802.3bj D3.0 sponsor ballot comment i-122

Contributors

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- Chris DiMinico – MC Communications/Panduit

Purpose

- **Supporting presentation D3.0 sponsor ballot comment i-122**
- **Review achievability of 802.3bj D3.0 mated test fixture specifications.**

Cl **92** *SC* **92.11.3.2** *P* **224** *L* **23** # i-122

Palkert, Thomas — Molex Incorporated

Comment Type G *Comment Status* X

MCB's and HCB's that are within reasonable manufacture impedance tolerances (~5%) can fail the 92.11.3.2 Mated test fixtures return loss specifications.
Change 92.11.3.2 Mated test fixtures return loss specifications to proposed limits.
See supporting presentation

SuggestedRemedy

Change 92.11.3.2 Mated test fixtures return loss specifications to..

Return loss(f)>/=	
20-1.429*f	0.01 </= f < 4.9 GHz
14.4-0.286*f	4.9 </= f < 10.85 GHz
12.05-51.1*log(f/10.5)	10.85 </= f < 13.8 GHz
5	13.8 </= f </= 25 GHz

Proposed Response *Response Status* O

Summary

- **Measurements of TP2/TP3 (HCB) and mated test fixtures provided.**

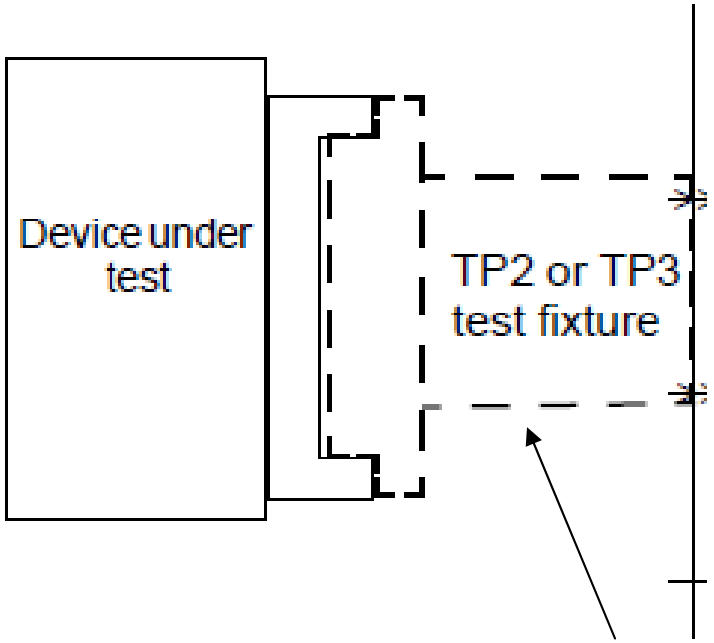
- **802.3bj mated test fixture specifications reviewed (D3.0).**
  - ✓**Insertion loss – meets maximum specification (better than minimum)**
  - ✓**Common mode return loss – meets specification**
  - **Return loss – marginal**
  - **Common to differential mode conversion loss – marginal**
  - **Common to differential mode return loss – marginal**
  - **Integrated crosstalk noise (ICN) – meets specification**

- **Proposals to adjust specification limits for marginal parameters and MTF IL minimum and TP2/TP3 reference PCB IL**

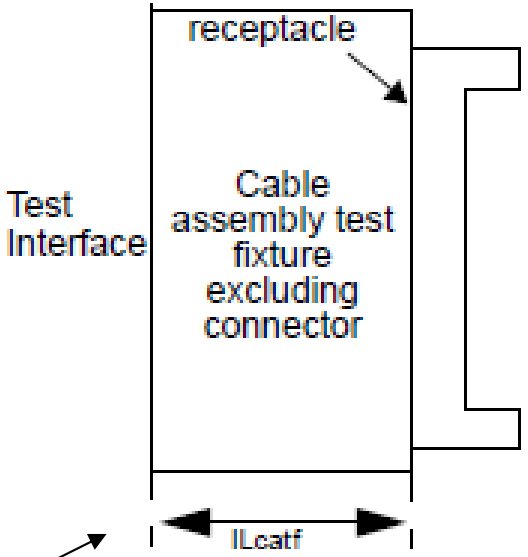
- **Proposal to specify TP2/TP3 (HCB) test fixture RL independent of (MCB)**
  - **TP2/TP3 (HCB) performance critical to performing accurate measurements of host ports. Specifying in mated state does not accurately represent achievable performance of TP2/TP3 (HCB).**

802.3bj Test Fixtures

TP2/TP3 Test fixture (HCB)

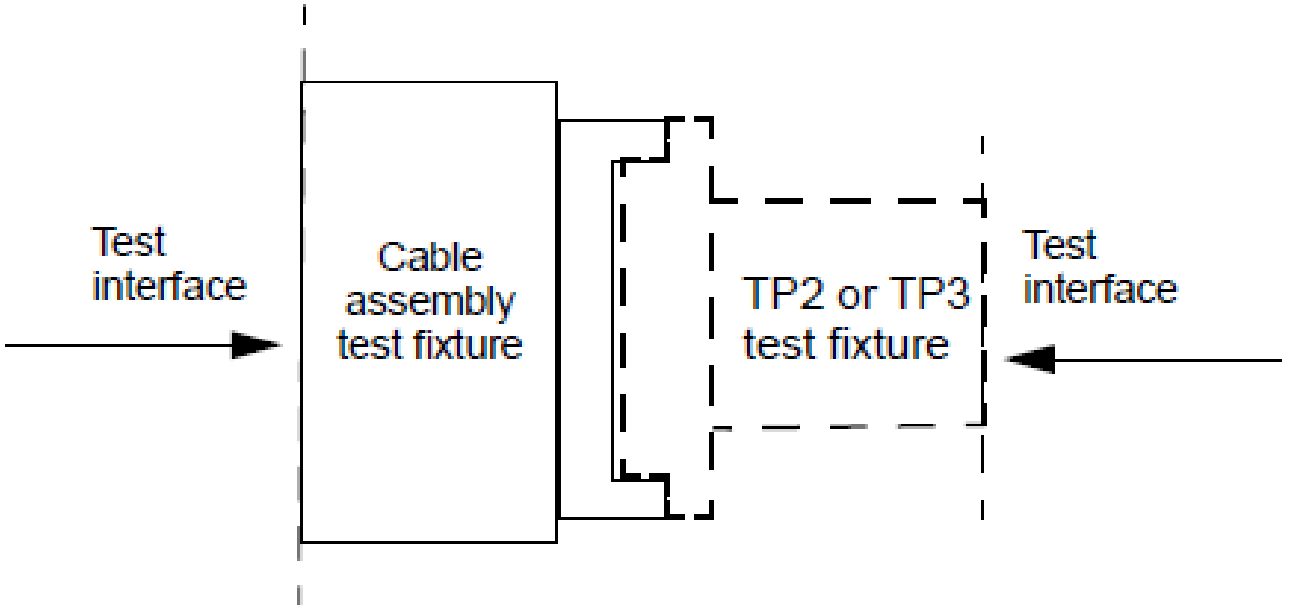


Cable assembly test fixture (MCB)



