

# Update regarding the Signal Conditioning Circuit

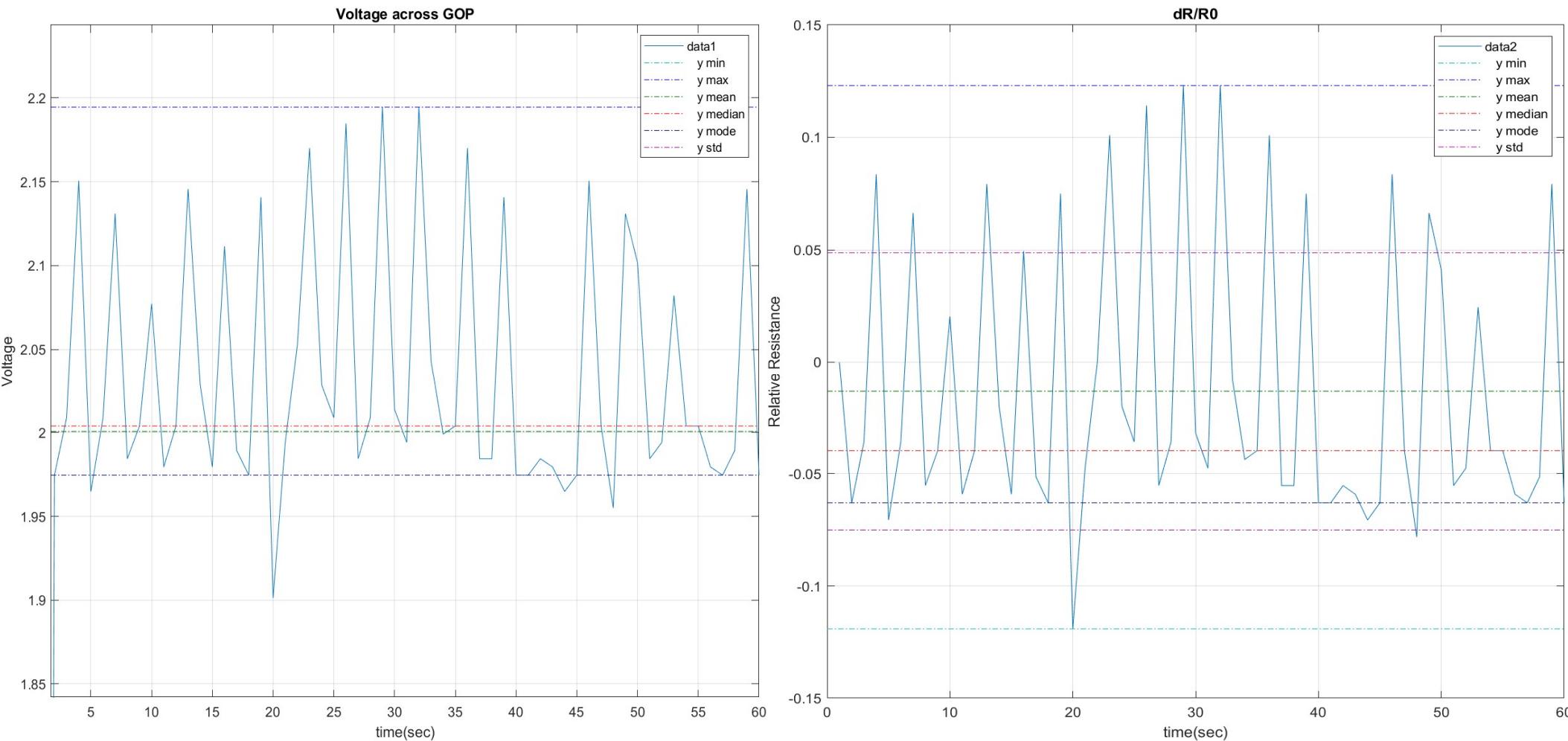
## Contents.

- Pages 2 to 6 includes the observations of the Voltage and Relative Resistance across GOP sensor during respiration.
- Pages 7 to 11 includes the frequency analysis graphs for GOP sensor signal.
- Pages 12 to 27 includes the variation in resistance across various dimensions of GOP sensor.

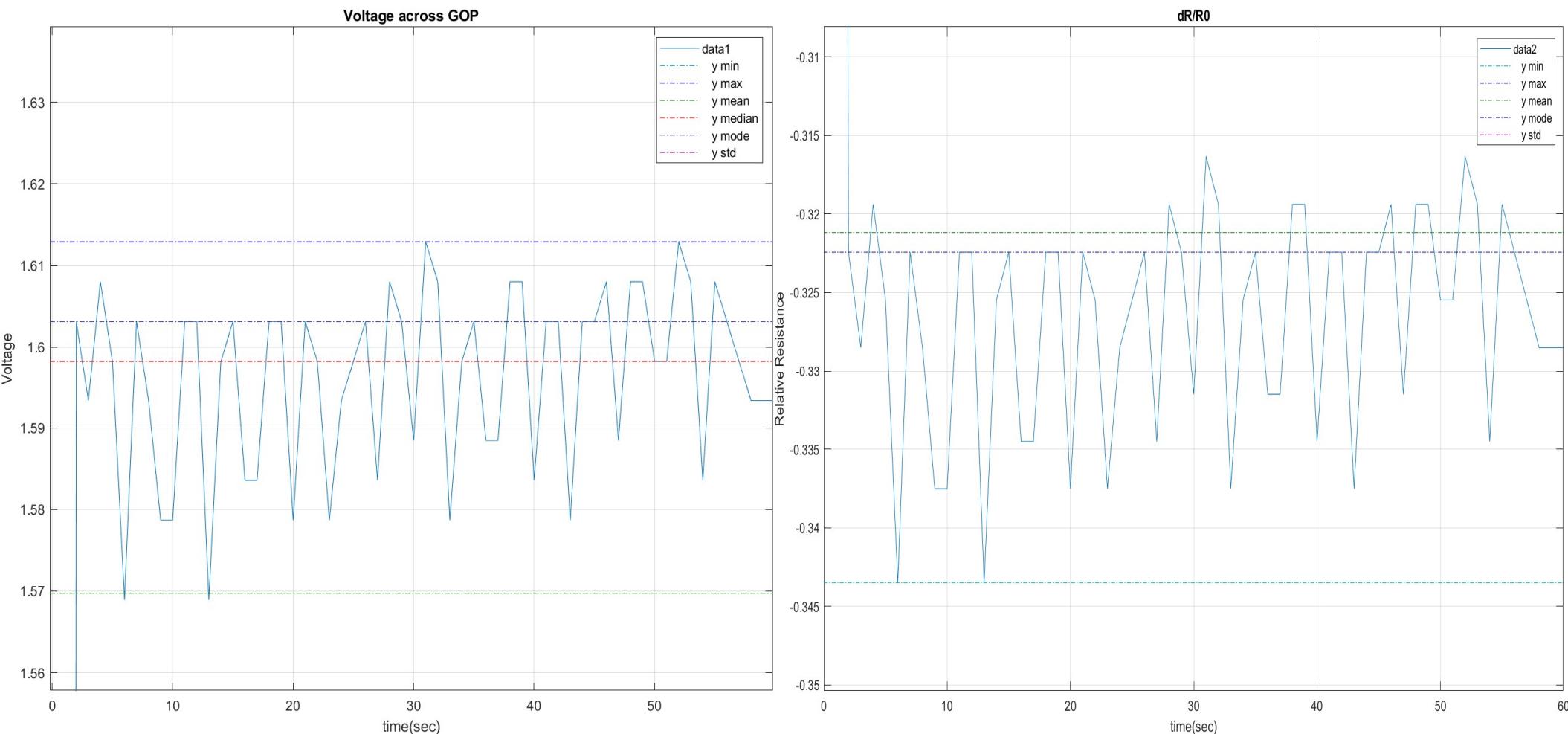
## Result:

- The observations until now are documented below.
- The frequency analysis of the signal is observed.
- The frequency range of the signal is from -0.49kHz to 0.49kHz . So, a bandpass filter must be designed with lower cut-off frequency of 0.0001kHz and upper cut-off frequency of 0.49kHz.
- The frequency analysis of the signal for duration of 60secs and 120secs are observed which gave similar results proving that the signal duration is independent of the frequency range.

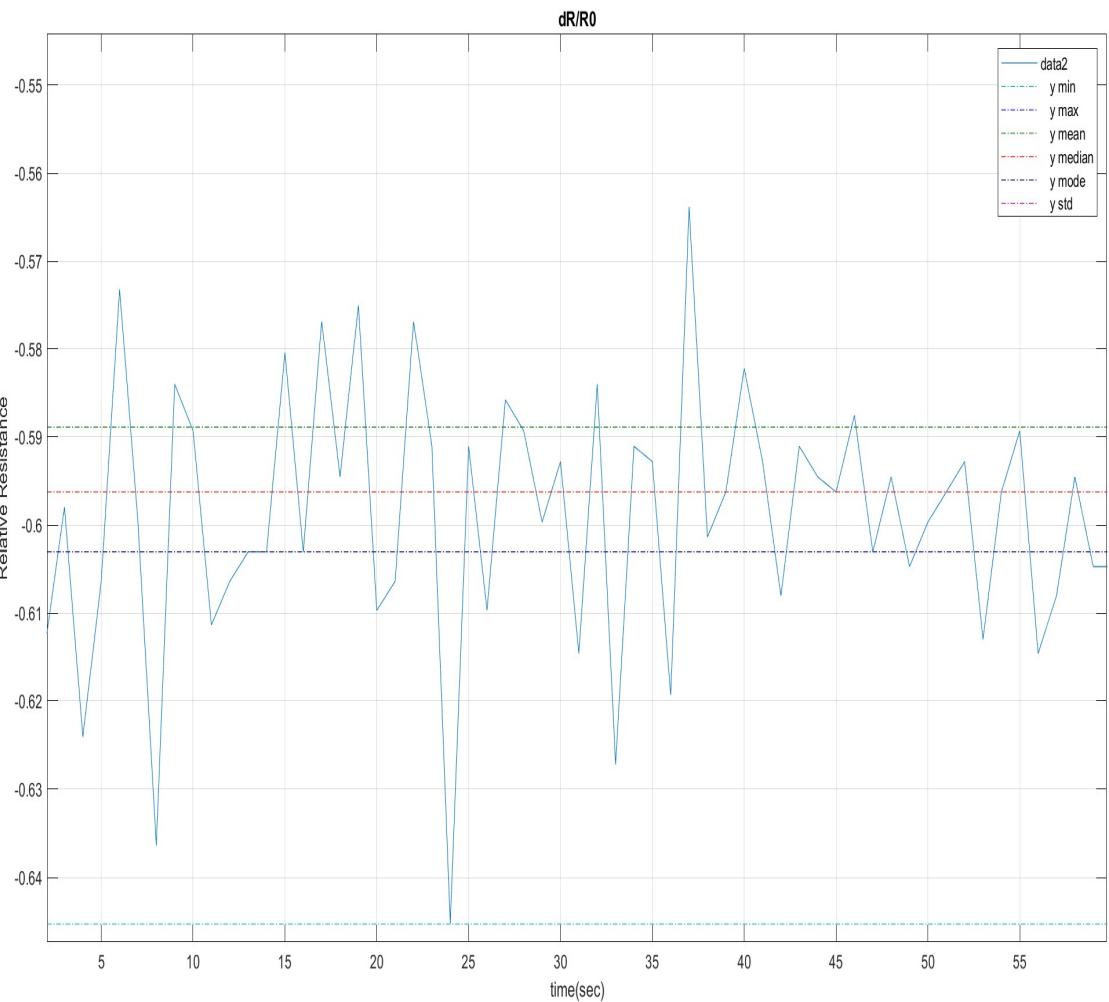
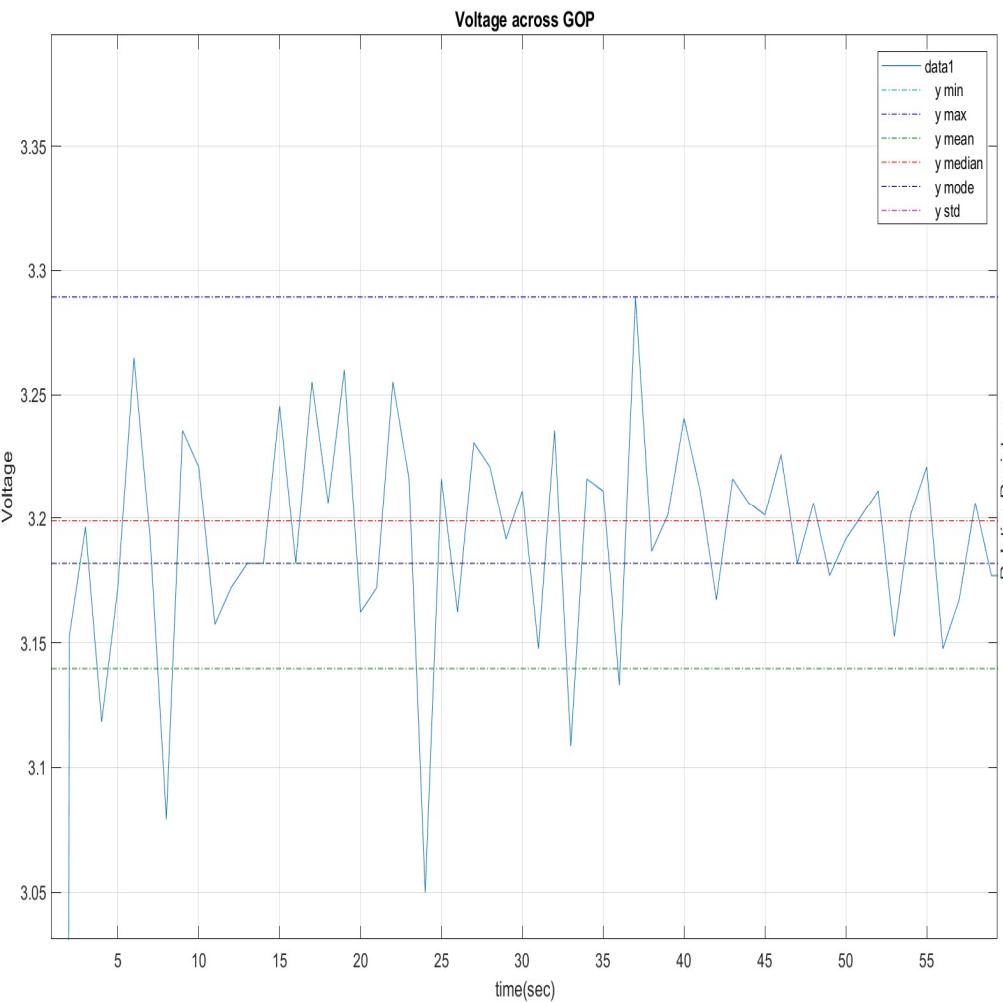
The Voltage and Relative Resistance observation during respiration for duration of 60secs. The GOP sensor used is HB 1cm\*0.5cm. The experiment was observed without usage of mask.



