Advanced Telecommunication Systems

Project 4

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362 Words

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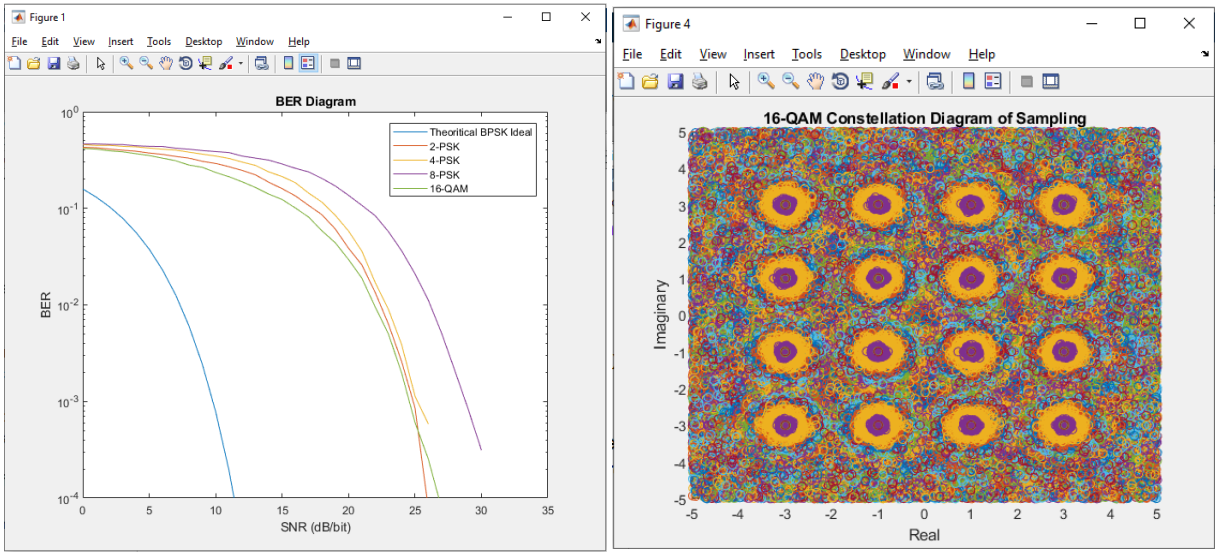
1 General Instructions

All files have been developed and tested in **Matlab 2017b 64-bit**. In the current folder there are two code files (.m files). Each one implements a different question of the project. Specifically, Question_A_B.m implements both question A and question B and Question_C.m implements the project's question C.

2 Question_A_B

We implement OFDM System without LTI channel (h filter) and thus without Equalizer. The results are the following:

First, we demonstrate our results of Bit Error Rate (BER) Diagram and Constellation Diagram of Sampling.



(a) Bit Error Rate (BER)

(b) Constellation Diagram of Sampling

Fig. 1. BER and Sampling of OFDM System without LTI Filter

It seems that all modulation are effective in higher SNR values, especially greater than 20dB. BPSK, QPSK and 16QAM have similar performances in contrast with 8PSK that has the worst.

Next, we provide the I and Q values in the Transmitter right before transmision.

