



NEUROSCIENCE LAB

Prof. S. Hajipour

Lab Report – 02

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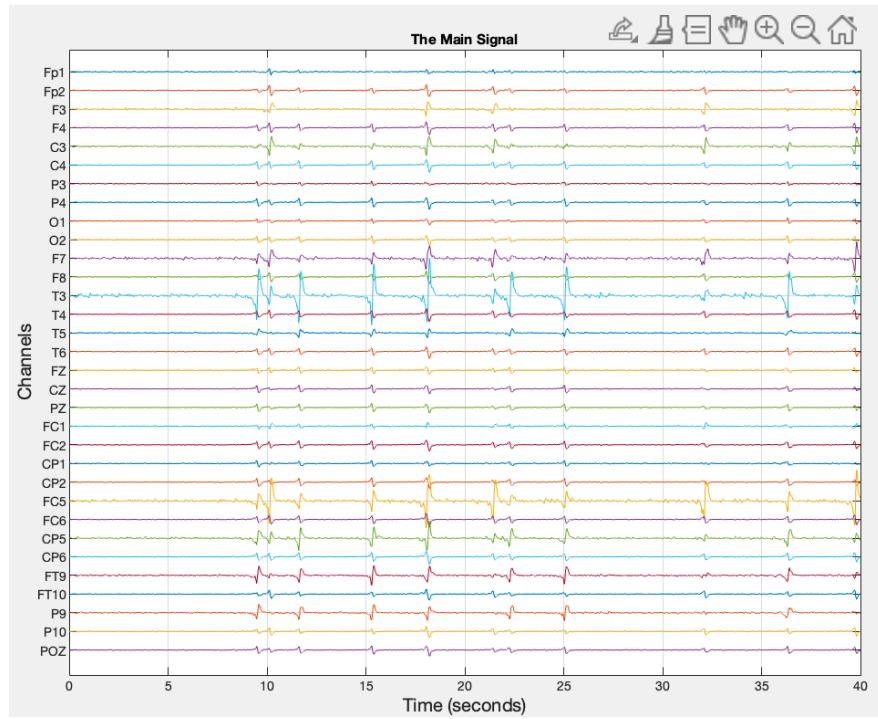
Amirmohammad Marshal Pirgheiby – 98109815

Amirali Razi - 98104133

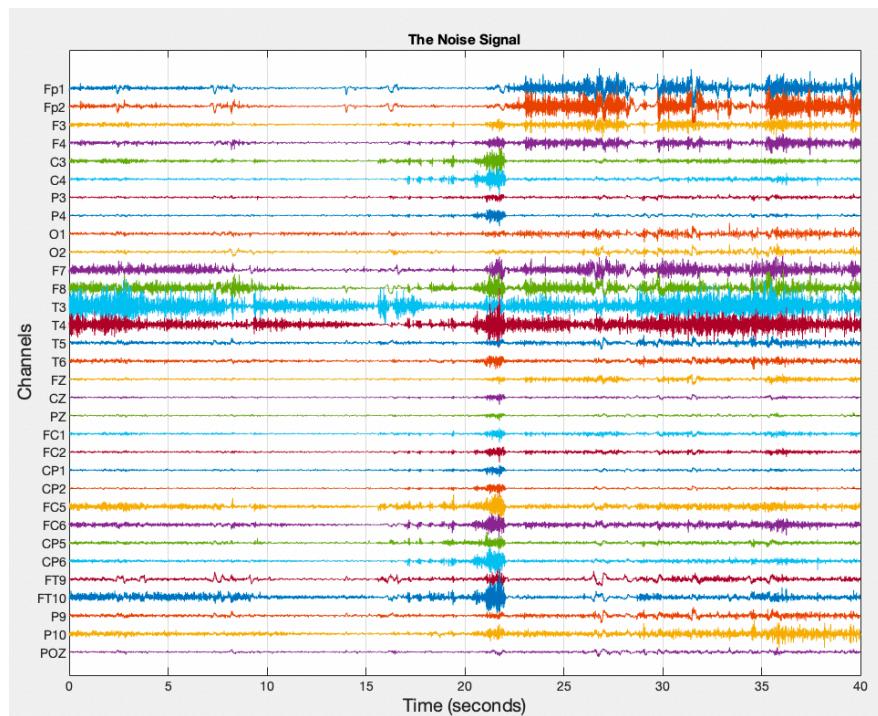
February 12, 2024

Part 1:

1 .

