Working document: TDP test draft – rev 1a

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(post meeting)

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Approach for this draft for TDP test

- Follow a similar format to clause 86
  - Reference clause 52 for basic TDP test with exceptions appropriate for 100GBASE-SR4
    - 10 MHz CRU corner bandwidth
    - No transversal filter
    - TDP test Rx has a lower bandwidth, chosen to produce the same eye closure penalty as 100 m OM4
    - Reference transmitter rise/fall times
  - TDP test Rx bandwidth values taken from *Petrilla_01_0113_optx*, amended for 100 m reach
    - Values in magenta are placeholders, and are expected to be updated.

Reminder of TDP test method in clause 86

86.8.4.4 Transmitter and dispersion penalty (TDP)

Transmitter and dispersion penalty (TDP) shall be as defined for 10GBASE-S in 52.9.10 with the following exceptions:

a) Each optical lane is tested individually with all other lanes in operation.
b) The test pattern is as defined in Table 86–12.
c) The transmitter is tested using an optical channel with an optical return loss of 12 dB.
d) The reference receiver (including the effect of the decision circuit) has a fourth order Bessel-Thomson filter response with a bandwidth of 6.1 GHz. The transversal filter of 52.9.10.3 is not used.
e) The reference sensitivity S and the measurement P_DUT are both measured with the sampling instant displaced from the eye center by ± 0.15 UI. For each of the two cases (early and late), if P_DUT(i) is larger than S(i), the TDP(i) for the transmitter under test is the difference between P_DUT(i) and S(i), TDP(i) = P_DUT(i) – S(i). Otherwise, TDP(i) = 0. The TDP is the larger of the two TDP(i).
f) The test setup illustrated in Figure 52-12 shows the reference method. Other measurement implementations may be used with suitable calibration.
g) The BER of 10^{-12} is for the lane under test on its own. See 86.8.2.1 for multi-lane pattern considerations.

NOTE—Because practical receivers and decision circuits have noise and timing impairments, the sampling instant offsets have to be calibrated. One method of doing this is via a jitter bathtub method using a known low-jitter signal.

Text in clause 95, (802.3bm D1p0)

95.8.5 Transmitter and dispersion penalty (TDP)

Transmitter and dispersion penalty (TDP) shall be as defined in TBD with the following exceptions:

a) Each optical lane is tested individually with all other lanes in operation.

b) The test pattern is as defined in Table 95–10

c) The transmitter is tested using an optical channel with an optical return loss of 12 dB.

d) The reference receiver (including the effect of the decision circuit) has a fourth-order Bessel-Thomson filter response with a bandwidth of TBD Hz. The transversal filter of 52.9.10.3 is not used.

e) The clock recovery unit (CRU) used in the TDP measurement has a corner frequency of 10 MHz and a slope of 20 dB/decade.

f) The reference sensitivity S and the measurement P_DUT are both measured with the sampling instant displaced from the eye center by ± 0.15 UI. For each of the two cases (early and late), if P_DUT(i) is larger than S(i), the TDP(i) for the transmitter under test is the difference between P_DUT(i) and S(i), TDP(i) = P_DUT(i) – S(i). Otherwise, TDP(i) = 0. The TDP is the larger of the two TDP(i).

g) The test setup illustrated in Figure 52-12 shows the reference method. Other measurement implementations may be used with suitable calibration.

h) TDP is defined for each lane, at the BER specified in Table 95.1.1 and is for the lane under test on its own. See 95.8.1.1 for multi-lane pattern considerations.

NOTE—Sampling instant offsets have to be calibrated because practical receivers and decision circuits have noise and timing impairments. One method of doing this is via a jitter bathtub method using a known low-jitter signal.

Proposed text for clause 95

95.8.5 Transmitter and dispersion penalty (TDP)

Transmitter and dispersion penalty (TDP) shall be as defined for 10GBASE-S in **52.9.10** with the following exceptions:

a) Each optical lane is tested individually with all other lanes in operation.
b) The test pattern is as defined in Table 95–10.
c) The transmitter is tested using an optical channel with an optical return loss of 12 dB.
d) The reference transmitter rise/fall times should be less than 12 ps at 20% to 80%.
e) The reference receiver (including the effect of the decision circuit) has a fourth-order Bessel-Thomson filter response with a bandwidth of **11.7** GHz. The transversal filter of 52.9.10.3 is not used.
f) The clock recovery unit (CRU) used in the TDP measurement has a corner frequency of 10 MHz and a slope of 20 dB/decade.
g) The reference sensitivity S and the measurement P_DUT are both measured with the sampling instant displaced from the eye center by ± **0.11** UI. For each of the two cases (early and late), if P_DUT(i) is larger than S(i), the TDP(i) for the transmitter under test is the difference between P_DUT(i) and S(i), TDP(i) = P_DUT(i) – S(i). Otherwise, TDP(i) = 0. The TDP is the larger of the two TDP(i).
h) The test setup illustrated in Figure 52-12 shows the reference method. Other measurement implementations may be used with suitable calibration.
i) TDP is defined for each lane, at the BER specified in Table 95.1.1 and is for the lane under test on its own. See 95.8.1.1 for multi-lane pattern considerations.

NOTE—Sampling instant offsets have to be calibrated because practical receivers and decision circuits have noise and timing impairments. One method of doing this is via a jitter bathtub method using a known low-jitter signal.

Further work:

- Agree TDP test receiver bandwidth
  - *(value expected to be updated in petrilla_01_0713_mmf)*
- Agree sampling instant offset

Back-up

Extract from Petrilla_01_0113

100G SR4 with KR4 FEC: Example TDP Test Channel (each lane)

Parameter	Unit	100G SR4	
Signal rate	GBd	25.78125	
Q (BER)		3.8905 (5.0E-5)	FEC corrects BER to < 1.0E-12
Reach	m	2	
Fiber Attenuation	dB/km	0.0	For 850 nm center wavelength
Dispersion min Uo	nm	1316	
Dispersion So	ps/nm^{2}km	0.10275	
Fiber modal bandwidth	MHz·km	2000	
Reflection Noise Factor		0	
Signal power budget at max TDP	dB	11.60	Model output
Fiber Insertion loss	dB	0.00	Model output
Attenuation (aka Connector loss)	dB	6.48	Adjusted to yield zero margin
Rx Bandwidth for TDP	MHz	11656	Adjusted to match Ptot of Ref Ch with106 m of OM4
TDP	dB	5.02	

Attributes and values in the above table provide a summary of the test channel using the TDP filter.

- Rx bandwidth for TDP = 11.7 GHz for 100 m OM4