

COMMUNICATION THEORY, Homework Assignment 5 Fall 2023

A bandpass analog signal $x_{bp}(t)$ has the following time-domain representation, written as a function of a specific reference frequency $f_c = 500$ MHz:

$$x_{bp}(t) = \text{sinc}(Wt) \cos[2\pi(f_c + \Delta f)t + \varphi_0]$$

where $W = 40$ MHz, $\Delta f = 10$ MHz and $\varphi_0 = \pi/2$.

1) Determine the following:

- a) the *envelope* and *phase* components of $x_{bp}(t)$, according to envelope/phase representation
- b) the *in-phase* and *quadrature* components of $x_{bp}(t)$, according to I/Q representation
- c) the low-pass equivalent signal $x_{lp}(t)$

2) Draw a picture of the spectrum (amplitude and phase) of both bandpass signal $x_{bp}(t)$ and its low-pass equivalent $x_{lp}(t)$, and indicate important frequencies.