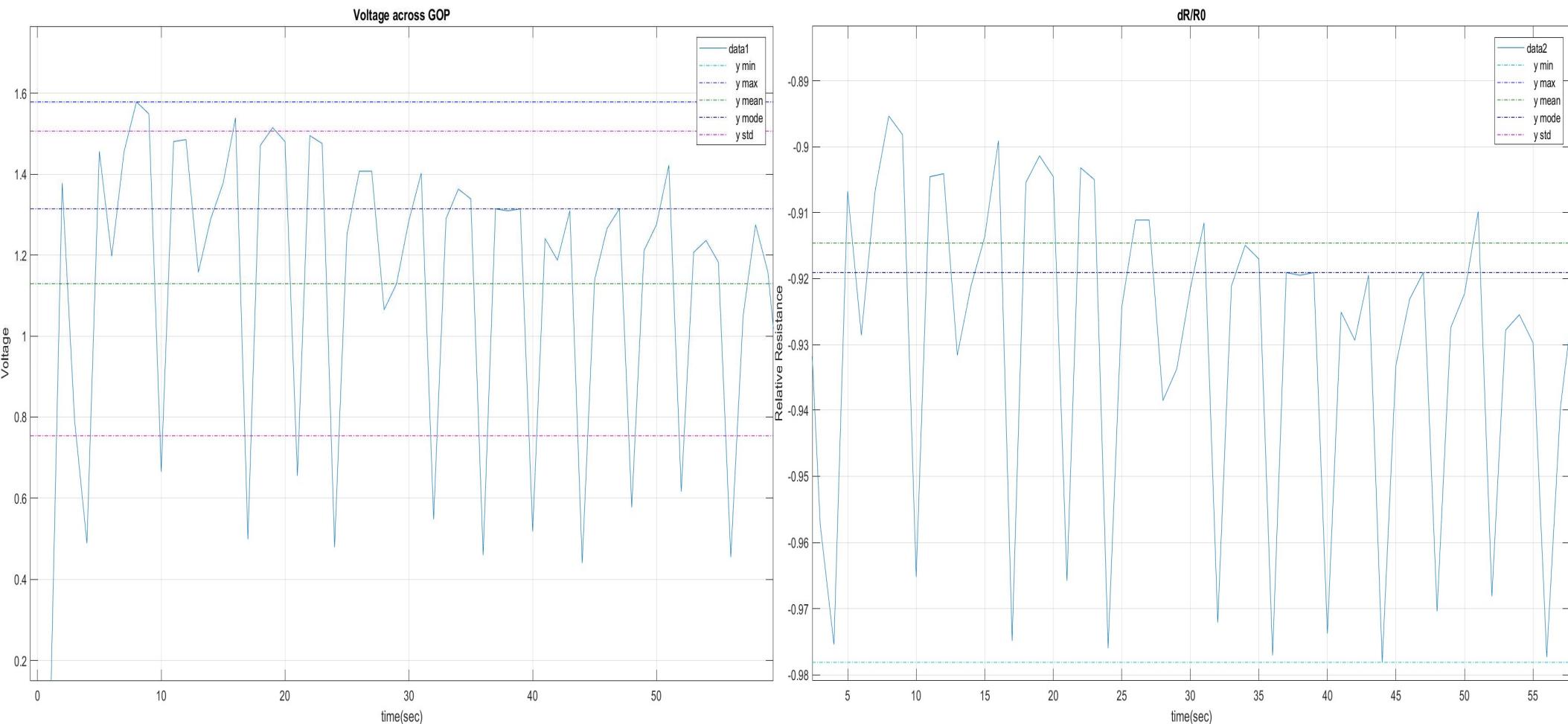
The Voltage and Relative Resistance observation during respiration for duration of 60secs. The GOP sensor used is HB 1cm\*0.5cm. The experiment was observed with usage of mask.



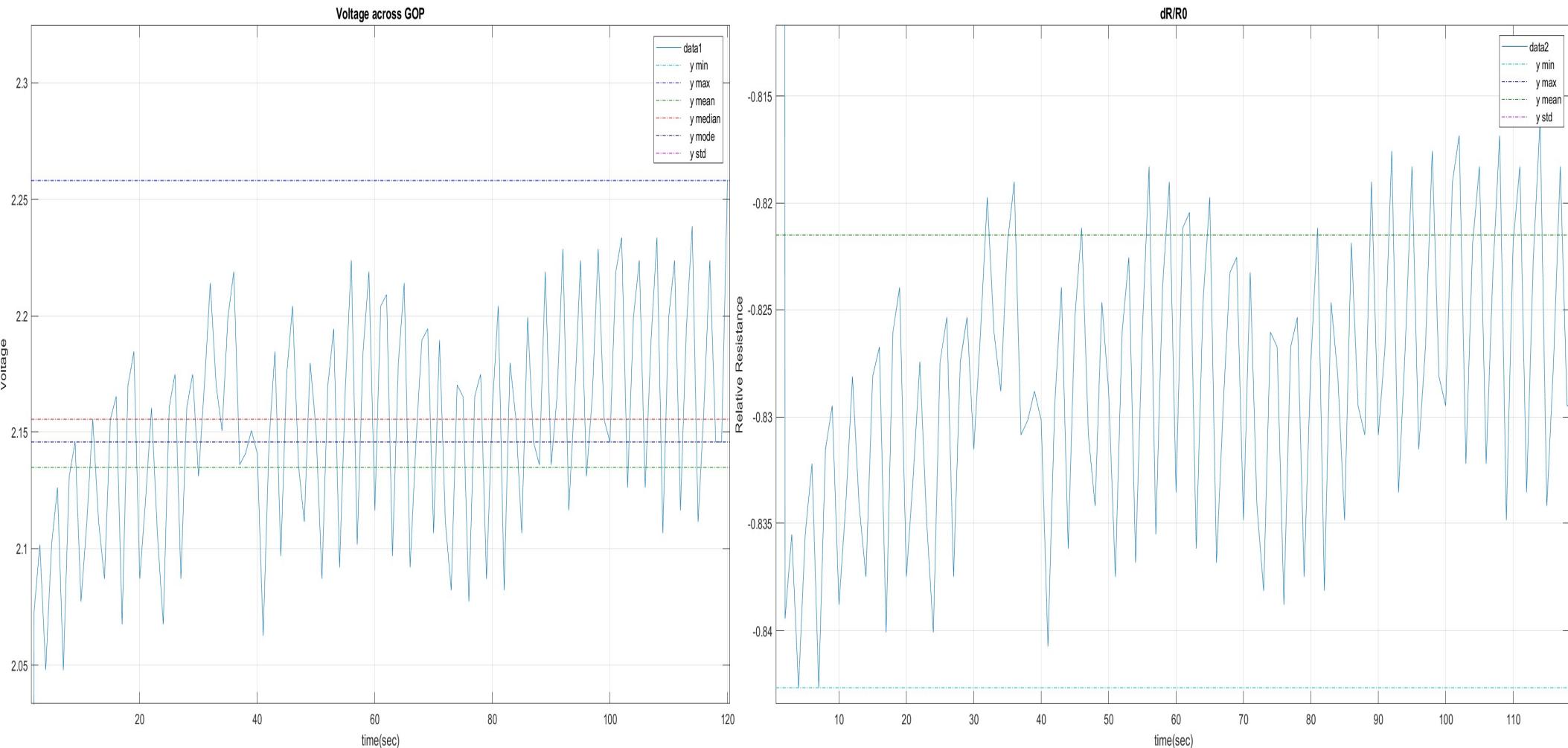
The Voltage and Relative Resistance observation during respiration for duration of 60secs. The GOP sensor used is 2B 1cm\*0.5cm. The experiment was observed without usage of mask.



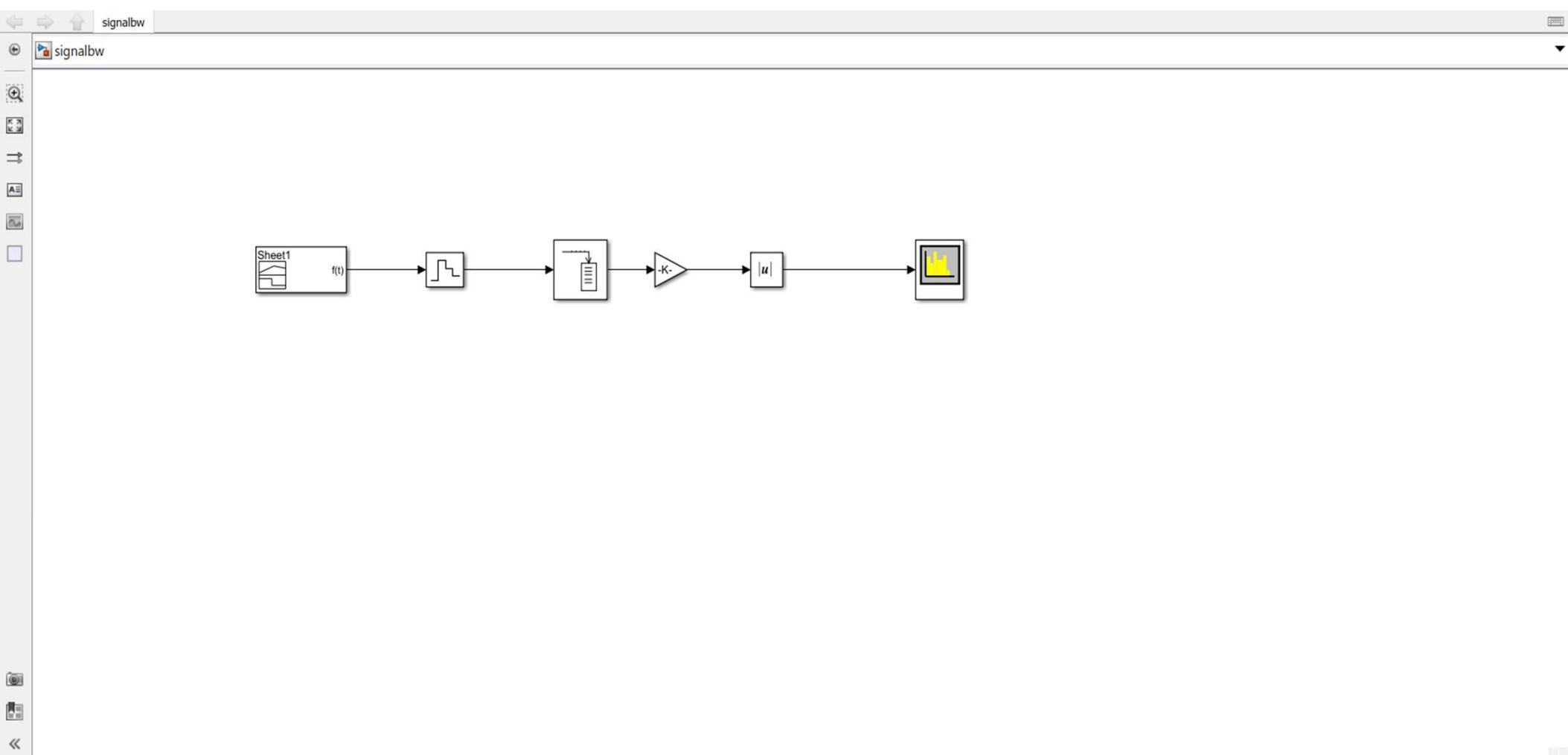
The Voltage and Relative Resistance observation during respiration for duration of 60secs. The GOP sensor used is HB 1cm\*0.5cm. The experiment was observed with usage of mask.



