ABSTRACT

Sparse Code Multiple Access (SCMA) can support the system when overloading occurs at the receiver side to improve the spectrum efficiency of the system by properly designing the symbol mapping. The performance of SCMA is determined by a sparse codebook by mapping bits directly to a multidimensional codeword that is affected by energy diversity and the minimum Euclidean distance of the multidimensional constellation (MC). Then, at the receiver side of the SCMA, there is a Message Passing Algorithm (MPA) that serves to reduce interference between users.

This final project simulates the design of three types of codebook designs, namely codebook design against phase and weighting codebook design with weight values $w_1 = 0.6$; $w_2 = 0.3$; $w_3 = 0.1$ against phase. Using $\frac{\pi}{4}$ and $\frac{\pi}{3}$ phase rotations, using Latin and non-Latin generators, line constellations with AWGN, Rayleigh fading, and Rician channels. There are also constellation indicators such as minimum Euclidean distance, number of collisions at constellation points, and using six users on four resource elements. The measured system performance is the BER.

The simulation results of this final project research show from the three channels tested, in the AWGN channel the optimal results occur in Latin $\frac{\pi}{3}$ with a BER value of 10^{-3} at SNR 6.96 dB and the worst in non-Latin $\frac{\pi}{3}$ with a BER of 10^{-1} at SNR 6 dB, in Rayleigh fading optimal in non-Latin $\frac{\pi}{3}$ with a BER of 10^{-3} at SNR 13.73 dB and worst in Latin $\frac{\pi}{3}$ with a BER of 10^{-3} at SNR 13.87 dB, and in Rician channel optimal in non-Latin $\frac{\pi}{4}$ and worst in non-Latin $\frac{\pi}{3}$ with no BER data. Then, the optimal and worst results of codebook design with the addition of weighting results in the AWGN channel are Latin $\frac{\pi}{3}$ with BER value 10^{-1} at SNR 12.27 dB and in

Non-Latin $\frac{\pi}{4}$ with BER value 10^{-1} at SNR 12.16 dB, in Rayleigh fading, non-Latin $\frac{\pi}{4}$ has a BER value of 10^{-1} at SNR 14.3 dB and Latin $\frac{\pi}{4}$ has a BER value of 10^{-1} at SNR 14.42 dB, on the Rician channel, Latin $\frac{\pi}{4}$ has a BER value of 10^{-3} at SNR 15.15 dB and non-Latin $\frac{\pi}{3}$ has a BER value of 10^{-3} at SNR 15.24 dB.

Key Word : Sparse Code Multiple Access, Codebook design weighting, Phase rotation, Basic constellation, BER.