Comparison of Proposed Models

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All Testing Performed by UNH-IOL

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IEEE 802.3ap Backplane Ethernet

Testing

- All measurements taken by UNH
  - Agilent 8720ES with N4418A test set ---
  - Also known as the Agilent N1951A 20GHz Physical Layer Test System (S/N US0020201)
  - Cals are SOLT (short open load thru) to 26GHz cal set into 50ohm loads at the end of SMA cables.
  - No de-embedding of the line cards was attempted/included at all.
  - Equipment Settings done in accordance with Ad Hoc Guidelines where possible
    - IF BW – 300 Hz
    - Launch Power - -0.5 dBm
    - Averaging – was not supported with equipment / software, being investigated
      - Time constraints limited use of smaller IF BW, but some data was gathered and will be reported on

- Thanks to Bob Noseworthy and Jeff Lapak, and everyone else there!

Test Setup @ UNH-IOL

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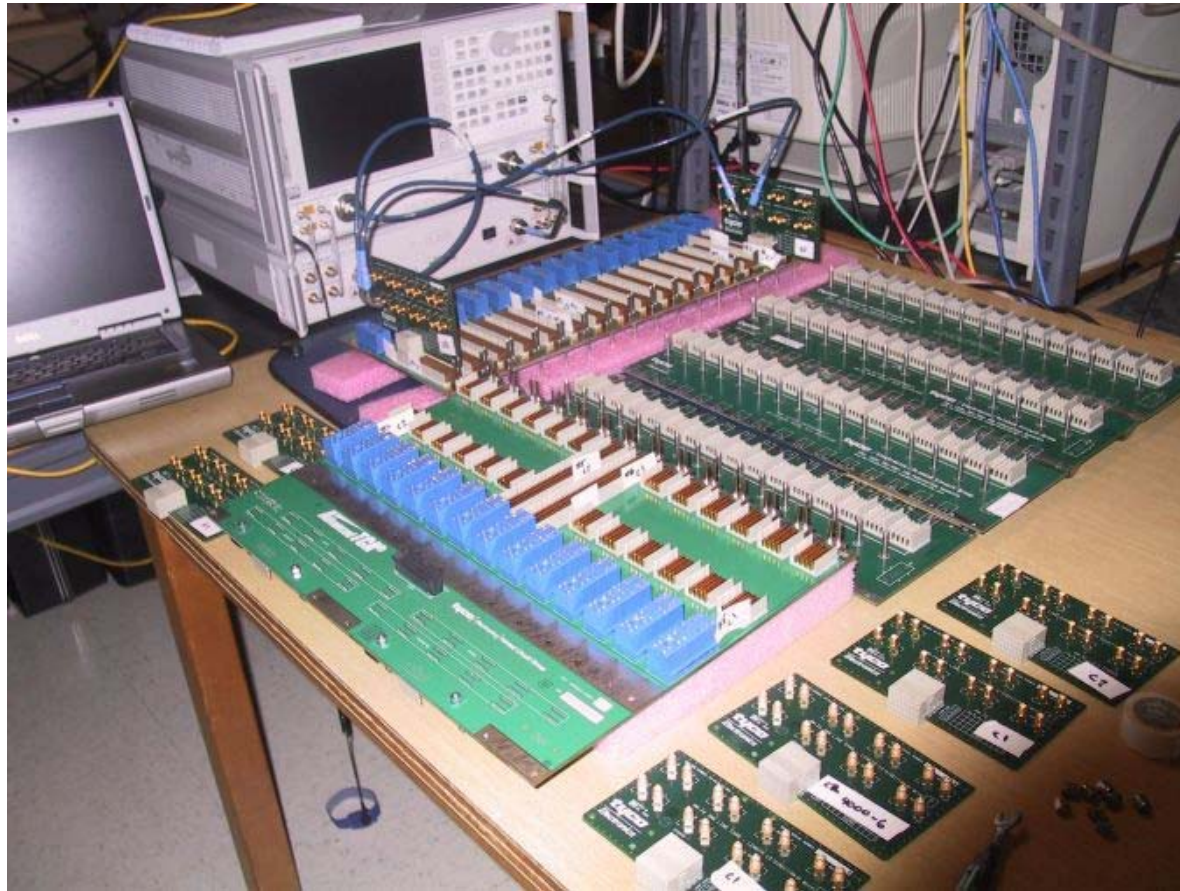
Tyco Electronics - Z-PACK HM-Zd Test Platforms
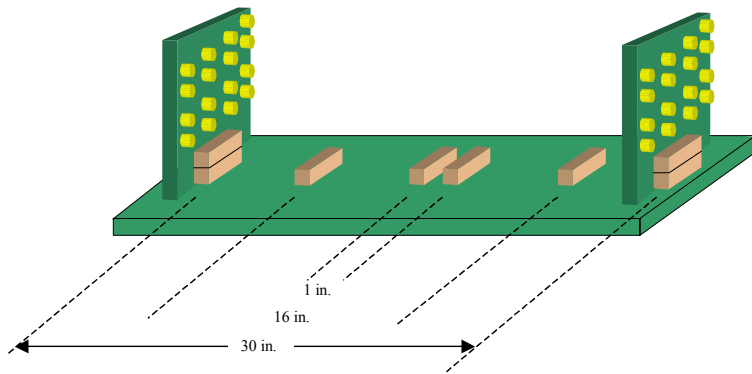
- **SMA Line Cards – All Platforms**
  - Nelco 4000-13, 4000-13SI
  - 6", and 10" trace
  - 6 mil trace width, 100 Ω Differential
  - 0.092" thickness
  - 4 Signal layers throughout board
  - All boards for each material from same panel
  - "Improved FR-4" used

