This document contains proposed changes to clause 86. Deleted text is shown with ~~blue strikethrough~~. Added text is shown with red underline

Change Table 86-6 as below:

Table 86–6—PPI electrical transmit signal output specifications at TP1a

Parameter description	Min	Max	Units	Conditions
Single ended output voltage	–0.3	4	V	Referred to signal common
AC common mode output voltage	–	15	mV	RMS
Differential output reflection coefficient, SDD22	–	See 86.6.1.1	dB	
Common mode output reflection coefficient, SCC22	–	See 86.6.1.2	dB	
~~TP1a Total~~ J9 Jitter output[a]	–	~~0.3~~ 0.26	UI	~~At BER = 10^{-12}~~
~~TP1a Deterministic~~ J2 Jitter output[b]	–	~~TBD~~ 0.18	UI	
Data Dependent Pulse Width Shrinkage (DDPWS)	–	~~TBD~~ 0.07	UI	
	Specification values			
Eye mask coordinates: X1, X2 Y1, Y2	0.12, 0.33 95, 350		UI mV	Hit ratio = 5×10^{-5}

[a] ~~***[Editor's note (to be removed prior to publication) – For further study, intermediate between 10G SFP+ and 8GFC]***~~
~~***[Editor's note (to be removed prior to publication) – Table notes in italic are from the baseline and are not expected to appear in the final draft]***~~

[b] ~~***[Editor's note (to be removed prior to publication) – proposals have been made to replace Deterministic Jitter with Data Dependent Jitter or 99% jitter. A value of 0.15 UI has been proposed for Dual Dirac Deterministic Jitter.]***~~

Change Table 86-7 as below:

Table 86–7—PPI electrical transmit signal input specifications at TP1a

Parameter description	Min	Max	Units	Conditions
Single ended input voltage tolerance	–0.3	4.0	V	Referred to TP1 signal common
AC common mode input voltage tolerance	15	–	mV	RMS
Differential input reflection coefficient, SDD11, at TP1	–	See 86.6.1.1	dB	10 MHz to 11.1 GHz
Reflected differential to common mode conversion, SCD11, at TP1	–	–10	dB	10 MHz to 11.1 GHz
~~Total~~ J9 Jitter tolerance ~~at~~[a]	~~0.3~~ 0.26	–	UI	~~At BER = 10^{-12}~~
~~Deterministic~~ J2 Jitter tolerance	~~TBD~~ 0.18	–	UI	
Data Dependent Pulse Width Shrinkage (DDPWS)	~~TBD~~ 0.07	–	UI	
	Specification values			
Eye mask coordinates: X1, X2 Y1, Y2	0.12, 0.33 95, 350		UI mV	Hit ratio = 5×10^{-5}

~~[a] ***[Editor's note (to be removed prior to publication)*** *For further study, intermediate between 10G SFP+ and 8GFC]*~~

~~***[Editor's note (to be removed prior to publication) – the following is from the baseline: presentation to progress this requested.***~~
~~*All values are provisional, shown for example, and will benefit from additional study. As requirements for 100 m MMF and 10 m Cu are harmonized, DJ jitter tolerance may be relaxed and the maximum input signal amplitude tolerance increased depending on the maximum supported PCB trace length. Alternatively, the ASIC could generate different signal amplitudes for copper and fiber.]***~~

Change Table 86-8 as below:

Table 86–8—40GBASE–SR4 and 100GBASE–SR10 optical transmit characteristics

Description	Type	Value	Unit
Center wavelength	Range	840 to 860	nm
RMS spectral width[a]	Max	0.65	nm
Average launch power, each lane[b]	Max	1[c]	dBm
Average launch power, each lane	Min	~~TBD~~ –8	dBm
Optical Modulation Amplitude (OMA), each lane	Max	3	dBm
Optical Modulation Amplitude (OMA), each lane	Min	~~–3~~[c d] –6[b]	dBm
Peak power, each lane	Max	4	dBm
~~Aggregate signal parameter TBD[e], each lane~~ Launch power per lane in OMA minus TDP[f]	~~TBD~~ Min	~~TBD~~ –7	dBm
Transmitter and dispersion penalty, each lane	Max	4	dB
Extinction ratio	Min	3	dB
$RIN_{12}OMA$	Max	–128[c d]	dB/Hz
Optical return loss tolerance	Max	12	dB
Encircled flux		> 86% at 19 μm, < 30% at 4.5 μm[e]	
Transmitter eye mask definition {X1, X2, X3, Y1, Y2, Y3}	Spec values	0.25, 0.4, 0.45, 0.25, 0.28, 0.4[g]	
Average launch power of OFF transmitter, each lane	Max	–30	dBm

[a] RMS spectral width is the standard deviation of the spectrum

[b] ~~***[Editor's note (to be removed prior to publication)** - Reference see presentation on eye safety by J. Petrilla at March 2008 meeting, petrilla_02_0308]~~Even if the TDP < 1 dB, the OMA (min) must exceed this value.

