# CR4 and CR10 TP2 Specifications

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# Supporters

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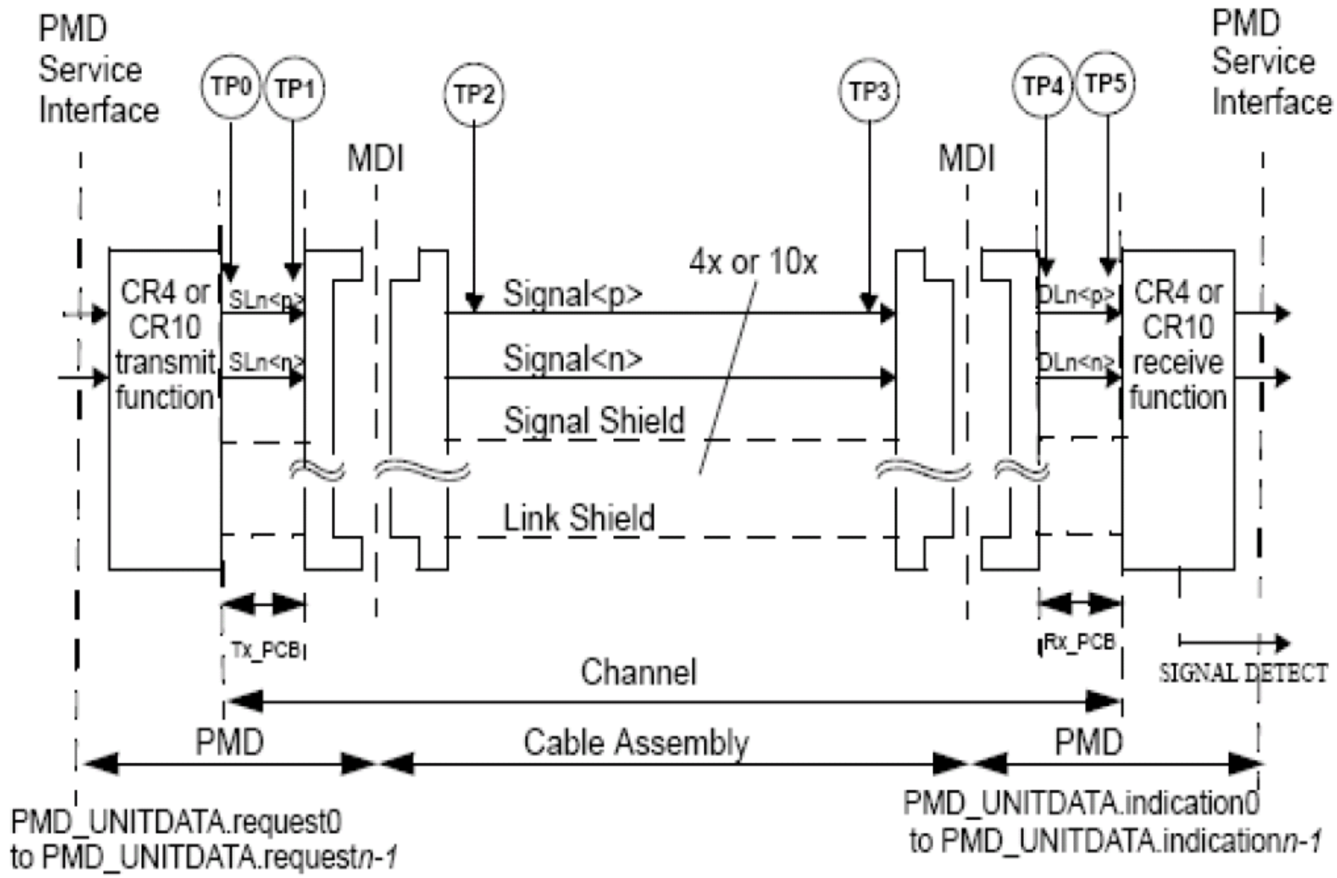
# Test Points for Clause 85



