

EECS 562
Homework 8

1. Let $x_{bb}(t) = 4\cos(2\pi 400t) + 3\cos(2\pi 450t) + 2.5\cos(2\pi 500t)$

This signal is input to an SSB modulator with $f_c = 5000\text{Hz}$ that uses the upper sideband.

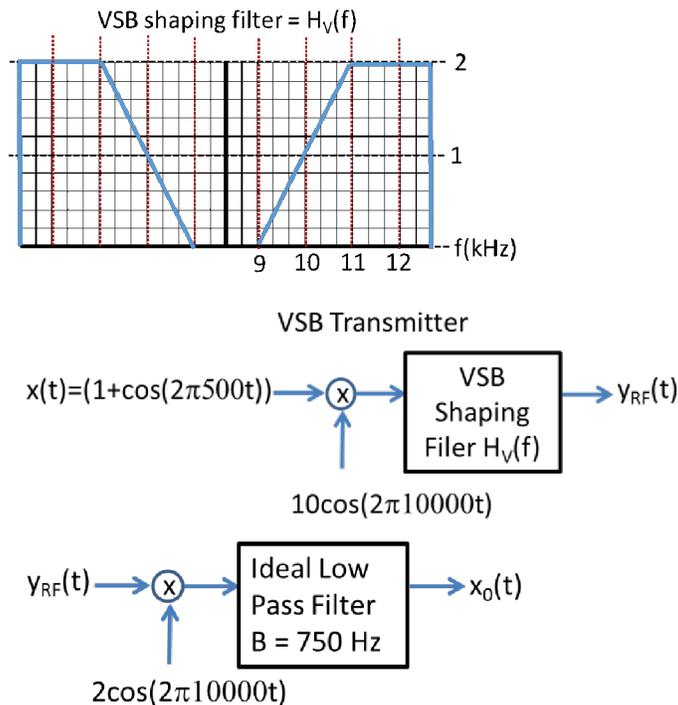
- a. Plot the RF Spectrum of the SSB signal.
- b. What is the required RF Bandwidth?
- c. A coherent detector is required to recover $m(t)$ from the RF signal. TRUE or FALSE
- d. Mathematically show how the message signal is recovered.
- e. Draw the block diagram for a receiver for this SSB signal.

2. Watch “8VSB, From Transport Stream to RF Signal”

https://www.youtube.com/watch?v=ZlAjfA-hU_8

- a. What does the 8 refer to in 8VSB?
- b. How is most of the lower sideband removed?
- c. 8VSB uses a synchronous receiver, TRUE or FALSE.
- d. Mathematically explain how shifting the signal by 1.25 V generates the pilot signal.

3. In this problem the information signal is $x_{bb}(t) = 1 + \cos(2\pi 500t)$. Let the input to the VSB shaping filter given below be $10(1 + \cos(2\pi 500t))\cos(2\pi 10000t)$, here $f_c = 10\text{kHz}$. Let $y_{RF}(t)$ be signal at the output of the VSB shaping filter as shown below. The VSB receiver is also given below.



- a. Sketch the spectrum of $y_{RF}(t)$, i.e., the signal at the output of the VSB shaping filter.
- b. Find the output signal, $x_o(t)$, of the receiver.