**Lab2 OFDM: Performance Evaluation**

**Exercise 1: OFDM System in AWGN Channel**

1. **What is the sub-carrier spacing, duration of transmitted OFDM symbol and duration of CP in seconds?**

for Bw = 37/50 \* 1e6:

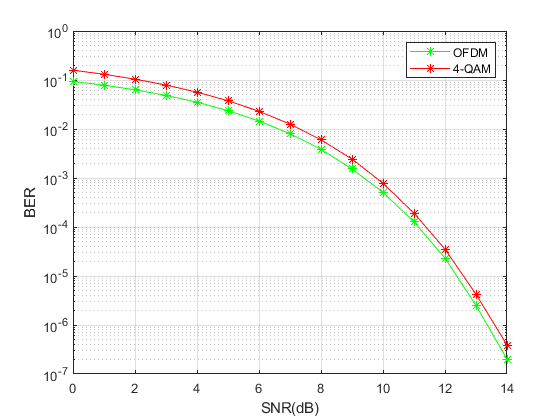
Sub-carrier Spacing = bandwidth / sub carrier number = 12.19 kHz

Duration of transmitted OFDM Symbol =sub carrier number / bandwidth= 82.05 us

Duration of Cp = Ncp / Bandwidth = 8.11 us when a = 0.1.

**2. Compare the results with a 4-QAM BER in AWGN channel and comment on your observations.**

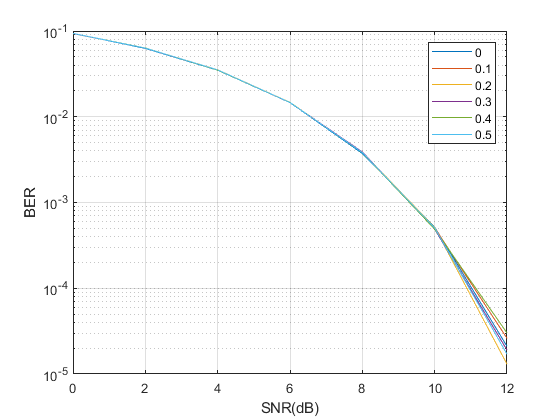
With the iteration time as 1000 and the number of the symbol 6400. The BER result of AWGN channel 4-QAM and OFDM is shown as below. The performance of OFDM is better than 4-QAM.



1. **BER vs SNR (OFDM and 4-QAM)**

**3. Change the CP length and comment on its effect in AWGN channel.**

Changing the CP length, we could obtain the figure as below, as we can see in the figure, when use 20% length of the data symbol length, we could get better performance of BER in different noise environments.

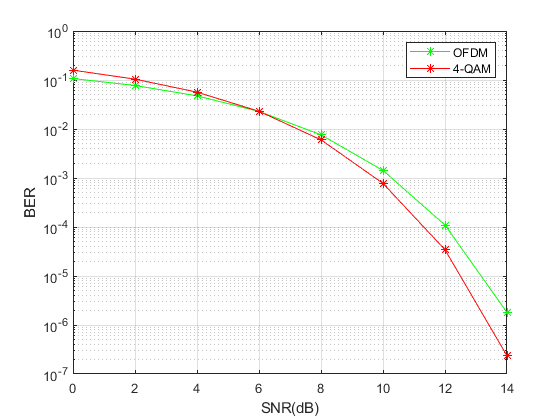


**Exercise 2: OFDM System in Frequency-Selective Channel**

**1. Compare the BER results for 4-QAM in AWGN Channel and comment on your observations.**

With using

The BER results for 4-QAM in AWGN channel and the OFDM system in Frequency-Selective Channel is shown as below. We can see that in high noise environment, OFDM will perform better, in low noise environment, 4-QAM will perform better.



**2. What is the minimum CP length required in the channel with nominal delay spread and the channel with short delay spread?**

The minimum cp length

**3. What happens to the BER when having insufficient CP length?**