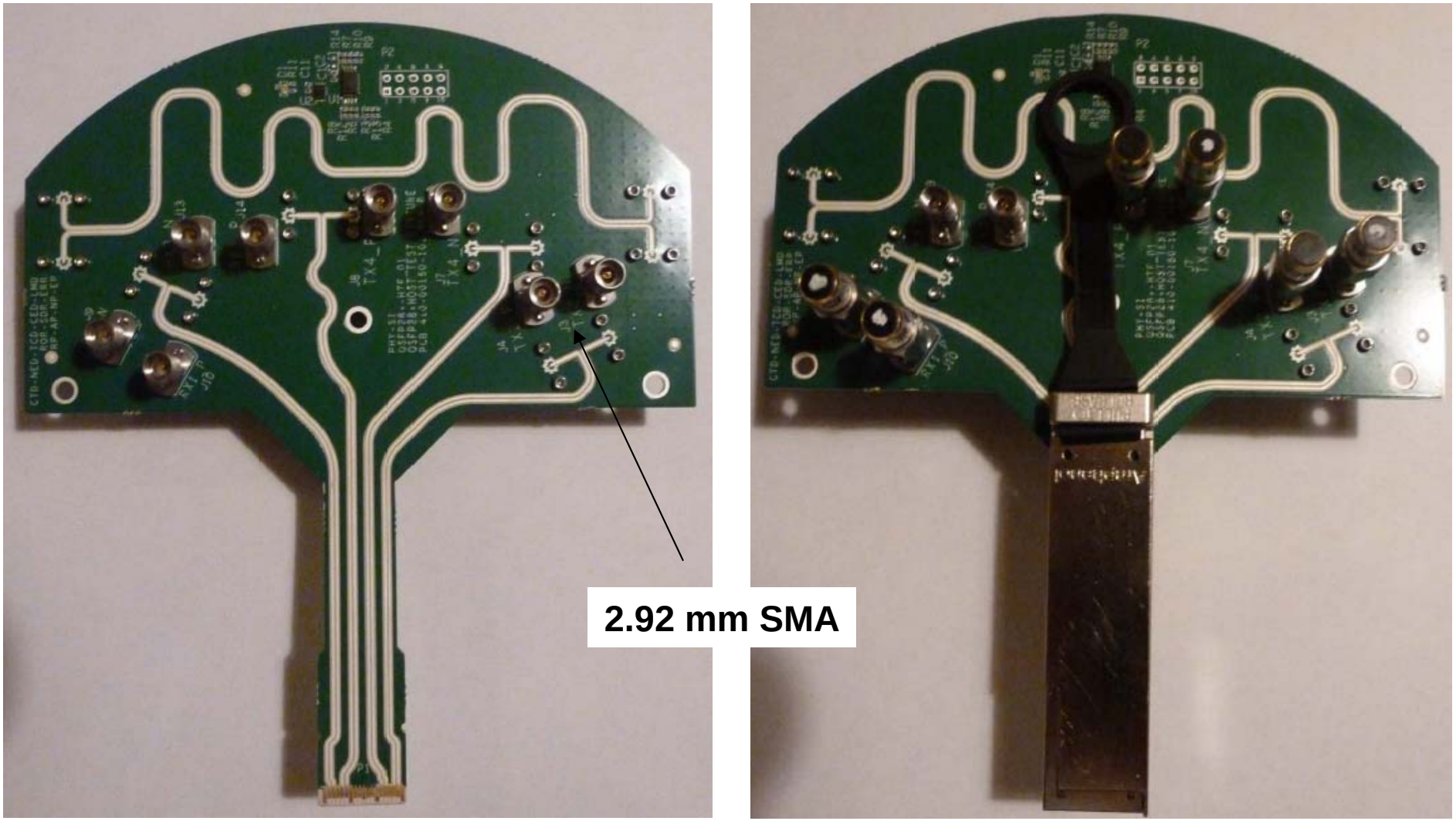
- **PCB reference IL specified**

802.3bj Test Fixtures

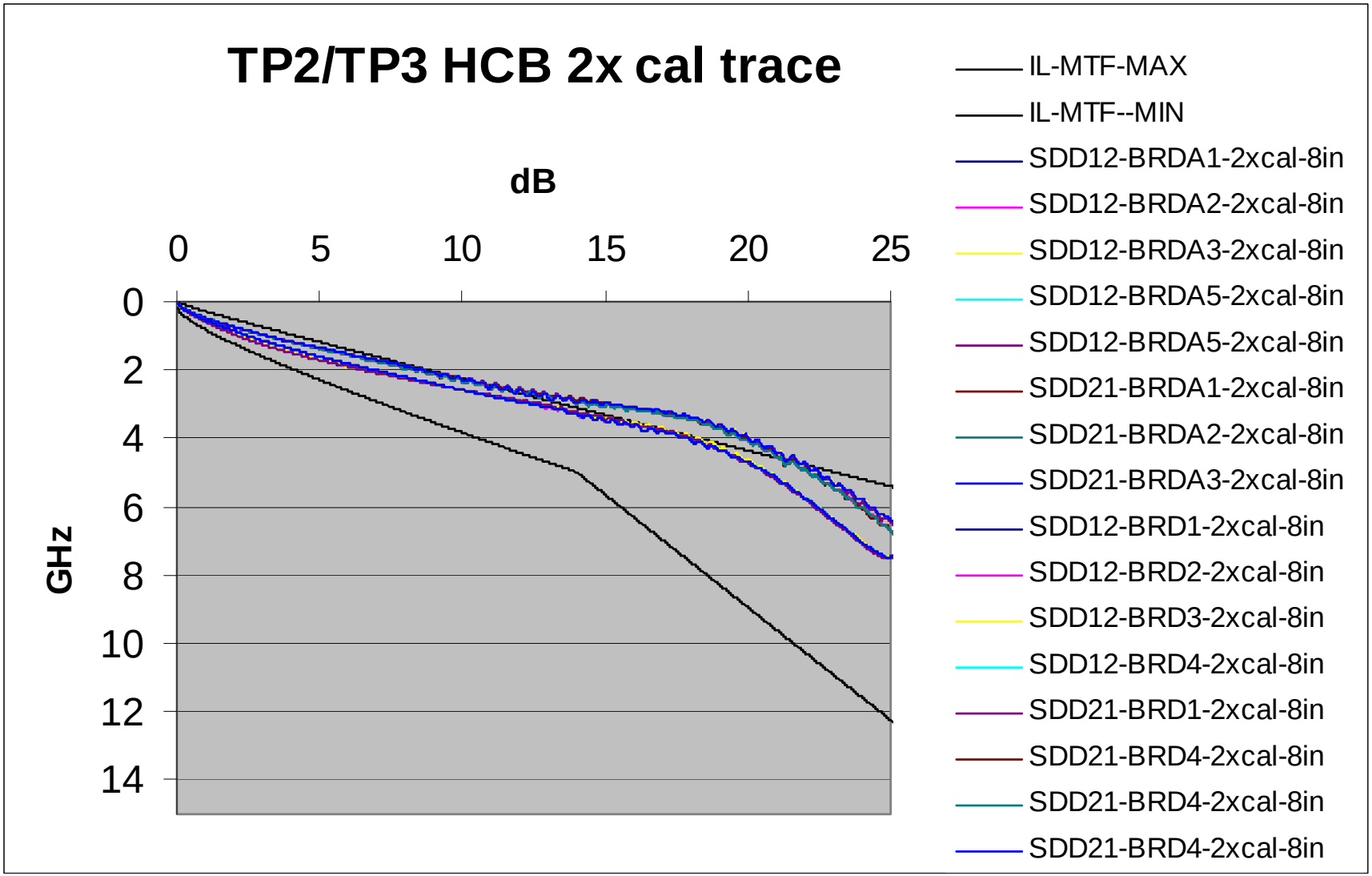


- **Specified in mated state**
  - **Insertion loss**
  - **Differential return loss**
  - **Common mode return loss**
  - **Common to differential mode conversion loss**
  - **Common to differential mode return loss**
  - **Integrated crosstalk noise (ICN)**

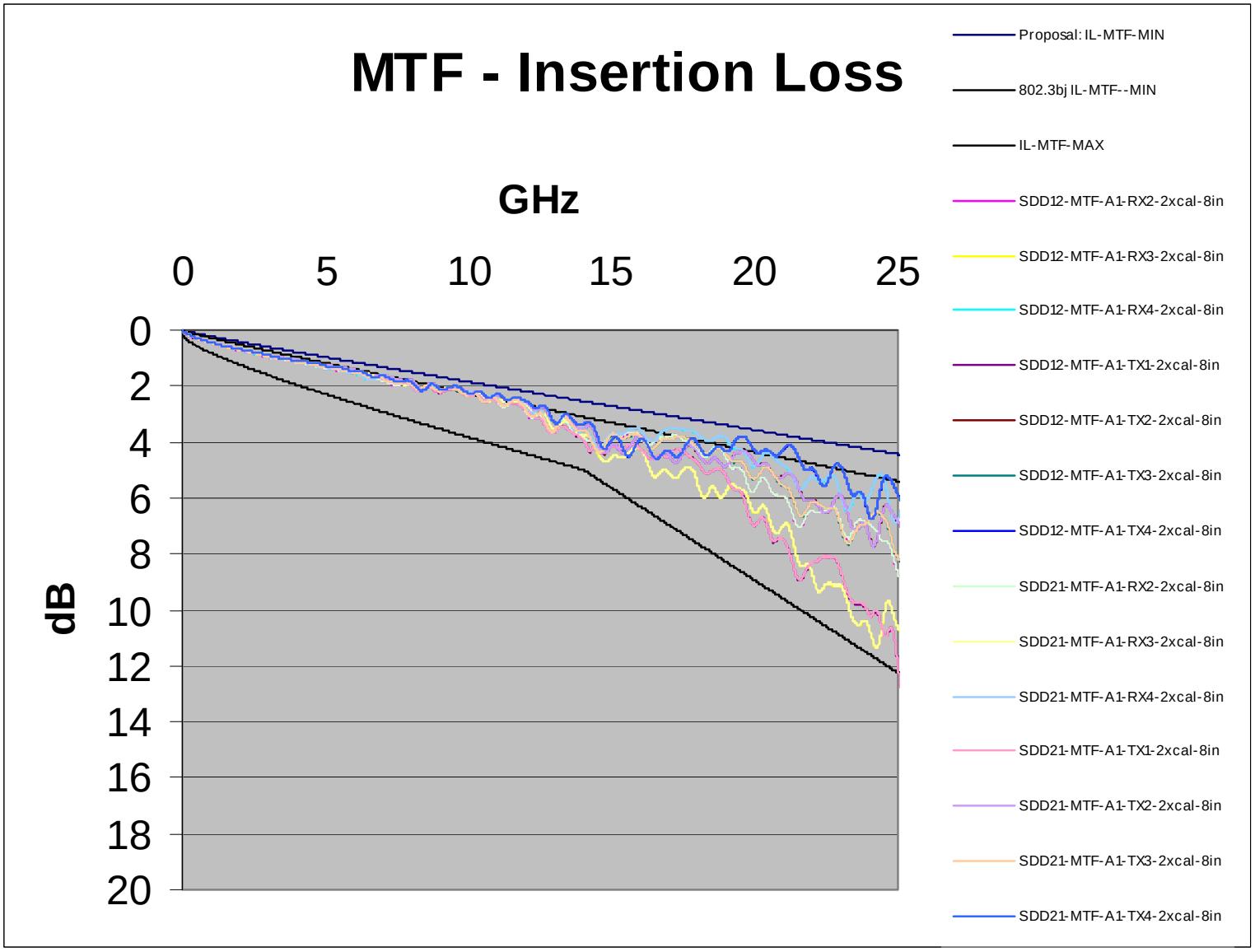
TP2/TP3 (HCB) Test Fixture



TP2/TP3 (HCB) 2x Cal Trace IL



QSFP28 MTF IL



Proposal: IL(f)>/= ILMTFmin=0.0656*sqrt(f)+0.164*f 0.01 </= f </= 25 GHz

MTF Insertion Loss

92.11.1.2 Test fixture insertion loss

$$IL(f) \le IL_{MTFmax}(f) = \left\{ \begin{array}{ll} 0.12 + 0.475\sqrt{f} + 0.221f & 0.01 \le f \le 14 \\ -4.25 + 0.66f & 14 < f \le 25 \end{array} \right\} \quad \text{(dB)} \qquad (92\text{–}43)$$

$$IL(f) \ge IL_{MTFmin}(f) = 0.08\sqrt{f} + 0.2f \quad 0.01 \le f \le 25 \quad \text{(dB)} \qquad (92\text{–}44)$$

where

f is the frequency in GHz

$IL(f)$ is the mated test fixture insertion loss at frequency f

Change (92-44) to:

IL(f)>/= ILMTFmin=0.0656*sqrt(f)+0.164*f 0.01 </= f </= 25 GHz

TP2/TP3 test fixture reference insertion loss proposal

92.11.1.2 Test fixture insertion loss

The test fixture printed circuit board insertion loss values determined using Equation (92–41) shall be used as the reference test fixture insertion loss. The effects of differences between the insertion loss of an actual test fixture and the reference insertion loss are to be accounted for in the measurements.

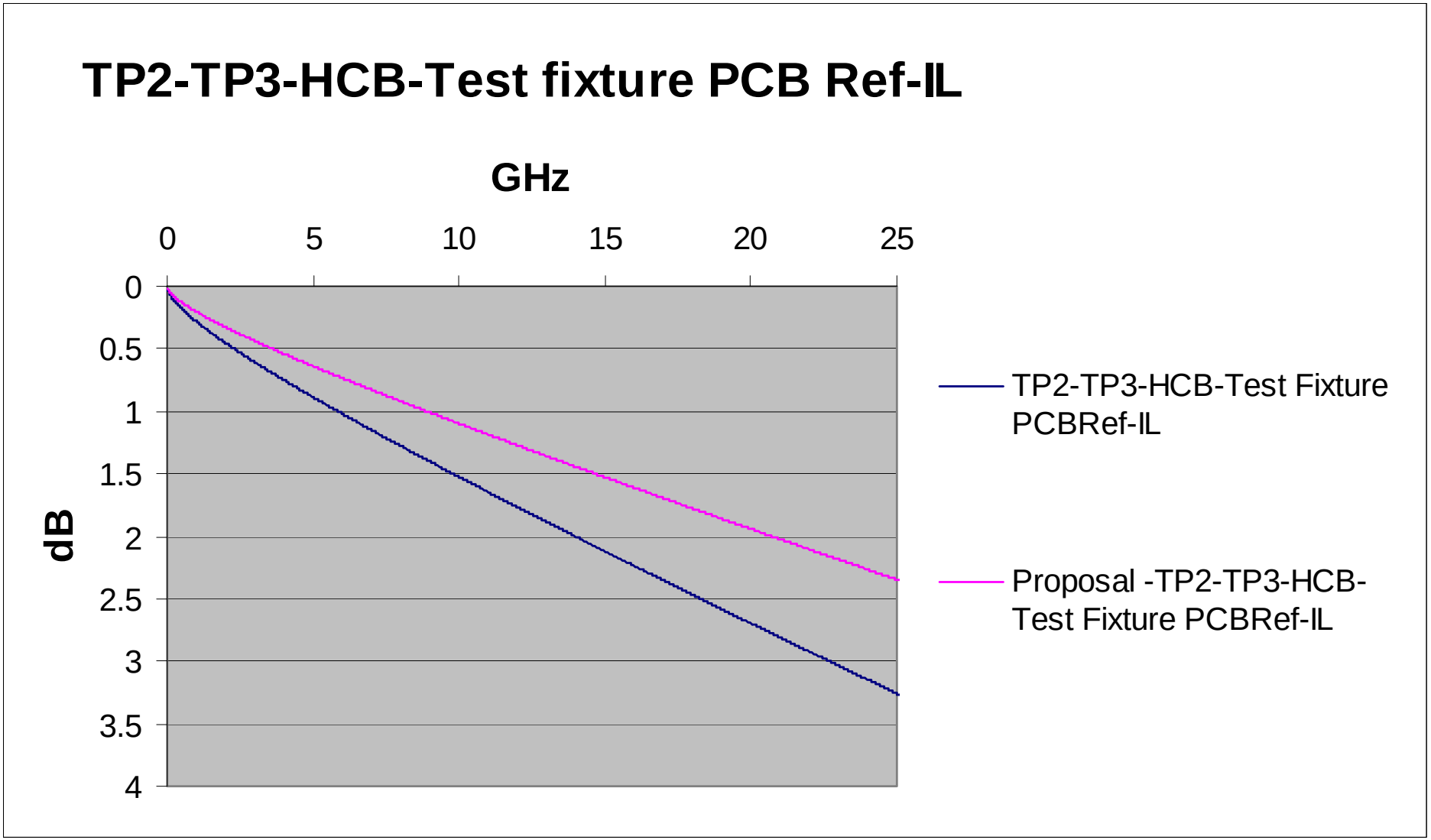
$$IL_{tfref}(f) = -0.002 + 0.192\sqrt{f} + 0.092\ f \quad \text{(dB)} \qquad (92\text{–}41)$$

