100GBASE-CR4
Comments D1.1 TBD's

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Purpose

- **Comments to be submitted against 802.3bj Draft 1.1 cable assembly subclauses to replace TBD's with equations/values**

- **274,275,276,278,279.280,281,283,284,285,286,288,290,292,293,294**

Contributors

- Patrick Casher, Michael Rost – Molex
- Charles Moore, Avago Technologies

92.8.3.2 Transmitter noise parameter measurements

#286 - P-121 L-10-14

- **"low-loss" cable assembly with insertion loss on the reference pair of 8.0 dB ± 1.6 dB at 12.8906 GHz**
- **"high-loss" cable assembly with insertion loss on the reference pair of 20.0 dB ± 1.5 dB at 12.8906 GHz**

#290 - P-121 L-12

- **The Steady state voltage, the sum of linear fit pulse response, p(k), from step 3) divided by M from step 3), shall be greater than 0.34 V and less than or equal to 0.60 V.**
- **The peak of the linear fit pulse response from step 3) shall be greater than 0.50 × Steady state voltage.**

#283 P-123 L-17-27

- **Table 92–6—Normalized transmit pulse template**
  - **Linear fit pulse length 11 UI**
  - **Linear fit pulse delay 2 UI**
  - **Equalizer length 11 UI**
  - **Equalizer delay 2 UI**

Table 92-8-100GBASE-CR4 interference tolerance parameters

#293 92.8.3.3.1 Coefficient initialization P123-L-52

the transmit equalizer shall be configured such that the ratio (c(0)+c(1)–c(–1))/(c(0)+c(1)+c(–1)) is 1.29 ± 10%
and the ratio (c(0)–c(1)+c(–1))/(c(0)+c(1)+c(–1)) is 2.57 ±–10%.

#292 92.8.3.3.2 Coefficient step size P-124 L-6-8

The change in the normalized amplitude of coefficient c(i) corresponding to a request to “increment” that coefficient shall be between 0.0083 and 0.05
.The change in the normalized amplitude of coefficient c(i) corresponding to a request to “decrement” that coefficient shall be between -0.0083 and -0.05

#292 92.8.3.3.3 Coefficient range P-124 L-21-26

With c(–1) set to zero and both c(0) and c(1) having received sufficient “decrement” requests so that they are at their respective minimum values,
the ratio (c(0) – c(1))/(c(0) + c(1)) shall be greater then or equal to 4
With c(1) set to zero and both c(–1) and c(0) having received sufficient “decrement” requests so that they are at their respective minimum values,
the ratio (c(0) – c(–1))/(c(0) + c(–1)) shall be greater then or equal to 1.54

#294 92.8.3.3.4 Waveform acquisition P-124 L-35

The value of M shall be an integer not less than 7

Table 92-8-100GBASE-CR4 interference tolerance parameters

#275

Table 92–8—100GBASE-CR4 interference tolerance parameters

Parameter	Test 1 values	Test 2 values	Units
Maximum BER	10^{-12}	10^{-12}	
Fitted insertion loss coefficients	$a_1 = 1.7$ $a_2 = 0.546$ $a_4 = 0.01$	$a_1 = 4.3$ $a_2 = 0.571$ $a_4 = 0.04$	dB/√GHz dB/GHz dB/GHz^2
Applied SJ[a] (peak-to-peak)	0.115	0.115	UI
Applied RJ[b] (peak-to-peak)	0.13	0.13	UI
Applied DCD (peak-to-peak)	0.035	0.035	UI
Calibrated far-end crosstalk (RMS)	6.3	2.2	mV
Calibrated ICN (RMS) – σ_{nx}	3.7	3.7	mV

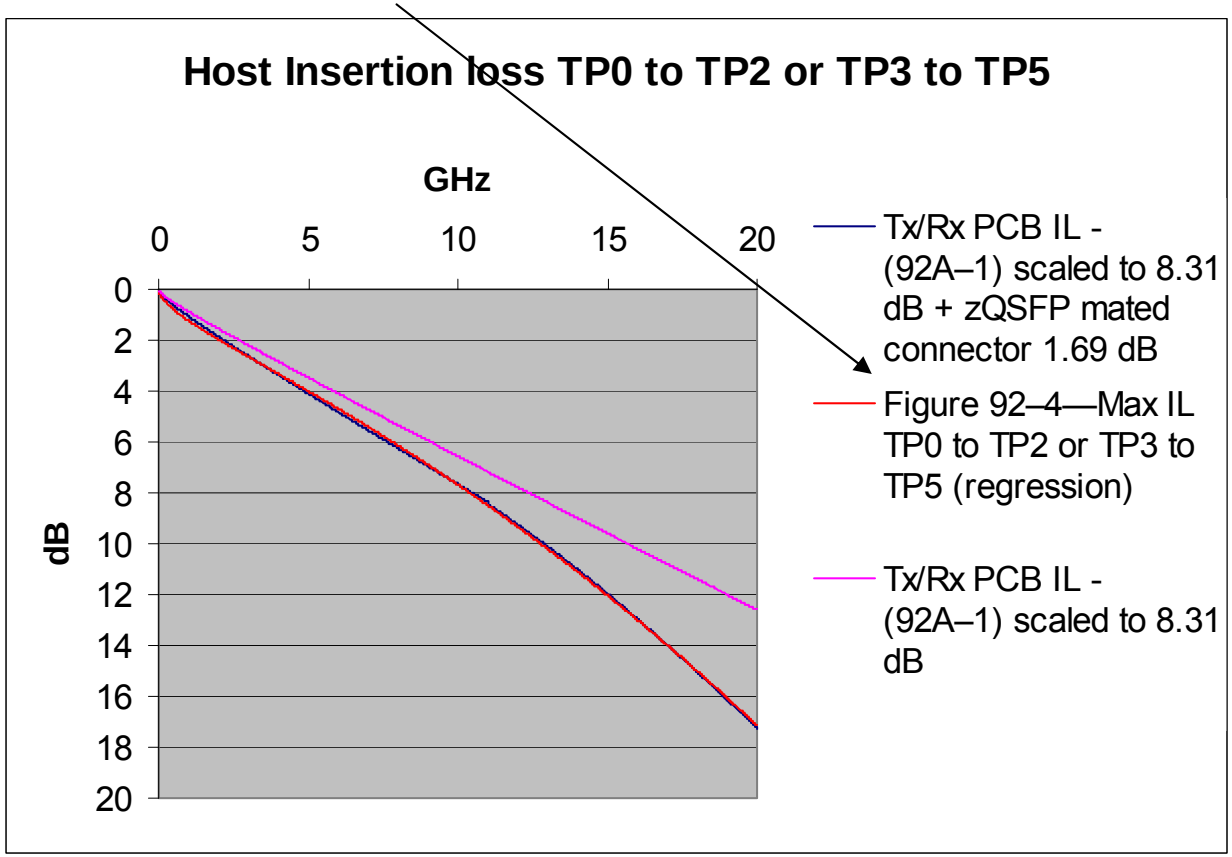
[a]Applied SJ frequency >15 MHz, specified at TP0.
[b]Applied random jitter at TP0 is specified at 10^{-12}.