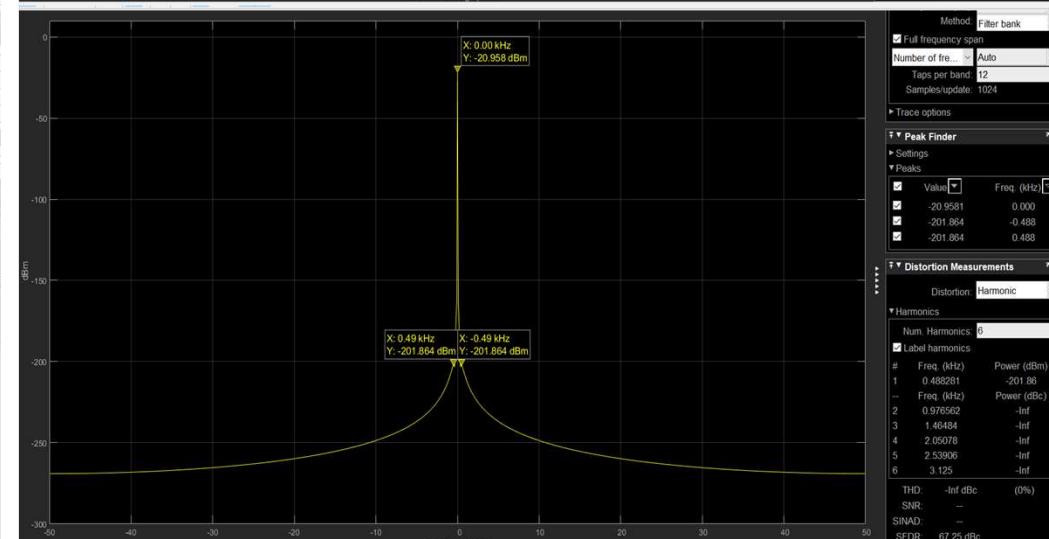
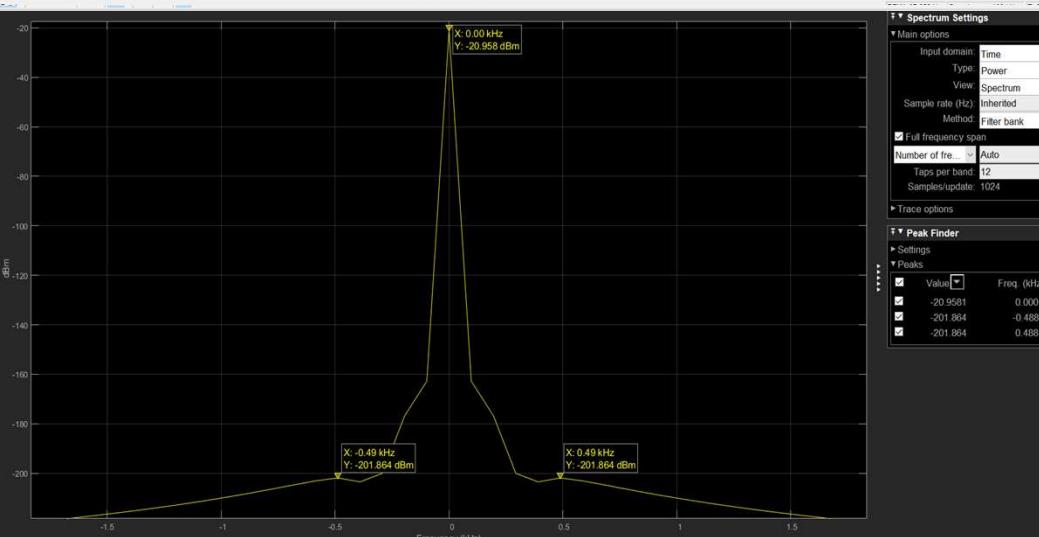
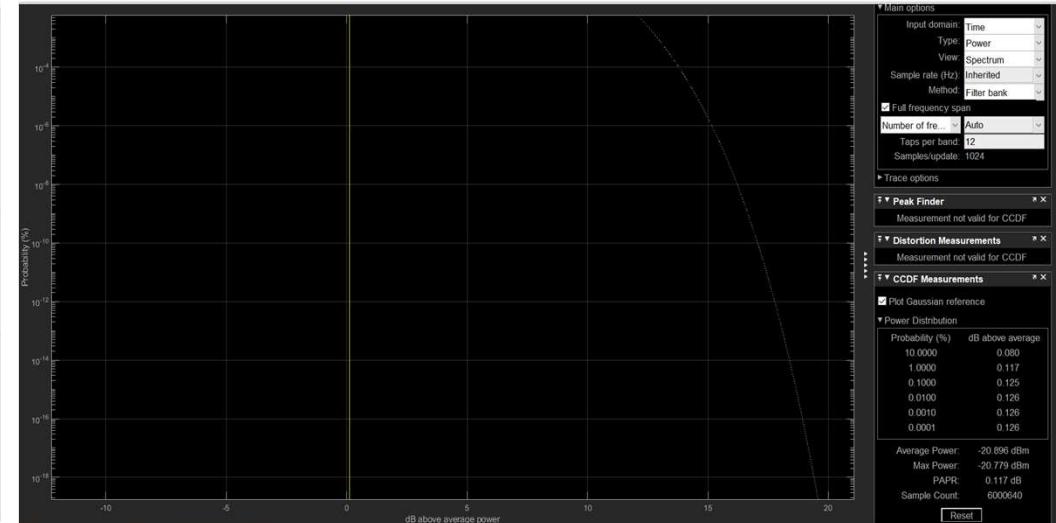
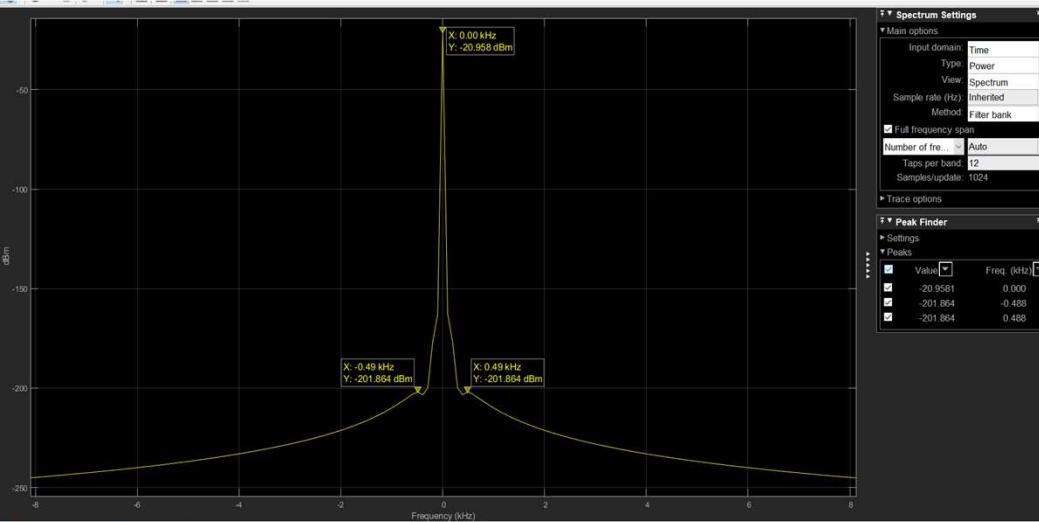
The Voltage and Relative Resistance observation during respiration for duration of 120secs. The GOP sensor used is HB 1cm\*0.5cm. The experiment was observed without usage of mask.



Simulink block to observe the frequency response.



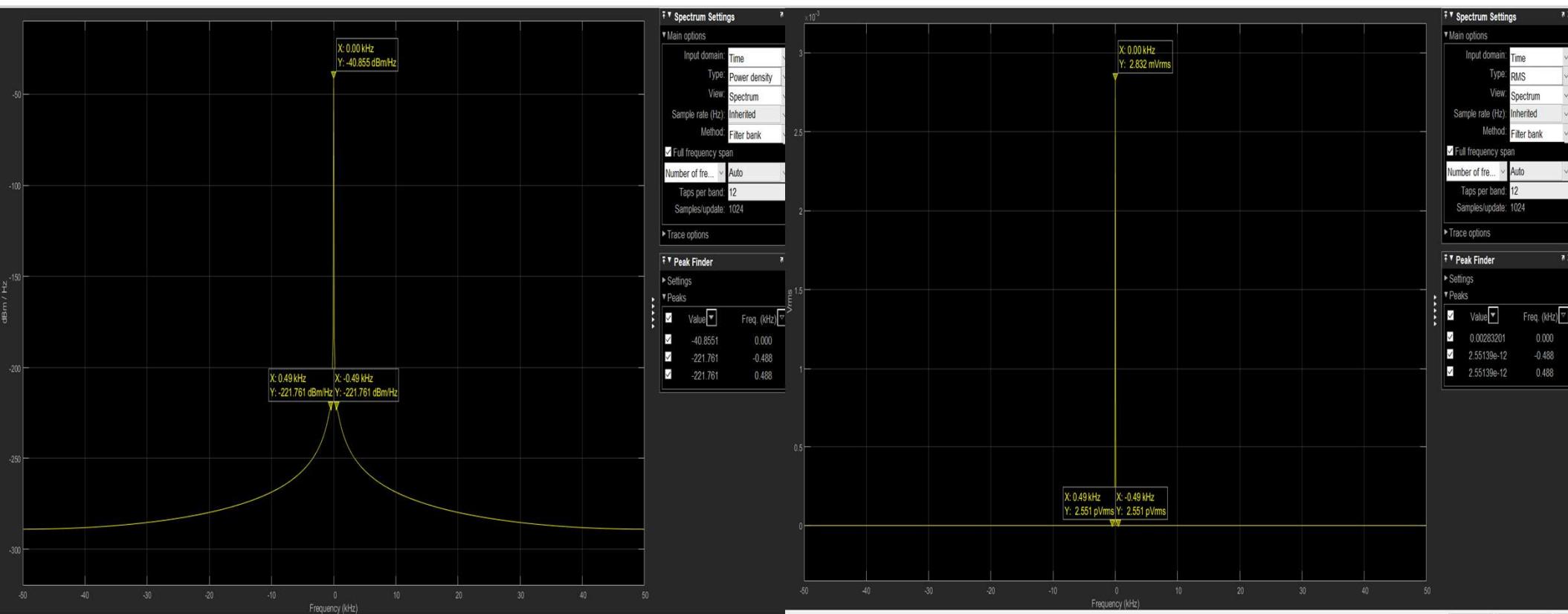
The spectrum analysis for signal obtained from GOP sensor for 60secs duration.



