http://helpass.com/uploads/20221002/41b96caea6c9fad131c99cd20500a8ee.pdf

Conclusion:
Oscilloscope related

1. Minimum is 20mV (background noise)
2. With current makes pk-pk shorted noise smaller
3. Get value through avg offset

Four point probe head:

1. Derive shorted background noise (omit open noise since we won't use it)
    a. Wire noise is about ⅛ of shorted; accounted in offset avg
    b. Adding capacitors filter out the unwanted peak noise (making offset noise smaller)

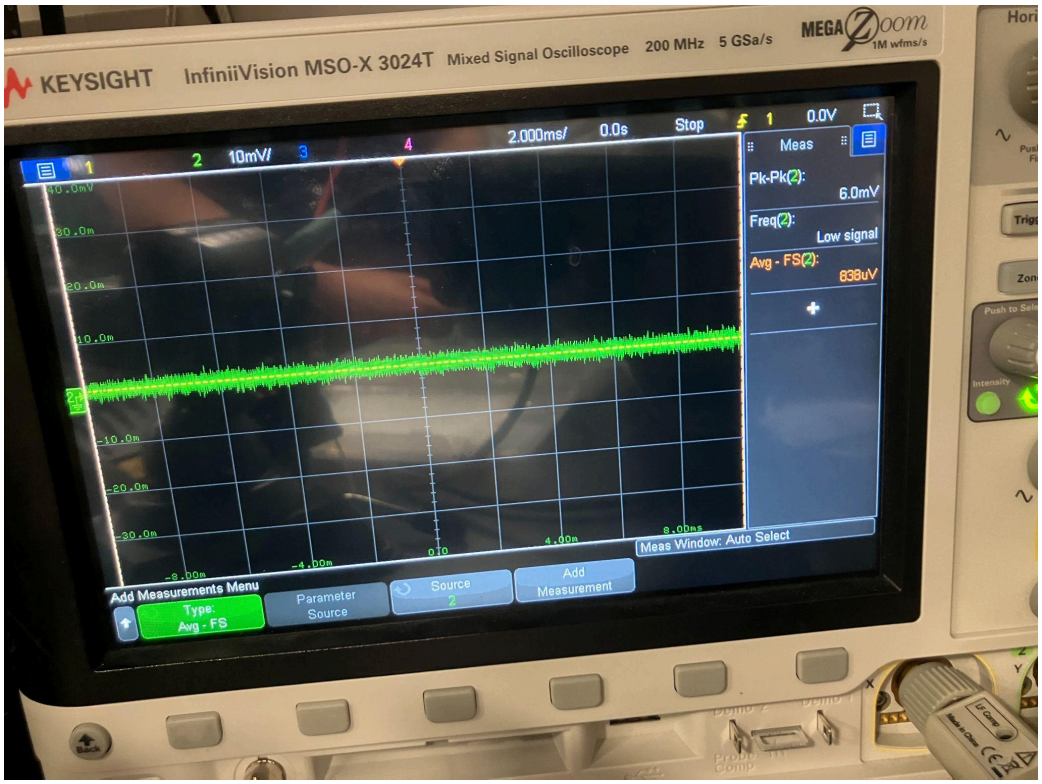
2. Smaller current (ex 0.2 vs 0.5) makes it more stable
    a. If we want to test higher resistivity, we can use higher current
3. Use avg_tested - avg_off to get the delta V between inner pins
4. Test 0.9 ohm and offset is high enough already (still need to test wafer since we are only emulating surface resistance with such ohm while FPP does better/more subtle with surface resistance)

5. The obvious offset can let us do correlation factor (formula fitting) since every head/measurement have different background noises; we potentially does not need an opamp but two 10uF.
    a.

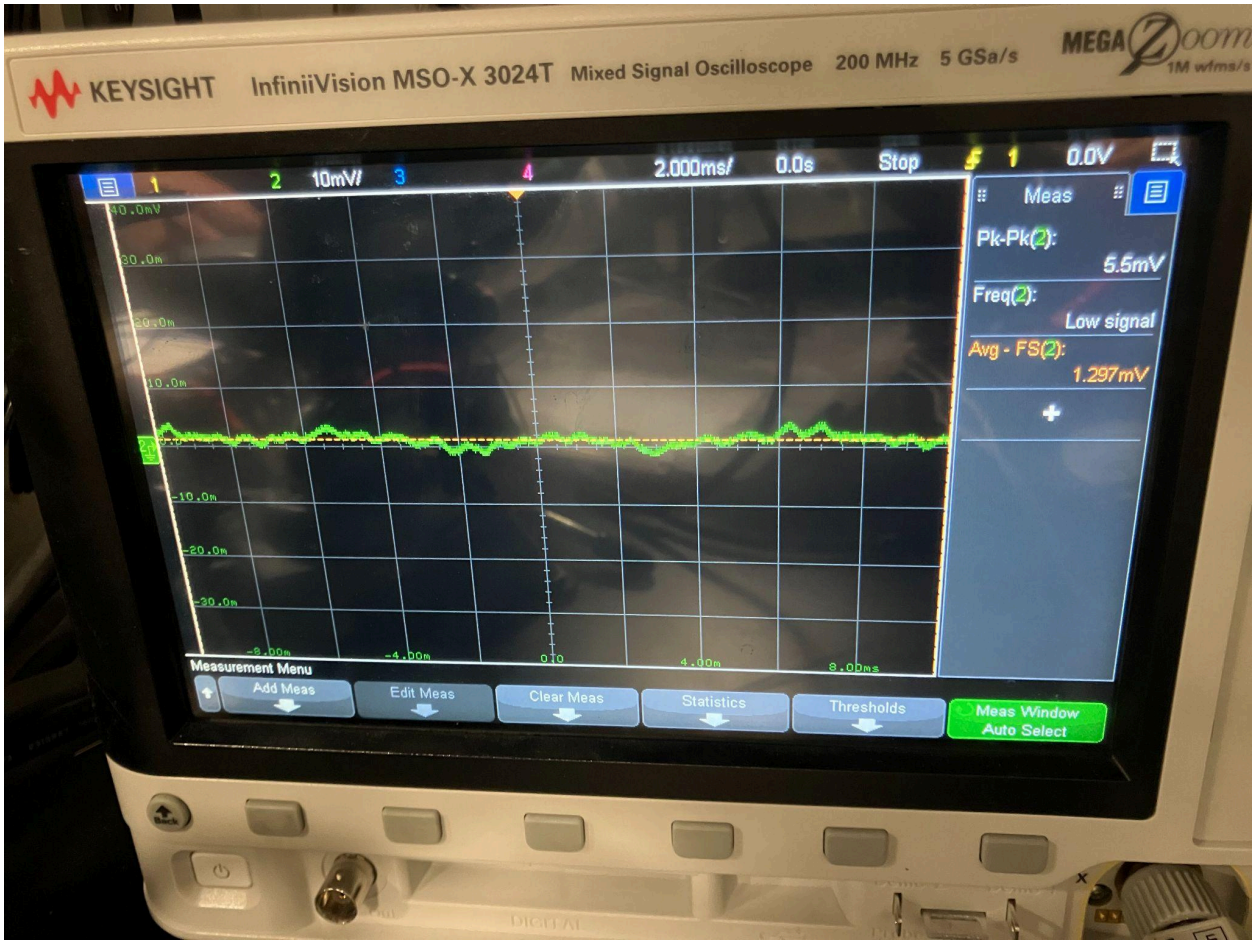
$$\left(0.1 \cdot 10 \cdot 10^{-6}\right)^{-1} = 1\,000\,000$$

$$\left(3 \cdot 10^{-3}\right)^{-1} = 333.3333333$$

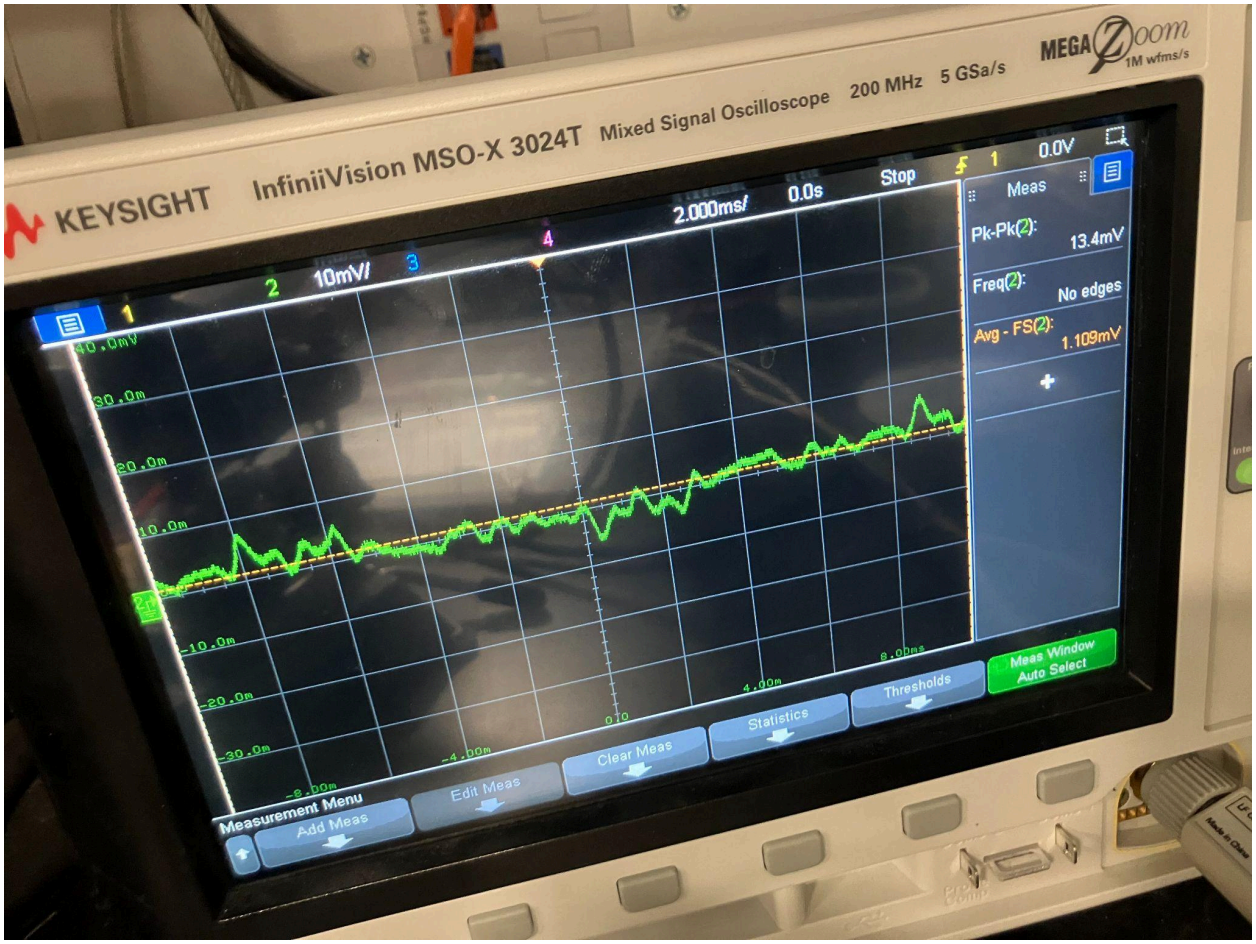
    b. When we tested 100*10^-6, oscilloscope couldn't read it (we already make avg offset as small as 1.6mV with 10uF)