Test 1 IL consistent with = 0.5 m cable assembly + PCB IL
Test 2 IL= 5.0 m cable assembly + PCB IL

92.8.3.4 Insertion loss TP0 to TP2 or TP3 to TP5

#284 92.8.3.4 Insertion loss TP0 to TP2 or TP3 to TP5 –P126 L-22 (Host 10 dB @12.89GHz)

Equation (92-14), Figure 92-4



Equation (92–14) Insertion_loss(f) ≤ (0.907)*SQRT(f)+(0.304*f)+(0.017*f^2)

Insertion_loss(12.8906) ≤ (0.907)*SQRT(12.8906)+(0.304*12.8906)+(0.017*12.8906^2)=10.00 dB @ 12.8906 GHz

92.10 Cable assembly

- 92.10.2 Cable assembly insertion loss Table 92-10 coefficients #274
- 92.10.7 Cable assembly integrated crosstalk noise (ICN) #285 slides#8-9
  Eq 92-32, Fig 92-11

#285 Cable Assembly ICN – 5 m – 24 AWG

RX1	ICN	Unit
MDNEXT	1.580	mV
MDFEXT	1.160	mV
PSXT	1.96	mV

RX2	ICN	Unit
MDNEXT	1.38	mV
MDFEXT	1.59	mV
PSXT	2.10	mV

RX3	ICN	Unit
MDNEXT	1.66	mV
MDFEXT	1.36	mV
PSXT	2.14	mV

RX4	ICN	Unit
MDNEXT	1.83	mV
MDFEXT	1.43	mV
PSXT	2.32	mV

Proposal: Maximum integrated crosstalk noise for maximum cable assembly insertion loss of 22.64 dB at 12.89 GHz.	Revise Equation 85A-6	3.5 to 3.2	mV

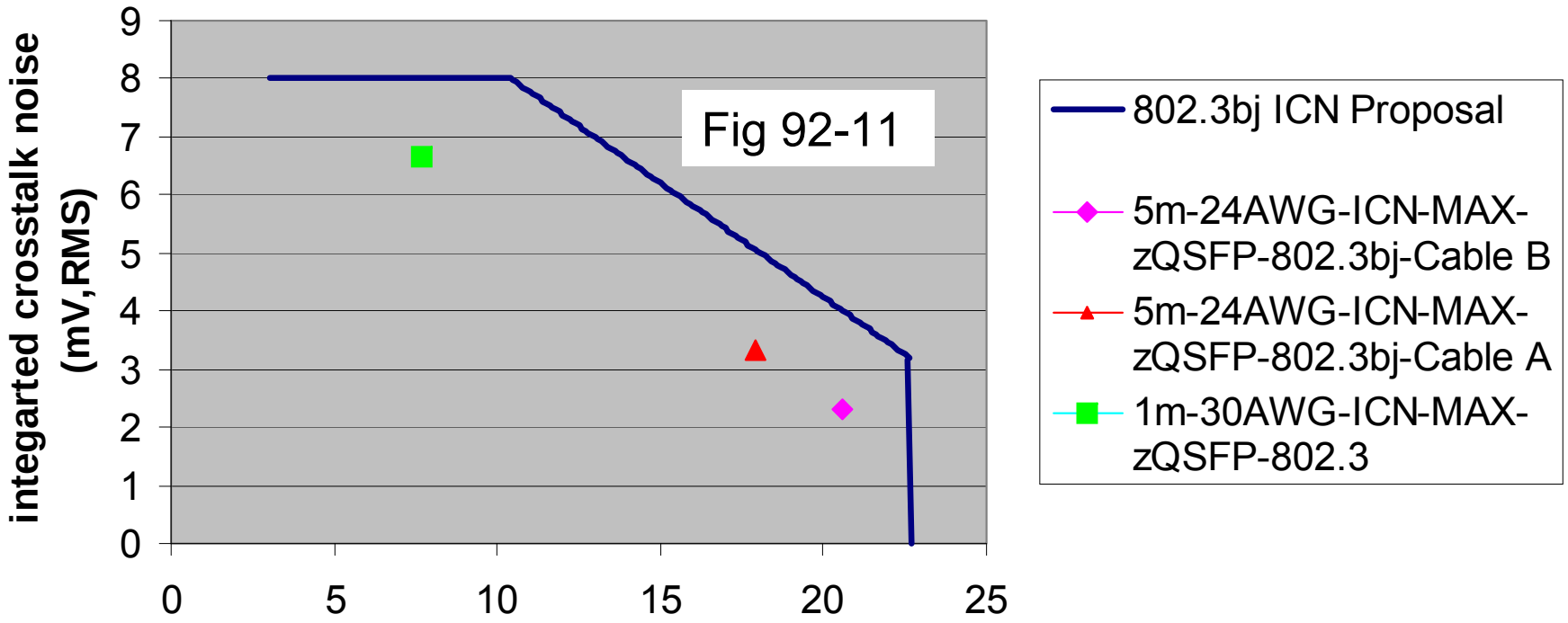
The total integrated crosstalk RMS noise voltage of the channel is recommended to meet the values determined using Equation (85A–6) illustrated in Figure 85A–2.

$$\sigma_{x,ch} \leq \begin{cases} 10 & 3 \leq IL \leq 7.5 \\ 13.4 - 0.45IL & 7.5 < IL \leq 24.44 \end{cases} \quad \text{(mV)} \qquad \text{(85A–6)}$$

where IL is the value of the channel insertion loss in dB at 5.15625 GHz.

#285 802.3bj Cable Assembly ICN – Proposal

802.3bj Integrated crosstalk noise



The total integrated crosstalk RMS noise voltage shall meet the values determined by Equation (92–33) illustrated in Figure 92–12.

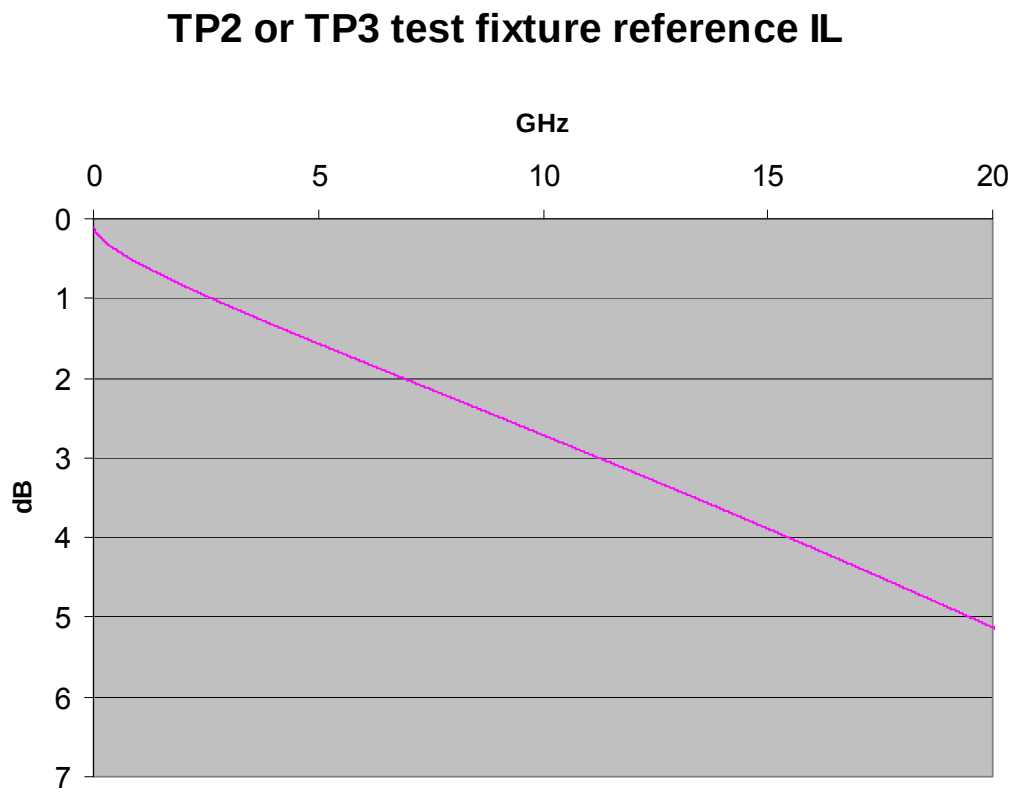
$$\sigma_{x,\,ca} \le \{TBD\} \quad \text{(mV)} \qquad \text{(92–33)}$$

