ABSTRACT

The use of analog-based radio communication is currently very limited. Considering the increasing communication demands, a migration to digital radio systems is necessary—not only for better signal quality and improved communication security, but also for more efficient use of the frequency spectrum. One of the currently developed digital radio technologies is DMR Trunking, which operates in the frequency range of approximately 400 MHz to 470 MHz. Due to the limited frequency band allocation and its susceptibility to interference from cellular networks, system upgrades and planning are required to anticipate future frequency needs. This planning was carried out at a frequency of 420 MHz, using the most suitable propagation model—Okumura-Hatta—based on the propagation category and calculation rules. The simulation was applied to an urban area in Banyumas Regency, covering a total area of 1,327.59 km². The planning results indicated that 2 gateway antennas were required based on coverage planning calculations. The simulation, conducted using Atoll software, showed that the signal could be distributed throughout Banyumas Regency, with RSSI values ranging from -65 dBm to -120 dBm and an average received signal of -47.27 dBm. The optimal RSSI values ranged from -65 dBm to -70 dBm, covering an area of 422.5 km². The SINR values ranged from 5 dB to 31 dB, with an average received signal of 24.81 dB. The widest SINR coverage occurred between 30 dB and 31 dB, covering an area of 497.2 km². These results indicate that most of Banyumas has very good SINR quality. In DMR Tier III Trunking, the channel bandwidth is typically 12.5 kHz, with one DMR channel capable of carrying 2 TDMA slots. The throughput quality in Banyumas reached a maximum of 4–6 kbps, with an average of 5.47 kbps. The effective signal quality was measured at -79.38 dBm, with the widest coverage found at -70 dBm over an area of 44.1 km². The best signal quality ranged from -43 dBm to -60 dBm, covering an area of 146.27 km². The largest overall coverage area was 547.2 km², with signal levels between -75 dBm and -105 dBm, which can be categorized as fairly good signal quality. All simulation results, through several trials of determining the best site locations, show that most of the area is adequately served by effective signal coverage in accordance with ETSI and Hytera standards. However, there are still blank spot areas that do not receive signal transmission, which require coverage redesign or the deployment of booster sites using base station repeaters.

Keywords: DMR Radio *Trunking*, Okumura-Hatta, *Coverage* Planning, Atoll.