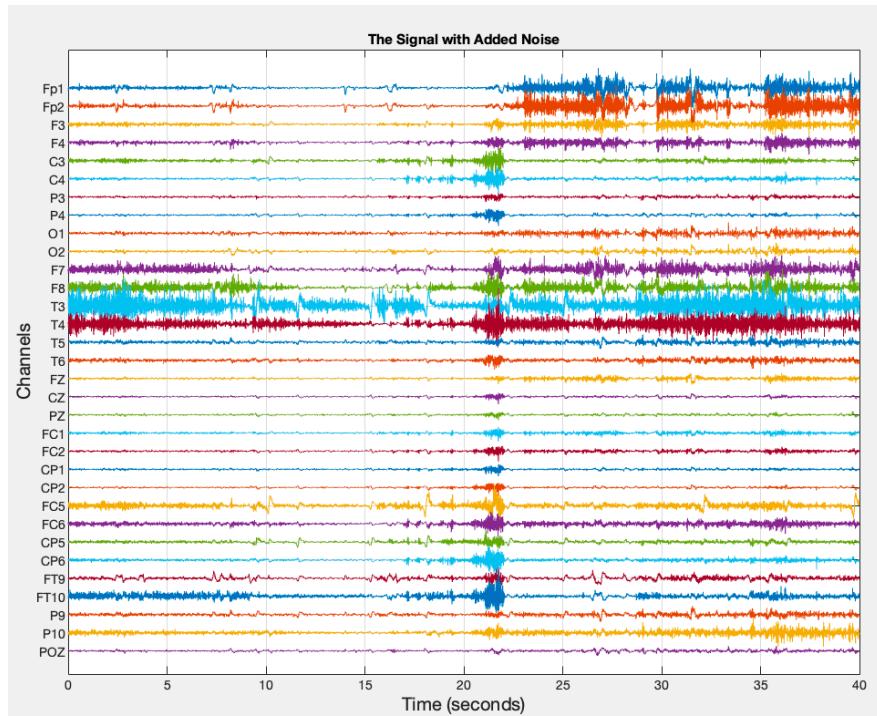


2 .

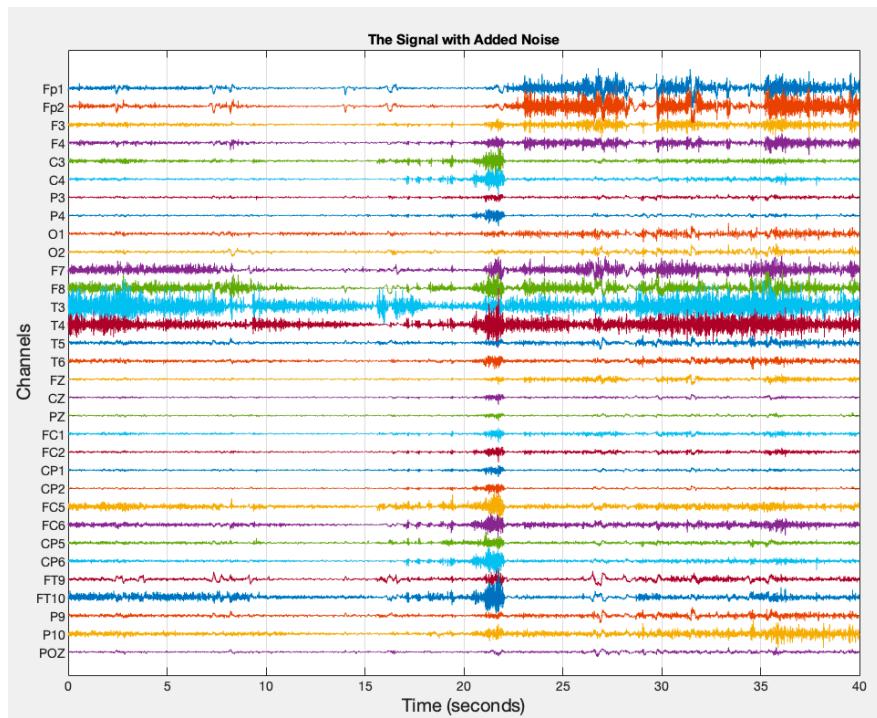


3.

SNR = -5dB:



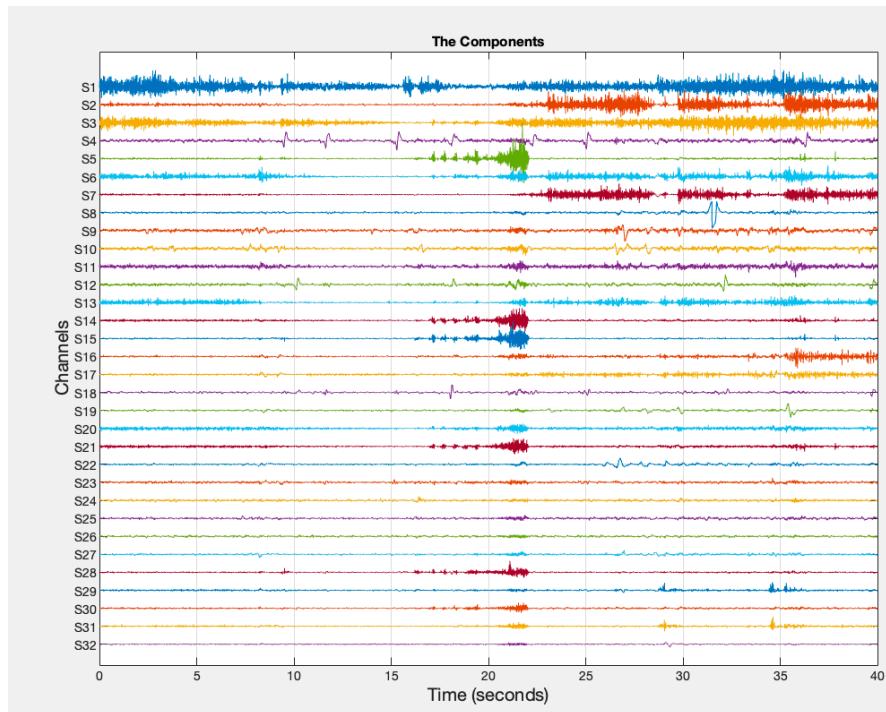
SNR = -15dB:



4.