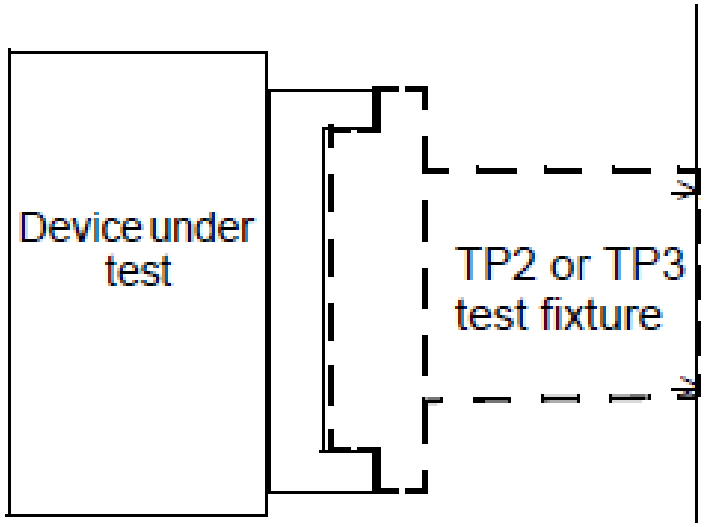
Replace equation (92-32) TBD with $\sigma_{x,ca} \le \begin{cases} 8 & 4 \le IL \le 10.4 \\ 12.1-0.393*IL & 10.4 < IL \le 22.64 \end{cases}$ (mV)

Test Fixture comments

- TP2 or TP3 – Test fixture
  - 92.8.3.6 – Test fixture impedance
    - (92.10.9.2) Mated test fixtures return loss #279 - slide#12
  - 92.8.3.7 - Test fixture insertion loss
    - Reference test fixture printed circuit board insertion loss #288 - slide#9
  - 92.10.9 Mated test fixtures
  - 92.10.9.1 Mated test fixtures insertion loss #278 – slide#11
  - 92.10.9.2 Mated test fixtures return loss #279 – slide#12
  - 92.10.9.3 Mated test fixtures common-mode return loss #280 – slide#15
  - 92.10.9.4 Mated test fixtures common-mode conversion loss #281 - slide#13
  - 92.10.9.5 Mated test fixtures integrated crosstalk noise #282 - slide#16

92.8.3.7 – TP2 or TP3 Reference test fixture PCB IL



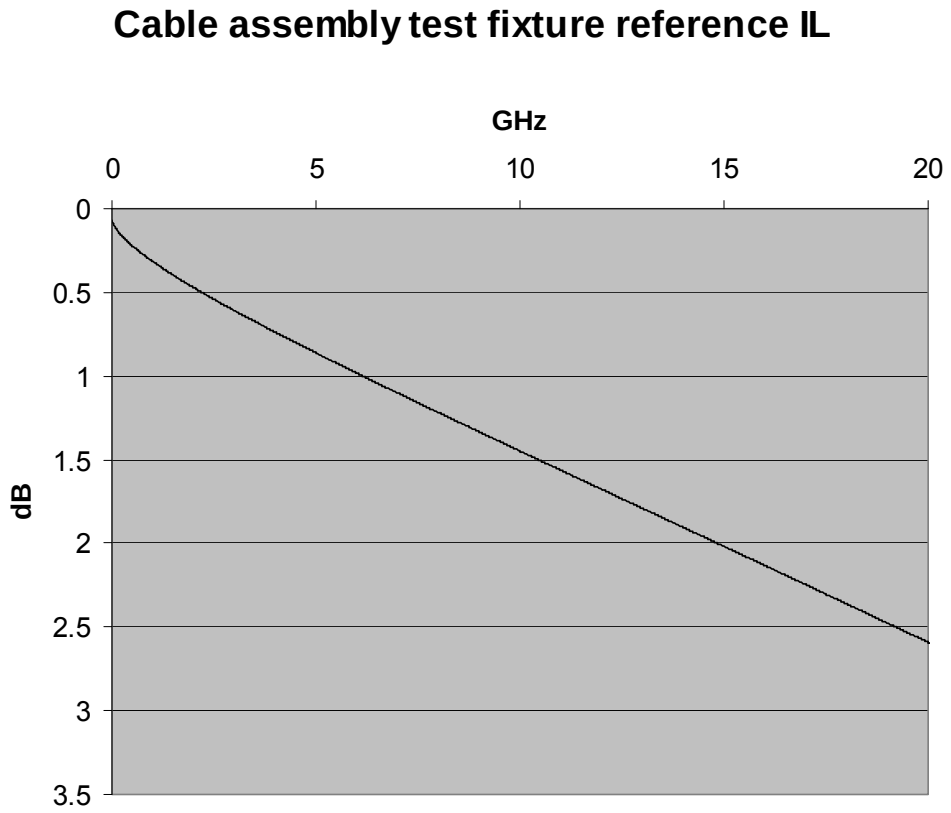


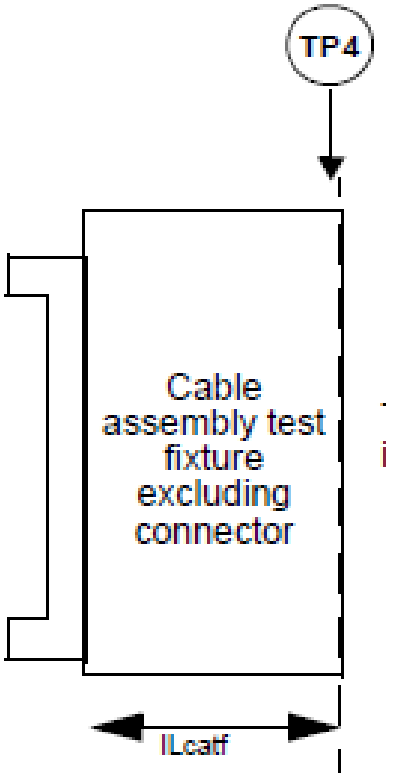
$IL_{tref}(f) = 0.086+0.331*\sqrt{f}+0.138*f+0.002*f^2$ dB 0.01 ≤ f ≤ 20 GHz