- **Platform Type #1 – HM-Zd QuadRoute Backplane**
  - Nelco 4000-13, 4000-13SI, 9000
  - 2", 16", and 30" traces
  - 4.75 mil trace width
  - 0.125" thickness, 100 Ω Differential
  - 8 Signal layers throughout board
    - Same routing capacity as 16 signal layers
  - Validating use of "Improved FR-4"

- **Platform #2 – Kaparel ATCA Full Mesh Backplane**
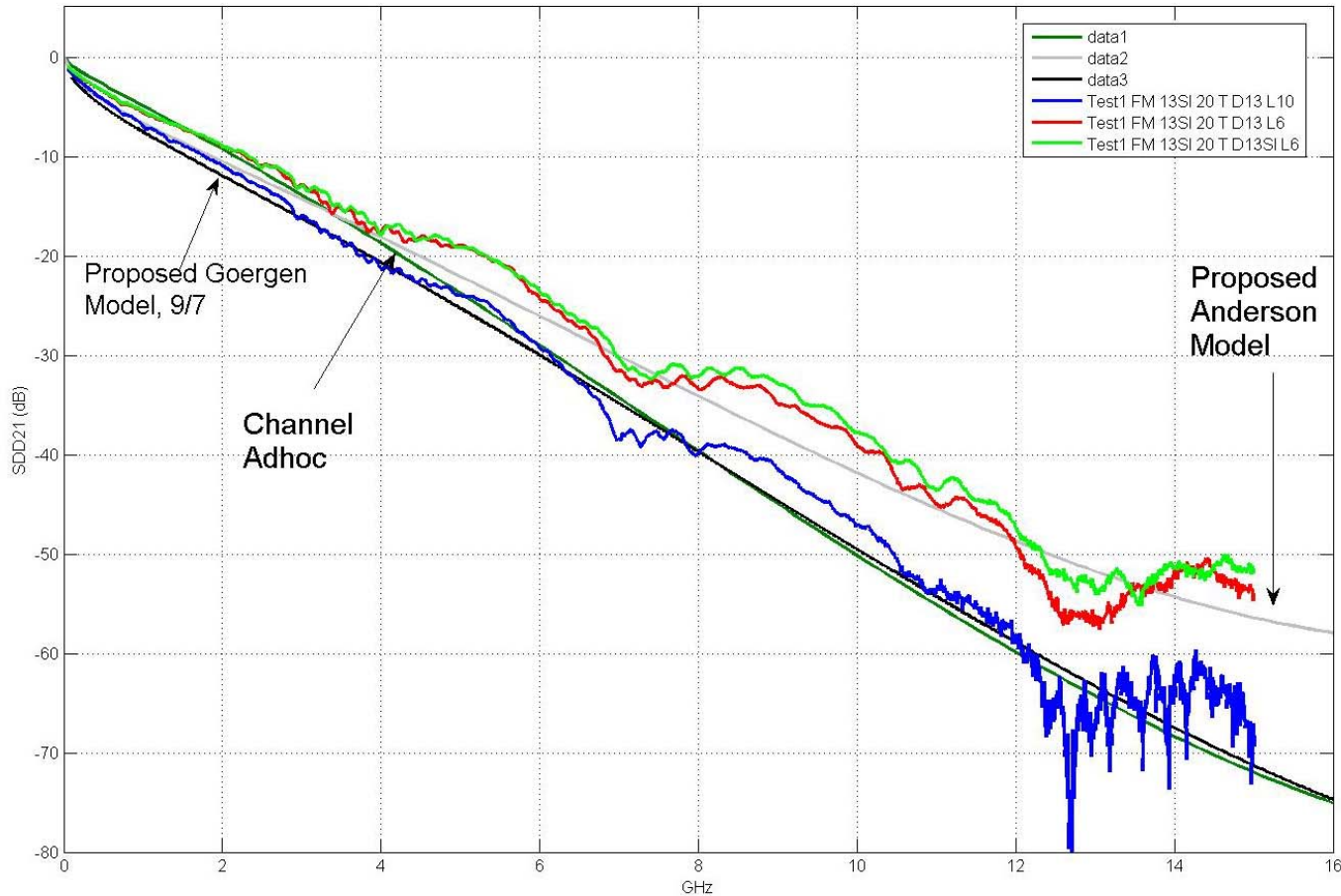 - Nelco 4000-13SI
  - 1" to 20" traces
  - Uses QuadRoute Technique
  - 0.125" thickness, 100 Ω Differential
  - 8 Signal layers throughout board
  - Validating use of "Improved FR-4"

