



Medical Signal Processing Lab  
Spring 2024  
Prof. S. Hajipour  
Lab 1

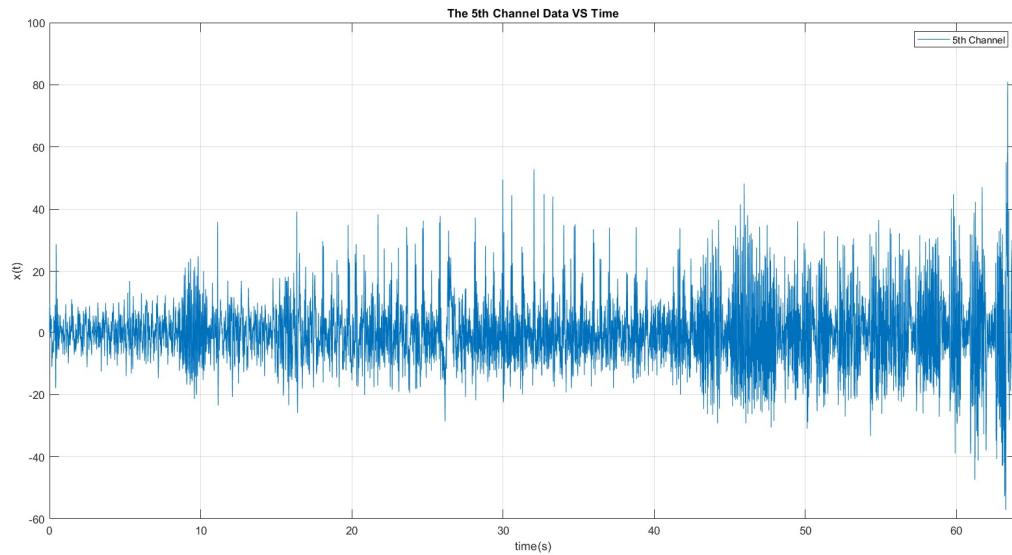
Amirali Razi  
Student No. 98104133

Amirmohammad Marshal Pirgheibi  
Student No. 98109815

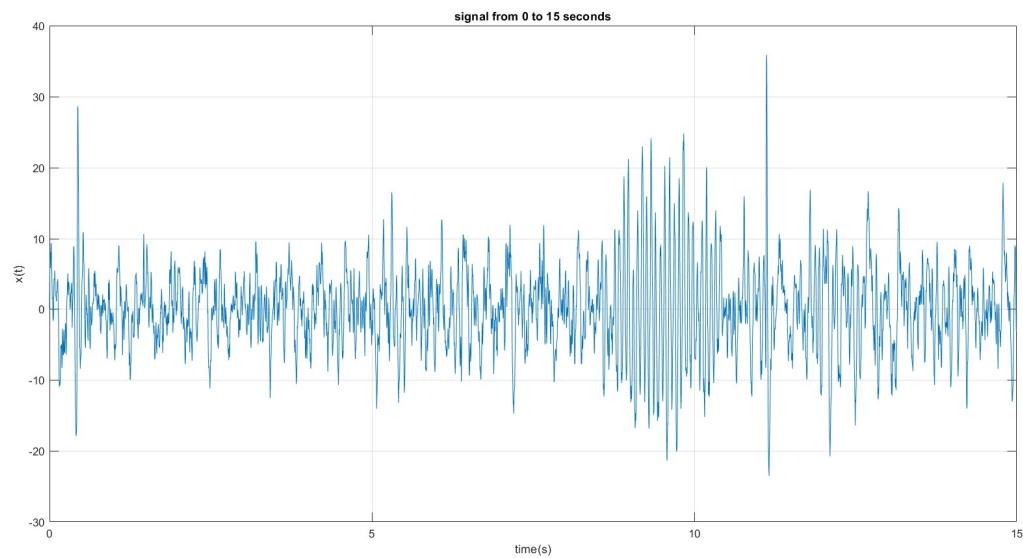
Parnian Taheri  
Student No. 99106352

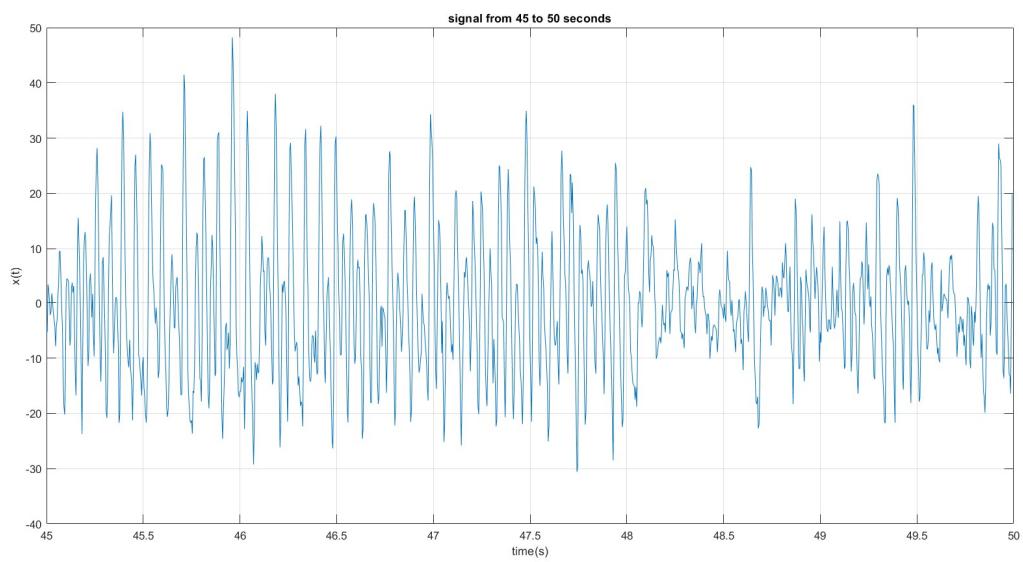
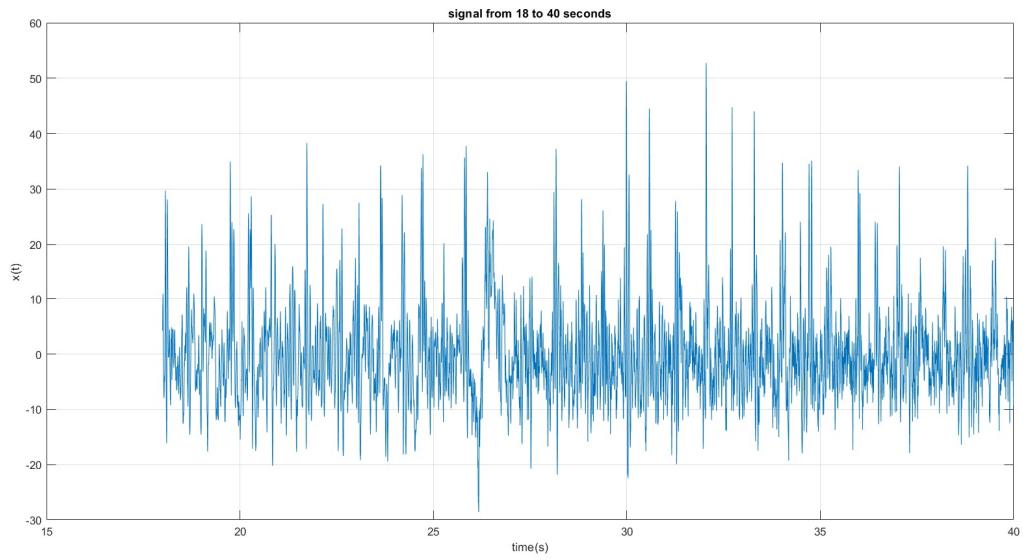
# Part 1: Electroencephalogram