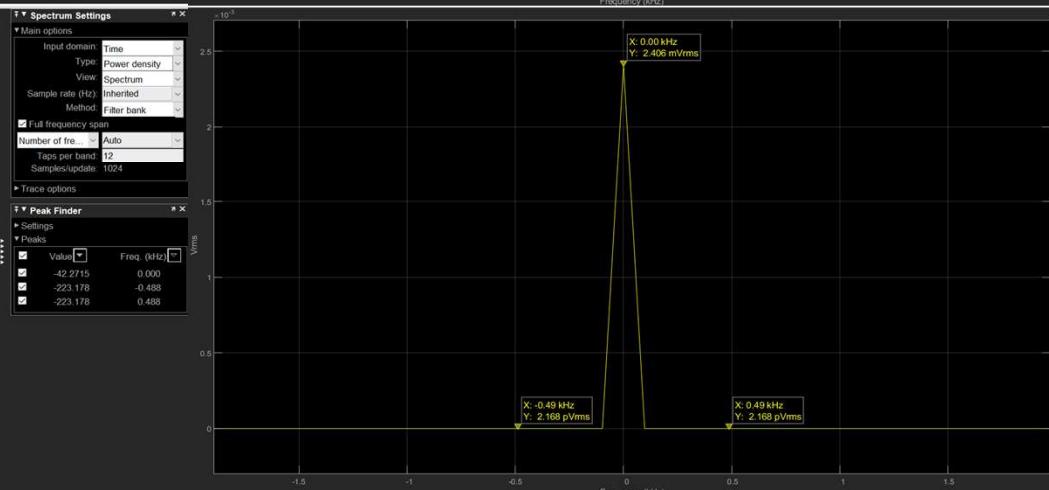
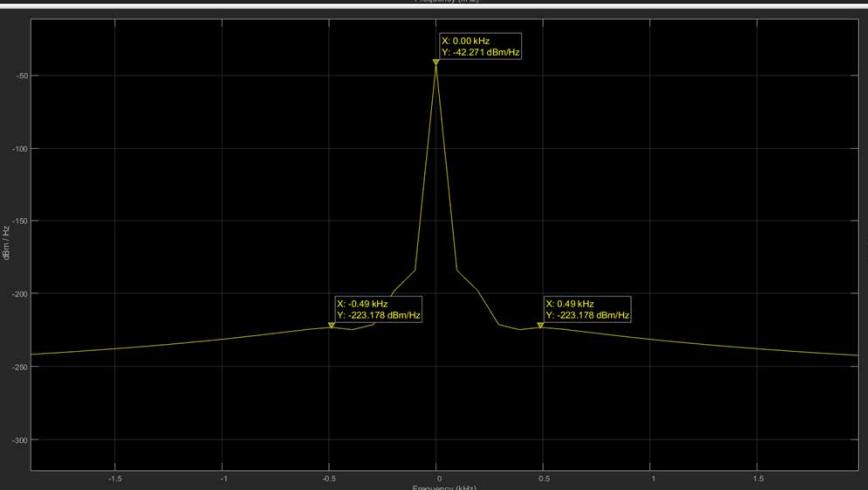
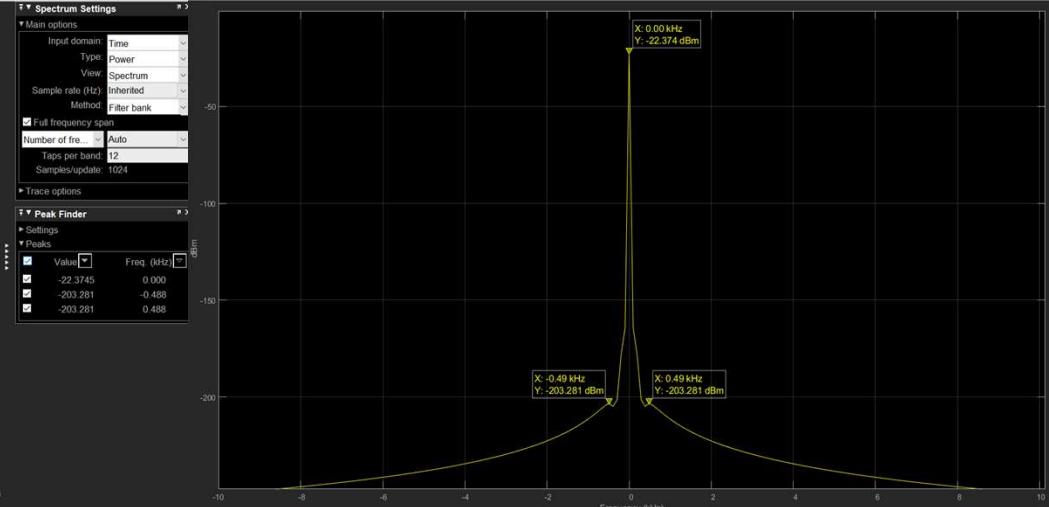
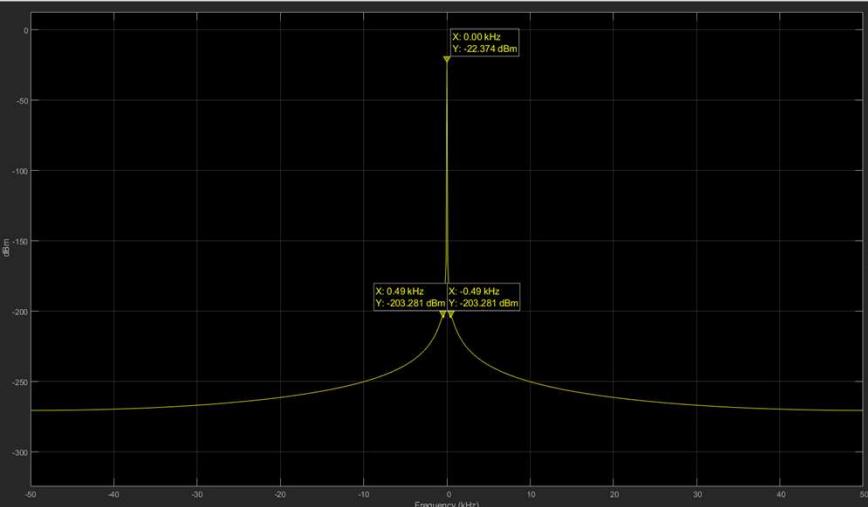
The spectrum analysis include graphs b/w frequency v/s dBm, dBm/ Hz, Vrms etc.

The graphs conclude that the signal lies in the frequency range of -0.49kHz to 0.49kHz. This implies to condition the signal we need to design a bandpass filter in the range 0.0001kHz to 0.49kHz.

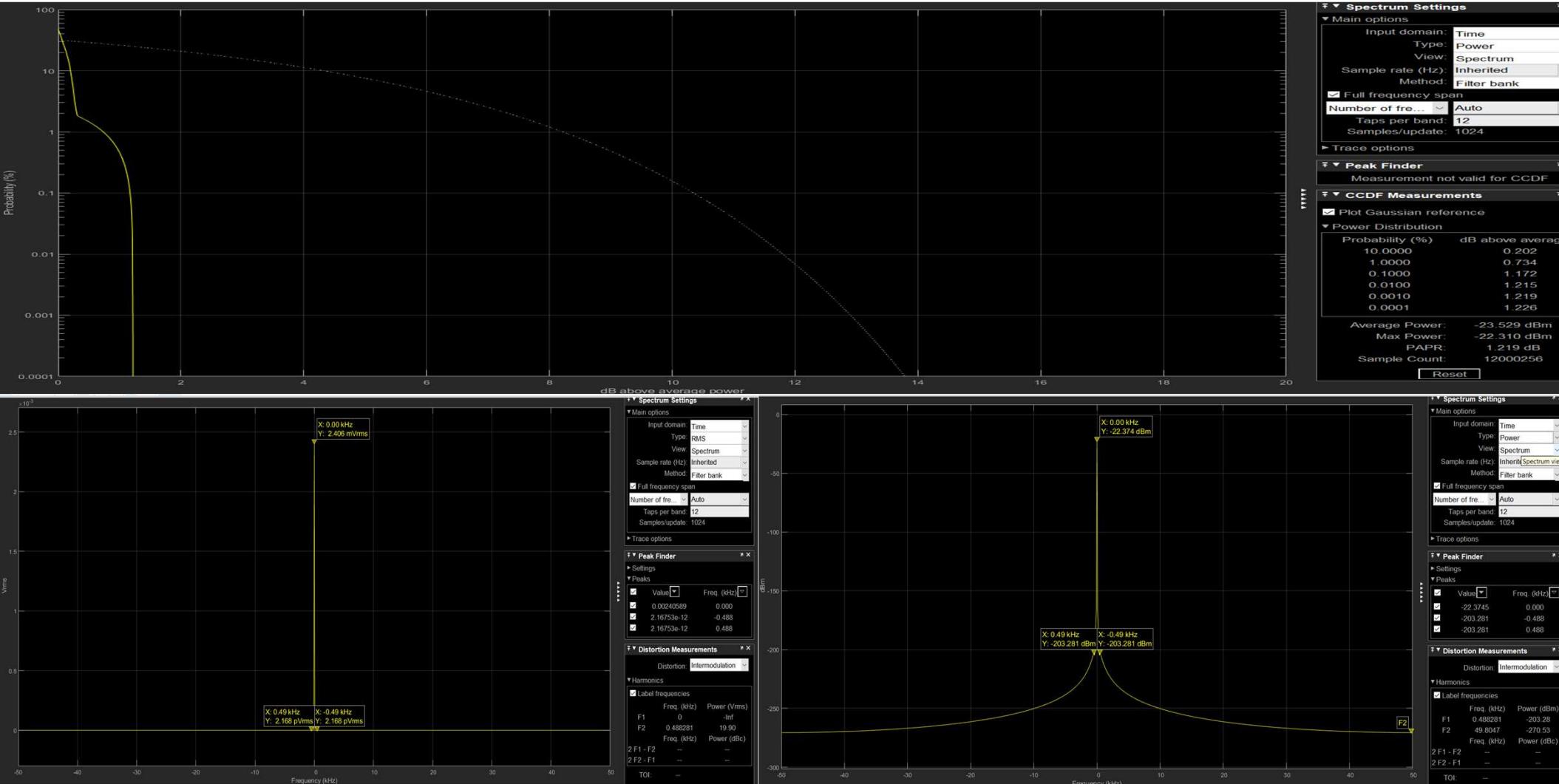
The Distortion Measurement and CCDF are also show in above graphs.



The spectrum analysis for signal obtained from GOP sensor for 120secs duration.



The graphs conclude that the signal frequency lies b/w 0.0001kHz to 0.49kHz independent of the time duration of signal.