# Existing Informative TP2 Specifications

**Table 85–5—Transmitter characteristics'at TP2 summary**

| Parameter | Value | Units |
|---|---|---|
| Maximum total jitter[a] | 0.36 | UI p-to-p |
| minimum KR transmit waveform "$v_2$" [b] | 267 | mV |
| QSQ[c] | 55.6 | |
| Vertical eye opening[d] | 340 | mV p-to-p |

[a]Measurement procedure is similar to TP0, with all TX lanes active and de-emphasis adjusted optimally.
[b]The test pattern for the transmitter output waveform is the square wave test pattern defined in 52.9.1.2, with a run of at least eight consecutive ones. Measurement procedure is similar to TP0, with same de-emphasis setting as total jitter measurement.
[c]The lane under test shall transmit square wave pattern defined in 52.9.1.2, with a run of at least eight consecutive ones, while other lanes shall transmit PRBS31. The value of the standard deviation of the sampled waveform at the center of the measurement window for v2 shall be measured as rn. QSQ is defined as (v2/rn); "20*log10(QSQ)" can be interpreted as SNR in "dB".
[d]Informative parameter; jitter is specified at BER $10^{-12}$.

- Not sufficient to ensure signal measured will propagate successfully to TP5 and be recovered.

# KR and CR

- Moving TP0 Specs to TP2
  - SDD21 effective is measurable, ILTP2(f)
  - Many Tx specification are not directly observable too much of the Channel in the way
    - Apply equalizations to TP2 measured data to recover signal back to a perhaps fictitious point RP0, before any loss or dispersion due to the IC, package, PCB, connector, or the test fixture.
  - Measure the waveform, RJ and DJ at RP0

# TP2 Specifications 1/3

- Table 85.5.Transmitter characteristics at TP2

| Parameter | Units | Value | | Notes |
|---|---|---|---|---|
| | | Max | Min | |
| Signaling Speed | GBd | 10.3135 | 10.3115 | |
| Unit Interval | ps | | | Place holder |
| Common Mode Voltage | V | 1.9 | 0 | |
| Differential Output Return Loss | dB | See Equation 85.XX | | |
| Peak to peak Amplitude | V | 1200 | | 72.7.1.4 (b) |
| Transmitted waveform | | | | 72.7.1.10 (b) |

# TP2 Specifications 2/3

| Parameter | Units | Value | | Notes |
|---|---|---|---|---|
| | | Max | Min | |
| ILTP2 AN0 | dB | 1.6 | -2.0 | (a) |
| ILTP2 AN1 | dB | 2.5 | 1.25 | (a) Further refinement |
| ILTP2 AN2 | dB | 1.0 | 0 | (a) Further refinement |
| ILTP2 AN4 | dB | 3.5 | 1.0 | (a) Further refinement |
| ILTP2 AN1+AN2 | dB | 3 | 1.5 | (a) Further refinement |
| ILDTP2 | | See Eq. 85.y | | (a) Place holder |
| DJ | UI | 0.15 | | (b) |
| DCD | UI | 0.035 | | (b) |
| RJ | UI | 0.25 | | (b) |
| TJ | UI | .36 | | (b) |
| Return Loss | dB | Eq 72.5 | | Section 72.4 |
| Propagated Noise Short | mVrms | 6*10E(AN0/20) | | (e) |
| Propagated Noise Long | mVrms | 0.6*10E(AN0/20) | | (f) |

# TP2 Specifications 3/3

a) ILTP2=20*(a0+a1*sqrt(f)+a2*f+a4*f^2)/log10 See Section 85.XXX

ANn = 20*an*(datarate/2)^(n/2)/log(10)

b) Measured with effect of ILiTP2 loss mathematically removed from  the signal at TP2 using a software FIR filter that is no more then 6UI long.

c) Jitter is specified at BER 10e-12

d) Duty Cycle Distortion is considered part of the deterministic jitter distribution.

e) Noise data filtered by the short cable transfer function See Section 85.YYY

f) Same data as in note e but with the filter being the long cable.

