EECS 562
Homework #6

1. A 4 kHz message signal is transmitted using DSB-SC with a carrier frequency f_c=200kHz over a nosey channel with noise power spectral density of $\eta/2=2x10^{-17}$ W/Hz. The received signal power is -75dBm. What is the post-detection S/N?
2. An AM receiver uses an envelope detector. The transmitter operates at total transmit power of 1KW with a 50% modulation index. The information signal is $m(t) = \sin(2000\pi t)$. The path loss between the transmitter and AM receiver is 90 dB. The noise power spectral density of η=-113dB/Hz. The RF bandwidth is 10kHz. What is the post-detection S/N?
3. Consider an FM transmitter with a transmitter power of 200KW. The path loss is 90dB, η=-113dB$_W$. The baseband bandwidth is 53 kHz. The modulation index is β=5.
   a) Find the $(S/N)_{bb}$?
   b) Find the $(S/N)_o$?
4. Consider an FM transmitter with a transmitter power of 200KW. The path loss is 90dB, η =-113dBW. The baseband bandwidth is 53 kHz.
   a. Find β such that the $(S/N)_o$=35dB?
   b. What is B_{RF}?
5. Comparison of system resources (power and B_{RF}) for different modulation schemes. In this case:
   - Path loss = 90dB
   - η = -113dB$_W$
   - 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				
SSC				
AM with m = 0.5				
AM with m = 1.0				
FM with β=1.67				
FM with β=5				
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.