

# 25G upstream power budget analysis

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# Background

- The power levels for 25G downstream is closed to be finished in the January meeting, while the power budget for upstream is open

## Motion #7

The 25G EPON PR30 specifications proposed in harstead\_3ca\_1b\_0118  
25G ONU receiver sensitivity: -25.7 dBm at BER= 1e-2 and ER=8 dB  
25G OLT transmitter: AVPmin = 4.8 dBm and ER min = 8 dB  
shall be adopted.

Moved: Ed Harstead

Second: John Johnson

For: 16 Against: 2 Abstain: 12

Technical ( $\geq 75\%$ ) Motion Passed

- This contribution analyze the upstream power levels for 25G upstream

# 10G APD capability

liu\_3ca\_1\_1117

10G EPON OLT module sensitivity based on random example from two vendors

Surrounding Temperature	Vendor A		Vendor B	
	10G EPON OLT module SN	Sensitivity@10G based on multiple ONU <sub>s</sub> (dBm)	10G EPON OLT module SN	Sensitivity@10G based on multiple ONU <sub>s</sub> (dBm)
25°C	XXX038	-31.26	xxx066	-29.61
	XXX028	-31.29	xxx313	-30.16
	XXX042	-31.46	xxx310	-31.03
	XXX054	-31.26	xxx312	-30.32
	XXX040	-30.96	xxx329	-30.10
	XXX003	-31.64	xxx256	-29.48
	XXX004	-32.69	xxx057	-30.35
	XXX001	-30.62		
	XXX002	-31.45		
	XXX005	-31.22		
65°C	XXX038	-30.95	xxx066	-29.32
	XXX028	-30.88	xxx313	-29.87
	XXX042	-31.65	xxx310	-30.34
	XXX054	-30.95	xxx312	-29.53
	XXX040	-30.95	xxx329	-29.51
	XXX003	-31.53	xxx256	-28.79
	XXX004	-32.18	xxx057	-29.66
	XXX001	-30.53		
	XXX002	-31.16		
	XXX005	-31.23		

Note: all the sensitivity are tested based really ONU transmitters without packet loss

- 30dBm@1E-3 at burst mode is feasible for 10G APD based on the test data from several

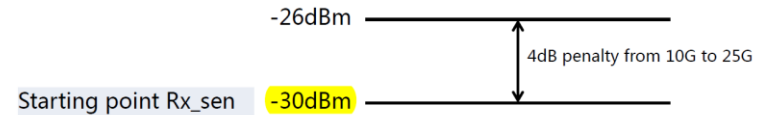
guo\_3ca\_1\_0917

## #1 Improved 10G APD deriving baseline

Let's take -29dBm OLT sensitivity which is used in XGS-PON (between N2 and E1) under 1E-3 and ER at 6dB as the deriving baseline.

- If in continuous mode, sensitivity could be better, assuming 0.5dB is enough.
- If ER is improved to 8dB, sensitivity could also be improved, also assuming 0.5dB (tanaka\_3ca\_1\_1116).
- Then at least 1dB sensitivity improvement can be achieved.
- In fact, -30dBm has been measured by most of our vendors. We believe it can be provisioned to market in few years.

If we consider 4dB 10G to 25G loss, and even consider 1dB margin, then there will be 1-2dB improvement of -24dBm as motioned in previous meetings.



