ABSTRACT

The fifth telecommunication generation New Radio (5G-NR) is using lower, mid, and high band, of which the high band of the millimeter wave (mm-wave) band is sensitive to environmental conditions. The deployment of 5G-NR in Indonesia requires channel model analyses to provide optimal services in Indonesia, because the tropical environmental effect of Indonesia is predicted to be high to the 5G-NR performances. This thesis proposes a 5G-NR channel model considering barometric pressure effects, where Telkom University (Tel-U) and Universitas Sriwijaya (UnSri) are selected to represent the conditions of major cities in Indonesia.

To obtain the 5G-NR channel model, which is mainly represented in power delay profile (PDP), this thesis considers: (i) environmental conditions of the area expressing the real Indonesia tropical climate and (ii) computer simulations to generate many instantaneous channel paths. The channel model is important to derive the theoretical outage performance of 5G-NR in Indonesia by assuming that Shannon channel capacity is achieved and strong channel coding is used. The proposed 5G channel model is evaluated by a series of computer simulations. The outage performance of the proposed channel is validated by frame-error-rate (FER) using cyclic prefix orthogonal frequency division multiplexing (CP-OFDM) for 5G NR numerology 2 with convolutional codes and 5G-NR quasi-cyclic low density parity check (QC-LDPC) codes base-graph 2 (BG2) for the bandwidth of 50 MHz and 200 MHz, respectively.

This thesis found that high barometric pressure causes less power of PDP path given the other parameters are the same. However, in practice, the power of each PDP may not be affected directly by only a single parameter of barometric pressure as in the UnSri channel model. This phenomenon makes the theoretical outage performances the 5G channel models of Tel-U and UnSri have slight opposite performances due to the difference in the power of each PDP path. These slight difference performances indicate that the barometric pressure effect is not significant to the 5G performances. The results of this thesis are expected to provide contributions to the development of 5G channel model in Indonesia and their practical implementations.

Keywords: *5G-New Radio*, *channel model*, *barometric pressure effects*, *channel capacity*, *outage performance*.