for $0.01 \le f \le 25$ GHz
where

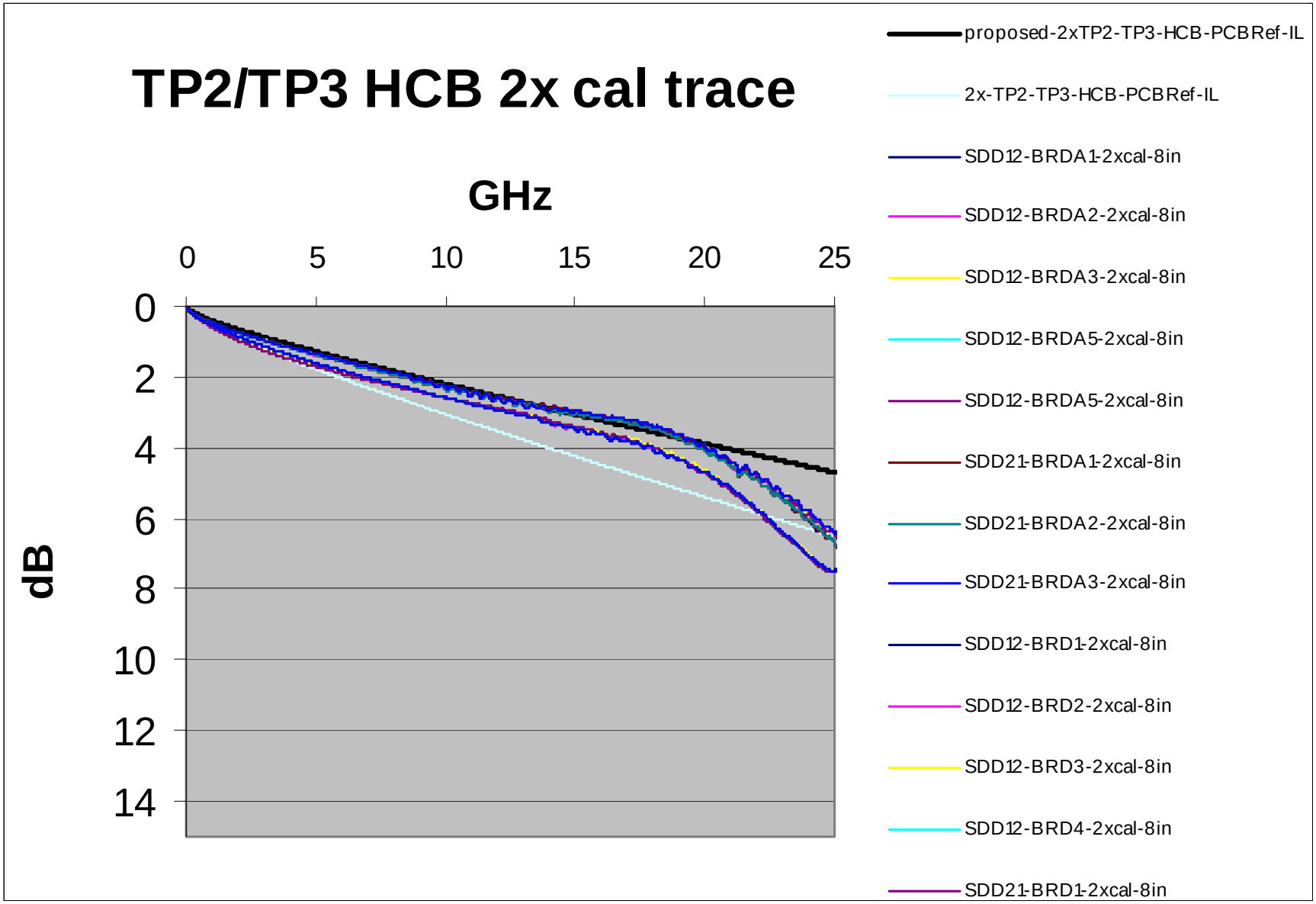
f	is the frequency in GHz
$IL_{tfref}(f)$	is the reference test fixture PCB insertion loss at frequency f

- **Change TP2/TP3 test fixture PCB reference insertion loss**
- **ILtfref (f) = – 0.00144 + 0.13824sqrt(f) + 0.06624f**

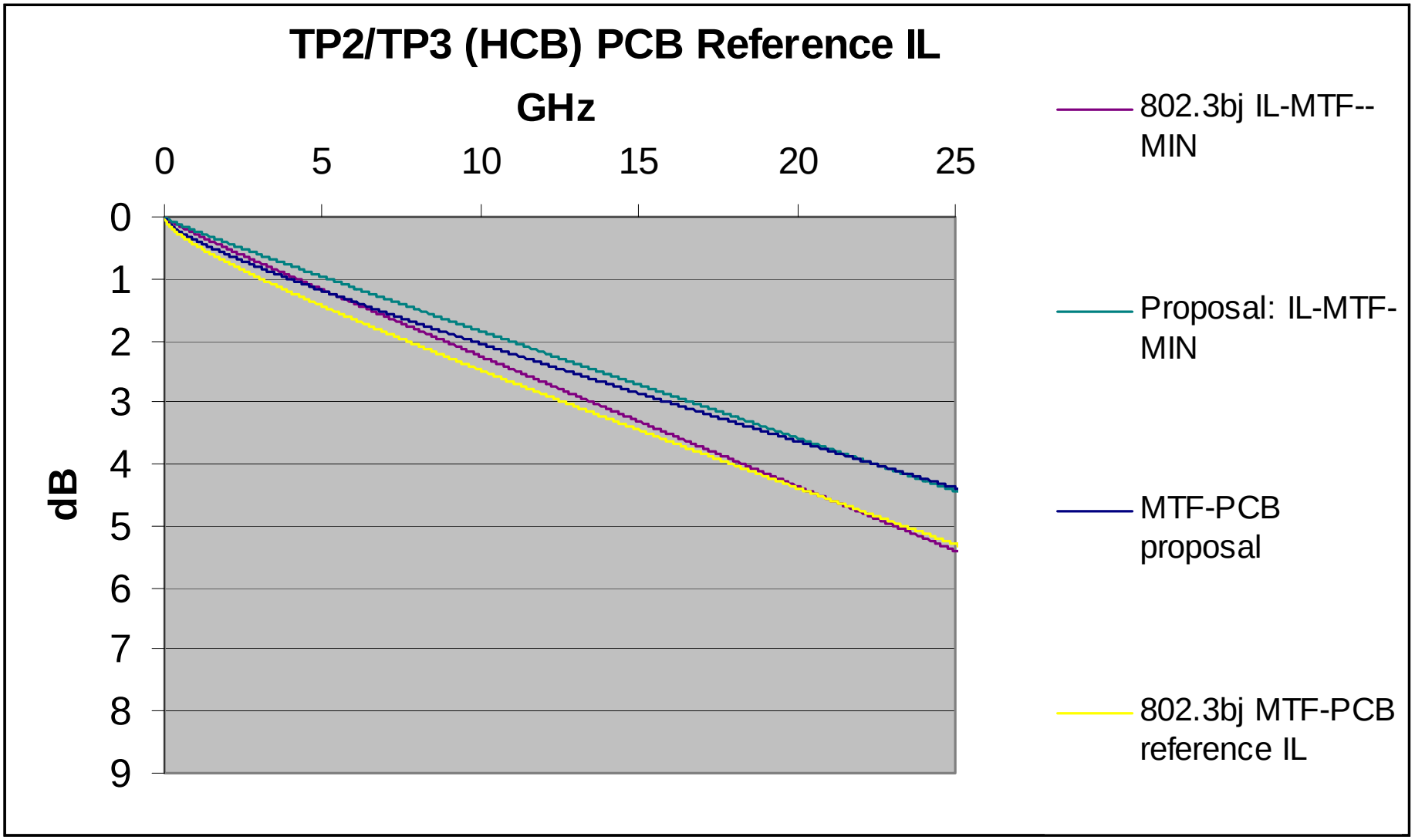
TP2/TP3 test fixture reference insertion loss proposal



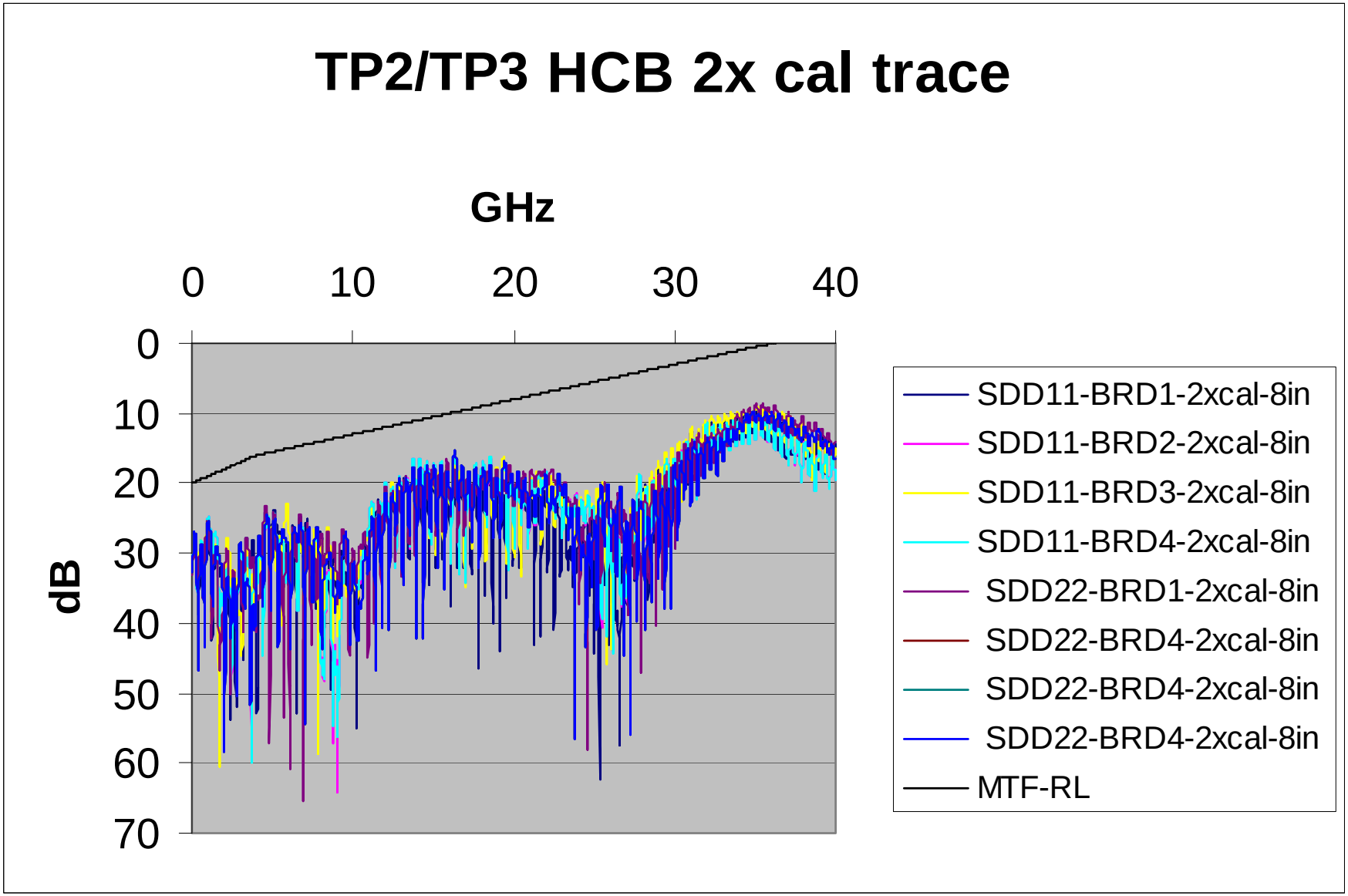
TP2/TP3 (HCB) test fixture reference IL proposal