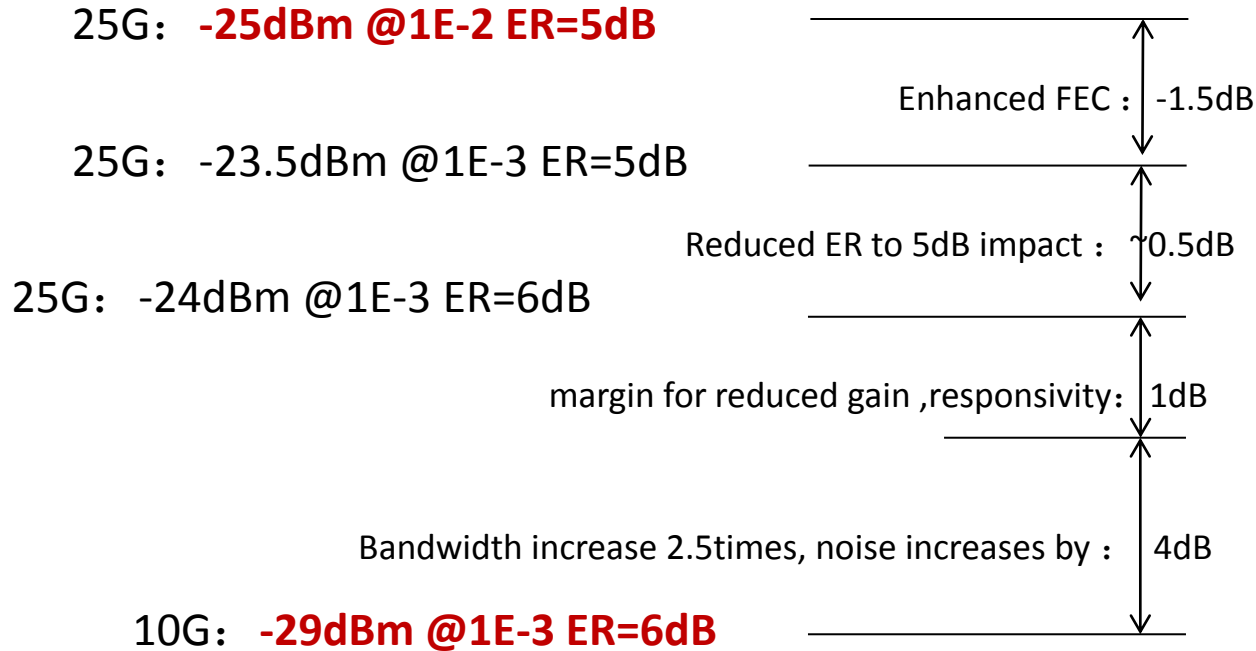
3 Sep 2017

IEEE p802.3ca Task Force meeting, Charlotte, NC, USA



-30dBm@1E-3 at burst mode is already feasible for 10G APD based on the test data from some vendors (based on Tx DML ER=6dB), at least -29dBm@1E-3 can be considered as the base line for 10G burst sensitivity

# 25G APD sensitivity iteration for upstream

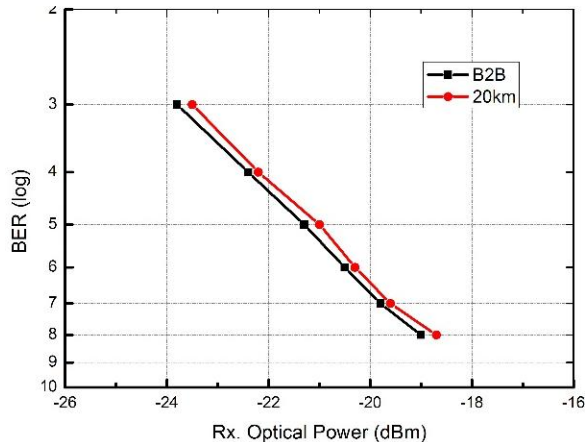


-25dBm@1E-2 based on ER=5dB can be derived based on the -29dBm sensitivity for 10G

