

## ABSTRACT

The future railway mobile communication system (FRMCS) based on the fifth telecommunication generation new radio (5G NR) third generation partnership project (3GPP) TS 22.289 and European telecommunication standard institute (ETSI) TR 103 459 is expected to support train operating at speed up to 500 km/h. FRMCS is still suffering from Doppler shift problem due to the change of channels within the duration of one orthogonal frequency division multiplexing (OFDM) symbol which damage the orthogonality. These effect results in the information damage for the high-speed railway communication system. This thesis proposes a Doppler spread compensator (DSC) having two functions: (i) to compensate the Doppler effect and (ii) to improve the signal quality using multiple input multiple output (MIMO) technique consisting two arrays.

Performances are evaluated in terms of the bit error rate (BER) and frame error rate (FER) against the signal to noise power ratio (SNR) and to the normalized Doppler spread ( $f_d T_s$ ) using series of computer simulations. The results of this thesis show that: (i) the proposed DSC can remove the Doppler effect significantly such that no more error-floor occurs and (ii) the proposed MIMO-DSC improves performance and provides a larger capacity for additional future applications. The results are expected to contribute to future development of high-speed.

**Keywords:** Doppler Spread Compensator, Doppler effect, Future Railway Mobile Communication System, Multiple Input Multiple Output.