

ABSTRACT

The development of cellular communications has reached a state of high level, including the technology in Indonesia. With data rate estimated to exceed 20 Gbps, the fifth generation of cellular communication technology (5G) New Radio (NR) is expected to accommodate stable and equitable services for each 5G NR user. However, problem about the unknown parameters in 5G NR technology, such as Fast Fourier Transform (FFT) size, cyclic prefix (CP) length, block length, coding rate, and bandwidth that good and suitable to be applied in Indonesia region indicates that 5G NR technology still needs further studies. This thesis investigates the characteristics of each OFDM Numerology, which is useful for implementation of 5G NR technology in Indonesia.

This thesis studies about 5G NR technology performances using Orthogonal Frequency Division Multiplexing (OFDM) with Numerologies 0, 1, 2, 3, and 4 under Indonesia 5G channels to serve various future 5G technology needs. This thesis calculates and evaluates the outage performances of Indonesia 5G channels, which are also validated using bit error rate (BER) and frame error rate (FER) performances. The simulation is based on OFDM Numerology concept in 5G NR standards with several cyclic prefix (CP) sizes and modulations according to the 5G services.

The results of this thesis are evaluation result of 5G NR performances in Indonesia for various Numerologies and evaluation result of potential parameters to be optimized to achieve 5G maximum performance in Indonesia. This thesis shows the characteristics of OFDM Numerologies 0, 1, 2, 3, and 4 under Indonesia 5G channels i.e., achieved diversity order of outage performances, energy per bit-to-noise power spectral density ratio (E_b/N_0) value at BER performances of 10^{-4} , number of paths obtained for each Numerology with the power of each path, and gap between obtained BER performances and existing theory. This thesis also provides table of power analysis based on different modulations for OFDM Numerologies 0, 1, 2, 3, and 4 which is expected to be an accurate reference for hardware development in Indonesia.

Keywords: 5G New Radio (NR), OFDM Numerology, Cyclic prefix (CP), Modulation, Indonesia 5G channel.