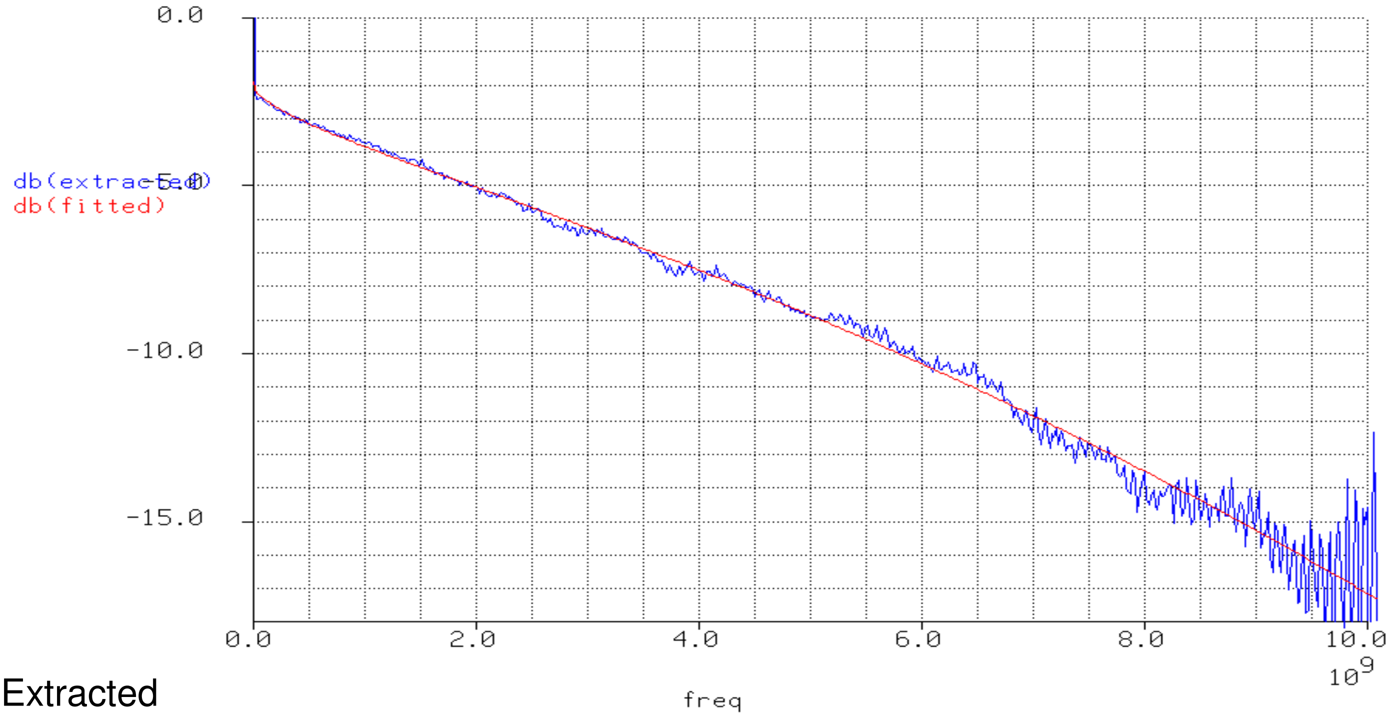
# Method for ILTP2 (Table85-5 note (a) Procedure

- Let IN be the ideal 1Vpp PRBS signal
- Let OUT be the capture TP2 signal
- FIN and FOUT are the complex DFT's of IN and OUT respectively
- XFER=complex ratio FOUT/FIN
- ILiTP2measured=-dB of XFER
- ILTP2 is the LMS fit to ILiTP2 , weighted by the SINC^2 to remove effects of null at $f_{baud}$
  - ILTP2=20*(a0+a1*sqrt(f)+a2*f+a4*f^2)/log10