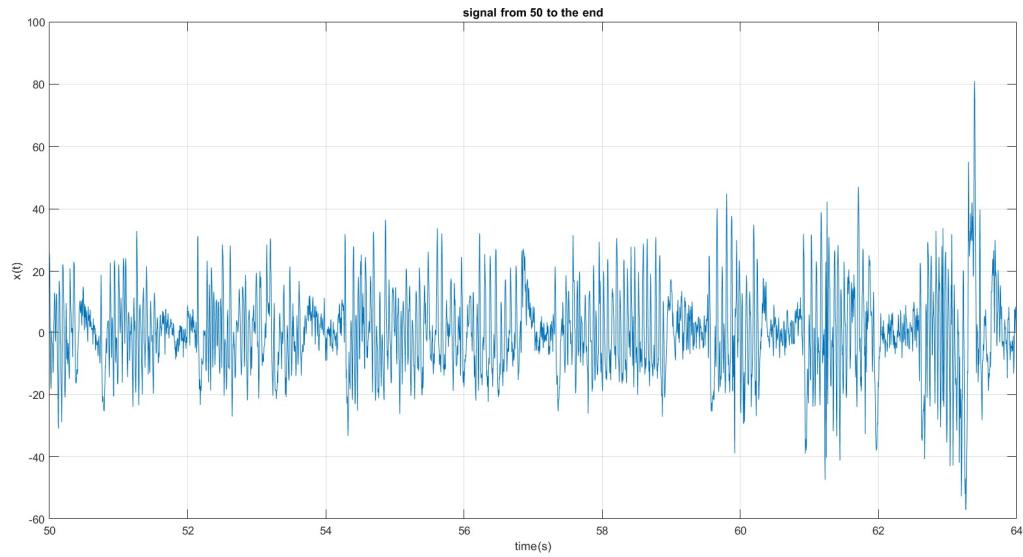
1-1)



1-2)

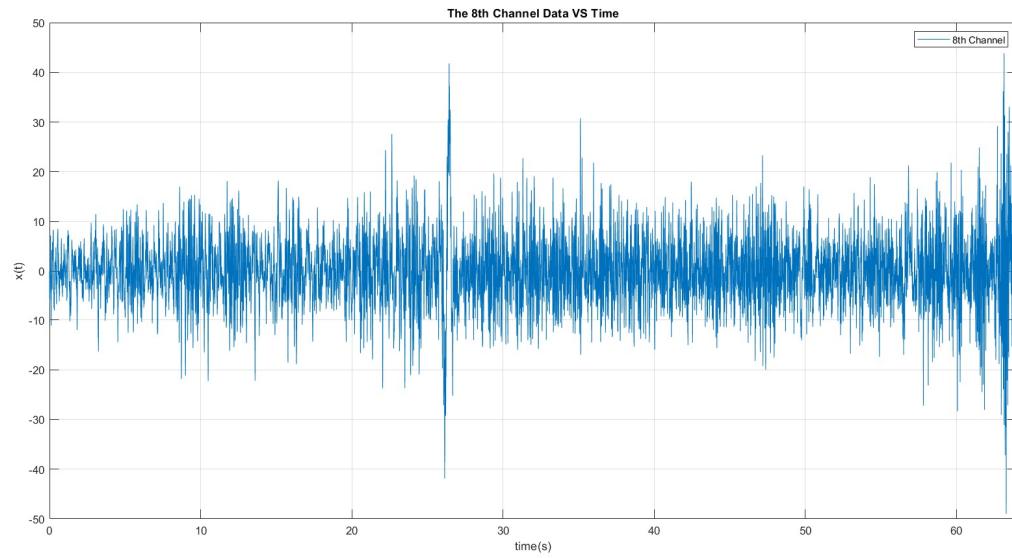






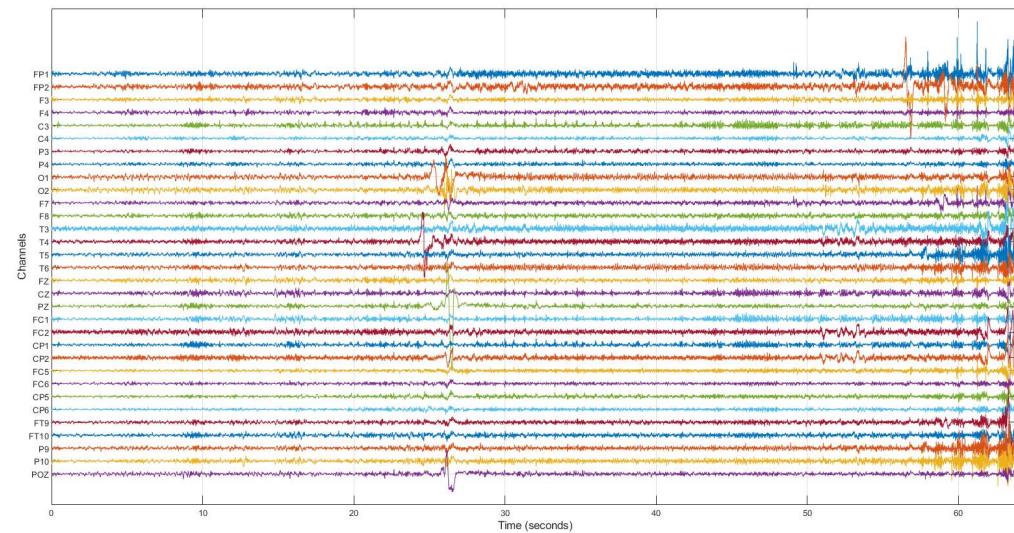
Some distinctive features of the signals are the periodic spikes and simultaneous intervals of high activity.

1-3)



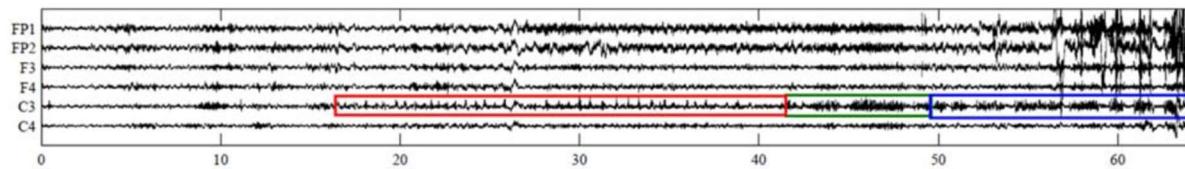
We can see that the 8<sup>th</sup> channel signal is different from the 5<sup>th</sup> channel signal.

1-4)



After 40 seconds, we can see high frequency activity in the C3 channel which is a sign of epilepsy.

