Transmitter Specifications for 800GBASE-LR1

Related comments 243, 244, 245

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Overview / Related Comments

Cl **185** *SC* **185.6.1** *P* **531** *L* **50** # 243

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Comment Type **T** *Comment Status* **X**

Tx frequency Slew rates and clock phase noise need definition

SuggestedRemedy

A contribution with updated values will be provided

Proposed Response *Response Status* **O**

Cl **185** *SC* **185.6.2** *P* **532** *L* **40** # 244

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Comment Type **T** *Comment Status* **X**

SOP evolution needs definition. Based on the available data, a value ≥ 20kRad/s should be specified. Aligining with previous standards of 50kRad/s, as well as 800GBASE-ER1-20 is recommended.

SuggestedRemedy

Replace TBD for State of polarization (max) with 50 kRad/s

Proposed Response *Response Status* **O**

Cl **185** *SC* **185.6.2** *P* **532** *L* **40** # 245

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Comment Type **T** *Comment Status* **X**

A value of Rx PDL (max) is required. An additional 0.5dB above the Tx X/Y imbalance is recommended

SuggestedRemedy

Replace TBD for Polarization dependent loss (max) with 2.0dB

Proposed Response *Response Status* **O**

This contribution provides input on the required parameters for 802.3dj

The majority of the content is on the Transmit side, but some additional Rx specs are included.

Laser Tracking Updates

Tx accuracy spec of ± 20GHz was adopted in 802.3dj D1.2

The dead zone ensures a laser offset of ≤ 900MHz

- Laser relative frequency tracking accuracy of ±0.9GHz was adopted in 802.3dj D1.2

Values for Slew rate are required:

- Tx laser frequency slew rate: pre acquisition (max) target to meet ≤ 2 second acquisition
  - Based on a worst case 40GHz offset between Rx signal and Local Oscillator → 20GHz/s minimum slew rate for acquisition
- Tx laser frequency slew rate: post acquisition (max)
  - When the Rx frequency exceeds the dead-zone of ±400MHz, a 1 THz/s rate allows fast tracking

SOP Tracking rate

Previous standards have specified a 50kRad/s SOP tracking rate

- Published data on DWDM links shows a wide range of SOP evolution rates, up to multiple Mrad/s

Limited data exists for SOP evolution for shorter/non CD compensated links

Measurements on a 40km and 7 km link were reported:

- Misha Boroditsky et al, “Polarization Dynamics in Installed Fiberoptic Systems”, 2005 IEEE LEOS Annual Meeting Conference Proceedings
- Deriving exact value is difficult, but the data presented shows a between ~20kRad/s and 32kRad/s SOP evolution

800GBASE-ER1-20 and 800GBASE-ER1 have adopted a 50kRad/s SOP tracking rate

A 50kRad/s rate is recommended to align with overlapping applications

Tx Clock Phase Noise

Tx Clock phase noise has been adopted as a parameter to improve interoperability

Previously values in 800ZR were agreed on to bound the penalty. The same values are proposed here, using the same definitions in the OIF 800ZR-IA

Tx clock phase noise (PN): Maximum PN mask Frequency (Hz): 1E4 4E5 1E6 ≥ 1E7	 -100 -132 -136 -146	 dBc/Hz
Tx clock phase noise (PN); Maximum total integrated random jitter	0.015	UI_rms
Tx clock phase noise (PN); Maximum total periodic jitter	0.03	UI_pp

Rx PDL

The Tx X/Y imbalance of 1.5dB sets a floor for the Rx PDL tolerance

An additional 0.5dB is proposed for the Rx PDL tolerance

- This addition aligns with the 800GBASE-ER allocations

2.0 dB is proposed for the Rx PDL tolerance

TQM (ETCC)

ETCC ($\Delta RSNR_{Tx}$) has been adopted as a TQM, as discussed in:

- https://www.ieee802.org/3/dj/public/24_05/maniloff_3dj_02_2405.pdf
- https://www.ieee802.org/3/dj/public/adhoc/optics/1024_OPTX/liu_3dj_optx_01_241017.pdf
- And references in these contributions

A value of 3.4 dB is proposed for ETCC(Max)

Additional ETCC details to capture in 802.3dj are being contributed separately

Tx Specifications (Table 185-5)

- **Items in green cells**
- **are proposed for adoption**

Description	Value	Unit
Signalling rate	123.7±50 ppm	Gbaud
Modulation Format	DP-16QAM	
Average Launch Power (Max)	-6	dBm
Average Launch Power (Min) for ETCC ≤ 1.0 dB for 1.0 > ETCC ≤ 3.4 dB	 -11.2 -12.2+ETCC	 dBm
Carrier Frequency (range)	228.675 ± 20 GHz	THz
Optical Frequency Accuracy	±20	GHz
Laser Linewidth	1	MHz
Power difference between X and Y polarizations (max)	1.5	dB
Skew between X and Y polarizations (max)	5	ps
ETCC (Max)	3.4	dB
Instantaneous I-Q offset per polarization (max)	-20	dB
Mean I-Q offset per polarization (max)	-26	dB
I-Q amplitude imbalance (mean)	1	dB
I-Q phase error magnitude (max)	5	deg
I-Q quadrature skew (max)	0.75	ps
Transmitter In Band OSNR	36	dB/12.5 GHz
Average launch power of OFF transmitter (max)	-20	dBm
Transmitter reflectance (max)	-20	dB
RIN average (max)	-145	dB/Hz
RIN peak (max)	-140	dB/Hz
Tx laser frequency slew rate: pre acquisition (max)	20	GHz/s
Tx laser frequency slew rate: post acquisition (max)	1	THz/s
Laser relative frequency tracking accuracy	± 0.9	GHz
Tx clock phase noise (PN): Maximum PN mask Frequency (Hz): 1E4 4E5 1E6 ≥ 1E7	 -100 -132 -136 -146	 dBc/Hz
Tx clock phase noise (PN); Maximum total integrated random jitter	0.015	UI_rms
Tx clock phase noise (PN); Maximum total periodic jitter	0.03	UI_pp

Tx Specifications (Table 185-6)

Description	Value	Unit
Signalling rate	123.7±50 ppm	GBd
Modulation Format	DP-16QAM	
Optical Frequency	228.675 ± 20 GHz	THz
Damage Threshold	-4	dBm
Average Receive Power (Max)	-6	dBm
Average Receive Power (Min) For ETCC(1.1E-2)< 1.0 dB For 1.0 ≤ ETCC(1.1E-2) ≤ 3.4 dB	 -17.5 -18.5+ETCC	dBm
Receiver reflectance (max)	20	dB
Frequency offset between received carrier and local oscillator (max)	40	GHz
Polarization dependent loss (max)	2.0	dB
State of polarization (max)	50	kRad/s

Thanks!