~~***[Editor's note (to be removed prior to publication)** - A possible peak power specification or a maximum OMA limit is under consideration for 40/100GBASE-SR]*~~

[c] ~~***[Editor's note (to be removed prior to publication)** - Subject to further study]*~~

[d] ~~***[Editor's note (to be removed prior to publication)** - To be made informative if aggregate signal parameter includes the effect]*~~

[e] ~~***[Editor's note (to be removed prior to publication)** - For further study, e.g. TDP, TWDP, etc.]*~~

[f] TDP is transmitter and dispersion penalty, see 86.7.5.4.

[g] ***[Editor's note (to be removed prior to publication)** - The numbers are provisional]*

Change Table 86-9 as below:

Table 86–9—Characteristics of signal within, and at the receiving end of, a compliant optical channel (informative)

Description	Minimum[a]	Maximum	Unit
Total average power for 40GBASE–SR4	–3.9 ~~–1.9~~	+7	dBm
Total average power for 100GBASE–SR10	+0.1 ~~+2.1~~	+11	dBm
Average power, each lane	–9.9 ~~–7.9~~	+1.0	dBm
Optical Modulation Amplitude (OMA), each lane	–7.9 ~~–4.9~~	+3 ~~+4.0~~	dBm

[a] ~~***[Editor's note (to be removed prior to publication)** Minimum values are subject to further study]***

Change Table 86-10 as below:

.

Table 86–10—40GBASE–SR4 and 100GBASE–SR10 optical receiver characteristics

Description	Type	Value	Unit
Center wavelength, each lane	Range	840 to 860	nm
Damage threshold[a]	Min	+2	dBm
Average power at receiver input, each lane	Max	+1[b]	dBm
	Min	–9.9 ~~–7.9~~ [b c]	dBm
Receiver reflectance	Max	–12	dB
Stressed receiver sensitivity in OMA, each lane[d] [e]	Max	TBD	dBm
Conditions of stressed receiver sensitivity test:			
Vertical eye closure penalty[f], each lane	–	TBD	dB
Stressed eye J2 jitter ~~J~~[g], each lane	–	TBD	UI
Stressed eye J9 jitter[g], each lane	–	TBD	UI

[a] The receiver shall be able to tolerate, without damage, continuous exposure to a modulated optical input signal having this power level on one lane. The receiver does not have to operate correctly at this input power. ~~***[Editor's note (to be removed prior to publication) – 1 dB above average receive power maximum, to allow headroom for receiver testing.]***~~

[b] ~~***[Editor's note (to be removed prior to publication) – For further study]***~~

[c] ~~***[Editor's note (to be removed prior to publication) – Depends on connector loss]***~~

[d] Measured with conformance test signal at TP3 (see 86.7.5.9) for BER = 10^{-12}.

[e] ~~***[Editor's note (to be removed prior to publication) – Values of -5.4 dBm for Stressed receiver sensitivity in OMA, 1.67 dB for Vertical eye closure penalty and 0.37 UI Stressed eye jitter J9 have been proposed. Further information is invited.]***~~

[f] Vertical eye closure penalty is a test condition for measuring stressed receiver sensitivity. It is not a required characteristic of the receiver.

[g] Stressed eye jitter is a test condition for measuring stressed receiver sensitivity. It is not a required characteristic of the receiver.