1-5)

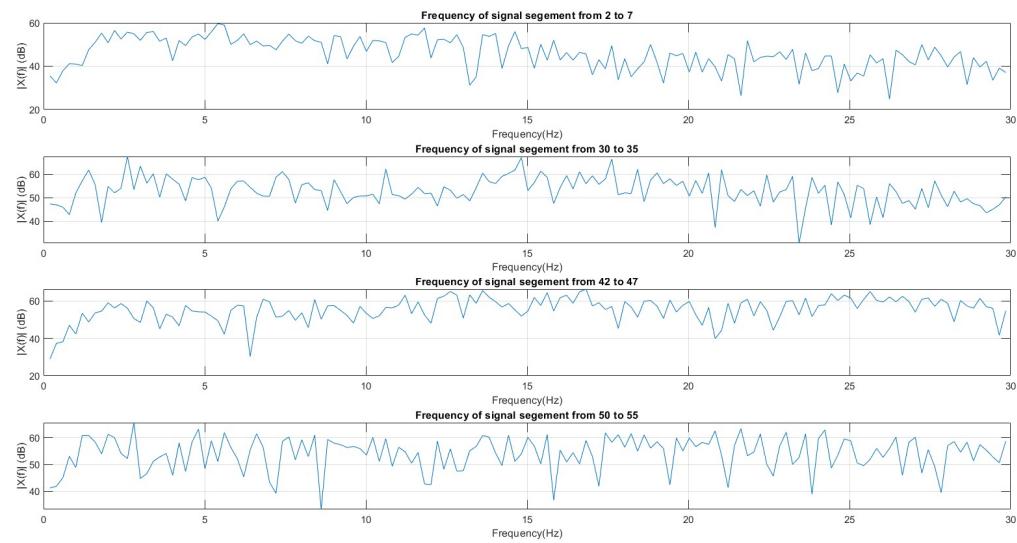
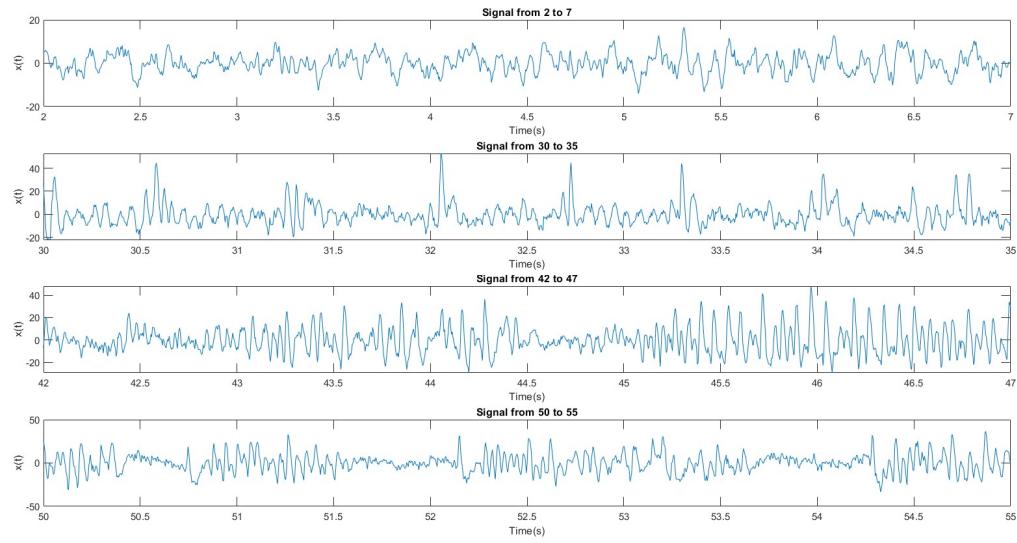


**Red:** In this part, we can see periodic spikes. This is usually a sign of an epilepsy attack.

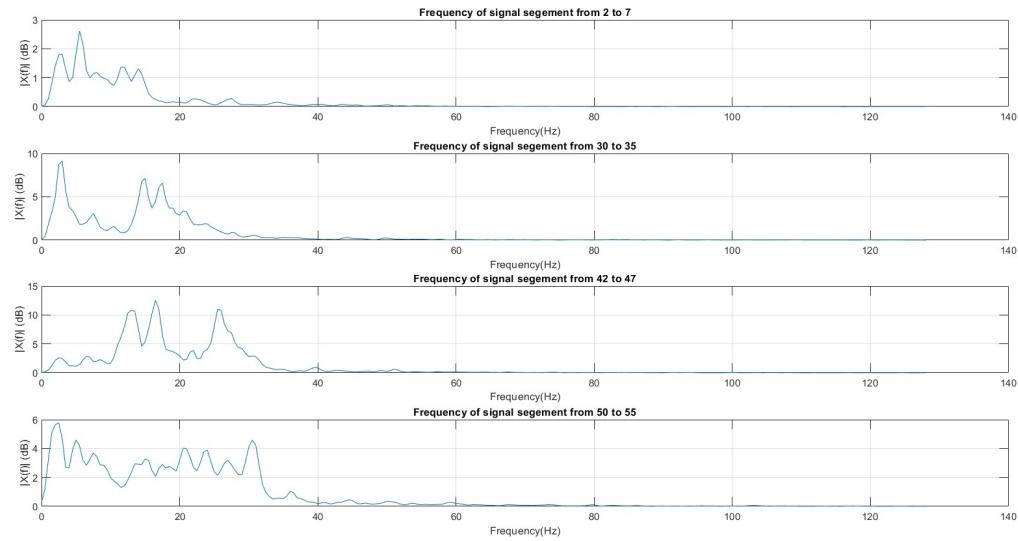
**Green:** This is the period in which the attack occurs.

**Blue:** This is the post attack interval which shows arrhythmic heart activity.

1-6)

