802.3df considerations for insertion loss specifications: MTF, Host, and Cable assembly

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Purpose

- Considerations for insertion loss specifications for MTF, Host, and Cable assembly
- Follow-on to MTF insertion loss considerations; https://www.ieee802.org/3/df/public/adhoc/electrical/22_0502/diminico_3df_01_220502.pdf

https://www.ieee802.org/3/df/public/adhoc/electrical/22_0418/ran_3df_elec_01a_220418.pdf

Call for action

- We need a clear process of adopting a loss budget
  - Proposals in terms of lengths and IL (assuming PAM4); detailed results with S-parameters would help
  - Explain the targeted application (switch, NIC, other)
- Until we adopt a loss budget we can't make any decisions on device electrical parameters (including reference Tx/Rx) or even modulation
  - Proposals in this area may be premature
- Let's not intermix these steps (e.g. run COM analysis on channels before loss budget is adopted)

Contributors

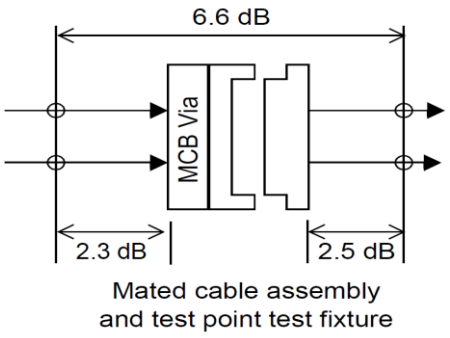
- **Sam Kocsis, Mike Rowland, Amphenol**
- **Nathan Tracy, TE Connectivity**

50G/100G CR insertion loss allocation

- The channel and test fixture insertion loss allocations are given in Table below for 50GBASE-R PHYs and 100GBASE-R PHYs for comparisons.

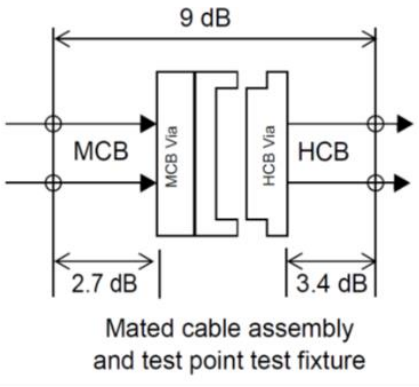
Component	50GBASE-CR,100BASE-CR2, 200GBASE-CR4 Insertion Loss dB @ 13.28 GHz	100GBASE-CR1,200GBASE-CR2, 400GBASE-CR4 Insertion Loss dB @ 26.56 GHz
Module Compliance Board (MCB) PCB	1.2	2.3
Host Compliance Board (HCB) PCB	1.38	2.5
Host PCB IL	7	6.875
Host Connector	1.69	1.6
Host	10.07	10.975
Mated Test Fixture (MTF)	3.65	6.6
MTF connector	1.07	1.6
Bulk cable and wire attachment	12.62	11.55
Channel	30	28.5

Mated test fixture insertion loss

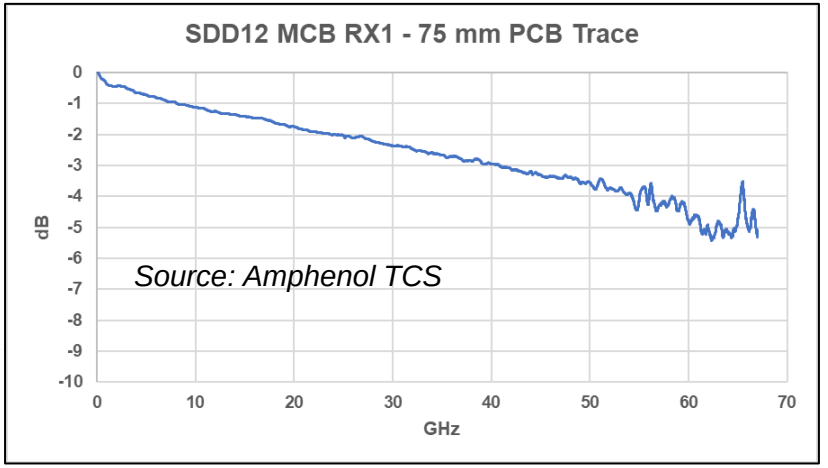


insertion loss @ 26.56 GHz

Figure source:
IEEE Draft P802.3ck/D3.1



insertion loss @ 53.125 GHz



Board material	Length inches	dB/in 50GHz	dB/in 53GHz
DJN3+	3	1.2	1.3
Simulation	3	1.1	1.2

