EXPERIMENT # 7
Quadrature Amplitude Modulation QAM

INTRODUCTION

QAM is a method for sending two separate (and uniquely different) channels of information. The carrier is shifted to create two carriers namely the sine and cosine versions. The outputs of both modulators are algebraically summed, the results of which is a single signal to be transmitted, containing the In-phase (I) and Quadrature-phase (Q) information. The set of possible combinations of amplitudes (A) and phases (θ), as shown on an x-y plot, is a pattern of dots known as a QAM constellation as shown in Figure 1.

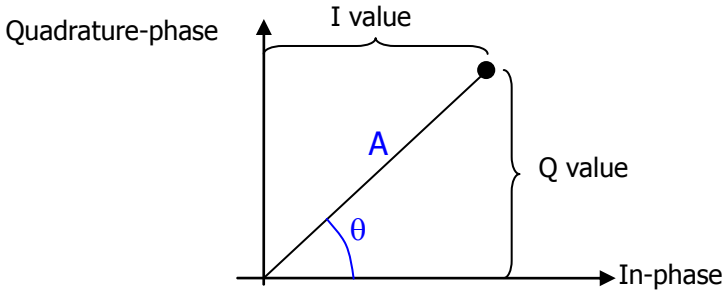

Figure 1

Consider the 16 QAM modulation schemes, in which 4 bits are processed to produce a single vector. The resultant constellation consists of four different amplitude distributed in 12 different phases.

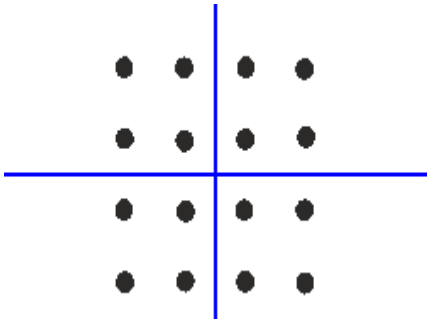

Figure 2: Constellation diagram**.**

Laboratory Procedure

- Consider the following 16 QAM transmission through an Additive White Gaussian Noise (AWGN) channel as shown in Figure 3..
- Set Different values of SNR in the AWGN channel and evaluate the system's performance based on the recorded BER. We recommend the student to go through the scatter plot at each SNR value.
- Change the constellation size to 32 and 64 and repeat the pervious step.

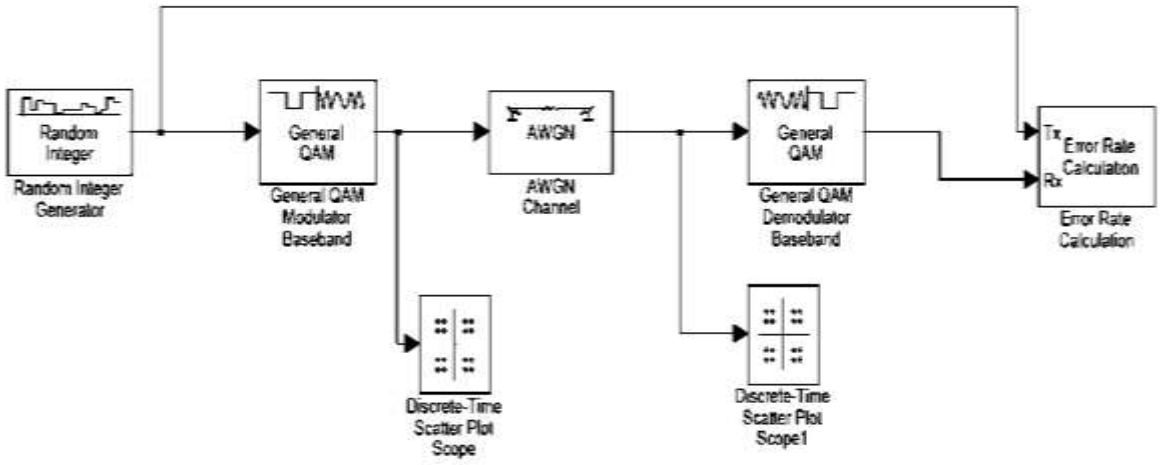

Figure 3: Block diagram of QAM system

Report:

1. Plot the BER vs. SNR for modulation size 16, 32 and 64.
2. Discuss the results.
3. Why we would switch to high modulation size while the error rate is higher? How the bandwidth of the transmit signal does change with the modulation size?

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