TP2/TP3 (HCB) test fixture reference IL proposal



2x Cal Trace RL

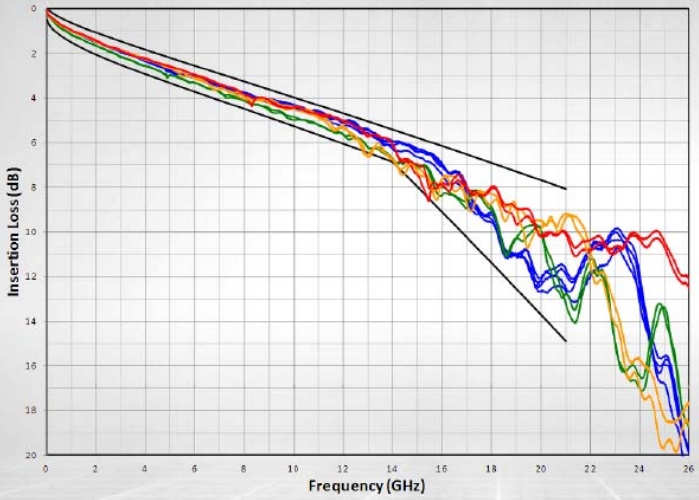


Review of MTF return loss

MTF RL

Insertion Loss– Mated Compliance Board

Comparison to Measured Data



Reference Values
- Minimum
  - 5.0dB @ 12.89GHz
  - 5.4dB @ 14.0 GHz
- Maximum
  - 6.4dB @ 12.89GHz
  - 6.8dB @ 14.0GHz

Legend
- SMT (top side)
- SMT (bottom side)
- Stacked Upper
- Stacked Lower

Minimum	$-0.116 + 0.524\sqrt{f} + 0.212f + 0.003f^2$	
Maximum	$0.393 + 1.024\sqrt{f} + 0.100f + 0.006f^2$	(f < 14GHz)
	$-9.412 + 1.024\sqrt{f} + 0.800f + 0.006f^2$	(14 < f < 21GHz)

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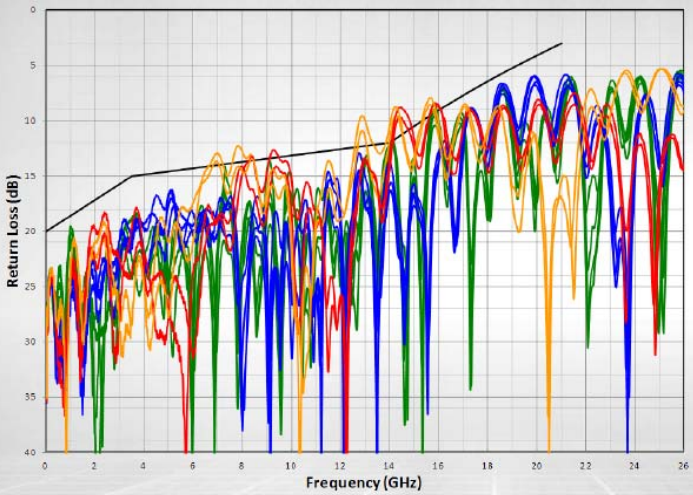
Return Loss – Mated Compliance Boards

Comparison to Measured Data



Reference Values
- 20dB @ DC
- 15dB @ 3.5GHz
- 12dB @ 7.0GHz
- 3dB @ 21.0GHz

Legend
- SMT (top side)
- SMT (bottom side)
- Stacked Upper
- Stacked Lower

Maximum	$20 - 1.429f$	(f ≤ 3.5GHz)
	$16 - 0.286f$	(3.5GHz < f ≤ 14.0GHz)
	$12 - 51.1 \cdot \log(f/14)$	(14.0GHz < f < 21.0GHz)

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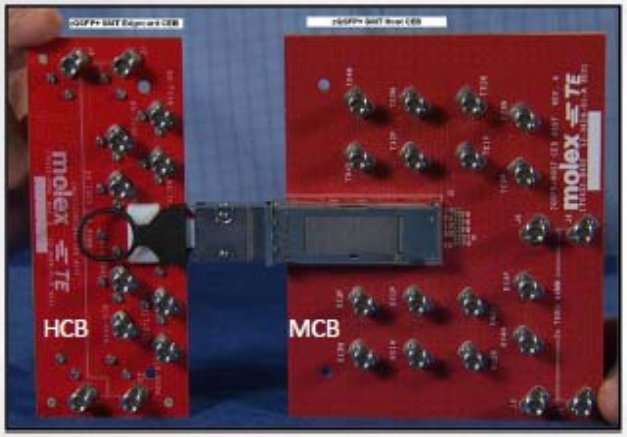
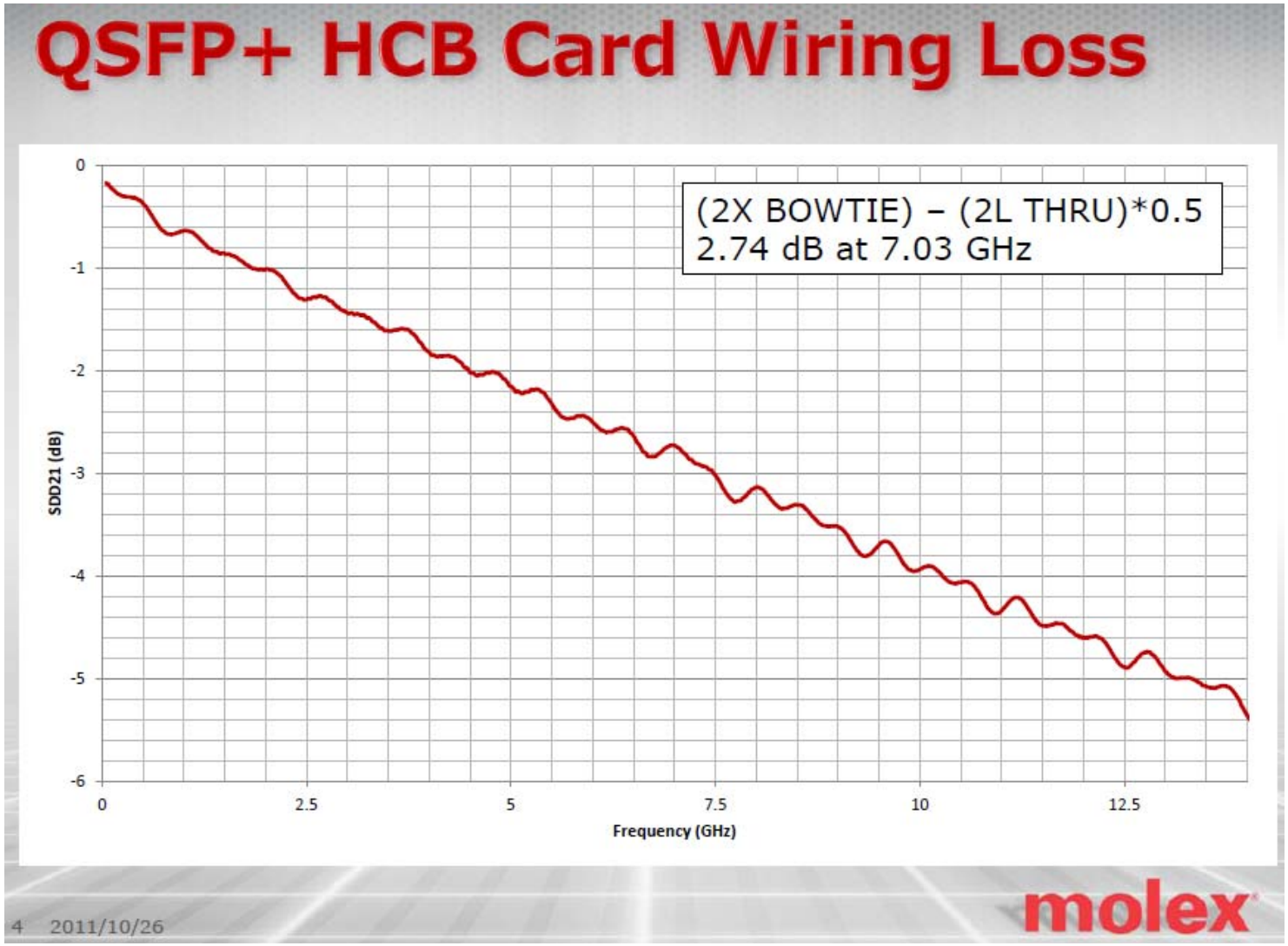
zQSFP+ smt



