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HW 9 Spread Spectrum CDMA Report

Github URL: [hambroise01/Communication-Systems \(github.com\)](https://github.com/hambroise01/Communication-Systems)

1. Download the attached file from Lathi & Ding Example 10.2
2. Adapt the code to calculate and plot the SIR's shown in Figure 10.24 (SIR = 5, 8, 10, 20 dB). The existing code just calculates SIR = 10 dB.
3. Add a non-spread QPSK signal. Calculate and plot the spectrum. Briefly discuss the comparison between the CDMA spread spectrum and the QPSK spectrum.
4. Add a calculation for the BER of the non-spread jamming using the same SIRs as above and plot the results as above. You need to consider how to set the amplitudes of the jamming signal and the QPSK signal when setting the SNRs and SIRs.
5. Provide source code as a .m file attachment or GitHub URL and discussion along with figures in a short report.

CDMA spread spectrum is the focus on optimizing the use of the available bandwidth while it transfers over the entire frequency range. The CDMA spread spectrum also has a wider bandwidth compared to QPSK spectrum. The QPSK spectrum uses a baseband signal that transmits two bits during each symbol period and it has peaks at the symbol rate. This makes the bandwidth efficiency higher by a factor of two. The CDMA spread spectrum also does not limit the frequency range of the user.

I first wrote a code that would generate a graph calculating the CDMA signal which allows numerous signals to occupy a single transmission channel like in figure 1. We also generated a plot for the QPSK spectrum.

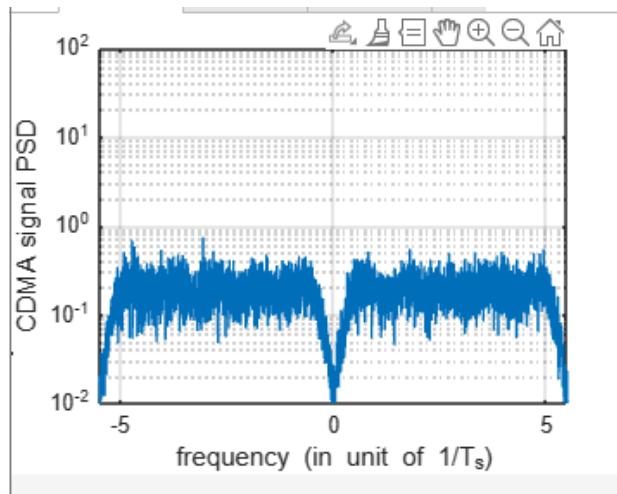


Figure 1: CDMA signal PSD

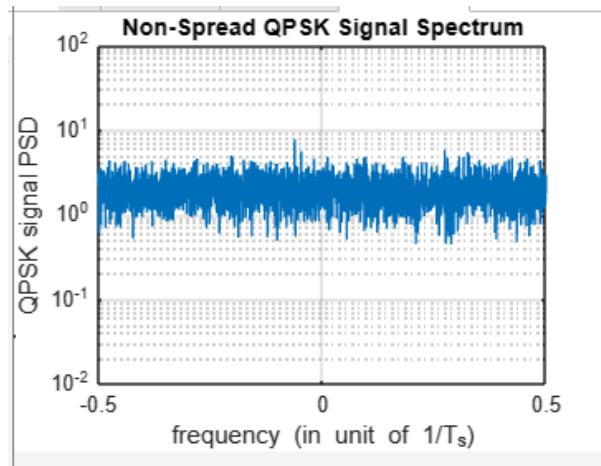


Figure 2: QPSK Signal Spectrum

I also wrote a code that would jam the previous CDMA signal which would result in the generation of the graph below for each of the SIR values which are 5dB, 8dB, 10dB, and 20dB. It helps to create interference on the CDMA signal and this code contains a pwelch function to estimate the power spectrum.

