

Specifying 25G EPON OLT receiver sensitivity for PR30: avoiding SOAs

Ed Harstead, Nokia

Naoki Suzuki, Mitsubishi Electric Corp.

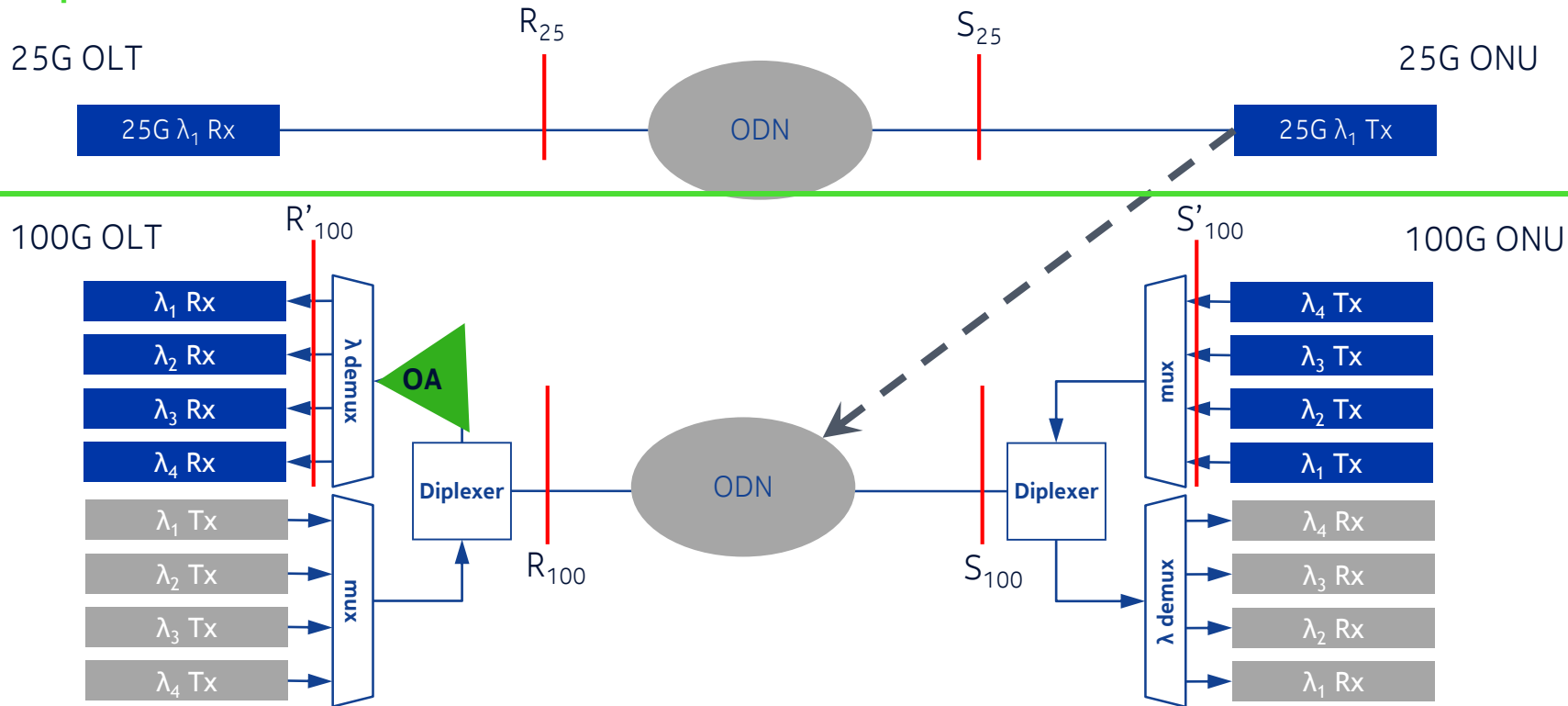
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Methodology

- Derive the 25G OLT receiver sensitivity specification from state-of-the-art 10G PON OLT performance
 - 10G PON optics have been/are being tested by the market to meet requirements for low cost
 - The specifications already include margins for burst mode, yield, temperature and end of life.
- Deriving a specification from small sample size measurements of 25G APDs in continuous mode is problematic:
 - Measurements do not include all margins, in particular burst mode penalty
 - Measurements in 2016-2017 do not account for improvements in 25G APDs over the next 2-3 years. 25G APDs receivers are in their infancy, and improvements are to be expected, including in TIAs and packaging.
- Propose to use the same derivation method as for 25G ONU sensitivity in harstead_3ca_4_0117
- As a baseline, propose: **-29 dBm** @10 Gb/s, 1e-3 BER and ER=6.
 - Aggressive but achievable 10G specification to relax 25G ONU launch power, while
 - Having a viable path to an APD implementation (with no SOA).