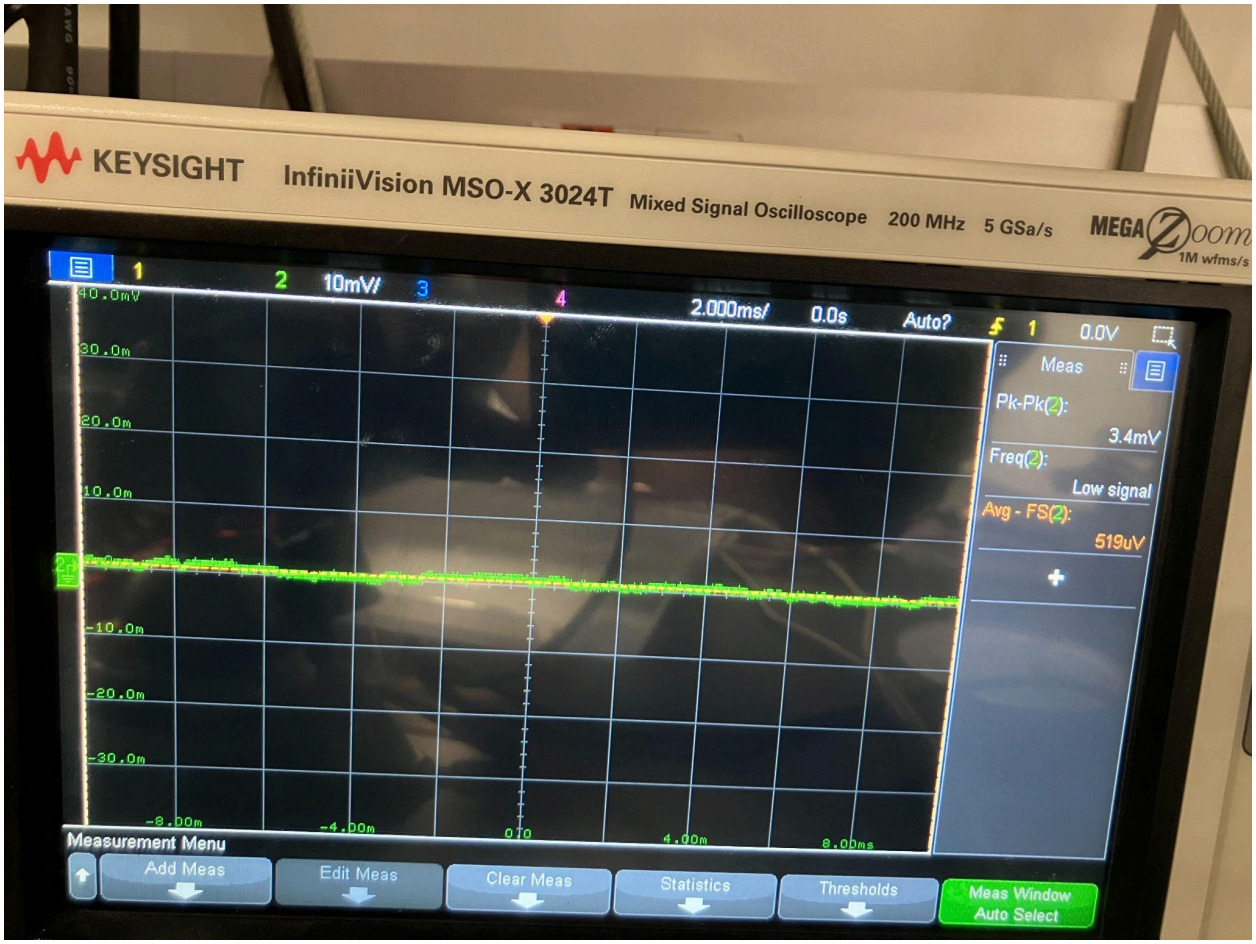
Shorted noise measurement under .5 A



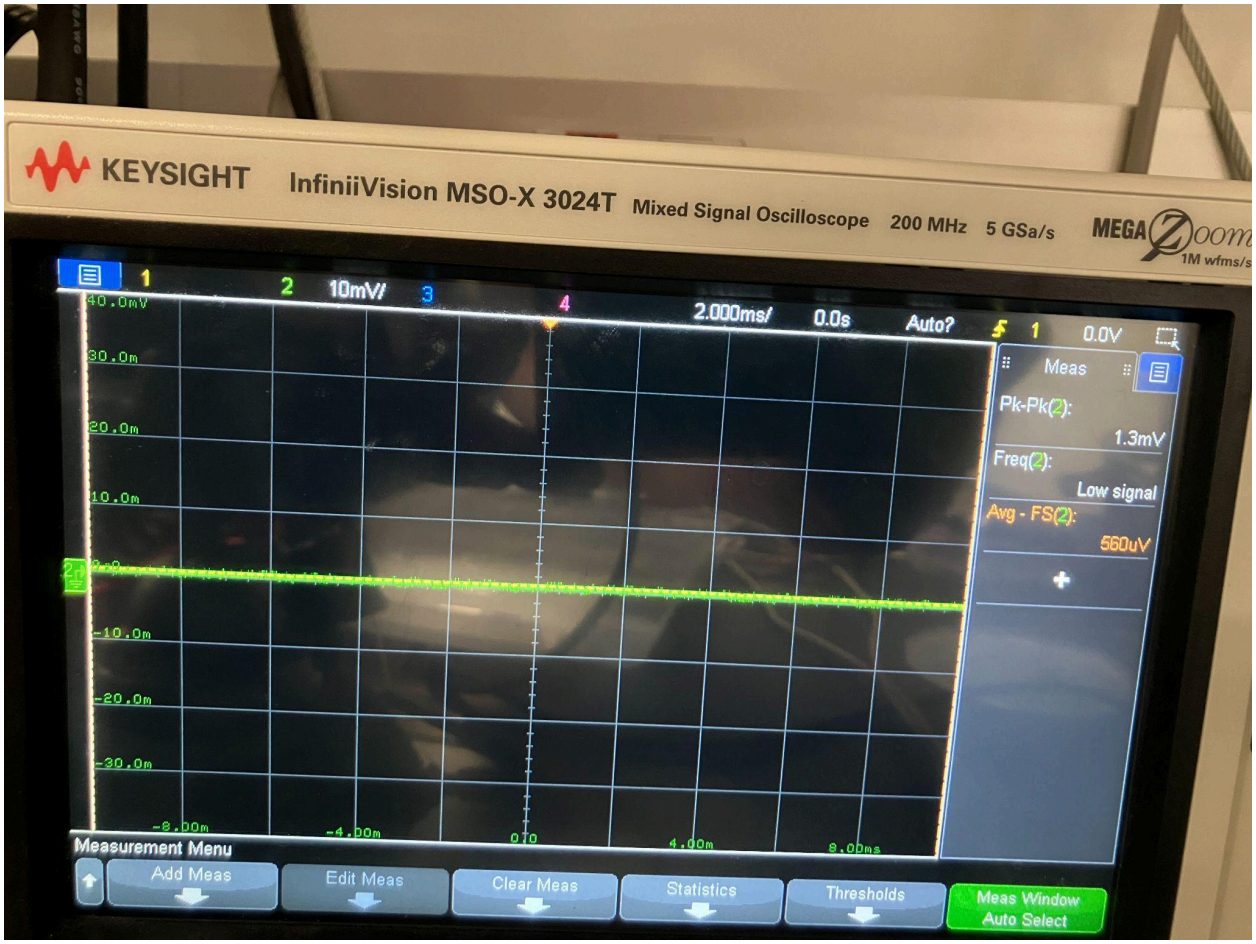
Shorted noise measurement under .2 A



