EE 6340/3861 Wireless Communications
InClass Assignment 3
13/3/2023 due at 1:30 pm

This Assignment is a Matlab exercise for which we will need Matlab. The Institute provides an academic license

We will do simulations for OFDM in a Broadband fast-fading. The baseband equivalent representation is given by $y_k = h_k a_k + v_k$, where a_k and y_k are the baseband equivalent transmitted and received signal, with v_k being noise and h_k being the fading coefficient.

Do stepwise as follows in Matlab:

Transmitter: Generating the OFDM signal

1. Assign M=2 and N=64.
2. Generate a block of random binary data (of length $\log_2$(M) ×N).
3. Map the data to the M-QAM signal constellation with Gray Mapping.
4. Take IFFT of the data (OFDM modulation).
5. Add Cyclic Prefix of length L=4;

Channel

6. Generate the random complex Gaussian fading coefficients for L=3 tap broadband channel. Assume average power in each tap is 0.3, 0.8 and 0.2
7. Convolve the fading coefficients with the transmitted OFDM signal and add AWGN for an average SNR of 30 dB.

Receiver

8. Remove the CP.
9. Take FFT of the remaining block
10. Demodulate the M-QAM symbols after equalization.
11. Repeat the process 10000 times.
12. Vary the noise variance to have SNR range between [0 dB, 30 dB].

Generate the following two plots.

• Figure 1

1. BER of OFDM with CP length of 4 in a broadband fading channel with L=3 taps 2-QAM
2. BER of OFDM with CP length of 2 in a broadband fading channel with L=3 taps 2-QAM

• Figure 2

3. Channel as seen in each narrow band channel for any realization

Analyze the Figures, and provide insights and interpretation.

Suggest any approach to improve the performance of above OFDM modulation.