Change Table 86-11 as below:

,

Table 86–11—PPI receiver electrical output specifications at TP4

Parameter description	Min	Max	Units	Conditions
Single ended output voltage	–0.3	4.0	V	Referred to signal common
AC common mode output voltage (RMS)	–	7.5	mV	
Termination mismatch at 1 MHz	–	5	%	
Differential output reflection coefficient, SDD22	–	See 86.6.5.1	dB	10 MHz to 11.1 GHz
Common mode output reflection coefficient, SCC22	–	See 86.6.1.2	dB	10 MHz to 11.1 GHz
Output transition time, 20% to 80%	28	–	ps	
~~Total~~ J9 Jitter output ~~at TP4~~	–	~~0.70~~[a] 0.63	UI	~~At BER = 10^{-12}~~
~~Deterministic~~ J2 Jitter output ~~at TP4 (pk-pk)~~	–	~~0.40~~[a] 0.46	UI	
	Specification values			
Eye mask coordinates: X1, X2 Y1, Y2	~~0.35~~ 0.29, 0.5 150, 425		UI mV	Hit ratio = 5×10^{-5} See 86.7.4.5

[a] ~~***[Editor's note (to be removed prior to publication)*** *For further study, intermediate between 10G SFP+ and 8GFC. A proposal has been made to reduce the "Total Jitter output at TP4" in Table 86–11 to 0.65 UI. Supporting evidence for this would be required.***]***~~

Change Table 86-12 as below:

Table 86–12—PPI receiver electrical input specifications at TP4a

Parameter description	Min	Max	Units	Conditions
Single ended input voltage tolerance	–0.3	4.0	V	Referred to TP4 signal common
~~Total~~ J9 Jitter tolerance	~~0.7[a]~~ 0.63	–	UI	
~~Deterministic~~ J2 Jitter tolerance[b]	~~0.4~~ 0.46	–	UI	
Differential input reflection coefficient, SDD11	–	See 86.6.5.1	dB	
Reflected differential to common mode conversion, SCD11	–	–10	dB	10 MHz to 11.1 GHz
	Specification values			
Eye mask coordinates: X1, X2 Y1, Y2	~~0.35~~ 0.29, 0.5 150, 425		UI mV	Hit ratio = 5×10^{-5} See 86.7.4.5~~See 86.7.3.2~~

~~[a] [Editor's note (to be removed prior to publication) – For further study, intermediate between 10G SFP+ and 8GFC]~~
~~[b] [Editor's note (to be removed prior to publication) – Proposals have been made to replace Deterministic Jitter with 99% jitter.]~~

~~[Editor's note (to be removed prior to publication) – the following is per the baseline: presentation to progress the specifications requested: All values are provisional, shown for example, and will benefit from additional study.]~~

Change Table 86-13 as below:

Table 86–13—40GBASE–SR4 and 40GBASE–SR10 link power budget (informative)

Parameter	Value	Unit
Effective modal bandwidth at 850 nm	2000[a]	MHz•km
Power budget (for max TDP)	8.3[b]	dB
Operating distance	0.5 to 100	m
Channel insertion loss[c]	1.9[d]	dB
Allocation for penalties (for max TDP)[e]	6.4	dB
Additional insertion loss allowed	0	dB

[a] Per IEC 60793-2-10

[b] ~~***[Editor's note (to be removed prior to publication) - *For further study*]***~~

[c] The channel insertion loss is calculated using the maximum distance specified in Table 86–1 and fiber attenuation of 3.5 dB/km at 850 nm plus an allocation for connection and splice loss given in 86.10.2.2.1.

[d] ~~***[Editor's note (to be removed prior to publication) - *Connector loss under study*]***~~

[e] Link penalties are used for link budget calculations. They are not requirements and are not meant to be tested.

Replace clause 86.7.3.1 with the following:

86.7.3.1 Total Skew and Dynamic Skew

Total Skew and Dynamic Skew are defined in 82.2.12. The measurement of Total Skew and Dynamic Skew is made by acquiring the data on each lane using a clock and data recovery unit with a high frequency corner bandwidth as specified in Table 86–17 and a slope of –20 dB/decade. The arrival times of the one to zero transition of the alignment marker sync bits on each lane are then compared. This arrangement ensures that any high frequency jitter that is present on the signals is not included in the skew measurement.

Insert a new clause 86.7.3.3 as below:

86.7.3.3 Jitter

86.7.3.3.1 J2 Jitter

J2 Jitter is defined as the time interval that includes all but 10^{-2} of the jitter distribution. If measured using an oscilloscope, it is the time interval from the 0.5th to the 99.5th percentile of the jitter histogram. Histograms should include at least 10 000 hits, and should be taken over about 1% of the signal amplitude.

86.7.3.3.2 J9 Jitter

J9 Jitter is defined as the time interval that includes all but 10^{-9} of the jitter distribution. If measured by plotting BER vs. decision time, it is the time interval between the two points with a BER of 2.5×10^{-10}.