- **Platform #3 – Tyco ATCA Dual Star Backplane**
  - Nelco 4000-13
  - 1" to 10" traces
  - Uses QuadRoute Technique
  - 0.125" thickness, 100 Ω Differential
  - 4 Signal Layer throughout board
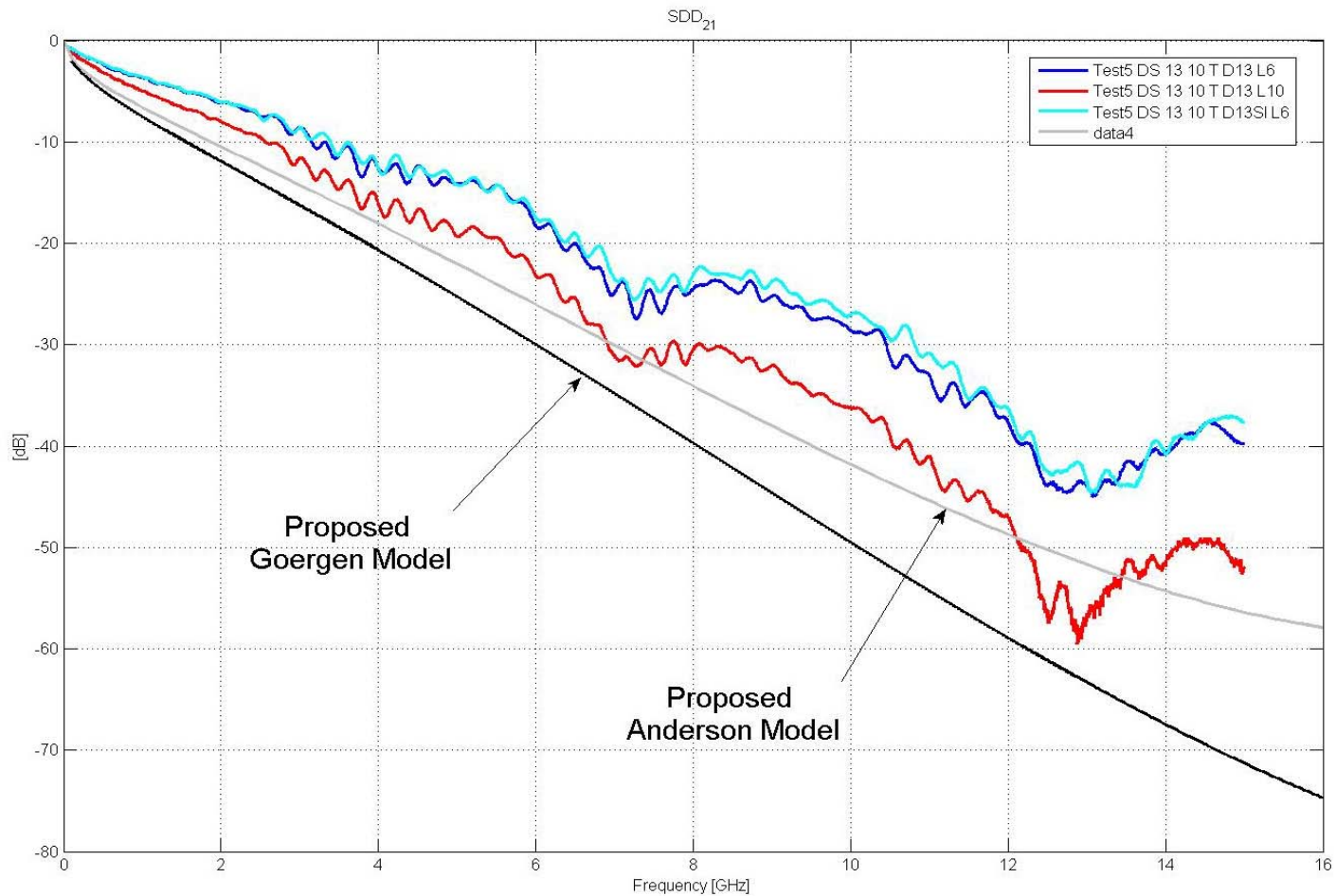 - Validating use of "Improved FR-4"

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Kaparel Full Mesh ATCA Total Lengths – 32" or 40"

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Tyco Dual Star ATCA Total Lengths – 22" or 30"

IEEE 802.3ap Backplane Ethernet

Tyco QR 4000-13 Total Lengths – 28" or 36"