Component	Insertion Loss (dB)
Module Compliance Board (MCB) PCB - 2" of ~1.35 dB/in	2.7
Host Compliance Board (HCB) - 1inch*1.35dB/in + 6inch coax * .28dB/inch + 0.5dB via and co-ax transitions.	3.4
Mated Test Fixture (MTF)	9
MTF connector + 2 via's	2.9

Mated test fixture insertion loss allocations @ 53.125 GHz

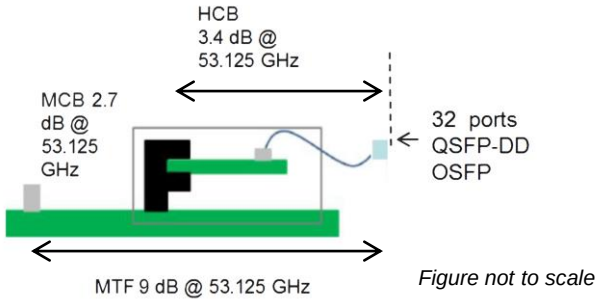
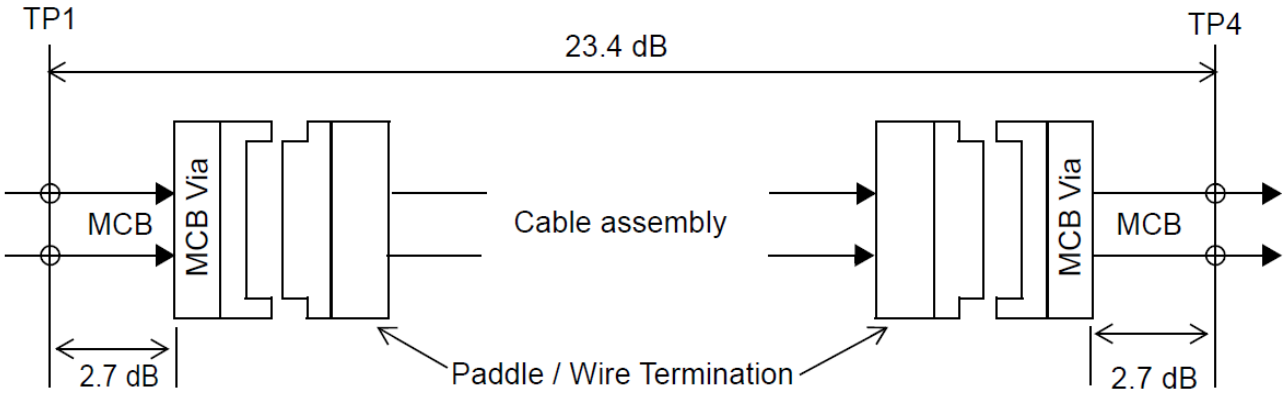


Figure not to scale

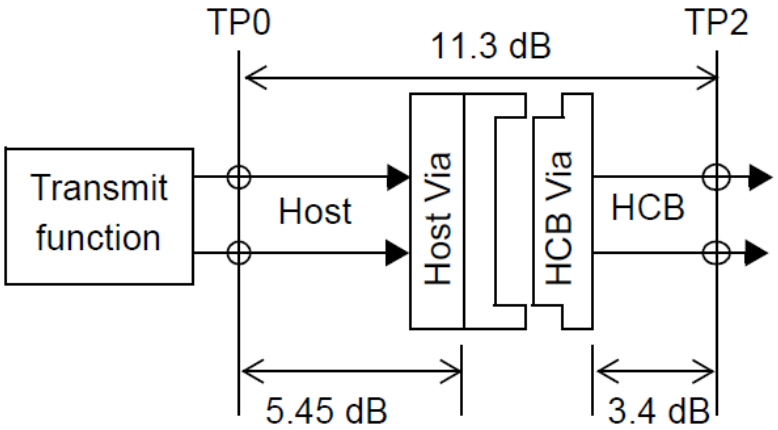
Source: https://www.ieee802.org/3/df/public/adhoc/electrical/22_0502/diminico_3df_01_220502.pdf