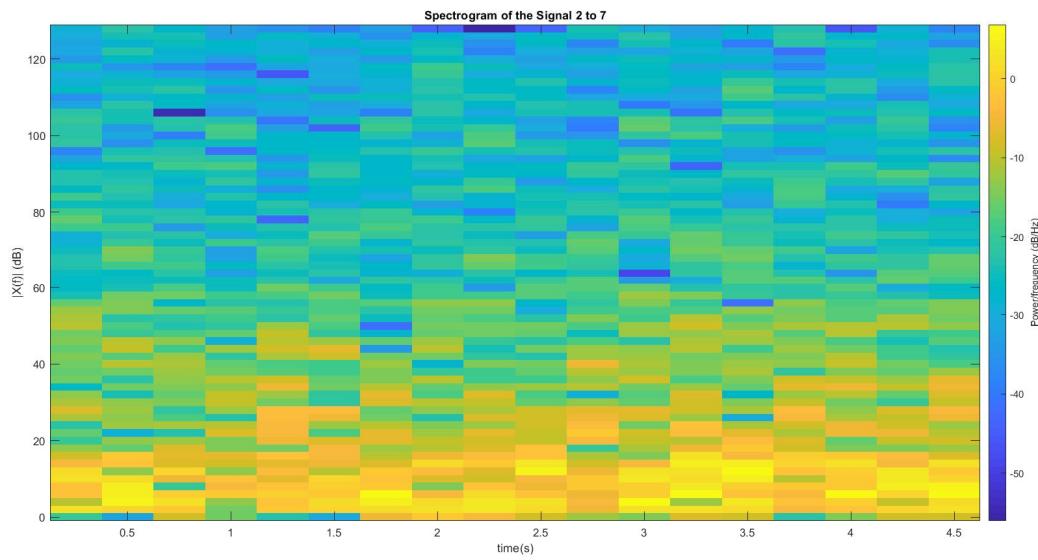


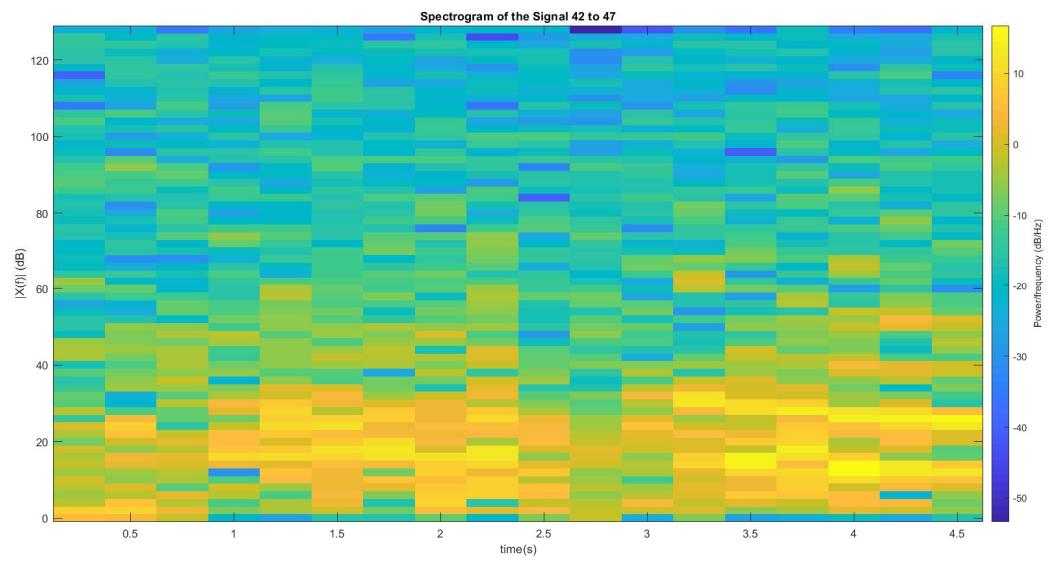
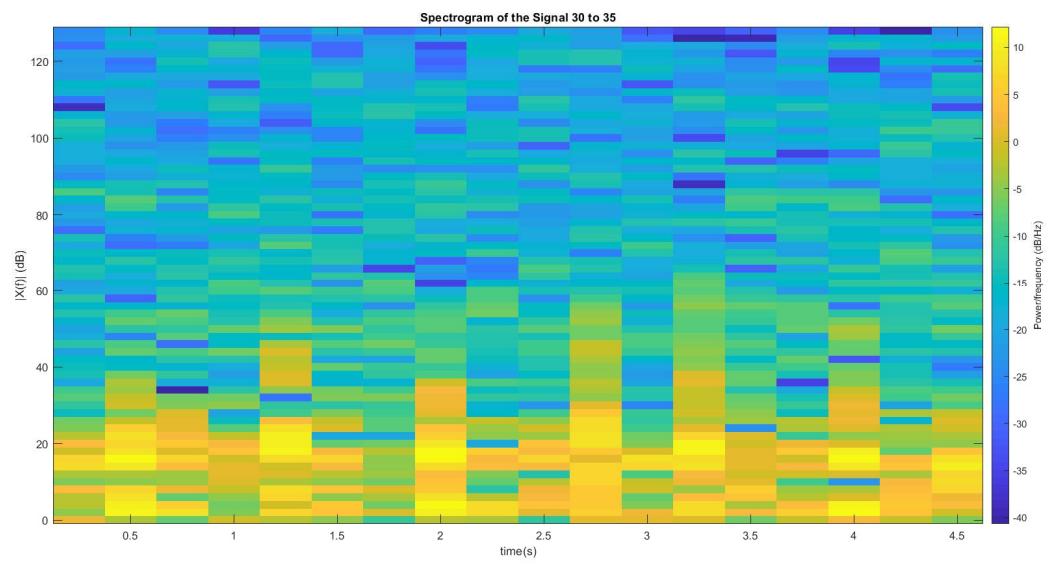
1-7)

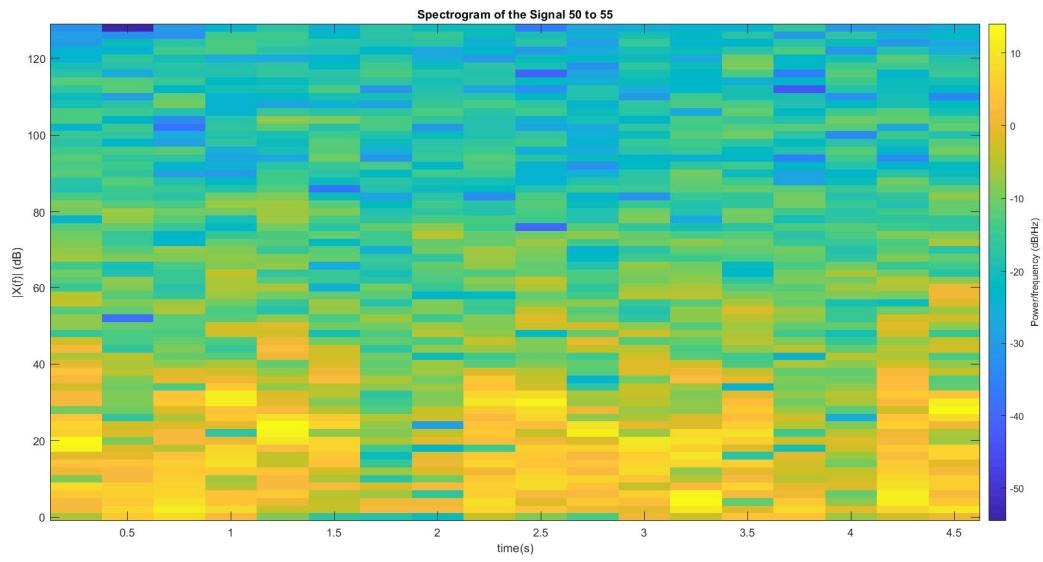


We can see that in intervals close to the attack, there are higher frequencies present.