IEEE 802.3ap Backplane Ethernet

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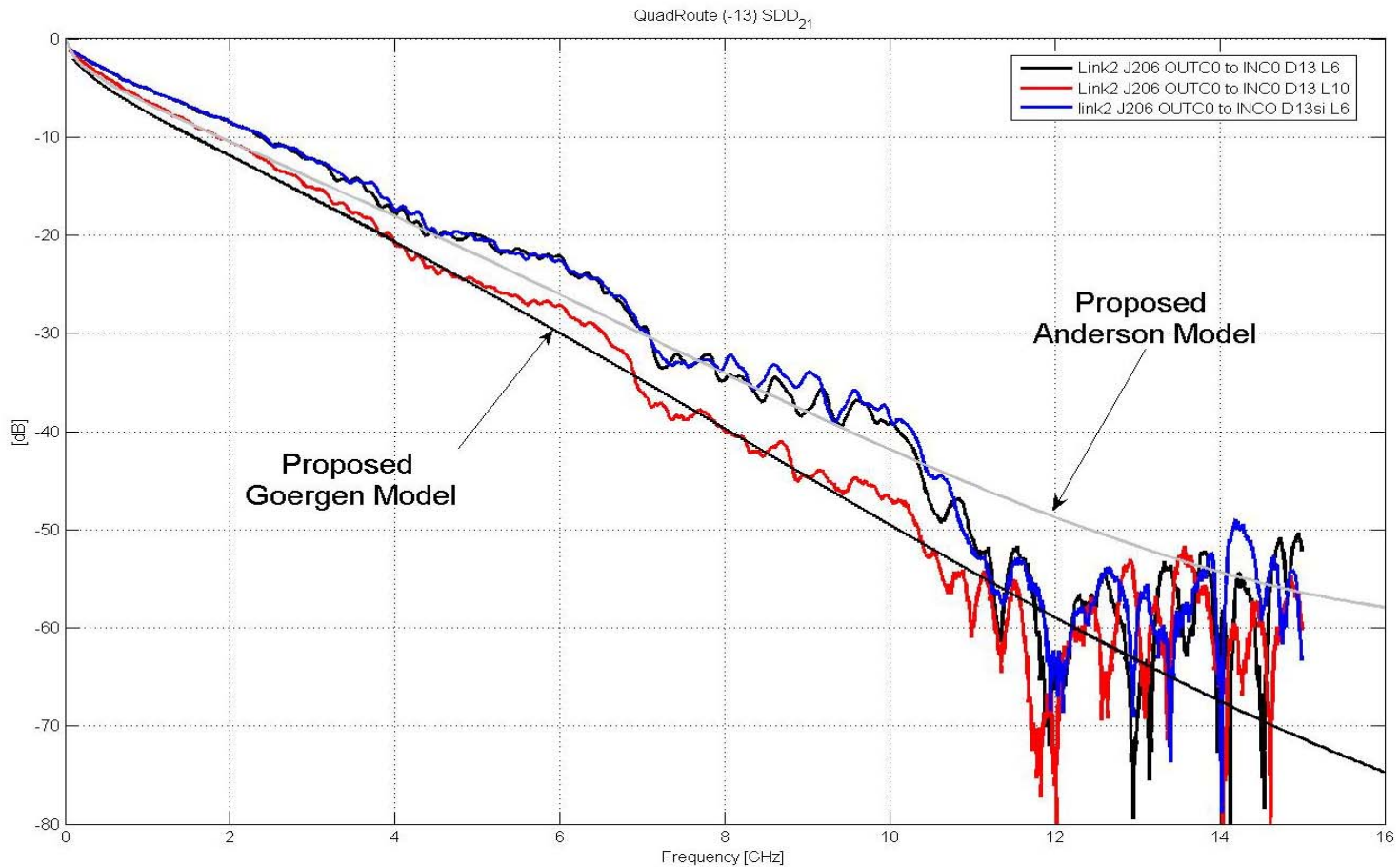
