Compensation of Channel Insertion Loss at ONU

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Motivation

Two issues on SOA pre-amplifier were introduced at the last meeting in New Orleans. We studied solutions.

- Dynamic range over damage threshold of PD.

  "SOA pre-amplified upstream signal power in 100G-EPON", Hanhyub Lee
  http://www.ieee802.org/3/ca/public/meeting_archive/2017/05/lee_3ca_1_0517.pdf

- Cross gain modulation from loud burst signal to weak burst signal.

  "Analysis of Multi-channel Crosstalk with SOA as Pre-amplifier in 100G EPON", Dekun Liu
  http://www.ieee802.org/3/ca/public/meeting_archive/2017/05/liudekun_3ca_1_0517.pdf

Solutions

- OLT: Single channel SOA + SOA Gain Control
  - No Cross Gain Modulation
  - OLT received power is adjusted by SOA gain control.

- ONU: Compensation of Channel Insertion Loss
  - SOA issues are caused by variations of the channel insertion loss (ChIL) between OLT and ONUs.

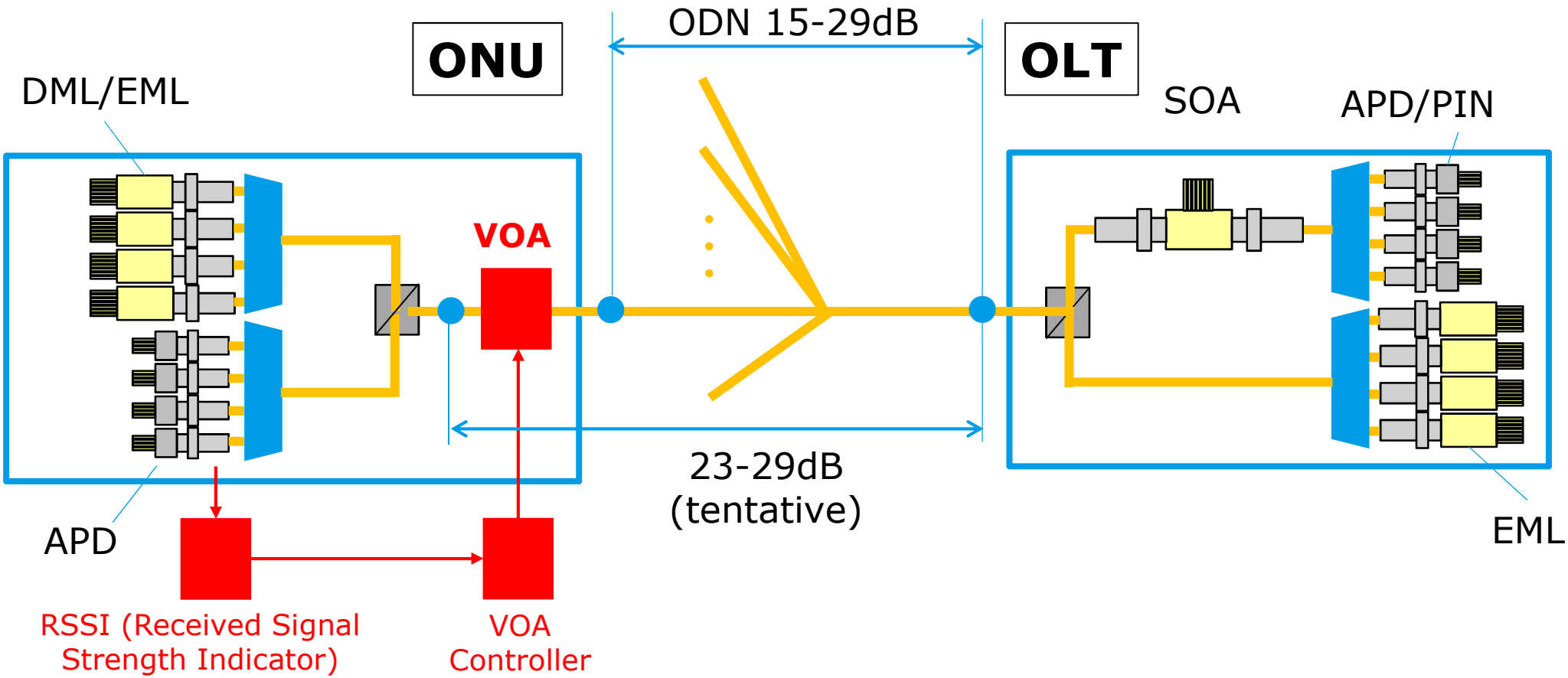
Concept of ChIL Compensation at ONU

- GPON defines “Power Levelling” function at ONU to relax the receiver dynamic range at OLT.
  - ONU controls Tx power (normal/-3dB/-6dB) based on the message from OLT.
  - Assumed that the laser current is adjusted to control Tx power. It’s not easy and the control power range is limited.
  - Complicated control sequence between OLT and ONU is needed.