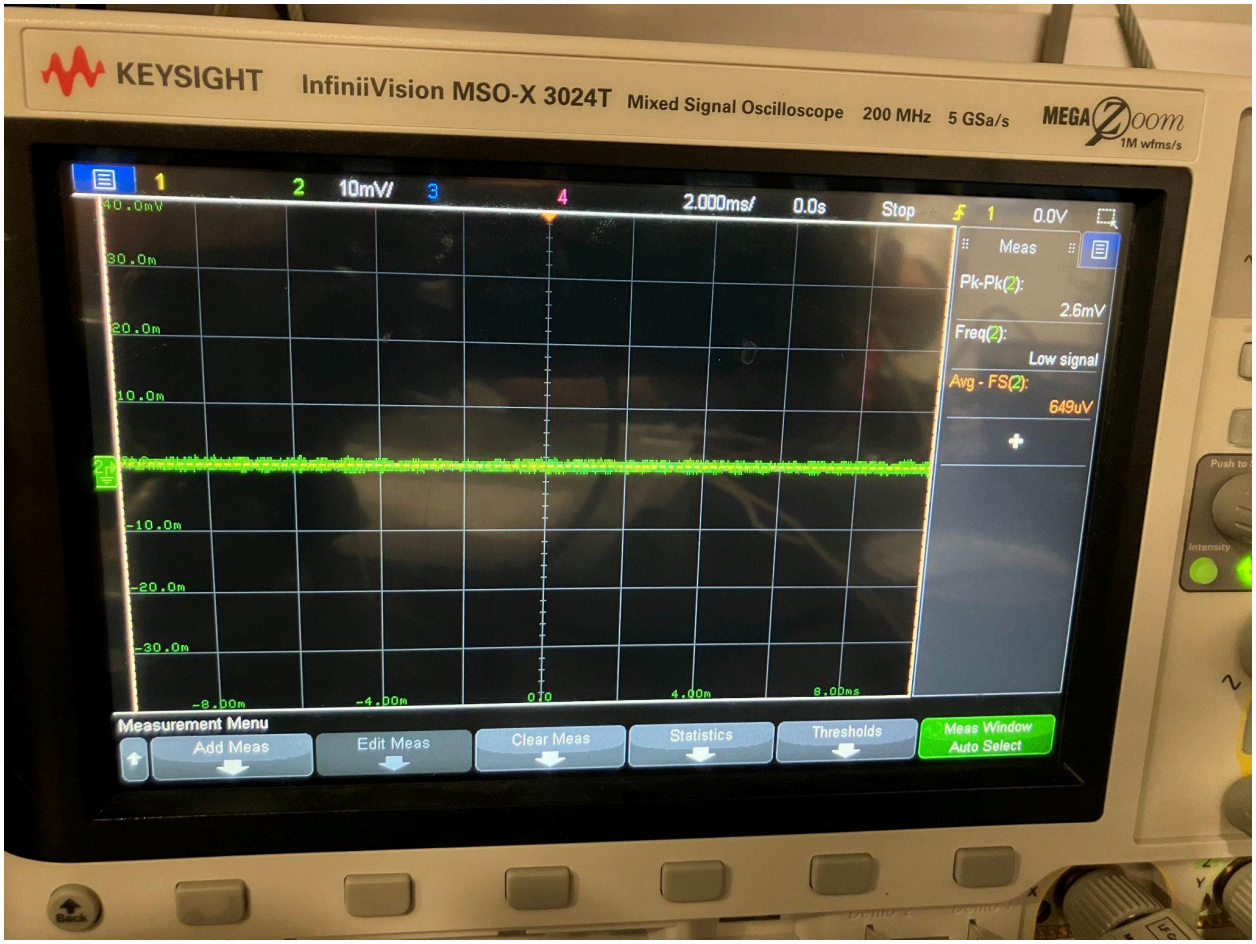
Only successful measurement on contact of a wafer



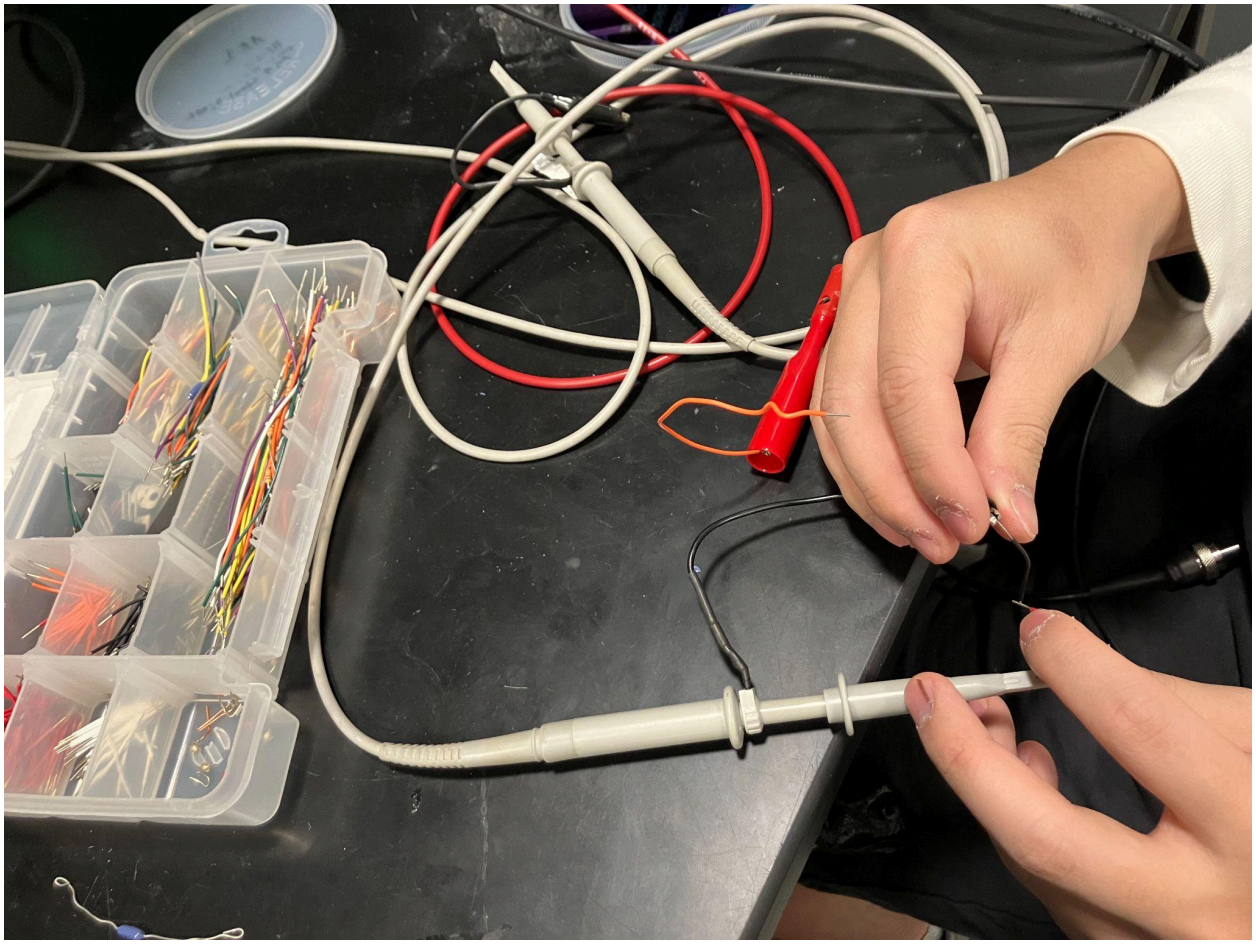
Open wire noise



Shorted wire noise (with only oscilliscope)