## Matlab code for the measurement of Voltage and Relative Resistance.

```
clc;
clear all;
close all;
a= arduino();
interv = 120;
init_time = 1;

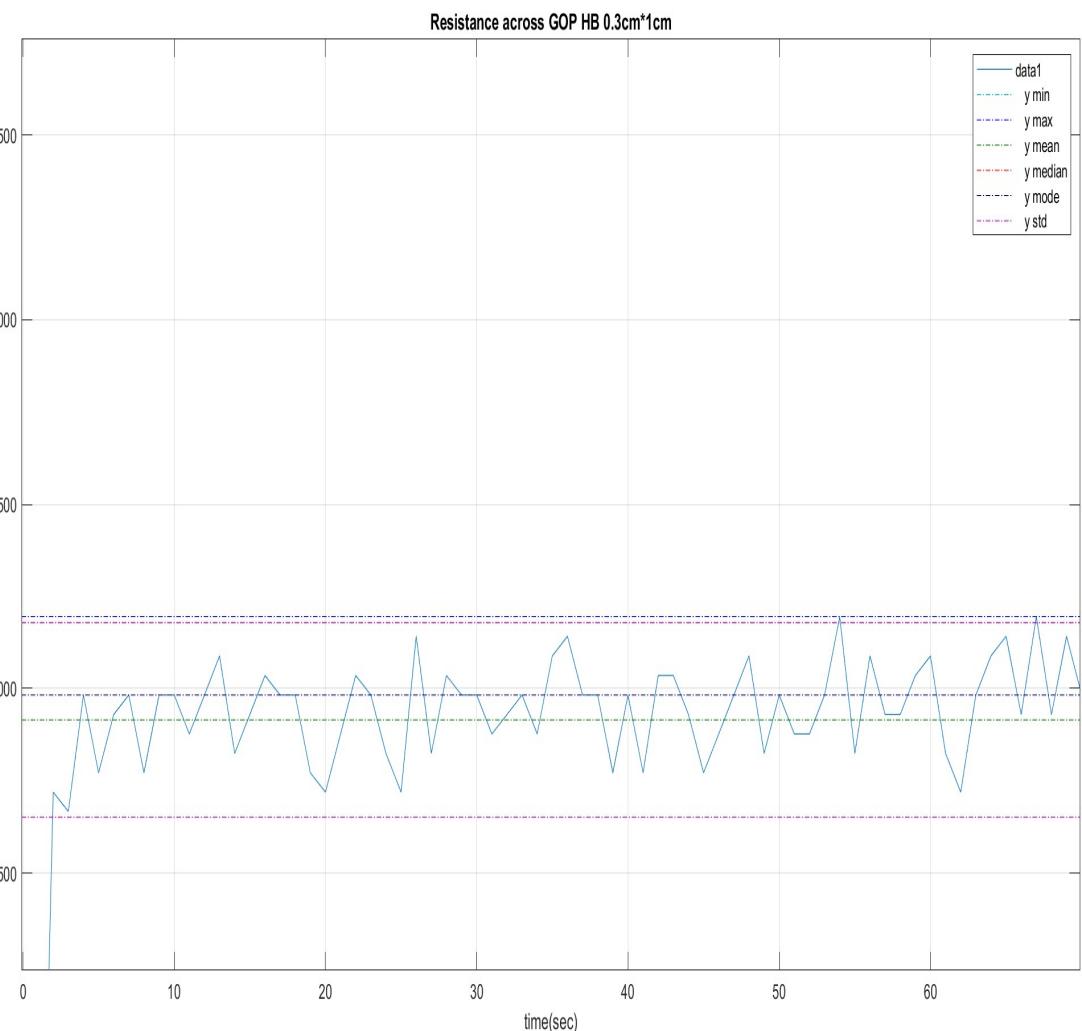
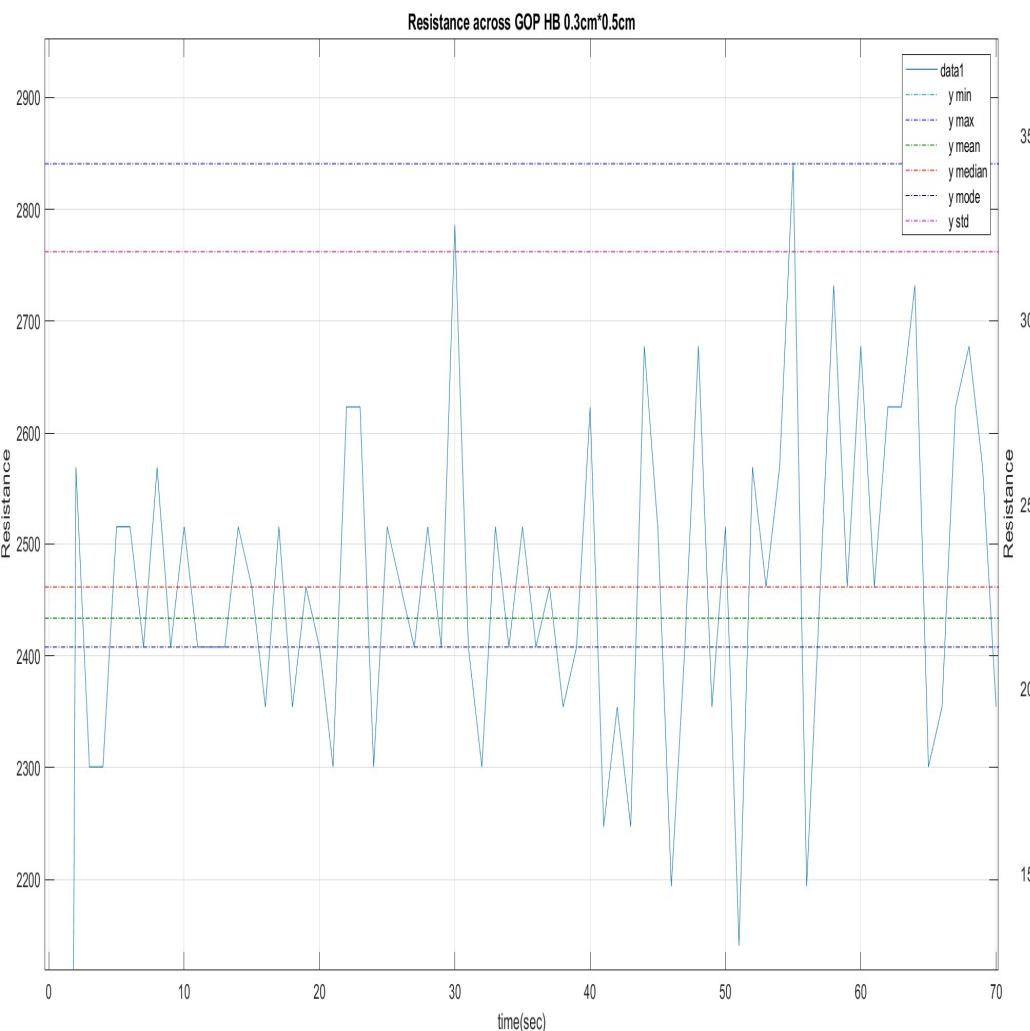
x=0;
z=0;

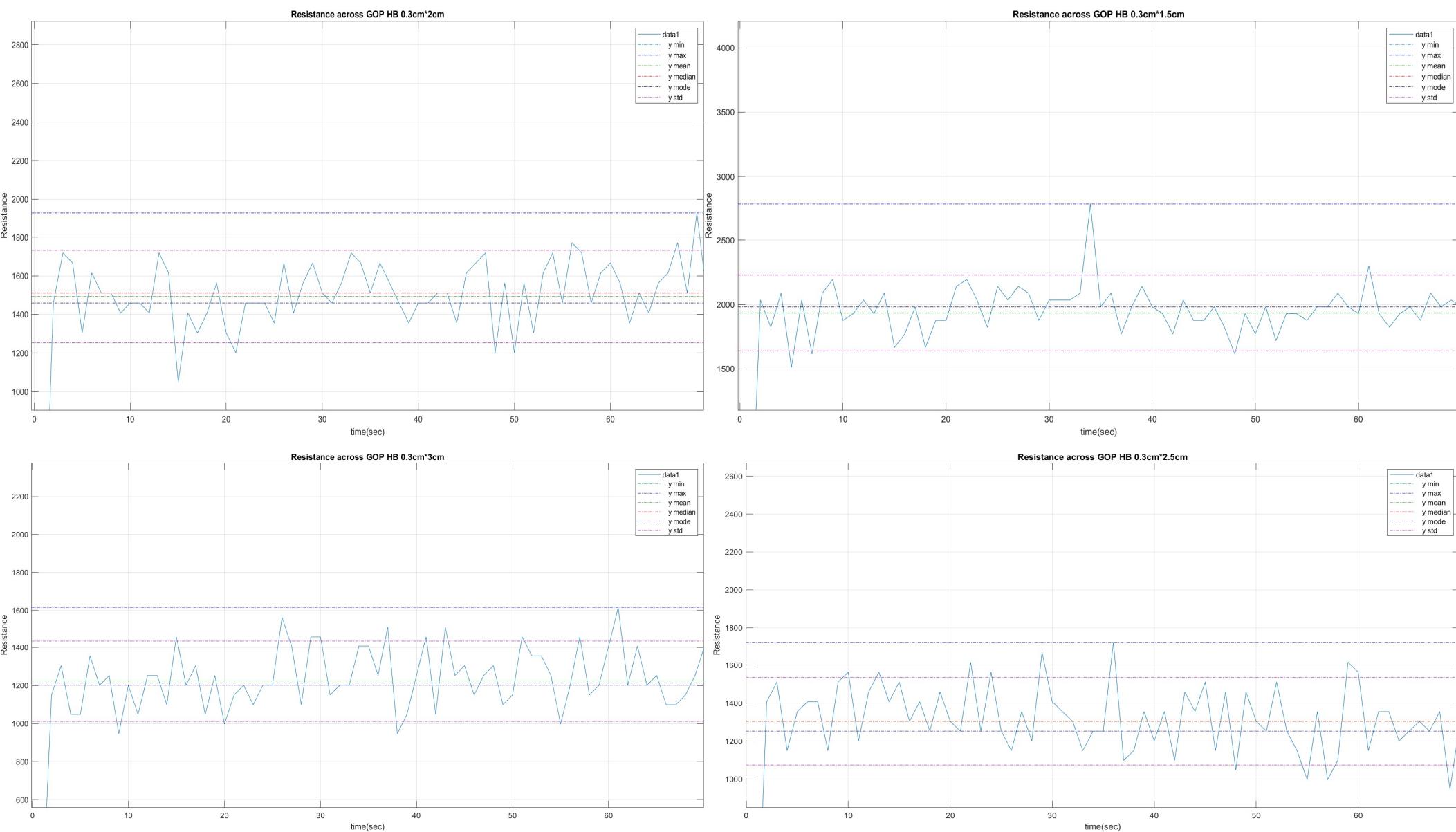
while (init_time<interv)
    b=readVoltage(a,'A0');
    %reading voltages from pin A0 , reads voltages not adc value ,
    %voltages = (ADC*5)/1024
    x=[x,b];
    subplot(1,2,1);
    plot(x)
    xlabel('time(sec)');
    ylabel('Voltage');
    title('Voltage across GOP');
    grid ON
    Vin=5;
    Rref=50000;
    R = Rref * (1 / ((Vin / b) - 1));
    R0=220420;
    dR=R-R0;
    RR=(R-R0)/R0;
    z=[z,RR];
    subplot(1,2,2);
    plot(z);
    xlabel('time(sec)');
    ylabel('Relative Resistance');
    title('dR/R0');
    grid on;

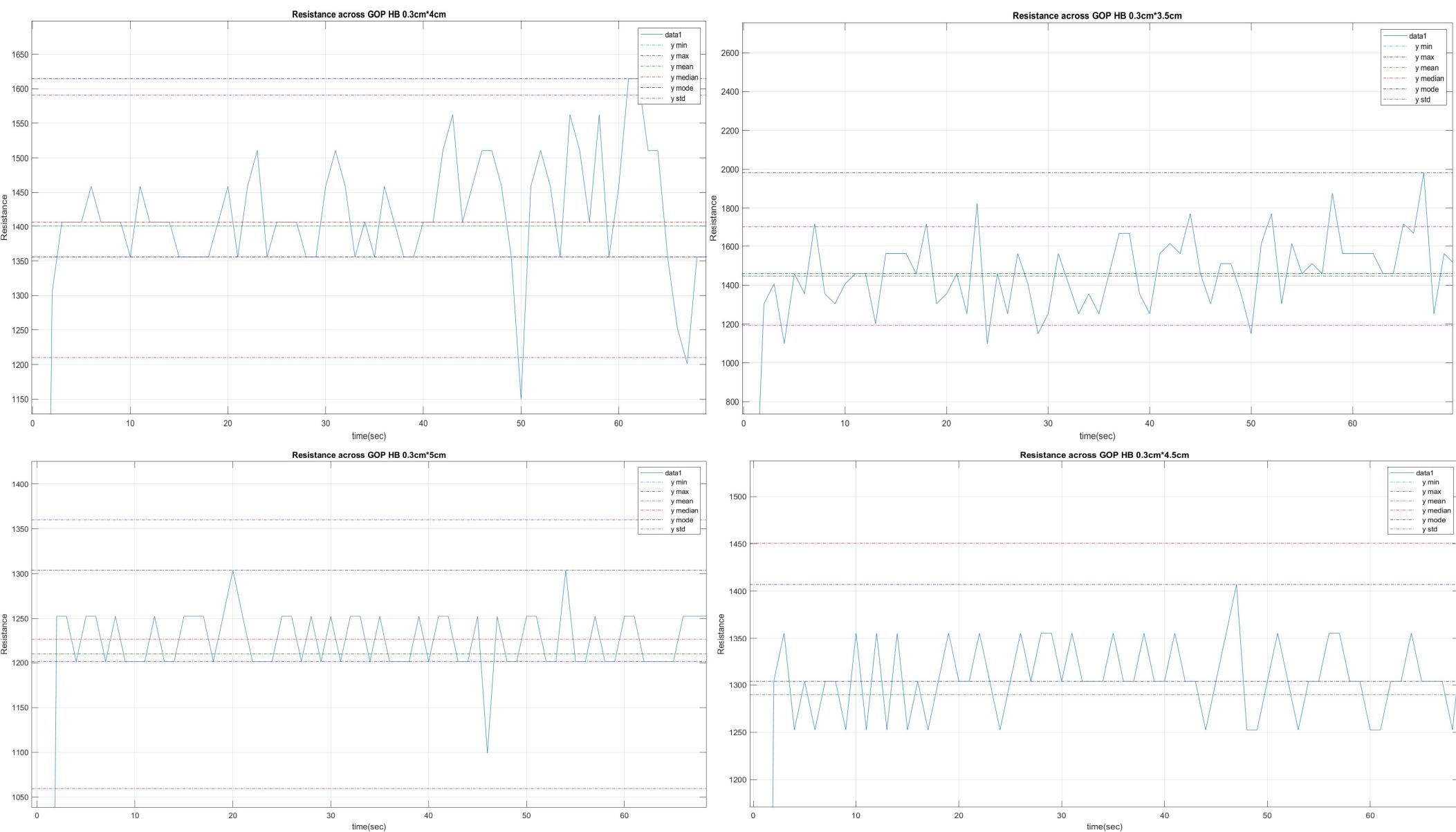
    pause(1);

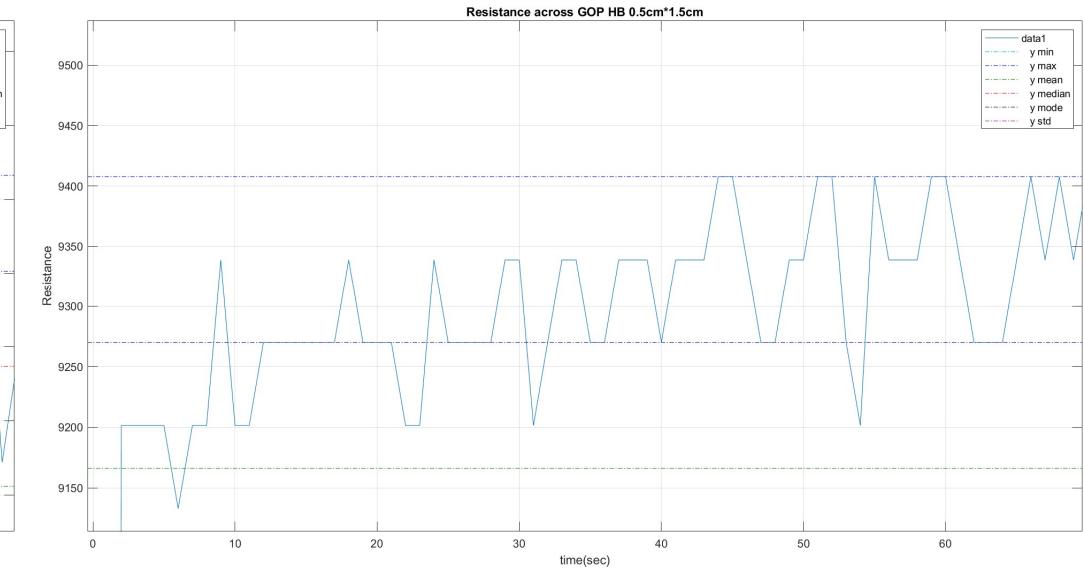
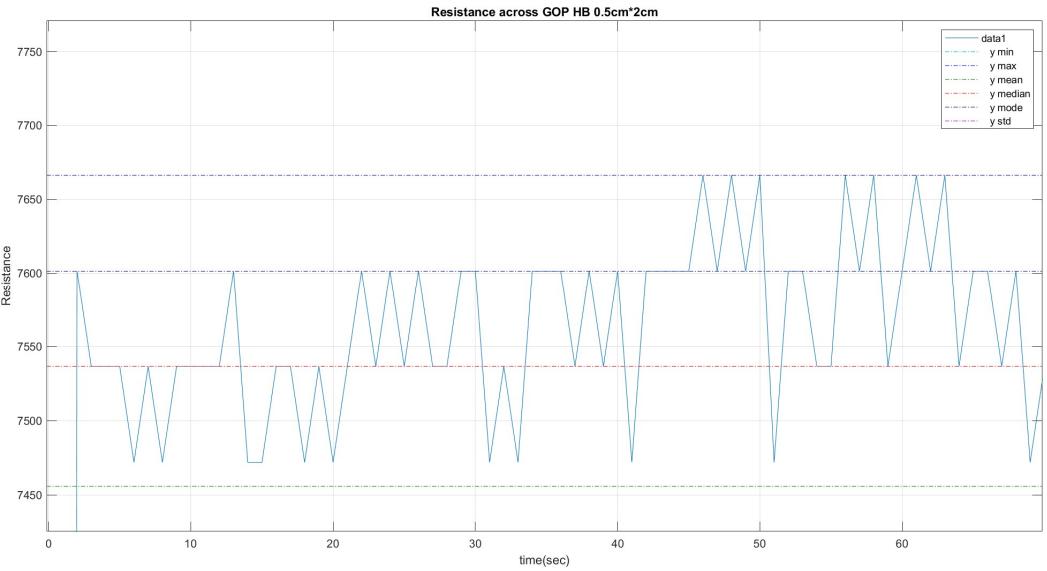
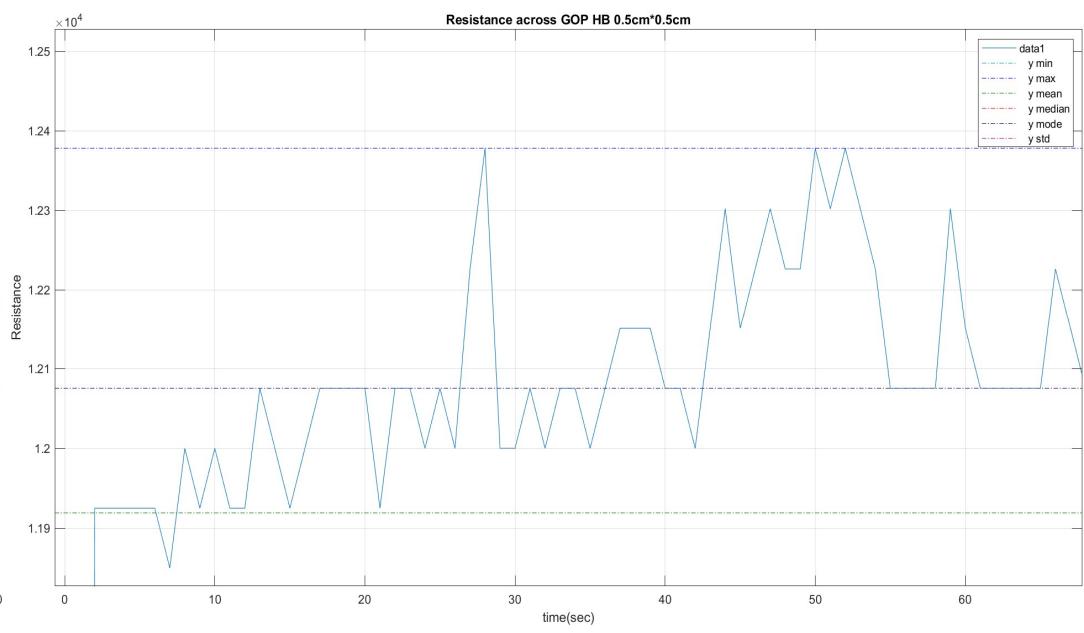
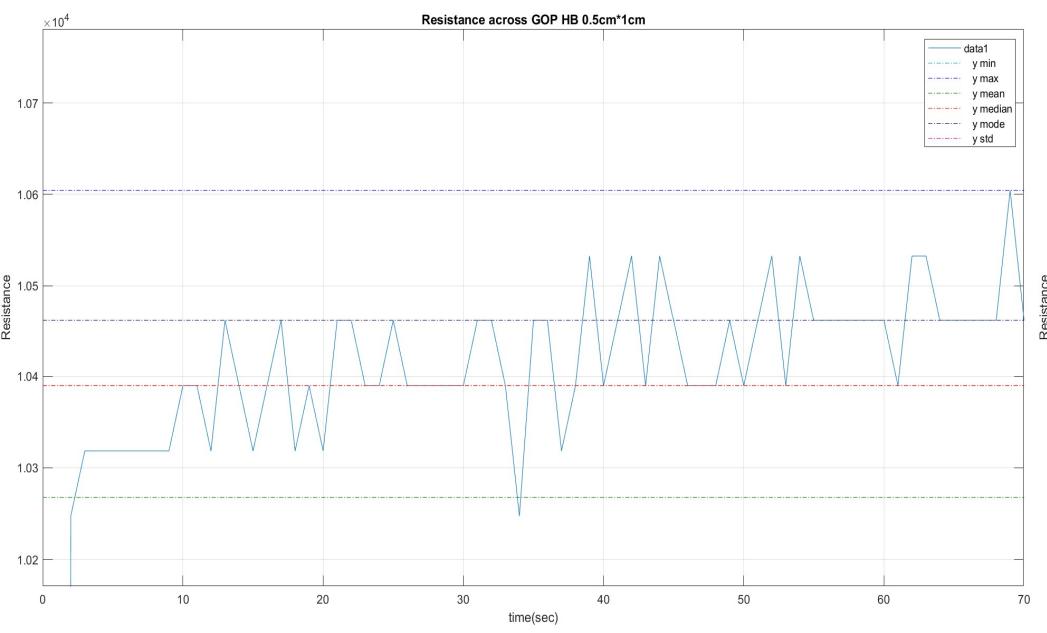
    init_time=init_time+1;
    drawnow
end
```

