A Physics Name_____

Enrichment – Channels of Communication

Instructions

In this unit we discussed different methods of transferring signals. This assignment will require you to analyze channels and their effects from the beginning to the end of the information transfer process. Complete the following questions on a separate sheet of paper.

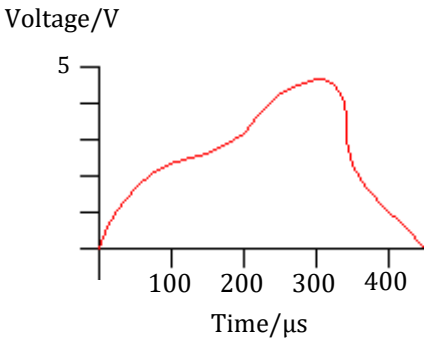
Analysis

An AM signal has a carrier wave with a frequency of 1.0 MHz and a signal frequency of 100 kHz.

Diagrams:

1. Draw the amplitude-modulated wave. The time axis on your graph should be from 0 to 10μs.
    a. On your graph, mark the time for one complete wave of the **signal**
    b. On your graph, mark the time for one complete wave of the **carrier**.
2. Draw the frequency spectrum of the carrier wave and label the bandwidth.

Binary:



The above analog signal is transmitted with 2 bits and is sampled at 100μs intervals. The least significant bit represents a value of 1 V.

1. Complete the following data table of the voltage levels at each time.

time *t*/μs	0	100	200	300	400
Digital number					

2. In the table, underline the most significant bit (MSB) for the digital number at time t = 0.
3. Plot the transmitted analogue signal from the DAC.
4. Repeat steps 1-3 with a sampling rate of 50μs and a bit count of 4 (make a new table).

Attenuation:

Suppose the 20 mW signal is sent through a fiber optic cable which has an attenuation of 0.4 dB/km. The cable stretches from Phoenix to San Francisco, a distance of about 1000 km.

1. What is the power of the signal once it reaches San Francisco?
2. How far does the signal need to travel before the noise level is the same as the signal?
3. Repeat steps 1-2 with a coaxial cable, which has an attenuation of about 5db/km.
4. What can be done to help the signal reach San Francisco? (Written response)
5. State and explain at least 4 benefits for using fiber optic cables.