Tyco QR 4000-13SI
Total Lengths – 28" or 36"
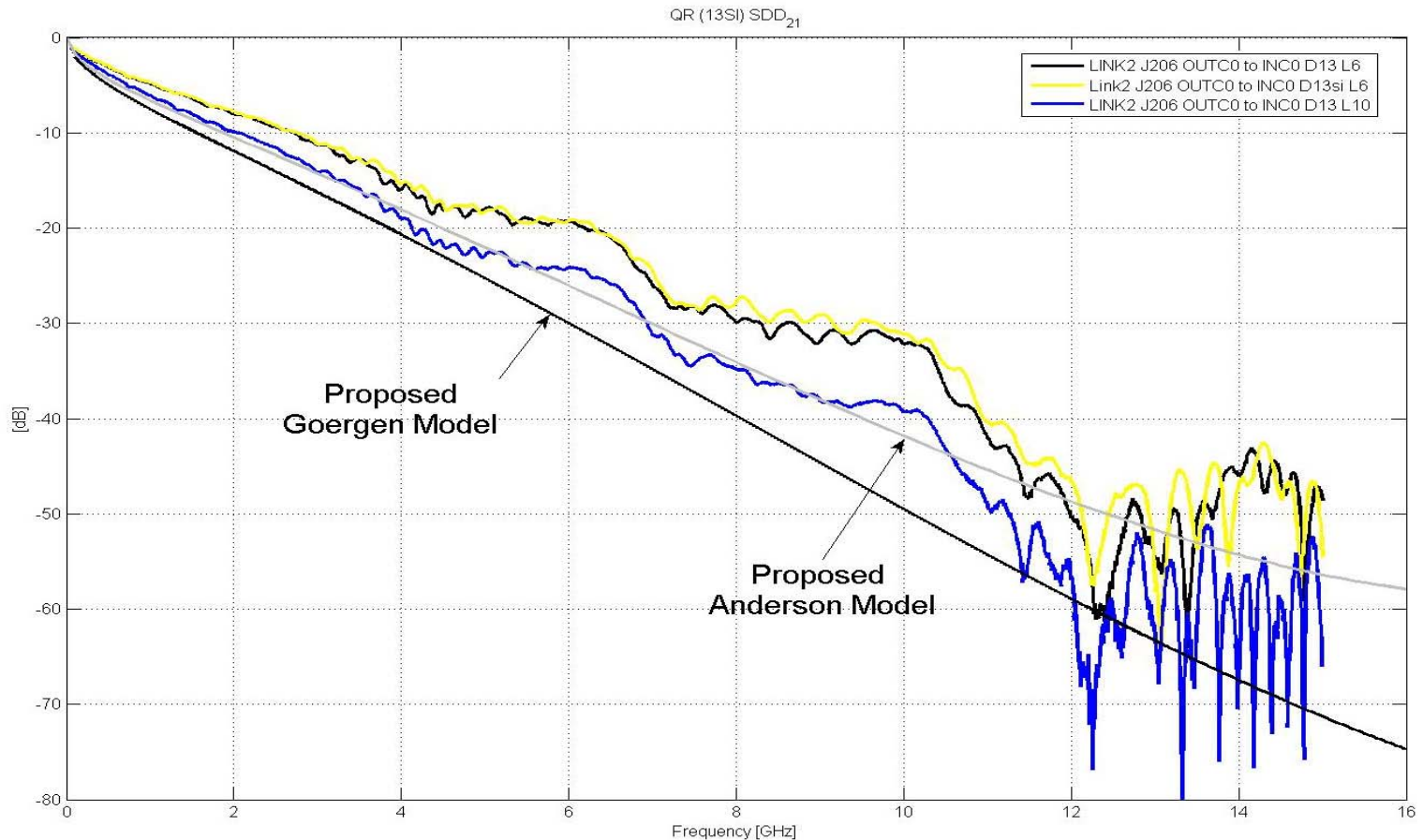
Tyco QR 4000-13SI
Total Lengths – 42" or 50"

