Design and Analysis of a BPSK Bandpass modulation and demodulation scheme in MATLAB Simulink

By - Arnav Tripathi

Abstract: -

Presented here is a BPSK modulation and demodulation scheme using MATLAB Simulink and analysing the Bit Error Rate for high and low SNR in the AWGN.

We use a randomly generated 16-bit sequence as input which is multiplied with a carrier sine wave of frequency 10 Hz.

Visualisation of the randomly generated sequence, carrier sine wave and their corresponding BPSK modulated waveform, a waveform with the addition of AWGN with high and low SNR as 2 cases for study, and finally the BPSK demodulated wave.

The Bit Error Rate (BER) calculation is also shown for the different SNR values.

Implementation: -

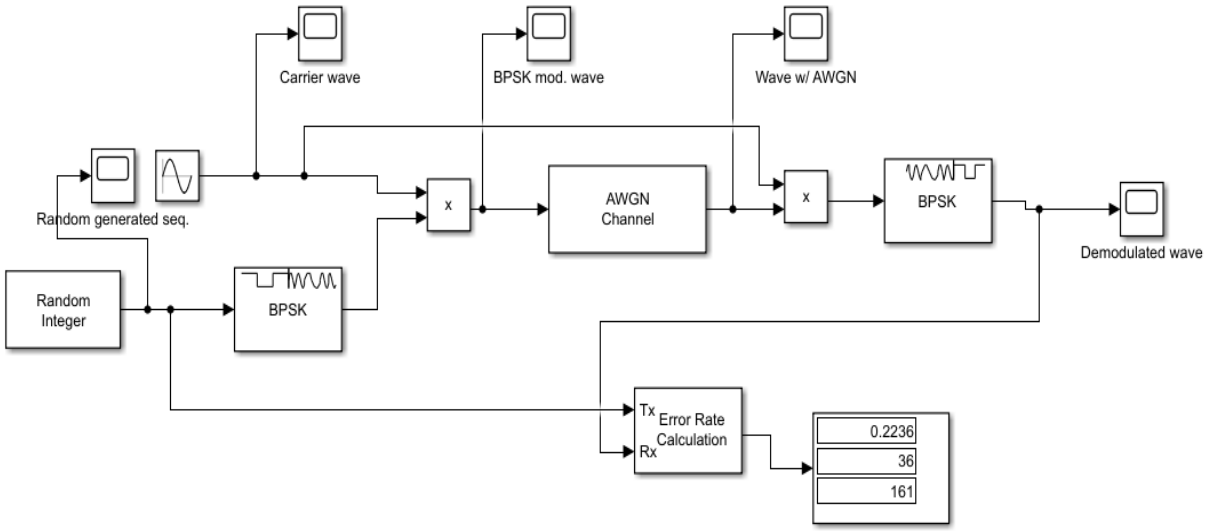

Figure 1 Block Diagram for implementation

Waveforms/Results: -

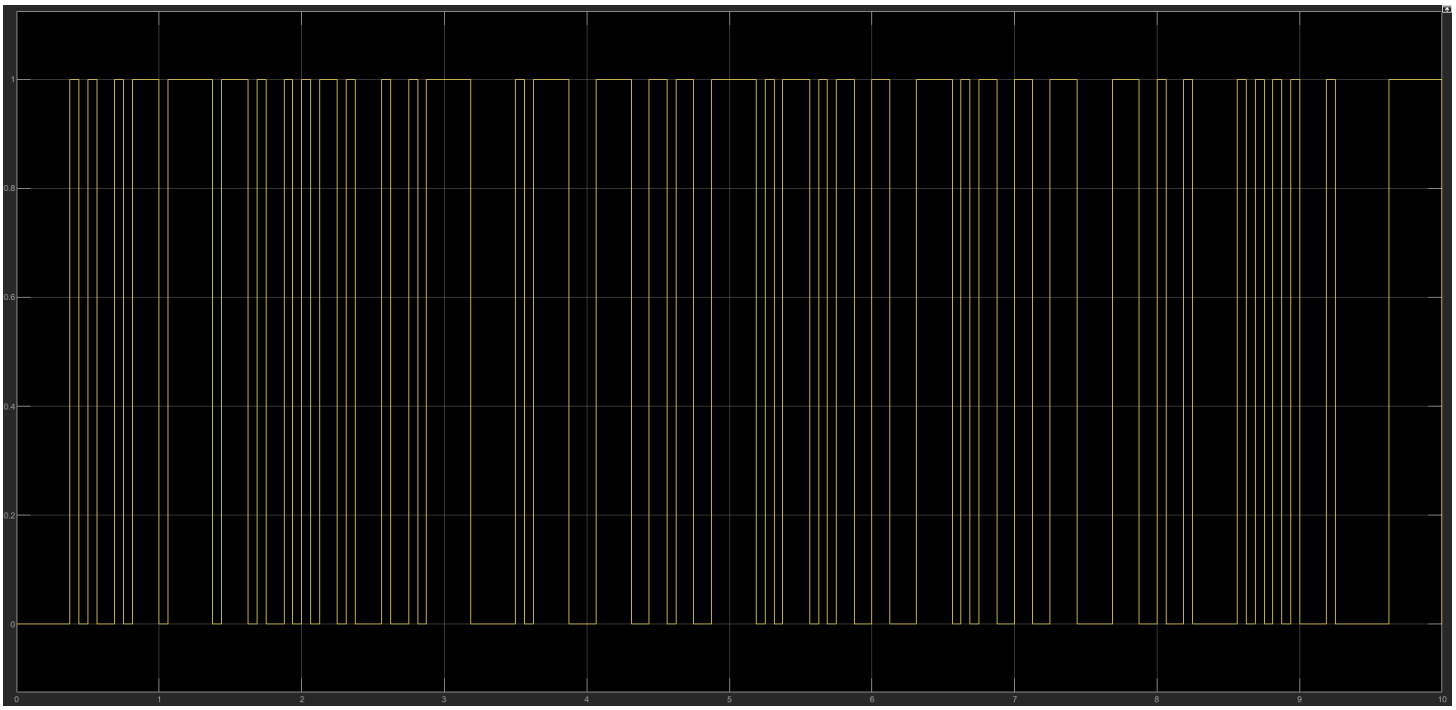

Figure 2 Randomly generated 16-bit sequence

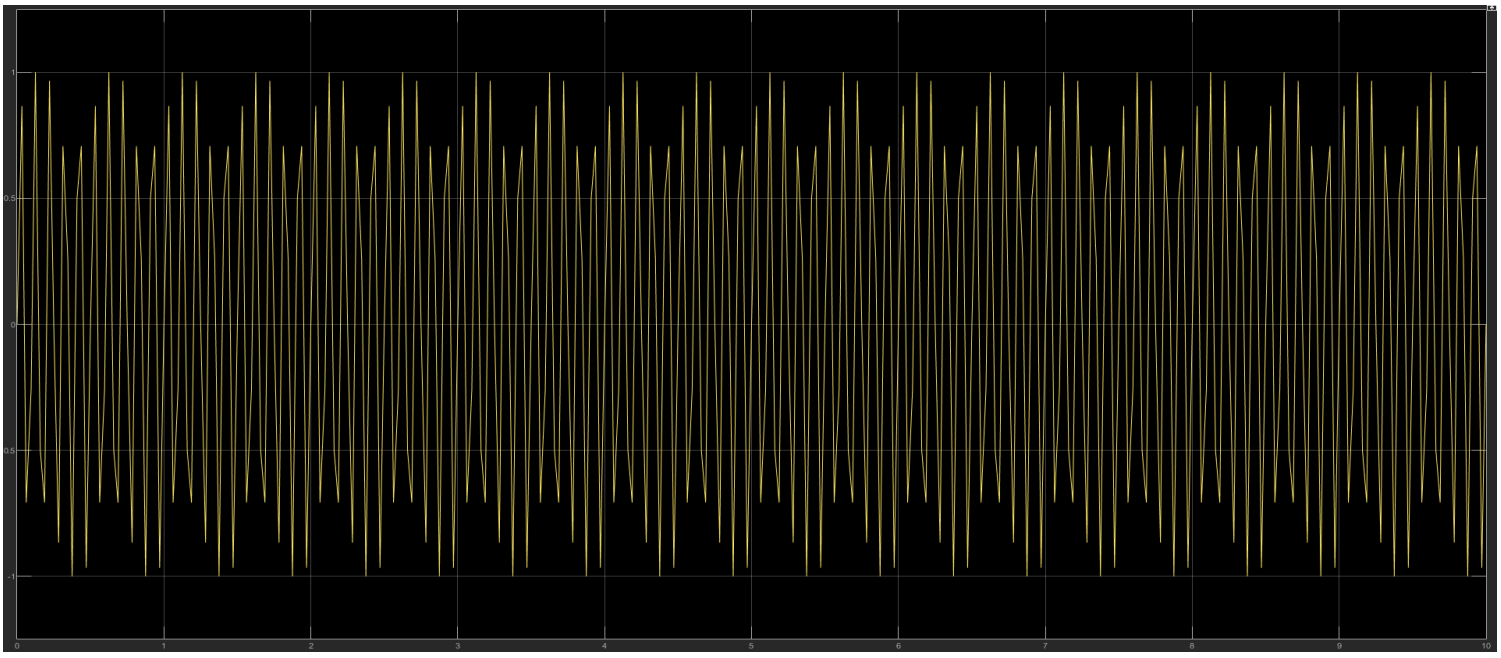

Figure 3 Carrier wave

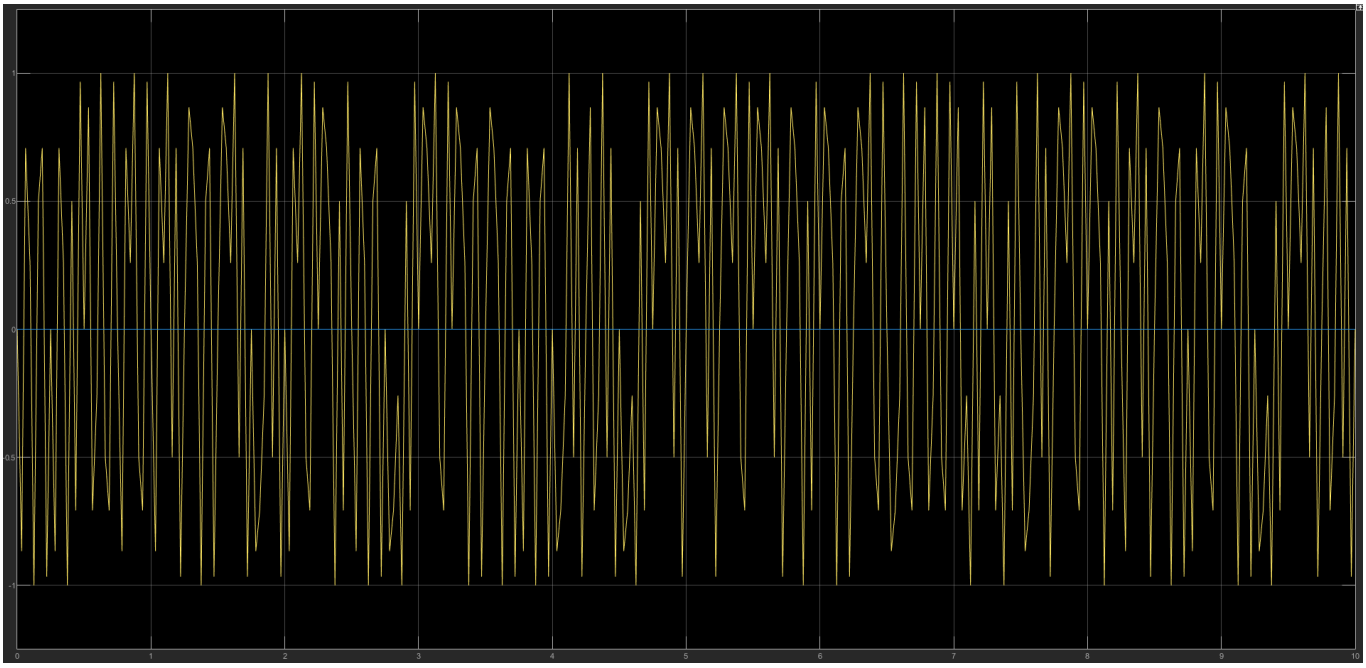