Scope

Scope of this document



Reference: harstead_3ca_1b_0916

Derivation of 25G PR30 OLT receiver sensitivity specification

Not including FEC improvement

④ 25G OLT Rx Sens_{max} = **-24 dBm** @ ER=6 dB , BER = 10⁻³

③ 25G APD vs. 10G APD performance margin
= 1 dB*

25G InP APD
Rx Sens_{max}

10G InP APD + EDB
Rx Sens_{max}

① Baseline:
10G OLT
receiver sensitivity= -29 dBm
@ER = 6 dB, BER = 1e-3

② 25G vs. 10G APD
noise penalty = 4 dB*

② 25G vs. 10G
EDB penalty = 5 dB*

*Similar derivation method as for 25G ONU sensitivity in harstead_3ca_4_0117

Discussion

- There may be some risk associated with the -24 dBm spec. Risk mitigation:
 - Ge/Si APD per pan_3ca_1_0317.
 - SOA preamp (last resort, hopefully only necessary for initial deployments, at most)
- FEC improvement will relax the ONU required launch power
 - Conservative: per umeda_3ca_1_0517, assume maximum input BER = $2e-3$. This corresponds to about 0.5 dB optical FEC improvement
 - Aggressive: For example LDPC per [laubach_3ca_1_0517.pdf](#), which corresponds to about 1.25 dB optical FEC improvement with the GE burst model. Let's assume this value for now.
- The 100G OLT will use an SOA preamp to overcome OLT demux loss and ONU mux loss

Reason to avoid a 25G specification that will never be realizable with APD

- The 100G Ethernet ER4 (40 km) receiver specification was initially based on a PIN+SOA.
- Ever since, they have been working to correct this mistake, with APD-friendly ER4f/ER4lite and now [4WDM MSA](#).

18 October 2016

Chris Cole, Finisar

100G 10km, 20km & 40km 4x25G NRZ WDM Optical Specifications Proposal, Draft 04

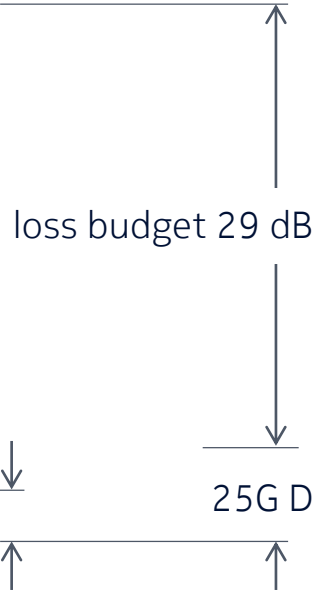
Specification	10km WDM4-10 w/ FEC 100G LR4 loss	20km WDM4-20 w/ FEC	40km WDM4-40 w/ FEC
Rate \pm 100 ppm Gb/s	25.78125	25.78125	25.78125
Reach km (RX type)	10 (PIN)	20 (PIN)	40 (APD)

- The cost of the SOA+PIN will depend on volumes, and it's now unlikely to have any significant volume from 100G Ethernet. Therefore it is likely to be high cost.
- The SOA+PIN will have significantly higher power dissipation than the APD. This will degrade OLT port density
- **Therefore a 25G OLT specification requiring SOA+PIN will be a liability for 25G EPON market success**

25G upstream straw loss budget, PR30

ONU AVP_{min} = 5.75 dBm

OLT Rx Sens_{max} **-24 dBm**
@ ER=6 dB , BER = 1e-3



25G US FEC improvement.
Assume **1.25 dB**.

25G BOSA launch power, all margins, year 2020, per vendor questionnaire harstead_3ca_1a_0716

AVPmin (dBm)	number	mean	σ
EML	6	4.5	0.8
cooled DML	8	7.0	1.2
uncooled DML	6	4.7	1.5

There is 1.25 dB margin to spare

Sumitomo: confirmed from the floor in New Orleans

Motion

The 25G-EPON PR30 OLT receiver sensitivity specification proposed in harstead_3ca_2b_0717.pdf page 4, -24 dBm at BER = 1E-3 and ER = 6 dB, shall be adopted as a starting point. The final specification would be adjusted if improved FEC with respect to 10G-EPON is adopted.

- Moved:
- Seconded:

- For:
- Against:
- Abstain:

NOKIA