- “ChIL Compensation” by VOA at ONU
  - VOA adds proper loss when ChIL is small.

Concept of ChIL Compensation at ONU

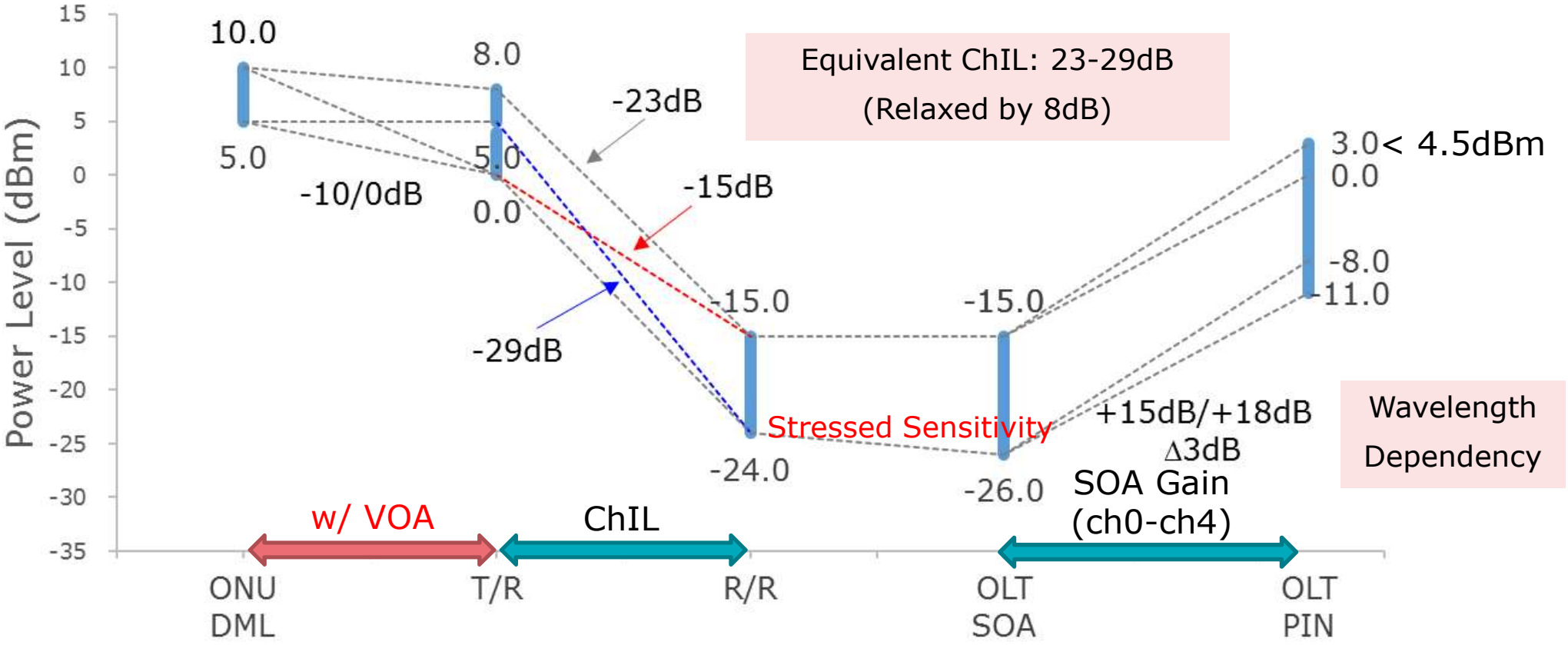
- VOA is on Tx/Rx path at ONU and control ChIL. IL of VOAs like MEMS shutter is small (~0).
- VOA is controlled based on ONU Rx power in CM, and Tx power is controlled together.
- OLT control isn't necessary.



Level Diagram w/ ChIL Control (Example)

4ch preamplifier might be possible. But strict ChIL compensation and high saturation/low NF/gain flat SOA are needed.

ChIL Compensation: 0 to 10dB ATT including o-mux loss, OLT Receiver: SOA-PIN



Summary

- Proposed the concept of “ChIL Compensation” to relax the receiver dynamic range at OLT. It would make “SOA Gain Control” easier. 4ch SOA preamplifier might be possible.
- MEMS VOA isn’t expensive. Need further study on assembly. For the 1st Gen, Fixed OA might be reasonable.
- WDM coexistence is needed. 1G/10G ONUs don’t support this function.