ABSTRAK

Perkembangan teknologi komunikasi generasi kelima (5G) menawarkan peningkatan signifikan terhadap kapasitas, kecepatan, dan kualitas layanan jaringan. Salah satu spektrum andalan adalah frekuensi 3,5 GHz (*mid-band*) yang memiliki keseimbangan optimal antara jangkauan dan *throughput*. Penelitian ini bertujuan merancang jaringan 5G pada frekuensi 3,5 GHz di Kecamatan Cibiru untuk mengoptimalkan cakupan (*coverage*) dan kapasitas (*capacity*) layanan *broadband*. Metode yang digunakan mencakup *coverage planning* dan *capacity planning* berbasis model propagasi *Urban Macro* (UMa) sesuai standar 3GPP, dengan parameter kinerja utama (KPI) seperti SS-RSRP, SS-SINR, dan *throughput*. Proses perancangan meliputi survei wilayah, analisis kebutuhan, perhitungan *link budget*, penentuan lokasi *gNodeB*, serta simulasi menggunakan perangkat lunak Atoll. Hasil simulasi menunjukkan rancangan jaringan mampu memberikan cakupan optimal pada seluruh area Kecamatan Cibiru, dengan nilai SS-RSRP ≥ -85 dBm dan SS-SINR ≥ 10 dB di mayoritas wilayah. Analisis kapasitas mengindikasikan kemampuan memenuhi kebutuhan trafik pengguna hingga proyeksi beberapa tahun ke depan, dengan *throughput* yang sesuai kebutuhan layanan *enhanced mobile broadband* (eMBB) seperti *streaming* 4K/8K, AR/VR, dan *cloud computing*. Penelitian ini diharapkan dapat menjadi acuan teknis perencanaan jaringan 5G di wilayah suburban, khususnya dalam memanfaatkan spektrum *mid-band* untuk optimalisasi layanan *broadband* berkecepatan tinggi.

Kata kunci: 5G, 3,5 GHz, *Coverage Planning*, *Capacity Planning*, Urban Macro

ABSTRACT

The fifth generation (5G*) mobile communication technology offers significant improvements in network capacity, speed, and service quality. One of its key spectrum bands is* 3.5 GHz *(mid-band), which provides an optimal balance between coverage range and throughput. This study aims to design a 5G network operating at* 3.5 GHz *in Cibiru District to optimize coverage and capacity for broadband services. The methodology includes coverage planning and capacity planning based on the Urban Macro* (UMa) *propagation model according to* 3GPP *standards, using key performance indicators (KPIs) such as* SS-RSRP, SS-SINR, *and throughput. The design process involves site surveys, requirements analysis, link budget calculation, gNodeB site selection, and simulation using Atoll software. Simulation results show that the proposed network design can provide optimal coverage across the entire Cibiru District, with* SS-RSRP ≥ -85 dBm *and* SS-SINR ≥ 10 dB *in most areas. Capacity analysis indicates the ability to meet user traffic demands for several years ahead, with throughput meeting the requirements of enhanced mobile broadband* (eMBB) *applications such as* 4K/8K *video streaming*, AR/VR*, and cloud computing. This research is expected to serve as a technical reference for* 5G *network planning in suburban areas, particularly in leveraging mid-band spectrum for high-speed broadband optimization.*

Keywords: 5G, 3.5 GHz, Coverage Planning, Capacity Planning, Urban Macro