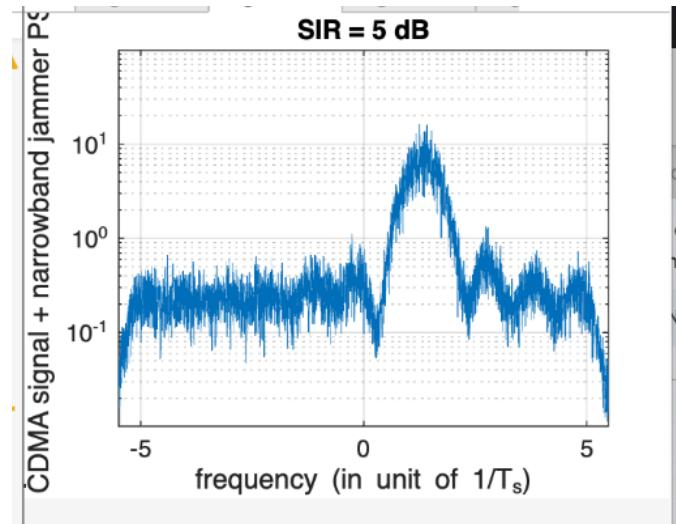


Figure 3: 5dB CDMA signal with a jammer

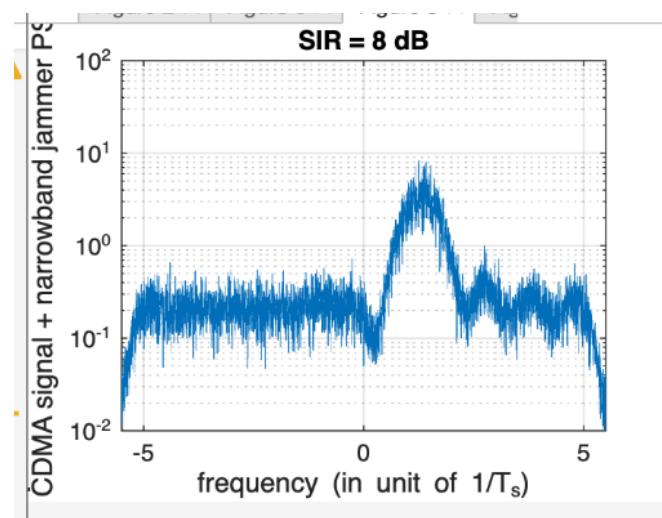


Figure 4: 8dB CDMA signal with a jammer

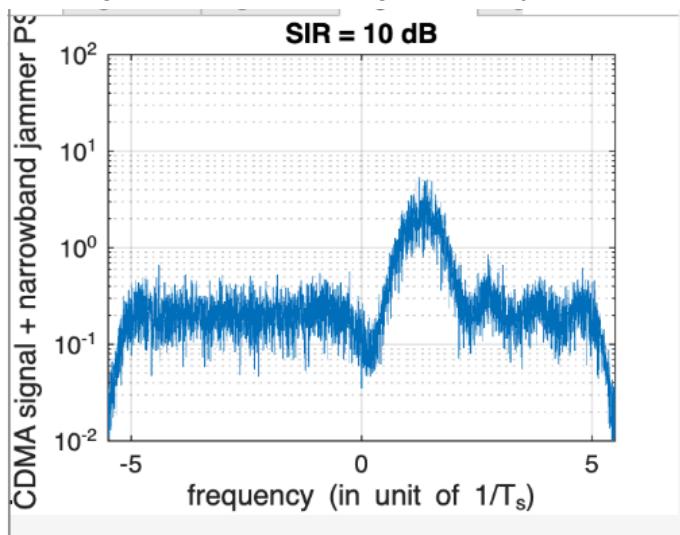


Figure 5: 10dB CDMA signal with a jammer

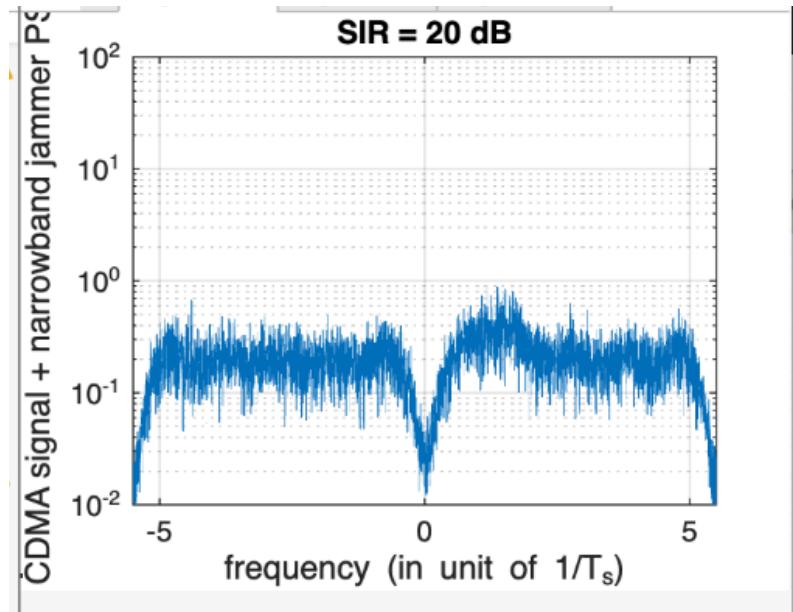


Figure 7: 20dB CDMA signal with a jammer

Figure 3 is found by dispersing the jamming on the CDMA signal and a calculation of the bit error rate based on the different SIRs being used.