# 25G TDP in upstream

25G DML dispersion penalty @1309nm

Johnson\_3ca\_1\_0318



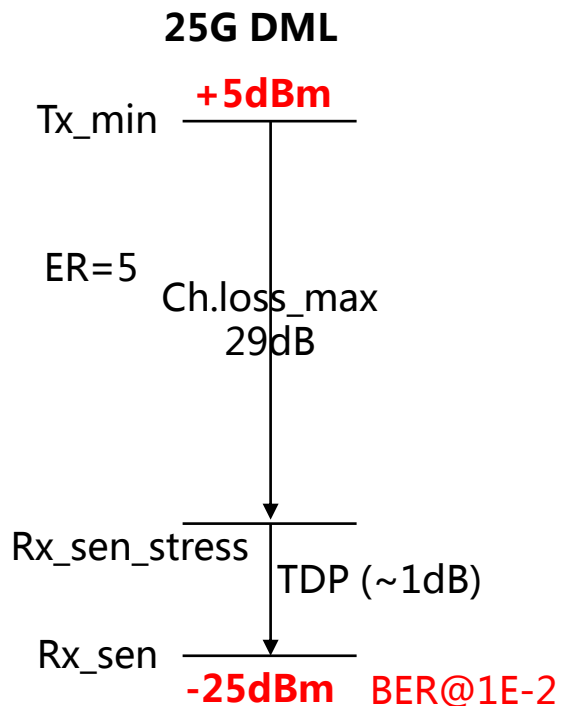
For 25G upstream ONU using a DML TX,

- Transmitter penalty (TP) will likely never be less than 0.5dB for cooled TX or 1.0dB for uncooled TX back to back (B2B).
- Upstream channels at different wavelengths can experience positive or negative dispersion, or no significant dispersion if the span is very short.
  - For US0-B DP(20km)  $\leq$  0dB so B2B is the worst case TDP.
  - For US0-A and US1 DP(20km)  $\geq$  0dB so B2B is the best case TDP.

The typical dispersion penalty for 25G DML at 1310nm is generally very small (less than 0.5dB)

- Even considering 0.5dB TP, another 0.5dB for margin, the typical TDP for 25G DML (both option A and B) should be no more 1.5dB (may be 1dB is OK)

# 25G upstream power budget analysis



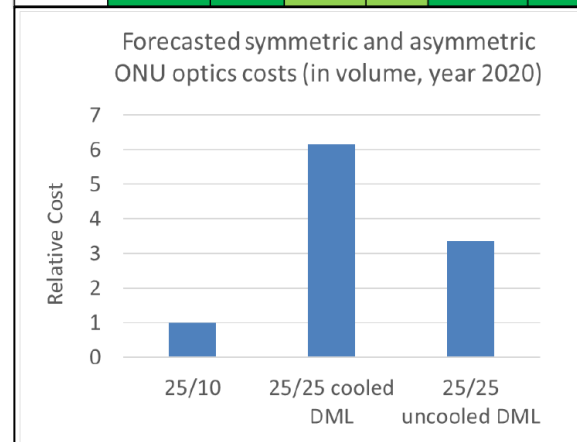
harstead\_3ca\_3\_0917

liu\_3ca\_4\_0517

harstead\_3ca\_1\_0317

AVPmin (dBm)	number	mean	$\sigma$
EML	6	4.6	0.7
EML+SOA	3	8.7	2.0
cooled DML	6	6.5	0.5
uncooled DML	5	4.7	1.0

	25G EML		25G cooled DML		25G uncooled DML	
	Power (dBm)	ER (dB)	Power (dBm)	ER (dB)	Power (dBm)	ER (dB)
vendor 1	3~4	8	7	4.5	5~6	4.5
vendor 2	3	8	5	5	4	4
vendor 3	4	6	4	4	xx	xx
vendor 4	2.5	8	5.8	4	xx	xx
vendor 5	4.3	8	5.5	4.5	4	4
vendor 6	4.5	8	6	5	4	4



5dBm launch power is feasible for both cooled and uncooled DML, which can enable the low cost ONUs

# 25G upstream power levels(proposed)

Parameter	US0-B	US0-A	Unit
Wavelength range	1260 to 1280	1290 to 1310	nm
OLT RX sensitivity@1E-2 (max)	-25.0		dBm
ONU Tx min (Note 1)	+5.0		dBm
ONU Tx max	+10.0		dBm
ONU Tx - TDP(min)	+4.0		dBm
ONU Tx ER(min)	5		dB
TDP (Note 1)	1		dB

Note 1: If a transmitter exhibits a higher TDP than specified, it can still comply if it equally increases the minimum launch power to compensate for extra TDP, while remaining under the maximum launch power

# Motions

The 25G EPON PR30 specifications proposed in liu\_3ca\_2\_0318:

- 25G OLT receiver sensitivity: -25.0 dBm at BER= 1e-2 and ONU Tx ER=5 dB
- 25G ONU transmitter: AVPmin = 5.0 dBm , ER min = 5 dB, AVPmin-TDP=4.0dBm

shall be adopted.

Moved: Dekun Liu    Second:



**Thank you**  
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