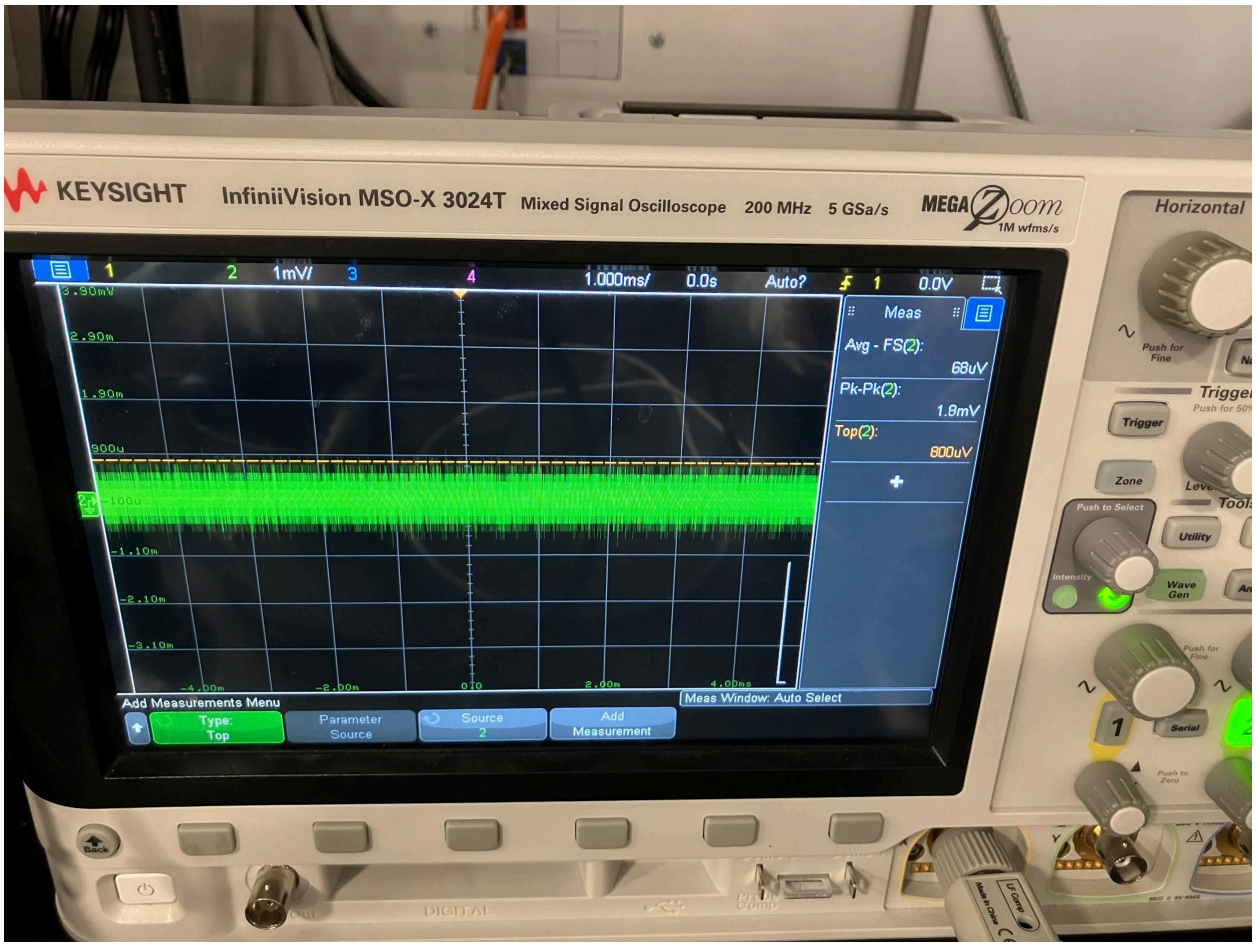


Shorted wire noise with drive+- connected but no current applied

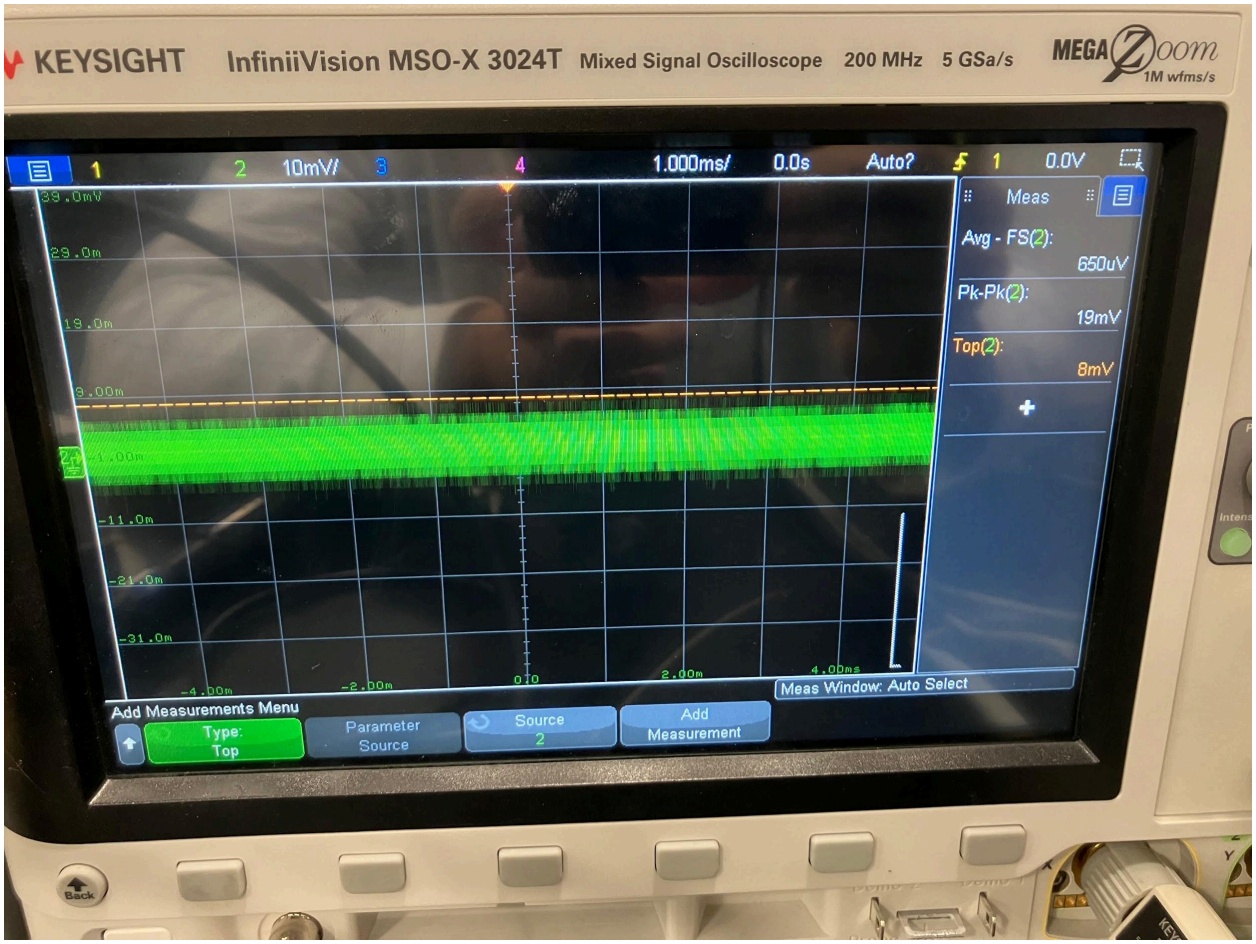


How we measure shorted wire(s) noise from oscilloscope

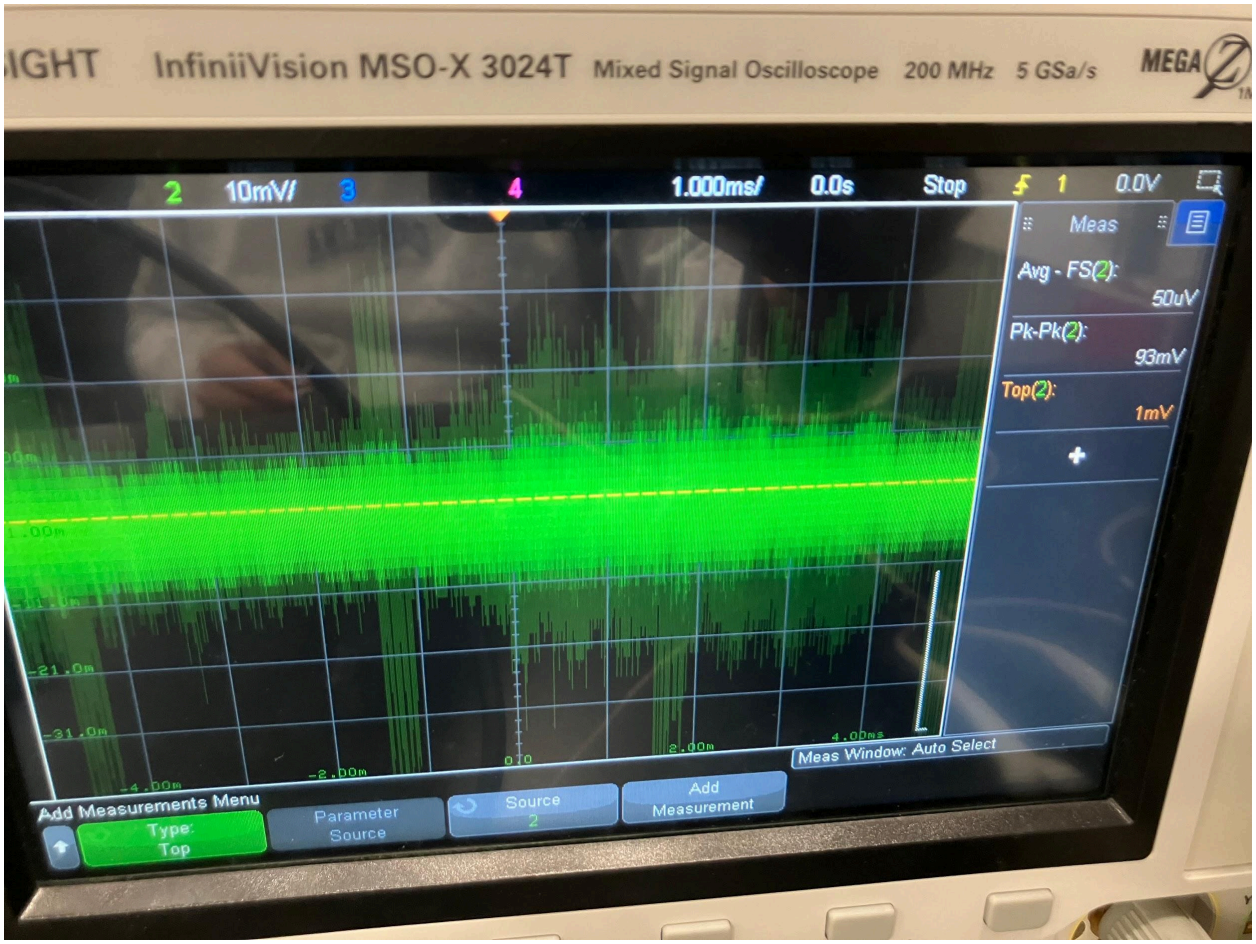
Second test(restarting oscilliscope)