$IL_{tref}(12.89) = 3.39$ dB 12.89 GHz

$IL_{tref}(14) = 3.65$ dB 14 GHz

92.10.8 Cable assembly test fixture reference PCB IL



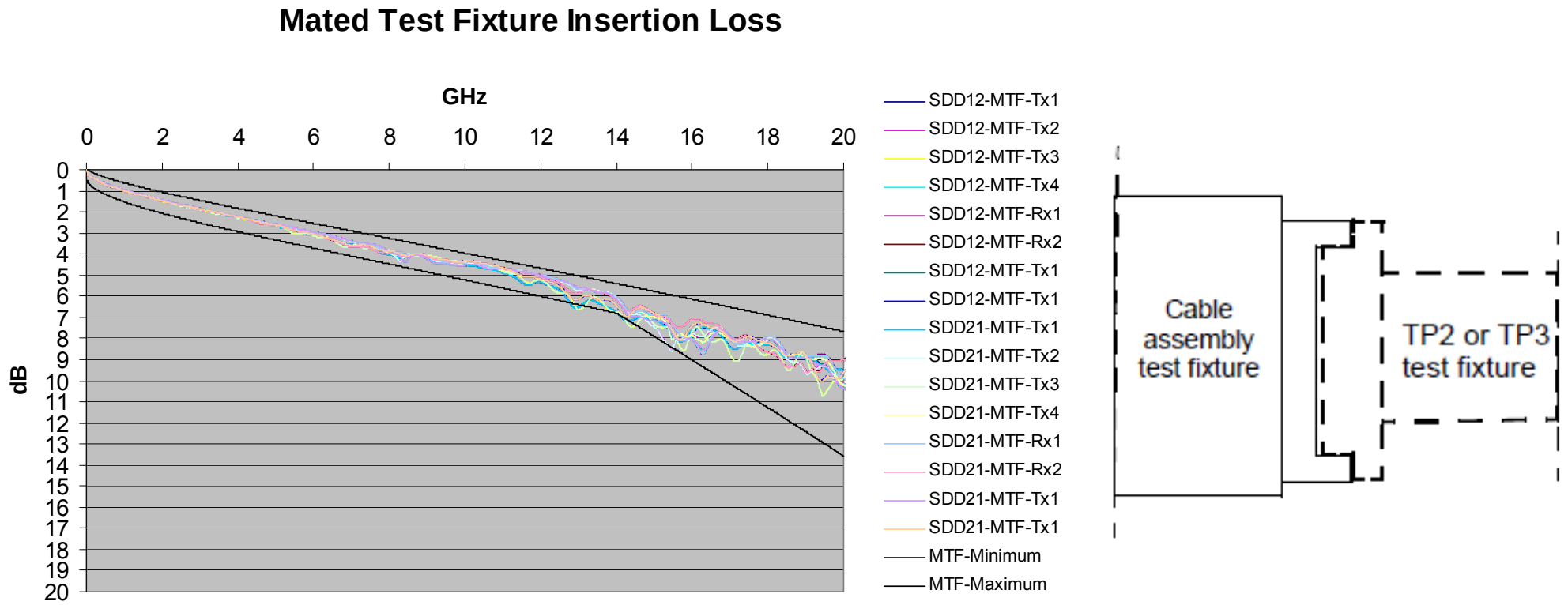


$L_{catf}(f) = 0.048+0.193*\sqrt{f}+0.074f+0.0005*f^2$ dB 0.01 ≤ f ≤ 20 GHz

$IL_{catf}(12.89) = 1.78$ dB 12.89 GHz

$IL_{catf}(14) = 1.90$ dB 14 GHz

92.10.9.1 Mated test fixtures insertion loss



Minimum $IL_{MTFmin}(f) = -0.116 + 0.524*\sqrt{f} + 0.212*f + 0.003*f^2$ dB $0.01 \le f < 20$ GHz

$IL_{MTFmin}(12.89) = 5.00$ dB 12.89 GHz

$IL_{MTFmin}(14) = 5.40$ dB 14 GHz

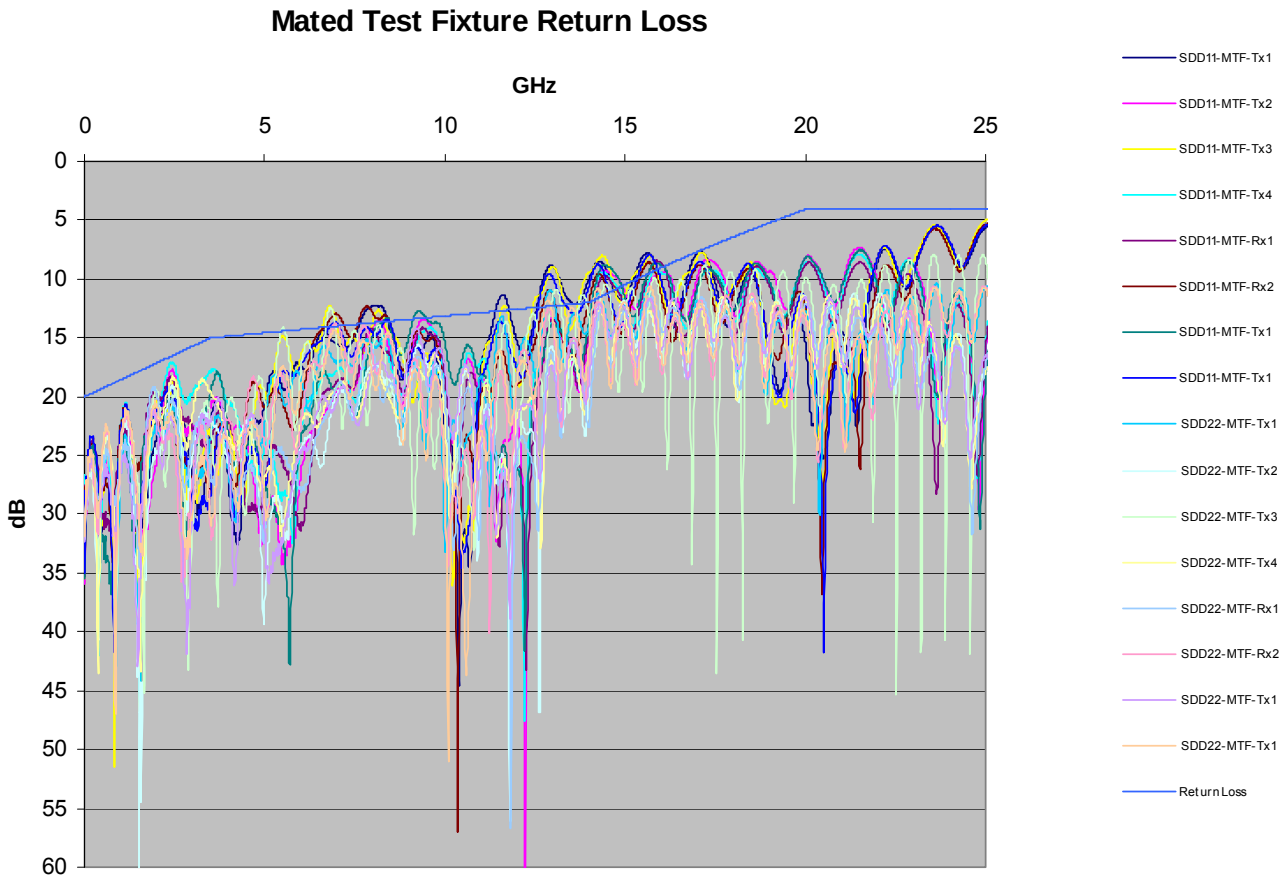
Maximum $IL_{MTFmax}(f) = 0.393 + 1.024*\sqrt{f} + 0.100f + 0.006*f^2$ dB $0.01 \le f < 14$ GHz