Figure 4 BPSK Modulated wave

For SNR = 30dB: -

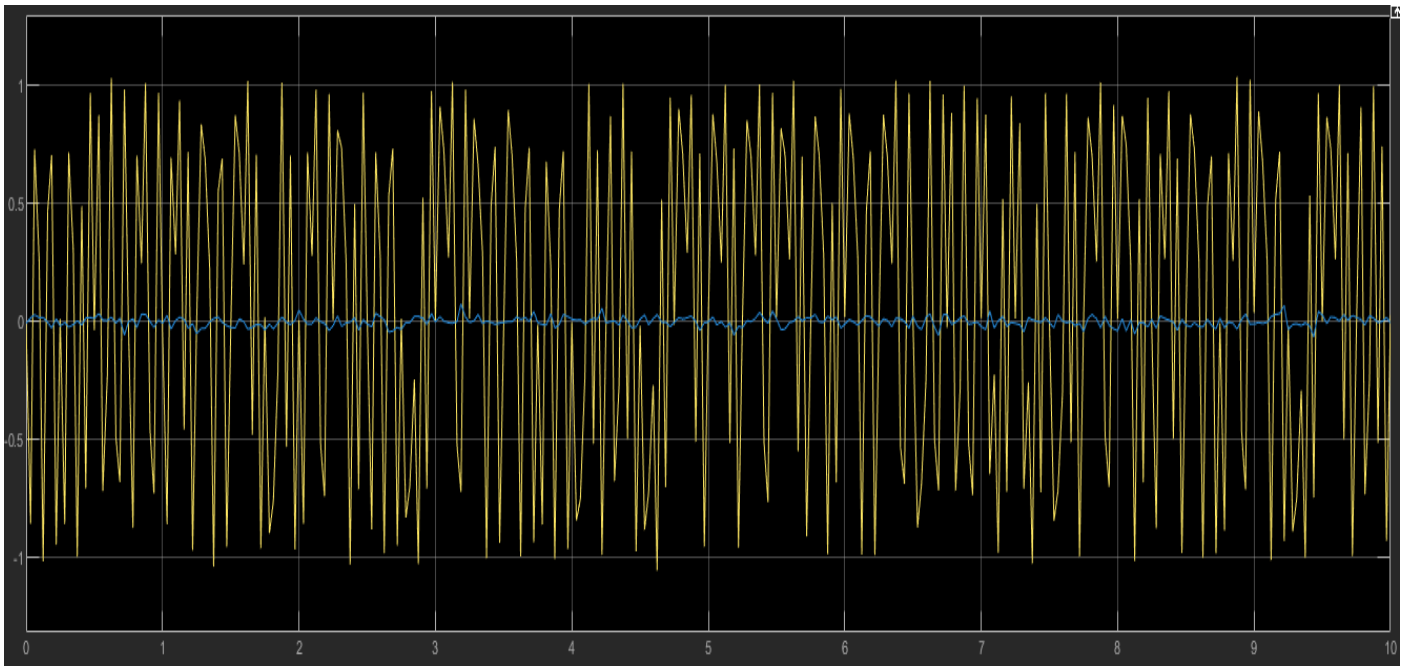

Figure 5 Wave with AWGN

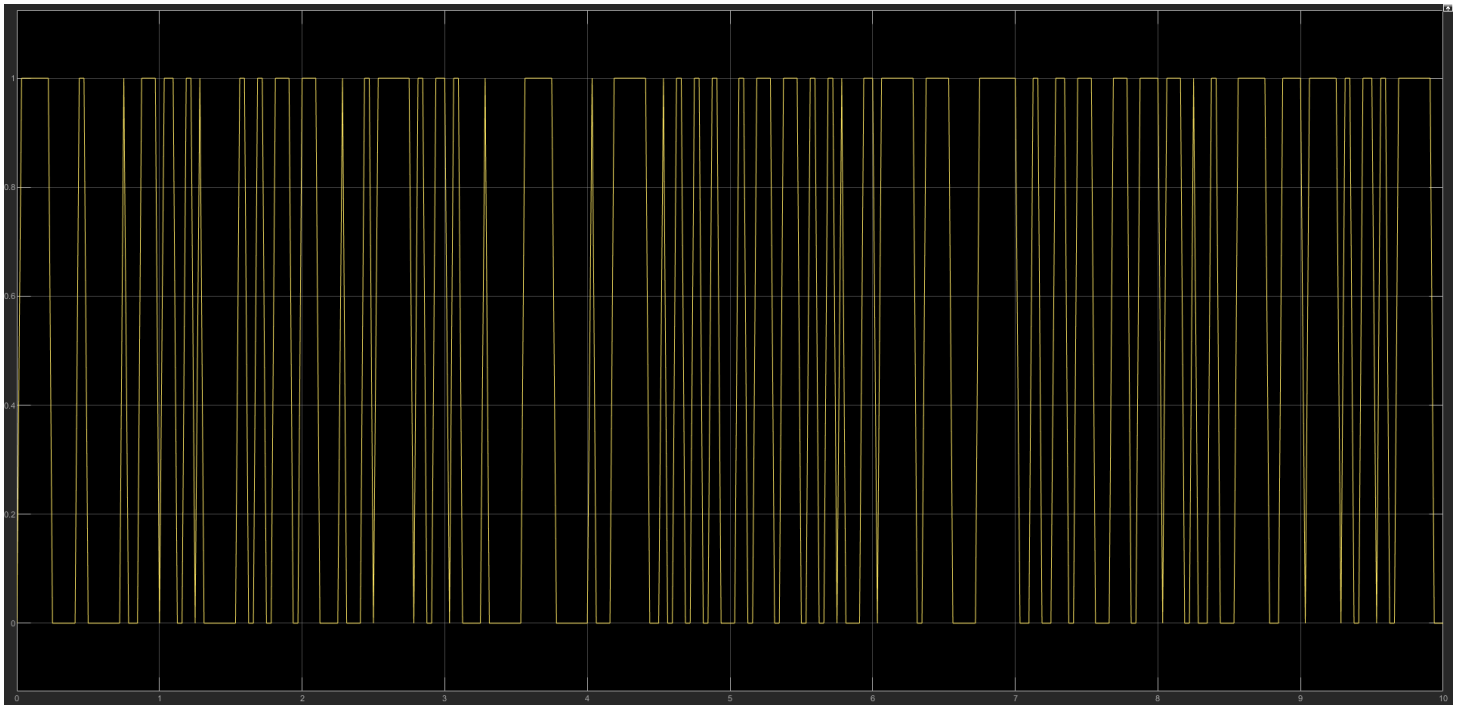

Figure 6 Demodulated Wave

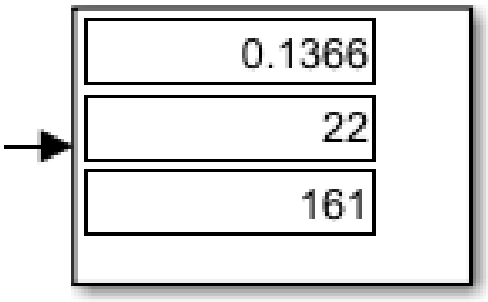

Figure 7 Error Calculation

For SNR = 0.5 dB: -

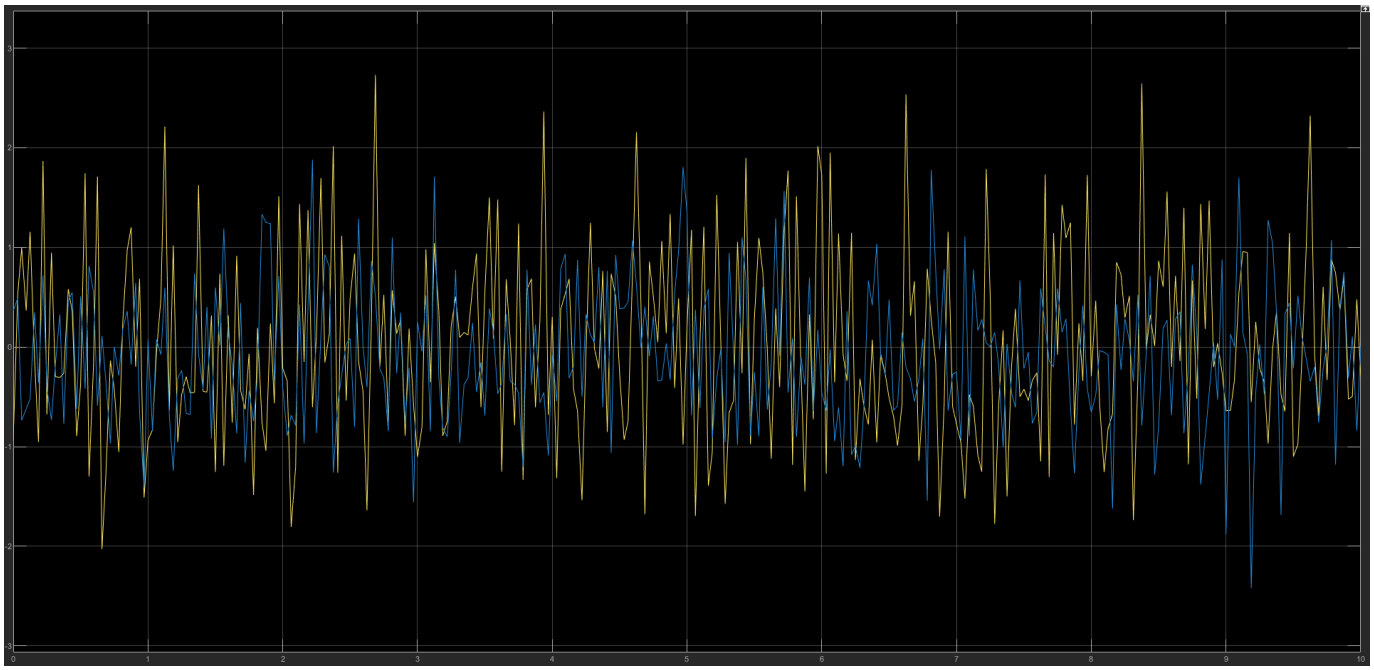