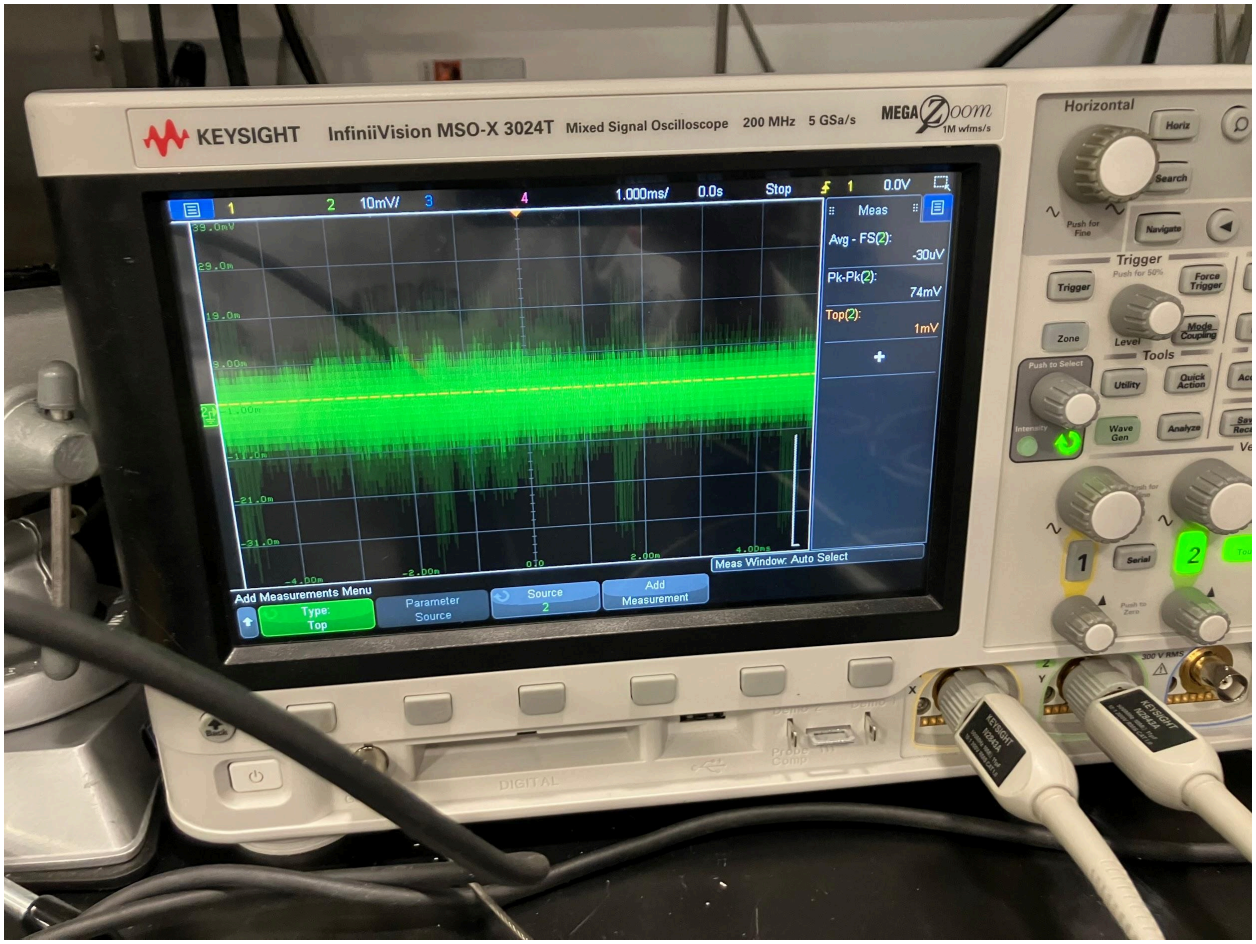
Oscilloscope noise without any connection



Shorted wire connection noise

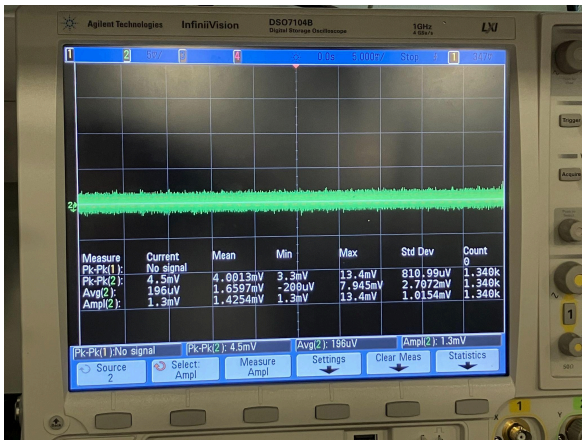


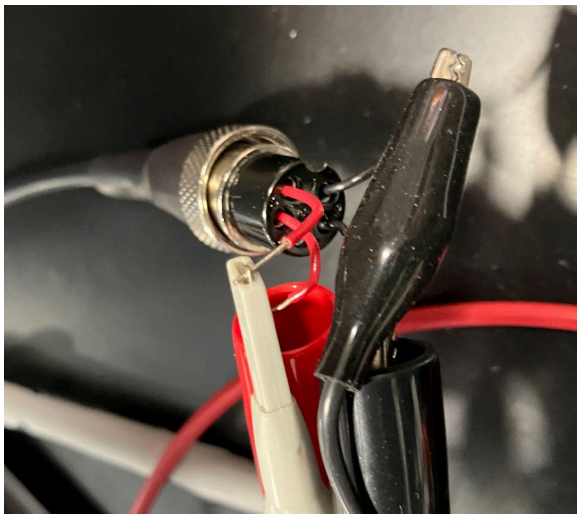
Drive +- and signal +- shorted but no current



Drive +- and signal +- shorted with 0.5A current

Test 3;



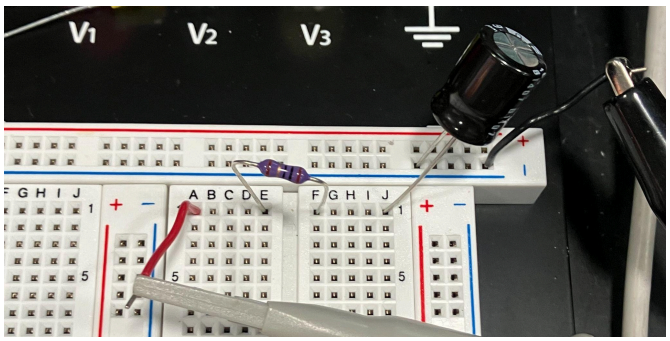


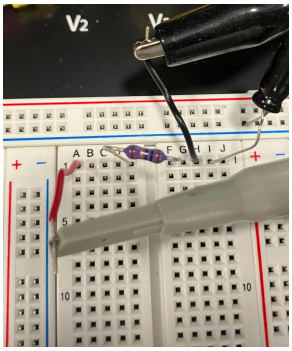
Background noise test @0.2A

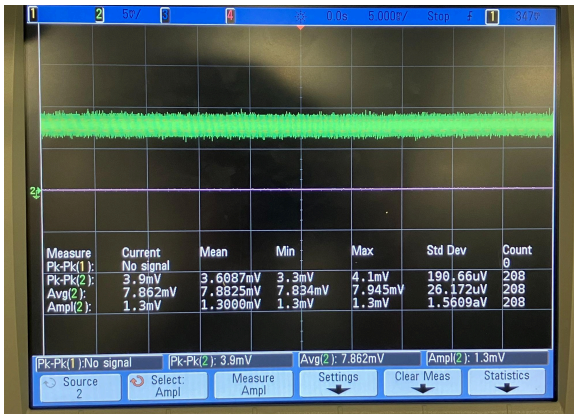
adding RC

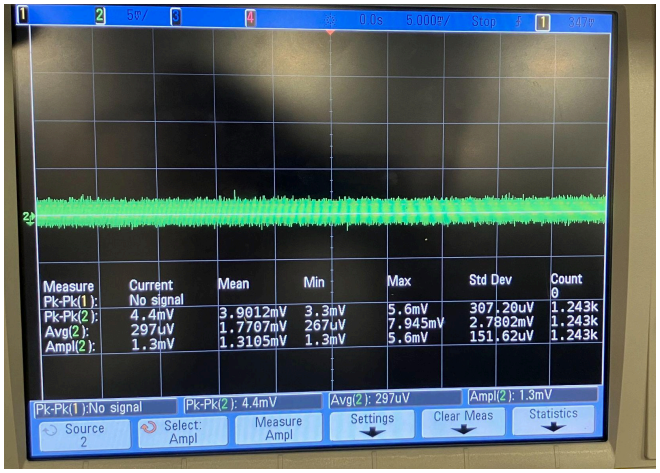
Setup 1;

