

Introduction to Communication Systems

Homework 9

Due November 30,2007

1. Consider an FM system that has a pre-detection SNR of 14dB and achieves a post-detection SNR of 30dB. If the message has a normalized average power of 1W and a bandwidth of 50kHz. Using Carson's rule (and assuming that the pre-detection SNR exceeds the necessary threshold) estimate the transmission bandwidth of the FM signal.
2. Repeat problem #1 assuming that pre-emphasis is used with $f_{3dB} = 10\text{kHz}$.
3. Consider a message signal $m(t) = \cos(400\pi t)$ that is transmitted via FM. If the final filter has an ideal characteristic from 100Hz to 300Hz, determine the post-detection SNR. (Assume that $k_f = 1\text{kHz/volt}$ and that the pre-detection SNR is 500.)
4. Suppose that the spectrum of a modulating signal occupies the frequency band $f_1 \leq |f| \leq f_2$. To accommodate this signal, the receiver of an FM system (without pre-emphasis) uses an ideal band-pass filter connected to the output of the FM detector. The filter passes frequencies in the interval $f_1 \leq |f| \leq f_2$. Determine the post-detection SNR and compare it to the baseband reference SNR.
5. The signal $\text{sinc}(100t)$ is sampled at a rate of 300Hz. Plot the spectrum of the sampled signal.
6. Suppose that an analog signal is found to have a bandwidth of 35 kHz and that samples of the signal may be modeled as having a uniform distribution. Find the minimum bit rate at which it would be possible to transmit a digital version of the music signal while maintaining an average SNR of at least 65dB.