$IL_{MTFmax}(f) = -9.412 + 1.024*\sqrt{f} + 0.800f + 0.006*f^2$ dB $14 \le f \le 20$ GHz

$IL_{MTFmax}(12.89) = 6.36$ dB 12.89 GHz

$IL_{MTFmax}(14) = 6.80$ dB 14 GHz

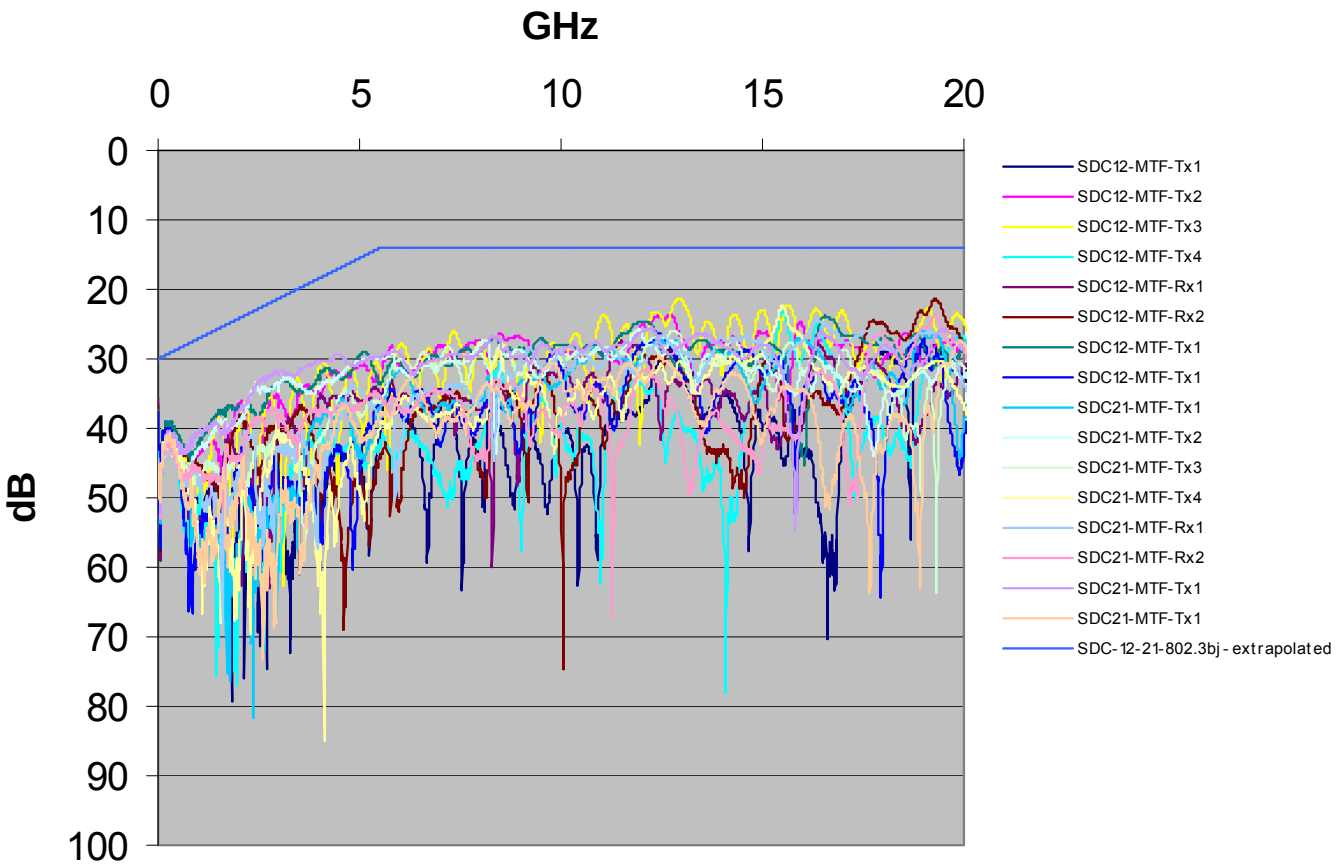
92.10.9.2 Mated test fixtures return loss



ReturnLoss(f)≥	20 - 1.429*f	0.01 ≤ f < 3.5 GHz
	16 - 0.286*f	3.5 ≤ f < 14.0 GHz
	$12 - 51.1 \cdot \log(f/14)$	14.0 ≤ f < 20.0 GHz
	4	20.0 ≤ f ≤ 25.0 GHz

