50G-EPON Power Budget Proposal

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Supporters

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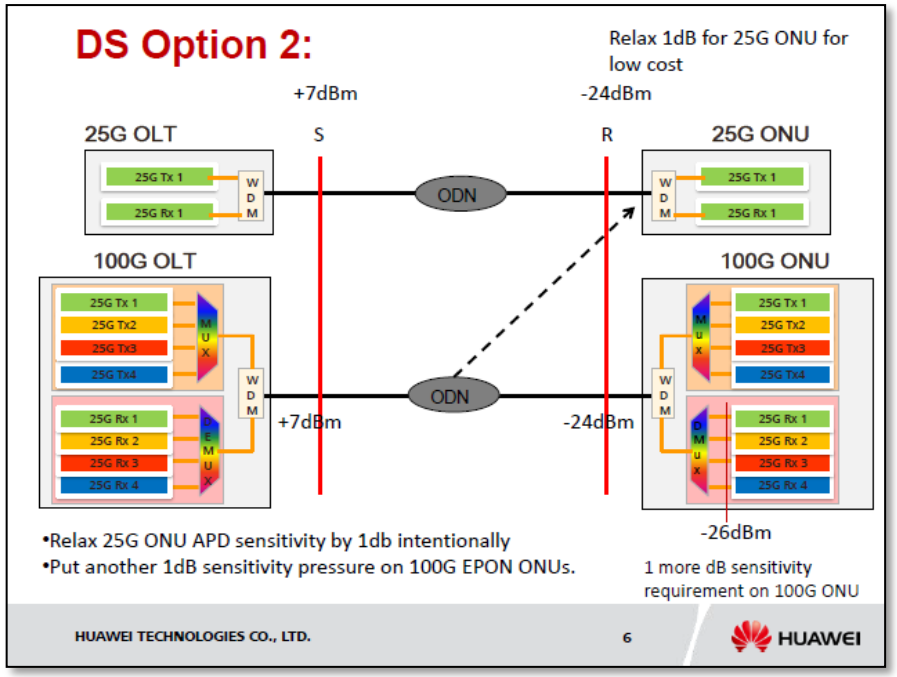
50G-EPON power budget

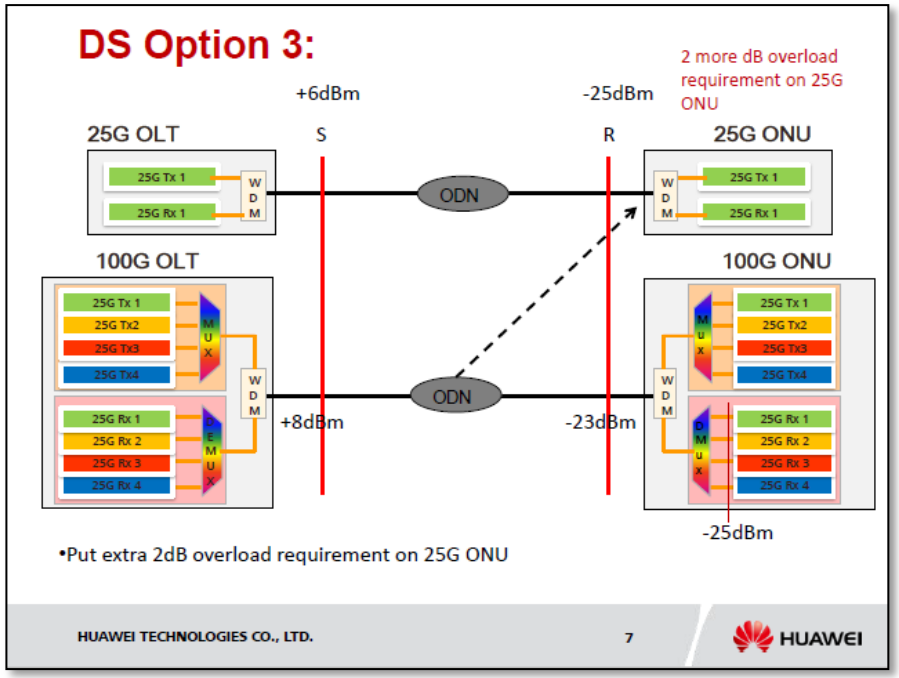
- 50G (2x25G) TX and RX will have additional mux/demux loss compared with 25G.
  - For single stage mux/demux, insertion loss for the second channel is ~0.5dB to ~1dB worst case.
  - 50G optics must absorb this additional 2dB max power budget
  - 50G OLTs must still interoperate with 25G ONUs.
- How should 50G OLT and ONU power budgets be specified at TP2/3 and TP6/7 to account for the additional 2dB loss?
  - Option #1: Use the same specs as 25G – Put equal 1dB burdens on OLT and ONU TX and RX components.
  - Option #2: Put more burden on the 50G OLT – Higher 50G OLT TX OMA and RX sens. 50G ONU components are same as 25G ONU.
- The cross-generational interoperability of 50G OLTs with 25G and 50G ONUs has been previously discussed.
  - Dynamic range of the ONU and OLT RX was identified as the main concern with different specs for 25G and 100G OLTs. The same concerns apply to 50G OLTs.
  - See: Powell_3ca_1_0716.pdf, Liu_3ca_2_0916.pdf
- In this contribution the pros and cons of the two options will be reviewed and a recommendation made for 50G-EPON power budget specs.

