Matlab Exercise

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1 Consider a channel with independent zero-mean complex Gaussian taps with exponentially decaying power profile $\mathrm{E}[|h_k|^2] = \alpha e^{-k/3}$ with $k \in [0, 21]$ and α chosen such that the average channel power is unitary, i.e.,

$$\alpha = \frac{1 - e^{-1/3}}{1 - e^{-22/3}} .$$

2 Design an OFDM system with unitary transmit power, minimum number of subcarriers (power of two) such that the CP is at most 20% of the DFT size and no ICI arises.

3 Simulate the OFDM system with equal power per subcarrier and 16-QAM transmissions.

4 Plot the average SER vs a SNR in the range 0 to 10 dB.

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1 Assuming to know the channel at the transmitter and considering additional Gaussian noise at the receiver, choose the subset of subcarrier that transmit with equal power (switching off the others) and using 16-QAM such that at the receiver an average signal to noise plus interference ratio of at least 15 dB is achieved. Do the same with a target SNR of 20 dB.

2 Plot the average bit rate vs SNR going from 0 to 30 dB. Plot the average BER.

3 For the same setting of point 5, plot the average BER