

## ABSTRACT

The relocation of Indonesia's capital city to East Kalimantan, called the Capital City of the Archipelago (IKN), aims to support equitable development and reduce the burden on Jakarta as the center of the national economy. IKN will become Indonesia's new center of government and economy. With a population projected to reach 1.9 million by 2045, a reliable broadband service telecommunications infrastructure is required to support the smart city concept. The main challenge faced is the absence of telecommunications network infrastructure in the KIPP-1A area, so this research focuses on designing optical and cellular networks to meet the needs of fixed broadband and mobile broadband services in the KIPP-1A area.

This research follows the 3GPP TS 38.133 Version 15.3.0 Release 15, ITU IMT-2020, and ITU-T G.655.E standards to support optical and cellular network *planning* at KIPP-1A. The solution includes designing a fixed broadband network using G.655.E single mode fiber optic cable, designed with a *Ring* topology to ensure stable and optimal connectivity. In addition, a mobile broadband network using 5G Non-Standalone (NSA) technology option 3x at 2300 MHz frequency, designed to provide high-speed data services with low latency. Planning simulations were conducted using the network planning *software* Optisystem and Atoll, consider the parameters of Link Power Budget (LPB), Signal to *Noise* Ratio (SNR), Q-Factor, and Bit Error Rate (BER), Synchronization Signal Reference Signal Received Power (SS-RSRP), Synchronization Signal Signal to *Noise* and Interference (SS-SINR), and *throughput*.

The research results show that the fixed broadband network designed for *Ring* 1, *Ring* 2, *Ring* 3, and *Ring* 4 has LPB values  $\geq -28$  dBm, SNR  $\geq 22$  dB, Q-Factor  $\geq 6$ , and BER  $\leq 10^{-9}$ , these results have achieved ITU-T standards. The 5G mobile broadband network produces uplink throughput of 324.47 Mbps and downlink 565.40 Mbps, meeting IMT-2020 standards with SS-RSRP -57.42 dBm and SS-SINR 15.63 dB. These results show good and optimal network performance. It is hoped that the implementation of this solution can support the development of IKN as a smart city and meet digital communication needs in various sectors.

**Keywords:** Capital City of Nusantara, Fixed Broadband, Mobile Broadband, 5G NSA, Single mode G.655.3, Network Planning.