

COMMUNICATION THEORY, Homework Exercise 8, Fall 2023

A digital source of information generates data at a bitrate $R_b = 50$ Mbps to be transmitted using baseband M-ary PAM, over a channel with available bandwidth $W = 6$ MHz.

- 1) Find the minimum number k of bits/symbol for encoding the M-ary PAM signal to fit within the available bandwidth W ; then compare the minimum theoretical bandwidth required by such value of k (i.e. when sinc-shaped pulses are used) with W , and find the maximum roll-off α of raised-cosine pulses that can be used instead of sinc-shaped pulses to fill the entire available bandwidth W .
- 2) Consider how the situation changes if we apply DSB modulation to the M-ary PAM signal in order to obtain a bandpass M-ary PAM, and re-calculate k and α when the available transmission bandwidth is still W (*hint: remember that bandwidth is always defined on the positive frequencies only, so the same value of W is more restrictive for a bandpass signal*).