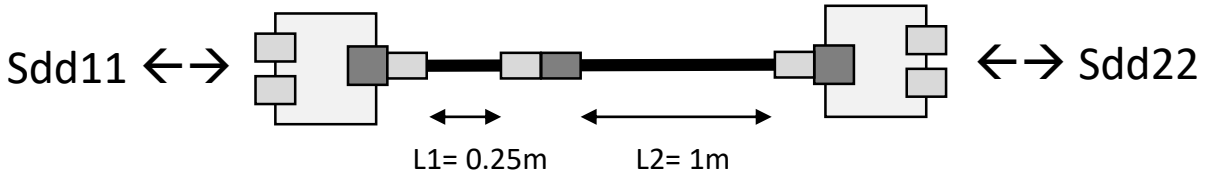
Micro-Reflection Response Link 2 (0.25-1-2) @ T=20 °C

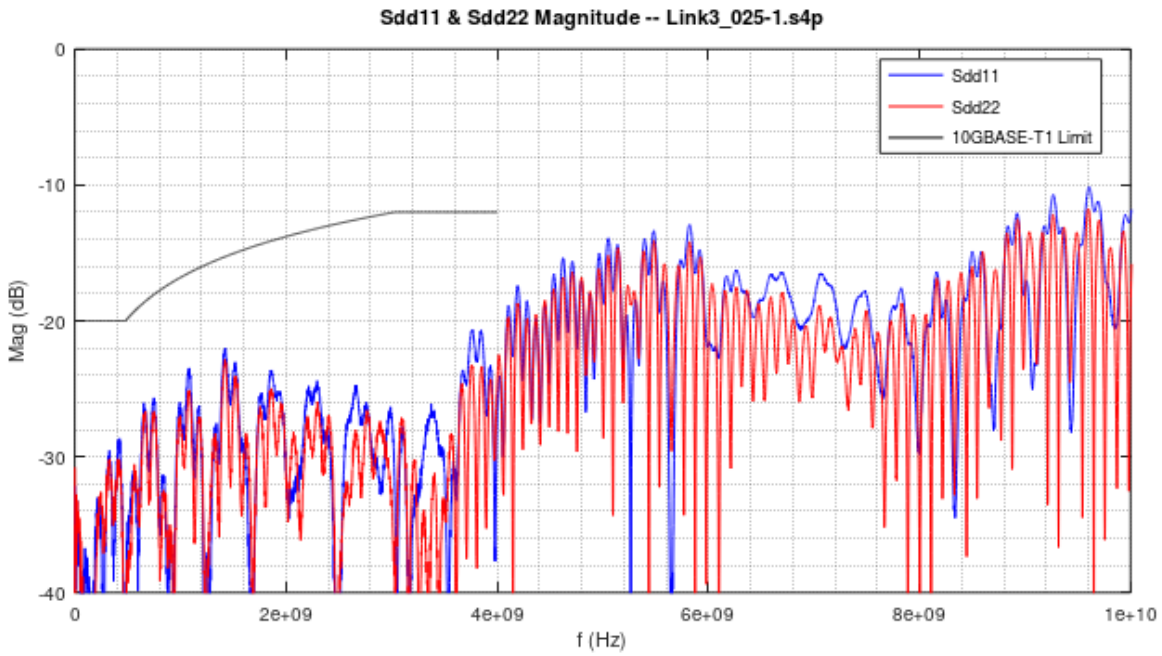


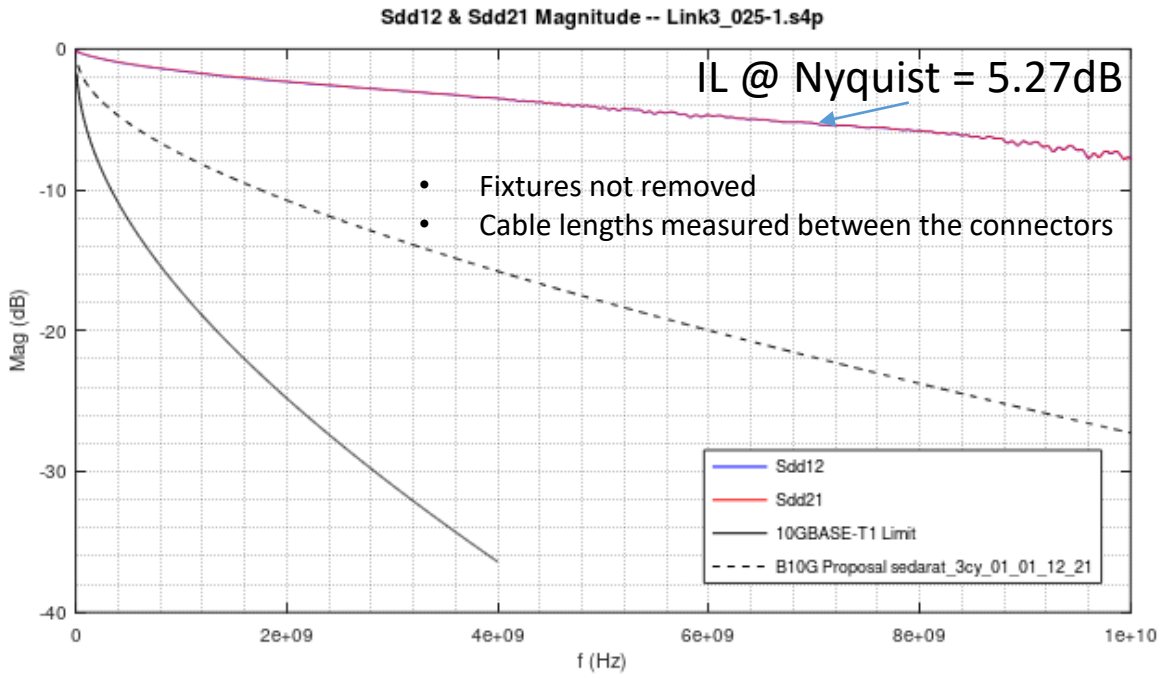