%% Part 4

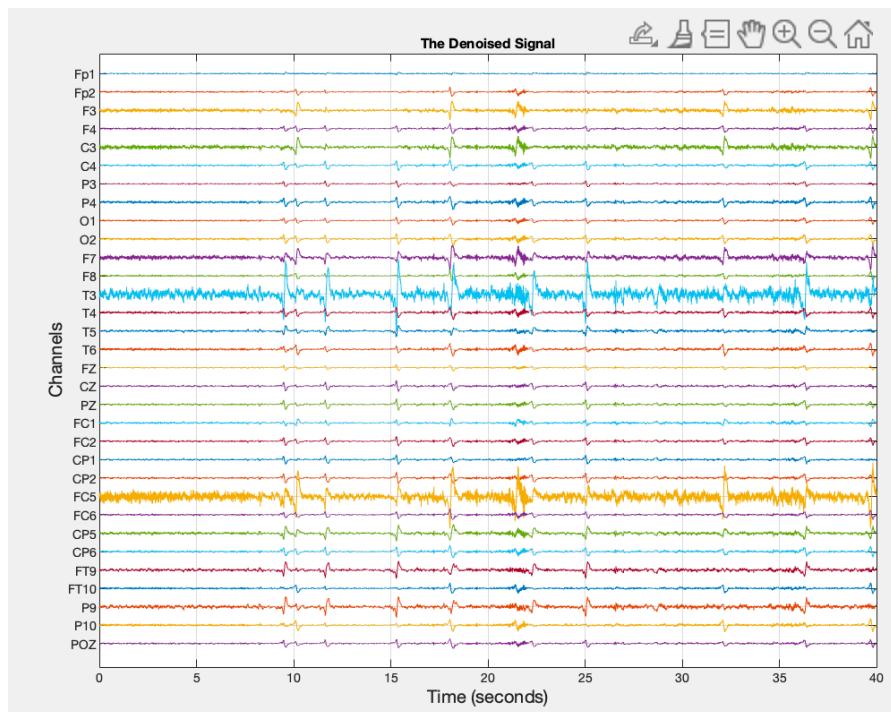
```
num_channel = 32;
[F,W,K] = COM2R(new_signal,num_channel);
componenet_signal = W * new_signal;
offset = max(max(abs(componenet_signal)))/2;
fesq = 256 ;
% ElecName = Electrodes.labels;
disp_eeg(componenet_signal,offset,fesq);
title("The Components")
```



5.

```
%% Part 5 and 6
idx = [4,12,18];
selected_signal = componenet_signal(idx,:);
reconstructed_signal = F(:,idx) * selected_signal;
offset = max(max(abs(reconstructed_signal)))/2;
freq = 256 ;
ElecName = Electrodes.labels;
disp_eeg(reconstructed_signal,offset,freq,ElecName);
title("The Denoised Signal")
```

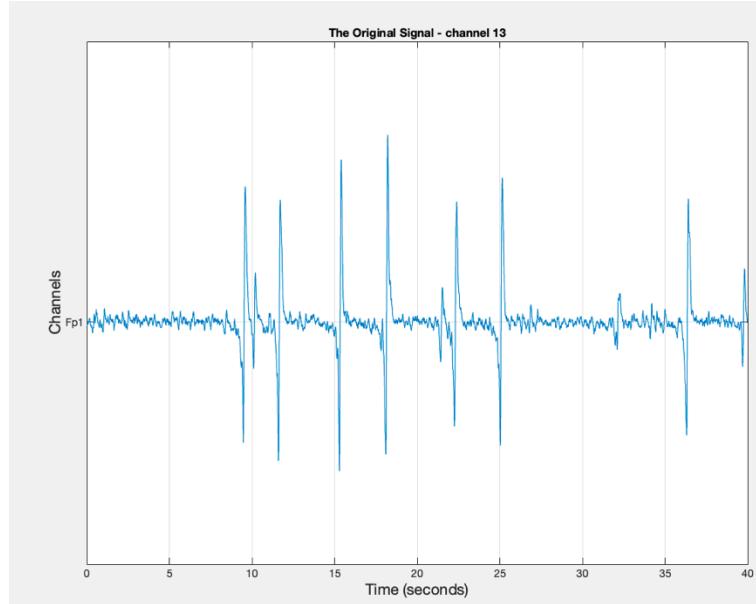
6.



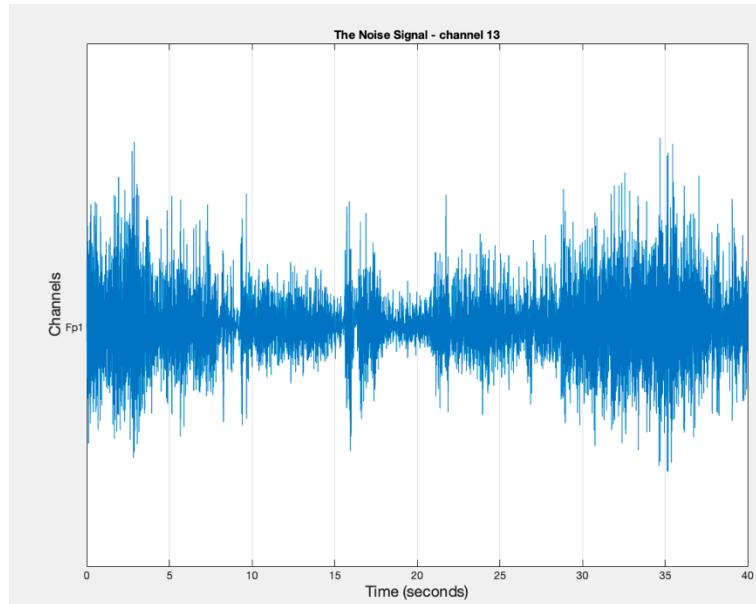
7.

