ABSTRACT

Communication systems for high-speed flying devices, such as drones and missiles, have an error-floor caused by the Doppler effect, which causes frequency and phase shifting, causing intercarrier interference (ICI), that destroys real-time data transmission. Error-floor can not be reduced by the channel coding, however the turbo-cliff effect is still expected to be provided by the channel coding. This thesis proposes low-density parity-check (LDPC) codes as the channel coding with a structure based on the second generation digital terrestrial television standard broadcasting system (DVB-T2) on a broadband communication system for high-speed flying devices. LDPC codes are chosen because they have performances approaching the Shannon limit with low decoding complexity and resistant to various channel conditions on high speed flying devices. This thesis also proposes some threshold $\mathcal{S}$ to avoid irrational bit-error-rate (BER), which is BER which suddenly increases even at signal-to-noise power ratio (SNR) is high, because log-likelihood ratio (LLR) is infinite during the decoding process.

The proposed system is evaluated using computer simulations for the additive white Gaussian noise (AWGN) and multipath Rayleigh fading channels using 4 quadrature amplitude modulation (4-QAM). This thesis also uses pilot-assisted channel estimation and the minimum mean squared error (MMSE) equalization method to get better performance, even though the channel changes quickly.

The results of this thesis are: (i) practical LDPC codes design as channel coding to be applied in flying devices, (ii) the maximum speed to achieve BER below 10^{-2}, and (iii) the best threshold $\mathcal{S}$ to avoid the infinite LLR. The results of this thesis are expected to contribute significantly to the development of communication systems on flying devices sending real-time multimedia data.

Keywords: Doppler effect, LDPC, OFDM, BER, real-time.