QuadRoute (13SI) SDD$_{21}$

Legend:
- LINK3 J204 OUTC0 to INC0 D13 L10
- LINK3 J204 OUTC0 to INC0 D13 L6
- LINK3 J204 OUTC0 to INC0 D13SI L6

Proposed Anderson Model

Proposed Goergen Model

[dB] vs Frequency [GHz]

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IEEE 802.3ap Backplane Ethernet
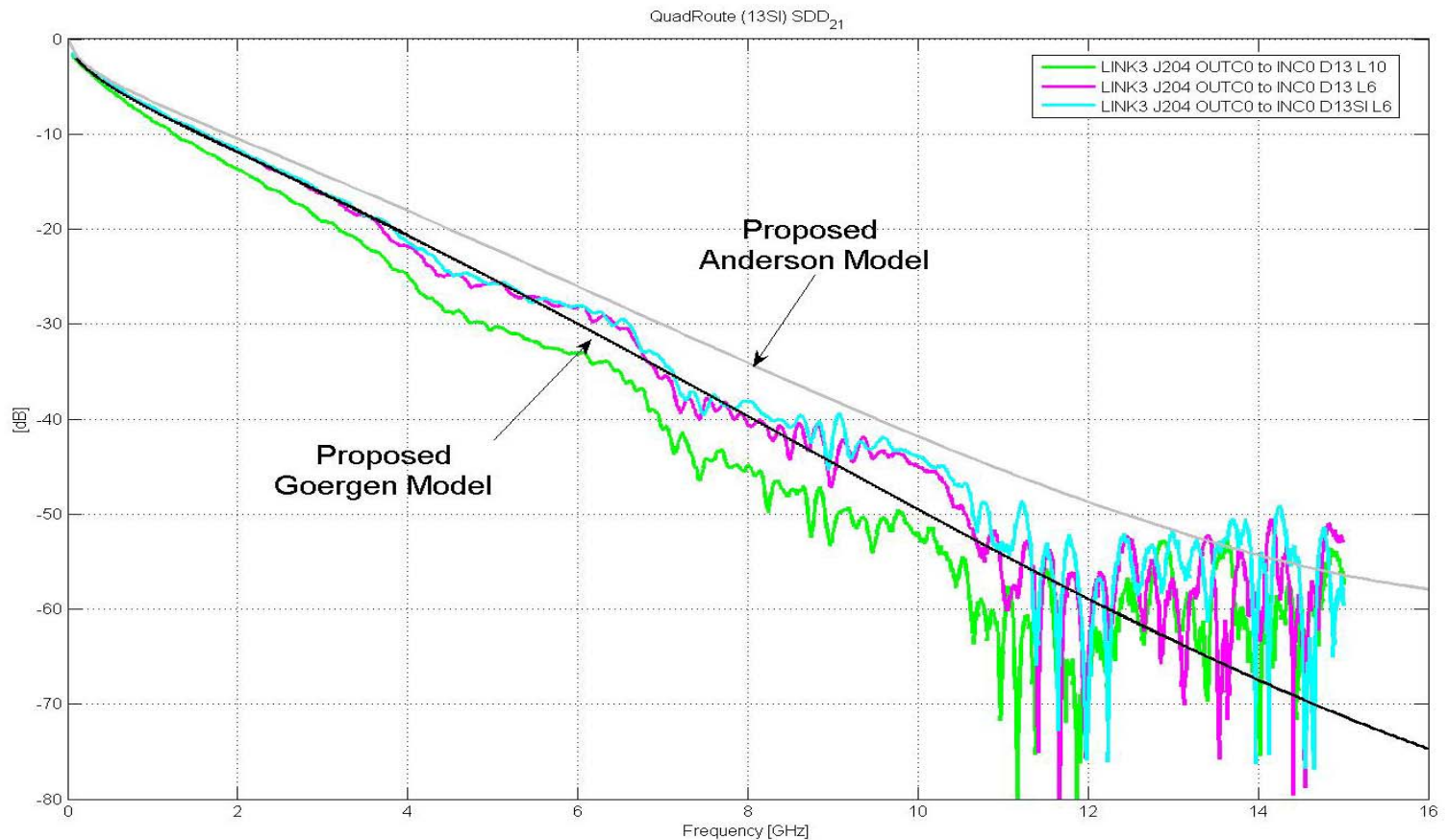
Summary

- ## Pass / Fail Criteria
  - "Must be above model"
  - Some issues above 10GHz, getting into noise floor?
  - Used up to 10 GHz for easy pass / fail criteria
- ## Proposed Anderson Model
  - 22 to 28 inches – passed
  - 28 – 36 inches – straddled model
  - 36 – 50 inches – below model
- ## Proposed Goergen Model
  - 22 to 36 inches – passed
  - 36 to 42 inches – straddled model
  - 50 inches – below model

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Conclusions

- Proposed Goergen model preferable to proposed Anderson model
  - More channels were able to pass or straddle channel model
  - Lower cost material (-13) was yielding acceptable results for ATCA-like distrance channels
- QuadRoute technique uses narrow traces
  - Increases skin effect
  - 1m channels become challenged, but still straddling proposed model @ 42 inches
  - Wider traces on backplane should help
    - Increase cost by increasing layer count
    - Increase trace width leads to overall thicker board making stubs more of an issue
  - But, approximately 12" to 20" on line cards with 6 mil or narrower trace
  - Results
    - ATCA applications – meet with margin
    - 36" – material selection dependency
    - 36" to 42" – straddles model
- Stub effect?

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