Optical parameters for coherent pt-pt (non DWDM) links

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Introduction

Over the past weeks there was offline email discussion around receiver optical parameter definitions for 800GBASE-LR1/ER1/ER1(-20) in Clauses 185 and 187.

This discussion is related to to submitted comments 108, 109, 110, 111, 113, and 114 submitted by Eric Maniloff. maniloff_3dj_01_2503 contains a supporting presentation for these comments.

During the CRG meeting reviewing comments to D1.3 in January 2025 it was identified that Clauses 185 and 187 lack a specification for receiver sensitivity.

maniloff_3dj_01_2503 proposed some (probably) non-controversial proposals for receiver sensitivity values. However the creation of an appropriate definition of receiver sensitivity and a modification of average receiver power appeared to be more controversial than expected. This mostly is a terminology issue.

Considerations

With the definition of non optically amplified, non-DWDM pt-pt optical links in the Ethernet space, employing coherent technology, we will be setting a foundation for increased usage of coherent technology at higher speeds and shorter distances.

Some of the proposals in maniloff_3dj_01_2503 are based on reusing terminology and definitions from in-force Clause 154 (100GBASE-ZR).

The author of this presentation feels that this may not be the best approach considering the receiver specification in Clause 154 reconciled the usage in both OSNR limited and power limited applications.

The author proposes to take a helicopter view and see what is fundamentally different between an Ethernet link using conventional IMDD technology versus coherent technology.

Considerations on specification methodology

Are there any fundamental differences between appropriate specifications for Ethernet links using conventional IMDD technology and those using coherent technology?

The author believes not, the only difference being how to deal with the penalties, TDECQ, MPI, and DGD penalties for IMDD versus ETCC (and MPI, DGD penalties?) and appropriate allocations for those in the power budget.

This presentation proposes to re-use as much as possible from established specification methodologies for IMDD technologies for the new coherent applications in clauses 185 and 187.

How are IMDD receivers specified?

Relevant parameters for IMDD receivers:

- Receiver sensitivity (**informative** in Clauses 88,121, 122, 124, 140 and **normative** in Clause 151 and draft new Clauses 180 – 183).
- Stressed receiver sensitivity (**normative** in Clauses 88,121, 122, 124, 140, 151 and draft new Clauses 180 – 183).
- Receive power (OMAouter) (max)
- Average receive power (min & max)

There is **no** specification of Receive power (OMAouter) (min) in IMDD Rx specifications.

It is simply a mathematical subtraction of maximum channel loss from minimum Tx power, and therefore inherently normative.

Therefore such a parameter may also not be necessary for clauses 185 and 187. However, if the TF feels this parameter should be maintained, it is the author's view that it should be as simple as possible.

How are coherent receivers currently specified in 185 & 187?

Relevant parameters for IMDD receivers:

- Average receive power (max)
- Average receive power (min)

As noted during the CRG meeting in Phoenix reviewing comments to D1.3, this is incomplete and the necessity of adding receiver sensitivity was identified. Proposals are made in maniloff_3dj_01_2503.

In some discussions the lack of a stressed receiver sensitivity (SRS) parameter was mentioned.

However, adding SRS with an adequate definition is probably too complicated in the current phase of TF review. It better be addressed during WG Ballot.

Proposals for receiver parameters in Clause 185

- Introduce parameter “Receiver sensitivity (max)” with detailed values and detailed descriptions from maniloff_3dj_01_2503 in Table 185-6.
- Add a new subclause with a definition of “Receiver sensitivity” in 185-8 along the lines of:
  - The receiver sensitivity (average power) shall be within the limits given in Table 185–6 if measured using a test pattern specified for receiver sensitivity in Table 185–11. The conformance test signal applied at TP3 meets the requirements for a 800GBASE-LR1 transmitter followed by an attenuator. The ETCC of the conformance test signal is measured according to 185.9, except that the test fiber is not used. The measured value of ETCC is then used to calculate the limit for receiver sensitivity (Average power) as specified in Table 185–6.
- Modify the definition of Average receiver power in 185.8.15 to “The minimum average receive power is the average launch power (min) minus the maximum channel insertion loss”.

Proposals for receiver parameters in Clause 187

- Introduce parameter “Receiver sensitivity (max)” with detailed values and detailed descriptions from maniloff_3dj_01_2503 in Table 187-6.
- Add a new subclause with a definition of “Receiver sensitivity” in 187-8 along the lines of:
  - The receiver sensitivity (average power) shall be within the limits given in Table 187-6 if measured using a test pattern specified for receiver sensitivity in Table 187-11. The conformance test signal applied at TP3 meets the requirements for a 800GBASE-ER1/800GBASE-ER1-20 transmitter followed by an attenuator. The ETCC of the conformance test signal is measured according to 187.9, except that the test fiber is not used. The measured value of ETCC is then used to calculate the limit for receiver sensitivity (Average power) as specified in Table 187-6.
- Modify the definition of Average receiver power in 187.8.16 to “The minimum average receive power is the average launch power (min) minus the maximum channel insertion loss”.

Proposed follow-up work for WG Ballot

- Review and refine the definition of Receiver sensitivity in Clauses 185 and 187.
- Consider whether this should be a normative or informative specification.
- Discuss the potential need for a parameter “Stressed receiver sensitivity” with appropriate value, conditions and definitions.

Thanks!