# MCB Insertion Loss
# D2.2 Comment #232

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# Supporters

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# Agenda

- Background
- Proposed Changes
  - Summary
  - Details

# Background

- MTF informative IL specification changed @ D1.5.
  - This is a fundamental methodology change from prior generations to clearly define MTF performance.
  - This had the consequence that connector and via improvements are absorbed into the test fixture and don't benefit cable, module or host.
- 07/25 and 09/25 meetings discussed the issue and built consensus over that period of time.
- This contribution provides a more thorough set of proposed changes that resulted from consensus building with a broad set of stakeholders through October.

## Background: MTF IL Specification Change Post D1.4

D1.4

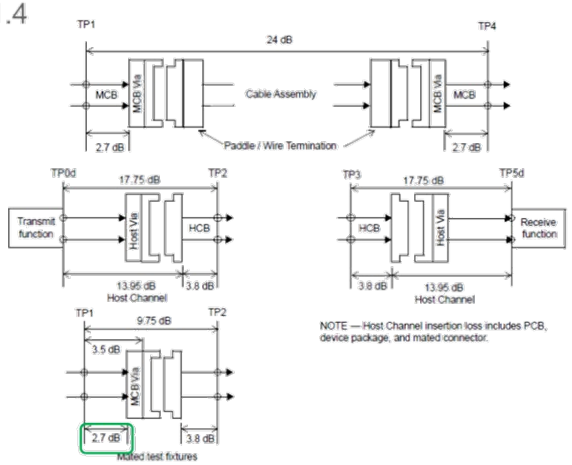


Figure 179A–1—Host-Nominal to Host-Nominal, Cable assembly, and test fixture insertion loss at 53.125 GHz

D2.2

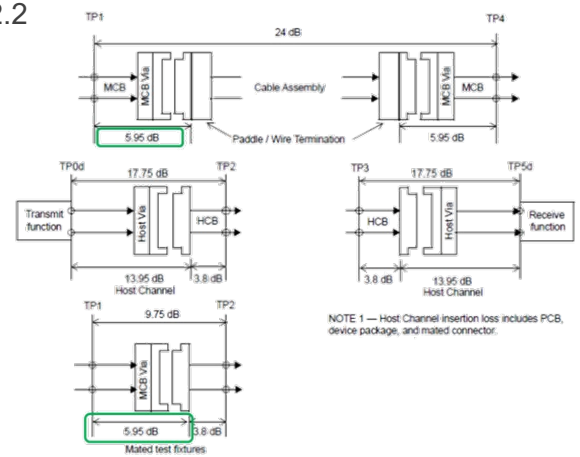


Figure 179A–1—Host-Nominal to Host-Nominal, Cable assembly, and test fixture insertion loss at 53.125 GHz

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IEEE P802.3dj Task Force, September 2025

# Summary of Proposed Changes (1)

| Location | Description |
|---|---|
| Figure 179A-1 | Reduce insertion loss by 1 dB:<br>• TP1-connector (2x) & connector-TP4 (1x)<br>• TP1-TP2 (1x)<br>• TP0d-connector (1x) & connector-TP5d (1x)<br>• TP0d-TP2 (1x) & TP3-TP5d (1x) |
| Figure 179A-2 | Reduce host channel insertion loss by 1 dB (2x).<br>Modify budget equation to reflect the IL changes. |
| Table 179A-1 | Reduce maximum insertion loss for all 3 host classes by 1 dB for host channels and for TP0d-TP2/TP3-TP5d. |
| Table 179A-2 | For all link configurations in the table reduce<br>• (Column 3) Ildd_TP0d-TP2,max by 1 dB<br>• (Column 4) Ildd_TP3-TP5d,max by 1 dB<br>• (Column 5) Ildd_MTFref by 1 dB |
| Table 179A-3 | Reduce Ildd_MTFref by 1 dB.<br>Modify budget equation to reflect the IL changes. |
| Table 179-7 | Change R_peak to account for change in IL (1 dB host loss) |
| Table 176D-3 | Change R_peak to account for change in IL (1 dB MCB loss) |
| Table 176D-6 | Change partial host trace lengths to account for reduced connector loss. Comment #204 proposes to change it to 280 mm. |