Intergenerational power levels

Option #1: Same specs for 25G and 50G OLTs



Option #2: 50G OLT has higher launch power



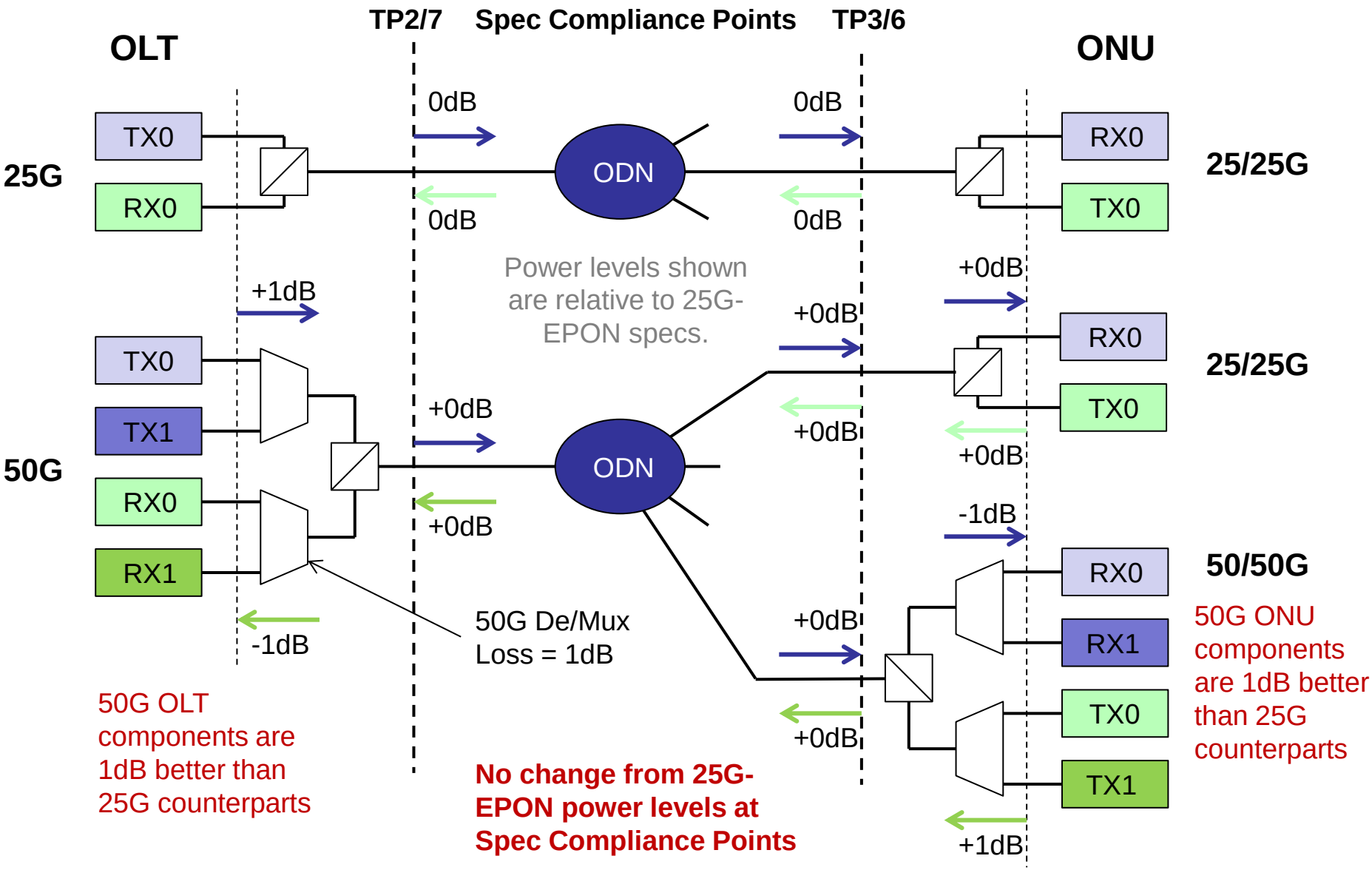
Source: Liu_3ca_2_0916.pdf

- As shown in previous contributions, increasing 100 OLT launch power to compensate for increased loss of 100G ONUs would result in burdening 25G ONUs with higher receiver overload requirements.
- The same issue exists for 50G OLTs although the mux/demux losses are less for 50G optics (0.5-1dB) than for 100G optics (2-2.5dB).

Option #1: Same specs as 25G

- 50G OLT and ONU lasers need +1dB output power, but power at TP2/6 is same as 25G OLT or ONU.
- 50G OLT and ONU APDs need -1dB sensitivity, but sensitivity at TP3/7 is same as 25G OLT or ONU.
- Advantages:
  - Simplicity – Same PMD specs apply for 25G and 50G OLT and ONU modules.
  - 25G ONU RX sees same input power as with 25G OLT – No dynamic range problems causing RX overload.
- Disadvantages:
  - 50G lasers need 0.5 to 1dB higher output power.
    - Should be able to select lasers with 0.5 to 1dB higher output power from 25G laser manufacturing distribution.
    - Expect improvements in laser power by ~2023 when 50G is needed.
  - 50G APDs need 0.5 to 1dB better sensitivity.
    - Agreed upon 25G RX specs are intentionally conservative.
    - Previous contributions suggest that there will be ~1dB upside for RX sensitivity with GeSi APDs and improved TIAs by 2023 when 50G is needed.
    - See: pan_3ca_1_0317.pdf, guo_3ca_1_0917.pdf, liu_3ca_1_1117.pdf and lee_3ca_1b_0118.pdf.
- Conclusion: Option #1 maintains current 25G ONU specs with only minor impact on the cost of 50G components.