1-8)

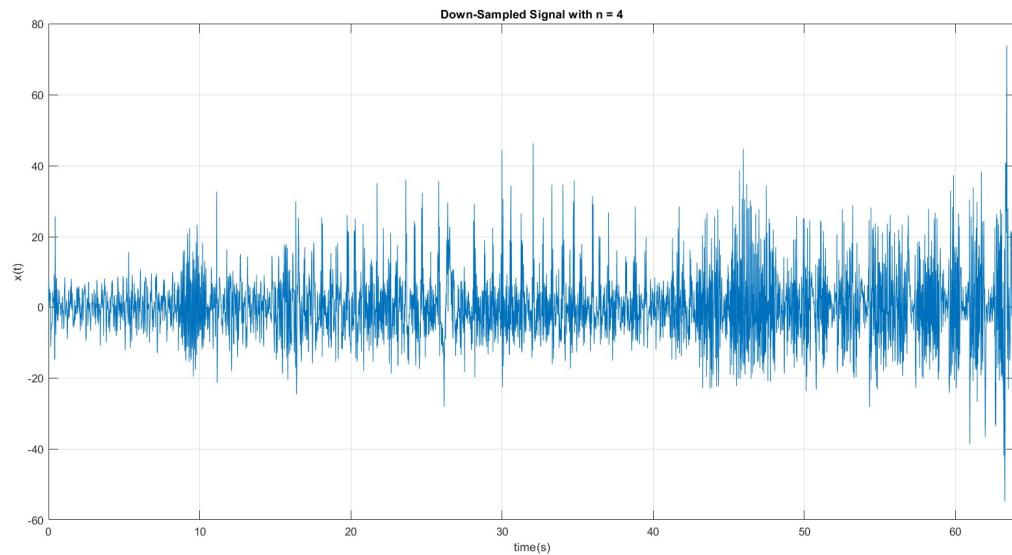


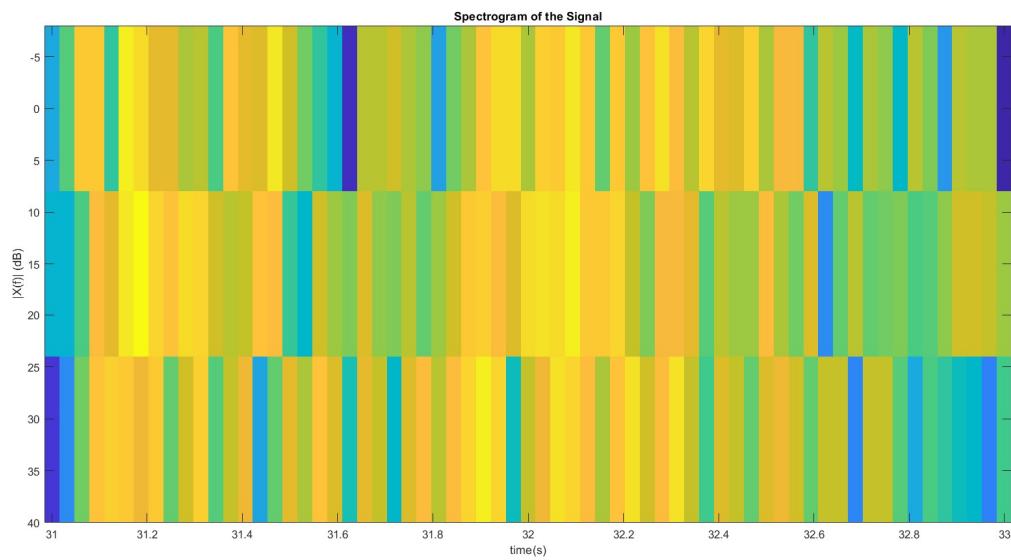
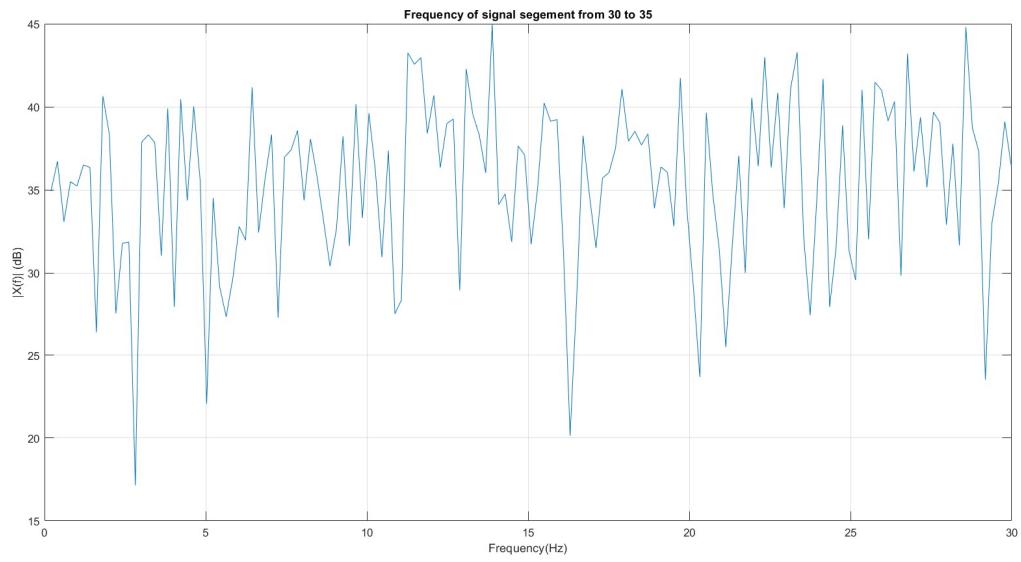




We can see that in intervals close to the attack, higher frequency components have higher power.

1-9)

