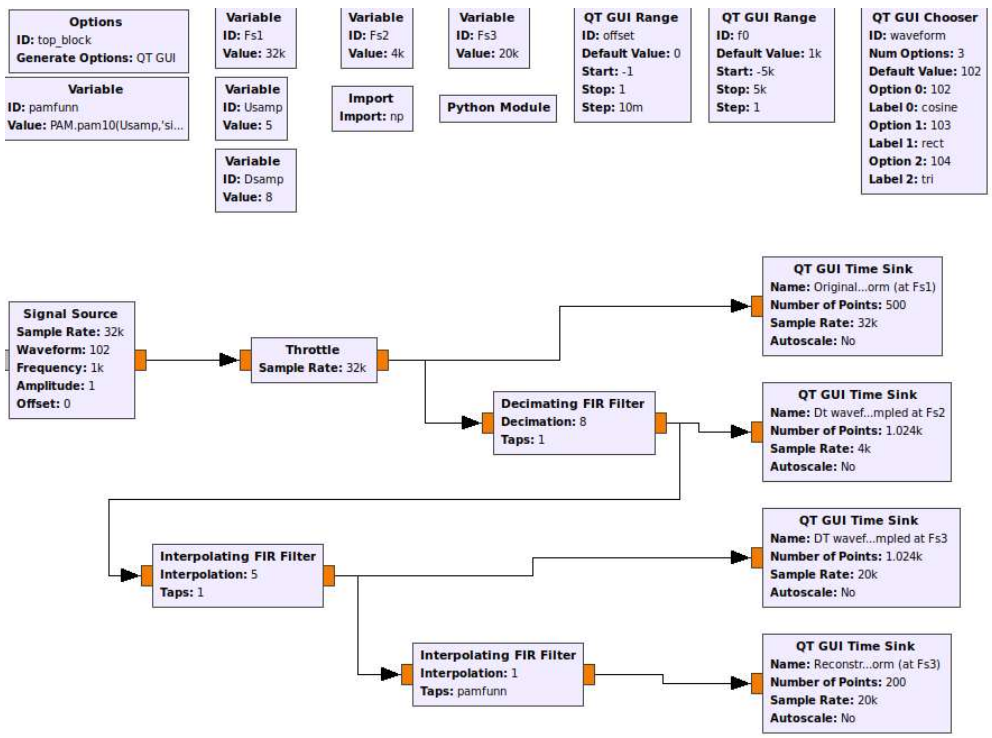
In [ ]:

Experiment 1 (a)

Visualisation of the sampling theorem. waveform used is a cosine waveform with frequency of 2700Hz

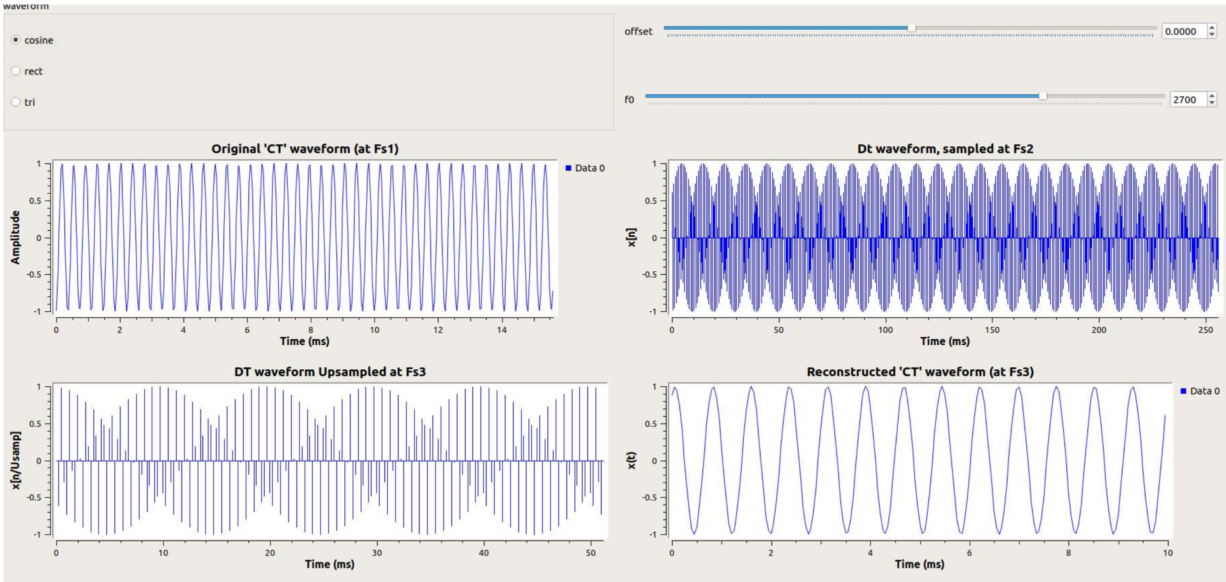
In [3]:
```python
from IPython.display import Image
Image(filename='capture.png')
```

Out[3]:



In [4]:
```python
from IPython.display import Image
Image(filename='capture.png')
```

Out[4]:



The reconstructed does not have the frequency of 2700 Hz. This is because this value is larger than (Fs/2 = 2000) Hz. hence it violates the Nyquists criterion and the waveform is not reconstructed correctly.

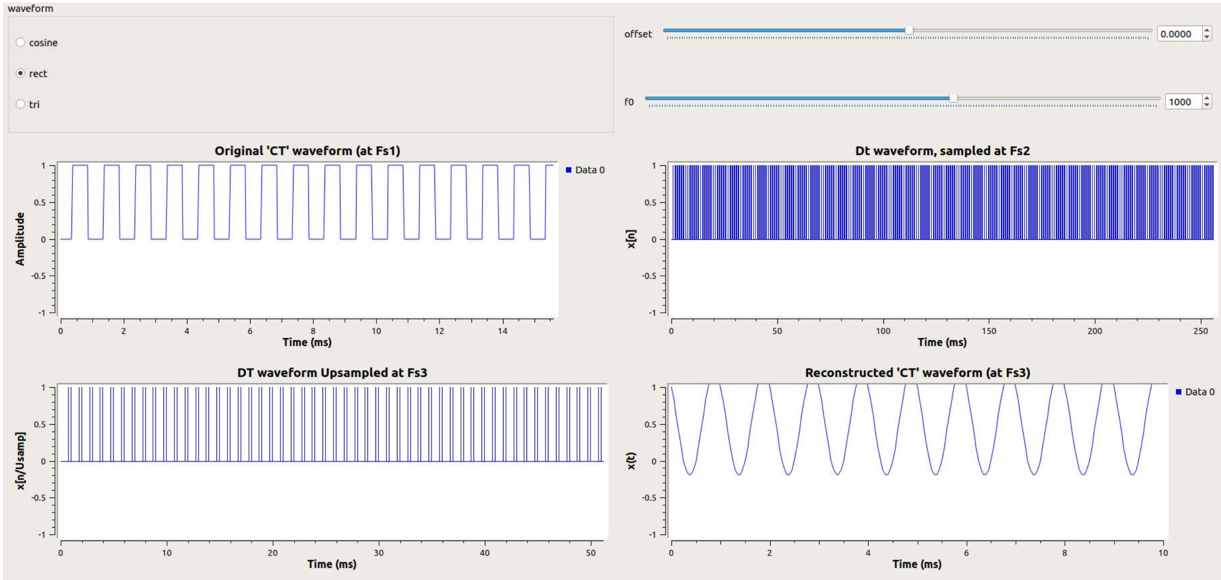
Expt 1(b)

Using a 1000 Hz squarewave with the same flowgraph as in (a).

