Task 4 Ruslans Babajans

1) A required baudrate of the QAM communication system 40 MBaud. A digital block of the system is implemented in such a way to ensure fN = 100 MHz Nyquist frequency. Calculate the following parameters of this communication system:

- Bandwidth Bw of the in-phase and quadrature channels in the baseband is 20 MHz for I channel and 20 MHz for Q channel.
- Bandwidth of the modulated QAM signal is 40 MHz.
- Symbol length tau= 1/R = 1/ (40 MBaud) = 25 ns.
- Sampling frequency Fs=2*FN=200 MHz.
- Number of samples per symbol N=fs/R=(200 MHz)/(40 MBaud)= 5

2) The capacity of the QAM communication system is 125 Mbps. A modulation 32-QAM is used for the transmission. Calculate symbol rate and the bandwidth occupied by the signal. What modulation should be used to double capacity in the same bandwidth?
    - 32-QAM => n= 5 bit
      C=n*R => R=C/n => 125 Mbps / 5 = 25 MBaud

      Bw ≈ R = 25 MHz.

    - C_doubled= C*2= 150 Mbps.
      n= C_ doubled /R = 250 Mbps / 25 Mbps = 10 bit

1024-QAM should be used to double capacity in the same bandwidth.

3) In the superheterodyne receiver, an intermediate frequency is fIF =450 kHz. The carrier frequency is equal to f0 = 1050 kHz. Find out all possible local oscillator frequencies and corresponding image frequencies.

F_LO1=1050-450=600 kHz F_IM1=600-450=150 kHz

F_LO2=1050+450=1500 kHz F_IM2=1500+450=1950 kHz