**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

1. 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.

1. 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