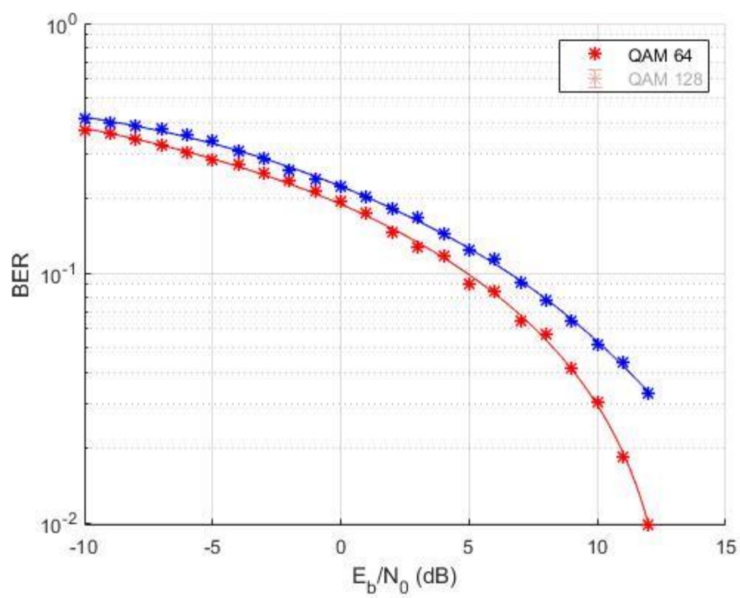
Telecom SubSystems Final Project Report

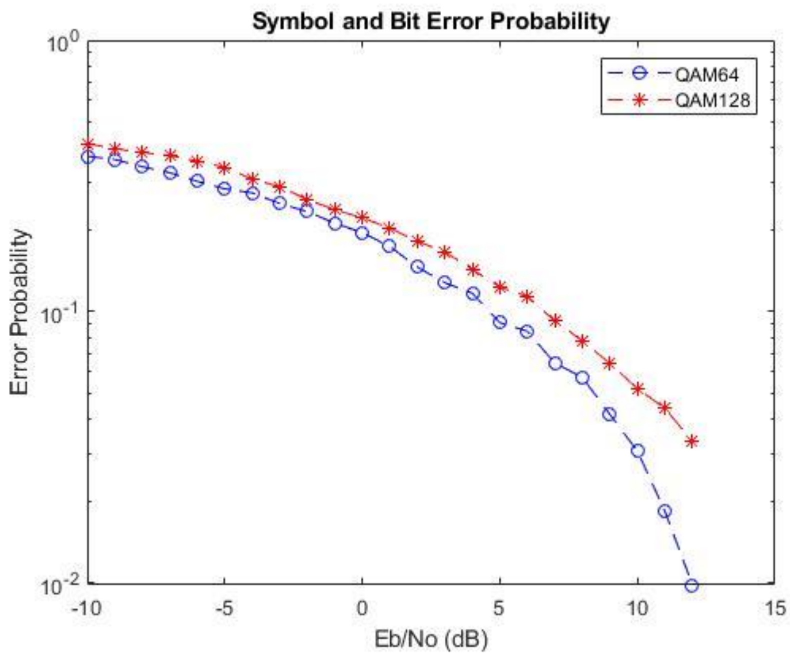
Name: Evangelos Siatiras
AM: EN2190001

In this project I implemented a Simulink model has been developed to simulate different types of QAM modulation/demodulation techniques at different bit rates of (64 and 128 bits) using Matlab/Simulink Communication System Toolbox. Also, the BERTool under Matlab is used to evaluate the performance of each QAM technique through plotting the Bit Error Rate (BER) vs. the ratio of bit energy to noise power spectral density (Eb/No).
Also I have implement the export of a plot showing comparison between the resulting transmission errors in the received signal at different noise or Eb/No levels. Since Eb/No is defined as the ratio of bit energy per symbol to noise power spectral density, in decibels, then increasing this ratio should result in less overall transmission errors and decreasing this ratio should result in higher transmission error.
Generally, as the transmission range increases, a step down to lower modulations would be required (e.g. Binary Phase Shift Keying "BPSK"). But, for closer distances higher order modulations like the QAM could be utilized for higher throughput.

The BERTool invokes the simulation for Eb/No specified ,collects the BER data from the simulation, and creates the following plot by implementing the Monte Carlo simulation technique to generate and analyze the BER data.



It is very similar with the plot I created with the difference in the fitting of the line (The one from the BERTool is normalized).

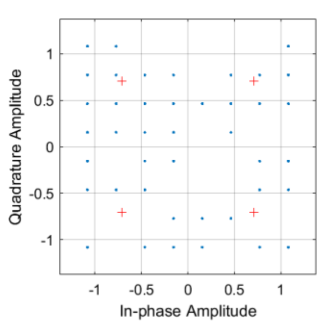


Both figures illustrate the fact that at higher transmission bit rates, the error in the received signal increases. This is known as the tradeoff between the transmission speed and the accuracy of the transmitted data.

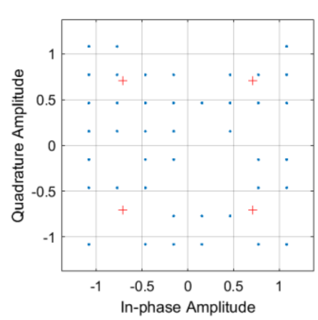
Increasing this Eb/No ratio should result in less overall transmission error and decreasing this ratio should result in higher transmission error as shown in the figure.

Also, a representation of a 64-QAM constellation is presented. The Random Integer Generator block generates a uniformly distributed random integers in the range [0, M-1], where M is the M-array number defined in Table 2. In this model, M is selected equal to the bit rate of the used QAM technique.

.



Before Noise



After Noise