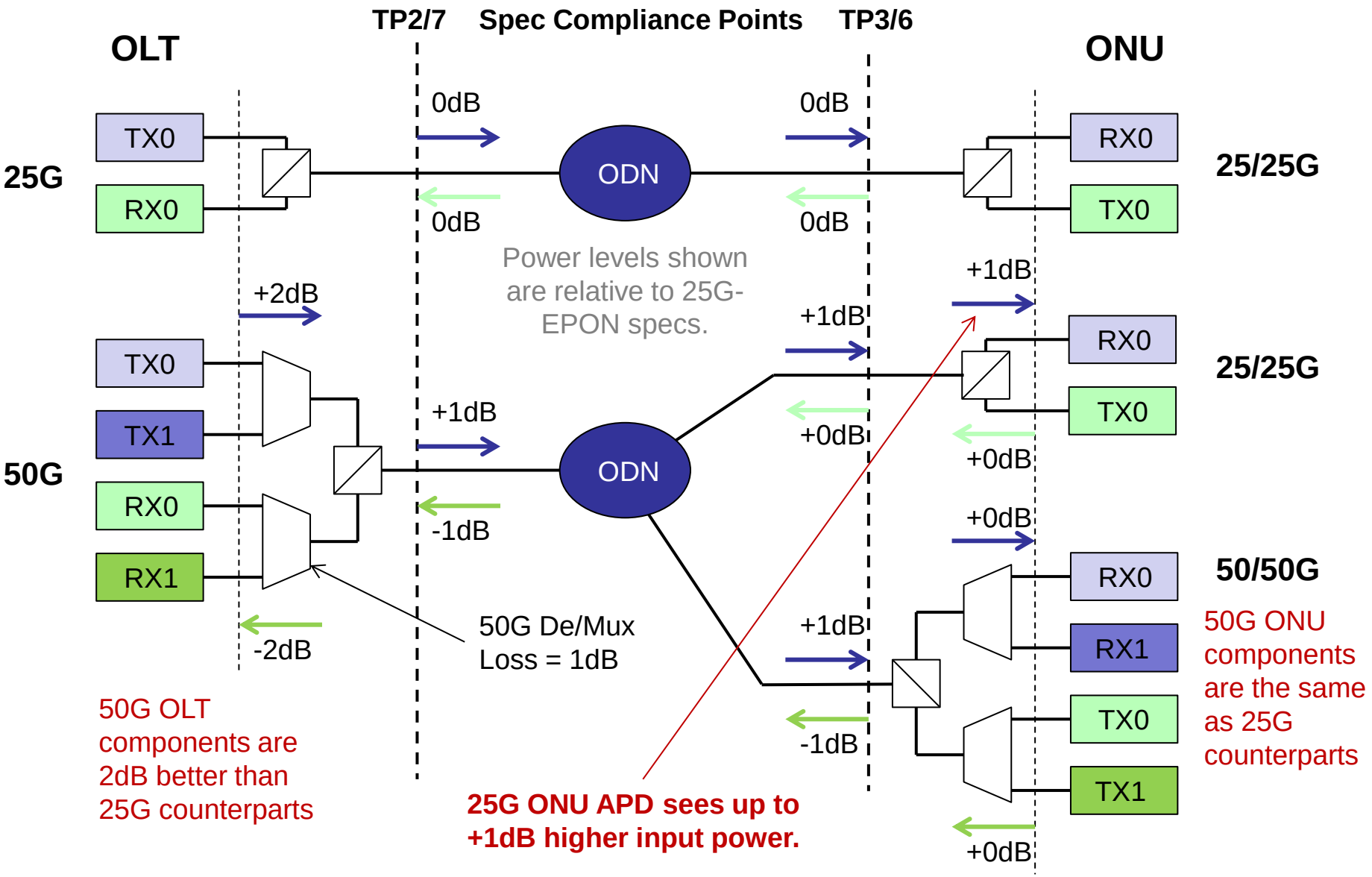
Option #1 Relative power levels



Option #2: Burden 50G OLT

- 50G OLT TX has +1dB min output power at TP2 to compensate 1dB demux loss in 50G ONU.
- 50G OLT RX has -1dB min sensitivity at TP7 to compensate 1dB mux loss in 50G ONU.
- 50G ONU has 1dB relaxed TP6 TX and TP3 RX specs compared with 25G ONU.
- Advantages:
  - 50G ONU laser and APD have same performance as 25G ONU components to keep 50G ONU component costs as low as possible.
  - Minimizes cost of the 50G RX in 50/25G ONUs which will likely be more widely deployed than 50/50G ONUs.
- Disadvantages:
  - 50G OLT components must be 2dB better than 25G OLT components.
    - Difficult to get 2dB by cherry-picking 25G component distributions.
  - Additional 2dB may require using SOAs for 50G OLT TX and/or RX, with much higher power dissipation and cost.
  - 25G ONU RX will need to have 1dB higher overload power to enable operation with 50G OLTs.
    - Could reduce the maximum 50G OLT launch power by 1dB, but that could reduce 50G OLT manufacturing yield and increase cost.
- Conclusion: Requires significantly different components or addition of SOAs in the 50G OLT. Unless max launch power is limited, 25G ONU RX will have to handle 1dB higher overload.

Option #2 Relative power levels



Summary and Recommendations

- 50G 2:1 mux/demux loss is in the range of ~0.5dB to ~1dB worst case, and must be supported by higher performance components.
- Option #1, keeping power levels at the spec compliance points the same as 25G-EPON is the best solution for 50G-EPON.
  - 50G TX lasers need 0.5 to 1dB higher output power, small enough to allow picking 25G lasers from the normal manufacturing distribution.
  - 50G RX need 0.5 to 1dB lower sensitivity, which is within the range of expected future 25G RX sensitivities.
  - Same components can be used for 25G and 50G optics.
  - No SOAs needed in the 50G OLT.
  - No increase in overload power for 25G ONUs.
  - Slightly higher component cost for 50G ONUs can be supported for top-tier business subscribers.
- Recommend that the Task Force adopt Option #1 for 50G-EPON PMD power budget.

Motion #N

- Move that the P802.3ca Task Force adopt the same downstream and upstream power budgets for the 50G-EPON PR30 PMDs as were adopted for the 25G-EPON PR30 PMDs.

- Moved: John Johnson
- Seconded:

- Technical (≥75% to PASS)
- For: Against: Abstain: