ABSTRACT

This study presents the design, implementation, and performance evaluation of a Fiber to the Home (FTTH) network based on Gigabit Passive Optical Network (GPON) technology in the Casa Jardin residential cluster. As the demand for high-speed, stable, and reliable internet continues to grow, FTTH-GPON emerges as an effective solution for delivering triple-play services—comprising internet, voice, and video—to end users. The research methodology encompasses a comprehensive site survey, network topology mapping using Google Earth Pro, signal parameter calculation employing the Power Link Budget method, and network performance simulation through OptiSystem software. The physical deployment involves the integration of critical optical components, including Optical Line Terminals (OLT), Optical Distribution Cabinets (ODC), Optical Distribution Points (ODP), and Optical Network Terminals (ONT), to ensure efficient optical signal transmission from the central node to customer premises. Experimental results demonstrate that the proposed network design achieves optimal performance characterized by low signal attenuation and stable transmission quality. The findings of this study serve as a technical reference for telecommunication service providers aiming to develop scalable, efficient, and sustainable optical access networks, particularly in urban residential areas. The research methodology includes a site survey, network topology mapping using Google Earth Pro, Power Link Budget calculation, and performance simulation with OptiSystem. The physical implementation involves key components such as the Optical Line Terminal (OLT), Optical Distribution Cabinet (ODC), Optical Distribution Point (ODP), and Optical Network Terminal (ONT). The test results show a total attenuation (loss) of 23.975 dB, meeting the ITU-T G.984 standard (< 28 dB). The received power from manual calculation is –18.975 dBm, while OptiSystem simulation produces –18.073 dBm for downstream and –17.907 dBm for upstream. Field measurements indicate a downstream value of –21.51 dBm. The Bit Error Rate (BER) is recorded at 3.20759×10^{-32}, far below the threshold of 1×10^{-9}, indicating excellent transmission quality.

Keywords: FTTH, GPON, Power Link Budget, OptiSystem, Optical network design, triple play, passive optical network (PON)