# Summary of Proposed Changes (2)

| Location | Description |
|---|---|
| Equation (179B-2) | Modify to reflect change in insertion loss. |
| Equation (179B-3) | Modify to reflect change in insertion loss. |
| Equation (179B-4) | Modify to reflect change in insertion loss. |
| Equation (179B-5) | Modify to reflect change in insertion loss. |
| Figure 179B-1 | Update to reflect change in (179B-2) |
| Figure 179B-2 | Update to reflect change in (179B-3), (179B-4), (179B-5) |

# Proposed Changes: Figure 179A-1

179A.5

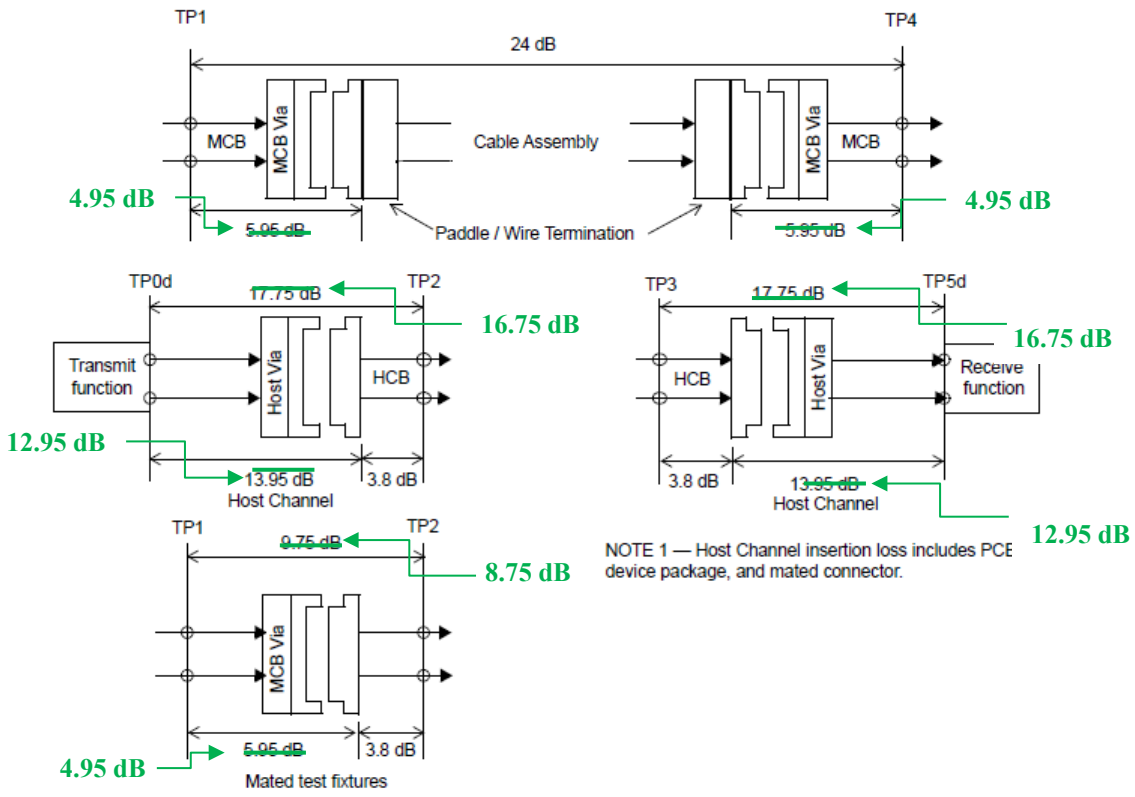



**Figure 179A–1—Host-Nominal to Host-Nominal, Cable assembly, and test fixture insertion loss at 53.125 GHz**

# Proposed Changes: Figure 179A-2

179A.5

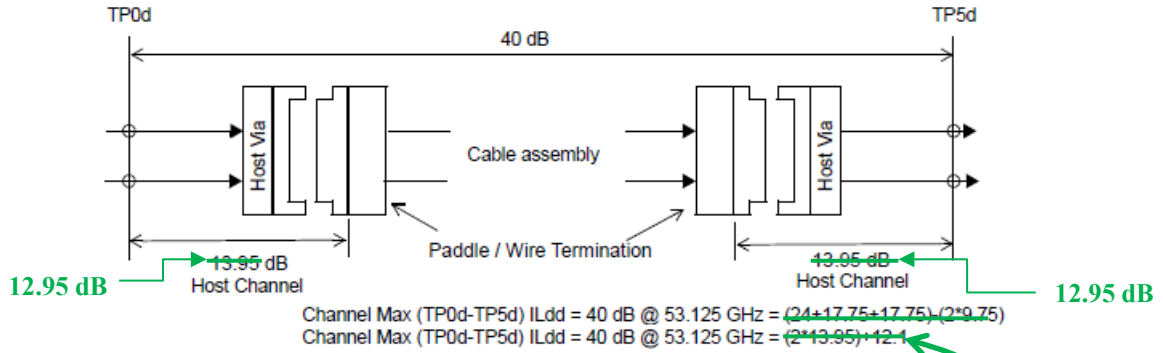



