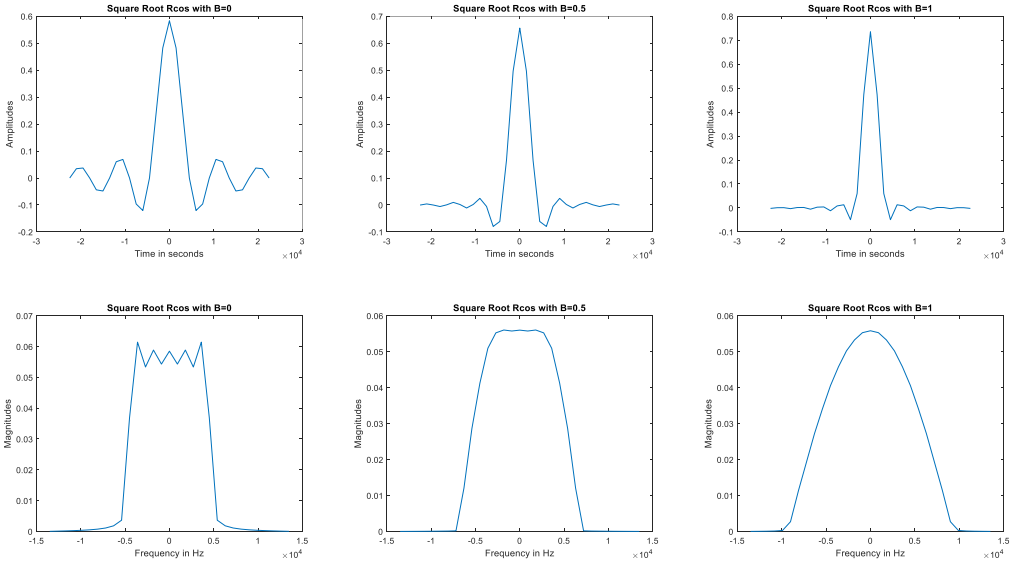
COMM 2 LAB REPORT 4

UTKU ACAR / 250206062

2)

I generated 2-ary PAM instead of 4-ary PAM. Because of that I have only 2 (-1,1) levels to represent amplitudes instead of 4(-3, -1,1,3). Because I don't remember level values exactly and I thought that using pammod(.) is forbidden. So, my eye diagram has 1(2-ary PAM) row of eyes instead of 3(4-ary PAM)

5)

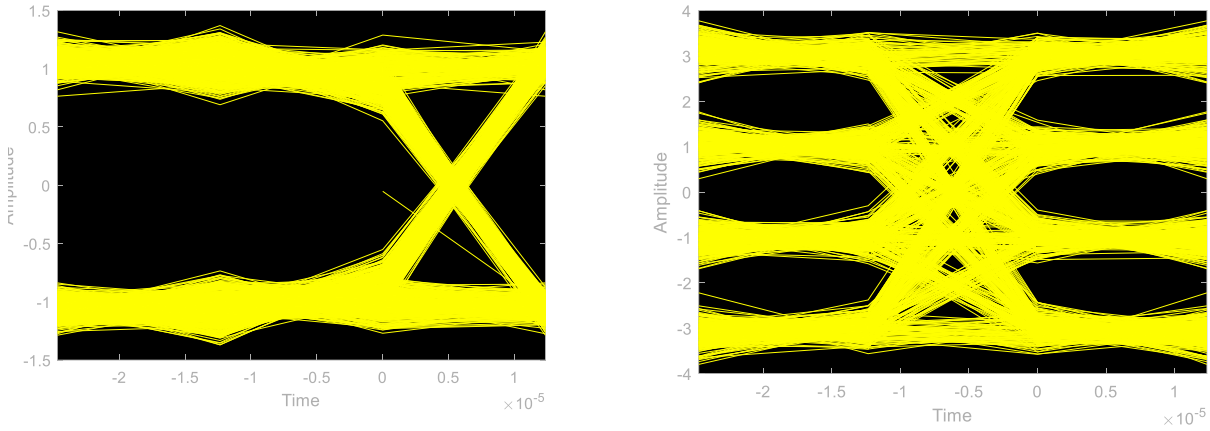


As we can see above while beta (roll off factor) is increasing from 0 to 1, signal gets higher value around t=0 and lower values and lesser oscillations while t getaway from t=0 in time domain which is expected from general behavior of Square Root Raised Cosine Filter (To avoid ISI). Also, we can see that in Frequency domain Smoothness of the peak around low frequencies is increasing while beta (roll off factor) is increasing and cutoff frequency increases. The increasement in cutoff frequency can cause less efficient noise filtering but more precise(selective) low pass filtering. Since we need to distinguish and separate closer frequency signals separately high beta value is more beneficial to our application.