setup 2

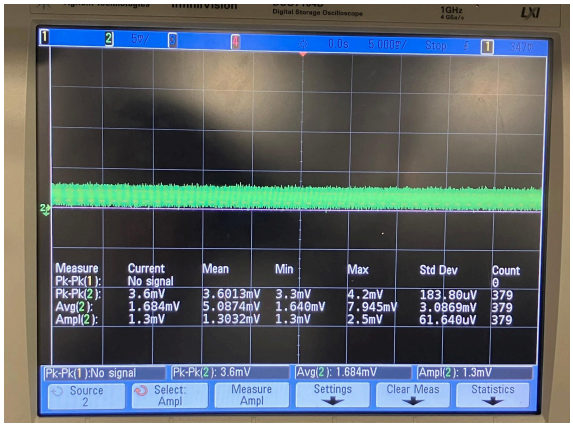


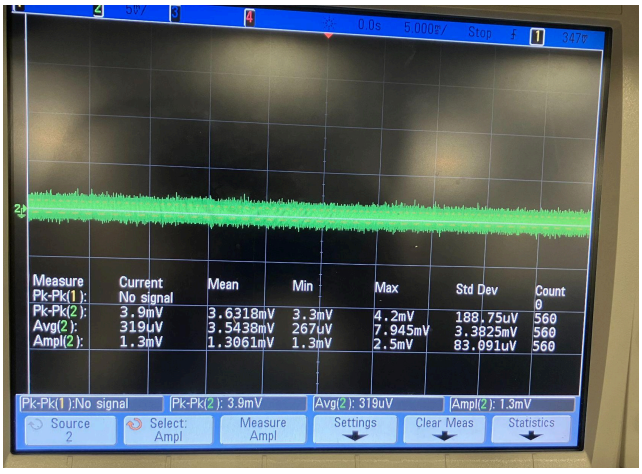






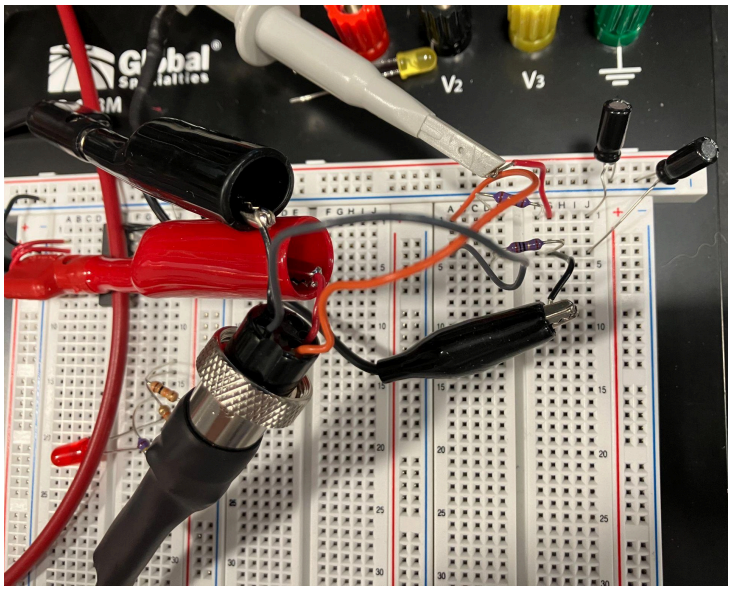
R= 10ohms; C=100uF;



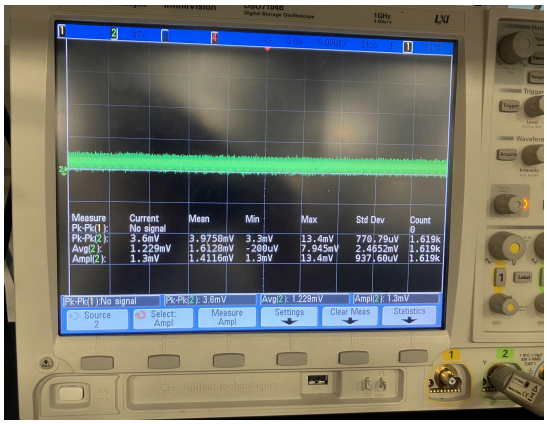


R=10ohms; C=10uF

Dual filtering test
Set up

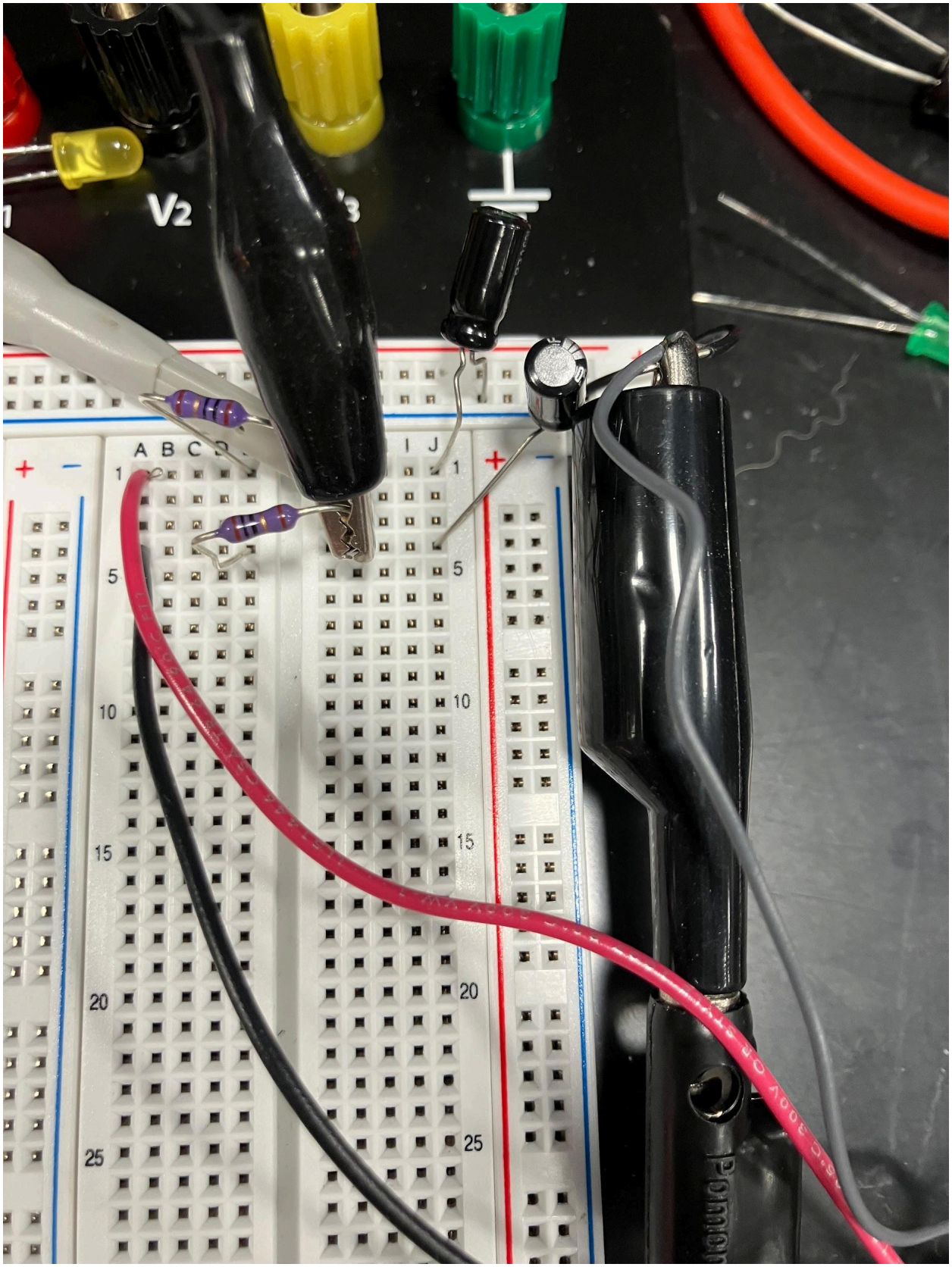


Output signals:



Open; shorted. r=10ohm and c=10uF; 21mV cross 10uF

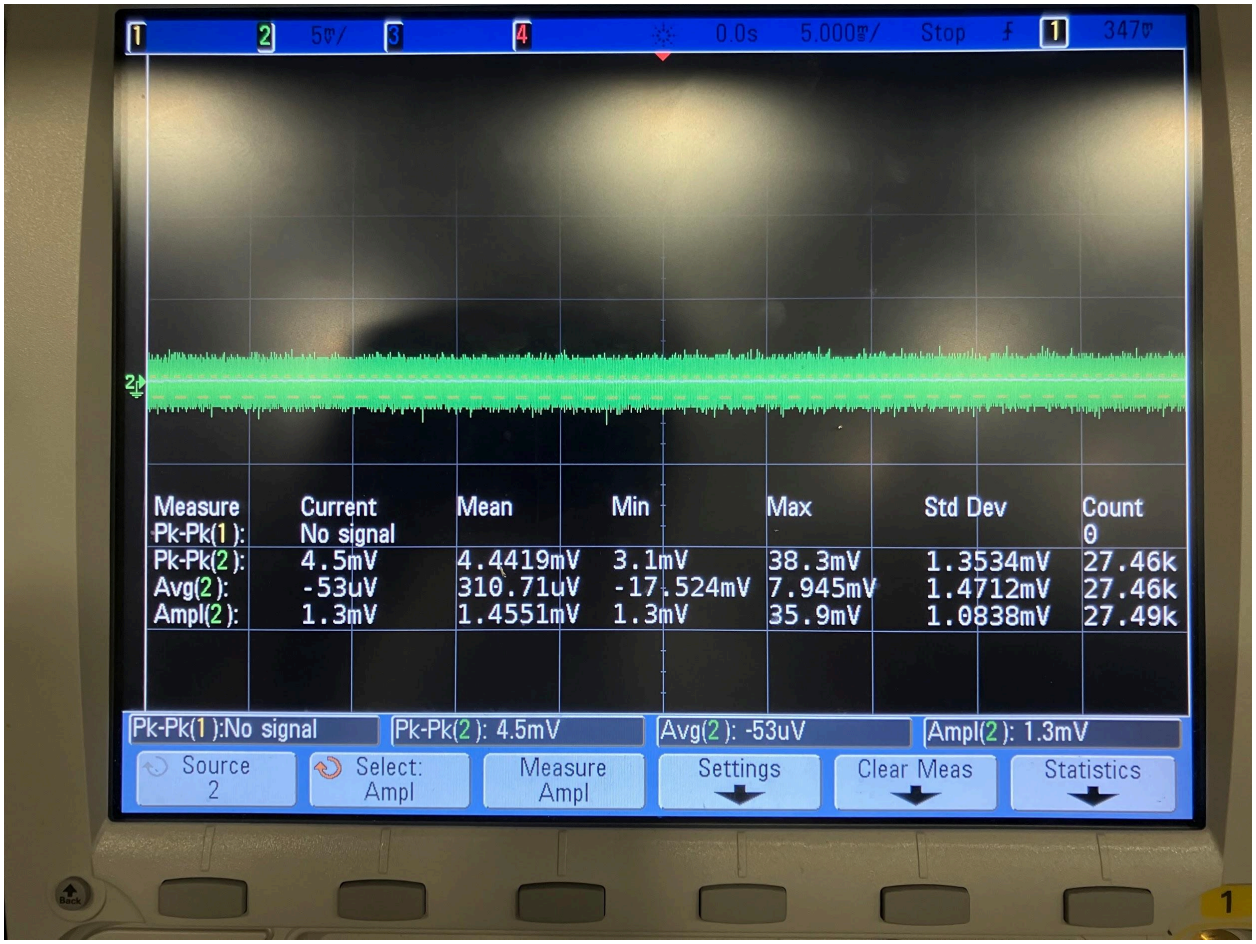
Connected to common gnd
Setup: R=10ohms; c=10uF