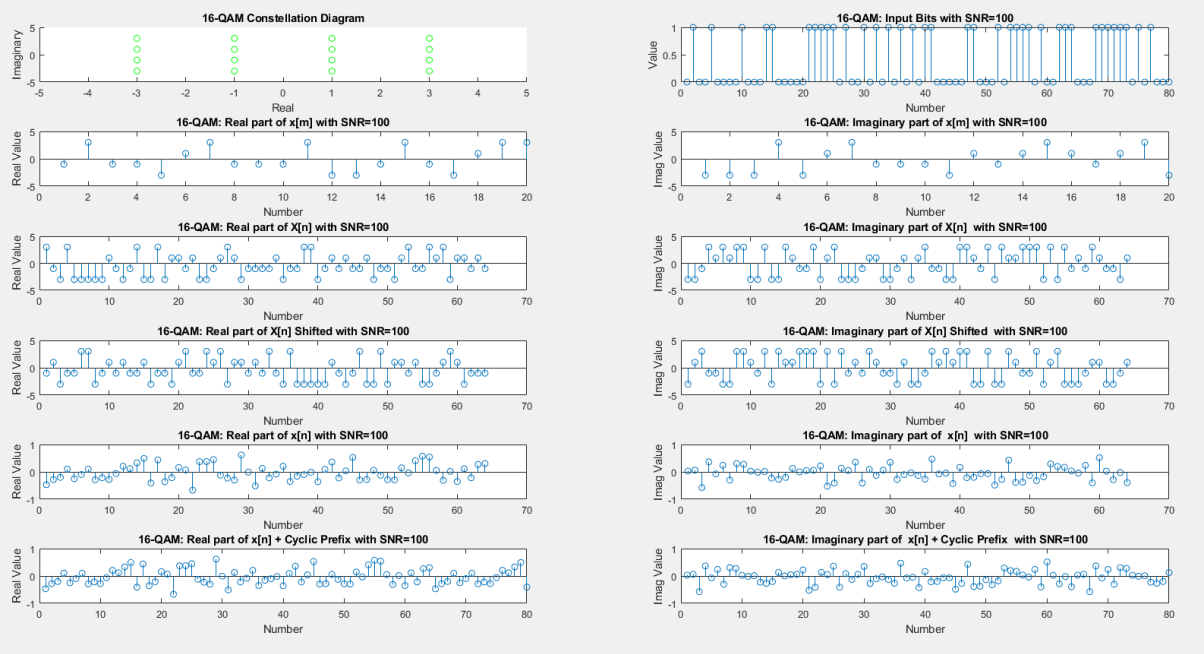


Fig. 2. I and Q streams in Transmitter

We could observe how the order of the values changes when we shift *X[n]* in 7 and 8 Diagrams. Also, we can see that when we add the Cyclic Prefix at the 11 