10GEPON Power Budget Discussion in Japan

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Power Budget Discussion

After the last Geneva meeting, following items were discussed among vendors in Japan

1. PIN@ONU vs APD@ONU 2nd Round

2. Enhanced FEC Preference

3. A Concern about Dual-rate Feasibility

4. IEEE Formalism

Enhanced FEC Preference

- Power budget cannot decide E-FEC adoption; **The stronger, the better**

  Standard-FEC (S-FEC) is mandatory for 10G budget,
  while E-FEC could be introduced to relax optics tight power target

- Proper burst-CDR at noisy signal may not prevent E-FEC adoption
  Further confirmation necessary with 10G burst-CDR test

- E-FEC preference for the Draft description divided into two groups

Conservative	**Aggressive**
Spec. with S-FEC first, E-FEC to be Option, or Revise after 10G CDR confirmed	Spec. with E-FEC first, Revise when difficulty revealed
- FEC gain increase relatively small, compared to S-FEC (e.g. 1.3dB up with RS(255,223)) - If budget achieved by high-power optics, E-FEC unnecessary - Burst-mode CDR not be fully investigated yet	- Relaxing optics' tight power target important - Additional improvement hopeful for TX impairment

A Concern about Dual-rate Feasibility

Possibly Short for 1G

* 3av_0703_effenberger_4.pdf

A concern was posted that, in the case of parallel PMD*,
current 1G/10G class B++ power budget may possibly be short for 1G
by some 0.5-1.0dB, considering possible additional penalties

GEPON B++ SRS_{OMA} (Current GEPON B++)	-27.6 dBm	Baseline
GPON B+ Path Penalty (G.984.2 amnd.1)	0.5 dB	Should count ??
GEPON PX20 U/S TDP (802.3ah)	1.8 dB	Should count ?? TX-oriented penalty ??

- Unclear how much penalties we should consider

Majority Opinion

- May be compensated for by vendor's implementation ;
  serial PMD*, parallel PMD*, and others
- Many people think actual penalty would be less than standard

IEEE Formalism

Japanese vendors have seriously discussed over Power Budget in IEEE formalism

No Support for Ground Plan

- Ground plan for discussion was proposed, but the proposal was **NOT** fully supported by vendors in Japan
- So far no clear agreements were made

Some claims TDP uncertainty

- TDP practical value is not well understood or measured
- Ideal receiver sensitivity S_{OMA} is not clear, either
- Spread sheet calculation does not fit the proposal

An extreme suggestion also arose

-10GEPON power budgets should use ITU-T formalism instead of IEEE, leaving TDP and SRS as informative

D/S Power Budget (PIN@ONU)

	PX10	PX20	B++	λ : 157x nm
CH IL (dB)	20	24	29	
Path Penalty (dB)	1	1	1	EML-Tx, <20km
ER (dB)	9	9	9	
ONU Sensitivity	-20 (-19)	-20 (-19)	-20 (-19)	BER<10^{-2} or 10^{-3} (BER<10^{-4})
OLT Launch (min)	+1 (+2)	+5 (+6)	+10 (+11)	
OLT Launch (max)	+4 (+5)	+8 (+9)	+13 (+14)	
ONU Overload	-1 (0)	-2 (-1)	-2 (-1)	

S OMA	-18.6 (-17.6)	-18.6 (-17.6)	-18.6 (-17.6)	ONU
TDP	1.5	1.5	1.5	~Pisi ??
SRS OMA	-17.1 (-16.1)	-17.1 (-16.1)	-17.1 (-16.1)	w/ E-FEC (w/ FEC)
Launch OMA	+2.9 (+3.9)	+6.9 (+7.9)	+11.9 (+12.9)	OLT

D/S Power Budget (APD@ONU)

	PX10	PX20	B++	λ : 157x nm
CH IL (dB)	20	24	29	
Path Penalty (dB)	1	1	1	EML-Tx, <20km
ER (dB)	9	9	9	
ONU Sensitivity	-26 (-25)	-26 (-25)	-28 (-27)	BER<10^{-2} or 10^{-3} (BER<10^{-4})
OLT Launch (min)	-5 (-4)	-1 (0)	+2 (+3)	
OLT Launch (max)	-2 (-1)	+2 (+3)	+5 (+6)	
ONU Overload	-7 (-6)	-8 (-7)	-10 (-9)	

S OMA	-24.6 (-23.6)	-24.6 (-23.6)	-26.6 (-25.6)	ONU
TDP	1.5	1.5	1.5	~Pisi ??
SRS OMA	-23.1 (-22.1)	-23.1 (-22.1)	-25.1 (-24.1)	w/ E-FEC (w/ FEC)
Launch OMA	-3.1 (-2.1)	+0.9 (+1.9)	+3.9 (+4.9)	OLT

U/S Power Budget

	PX10	PX20	B++	λ : 1310 nm
CH IL (dB)	20	24	29	
Path Penalty (dB)	1	1	1	
ER (dB)	6	6	6	
OLT Sensitivity	-20 (-19)	-26 (-25)	-26 (-25)	BER<10^{-2} or 10^{-3} (BER<10^{-4})
ONU Launch (min)	+1 (+2)	-1 (0)	+4 (+5)	
ONU Launch (max)	+6 (+7)	+4 (+5)	+9 (+10)	
OLT Overload	+1 (+2)	-6 (-5)	-6 (-5)	

S OMA	-21.2 (-20.2)	-27.2 (-26.2)	-27.2 (-26.2)	OLT
TDP	3.0	3.0	3.0	~Pisi ??
SRS OMA	-18.2 (-17.2)	-24.2 (-23.2)	-24.2 (-23.2)	w/ E-FEC (w/ FEC)
Launch OMA	+1.8 (+2.8)	-0.2 (+0.8)	+4.8 (+5.8)	ONU

Note : APD parallel PMD (ATT inserted) is assumed for 1G/10G dual-mode Rx.

Summary

1. **PIN or APD** discussions for ONU-RX still aggressively continue
2. E-FEC ; **"the stronger, the better"**, from the power budget view point

   Vendor preferences are divided over **E-FEC description** for the Draft
3. A concern about 1G/10G **dual-rate feasibility** was introduced

   - 10G RX sensitivity may possibly be a little short for 1G (in the case of parallel PMD)

   - Consensus was that there would be no problem when considering actual penalty and implementation
4. 10GEPON power budget **in IEEE formalism** was proposed

   based on 3av_0705_takizawa_01.pdf

   But the proposal is not fully supported by Japanese vendors

   - **TDP uncertainty** makes Japanese vendors skeptical