92.10.9.4 Mated test fixtures common-mode conversion loss

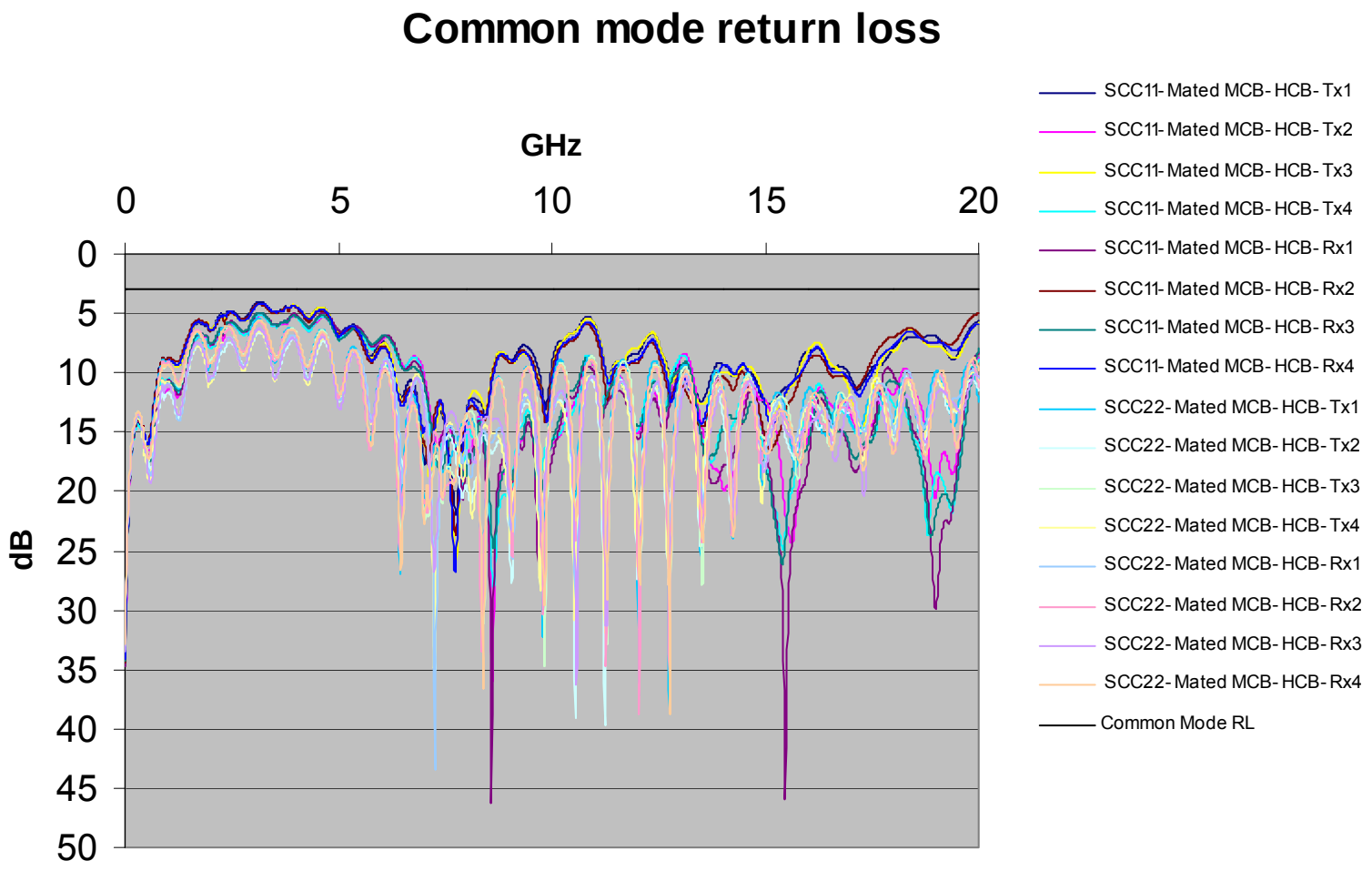
Mated test fixture conversion loss



Conversion_Loss(f)≥ 30 – 2.91*f 0.01 ≤ f < 5.5 GHz

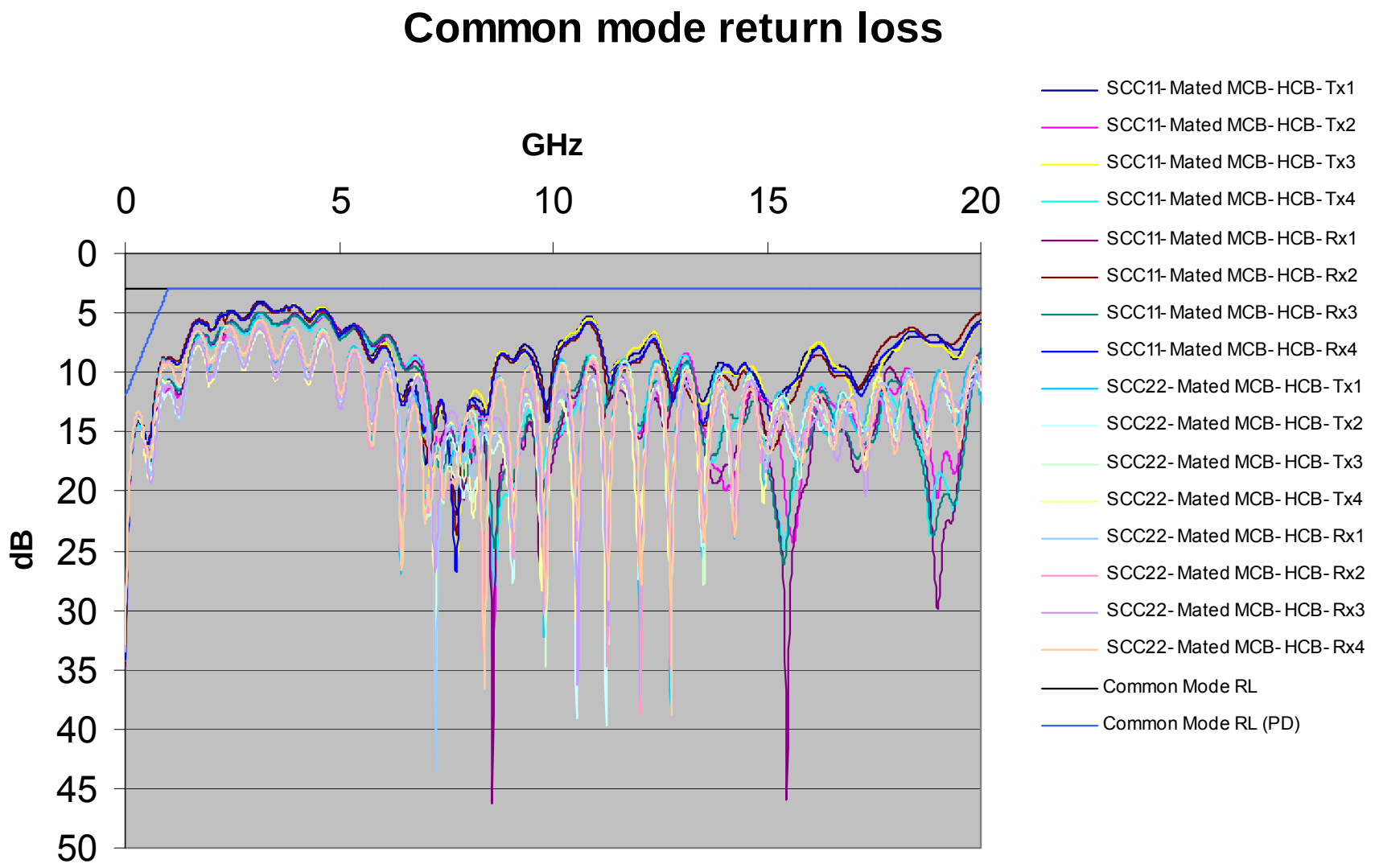
14 5.5 ≤ f ≤ 20 GHz

92.10.9.3 Mated test fixtures common-mode return loss



Return_Loss(f)≥ 3 dB 0.01 ≤ f ≤ 20 GHz

92.10.9.3 Mated test fixtures common-mode return loss



$$\text{ReturnLoss}(f) \geq \begin{cases} 12 - 9f & 0.01 \leq f < 1.0 \text{ GHz} \\ 3 & 1.0 \leq f \leq 20.0 \text{ GHz} \end{cases}$$

92.10.9.5 Mated test fixtures integrated crosstalk noise

Mated test fixture ICN (based on SMT)

MDFEXT (RMS) 3.5 mV

MDNEXT (RMS) 1.0 mV

Description	Symbol	Value	Units
Symbol rate	f_b	25.78125	GBd
Near-end disturber peak differential output amplitude	A_{nt}	600	mV
Far-end disturber peak differential output amplitude	A_{ft}	600	mV
Near-end disturber 20% to 80% rise and fall times	T_{nt}	9.6	ps
Far-end disturber 20% to 80% rise and fall times	T_{ft}	9.6	ps

, f_r is the 3 dB reference receiver bandwidth, which is set to 20 GHz.

