# ABSTRACT

The fifth telecommunication generation (5G) is started to be deployed in 2020, where the candidates of high frequencies of 1–100 GHz are causing big attenuations compared to the sub-1 GHz bands. This thesis considers a study on 5G system with operating frequency of 3.3 GHz and bandwidth of 99 MHz based on the 5G New Radio (NR) specification of Orthogonal Frequency Division Multiplexing (OFDM) numerology $\mu = 1$.

This thesis proposes (i) Telkom University 5G channel model considering humidity effects and (ii) a framework to derive 5G channel model using real-field parameters for in Indonesia. The 5G channel model is obtained from thousand trials for several areas in the Telkom University campus. The validity of the proposed 5G channel model is confirmed using the similarity of gradients of Frame-Error-Rate (FER) performances and the theoretical outage performances.

The results of this thesis are (i) the valid Power Delay Profile (PDP) of Telkom University 5G channel model considering humidity effects, (ii) reasonable theoretical outage performances of Telkom University 5G channel model derived based on the Shannon capacity, (iii) reasonable bit-error rate (BER) and FER performances of the 5G waveform evaluated using the obtained 5G channel model using channel coding, and (iv) a clear framework to derive 5G channel model for all cities in Indonesia. This thesis found that 5G channel model at maximum humidity has small number of paths and worse outage performance compared to that of at minimum humidity. The results show that the utilization of cyclic prefix (CP)-OFDM with channel coding helps the diversity effect of 5G transmissions to achievable. This thesis also conclude that the Convolutional codes are not strong enough to evaluate the outage performances compared to Polar codes under Telkom University 5G channel model considering humidity effects. The results of this thesis are expected to provide contributions to the development of 5G in Indonesia, where all outage performances and related curves are used as the references in the implementations.

**Keywords:** 5G New Radio (NR), channel model, humidity effects, power delay profile, outage performance.