

## ABSTRACT

*The need for high data rate is increasing in telecommunication network to be able to serve high bandwidth applications with good quality. By increasing the data rate requirement, power consumption needs solution for energy efficiency. Energy efficiency has become a very important aspect in network design because of the increasing of energy consumption when transmission related to the performance of system.*

*The evolution of Gigabit Passive Optical Network (GPON) technology to Next Generation Passive Optical Network stage 2 (NGPON2) is a step in delivering better services that deliver bandwidth and quality of service (QOS) for high-speed best-effort connectivity services with more split ratio and further range. In this research will design and simulate Bidirectional NGPON2 network with TWDM technique which has total bitrate 40 Gbps for downstream and 10 Gbps for upstream by using 3 stage combination passive splitter at 30 km distance. Approach to get results using power link budget calculations, BER and Q-Factors then refers to the ITU-T standard.*

*Based on simulation results, best combination for 64 ONU is (1:4, 1:4, 1:4) with Q-Factor = 11,20 and BER =  $2,68 \times 10^{-21}$  at downstream then Q-Factor = 10,69 and BER =  $2,83 \times 10^{-20}$  at upstream. (1:2, 1:8, 1:8) for 128 ONU with Q-Factor = 13,59 and BER =  $2,98 \times 10^{-34}$  at downstream then Q-Factor = 13,06 and BER =  $5,34 \times 10^{-31}$  at upstream and (1:4, 1:4, 1:16) for 256 ONU with Q-Factor = 8,38 and BER =  $7,73 \times 10^{-13}$  at downstream and Q-Factor = 7,24 and BER =  $1,08 \times 10^{-12}$  at upstream. The value of Q-Factor and BER indicates that the system meets the operating feasibility standards and the value of Link Power Budget meets ITU-T defined standards for ODN classes.*

**Keyword : NGPON2, Bandwidth, BER, Link Power Budget, Q-Factor**