Cable assembly insertion loss

- Cable assembly and host insertion loss @ 53.125 GHz for 28 dB Channel



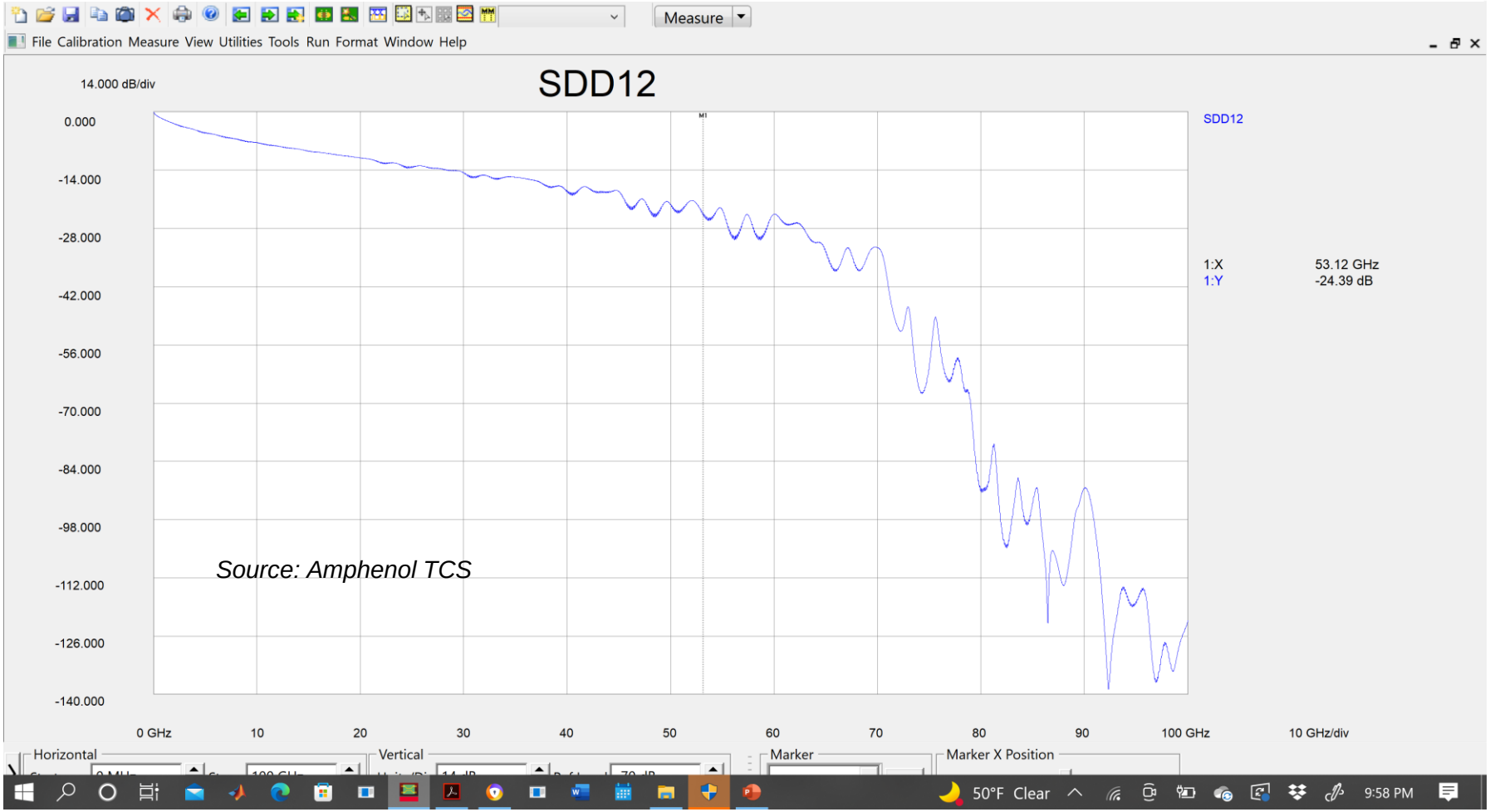
Cable assembly insertion loss @ 53.125 GHz- 1 m