Open; no input

Short; no input

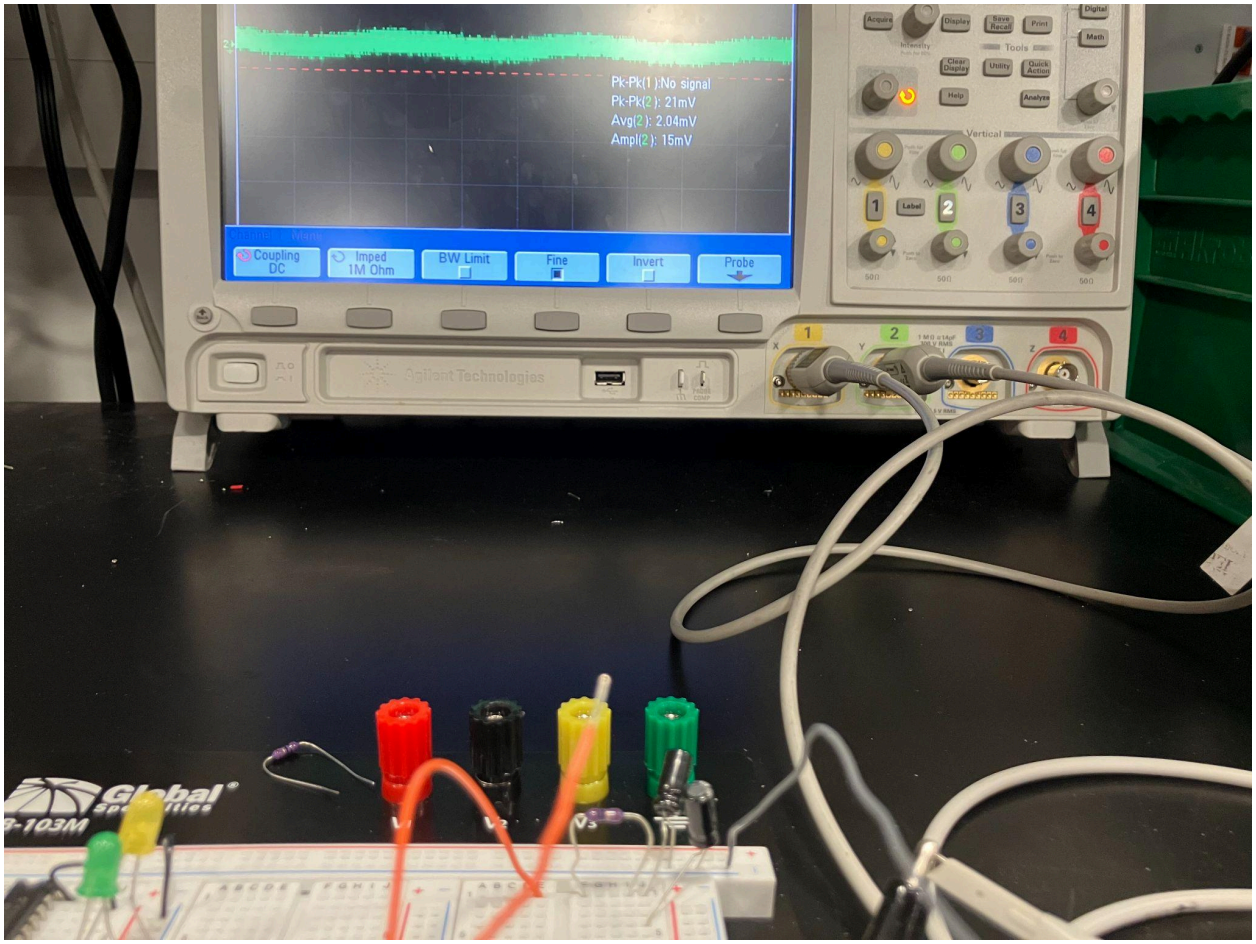
Open; input of .2A

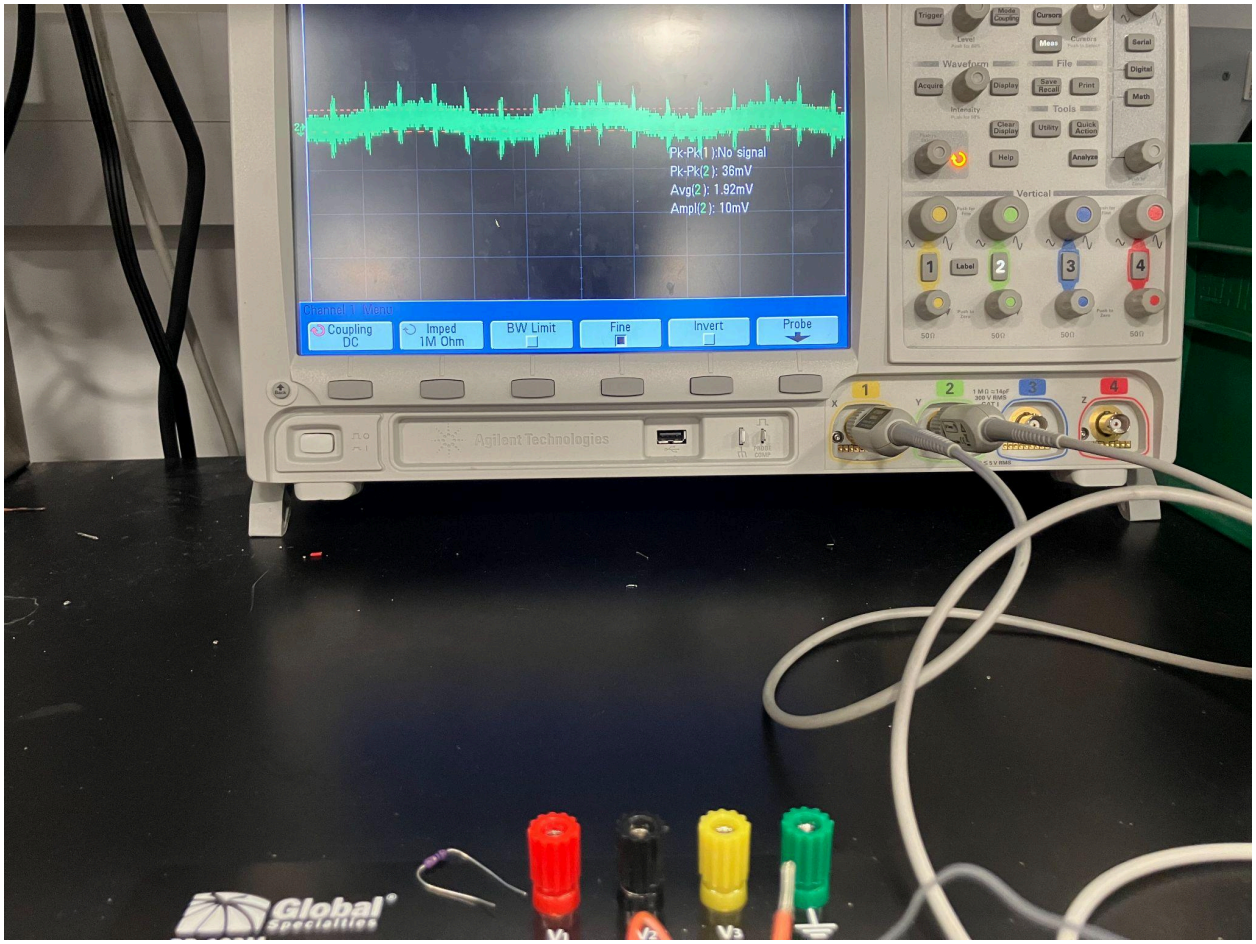


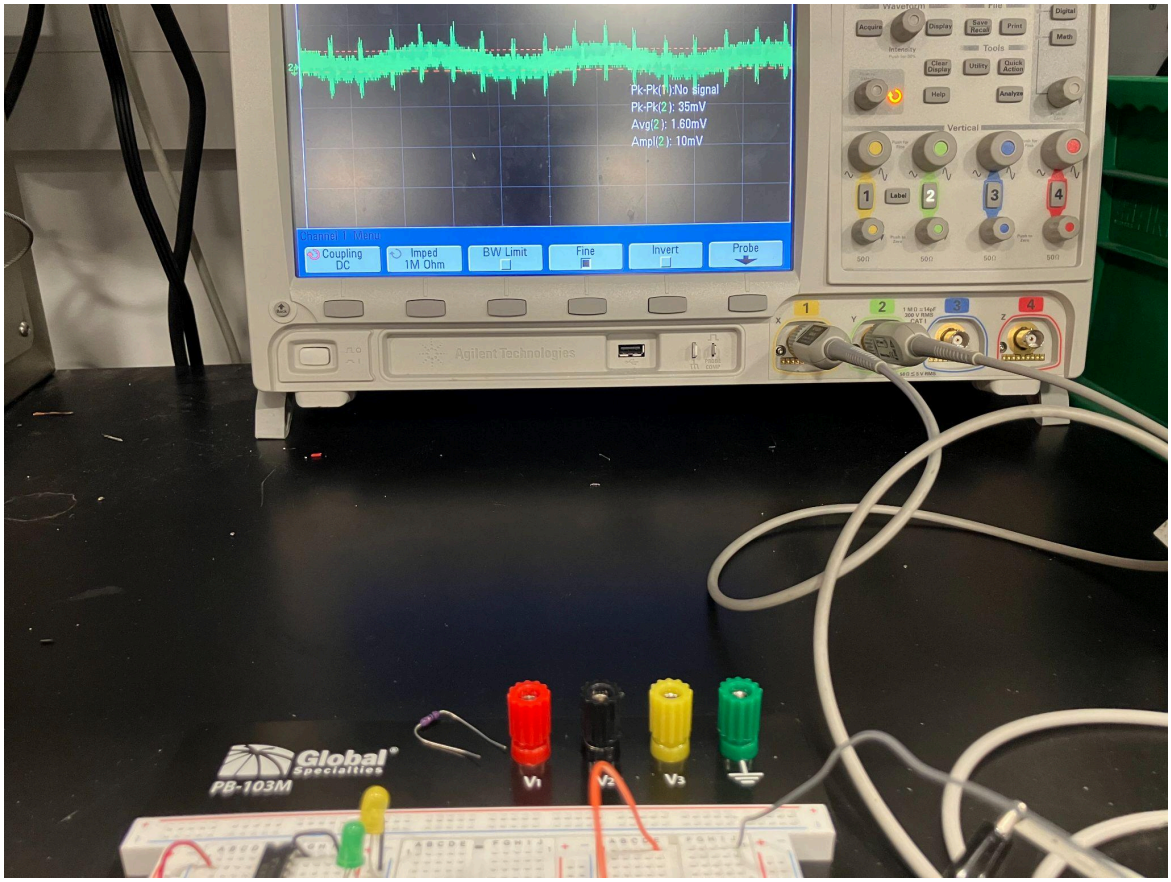
Shorted input of 0.2A

Nest test;
1. with only capacitor
2 with RC to offset overal signal
3. Find freq. response