Replace clause 86.7.4.4 with the following:

86.7.4.4 Jitter

86.7.4.4.1 Data Dependent Pulse Width Shrinkage (DDPWS)

An oscilloscope, time interval analyzer, or other instrument with equivalent capability may be used to measure DDPWS. A repeating PRBS9 pseudo-random test pattern, 511 bits long, is used. For electrical jitter measurements, the measurement bandwidth is 12 GHz. If the measurement bandwidth affects the result, it can be corrected for by post-processing. However, a bandwidth above 12 GHz is expected to have little effect on the results.

The crossing level is the average value of the entire waveform being measured. The instrument is synchronized to the pattern repetition frequency and the waveforms or the crossing times are averaged sufficiently to remove the effects of random jitter and noise in the system. The PRBS9 pattern has 128 positive-going transitions and 128 negative-going transitions. The crossing times t_1 to t_{256} of each transition of the averaged waveform (when the averaged waveform crosses the crossing level) are found as shown in Figure 86–5.

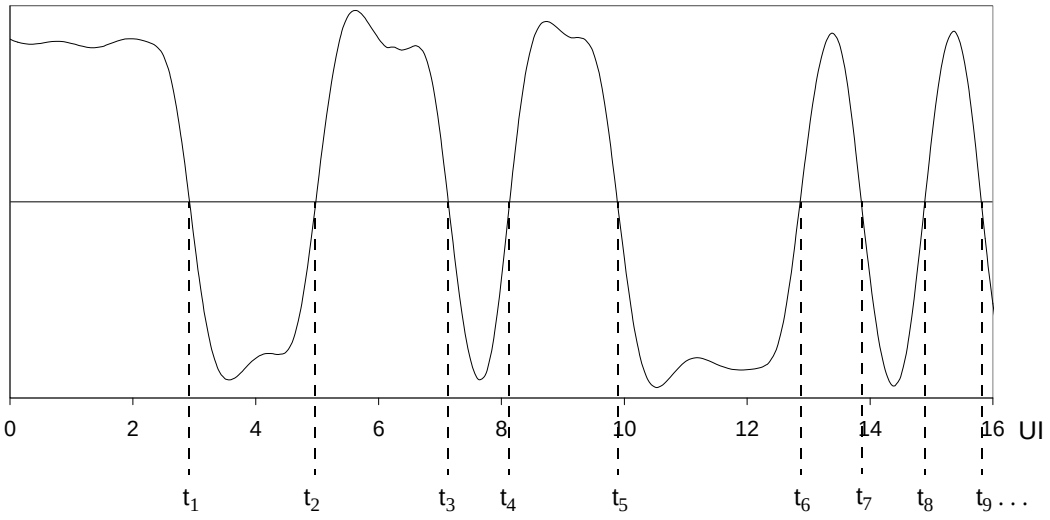

Figure 86–5—Data Dependent Pulse Width Shrinkage test method

The DDPWS is the difference between one symbol period and the minimum of all the differences between pairs of adjacent transitions:

$$DDPWS = T - \min(t_2-t_1,\ t_3-t_2,\ldots..\ t_{256+1}-t_{256}) \quad (86–1)$$

Where T is one symbol period.

Note that the difference from the next transition in the repeating sequence, t_{256+1}, is also considered.

Replace clause 86.7.5.4 "Aggregate TP2 signal metric" with the following

86.7.5.4 Transmitter and dispersion penalty (TDP)

Transmitter and dispersion penalty (TDP) is as defined 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 86–16;
c) the transmitter is tested using an optical channel with an optical return loss of 12 dB;
d) the reference receiver sensitivity S is measured with the sampling instant displaced from the eye center by ± 0.15 UI and the lower S value used;
e) the effect of the transversal filter is realised by a reference receiver / filter combination having a fourth order Bessel-Thomson filter response with a bandwidth of 6.0 GHz;
f) P_DUT is measured with the sampling instant displaced from the eye center by ± 0.15 UI and the larger TDP value is used.

Change clause 86.7.5.7 as below

86.7.5.7 Transmitter optical waveform (transmit eye)

[Editor's notes (to be removed prior to publication) -
~~*An absolute eye mask is being considered as the aggregate signal parameter for 40GBASE-SR4 and 100GBASE-SR10 replacing the relative mask defined in Table 86–8.]*~~
*Details of the transmit eye mask measurement are being studied by the Statistical Eye Ad Hoc and consequently the contents of this clause together with the mask parameters in Table 86-8 are provisional.**]***

Delete clause 86.7.5.8 "Transmit jitter for each lane of 40GBASE–SR4 and 100GBASE–SR10"