**Figure 179A–2—HN-to-HN Channel Max (TP0d-TP5d) at 53.125 GHz**

**Channel Max (TP0d-TP5d) ILdd = 40 dB @ 53.125 GHz = (24+16.75+16.75)-(2*8.75)**
**Channel Max (TP0d-TP5d) ILdd = 40 dB @ 53.125 GHz = (2*12.95)+14.1**

# Changes: Figure 179A-3

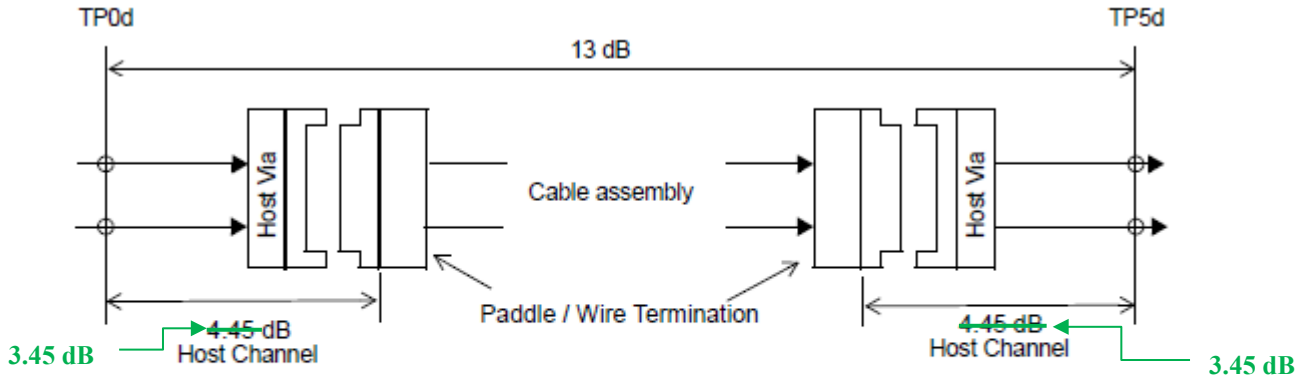



**Figure 179A–3— Channel Min (TP0d-TP5d) at 53.125 GHz**

**Channel Min (TP0d-TP5d) ILdd = 13 dB @ 53.125 GHz = (16+7.25+7.25)-(2*8.75)**
**Channel Min (TP0d-TP5d) ILdd = 13 dB @ 53.125 GHz = (2*3.45)+6.1**

**Table 179A–3—Minimum Insertion loss budget values at 53.125 GHz**

| Link Configuration | $ILdd_{CA,min}$ (dB) | $ILdd_{TP0d-TP2,min}$ (dB) | $ILdd_{TP3-TP5d,min}$ (dB) | $ILdd_{MTFref}$ (dB) | $ILdd_{Ch,min}$ (dB) |
|---|---|---|---|---|---|
| Host-Min to Host-Min | 16 | 8.25 | 8.25 | 9.75 | 13 |