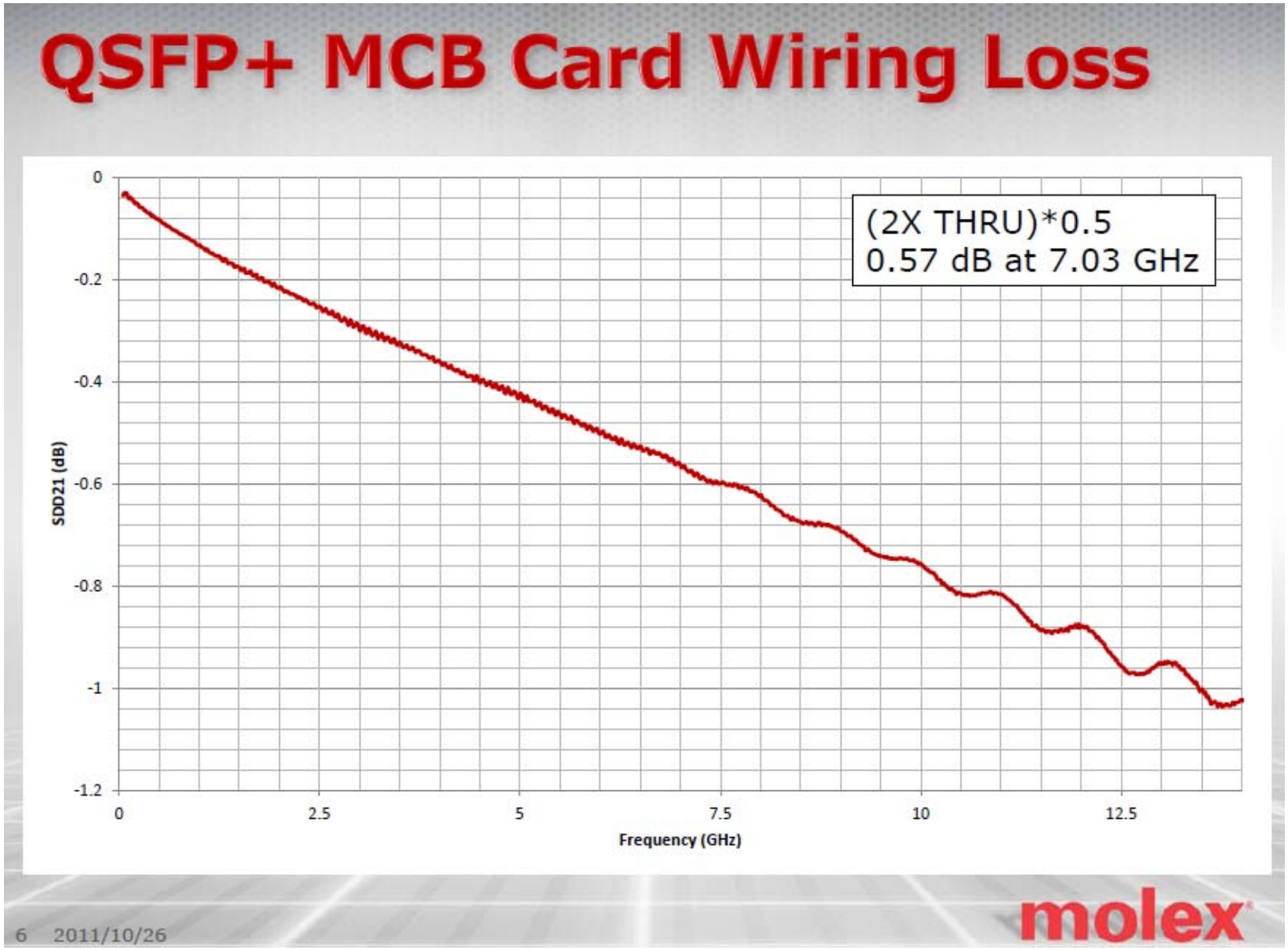
TP2/TP3 (HCB) IL



~5 dB @ 12.5 GHz

Mike Rost - fdr_qsfp_hcb_mcb_loss_20111026.pdf

Cable assembly TF (MCB) IL



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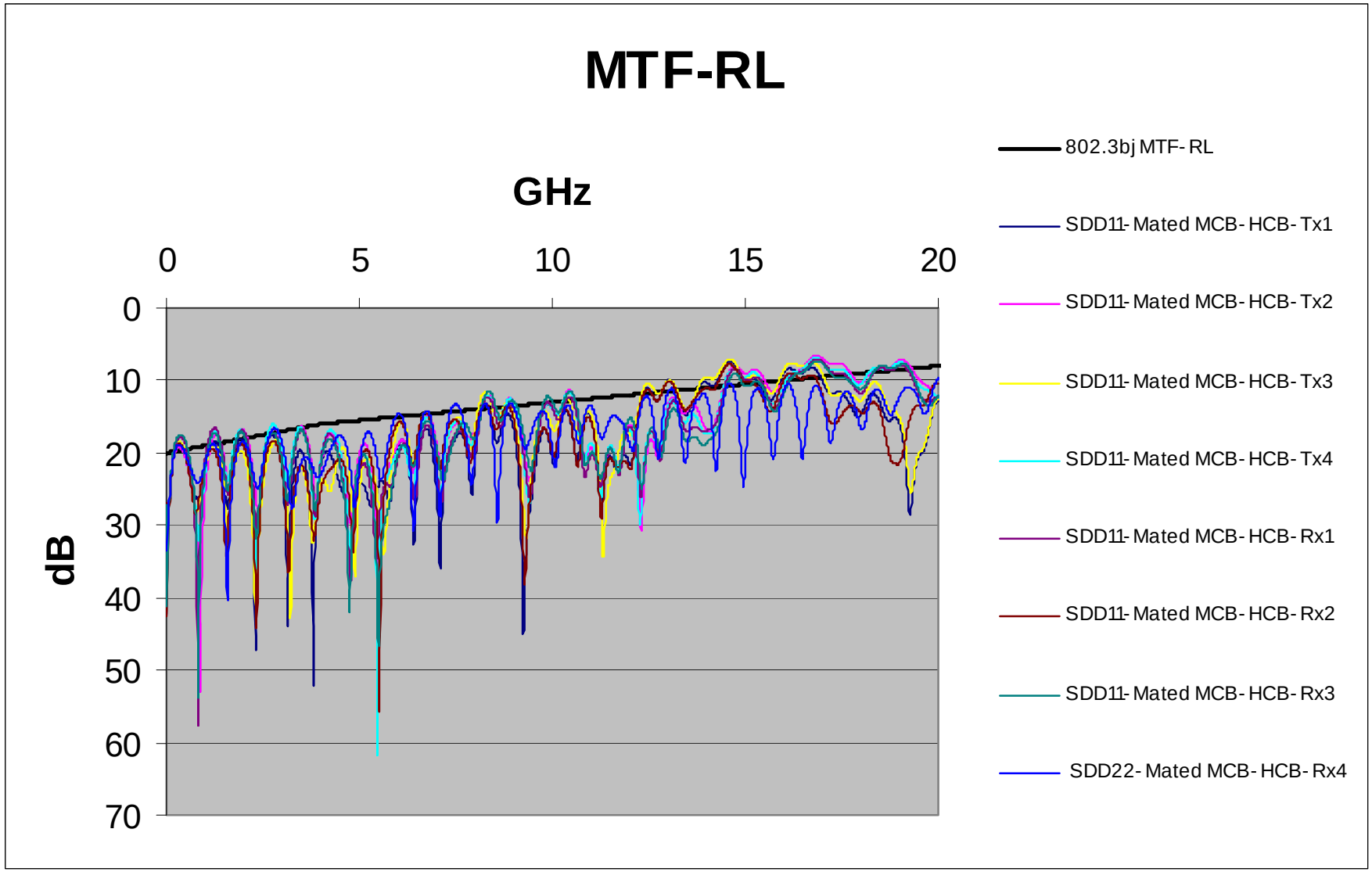
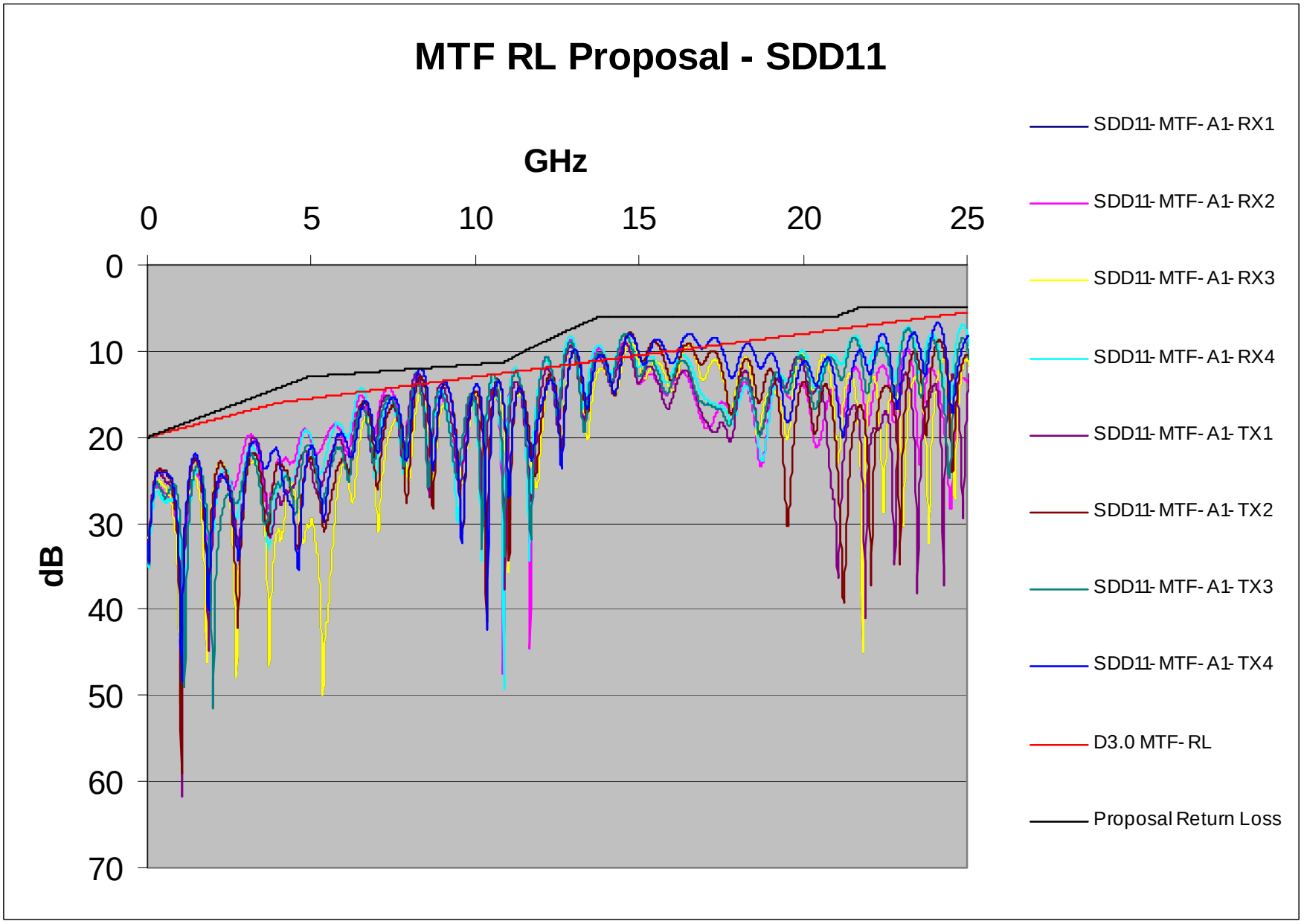
MTF RL