Host insertion loss @ 53.125 GHz

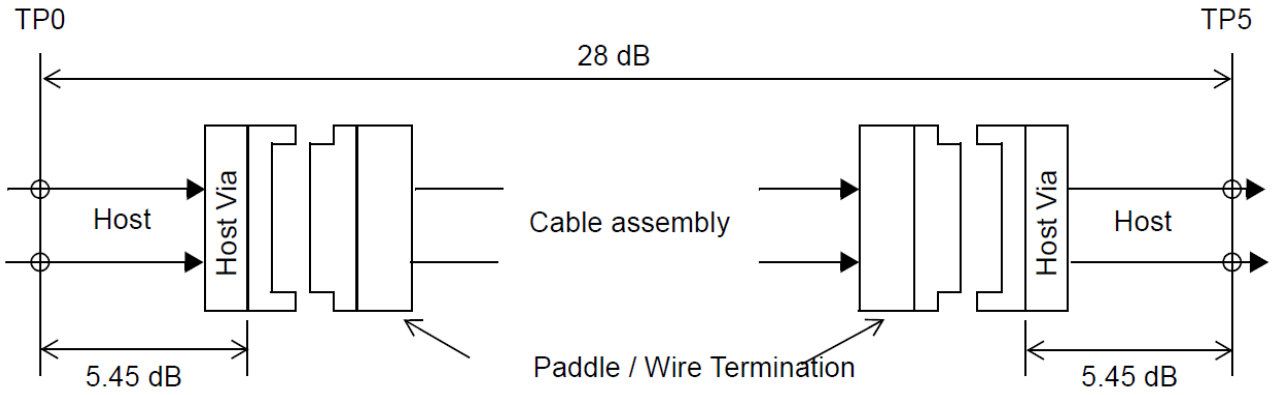
Cable assembly insertion loss - HFFS model

- 1 meter, 27 AWG



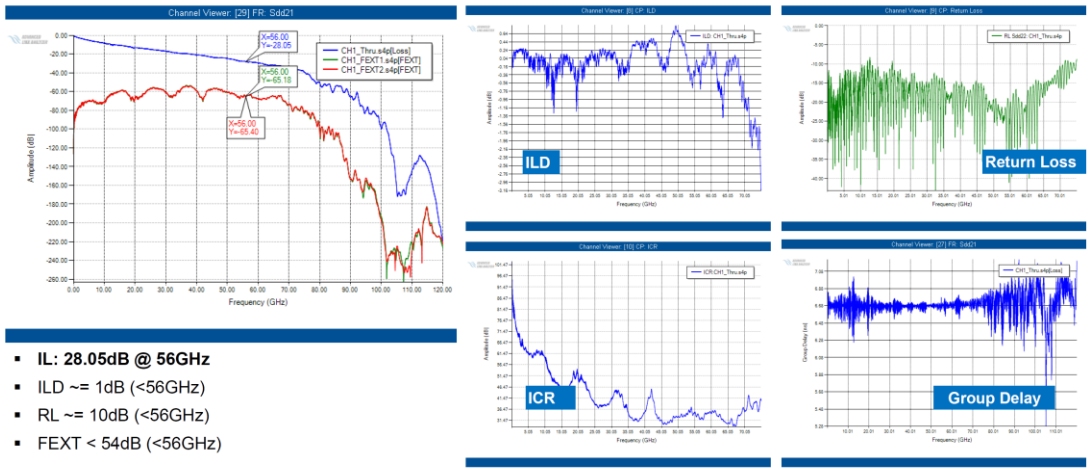
Channel insertion loss

- TP0-TP5 Channel insertion loss consistent with cable assembly insertion loss.



