ABSTRACT

Nowadays, telecommunication systems are required to fulfil diverse demands requiring very high data speeds up to 20 Gbps, which is achievable by using high index modulation. The fifth telecommunication generation new radio (5G NR) is developed to increase data rate supported by very high modulation 256-quadrature amplitude modulation (256-QAM). 256-QAM has high modulation index to increase of spectrum efficiency significantly. However, 256-QAM 5G NR has the disadvantage of being susceptible to noise and interference due to its large size constellation and it is not supporting iterative decoding.

This undergraduate thesis proposes a design of 256-QAM demapper to have iterative decoding capabilities that increases resistance to noise and interference due to support of error correction coding. Due to the use of iterative decoding, this undergraduate thesis considers extrinsic information transfer (EXIT) chart as a tool to evaluate the 5G NR and decoder parameters accordingly.

This undergraduate thesis examines 256-QAM 5G NR demapper released by the 3^{rd} Generation Partnership Project (3GPP) standard with a demapper using soft demapper principle. The 5G 256-QAM NR performance is evaluated on Additive White Gaussian Noise and frequency-flat Rayleigh Fading channel. The performance is then further improved by selecting the appropriate channel coding with the help of the EXIT trajectory. The number of iterations and demapper complexity is confirmed by using the EXIT chart. The result of this undergraduate thesis is the 256-QAM 5G NR modulation characteristics through the results of several test and this undergraduate thesis discovered that 256-QAM 5G NR does not support iterative decoding. This undergraduate thesis also results the new proposed 5G NR demapper having iterative decoding capability. This undergraduate thesis is expected to be the reference of 5G NR and the next generation developement.

Keywords: 5G New Radio, 256-QAM, demapper, EXIT chart.