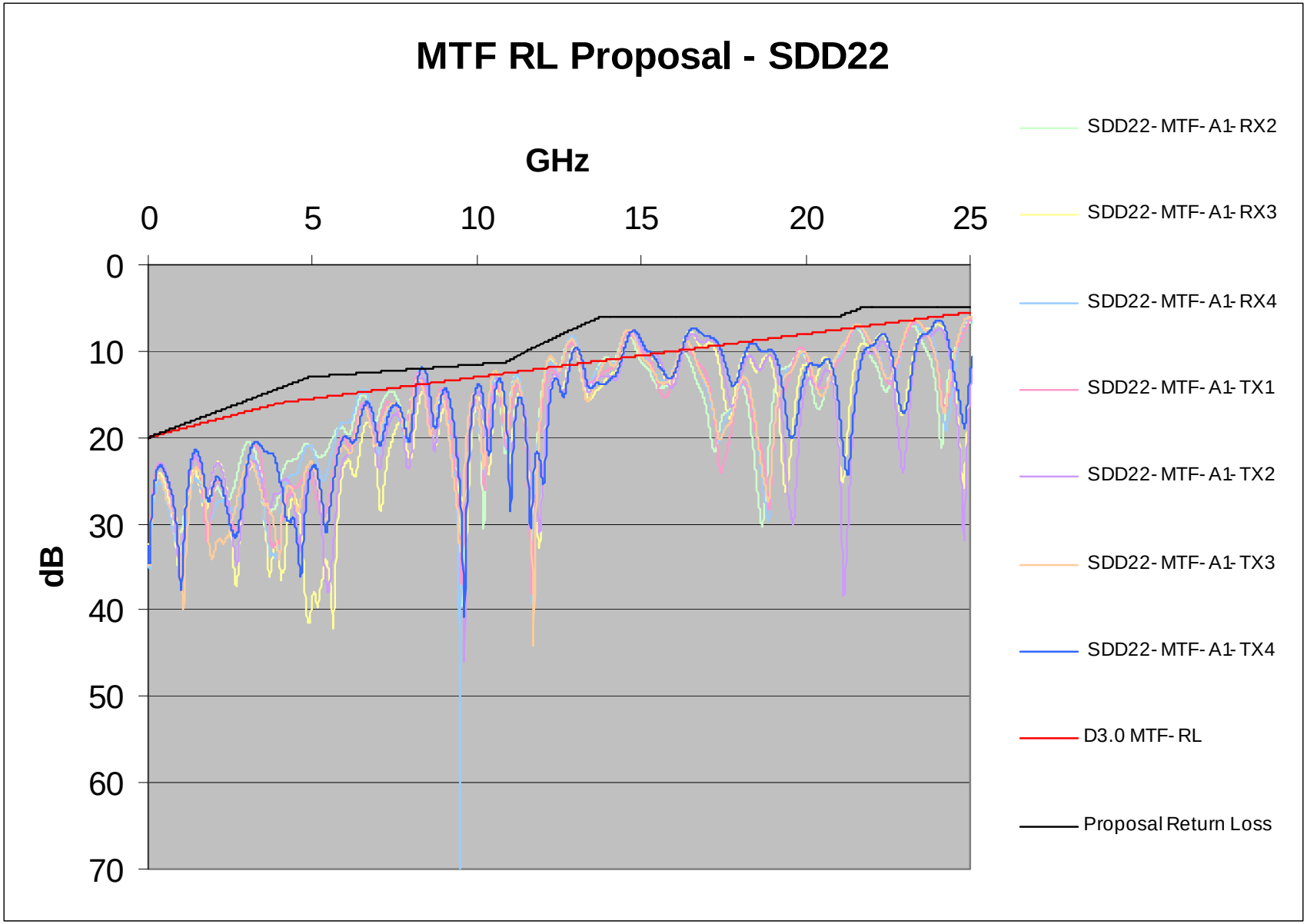


Source: measurements fdr_qsfp_hcb_mcb_loss_20111026

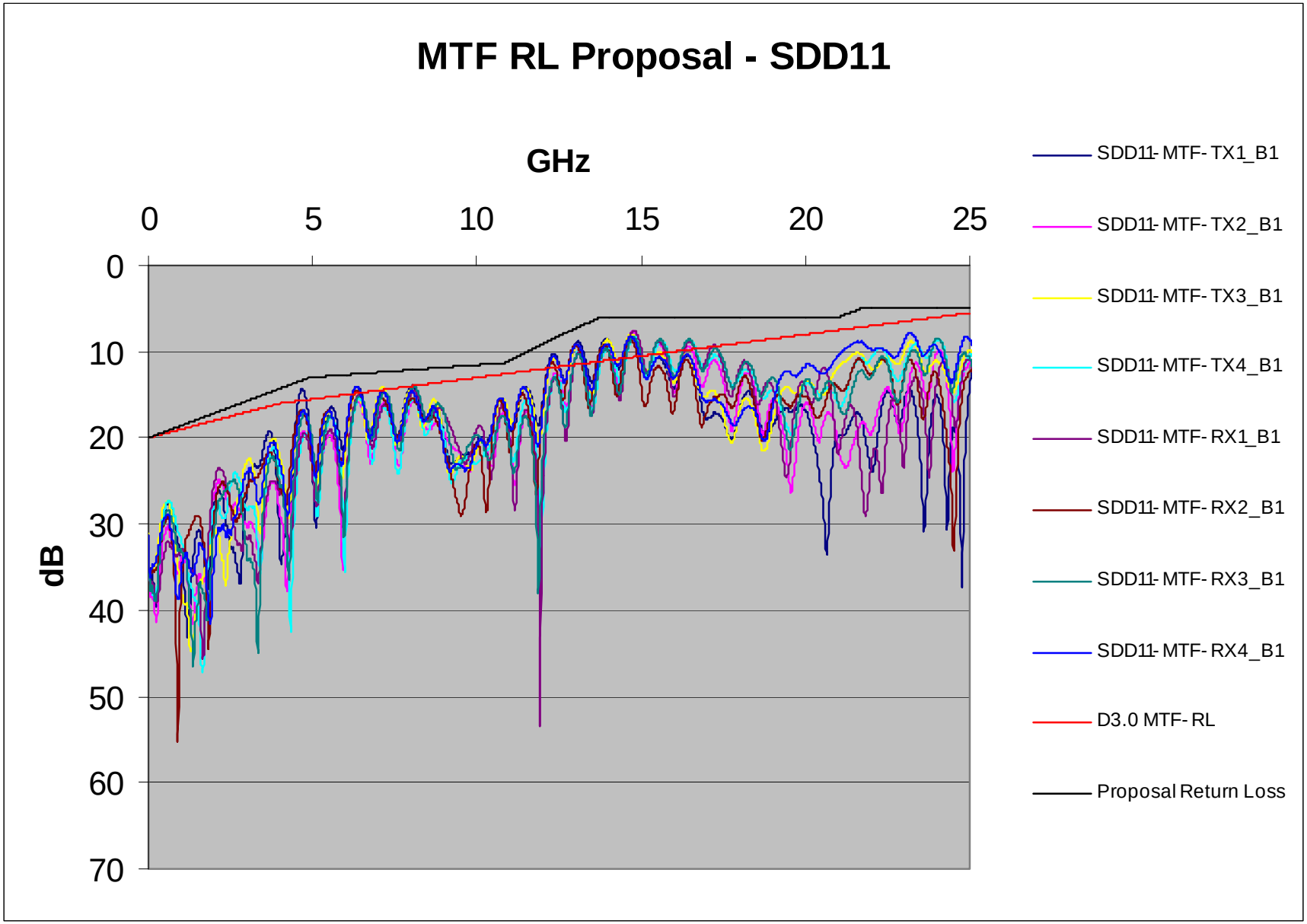
QSFP28 MTF RL (HCB-A)



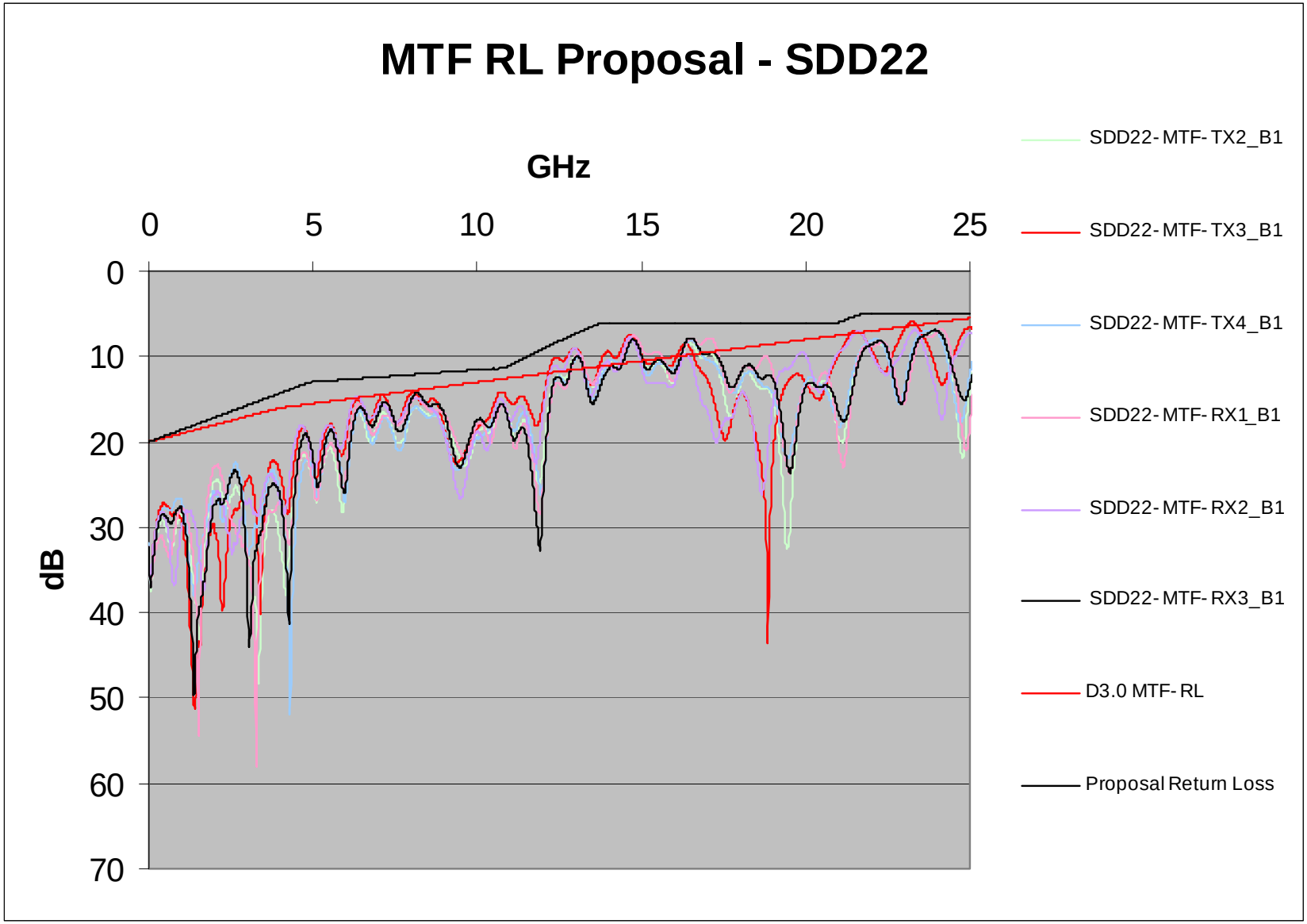
QSFP28 MTF RL (HCB-A)