Changing the Frequency from 1000 Hz to 1200 Hz

In [5]:
```python
from IPython.display import Image
Image(filename='capture.png')
```

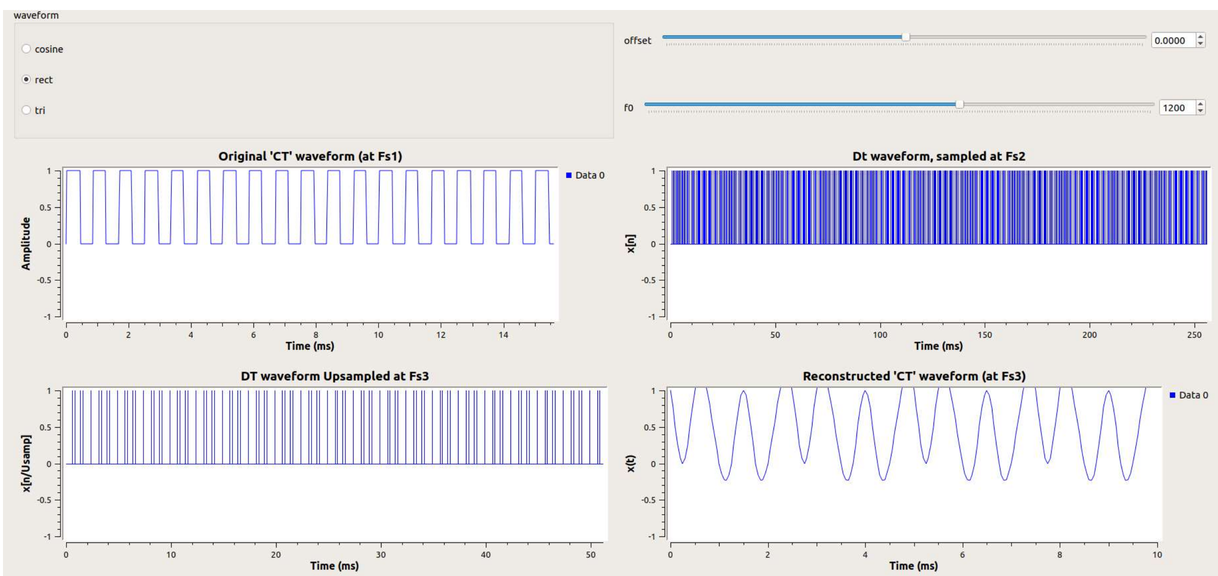
Out[5]:



We see that the reconstructed waveform is no longer square. This is because we are using a sinc pulse to interpolate the waveform.

In [6]:
```python
from IPython.display import Image
Image(filename='capture.png')
```

Out[6]:



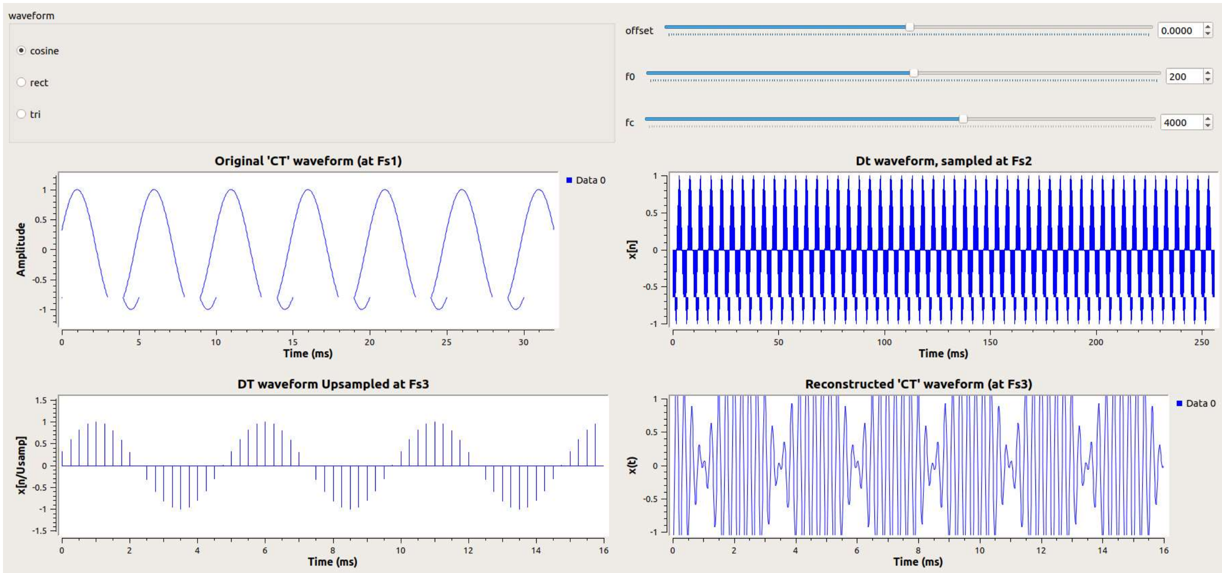
The waveform is now completely haywire since the frequency is now violates the Nyquist Frequency and hence the wave cannot be reconstructed correctly.

Expt 1(c)

Using a bandpass filter to reconstruct a CT waveform

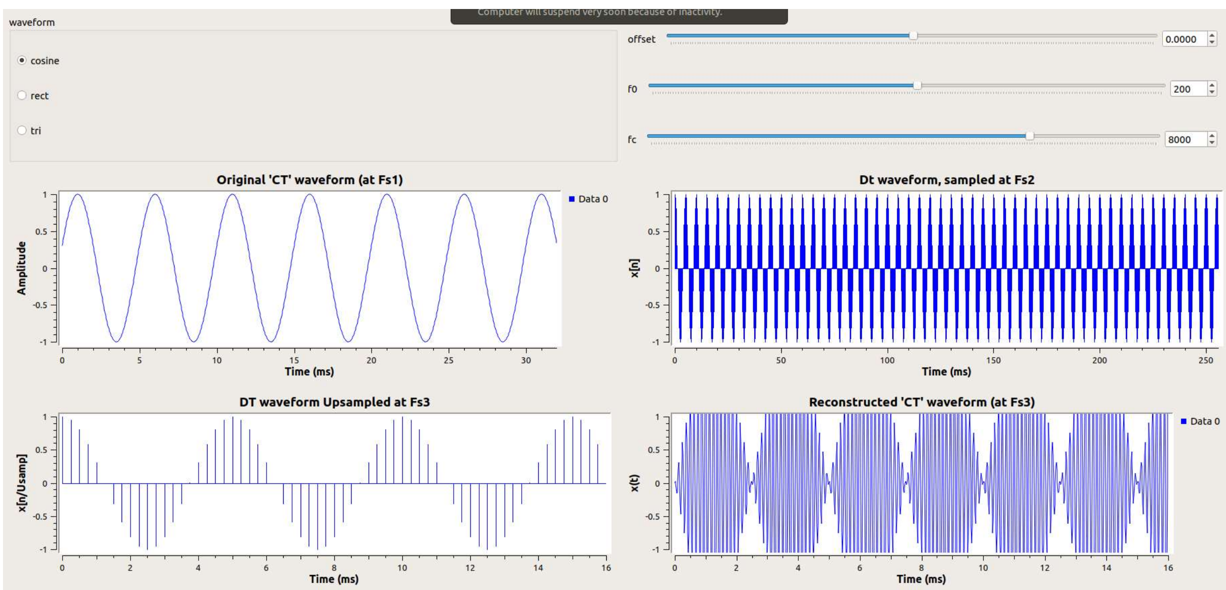
In [7]:
```
from IPython.display import Image
Image(filename='capture.png')
```

