

ABSTRACT

The development of intelligent transportation systems requires reliable communication networks with high capacity and low latency. One of the enabling technologies is the 5G New Radio (NR) network, particularly for supporting Vehicle-to-Infrastructure (V2I) services. This study aims to analyze the design of a 5G NR network operating on lowband 700 MHz (n28) and midband 2.3 GHz (n40) frequencies to support V2I services along Ahmad Yani Road to Tunjungan Road, Surabaya City, covering a distance of 9.46 km with dense urban characteristics and high traffic volume.

The research methodology involves coverage and capacity planning based on 3GPP standards using the Urban Macro (UMa) propagation model, followed by validation through simulations using ATOLL software. Network performance is evaluated using key performance indicators (KPIs), including SS-RSRP, SS-SINR, and throughput. In addition to technical aspects, this study also considers economic, sustainability, regulatory, and user-related aspects.

Simulation results indicate that the 700 MHz frequency provides wider coverage with fewer required sites but is limited in terms of capacity and throughput. In contrast, the 2.3 GHz frequency demonstrates superior performance in signal quality and throughput, achieving an average throughput of approximately 219 Mbps in the coverage scenario and 235 Mbps in the capacity scenario. Overall, the 2.3 GHz band is more suitable for supporting V2I services that require high capacity and stable channel quality in dense urban environments, while the 700 MHz band is more appropriate as a wide-area coverage layer. This study is expected to serve as a reference for 5G NR network planning to support V2I implementation in urban areas in Indonesia.

Keywords: *5G New Radio, Vehicle-to-Infrastructure, Lowband, Midband, Coverage, Capacity.*