92A Channel

#289 92A.5 Channel insertion loss
The channel insertion loss between TP0 and TP5 representative of a 0.5 m cable assembly and a maximum host channel is determined using Equation (92A–4)

Add equation for min IL cable assembly (0.5 m) = 8 dB @ 12.8906 GHz Under 92.10.2 Cable assembly insertion loss

$= a_1\sqrt{f} + a_2 f + a_4 f^2$ (dB) **a1=0.7, a2=0.3, a4=0.01**

Channel IL @ 12.8906 GHz =8 dB+(2*10 dB)-(2*3.82 dB) = 20.36 dB
Change Equation (92A-4) – remove TBD change ILcamax to ILcamin use min IL cable assembly (0.5m)

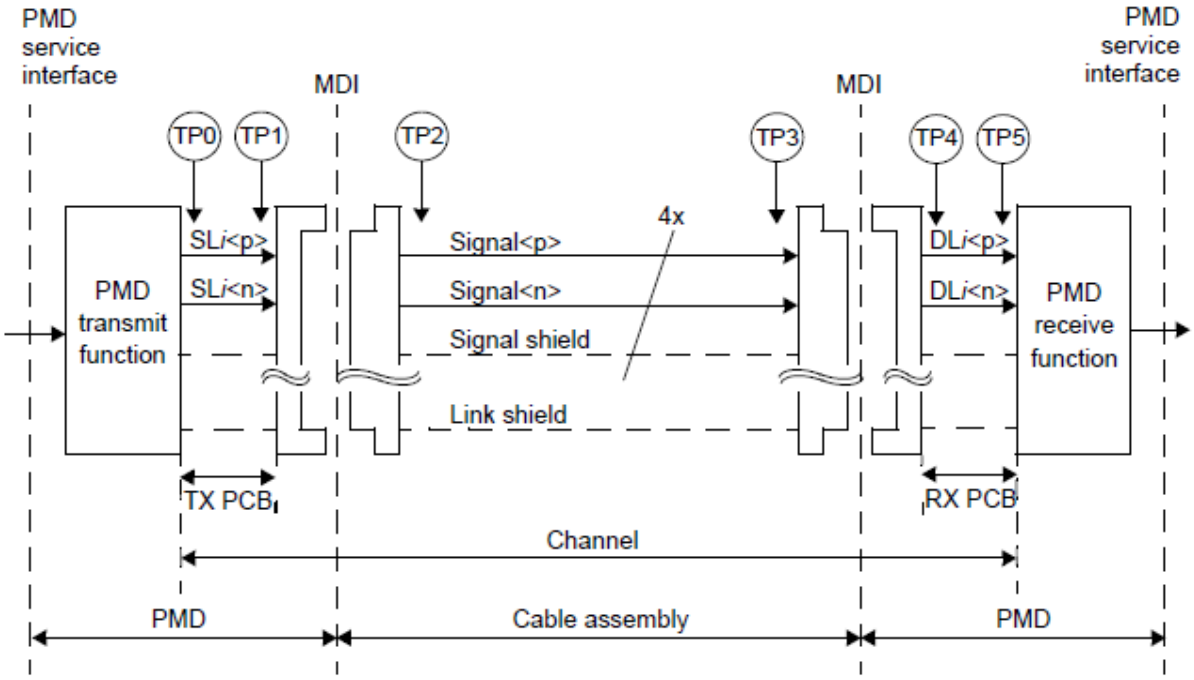
$$IL_{Ch0.5m}(f) = TBD \times IL_{Camax}(f) + 2IL_{Host}(f) - 2IL_{MatedTF}(f) \text{ (dB)} \qquad (92A\text{–}4)$$

92A Channel

#276 92A.8 Channel integrated crosstalk noise (ICN) Equation (92A–6) , Figure 92A–2