Residual Echo Limit Referencing jonsson_3cy_01_12_08_20

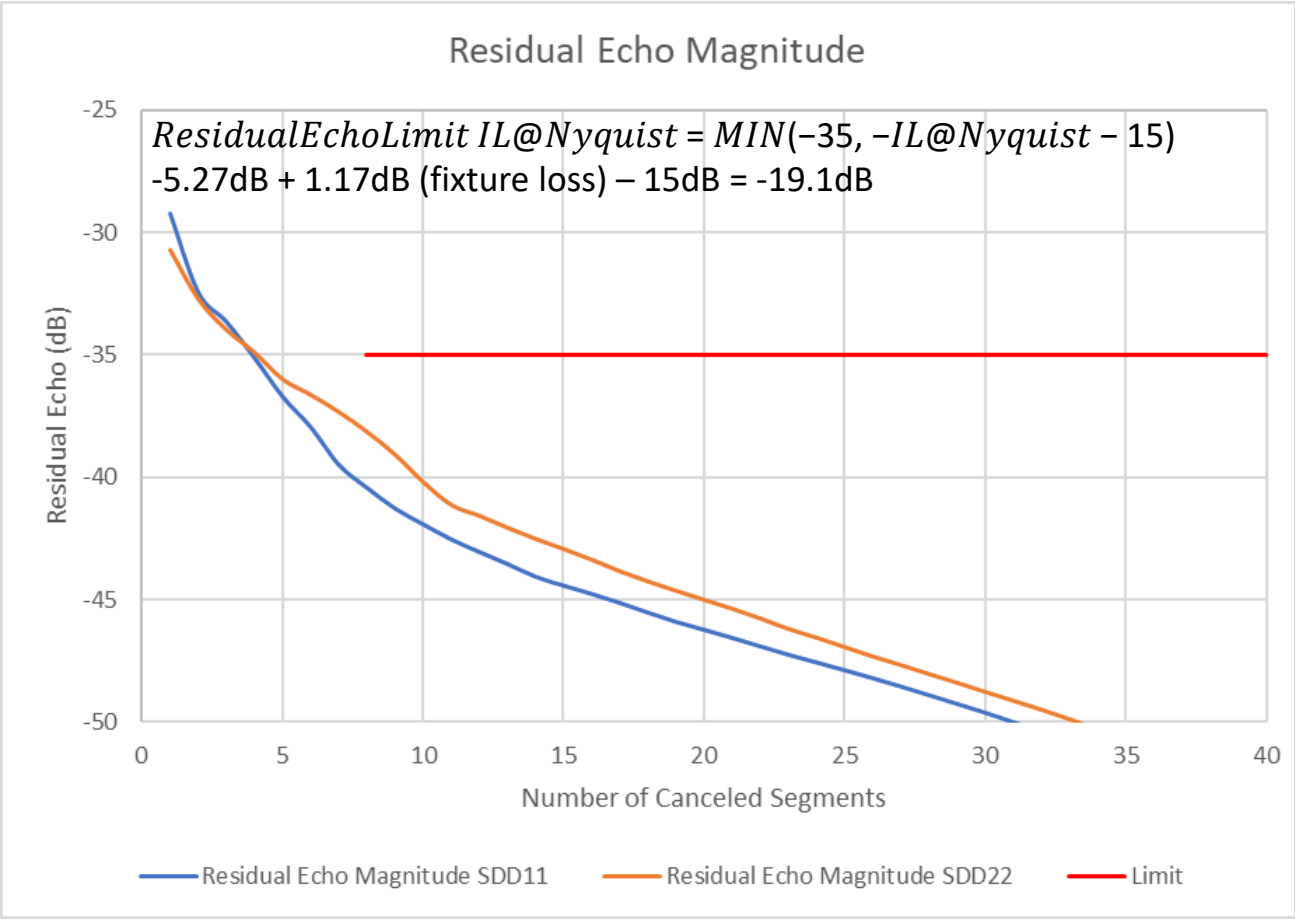
Link Segment with Inliner – Link 3 (0.25-1) @ T=20 °C