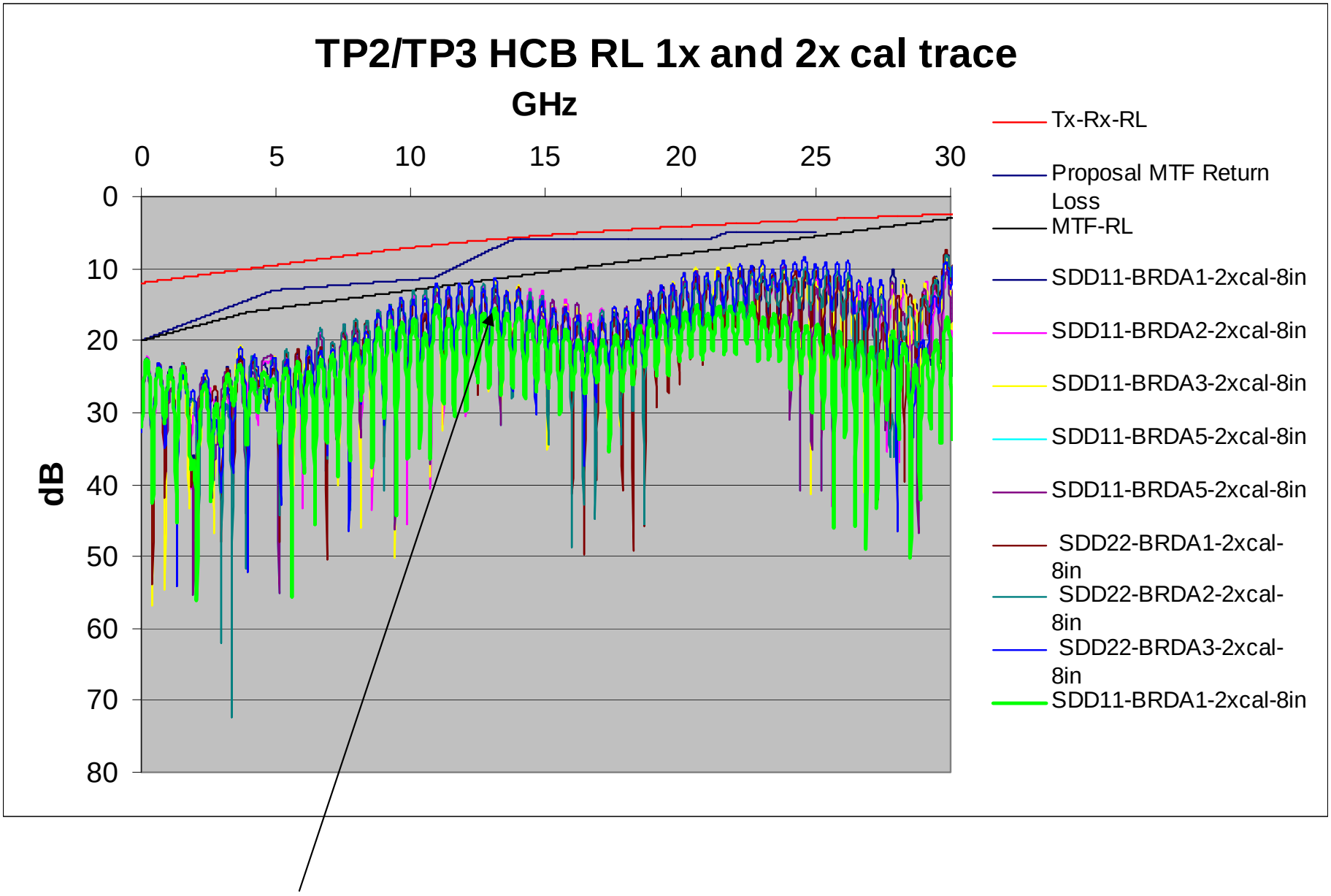
QSFP28 MTF RL (HCB-B)



QSFP28 MTF RL (HCB-B)



TP2/TP3 Cal Trace RL



- ***Pessimistic - RLcorrected = RL+2xcal measurement***

TP2/TP3 RL

- **Specify TP2/TP3 RL reference using equation below. The MTF RL is specified as proposed slide 21.**

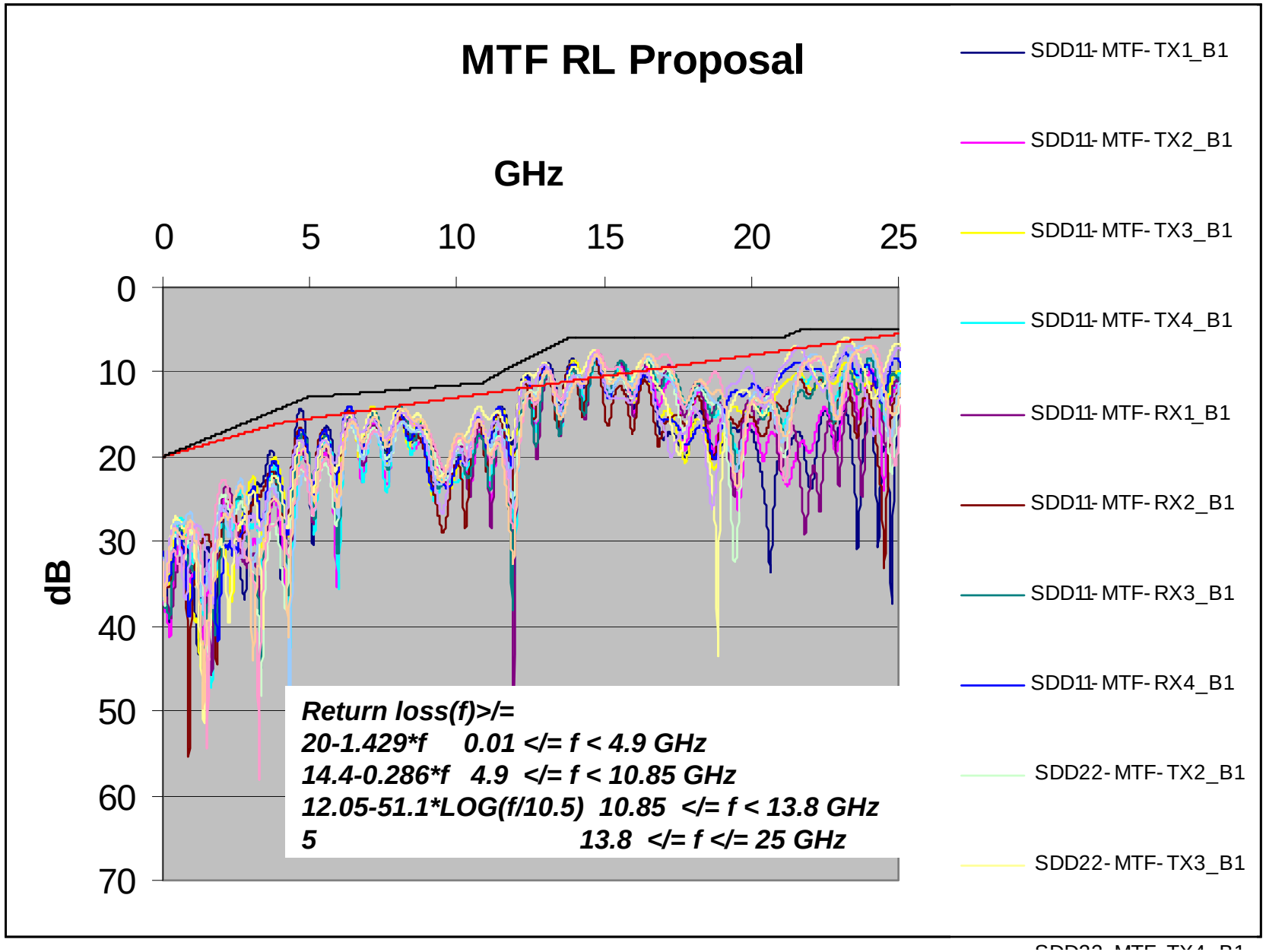
$$Return\_loss(f) \geq \begin{cases} 20 - f & 0.01 \leq f < 4 \\ 18 - 0.5f & 4 \leq f \leq 25 \end{cases} \quad \text{(dB)}$$

where

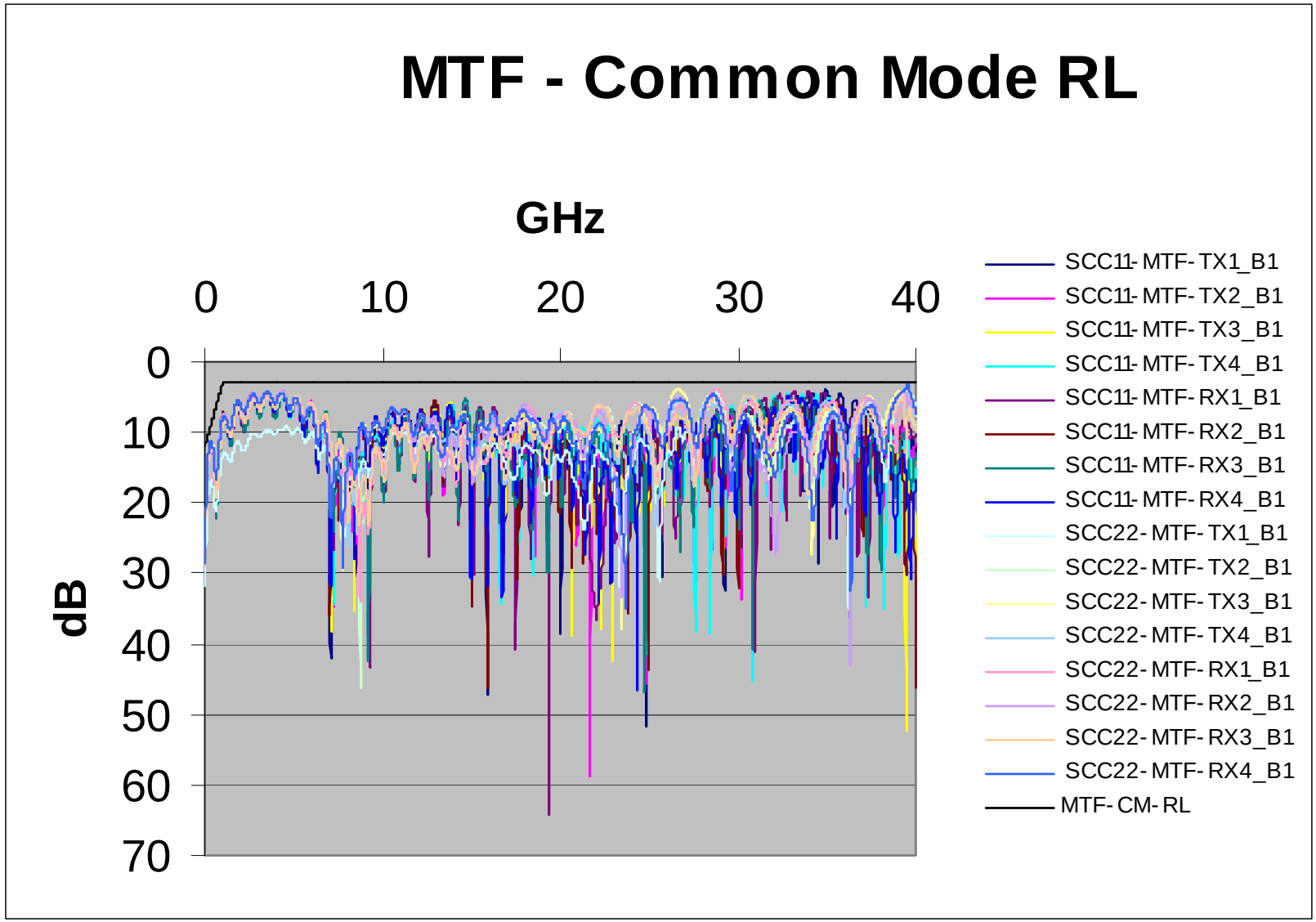
f	is the frequency in GHz
$Return\_loss(f)$	is the return loss at frequency f