Out[7]:



In [8]:
```
from IPython.display import Image
Image(filename='capture.png')
```

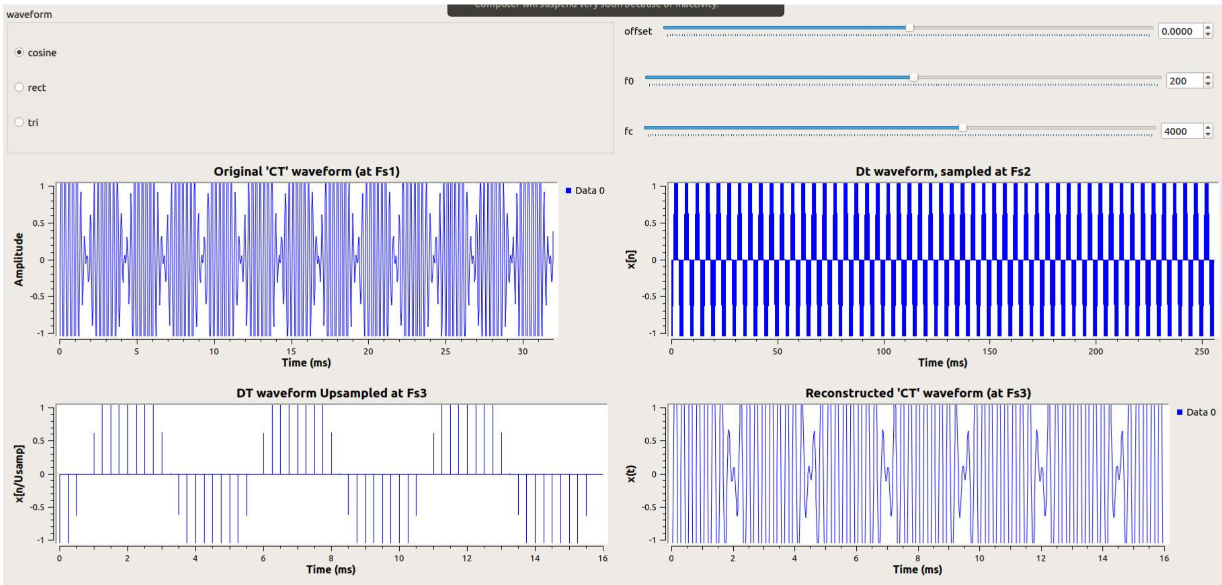
Out[8]:



verifying that the input and out waveforms are the same

In [3]:
```
from IPython.display import Image
Image(filename='capture.png')
```

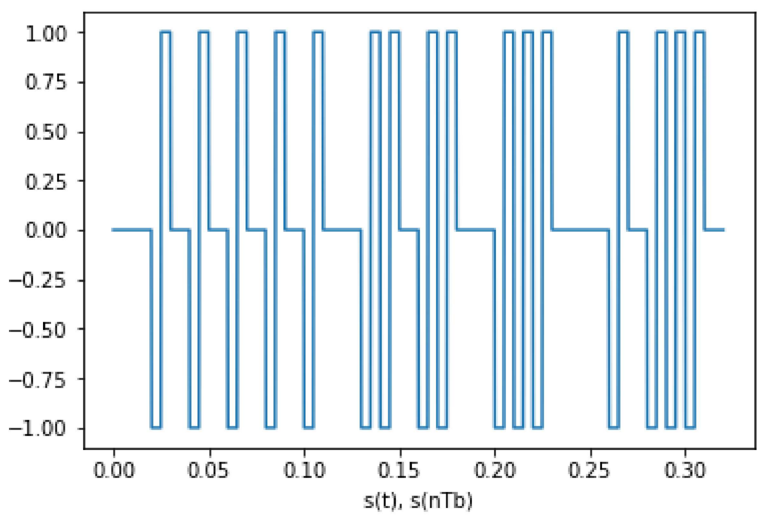
Out[3]:



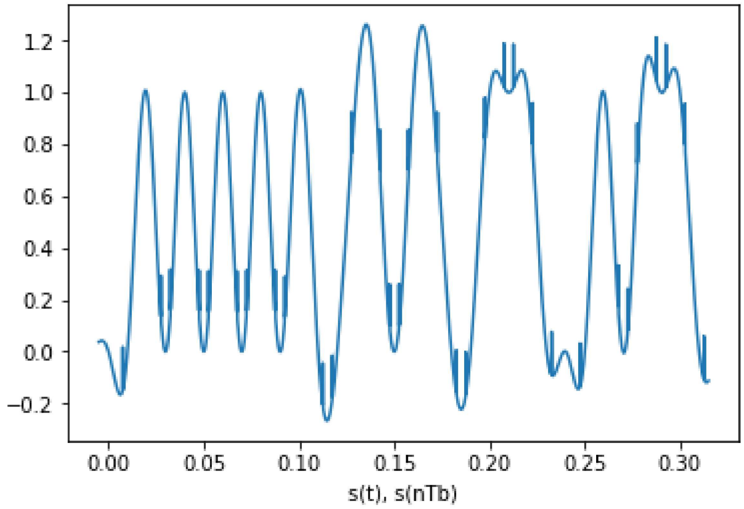
Expt 1(d)

generating Rcf pulse and the manchester pulse

In [2]:
```
run Q1D
```



In [2]:
```
run Q1D
```

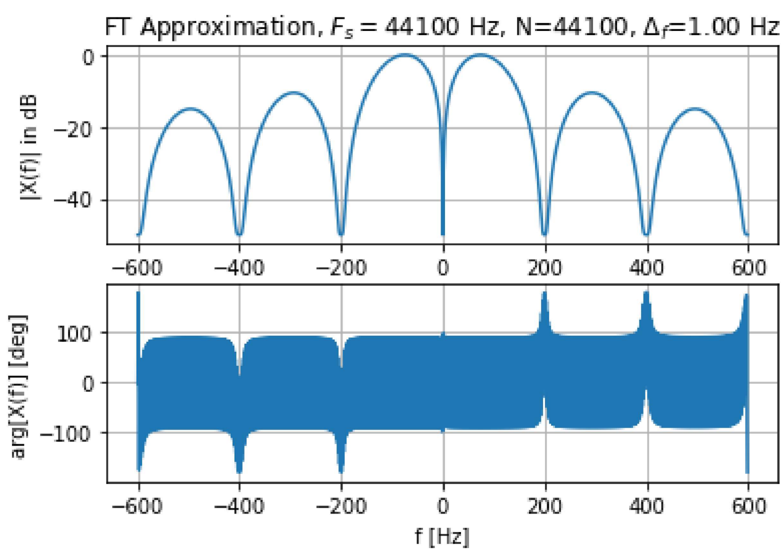


Expt 1 (e)