and 12 Diagrams, the first 16 bits are copied to the end of the sequences.

Finally, we demonstrate our I and Q values when traversing the blocks in Receiver.

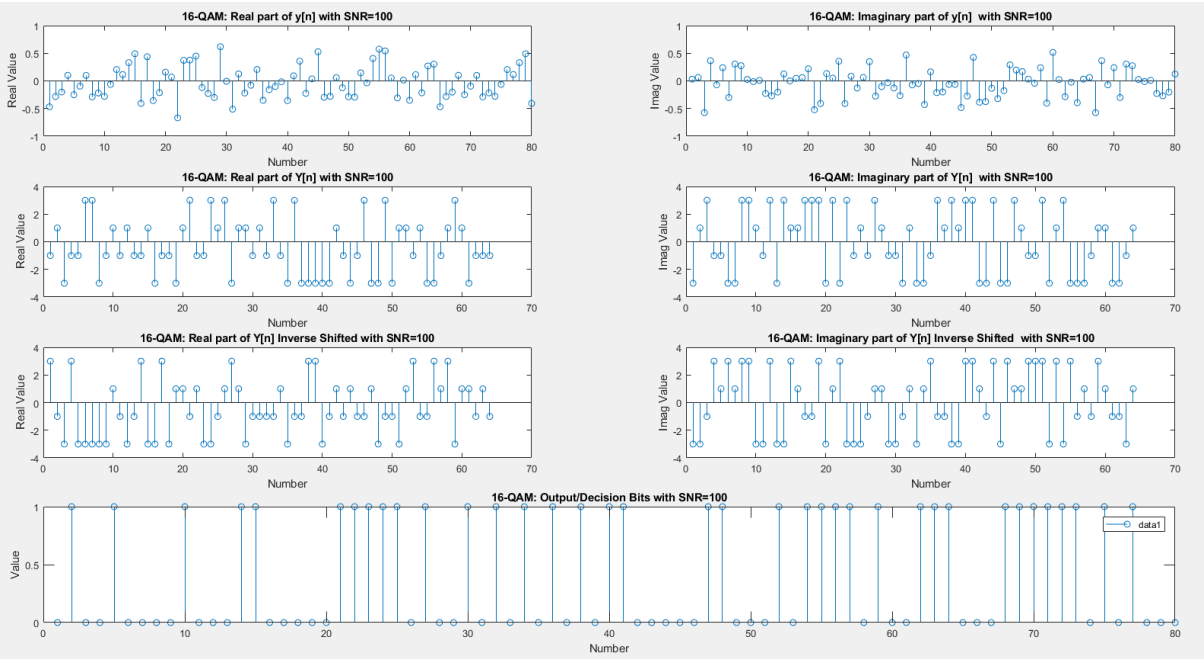
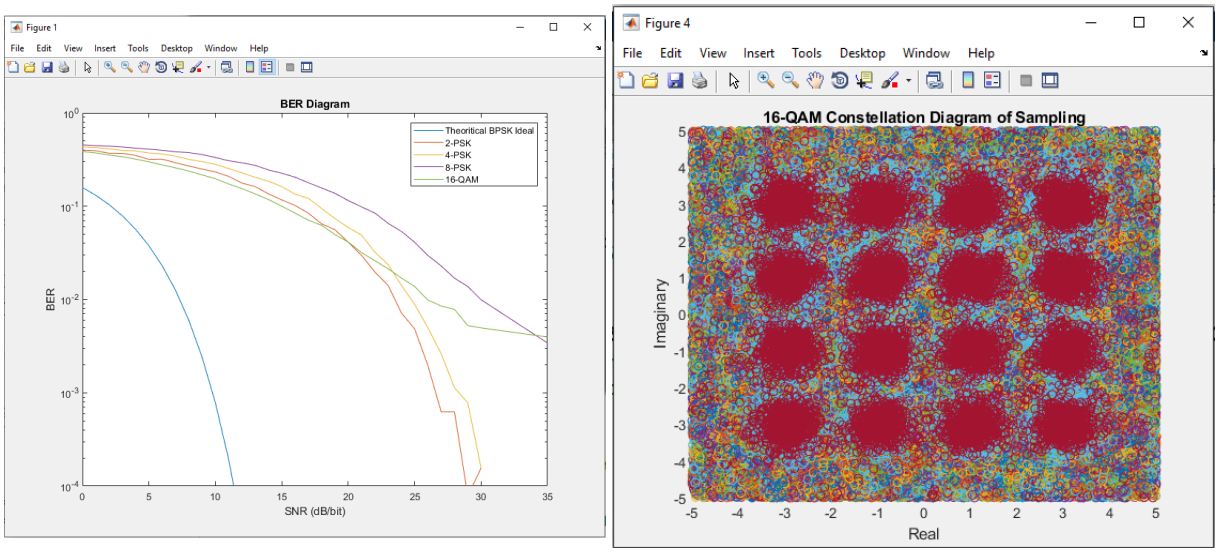