Channel *ILdd* = 28 dB @ 53.125 GHz = 2*(5.45+2.45)+12.2

224 Gbps-PAM4 CR+ Channel Characteristics

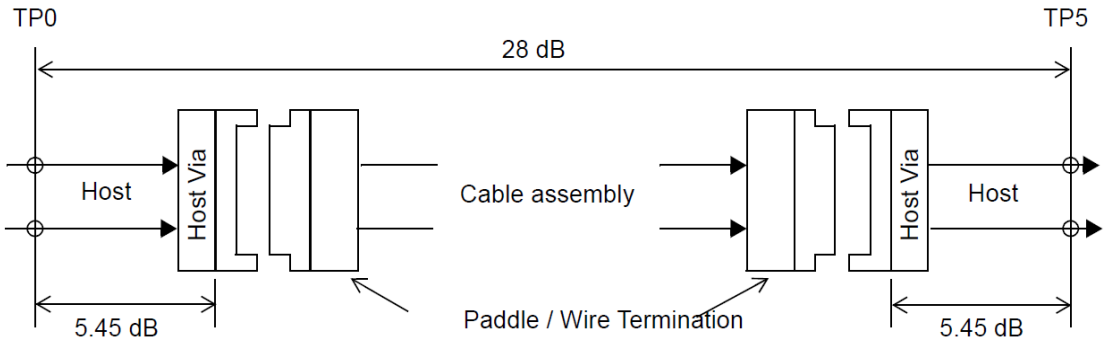


- **IL: 28.05dB @ 56GHz**
- ILD ~= 1dB (<56GHz)
- RL ~= 10dB (<56GHz)
- FEXT < 54dB (<56GHz)

https://www.ieee802.org/3/df/public/22_03/li_3df_01a_220322.pdf

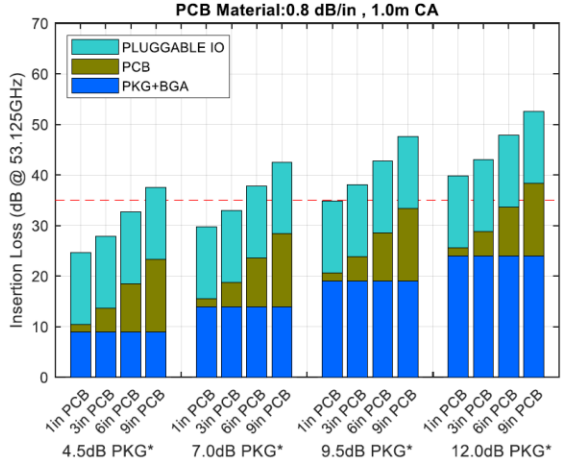
Channel insertion loss - PCB Host

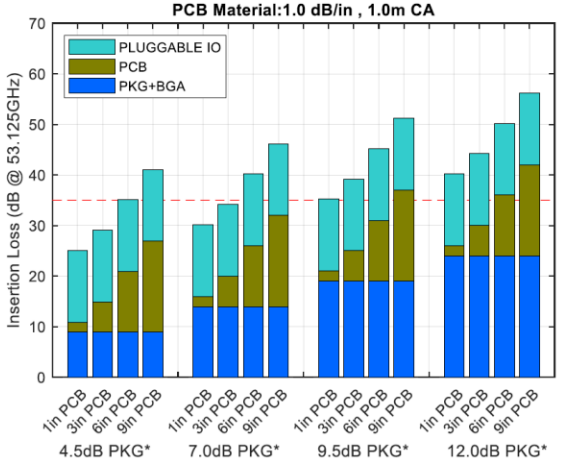
- TP0-TP5 Channel insertion loss consistent with cable assembly insertion loss.