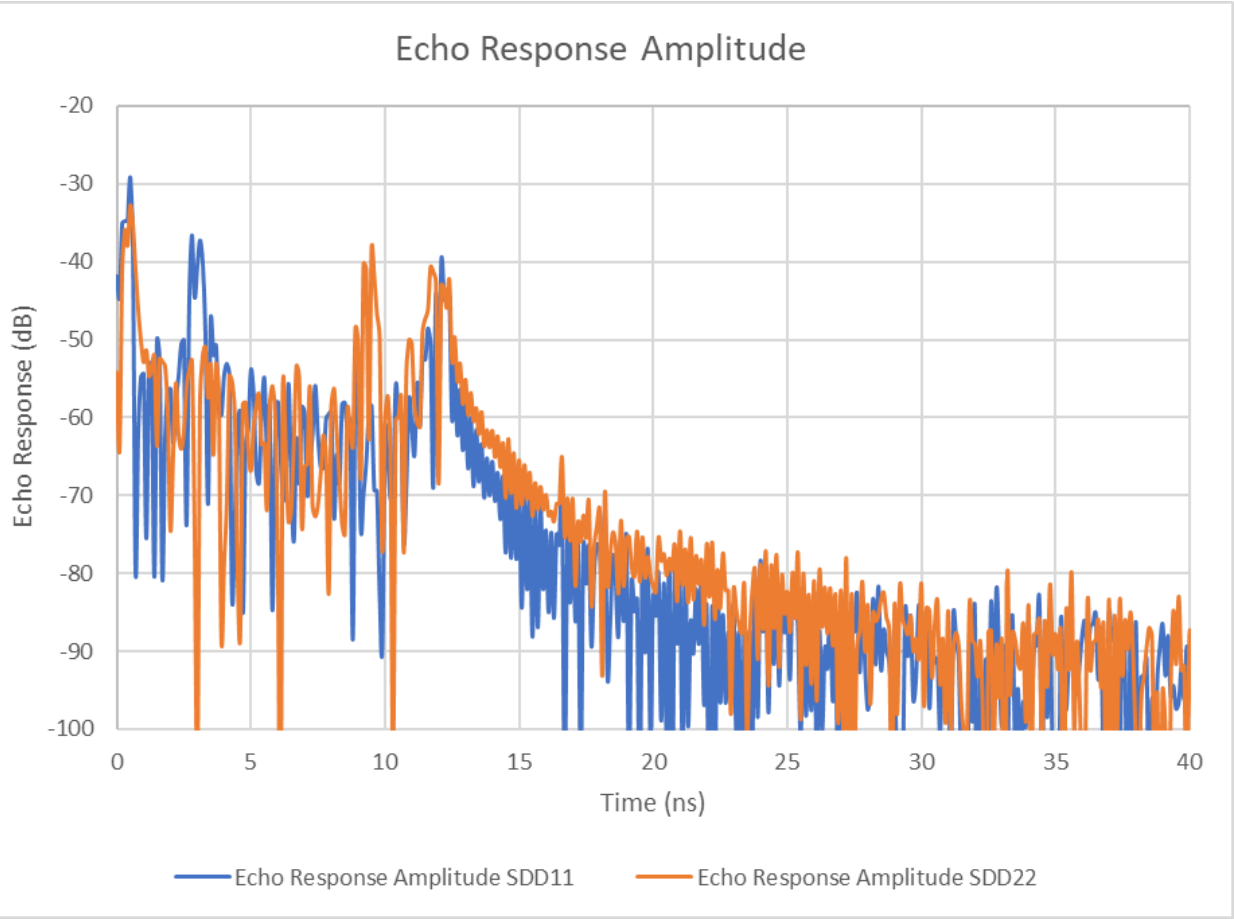






Micro-Reflection Response Link 3 (0.25-1) @ T=20 °C





Residual Echo Limit Referencing jonsson_3cy_01_12_08_20

Conclusions / TBD's

- Proposed insertion loss limit (Sedarat_3cy_01_01_12_21) can be met with AWG26 cables up to 7m including margin for higher temperature
- Proposed insertion loss limit cannot be met with currently available AWG26 cables up to 11m
  - New SDP cables needed (larger AWG)
  - Use coax cable
  - Different modulation (lower Nyquist frequency)
  - Muilt-lane architecture
- With this automotive cable, the residual echo limits can be met (jonsson_3cy_01_12_08_20).
  - If the inliners are close to the measurement port, the residual echo is higher but can still meet the limit.
- Further analysis of return loss measurements and simulations to proposed a link segment return loss limit.
  - Utilize all cable segment combinations from (wienckowski_3cy_01_01_12_21)

Thank You!!!