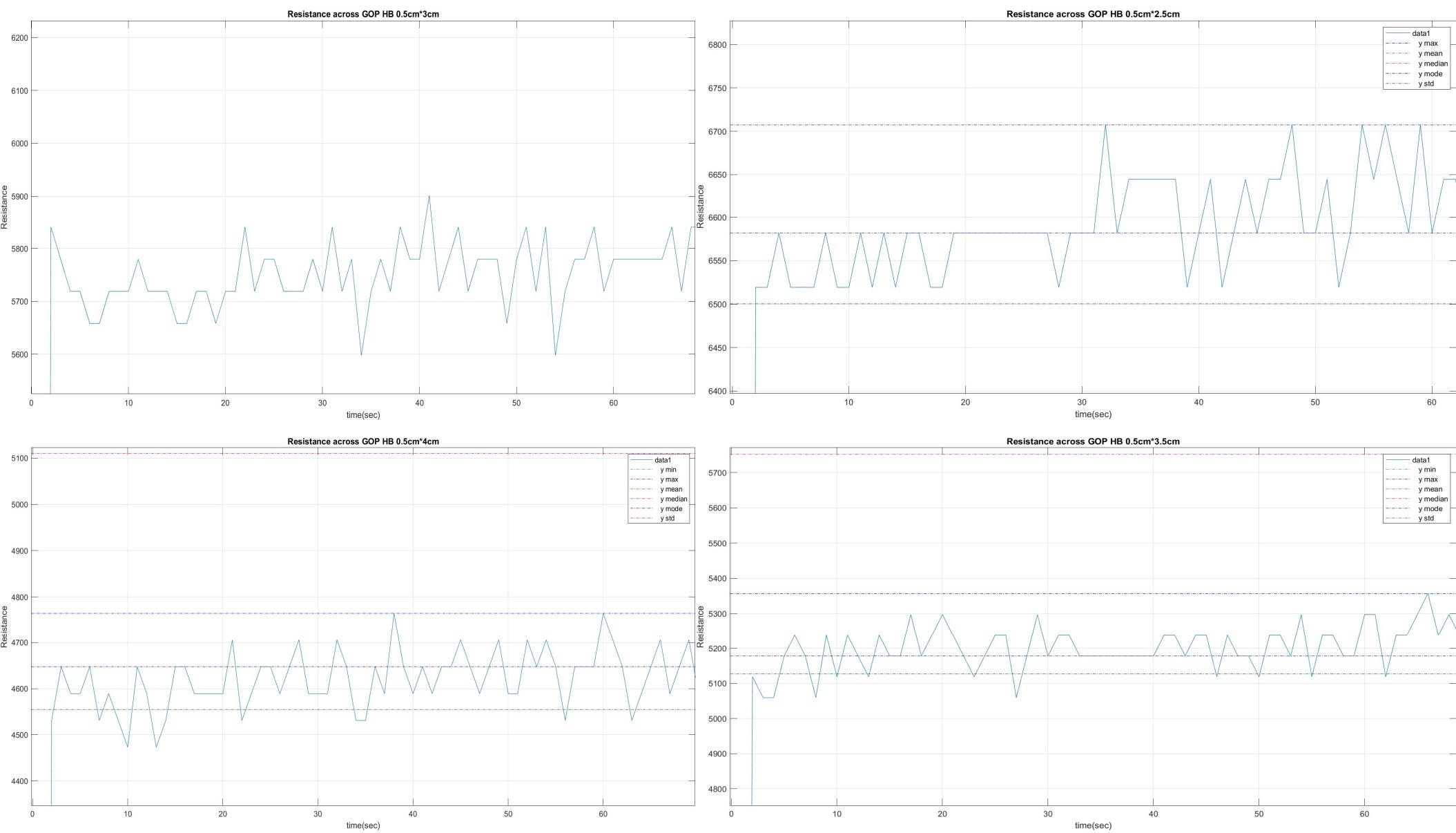
The below graphs shows the variation of Resistance values across various dimensions of GOP sensor. The variations are with the criterion of HB and 2B also.