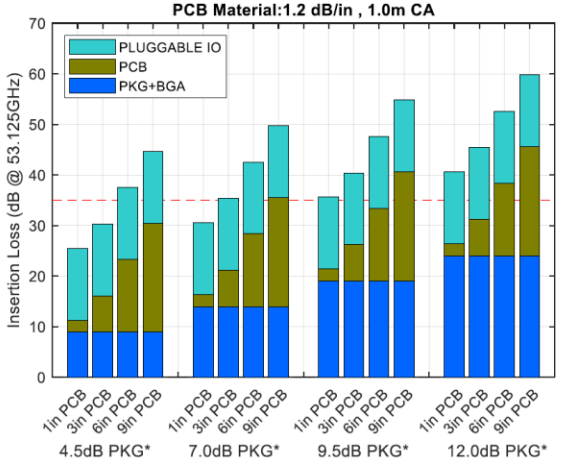


Channel *ILdd* = 28 dB @ 53.125 GHz = 2*(5.45+2.45)+12.2

https://www.ieee802.org/3/B400G/public/21_08/kocsis_b400g_01a_210826.pdf

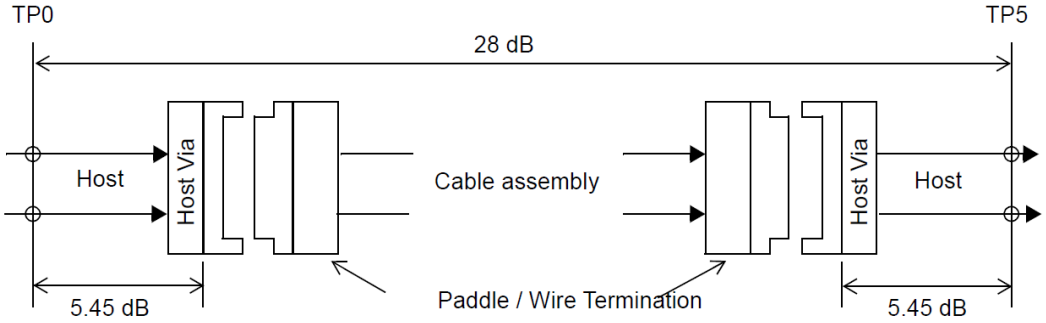






Channel insertion loss - Cabled Host

- TP0-TP5 Channel insertion loss consistent with cable assembly insertion loss.