Channel 13:

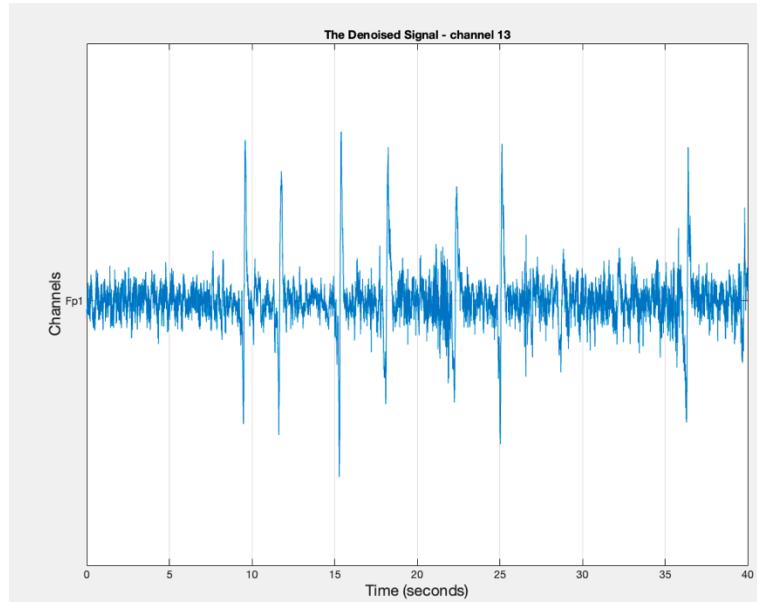
Original signal:



Noisy signal:

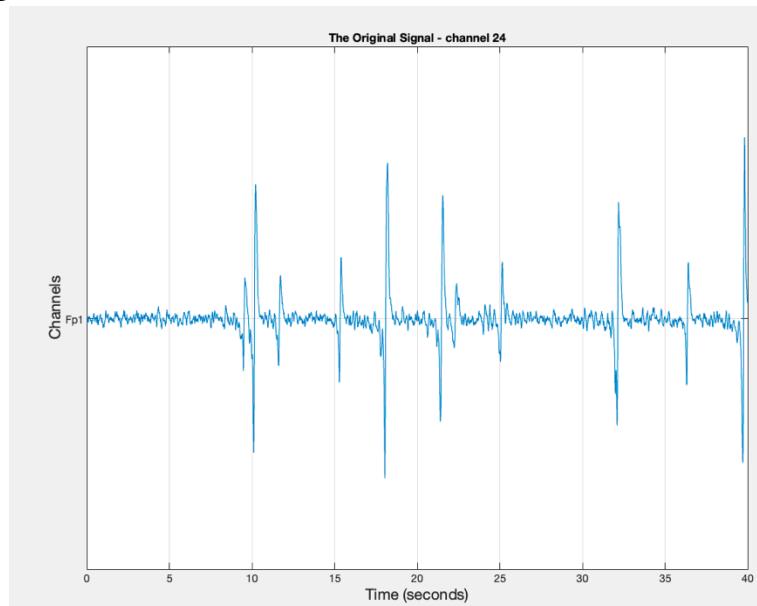


Denoised signal:

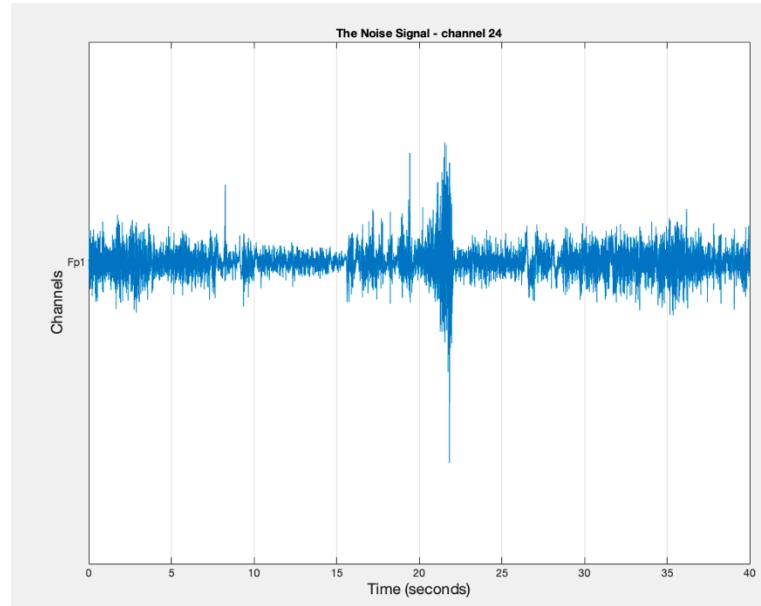


Channel 24:

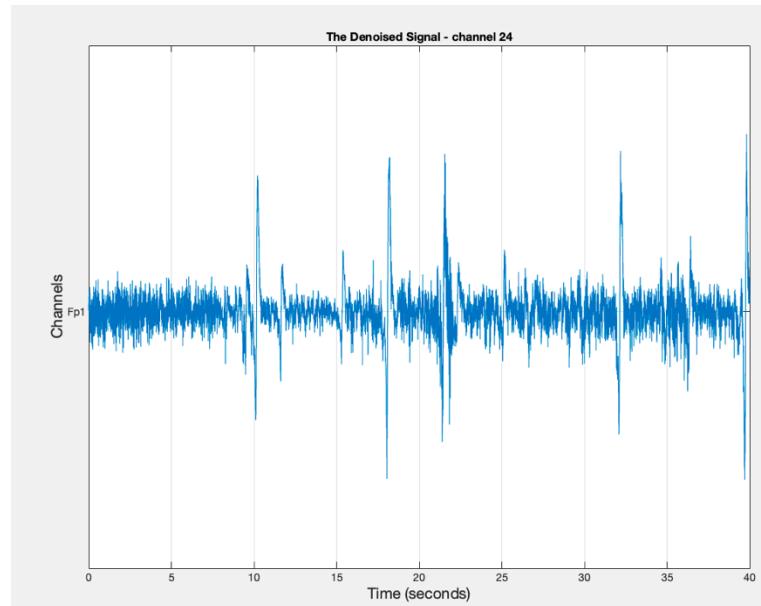
Original signal:



Noisy signal:



Denoised signal:



8.

```
RRMSE = sqrt(sum(sum((X_org-reconstructed_signal).^2,1),2)) / sqrt(sum(sum((X_org).^2,1),2));
disp(RRMSE)
```

RRMSE -5dB = 0.6160

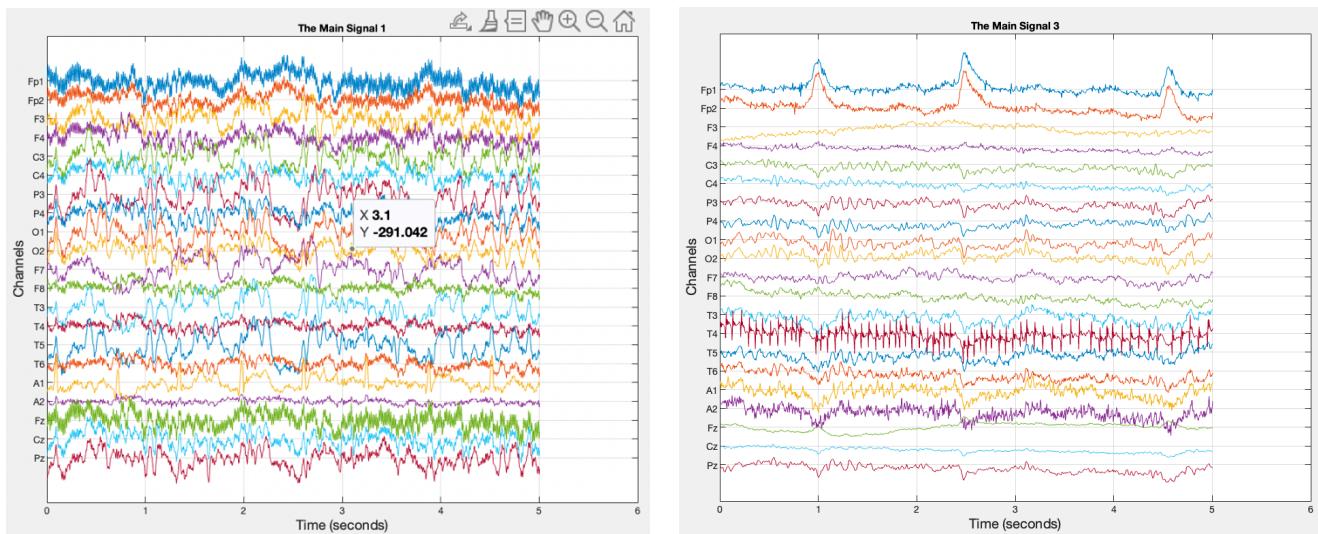
RRMSE -15dB = 7.6312

As you can see, the RRMSE error is less for -5dB SNR.

Part 2:

1.

We choose signals 1 and 3.



2.

According to the graphs, it can be said that we have eyelid jump artifact, EMG signal, and also city electricity. As we know, blink and eye movement components as well as EMG and muscle noise can be removed with ICA.

