ABSTRACT

This thesis studies the preparation for the realization of fifth-generation (5G) new radio (NR) future railway mobile communication systems (FRMCS) for high-speed train signaling technology in Indonesia. According to International Union of Railways (UIC), FRMCS will be implemented globally in 2035, of which the preparations in Indonesia must start early. In addition, Indonesia does not determined the exact frequency yet for high speed train (HST) in Indonesia, therefore, studying the frequency issue is also important in this thesis. To realize the FRMCS, HST signaling requires high reliable transmissions, which is achievable by (i) channel coding, (ii) synchronization, and (iii) performance at the best frequency.

Regarding channel coding, this thesis analyzes based on the density evolution (DE) technique for the matrix of 5G NR quasi-cyclic (QC) low density parity check (LDPC) codes to determine the characteristics of channel coding when the channel changes rapidly due to high speed movement of the train. This thesis also evaluates the coding performance of the 5G NR QC-LDPC codes with several iteration patterns to find the best iteration pattern to support in practice the HST.

This thesis successfully analyzed 5G NR QC-LDPC codes based on the DE technique and found that the increasing the number of extended parity causes the increase of error-floor due to increase of degree one. This thesis has also found the best iteration pattern for the performances evaluated under the additive white Gaussian noise (AWGN) channel. On the other hand, the solutions for synchronization and frequency selection are currently under the progress to be reported later.

Keyword: FRMCS, Channel Coding, Synchronization, Channel Model.