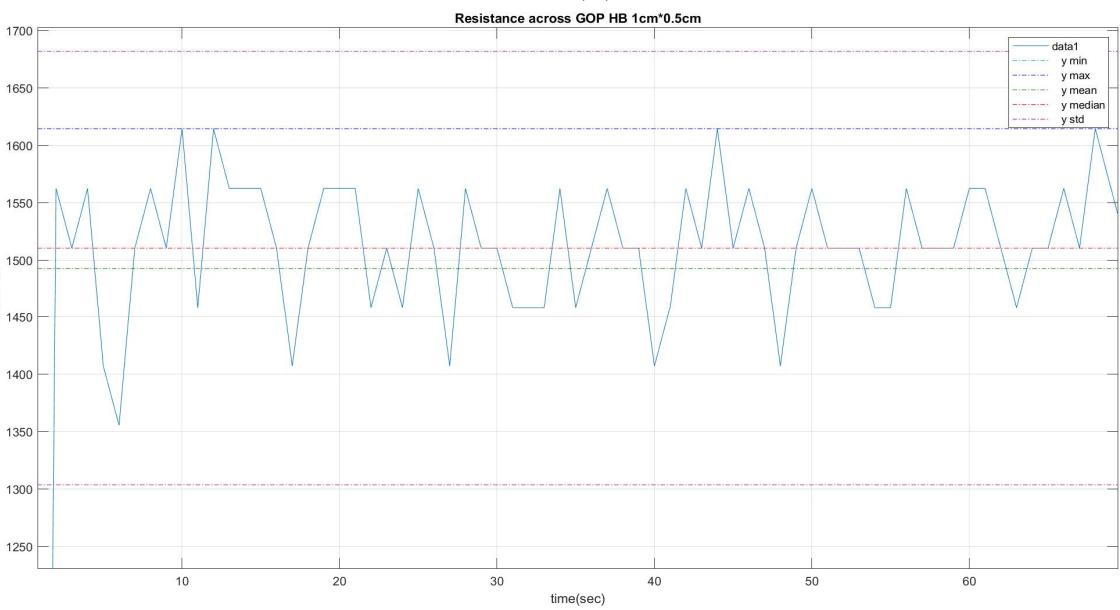
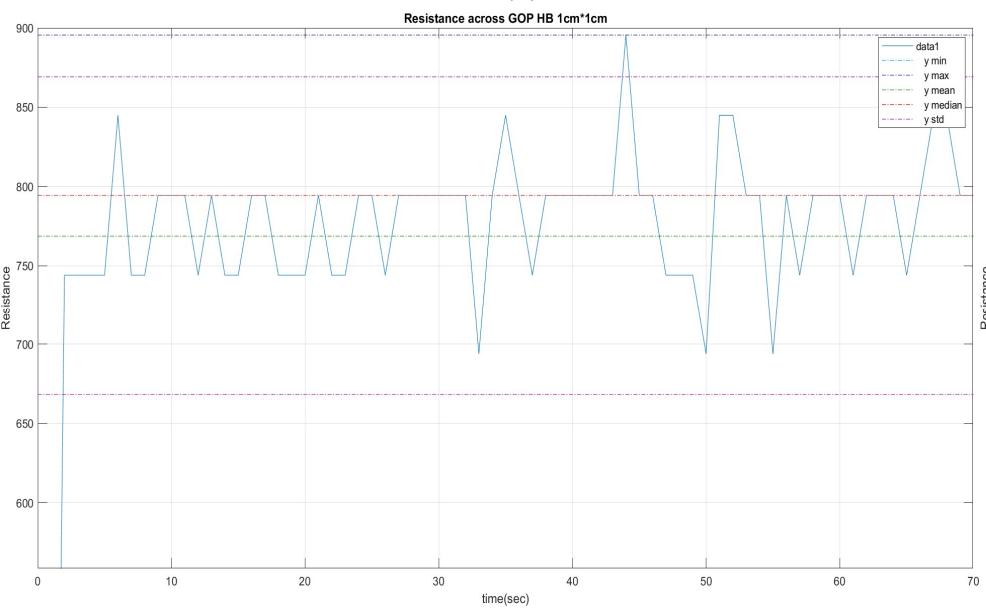
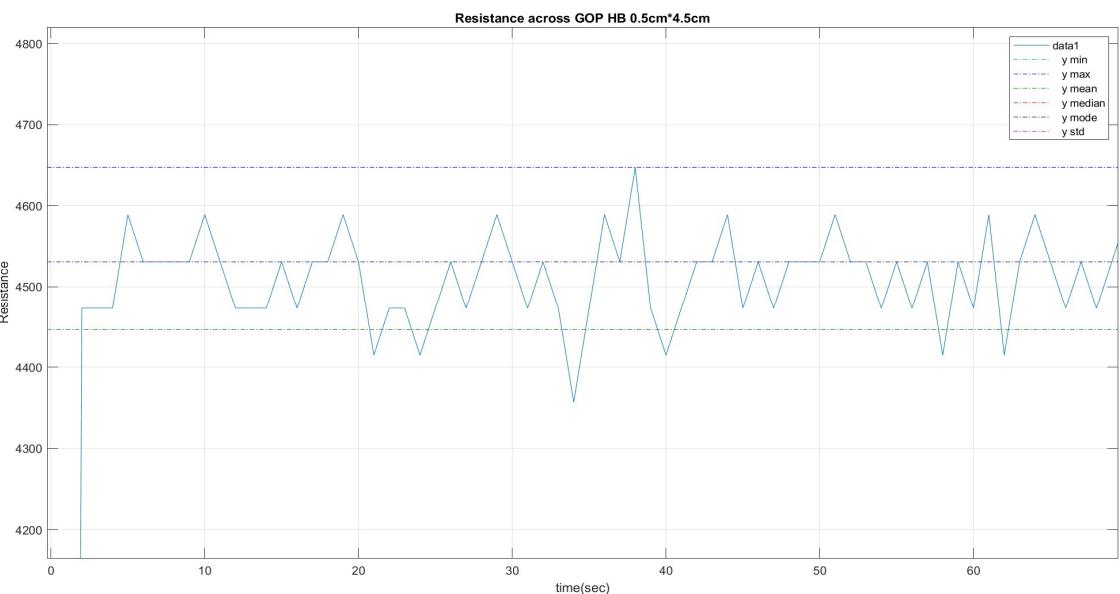
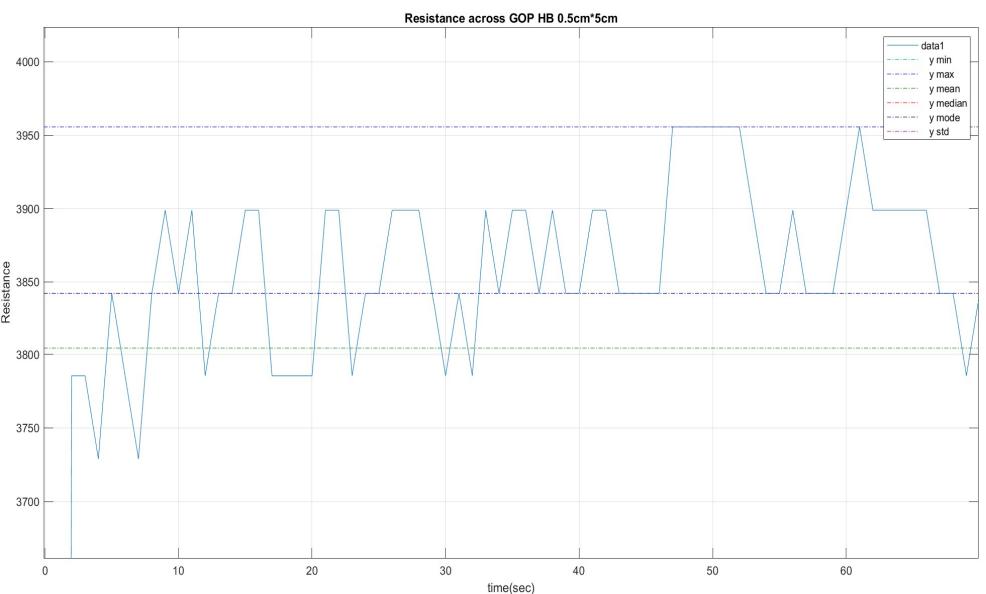