Figure 8 Wave w/ AWGN

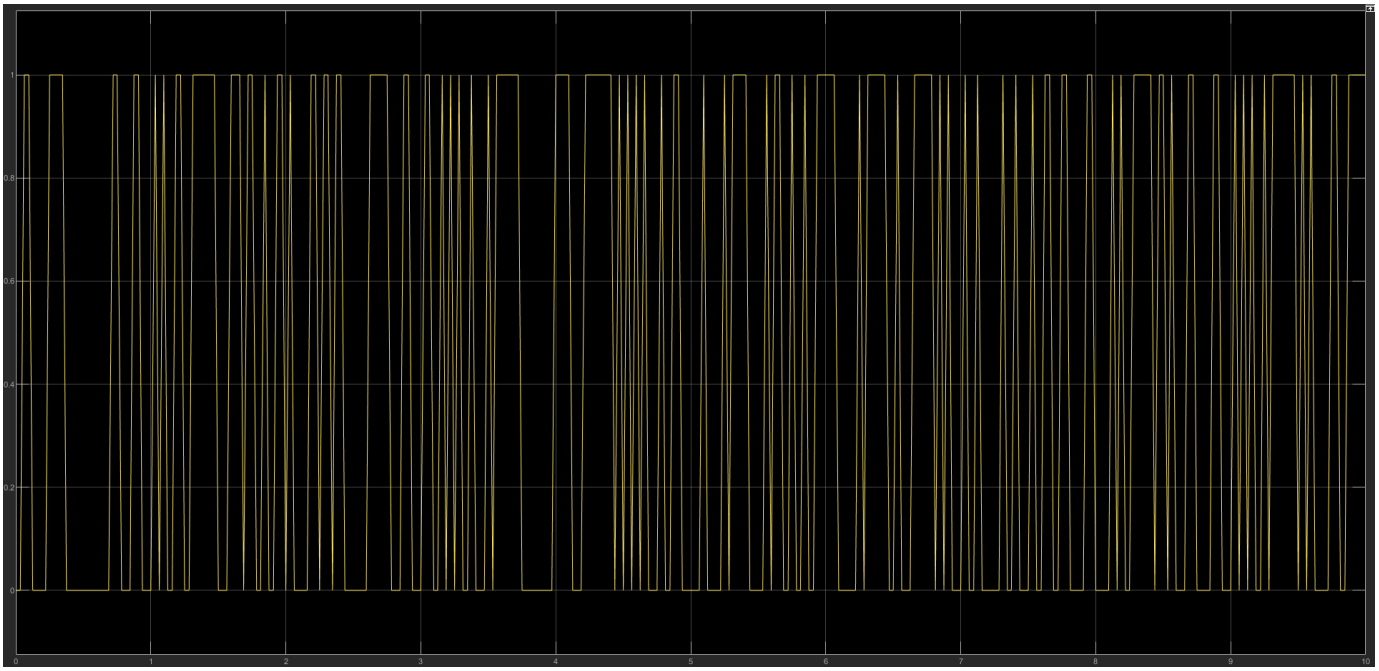

Figure 9 Demodulated Waveform

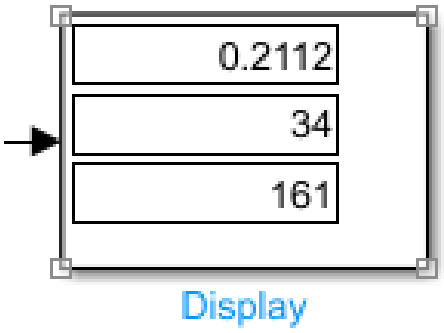

Figure 10 Error Calculation

Note: The error calculation shows 3 values. The first is BER or Bit Error Rate or the fraction of error bits with respect to the total number of bits transmitted. The second value shows the number of errors detected. The third value shows the total number of bits transmitted.

Conclusion: -

The BER is higher for a lower value of SNR (in dB), which aligns with the theory since a lower SNR means higher noise.

The difference in noise magnitude is evident in the two cases (noise being the blue plot in Figures 5 and 8).