Generating the Fourier Transform for the pulses generated above

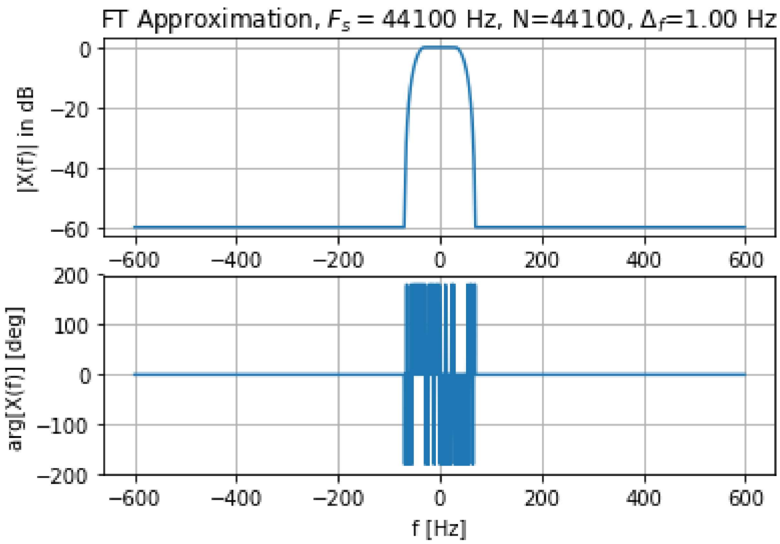
For the manchester pulse

In [4]:
```
run Q1E
```



For the RCF pulse

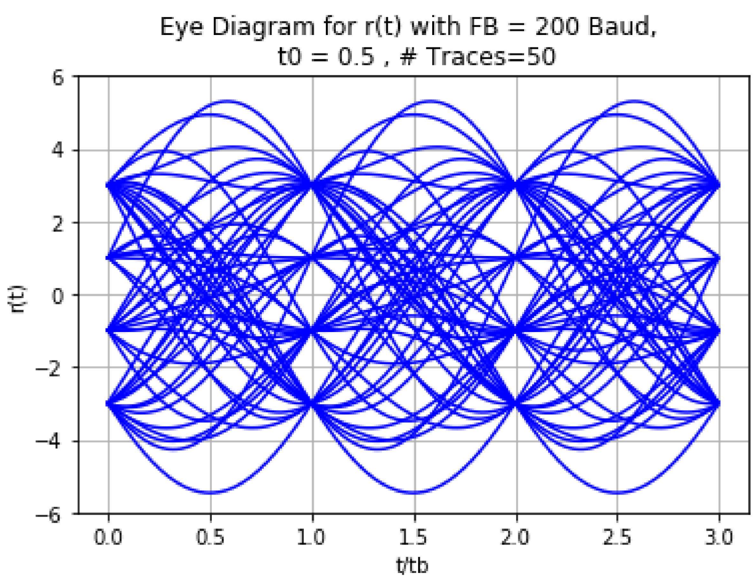
In [5]:
```
run Q1E
```



Expt 2(a)

Generating an eye diagram with random data

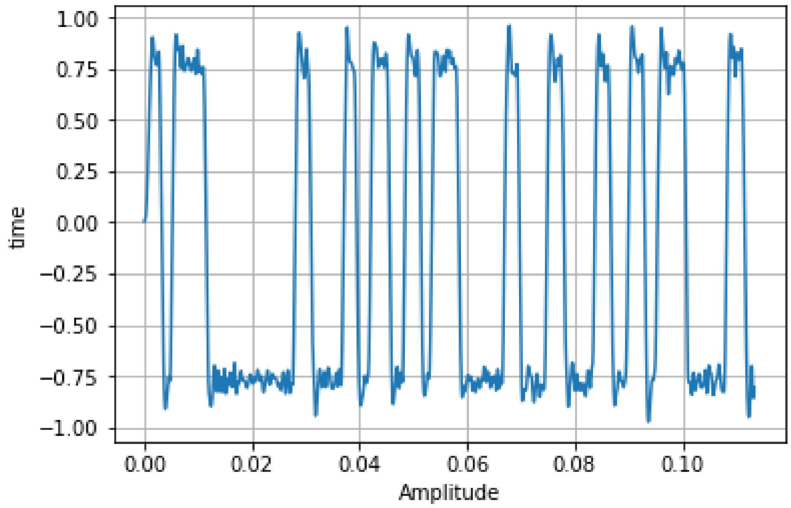
In [2]:
```
run Q2A
```



Expt 2(b)

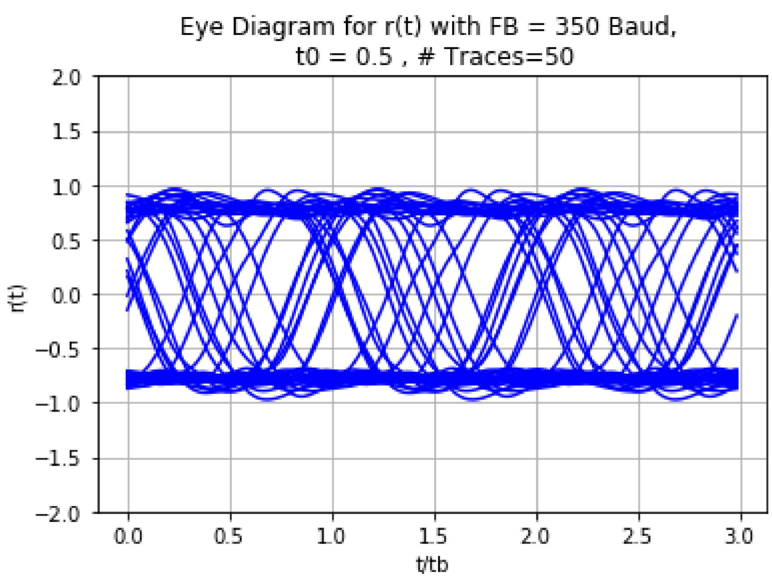
analysis of pamsig401

In [3]:
```
run Q2B
```

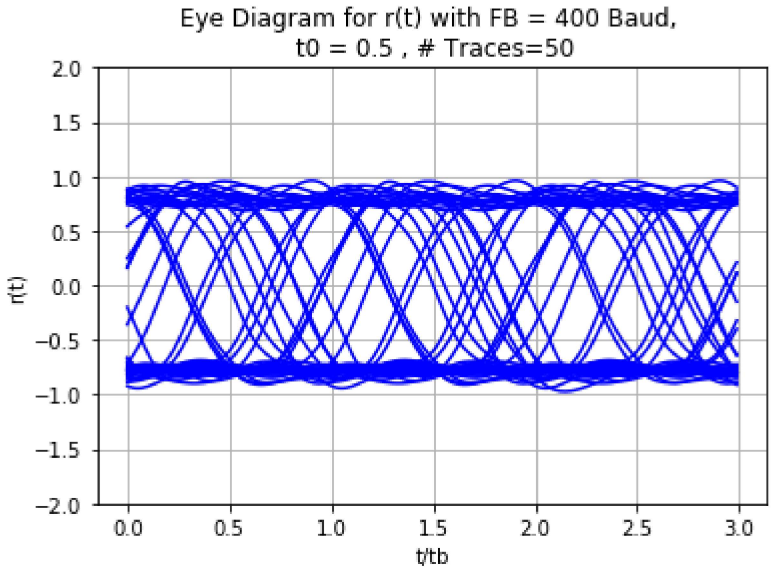


By manually observing the signal in the time domain we observe that the baud rate is approximately 1bit per 0.002sec. The signal also appears to be bipolar binary. We obtain multiple eye diagrams and FFT by changing the FB to different approximations and choosing the best one.