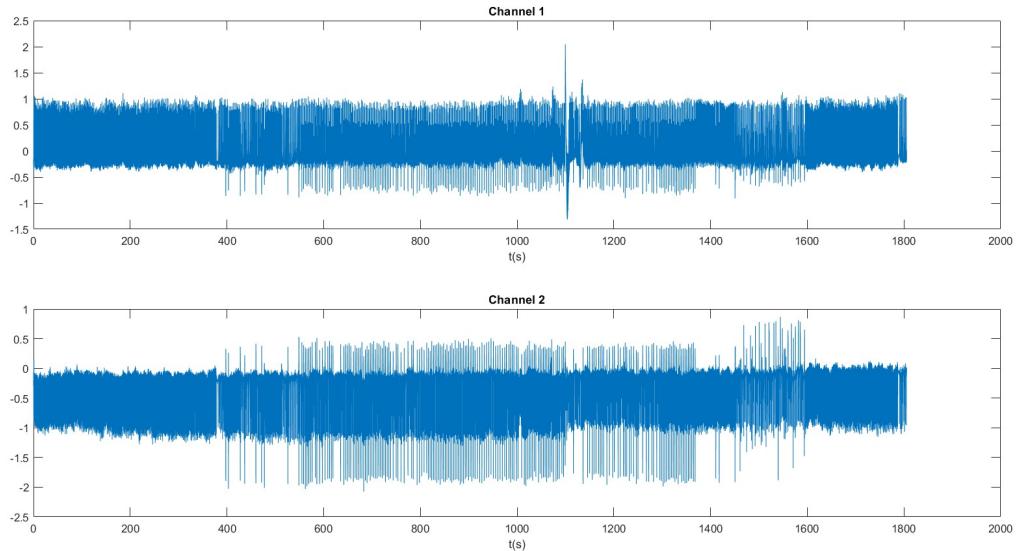




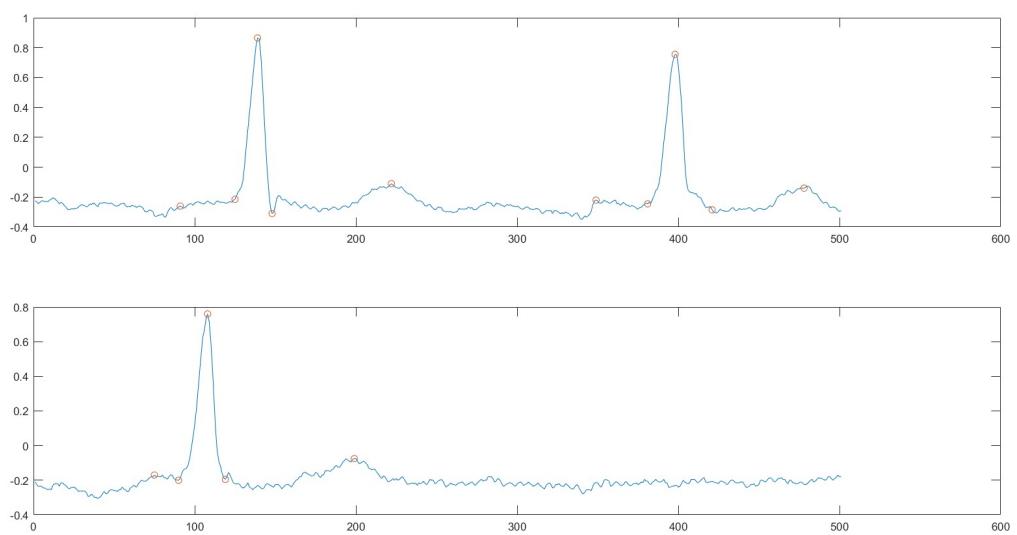
We can see that the characteristics of our signal stays the same. This was expected because the sampling frequency is much higher than the frequency of the main components of our signal.

# Part 2: Electrocardiogram

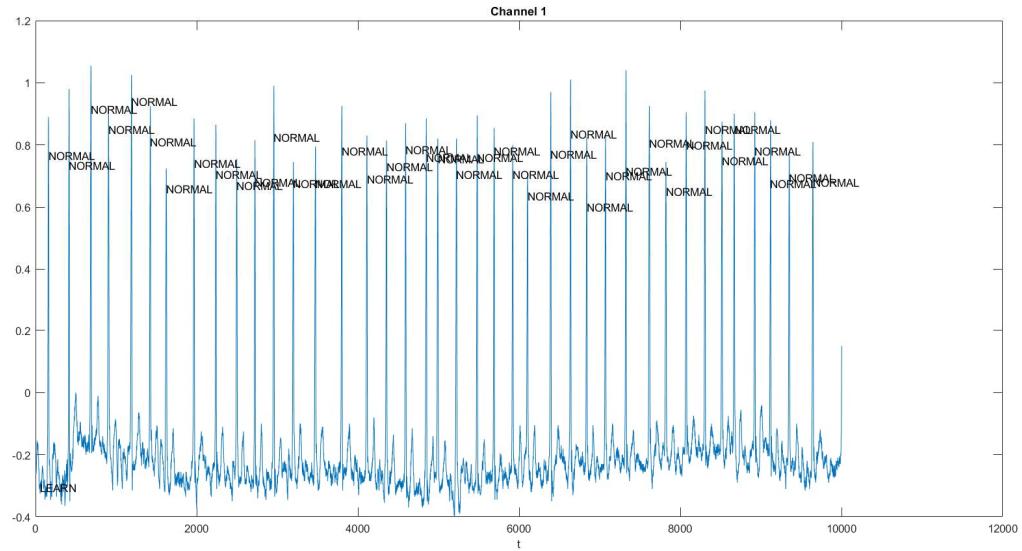
## 2-1)



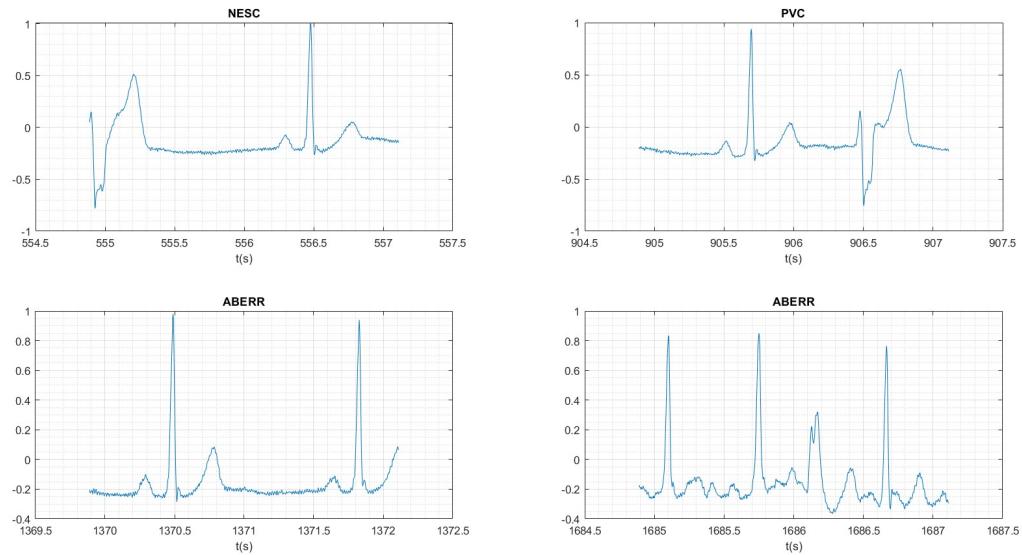
By looking at the 2 channels, we can see that they are different but they are coupled together. This means that a change of channel 1's pattern means change of channel 2's pattern.



2-2)



2-3)



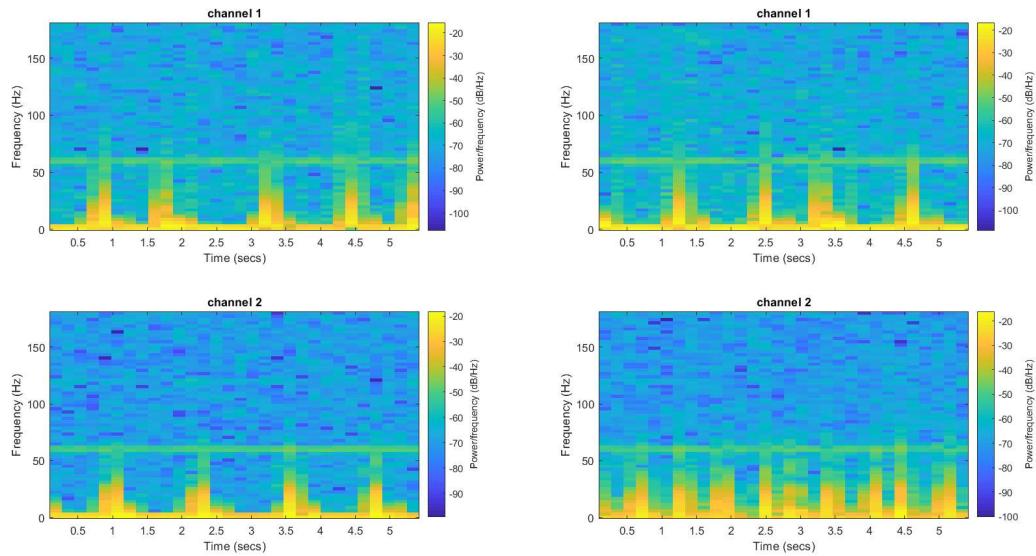
**NESC:** nodal escape beat is a delayed heartbeat originating not from the atrium but from an ectopic focus somewhere in the atrioventricular junction. It occurs when the rate of