# Proposed Changes: Table 179A-1

**Table 179A–1—Recommended differential insertion loss limits at 53.125 GHz**

| Host class | Host channels | TP0d to TP2 or TP3 to TP5d |
|---|---|---|
| | Max (dB) | Max (dB) |
| Host-Low (HL) | ~~8.95~~ 7.95 | ~~12.75~~ 11.75 |
| Host-Nominal (HN) | ~~13.95~~ 12.95 | ~~17.75~~ 16.75 |
| Host-High (HH) | ~~18.95~~ 17.95 | ~~22.75~~ 11.75 |

# Proposed Changes: Table 179A-2

**Table 179A–2—Maximum Insertion loss budget values at 53.125 GHz**

| Link Configuration | $ILdd_{CA,max}$ (dB) | $ILdd_{TP0d\text{-}TP2,max}$ (dB) | $ILdd_{TP3\text{-}TP5d,max}$ (dB) | $ILdd_{MTFref}$ (dB) | $ILdd_{Ch,max}$ (dB) |
|---|---|---|---|---|---|
| HH to HN | 19 (CA-A) | ~~22.75~~ 21.75 | ~~17.75~~ 16.75 | ~~9.75~~ 8.75 | 40 |
| HH to HL | 24 (CA-B) | ~~22.75~~ 21.75 | ~~12.75~~ 11.75 | ~~9.75~~ 8.75 | 40 |
| HN to HN | 24 (CA-B) | ~~17.75~~ 16.75 | ~~17.75~~ 16.75 | ~~9.75~~ 8.75 | 40 |
| HN to HL | 29 (CA-C) | ~~17.75~~ 16.75 | ~~12.75~~ 11.75 | ~~9.75~~ 8.75 | 40 |
| HL to HL | 34 (CA-D) | ~~12.75~~ 11.75 | ~~12.75~~ 11.75 | ~~9.75~~ 8.75 | 40 |

# Proposed Changes: Table 179-7 & Table 176D-3

**Table 179–7—Summary of transmitter specifications at TP2**

| Parameter | Reference | Value | Units |
|---|---|---|---|
| … | … | … | … |
| Linear fit pulse peak ratio, $R_{peak}$ (min) | 179.9.4.1.2 | | |
| Host class HL | | ~~0.456~~ 0.424 | — |
| Host class HN | | ~~0.345~~ 0.324 | — |
| Host class HH | | ~~0.234~~ 0.263 | — |

**Table 176D–3—Summary of module output specifications at TP4**

| Parameter | Reference | Value | Units |
|---|---|---|---|
| … | … | … | … |
| Linear fit pulse peak ratio, $R_{peak}$ (min) | 176D.8.5 | ~~0.456~~ 0.165 | — |

For specifics on proposed values please refer to healey_3dj_01_2511.

# Proposed Changes: Table 176D-6

**Table 176D–6—Host and module model parameters *(continued)***

| Parameter | Symbol | Value | Units |
|---|---|---|---|
| … | … | … | … |
| Partial host channel model | | | |
| Single-ended board capacitance at the package-to-board interface | $C_0$ | 0 | nF |
| Transmission line parameter $\gamma_0$ | $\gamma_0^{(h)}$ | 0 | 1/mm |
| Transmission line parameter $a_1$ | $a_1^{(h)}$ | $5.95 \times 10^{-4}$ | $ns^{1/2}/mm$ |
| Transmission line parameter $a_2$ | $a_2^{(h)}$ | $2.6 \times 10^{-5}$ | ns/mm |
| Transmission line parameter $\tau$ | $\tau^{(h)}$ | $5.79 \times 10^{-3}$ | ns/mm |
| Transmission line characteristic impedance | $Z_c^{(h)}$ | 92.5 | Ω |
| Transmission line length | $z_p^{(h)}$ | ~~250~~ | ~~mm~~ |
| Single-ended capacitance at the model-to-measurement interface | $C_1$ | 0 | nF |