# Method for Propagated Noise Table 85-5 notes (e and f)

- Measured with transmitter sending through TP2 a PRBS9, and all other transmitters terminated beyond TP2 sending PRBS31. sample at least 1000000 consecutive bits, sampling at least 3 times the data rate. For each bit, select the sample closest to the optimum sampling point for data recovery. For each of the 511 bits in the PRBS pattern, find the average of the near optimum samples. Filter the noise either
  a) The frequency domain by performing a DFT on the noise samples and multiplying the loss function defined in equation 85.x1 for short channel and equation 85.x2 for the long channel
  b) The time domain by convolving the samples with the FIR filter samples given in Table 85.yyy for the short channel or the long channel.

# Raw and Fitted Test Channel 1




Loss Breakdown (dB)

| | |
|---|---|
| PCB | 2 |
| Conn. | 0.5 |
| HCB | 1 |
| Package | 1(model) |
| Tr/Tf | 1.67 |
| Cabling | 0.88* |
| Total | 7.05 |

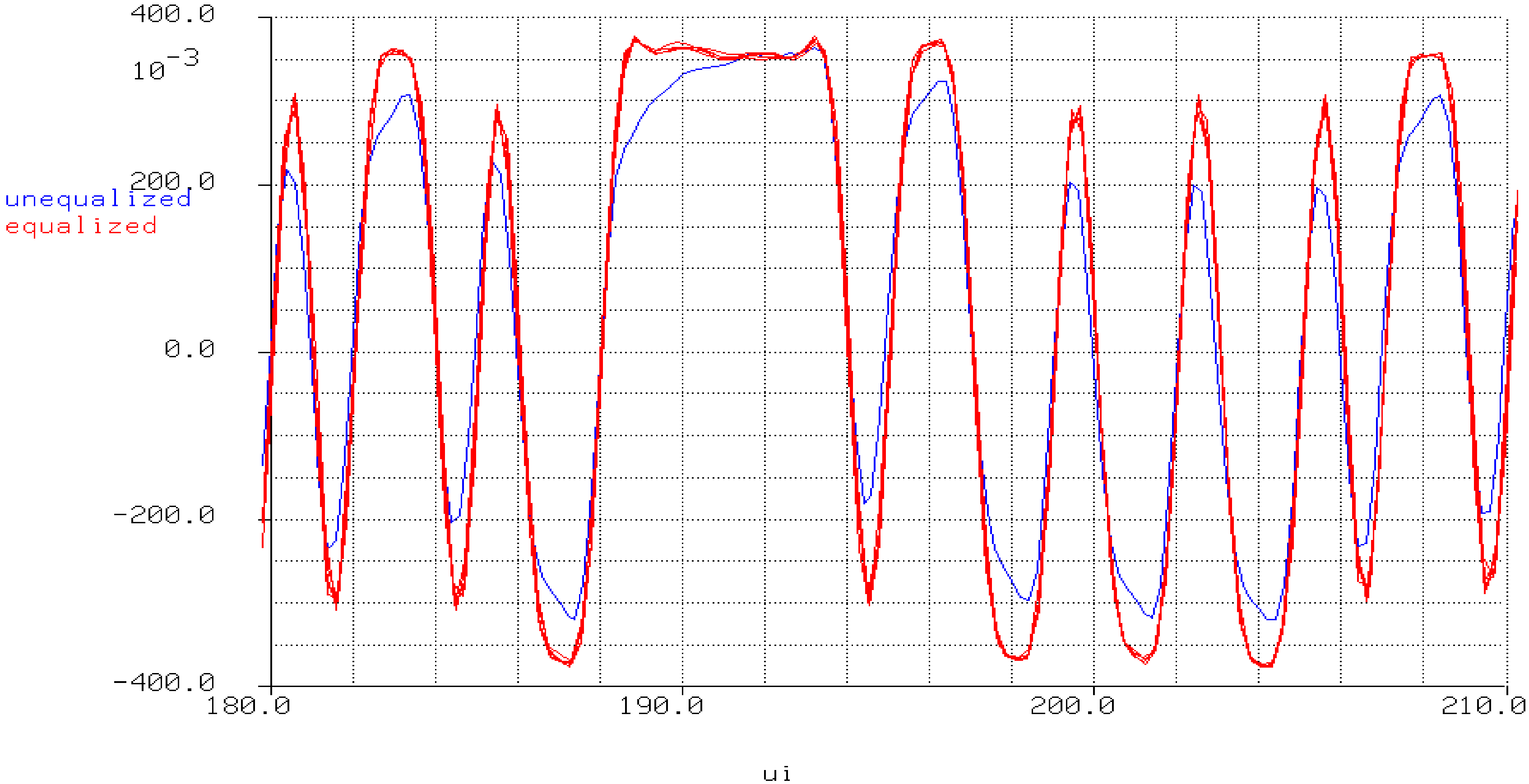
Extracted
DCD : 7mUI p-p
other PJ : 26mUI p-p
RJ : 17mUI RMS
TJ : 276mUI p-p