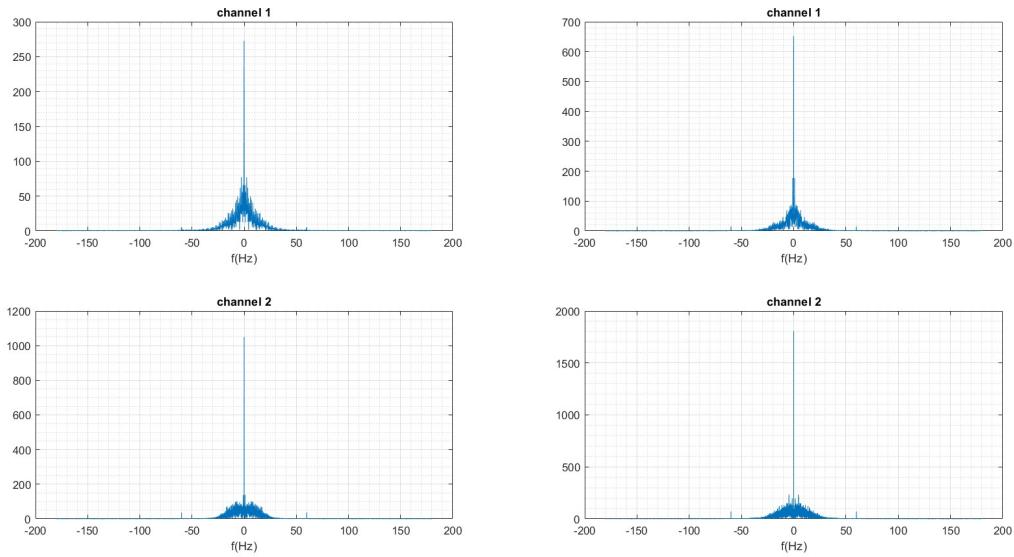
depolarization of the sinoatrial node falls below the rate of the atrioventricular node.

**PVC:** premature ventricular contraction occurs when the electrical signal that starts your heartbeat comes from your lower heart chambers instead of your top heart chamber.

**ABERR:** aberrated atrial premature beat is an extra heartbeat originating from an abnormal site within the atria.

2-4)

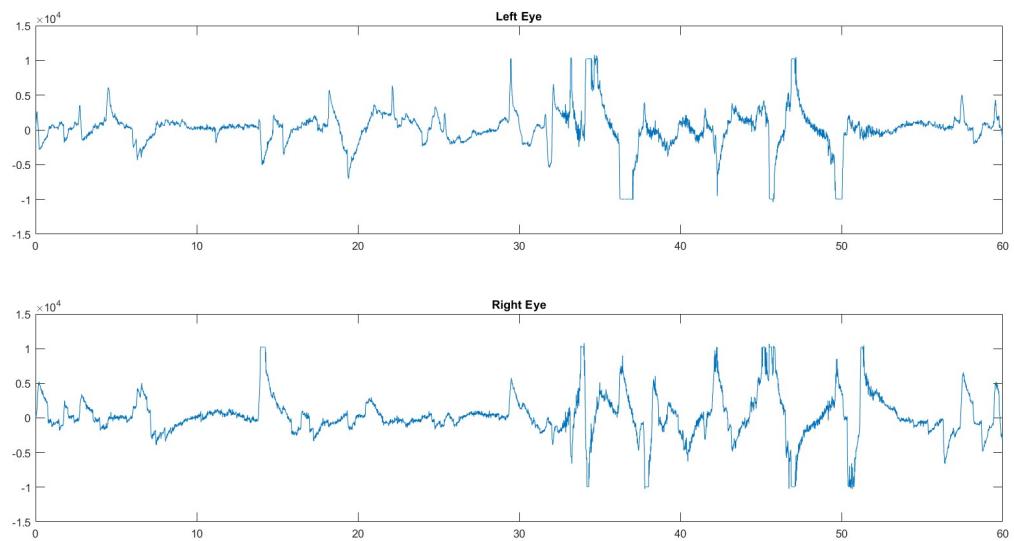




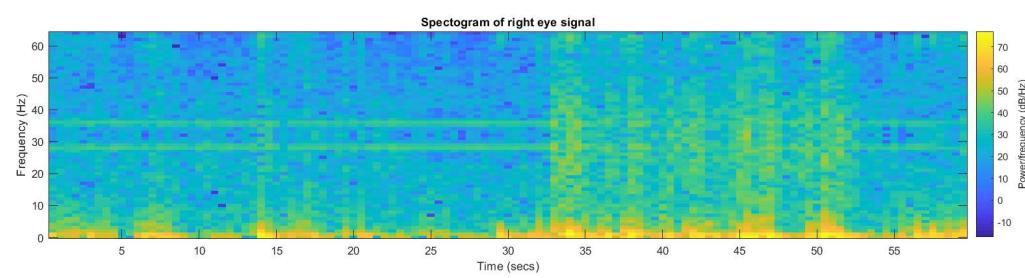
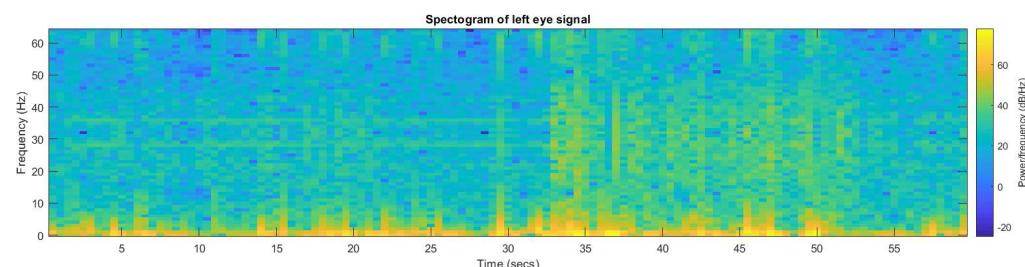
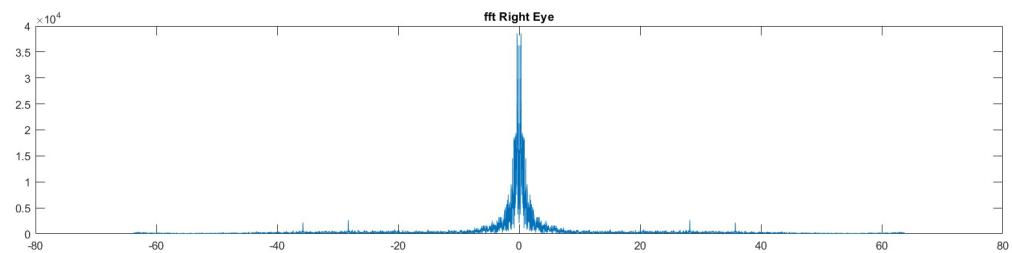
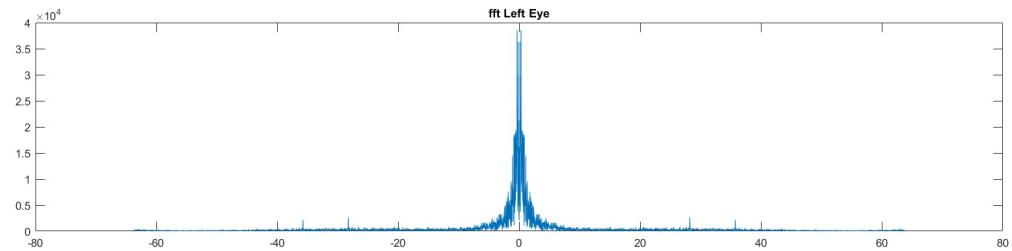
This may depend on the type of arrhythmia but in this case, we cannot distinguish between a normal and an arrhythmic signal just from its frequency domain representation.

