Project Report for
ECE-GY 6023. Wireless Communications

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1. **Implemented codes**

   (a) Digital to analog converter (DAC): A class based implementation similar to analog to digital converter (ADC) class. It can handle multiple streams with different powers. Also, instead of calculating the optimal step size similar to ADC class, I used precalculated values.

   (b) PHYTX: A class based implementation of PHY layer before DAC. It performs upsampling and low pass FIR filtering. It also includes fixed-point implementation of the filter. For the case of 'isfixedpoint = false', I used the 'resample' function with a high order kaiser window (parameters are selected with trial and error).

   (c) IIR_filter: A class based implementation of low pass IIR filter after DAC. Also, includes fixed point implementation. I used an elliptic filter as it worked best for both ordinary and fixed-point implementation.

2. **Other changes**:

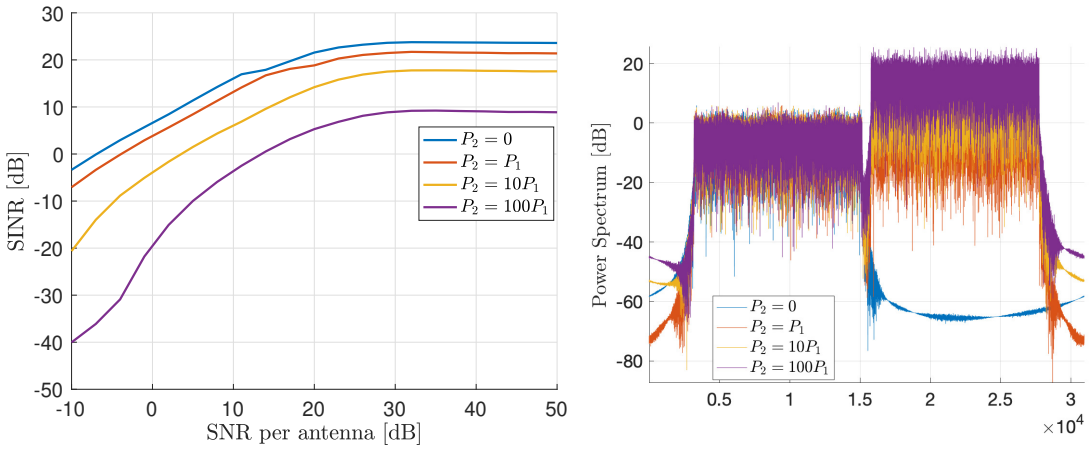
   (a) File 'NRgNBTx.m' has been slightly modified to incorporate PHY, DAC and IIR_filter operations.

   (b) File 'rffeTest.m' has also been slightly modified so that only one receiver is considered.

3. **Simulation assumptions**: We consider one transmitter using two adjacent subbands. The first subband includes the data and the signal in the second subband is treated as interference. We are interested in the effect of interference signal on the received SINR of the desired signal in presence of non-linear transmitter and receiver. The considered transmitter only includes PHY, DAC, and IIR_filter. The receiver function considers effect of thermal noise, LNA, MIXER, AGC, ADC, and PHY.

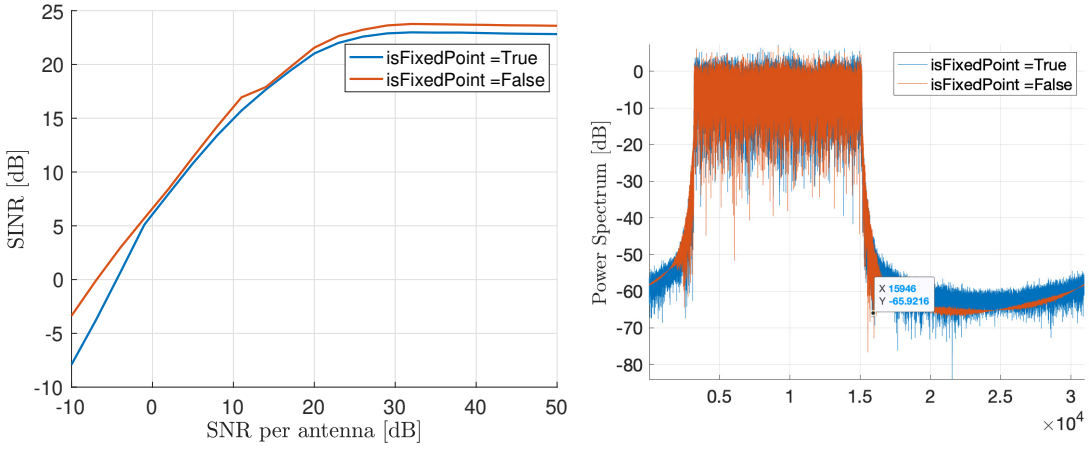
4. **Simulation plots**: The code requires +mmWsim package to run. For the first simulation, we change the adjacent band power ratio and calculate the received SINR for different values of the per receiver antenna average SNRs. The results are plotted in Fig. 1. As expected increasing the interference power in the adjacent band degrades the SINR of the desired signal since the transmitter and receiver are nonlinear.

   For our second simulation we investigate the effect of fixed point implementation of PHY and IIR_filter layers for when there is no adjacent band interference. The results are plotted in Fig. 2. We observe that using fixed-point implementation, we have higher leaked power in adjacent band and SINR performance drops.



(a) (b)

Figure 1: (a) SINR of the desired signal for different per antenna received SNRs and adjacent band power ratios (b) Power spectrum of the transmit signal for the considered adjacent band power ratios.



(a) (b)

Figure 2: Impact of fixed point implementation on (a) desired signal SINR and (b) power spectrum of the transmit signal.