EECS 562
Homework #6

1. A 4 kHz message signal is transmitted using DSB-SC with a carrier frequency f_c=980kHz over a nosey channel with noise power spectral density of $\eta/2=2x10^{-17}$ W/Hz. The received signal power is -100dBm. What is the post-detection S/N?
2. An AM receiver uses an envelope detector. The transmitter operates at total transmit power of 2KW with a 75% modulation index. The information signal is m(t) = cos(2000πt). The path loss between the transmitter and AM receiver is 93 dB. The noise power spectral density of η=-113dB$_W$/Hz. The RF bandwidth is 10kHz. What is the post-detection S/N?
3. Consider an FM transmitter with a transmitter power of 2KW. The path loss is 93dB, η=-113dB$_W$. The baseband bandwidth is 53 kHz. The modulation index is β=4.
   a) Find the $(S/N)_{bb}$ in dB?
   b) Find the $(S/N)_o$ in dB?
4. Consider an FM transmitter with a transmitter power of 2KW. The path loss is 93dB, η =-113dB$_W$/Hz. The baseband bandwidth is 53 kHz.
   a. Find β such that the $(S/N)_o$=23dB?
   b. What is B_{RF}?
5. Comparison of system resources (power and B_{RF}) for different modulation schemes. In this case:
   - Path loss = 93dB
   - η =-113dB$_W$/Hz
   - B_X= baseband bandwidth = 53 kHz

   a. To meet a required output signal-to-noise ratio, $(S/N)_o$=44.5dB fill out the table below:

Modulation	Transmit power = P_T (dB$_W$)	Transmit power = P_T (Watts)	B_{RF} (kHz)	B_{RF}/B_x BW Expansion Factor
DSB-SC				
SSB				
AM with m = 0.75				
AM with m = 1.0				
FM with β=1.67				
FM with β=4				
FM with β=7.5				

   b. For the FM cases above discuss the trade-off between B_{RF} and P_T.

   c. Comment of the feasibility of using each modulation format given the required transmit power. [Consider using a spreadsheet to do these calculations]