ABSTRACT

5G technology is believed to accelerate social, economic, and cultural transformation digitally. One of the advantages of the 5G network is its high data transfer speed and low latency. The initial 5G cellular network operates based on IMT-2020 (International Mobile Telecommunications-2020) technology on the 2,300 MHz or 2.3 GHz frequency band. The 5G network has three main specifications: eMBB (Enhanced Mobile Broadband) with a download speed of 10 Gbps, URLLC (Ultra Reliable and Low Latency Communications) with latency below 1 millisecond, and mMTC (Massive Machine Type Communications) with one million devices per km². Currently, the government and operators face several challenges in preparing for the implementation of the 5G network, including regulations and the necessary infrastructure that must be developed.

Pekanbaru is one of the largest economic centers on the island of Sumatra and is a city with high levels of growth, migration, and urbanization. The high-speed internet and reliable connectivity offered by 5G can drive economic growth in Pekanbaru. The economy of Pekanbaru is supported by trade and oil mining. The city has an international airport, intercity and interprovincial bus terminals, and two ports. The population of Pekanbaru is cosmopolitan, influenced by its strategic location in the middle of the Eastern Sumatra Highway. Therefore, the development of cellular network technology is necessary to meet the needs of the community. Thus, the 5G cellular network becomes a solution to support high-speed data communication. This research plans and optimizes the 5G NR cellular network at a frequency of 2.3 GHz in Pekanbaru City, aiming to support the planning and optimization of the 5G NR cellular network in Pekanbaru City using capacity planning and coverage planning analysis. In this study, 5G network planning and simulation are conducted using Atoll 3.4 software. This network planning uses the 2.3 GHz frequency in a Non-Standalone (NSA) scenario.

Based on the simulation results, a capacity planning analysis was obtained with an average SS-RSRP value of -105.88 dBm, which is in the bad signal category, an average SS-SINR value of 16.82 dB, which is in the good category, and a throughput of 265 Mbps. Meanwhile, the coverage analysis with an average value

of -84.52dBm is in the very good category, the average SS-SINR value is 8.97 dB, which is in the normal category and throughput is 216.2 Mbps. Then capacity planning optimization was carried out and an average RSRP of -71.59 dBm was obtained, including the very good signal category, with a focus zone of 67.1%, and a throughput of 224 Mbps. Meanwhile, optimization was also carried out with coverage planning and an average RSRP of -67.99 dBm was obtained, including the very good signal category, with a focus zone of 99.8% and a throughput of 235 Mbps.

Keywords: 5G NR, Capacity, Coverage, SS-RSRP, SS-SINR, Throughput.