Experiment No. 5

Bit error rate of 16 bit Quadrature Amplitude Modulation (16- QAM) with and without Gray labelling

Write a MATLAB program (without using communication toolbox inbuilt functions like 'qammod') to perform 16 bit QAM and demodulation with and without Gray labelling. Come up with own constellation diagram for both the cases.

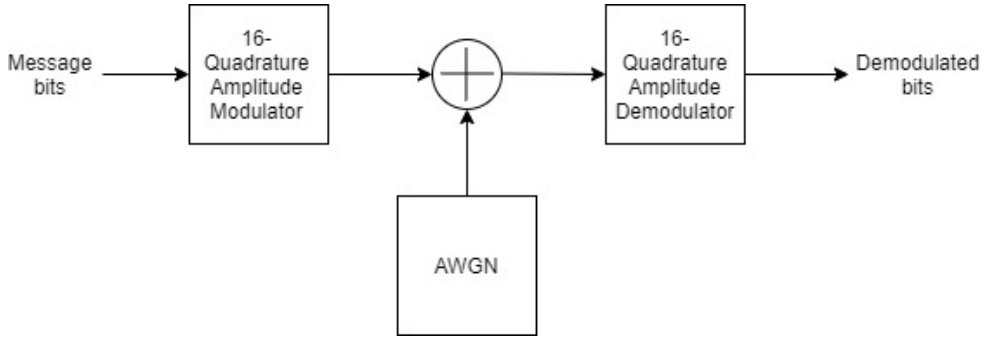

Figure 1: BPSK modulation block diagram

Generate random bits sequence and perform QAM. Add additive white gaussian noise (AWGN) with SNR varying in the range of -10 to +10 dB in steps of 1 dB. The generation of noise remains same as in BPSK experiment (Note that the noise has to be complex as QAM signals are complex in nature). Demodulate the received signal. Compare the demodulated bits and the message bits to obtain the error bits.Find out the error probability and plot Bit Error Rate (BER) vs. Signal to Noise Ratio (SNR) curve for simulated values in the following two cases:

a. 16-QAM without Gray labelling.

b. 16-QAM with Gray labelling.

Compare them with the plots obtained by plotting theoretical values computed using the equations based on Q-function.