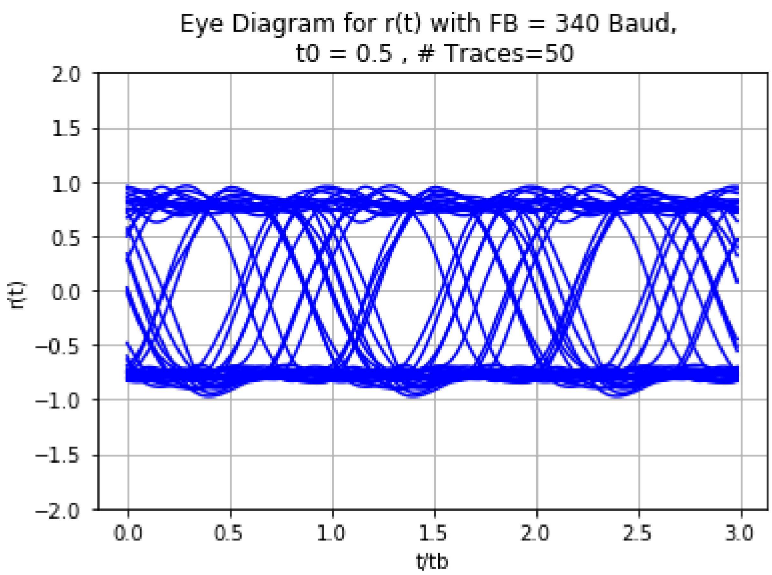
In [15]:
```
run Q2B
```



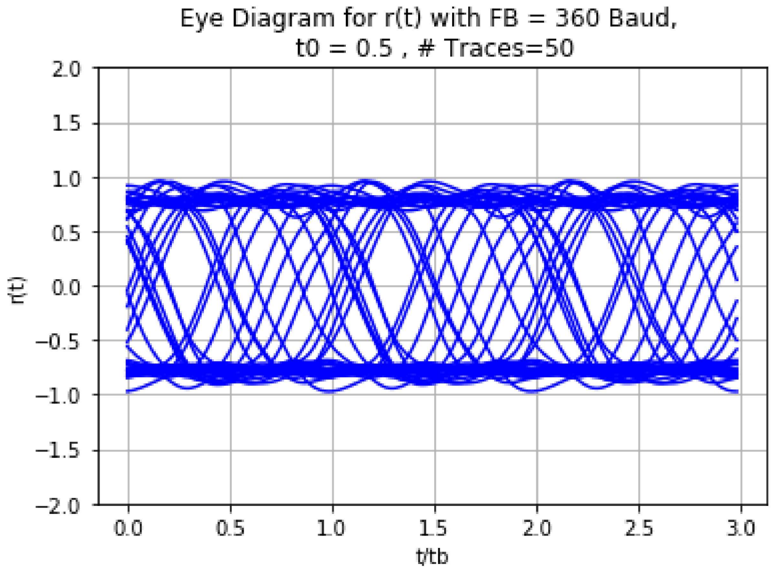
In [14]:
```
run Q2B
```



In [12]:
```
run Q2B
```

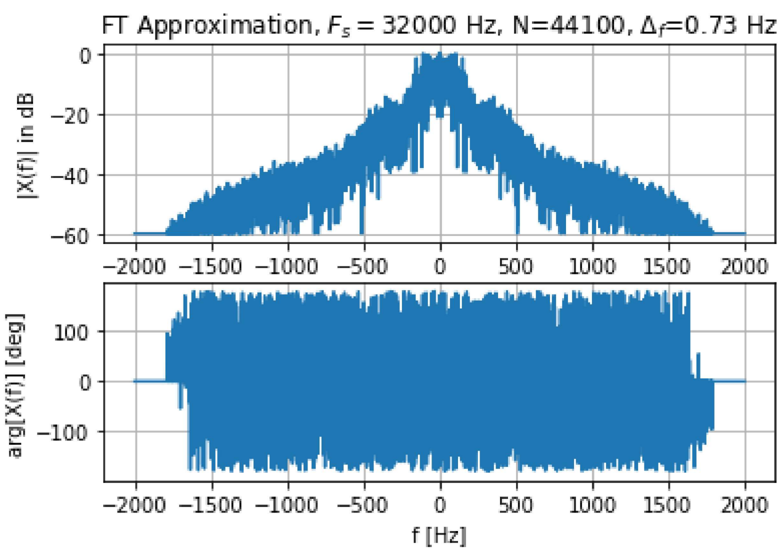


In [11]:
```
run Q2B
```



Thus we can conclude that for FB=340 we get the best eye diagram. We can also conclude that the signal only has two levels. It also appears as if the signal suffers from some time jitters

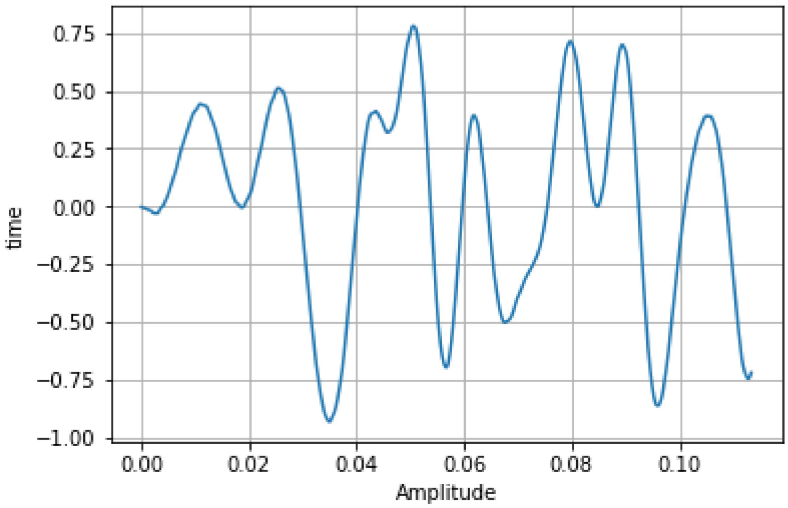
In [18]:
```
run Q2B
```



After looking at the FFT it seems that the interpolation signal maybe a rcf signal