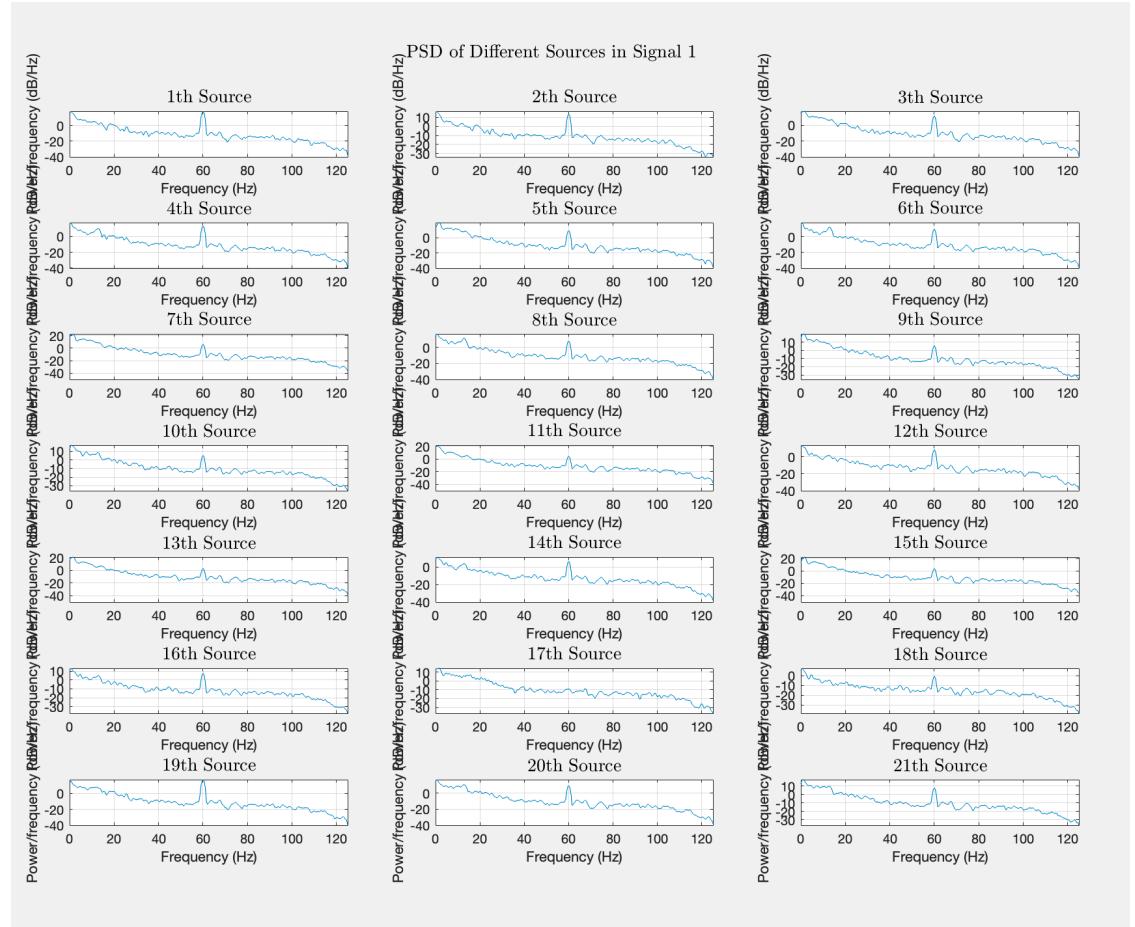
3.

%% Part 3

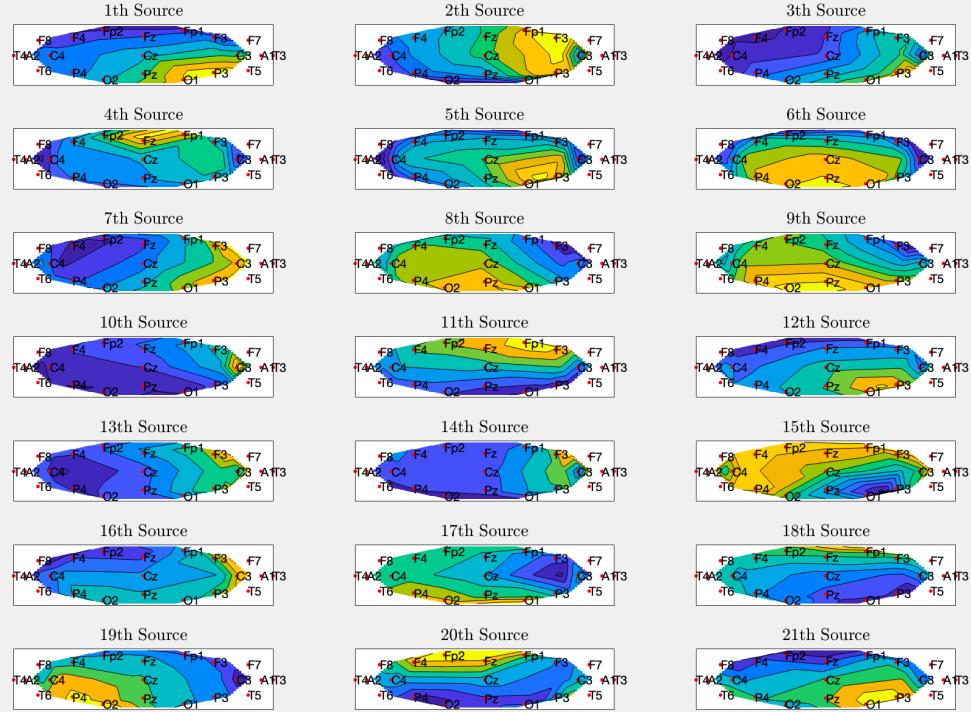
```
num_channel = 21;  
[F_1,W_1,K_1] = COM2R(signal_1,num_channel);  
[F_2,W_2,K_2] = COM2R(signal_2,num_channel);
```

4.

