Updates to 800GBASE-LR1 and 800GBASE-ER1 Rx Optical Power Specifications

Addressing comments 108, 109, 110, 111, 113, 114

Eric Maniloff - Ciena

IEEE P802.3dj

March 2025, Atlanta GA, USA

Comment addressed

A group of related comments was submitted covering updates to the optical power specs

Cl **185** *SC* **185.6.2** *P* **551** *L* **34** # 108

Maniloff, Eric Ciena

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

In addition to the Average Receive Power (min) there should be an entry for Receiver Sensitivity. Average Receive power is at TP3 including link optical impairments, while sensitivity (informative) is defined without optical impairments.

SuggestedRemedy

Add an entry in Table 186-6 for Receiver Sensitivity (Average Power, max) with units of dBm as an informative specification. A supporting presentation will be provided.

Proposed Response *Response Status* **O**

Cl **185** *SC* **185.8.15** *P* **556** *L* **46** # 109

Maniloff, Eric Ciena

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

Average receive power as specified in Table 185-6 should include optical impairments, and be specified with the minimum Transmitter OSNR.

SuggestedRemedy

Update the definition for Average receive power in 185.8.15 to specify that is specified at TP3, and includes the Optical Penalties defined in Table 185-7. A supporting presentation will be provided.

Proposed Response *Response Status* **O**

Cl **185** *SC* **185.8.x** *P* **556** *L* **50** # 110

Maniloff, Eric Ciena

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

A definition for Receiver Sensitivity should be provided. Receiver Sensitivity does not include Optical Penalties, and is an informative specification.

SuggestedRemedy

Add a definition for receiver sensitivity in Clause 185.8. A supporting presentation will be provided.

Proposed Response *Response Status* **O**

Cl **187** *SC* **187.6.2** *P* **624** *L* **33** # 111

Maniloff, Eric Ciena

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

In addition to the Average Receive Power (min) there should be an entry for Receiver Sensitivity. Average Receive power is at TP3 including link optical impairments, while sensitivity (informative) is defined without optical impairments. A supporting presentation will be provided.

SuggestedRemedy

Add an entry in Table 187-6 for Receiver Sensitivity (Average Power, max) with units of dBm as an informative specification. A supporting presentation will be provided.

Proposed Response *Response Status* **O**

Cl **187** *SC* **187.8.16** *P* **629** *L* **45** # 113

Maniloff, Eric Ciena

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

Average receive power as specified in Table 187-6 includes optical impairments, and is specified with the minimum Transmitter OSNR.

SuggestedRemedy

Update the definition for Average receive power in 187.8.16 to specify that is specified at TP3, and includes the Optical Penalties defined in Table 187-7. A supporting presentation will be provided.

Proposed Response *Response Status* **O**

Cl **187** *SC* **187.8.17** *P* **629** *L* **49** # 114

Maniloff, Eric Ciena

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

A definition for Receiver Sensitivity should be provided. Receiver Sensitivity does not include Optical Penalties, and is an informative specification.

SuggestedRemedy

Add a definition for receiver sensitivity in clause 187-7. A supporting presentation will be provided.

Proposed Response *Response Status* **O**

Overview

Both 800GBASE-LR1 and 800GBASE-ER1 include Rx specs for Average Receive Power (min)

- This is the minimum Rx power at TP3, and includes allocations for link impairments

Both specs should have Receiver Sensitivity specifications as well

- Rx Sensitivity is defined without link impairments

This contribution includes

- Receiver Sensitivity specifications for Clauses 185 and 187
- Definitions for Receiver Sensitivity
- Updated definitions for Average Receive Power to clarify

Note: The definitions were updated after the initial version of this contribution was submitted.

Receive Power Specifications

Clause 154 (100GBASE-ZR, 802.3ct) includes both amplified (DWDM) and unamplified (Power limited) applications

For the unamplified application, two optical power specifications are defined

- Average Optical Power (min) – The minimum power to meet the BER requitements at TP3, including attenuation and link impairments - Normative
- Receiver Sensitivity (max) – The optical power required to meet the BER requirements without any optical impairments - Informative

Currently 800GBASE-LR1, 800GBASE-ER1, and 800GBASE-ER1-20 specify the Rx Average Receive power at TP3

Adding a sensitivity spec will help clarify the optical specifications

- The sensitivity spec will equal the Average receive power – the Penalty Allocations

More on 100GBASE-ZR1 (802.3ct)

Table 154–8—100GBASE-ZR receive characteristics

Description	Value	Unit
Signaling rate (range)	27.9525 ± 20 ppm	GBd
Modulation format	DP-DQPSK	—
Nominal center frequency	The frequency in Table 154–5 where the channel index number equals the variable Rx_optical_channel_index	THz
Damage threshold[a]	3	dBm
Average receive power (max)	0	dBm
Average receive power (min)	–27	dBm
Receiver sensitivity[b] (max)	–30	dBm

average power level. The receiver does not have to operate correctly at this input power.