Fig. 3. I and Q streams in Receiver

3 Question_C

Here we implement OFDM System with LTI channel (h filter) and thus with Equalizer. First, we demonstrate our results of Bit Error Rate (BER) Diagram and Constellation Diagram of Sampling.



(a) Bit Error Rate (BER)

(b) Constellation Diagram of Sampling

Fig. 4. BER and Sampling of OFDM System with LTI Filter

It seems that all modulation are effective in higher SNR values, especially greater than 20dB. Next, we provide the I and Q values in the Transmitter right before transmision.

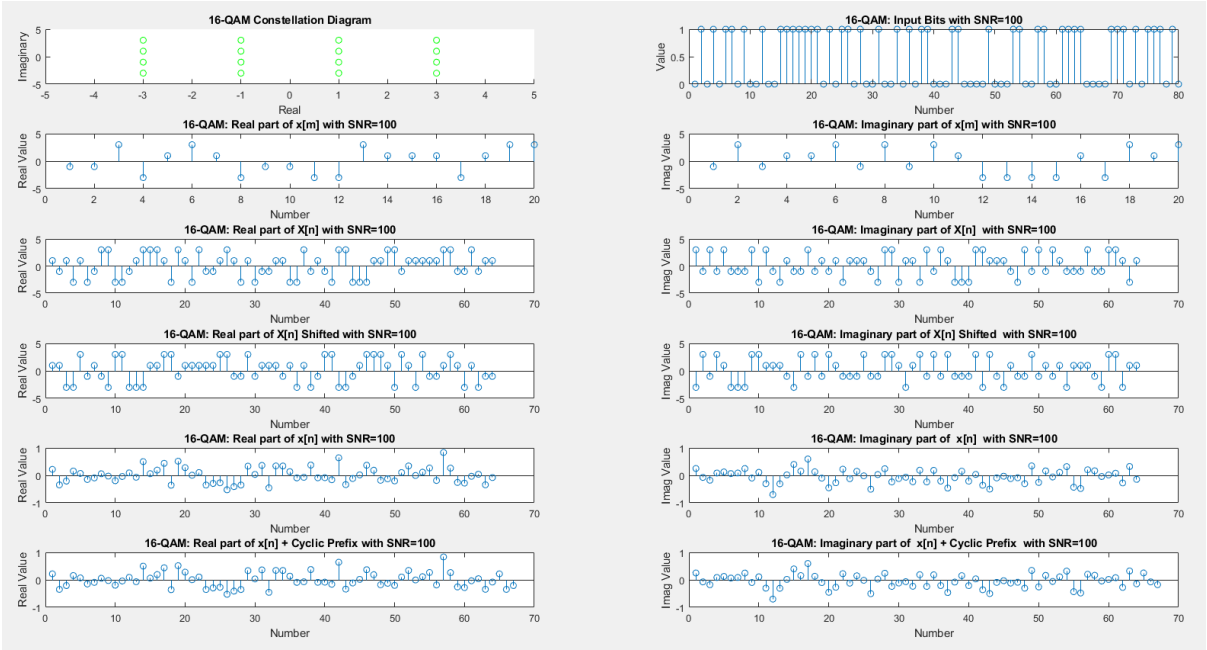


Fig. 5. I and Q streams in Transmitter

In order to find μ, Cyclic Prefix Length we should measure h filter's length. We observe that the latter is equal to 3 (three). Our goal is to prevent Intersymbol Interference (ISI) between OFDM symbols. Thus we have to use a Cyclic Prefix Length (CP_len) equal or greater than 3 (three). We choose to implement **CP_len = 3**. So, we can see that when we add the Cyclic Prefix at the 11 and 12 Diagrams in the picture above, the first 3 bits are copied to the end of the sequences.

Finally, we demonstrate our I and Q values while being transmitted in the channel and when traversing the blocks in Receiver.

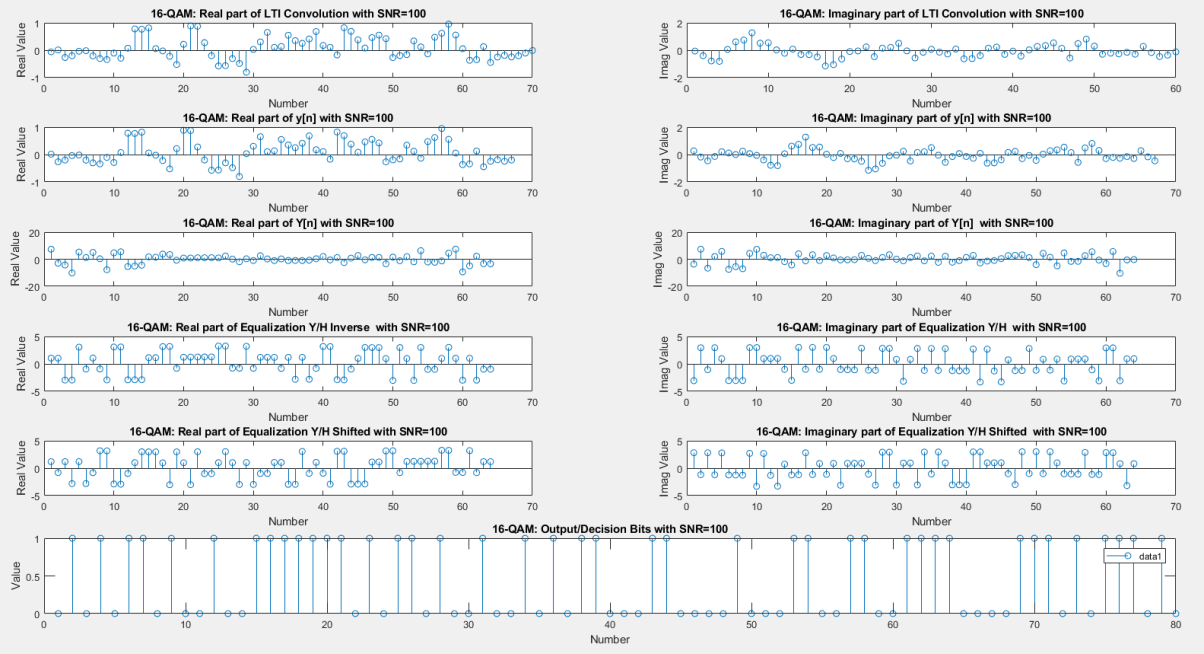


Fig. 6. I and Q streams in LTI channel and in Receiver