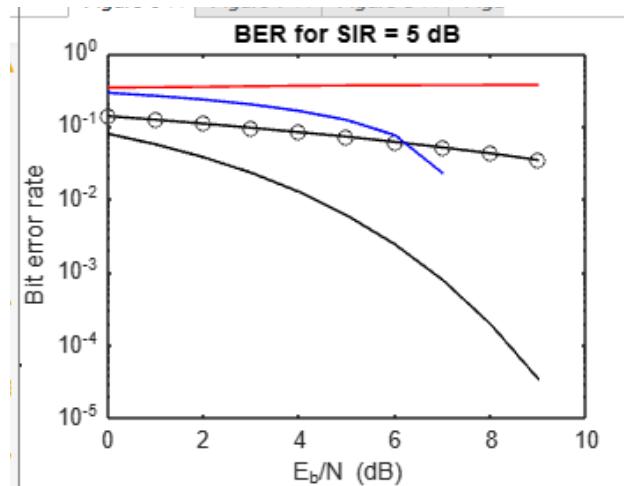


Figure 8: 5dB BER calculation

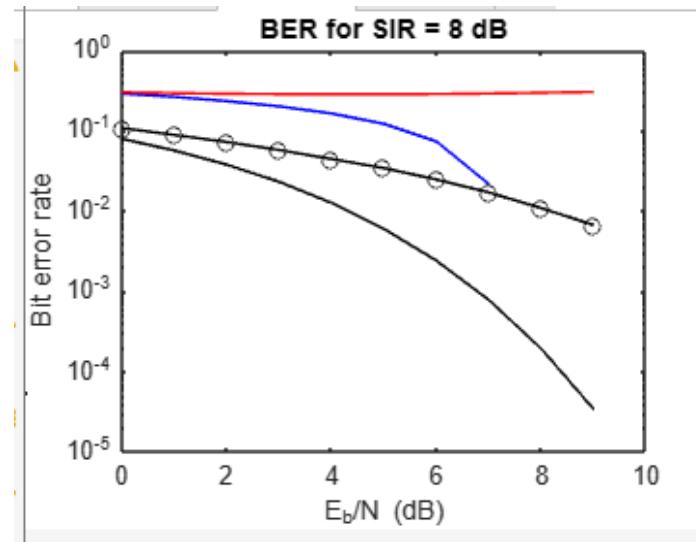


Figure 9: 8dB BER calculation

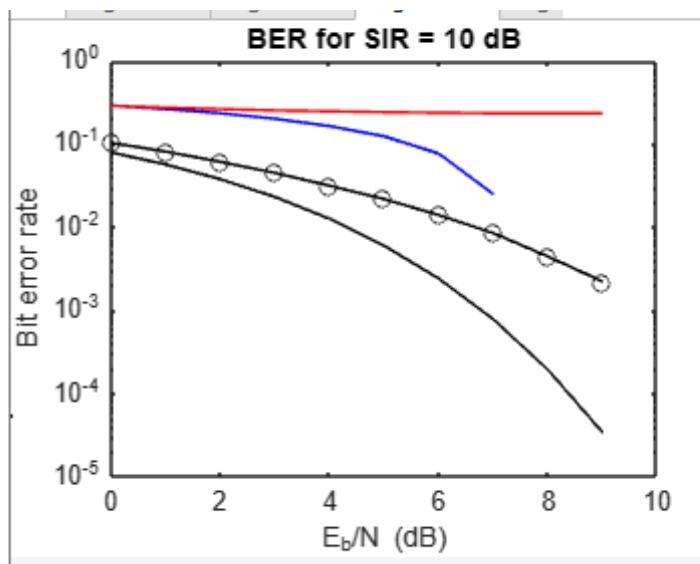


Figure 10: 10dB BER calculation

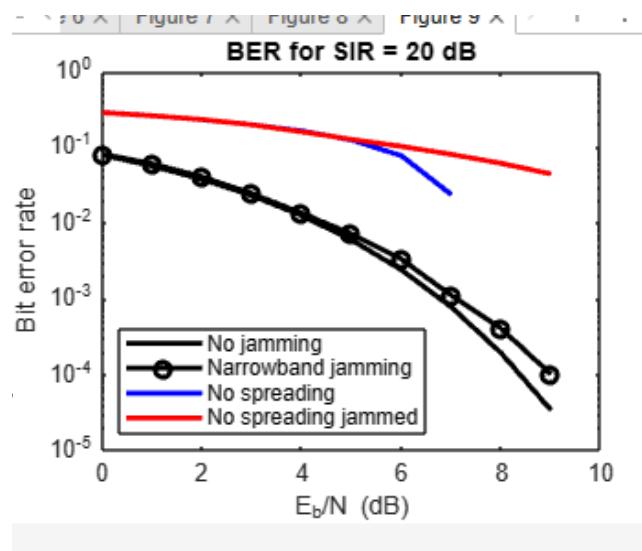


Figure 11: 20dB BER calculation