[b] Receiver sensitivity (max), for OSNR ≥ 35 dB (12.5 GHz), and Receiver OSNR tolerance are optional.

Information on the Rx optical specs in 802.3ct is available in

https://www.ieee802.org/3/ct/public/tf_interim/20_1203/stassar_3ct_02b_201203.pdf

Sensitivity Definition in 802.3 Clause 154

Definitions from in-force Clause 154:

154.9.14 Receiver sensitivity

Receiver sensitivity is defined as the minimum value of average receive power at TP3 to achieve the specified maximum BER in 154.1.1. This is to be met with a transmitter with worst-case values of error vector magnitude, optical return loss at TP2, connector degradations, and OSNR. This does not have to be met in the presence of impairments caused by the DWDM black link, such as dispersion or reflections from the optical path. These effects are specified separately in the allocation of maximum optical path power penalty.

154.9.13 Average receive power

The average receive power shall be within the limits given in Table 154–8. These limits define the range of average receiver input power over which the BER requirement in 154.1.1 has to be met at the values of minimum OSNR defined in Table 154–8.

800GBASE-LR1

Tx

Average launch power (min) for ETCC ≤ 1 dB for 1 < ETCC ≤ 3.4 dB	 –11.2 –12.2 + ETCC	dBm

Rx

Average receive power (min) for ETCC ≤ 1 dB for 1 < ETCC ≤ 3.4 dB	 –17.5 –18.5 + ETCC	dBm

Link

Parameter	Value	Unit
Power budget	6.8	dB
Operating distance	10	km
Channel insertion loss[a]	6.3	dB
Maximum discrete reflectance	–27	dB
Allocation for penalties[b]	0.5	dB
Additional insertion loss allowed	0	dB

Add:

Receiver Sensitivity (Average Power, max)

For ETCC ≤ 1 dB -18 dBm

For 1< ETCC ≤ 3.4 dB -19 + ETCC dBm

Sensitivity Definition, Clause 185

Receiver sensitivity is defined as the minimum value of average receive power to achieve the specified maximum FLR in Clause 185-2. Receiver sensitivity does not have to be met in the presence of link impairments captured in the penalty allocations in Table 185-7

The conformance test signal meets the requirements for an 800GBASE-LR1 transmitter followed by an attenuator.

The ETCC of the transmitter is measured according to Clause 185.9. The ETCC is then used to calculate the Receiver Sensitivity specified in Table 185-6.

Average Receiver Power definition, 800GBASE-LR1

Average receive power should specify that it is measured at TP3, and includes optical link impairments.

Updated Definition

The average receive power defines the range of average receiver input power at TP3 over which the frame loss ratio requirement in 185.2 has to be met.

The conformance test signal meets the requirements for an 800GBASE-LR1 transmitter, followed by optical impairments as specified in Table 185-6 and Table 185-8.

The ETCC of the transmitter is measured according to Clause 185.9. The ETCC is then used to calculate the minimum Average Receive Power requirement specified in Table 185-6.

This power may be measured per IEC 61280-1-3.

800GBASE-ER1

Tx

Description	800GBASE-ER1-20	800GBASE-ER1	Unit
Average launch power (max)	–7	–1	dBm
Average launch power (min)	–11	–5	dBm

Rx

Average receive power (min)	–18		dBm

Link

Parameter	800GBASE-ER1-20	800GBASE-ER1	Unit
Power budget	7.5	13	dB
Operating distance	20	40	km
Channel insertion loss[a]	7	12	dB
Maximum discrete reflectance	–27		dB
Allocation for penalties[b]	0.5	1	dB
Additional insertion loss allowed	0		dB

Add:

Receiver Sensitivity (Average Power, max)

800GBASE-ER1-20: -18.5dBm | 800GBASE-ER1: -19 dBm

Sensitivity Definition, Clause 187

Receiver sensitivity is defined as the minimum value of average receive power to achieve the specified maximum FLR in Clause 187-2. Receiver sensitivity does not have to be met in the presence of link impairments captured in the penalty allocations in Table 187-7

The conformance test signal meets the requirements for an 800GBASE-ER1 transmitter followed by an attenuator, including the maximum ETCC specified in Table 187-5.

Average Receiver Power definition, 800GBASE-ER1-20 and 800GBASE-ER1

Average receive power should specify that it is measured at TP3, and includes optical link impairments.

Updated Definition

The average receive power defines the range of average receiver input power at TP3 over which the frame loss ratio requirement in 187.2 has to be met.

The conformance test signal meets the requirements for an 800GBASE-ER1 transmitter, including the maximum ETCC specified in Table 187-5, followed by optical impairments as specified in Table 185-6 and Table 185-8.

This power may be measured per IEC 61280-1-3.

Summary

This contribution includes

- Receiver Sensitivity specifications for Clauses 185 and 187
- Definitions for Receiver Sensitivity
- Updated definitions for Average Receive Power to clarify their meaning

Thanks!