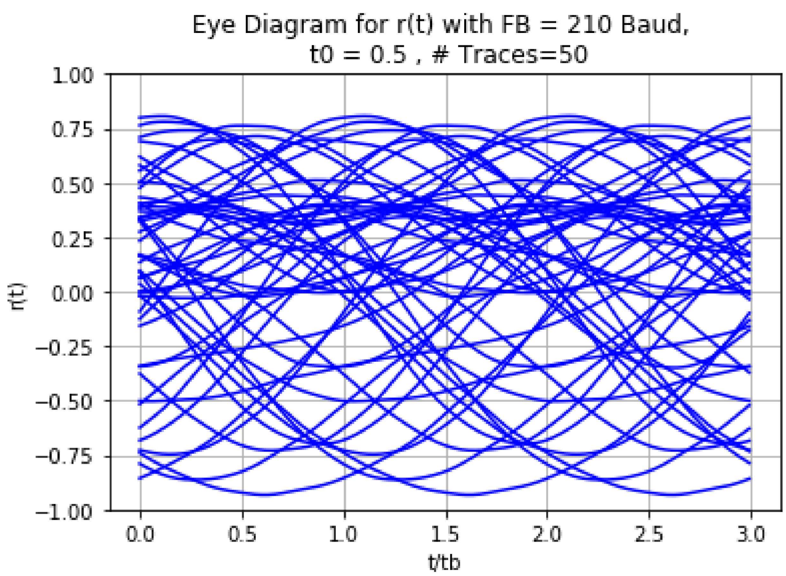
Analysis of Pamsig402

In [14]:
```
run Q2B
```

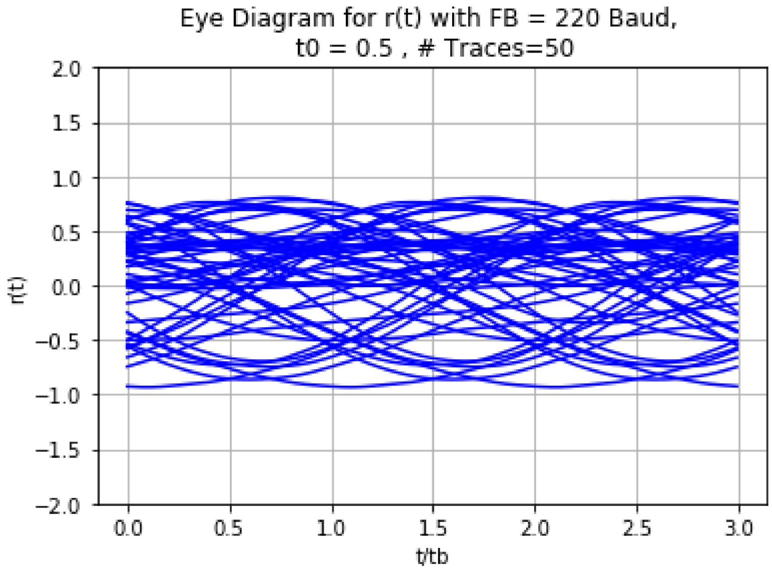


From observing the signal in the time axis we observe that the signal has a baud rate of approximately 9 bits per 0.05 sec. The signal also uses a minimum of 5 levels. We obtain multiple eye diagrams and FFT by changing the FB to different approximations and choosing the best one.

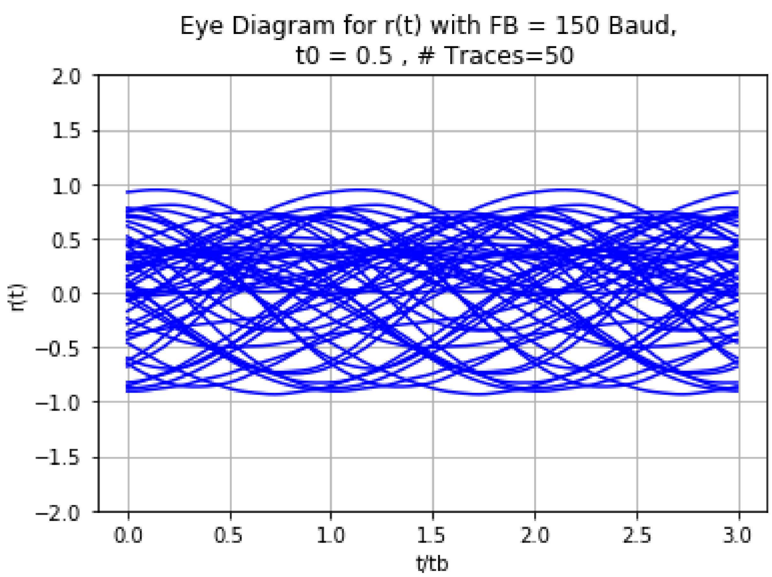
In [26]:
```
run Q2B
```



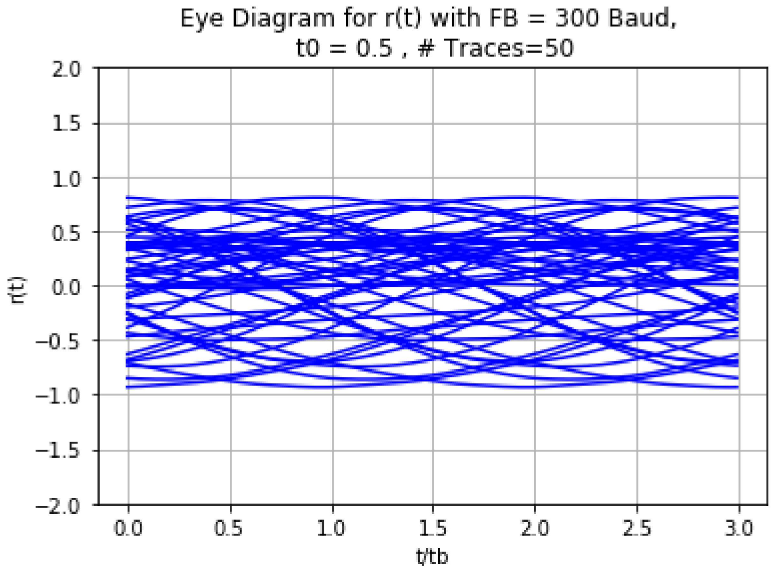
In [21]:
```
run Q2B
```



In [22]:
```
run Q2B
```



In [23]:
```
run Q2B
```



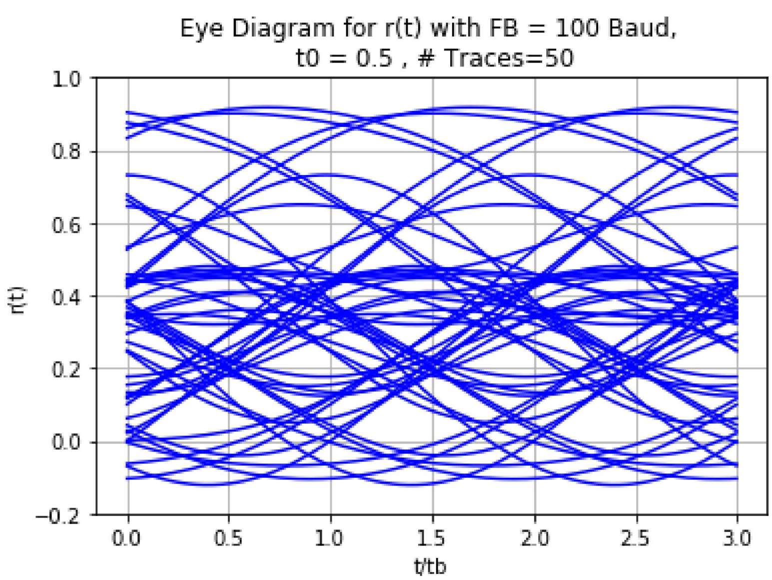
run Q2B

From the eye diagrams we can tell that the signal has some time jitter and the FB is probably equal to 210 as the eye diagram is the best for this bit rate. From the FFT we can conclude that the interpolating signal was Rcf

Expt 2(c)