- **Add TP2/TP3 RL specification to 92.11.1 TP2 or TP3 Test fixture**

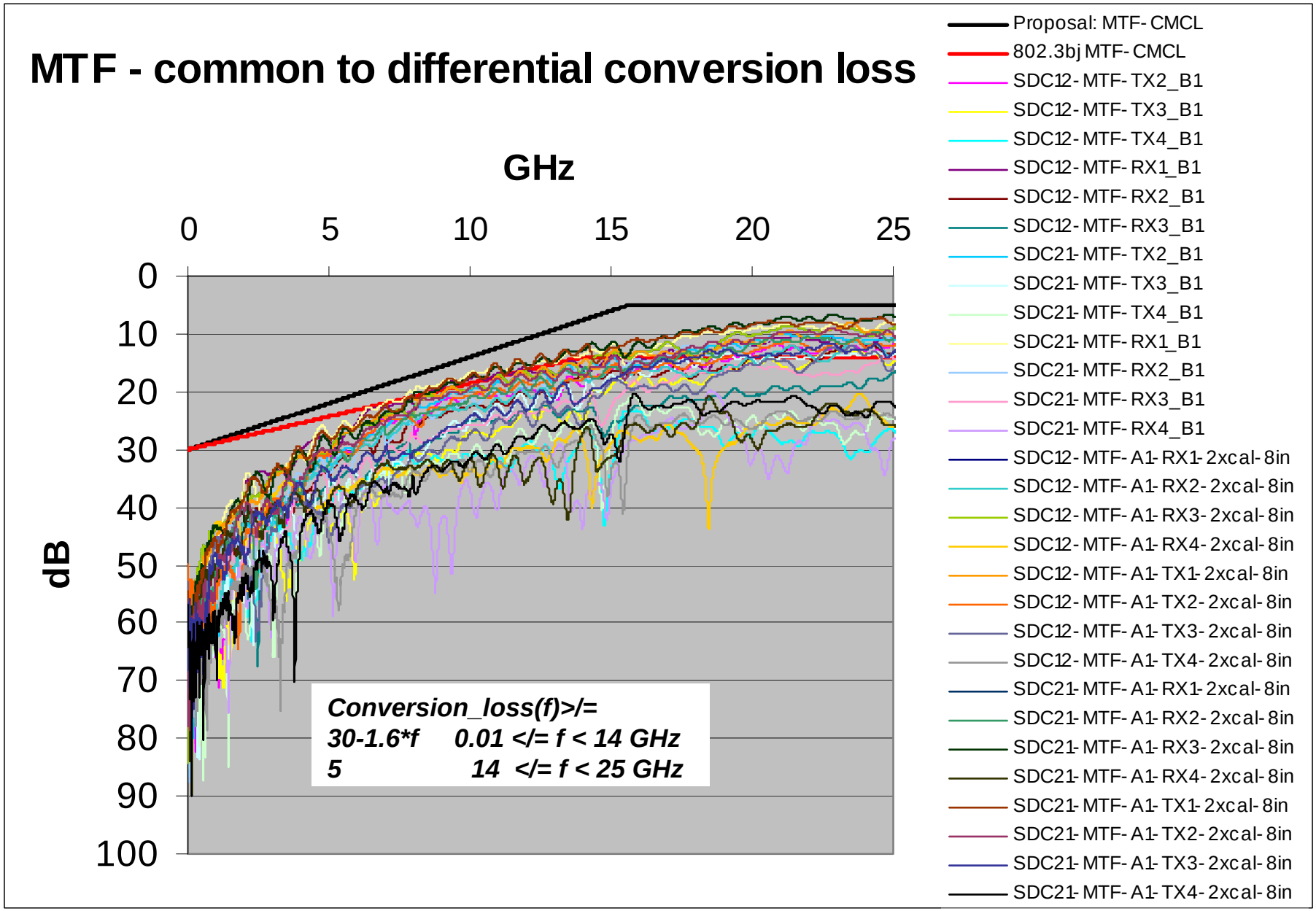
MTF RL Proposal



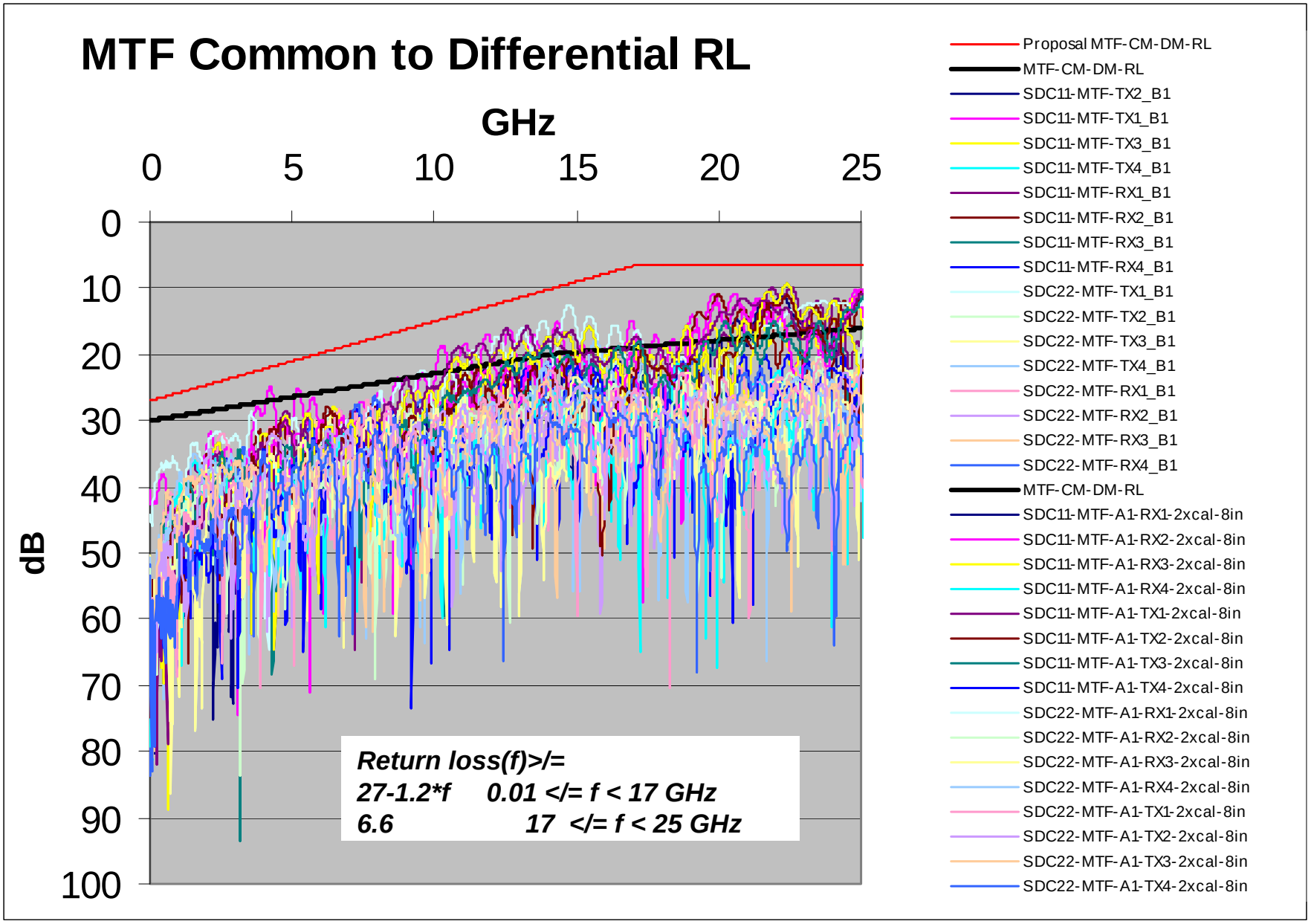
QSFP28 MTF CMRL



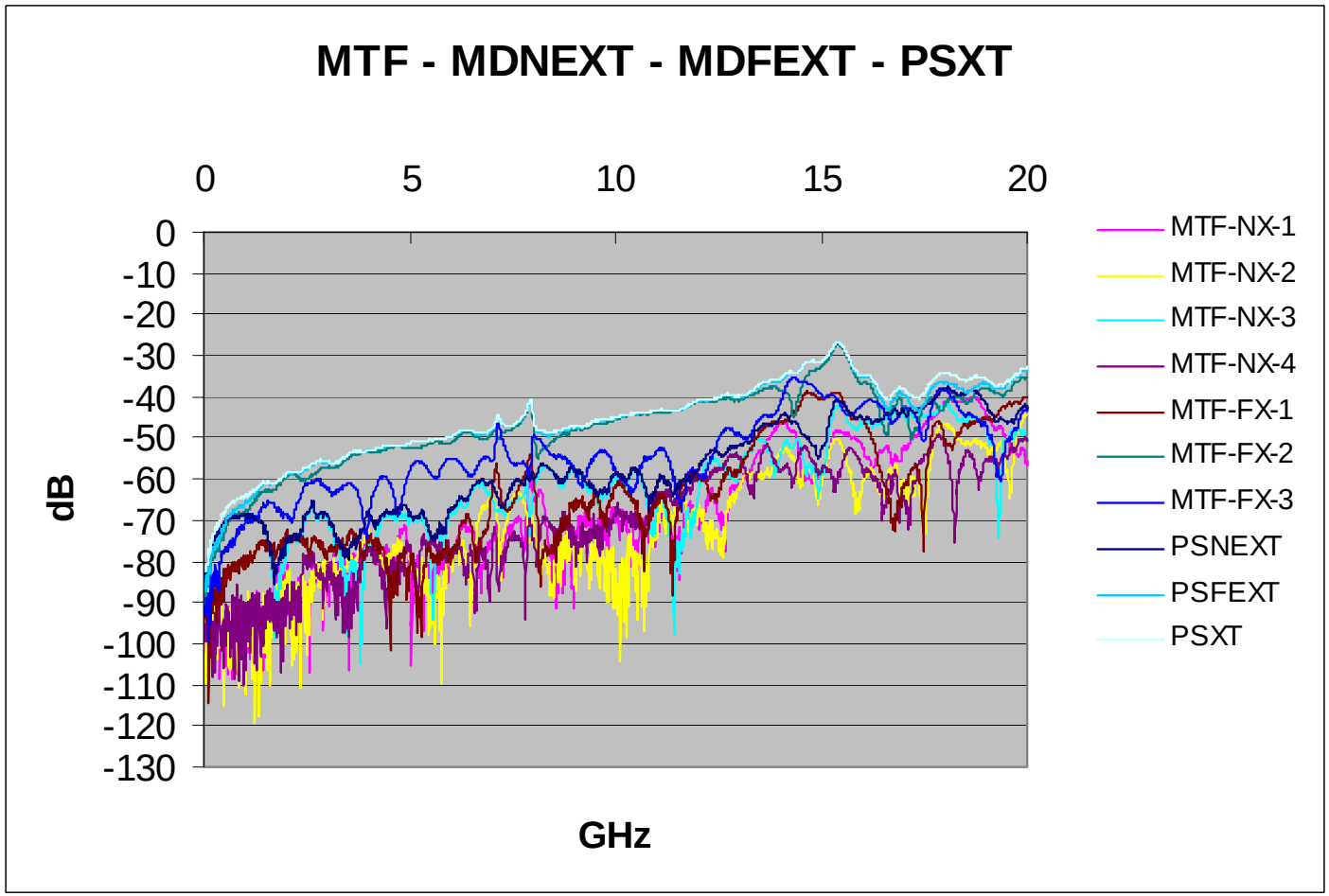
QSFP28 MTF CM-DM-CL



QSFP28 MTF CM-DM-RL



QSFP28 MTF ICN



MDNEXT ICN	1.1078
MDFEXT ICN	4.1118

Table 92–15—Mated test fixtures integrated crosstalk noise

Parameter	100GBASE-CR4	Units
MDNEXT integrated crosstalk noise voltage	less than 1.8	mV
MDFEXT integrated crosstalk noise voltage	less than 4.8	mV

Summary

- Measurements of TP2/TP3 (HCB) and mated test fixtures provided.

- 802.3bj mated test fixture specifications reviewed (D3.0).
  - ✓Insertion loss – meets maximum specification (better than minimum)
  - ✓Common mode return loss – meets specification
  - Return loss – marginal
  - Common to differential mode conversion loss – marginal
  - Common to differential mode return loss – marginal
  - Integrated crosstalk noise (ICN) – meets specification

- Proposals to adjust specification limits for marginal parameters and MTF IL minimum and TP2/TP3 reference PCB IL

- Proposal to specify TP2/TP3 (HCB) test fixture RL independent of (MCB)
  - TP2/TP3 (HCB) performance critical to performing accurate measurements of host ports. Specifying in mated state does not accurately represent achievable performance of TP2/TP3 (HCB).