## Part 3: Electrooculogram

### 3-1)

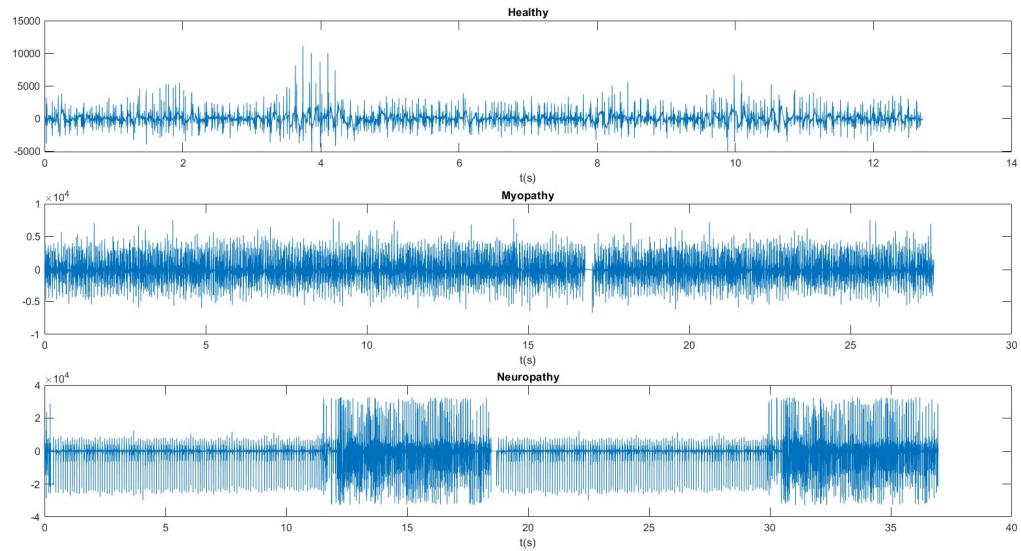


3-2)



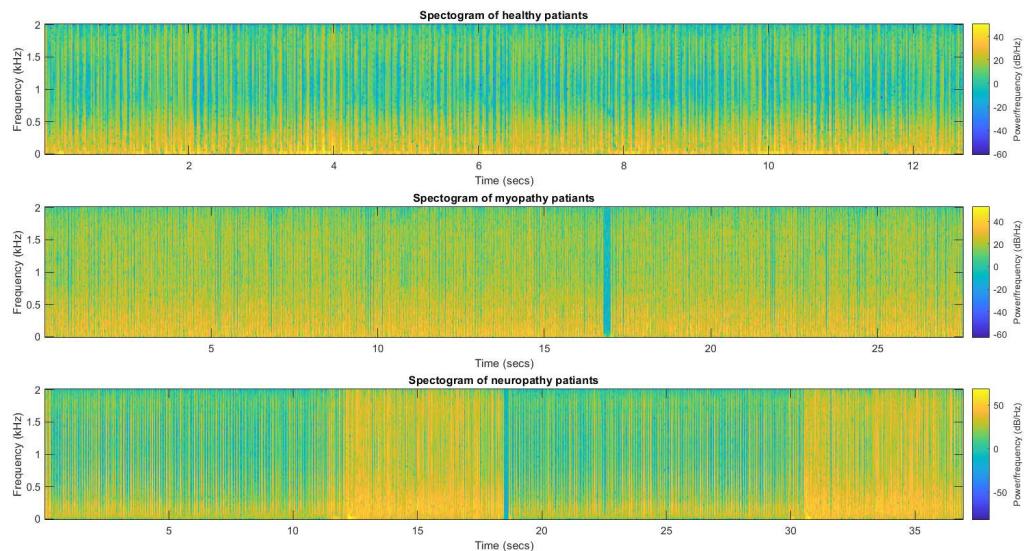
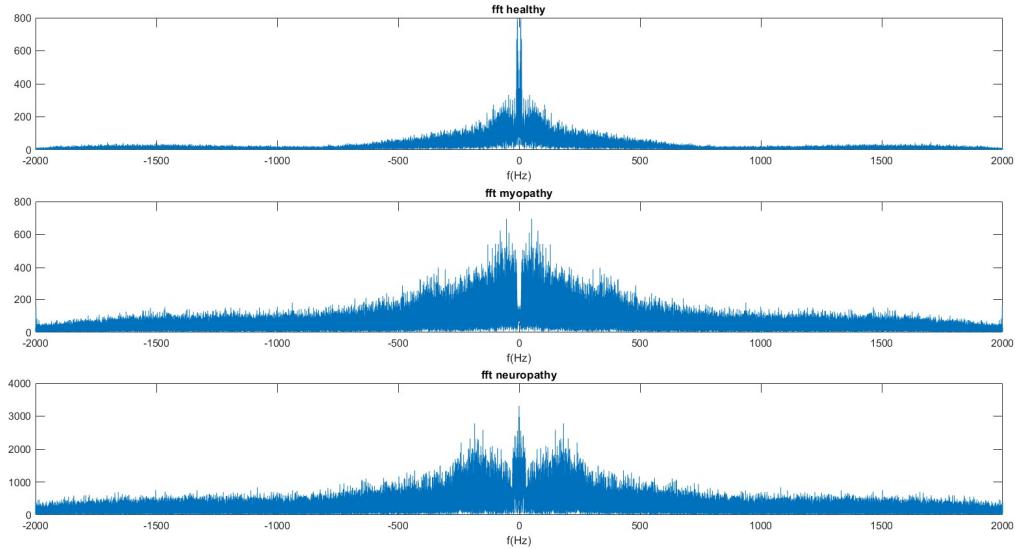
# Part 4: Electromyogram

## 4-1)



If we compare the myopathic patient with the normal patient, we can see that the EMG signal of the myopathic patient has a continuous high frequency component on its signal. The Neuropathic patient, on the other hand, has periods of high frequency and high amplitude activity.

4-2)



This plot shows the same information shown above. The high frequency components of the myopathic patient have higher amplitudes than that of the normal patient. The neuropathic patient had a non-continuous high frequency chapter, that's why there is a spike in the middle of the FFT plot.

4-3)

The healthy signal is from a 44-year-old man without history of neuromuscular disease. The neuropathy signal is for a 62-year-old man with chronic low back pain and neuropathy due to a right L5 radiculopathy and the myopathy signal is for a 57-year-old man with myopathy due to longstanding history of polymyositis, treated effectively with steroids and low-dose methotrexate.