| | real | imaginary | ANn |
|---|---|---|---|
| a[0]= | -2.2129e-01 | 3.2488e+00 | -1.9221 |
| a[1]= | -5.0368e-06 | -1.5261e-05 | -3.1415 |
| a[2]= | -5.2032e-11 | 1.8501e-10 | -2.3304 |
| a[4]= | -7.2995e-21 | -7.4721e-21 | -1.6857 |

$IL_{TP2}(f)=20*(A_0+A_1(f)^{1/2}+A_2(f)+A_4(f)^2)/\log(10)$

*Note: There is 0.88 instrumentation loss that should be calibrated out.

# Equalized and Raw data from Channel 1



# Benefits Over TWDP

- TP2 specifications only rely on measured TP2 channel with exception of propagated noise.
- Tied directly to the SDD21 loss budget
- Assumes nothing about the Rx other then what KR assumed.
- Assumes nothing about the Tx except what KR assumed.

# TP2 to TP5 Noise Propagation

Equations to propagate noise
short channel

loss= 39e-6*sqrt(f)+ 300e-12*f    85-x1

long channel

loss=154e-6*sqrt(f)+1200e-12*f  85-x2

Table 85.yyy

| tap | long channel | short channel |
|---|---|---|
| 0 | 0.0240 | -0.0673 |
| 1 | 0.0071 | 0.2062 |
| 2 | 0.3299 | 0.7307 |
| 3 | 0.2710 | -0.0223 |
| 4 | 0.0805 | 0.0729 |
| 5 | 0.0746 | -0.0205 |
| 6 | 0.0300 | 0.0359 |
| 7 | 0.0378 | -0.0151 |
| 8 | 0.0159 | 0.0235 |
| 9 | 0.0239 | -0.0118 |
| 10 | 0.0099 | 0.0173 |
| 11 | 0.0170 | -0.0097 |
| 12 | 0.0068 | 0.0137 |
| 13 | 0.0129 | -0.0082 |
| 14 | 0.0049 | 0.0113 |
| 15 | 0.0103 | -0.0071 |
| 16 | 0.0037 | 0.0096 |
| 17 | 0.0085 | -0.0063 |
| 18 | 0.0029 | 0.0084 |
| 19 | 0.0072 | -0.0057 |
| 20 | 0.0023 | 0.0074 |
| 21 | 0.0062 | -0.0051 |
| 22 | 0.0019 | 0.0066 |
| 23 | 0.0054 | -0.0047 |
| 24 | 0.0016 | 0.0060 |
| 25 | 0.0048 | -0.0043 |
| 26 | 0.0013 | 0.0055 |
| 27 | 0.0043 | -0.0040 |
| 28 | 0.0011 | 0.0050 |
| 29 | 0.0039 | -0.0037 |