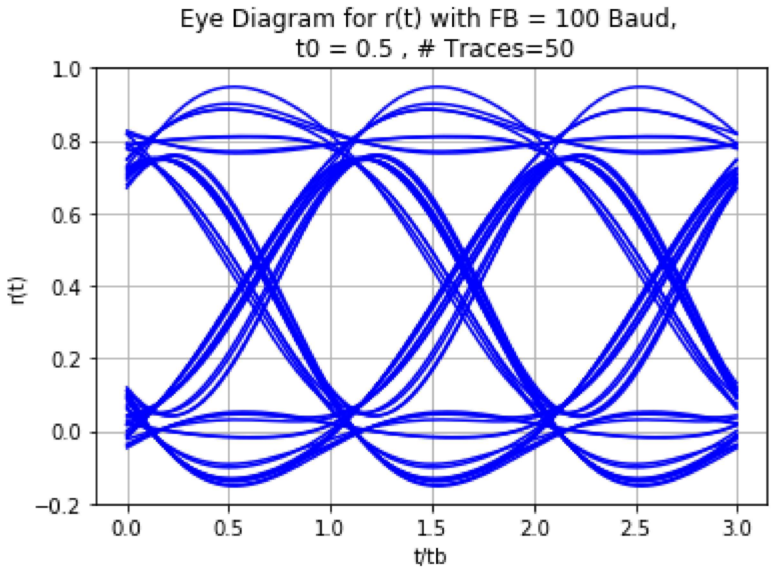
for FI = 0.25* FI

In [28]:
```
run Q2B
```

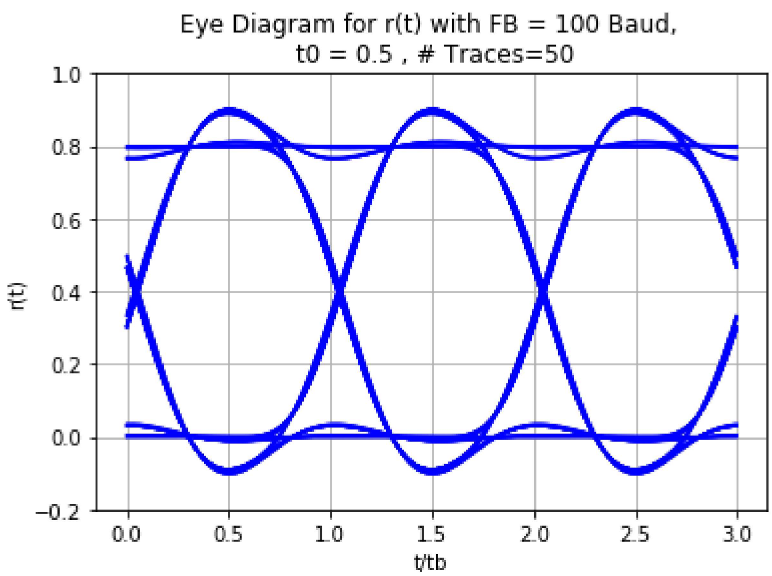


For Fl = 0.5 *Fl

In [29]:
```
run Q2B
```

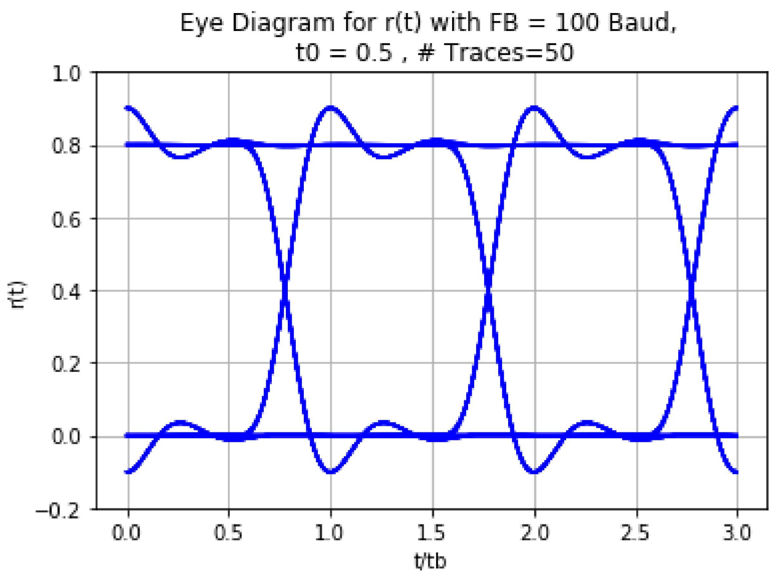


In [30]:
```
run Q2B
```



For a high Fl = 10*FB

In [33]:
```
run Q2B
```

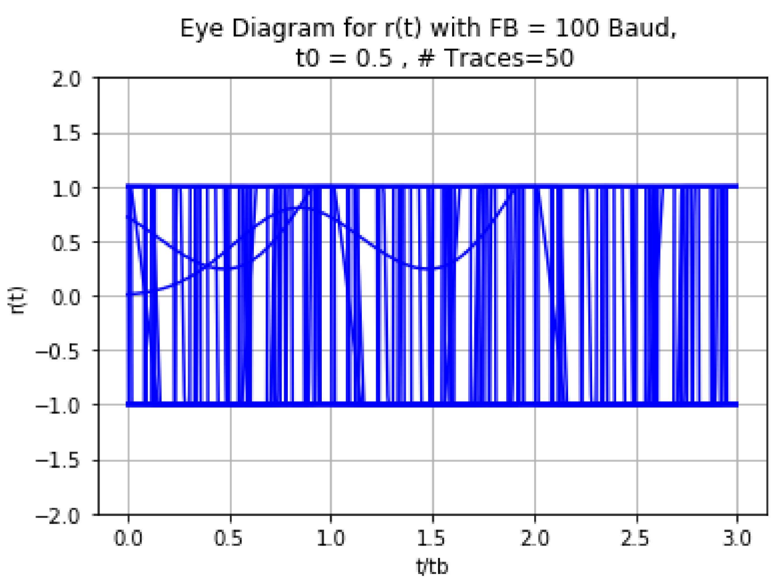


For reasonable detection Fl =0.5 * FB will survive

To determine the N and Fl of the filter used in the given picture, We try different combinations of N and Fl

