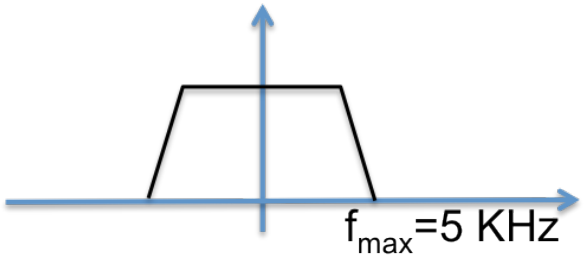
Tutorial 4, CS1031

1. Modulation and spectrum

Consider a baseband signal with the power spectrum as in the figure below.



1. Explain what happens to the spectrum of the signal when the signal is multiplied by a sinusoid wave of frequency equal to 20 KHz. Then plot the resulting power spectrum, showing all the relevant frequency values in the x axis.
2. Show the power spectrum plot of the same signal when it is modulated with a sinusoid wave of frequency equal to 2 KHz. Then explain whether this creates any issue.

2. Fourier transform and signal digitisation

The figure below shows a signal in the time domain (on the left) and its associated spectrum (on the right). You are trying to digitalise the time-domain signal by sampling it at difference frequencies of, respectively, 1KHz, 1.2KHz and 1.4KHz.

Show with a frequency plot, the spectra generated by a Discrete-Time-Fourier-Transform (DTFT) at the three different sampling frequencies, then give a detailed description of your drawings, and state whether information is lost during each of these sampling processes.