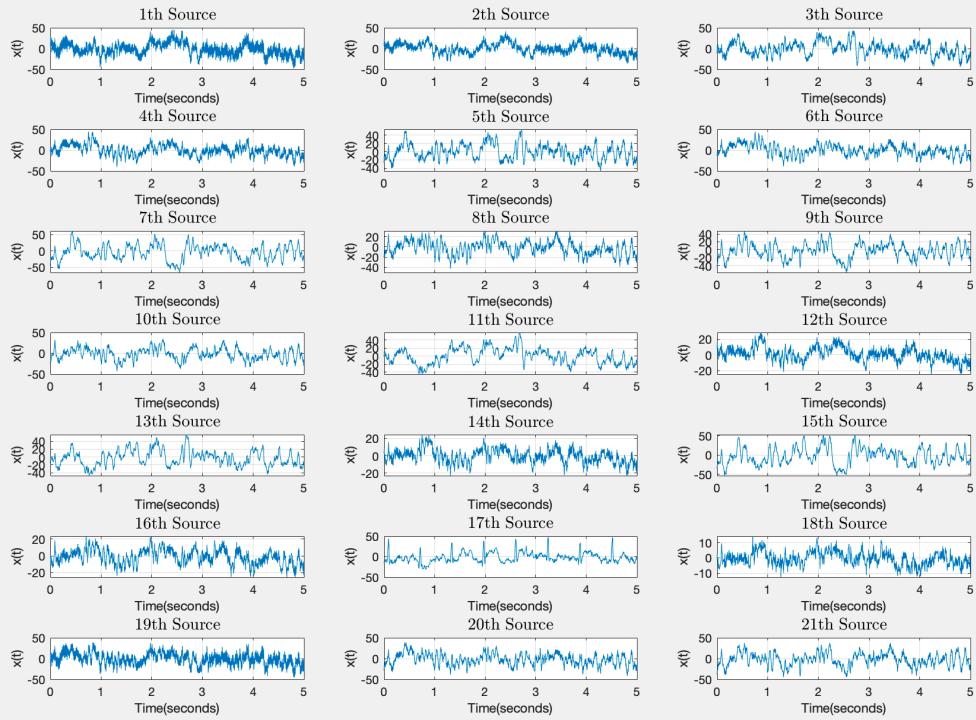
Signal 1:



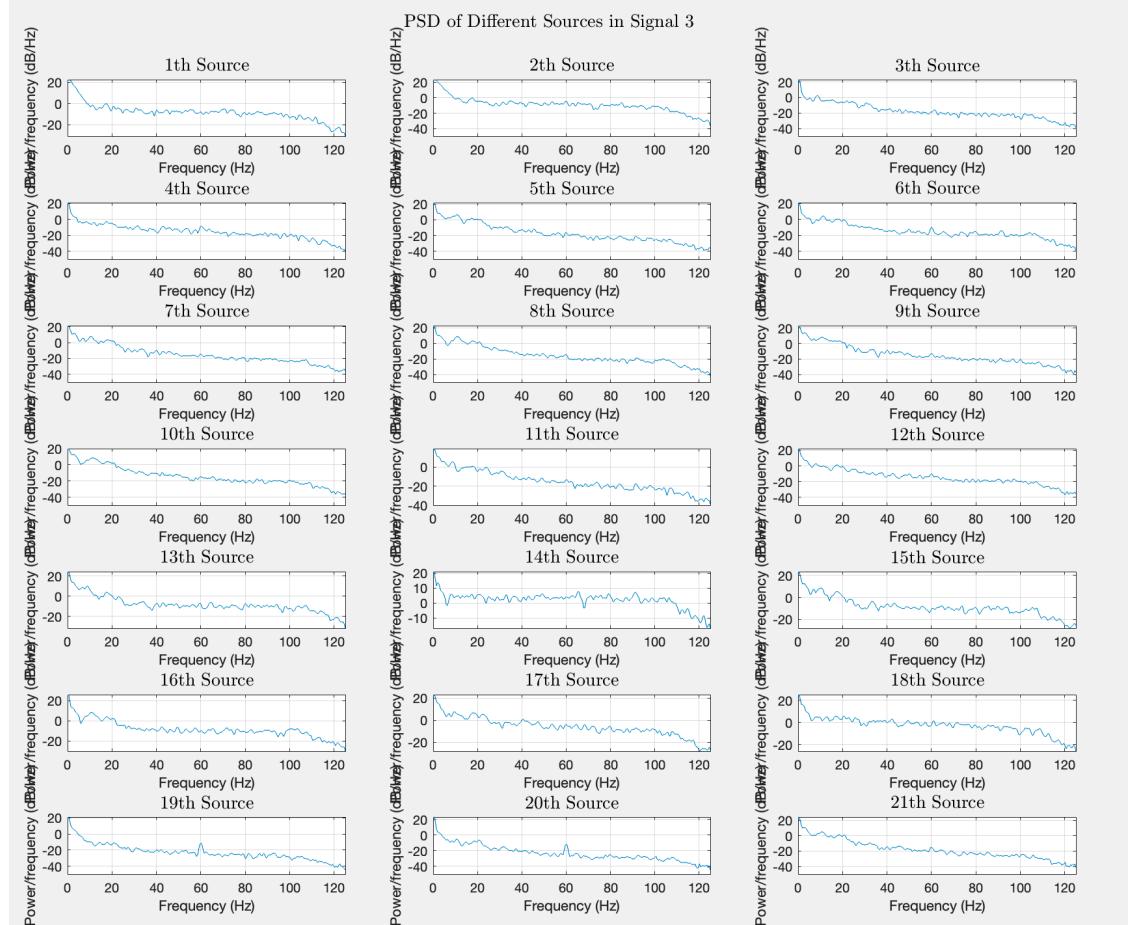
Different Sources in Signal 1



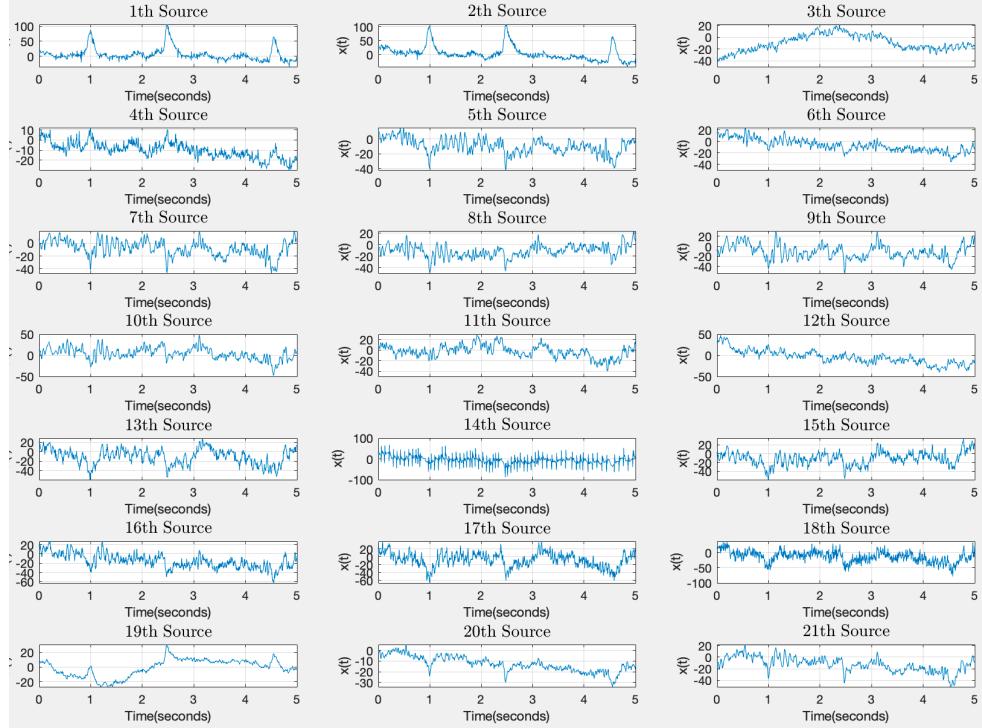
The Signal Time Domain for Signal 1



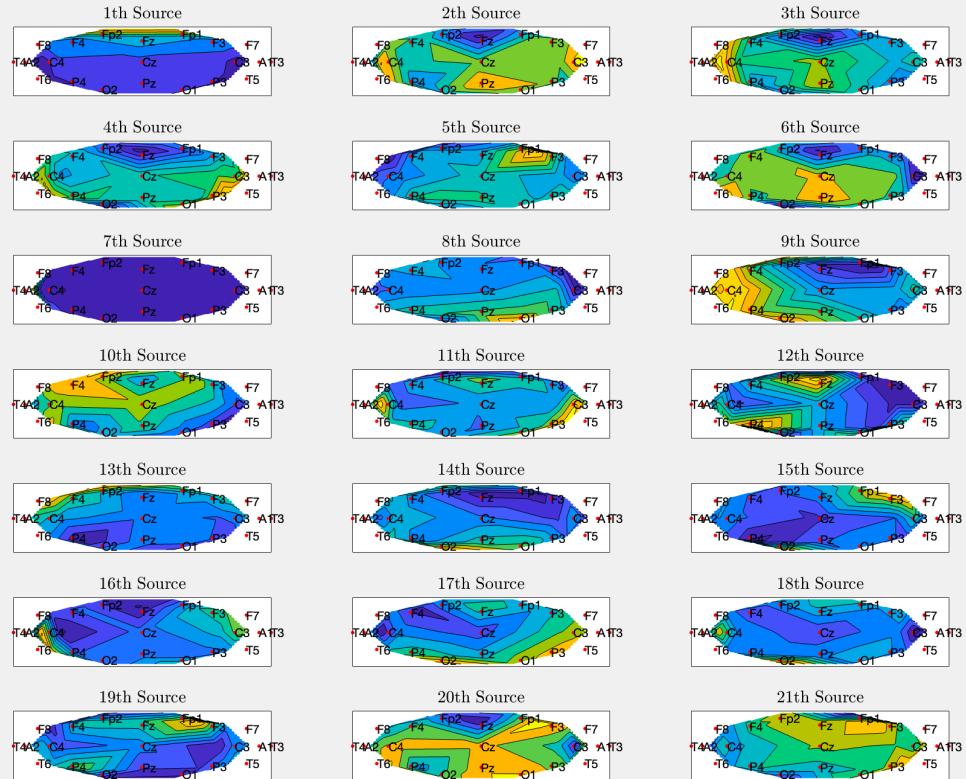
Signal 3:



The Signal Time Domain for Signal 3



Different Sources in Signal 3



5.

%% Part 5

```
idx_1 = [2,3,5,6,7,8,9,10,11,12,13,14,15,16,17,18,19,20,21];
idx_2 = [2,6,9,10,14,17,18,19,20,21];
component_signal_1 = W_1 * signal_1;
component_signal_2 = W_2 * signal_2;

signal_1_denoised = F_1(:,idx_1) * component_signal_1(idx_1,:);
signal_2_denoised = F_2(:,idx_2) * component_signal_2(idx_2,:);
```