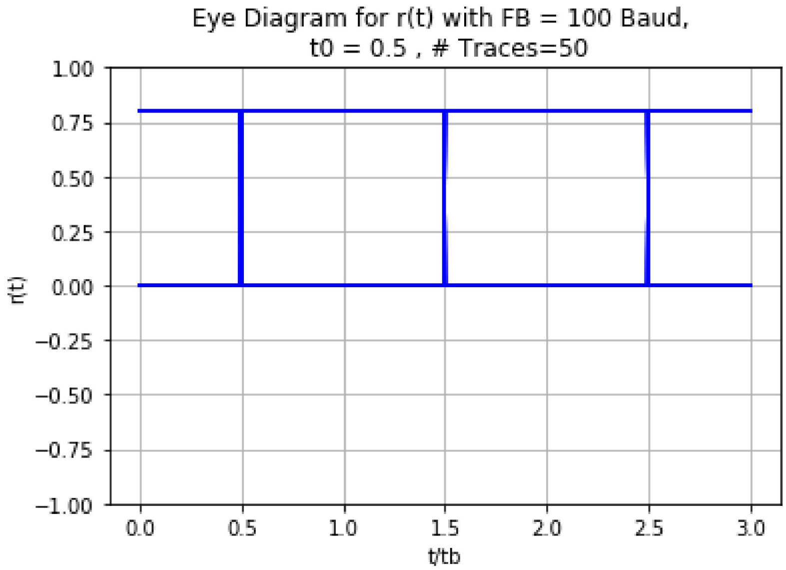
for a high N

In [36]:
```
run Q2B
```



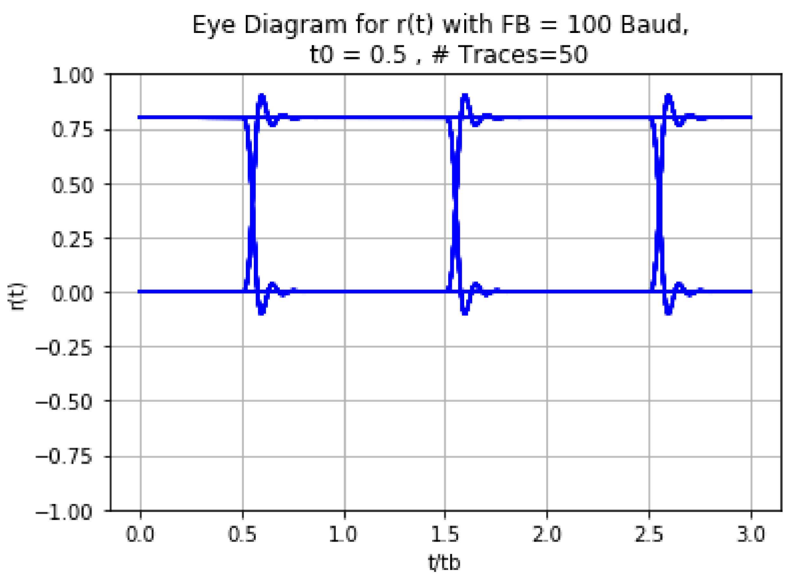
For Low L

In [39]:
```
run Q2B
```



For high Fl

In [40]:
```
run Q2B
```



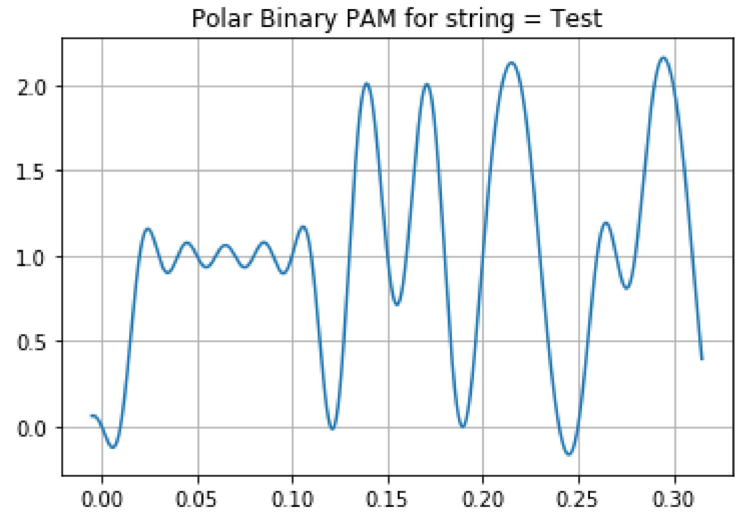
As we can see from these extra plots, low N's create the desired "flatness" on the top and bottom of the traces of the eye diagram and lower fL's create the slow, curved transitions (rather than steep, vertical transitions with high fL's)

Also from the diagram the curves look like ethe charging and discharging of capacitors in order 1 RC filter circuits. Thus possible values can be N= 1 and Fl= 0.5*Fb

Expt 3(a)

Generating a PAM signal using a Class 1 PR1 signal

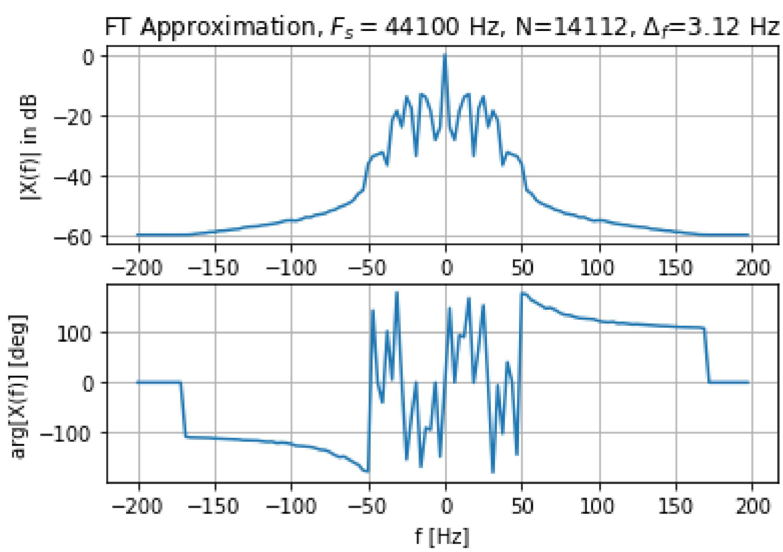
In [2]:
```
run Q3A
```



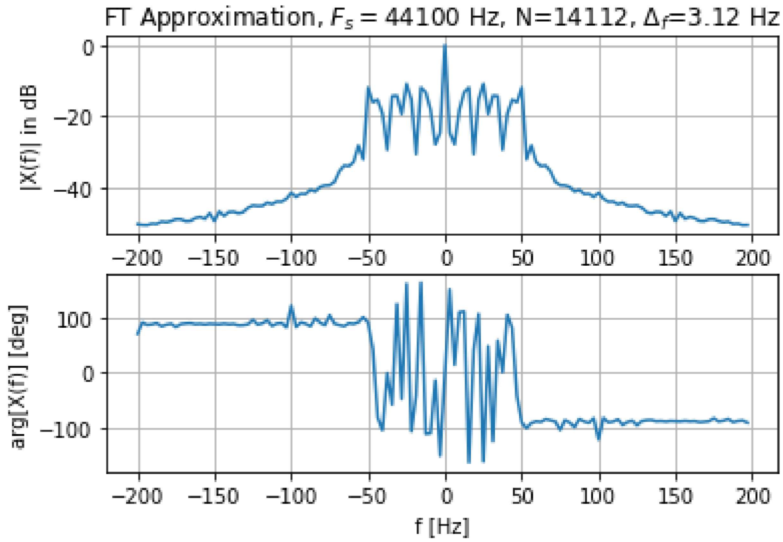
Expt 3(b)

Comparing the FT of a PR1 pulse(i) and the FT of a sinc pulse(ii)

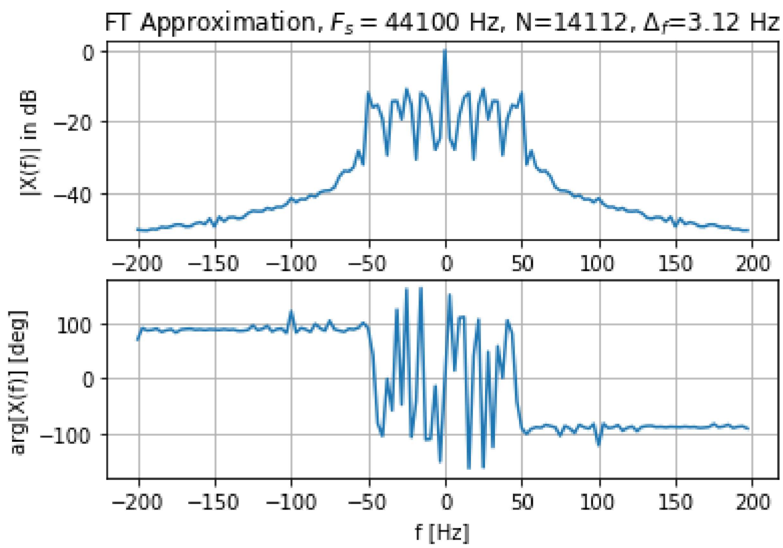
In [43]:
```
run Q1E
```



In [44]:
```
run Q1E
```



In [44]: run Q1E



Expt 3(c)

In [3]:
```
run Q3C
```

```
A leader knows what the best thing to do is;
a manager only knows how to do it best
```

Expt 3(d)