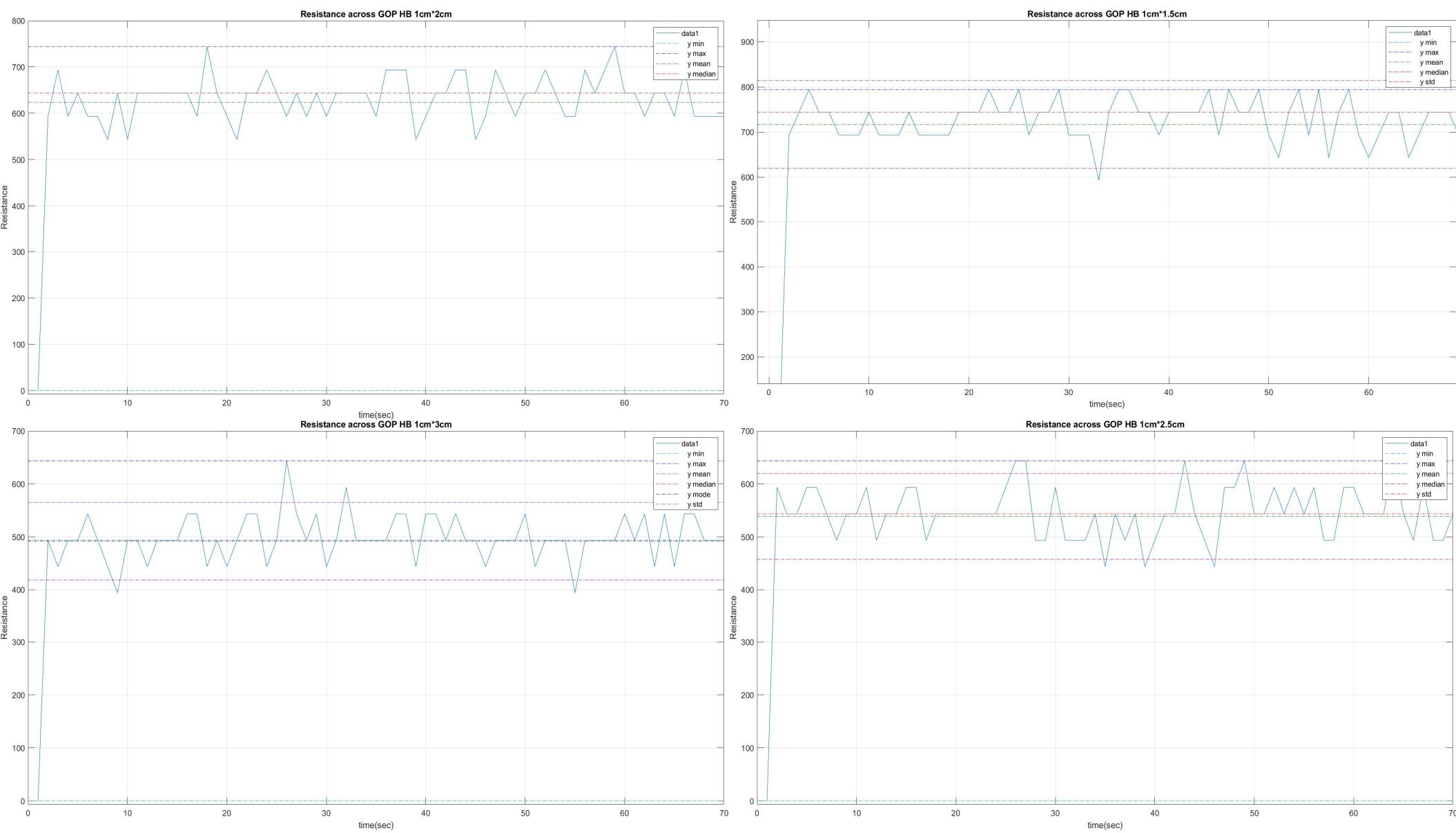


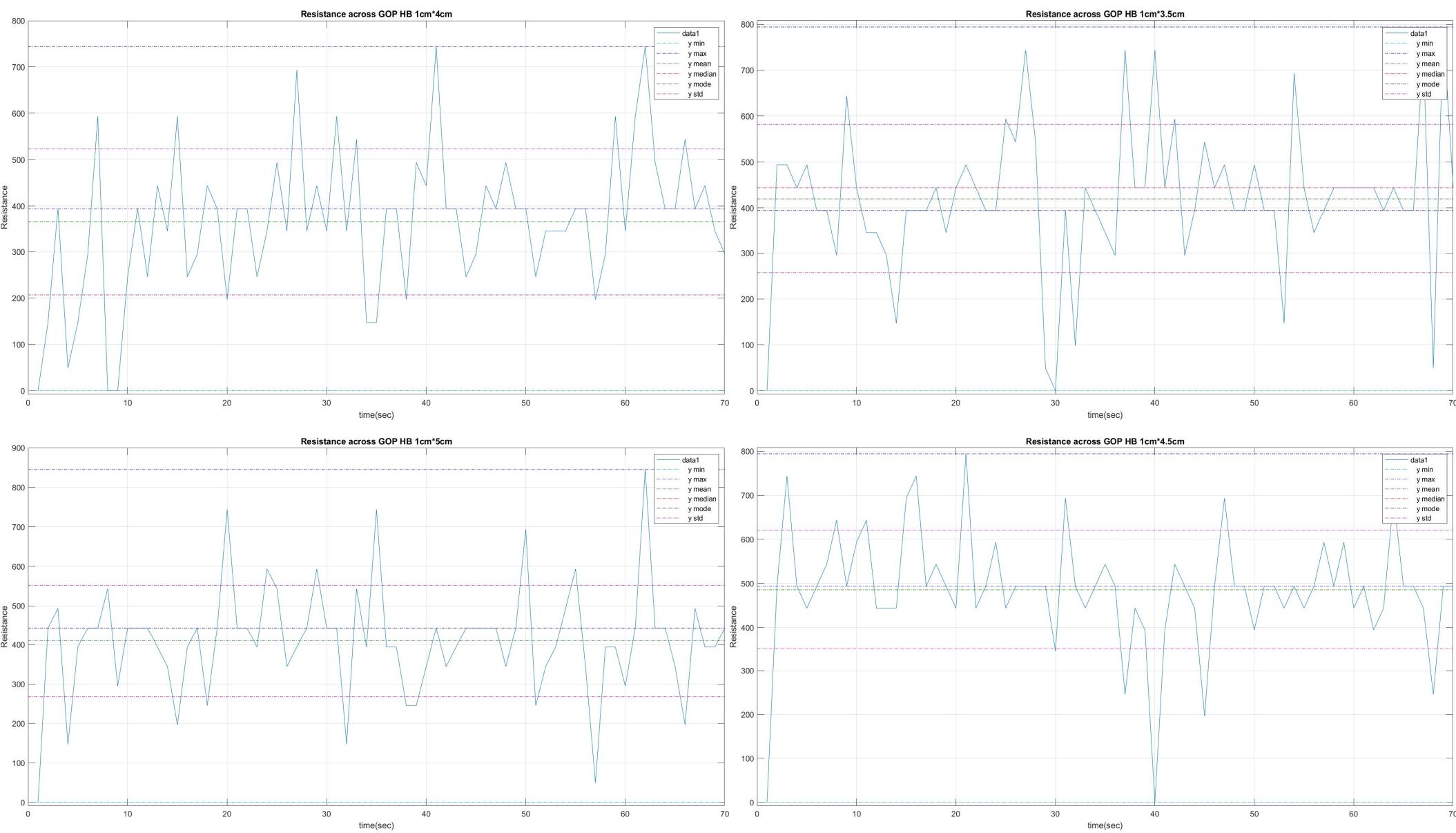


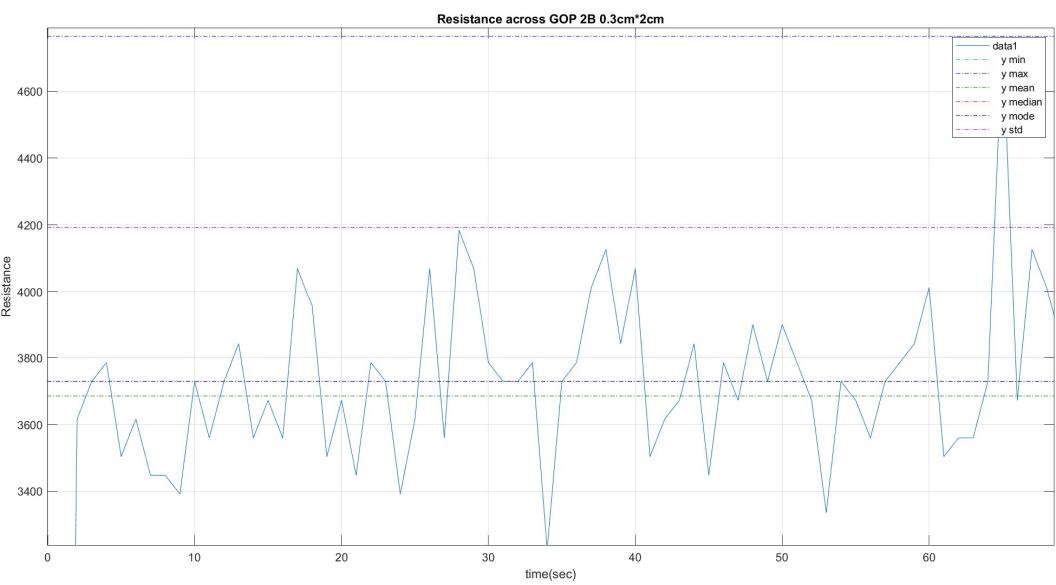
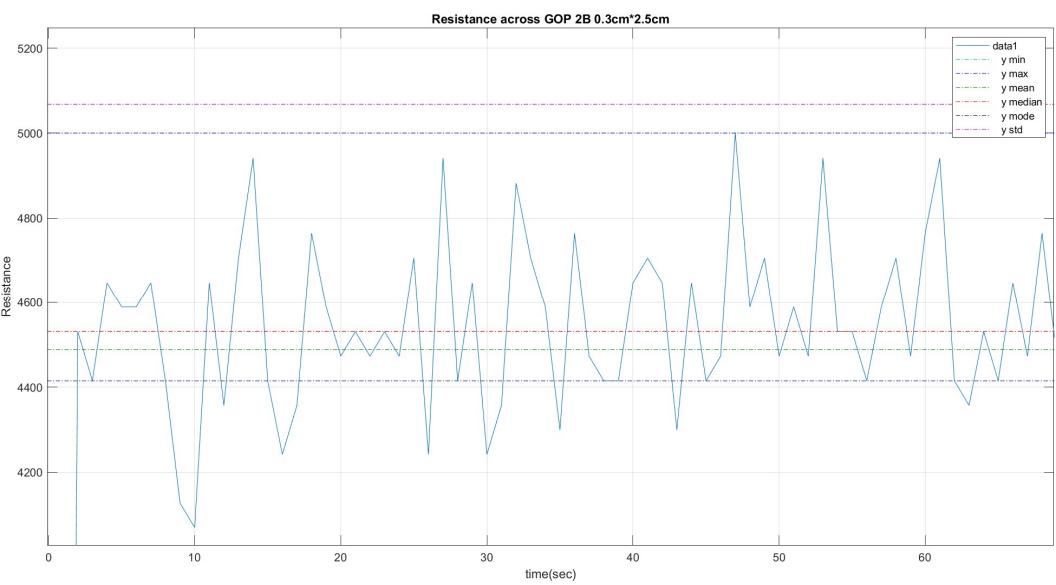
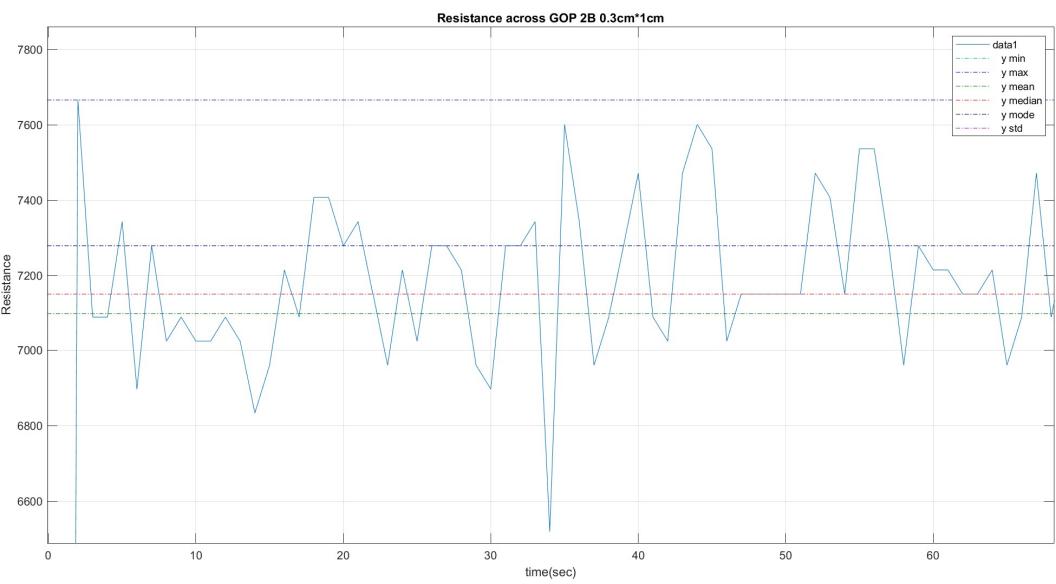
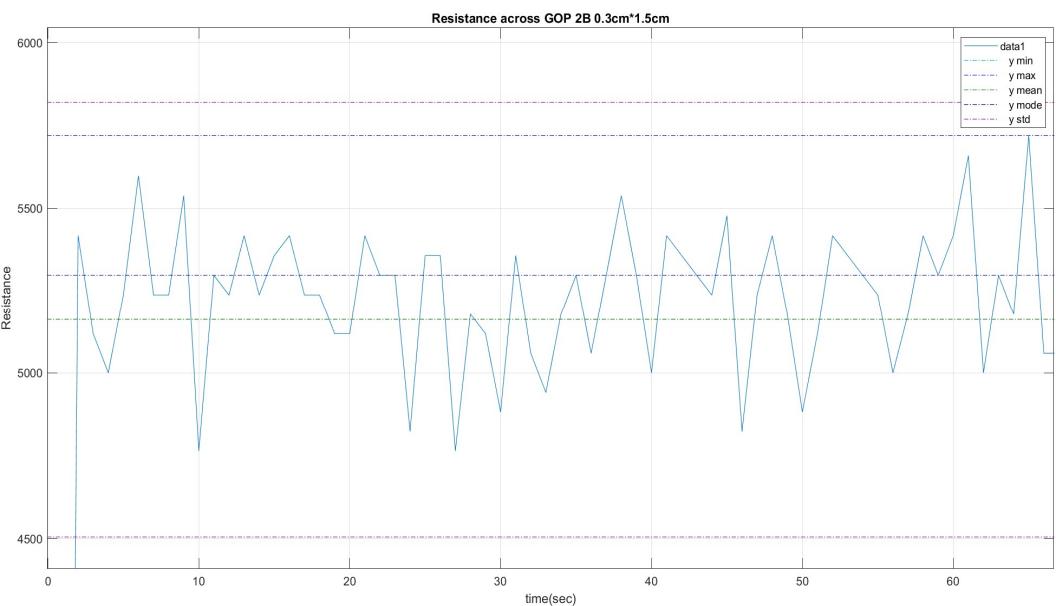




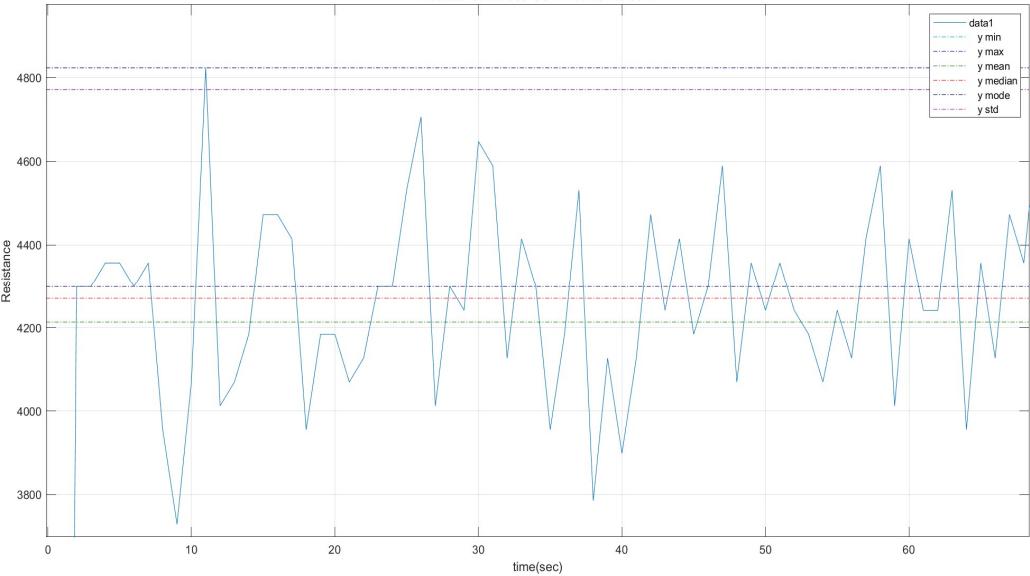




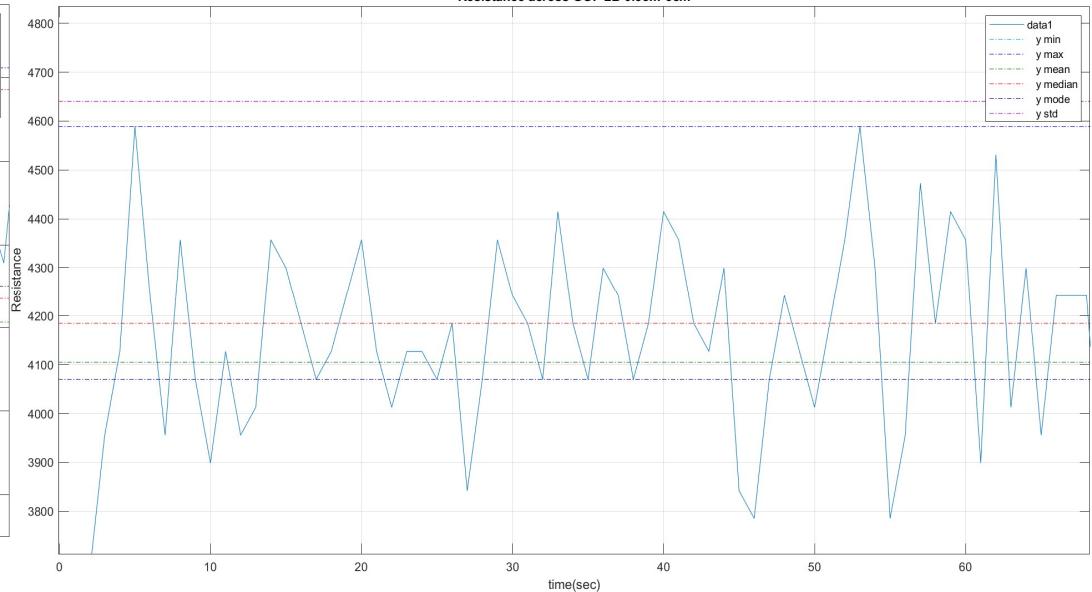




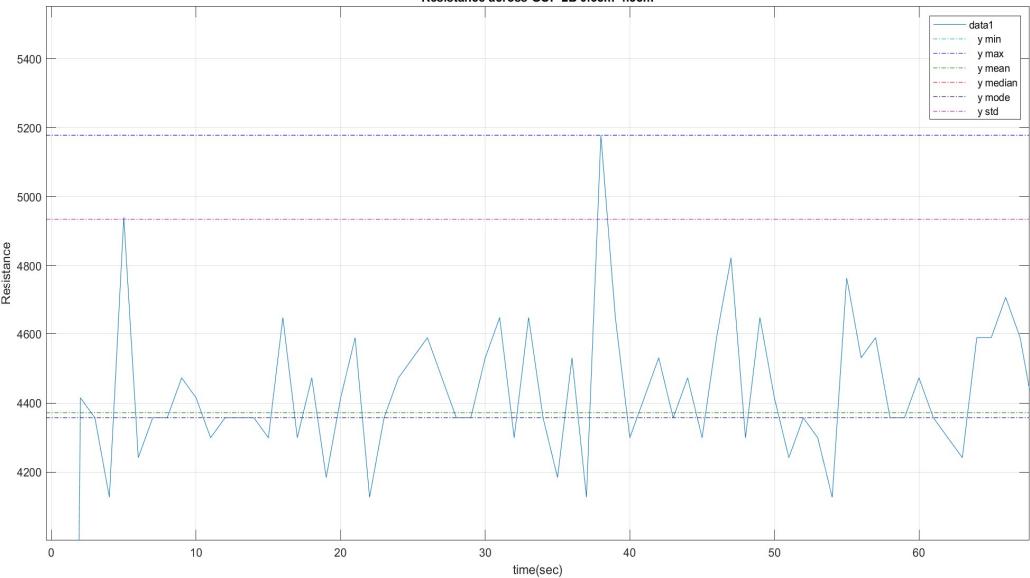
Resistance across GOP 2B 0.3cm\*3.5cm



Resistance across GOP 2B 0.3cm\*3cm



Resistance across GOP 2B 0.3cm\*4.5cm



Resistance across GOP 2B 0.3cm\*4cm