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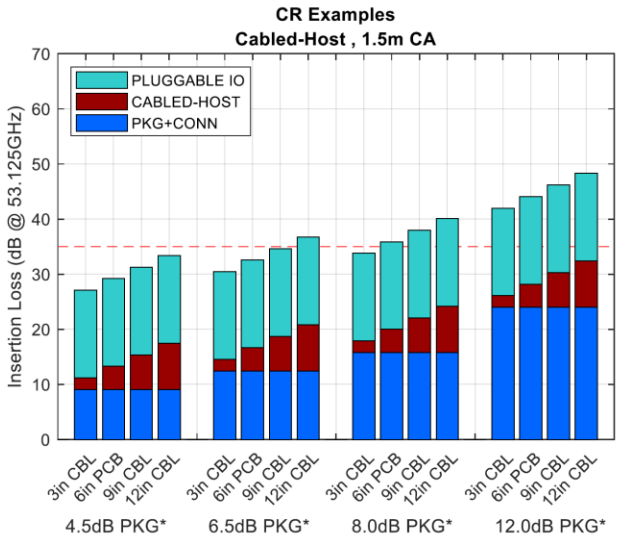
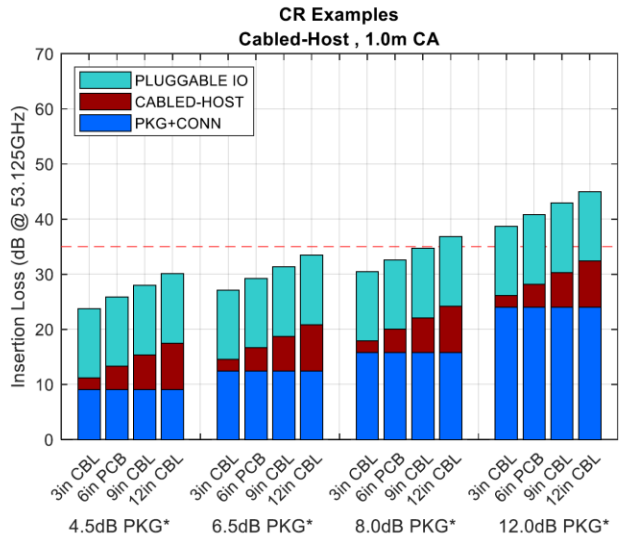
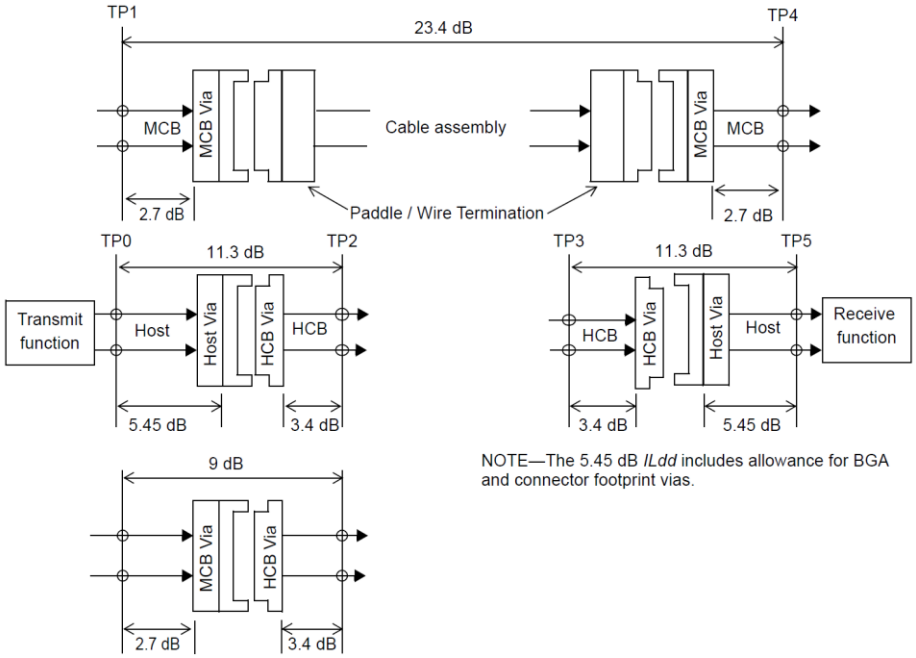




802.3df - Annex XXXA (informative)

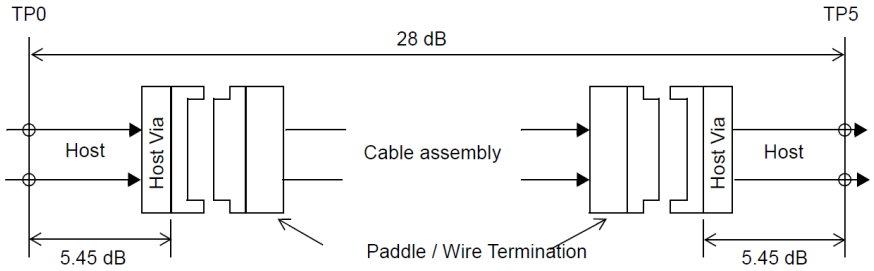
Annex XXXA
(informative)
Transmitter, receiver and channel parameters associated with test points TP0 and TP5 for 200GBASE-CR1, 400GBASE-CR2, 800GBASE-CR4, and1.6TBASE-CR8.



NOTE—The 5.45 dB *ILdd* includes allowance for BGA and connector footprint vias.

NOTE—implications of RF connector (TBD)

Figure XXXA–3—Cable assembly, host, and test fixture insertion loss at 53.125 GHz



Channel *ILdd* = 28 dB @ 53.125 GHz = 2*(5.45+2.45)+12.2

NOTE—Channel *ILdd* derived from cable assembly host, and mated test fixture

Figure XXXA–4—Channel insertion loss at 53.125 GHz

Summary

- Considerations for insertion loss specifications for MTF, Host, and Cable assembly
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