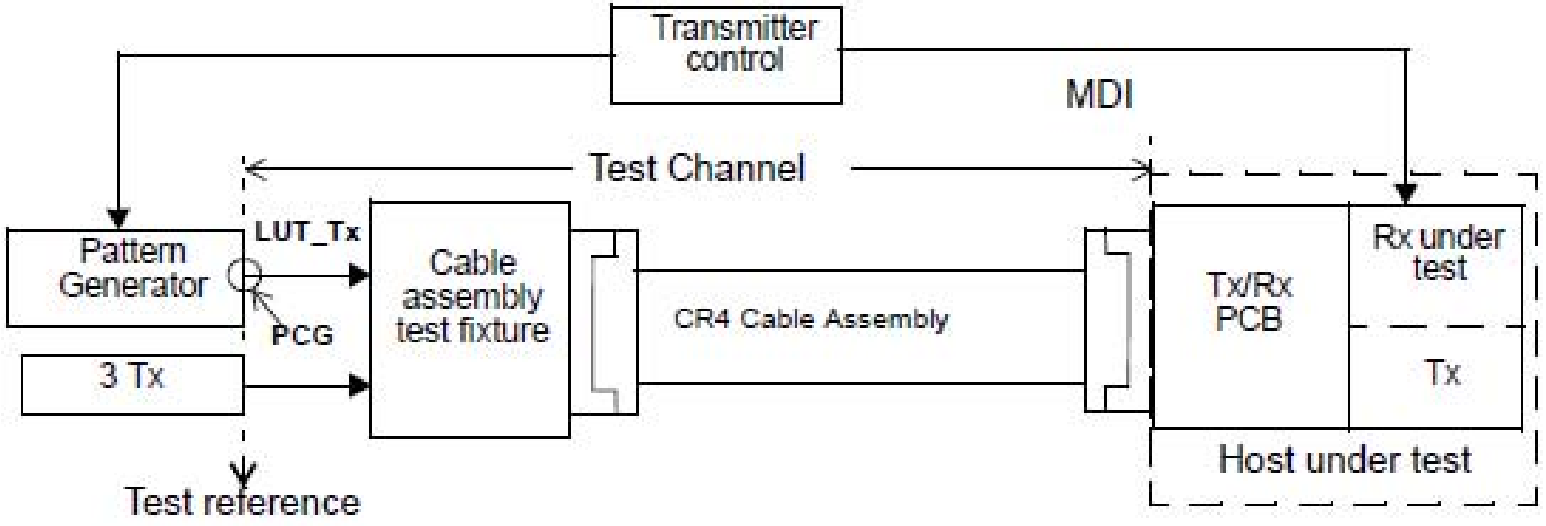
Backup

Rx interference tolerance test Channel TP0-TP4

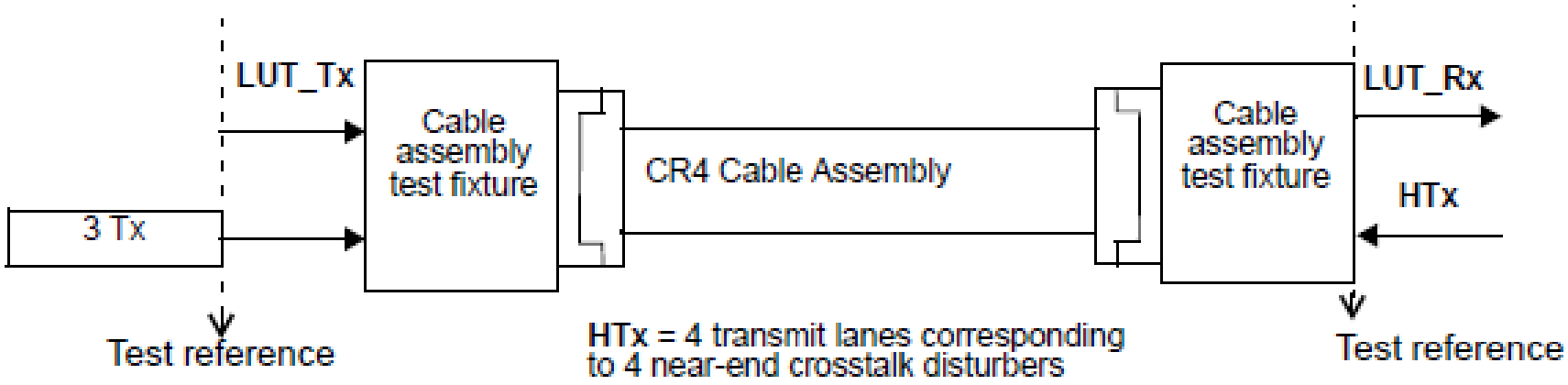


Test points	Description
TP0 to TP5	The 100GBASE-CR4 channel including the transmitter and receiver differential controlled impedance printed circuit board insertion loss and the cable assembly insertion loss.
TP1 to TP4	All cable assembly measurements are to be made between TP1 and TP4 as illustrated in Figure 92–2. The cable assembly test fixture of Figure 92–12 or its equivalent, is required for measuring the cable assembly specifications in 92.10 at TP1 and TP4.
TP0 to TP1 TP4 to TP5	A mated connector pair has been included in both the transmitter and receiver specifications defined in 92.8.3 and 92.8.4. The maximum insertion loss from TP0 to TP2 or TP3 to TP5 including the test fixture is specified in 92.8.3.4.
TP2	Unless specified otherwise, all transmitter measurements and tests defined in Table 92–5 are made at TP2 utilizing the test fixture specified in 92.8.3.5.
TP3	Unless specified otherwise, all receiver measurements and tests defined in 92.8.4 are made at TP3 utilizing the test fixture specified in 92.8.3.5.

Rx Interference tolerance test

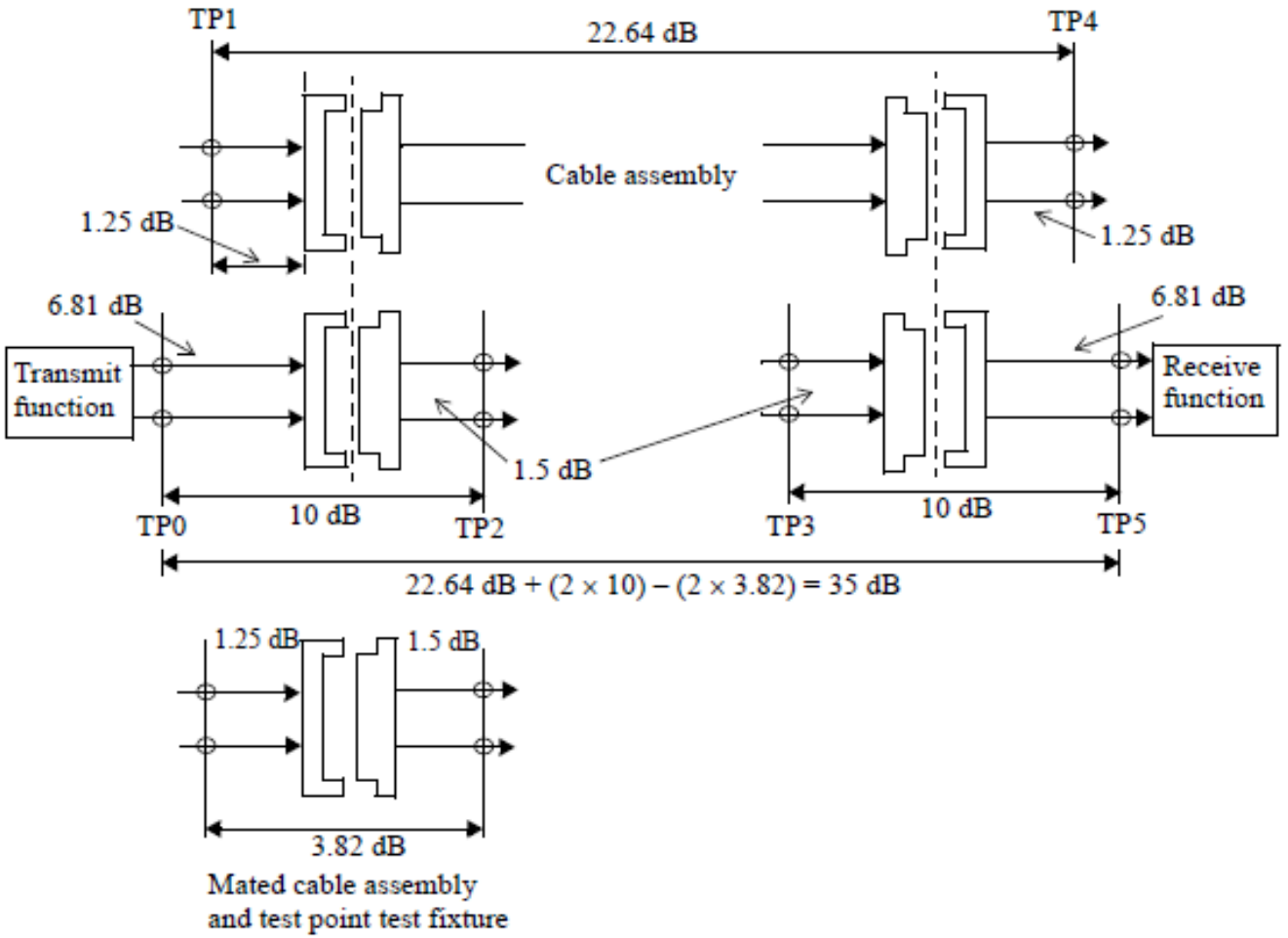


Rx Interference tolerance test setup



Rx Interference tolerance test calibration

92A.5 Channel insertion loss (to be updated)



NOTE—The connector insertion loss is 1.07 dB for the mated test fixture. The host connector is allocated 0.62 dB of additional margin.

Figure 92A–1—35 dB channel insertion loss budget at 12.8906 GHz