280 Refer to comment #204

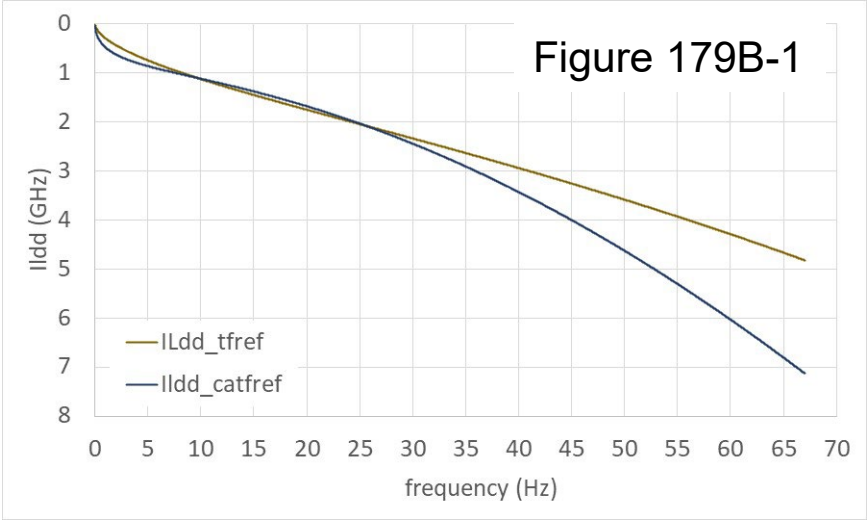
# Proposed Changes: 179B Equations & Figures

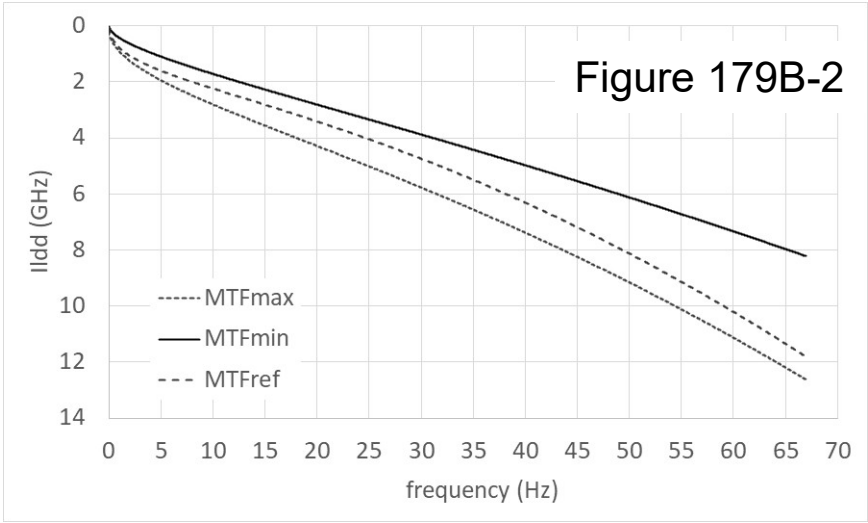
$$ILdd_{catref}(f) = -0.0269 + 0.65\sqrt{f} - 0.165f + 0.02325f^{1.5} \quad \text{(179B-2)}$$

$$IL_{dd}(f) \geq ILdd_{MTFmax}(f) = 0.1 + 0.8\sqrt{f} + 0.0055f + 0.00125f^2 \quad \text{(179B-3)}$$

$$IL_{dd}(f) \geq ILdd_{MTFmin}(f) = 0.3854\sqrt{f} + 0.0455f + 0.00045f^2 \quad \text{(179B-4)}$$

$$ILdd_{MTFrefTF}(f) = -0.0419 + 0.93\sqrt{f} - 0.13005f + 0.0183f^{1.5} + 0.00065f^2 \quad \text{(179B-5)}$$



# THANK YOU

# Equation Fitting for 179B

$$ILdd_{MTFmax}(f) = 0.1 + 0.8\sqrt{f} + 0.0055f + 0.00125f^2$$

$$ILdd_{MTFmin}(f) = 0.3854\sqrt{f} + 0.0455f + 0.00045f^2$$