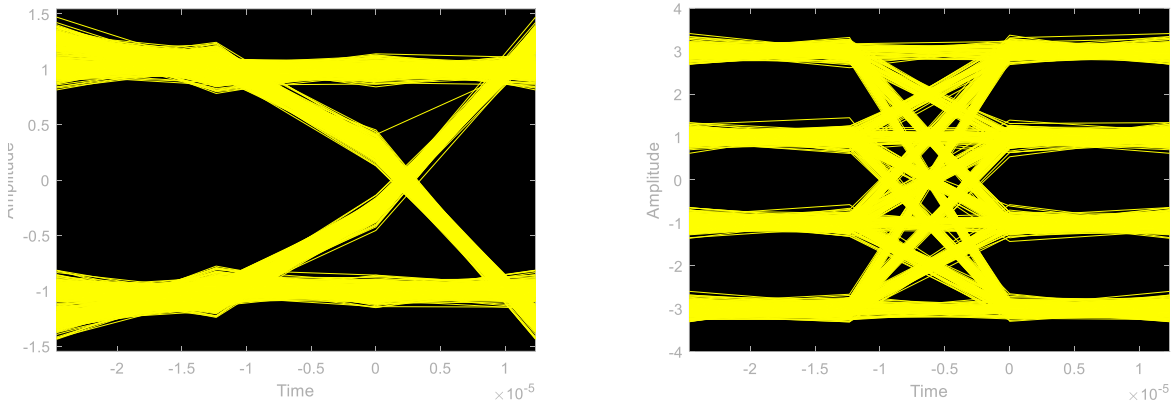
10)

The corrected versions at right side of the original image (at left)

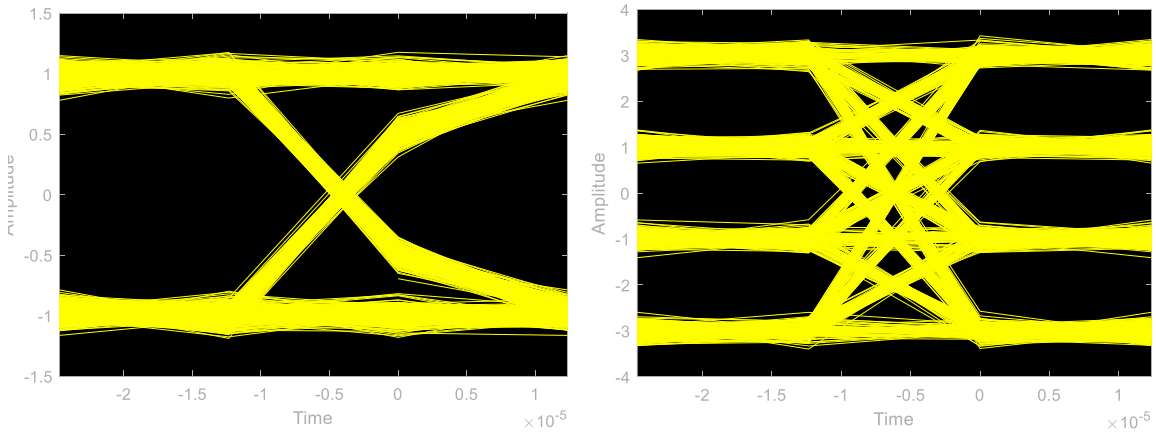
For beta = 0



For beta = 0.5



For beta =1



As beta increases the eyes getting bigger (wider), noise margin getting bigger too as I mentioned in part 2.

Q1)

There are some ways to deal with ISI:

First one is designing systems such that makes impulse responses (time domain) short so that just negligible part of the energy of signals overlap with next signal(symbol). This can be achieved by using raised cosine function with high beta coefficient such as 1.

Second one is using period barriers which can provide us to separate different symbols. (Delaying each symbol with some period)

Third one is applying an equalizer to ignore channeling effect by using inverse filter.

Q2)

While beta is being small the eyes got smaller and while beta is being higher, the eyes get wider height wise. Also, noise margin gets higher while beta increases.

Q3)

Excess of bandwidth can be seen by looking height of the eyes while beta increases eye height increases so the noise margin increases. This means that there is more noise in the signal while beta close to 1. In same manner we can observe that while beta increases cutoff frequency of raised cosine function is also increasing. There is less link between the eyes while beta gets close to 1.

Q4)

To satisfy zero ISI condition we should choose our bandwidth respect to Nyquist criterion ($Rb \leq 2W$)

$M=4$

$Rb=18000$ bits/second

$Rs=Rb/\log_2(M)$

$Rs=18000/2=9000Hz$

$W \geq Rs$

$W \geq 9000$ Hz