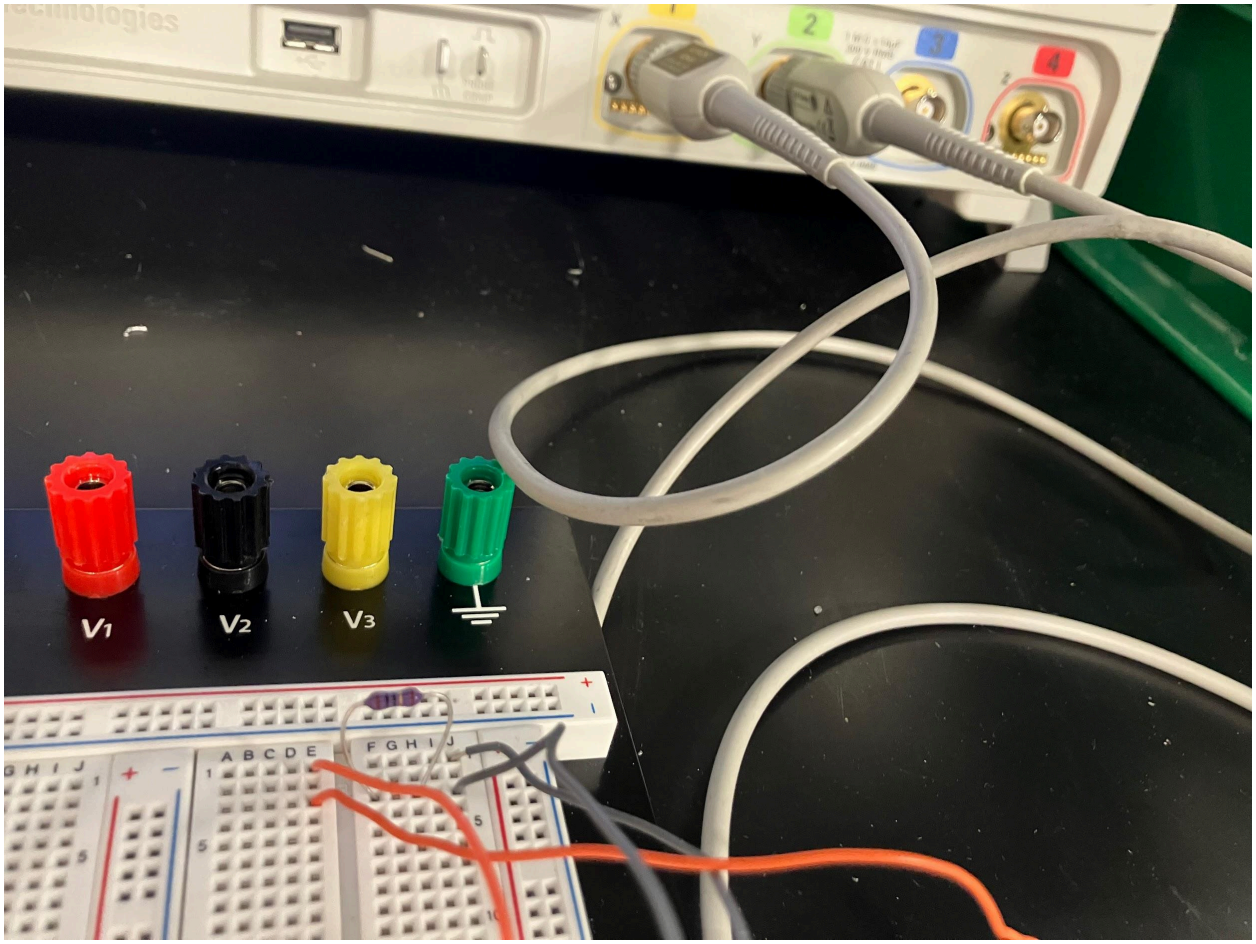
Oscilloscope background noise retest:
Under scale of 20mV/ and 5ms/

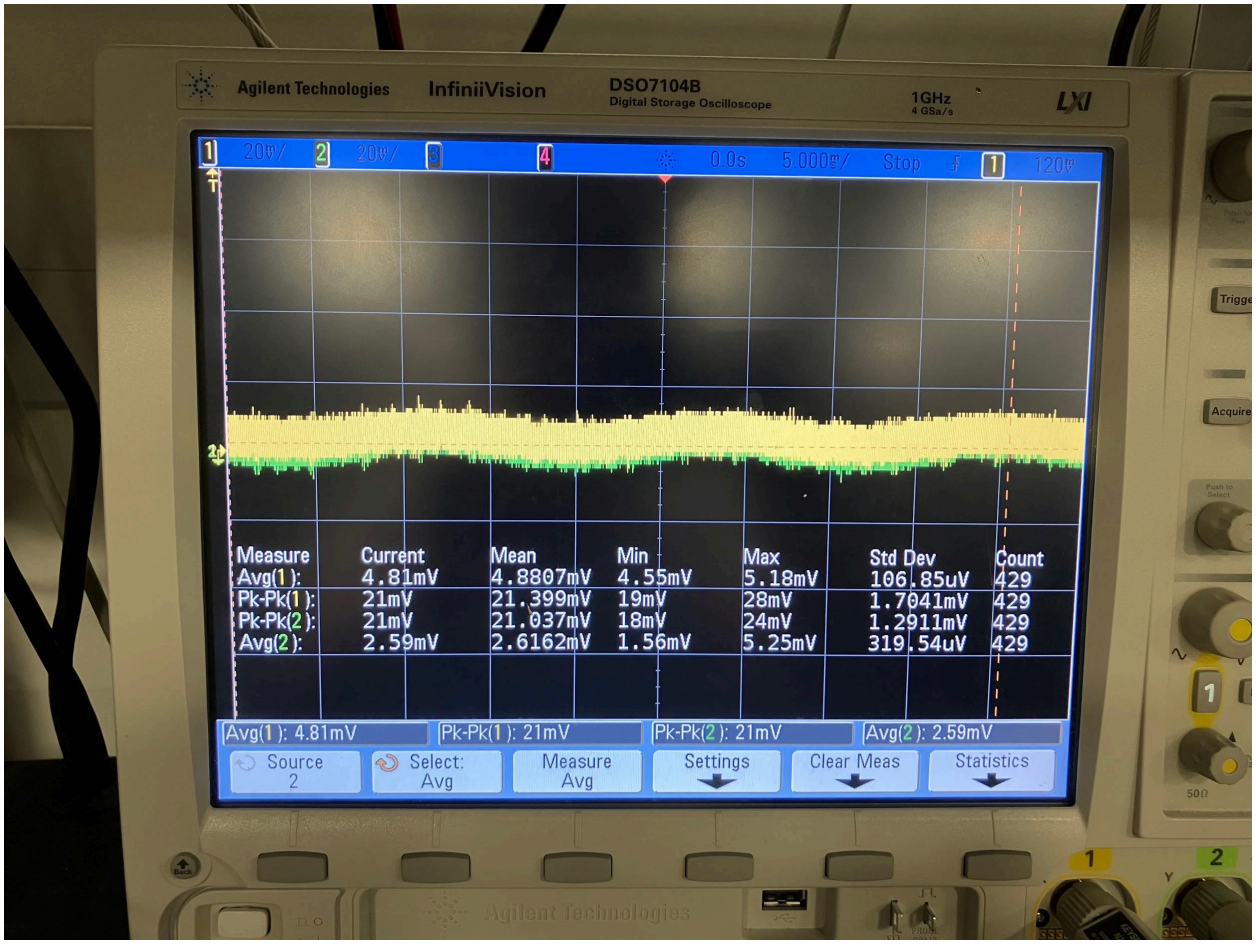

Pk-Pk(1):No signal
Pk-Pk(2): 21mV
Avg(2): 2.04mV
Ampl(2): 15mV
Coupling DC
Imped 1M Ohm
BW Limit
Fine
Invert
Probe
Vertical
Agilent Technologies

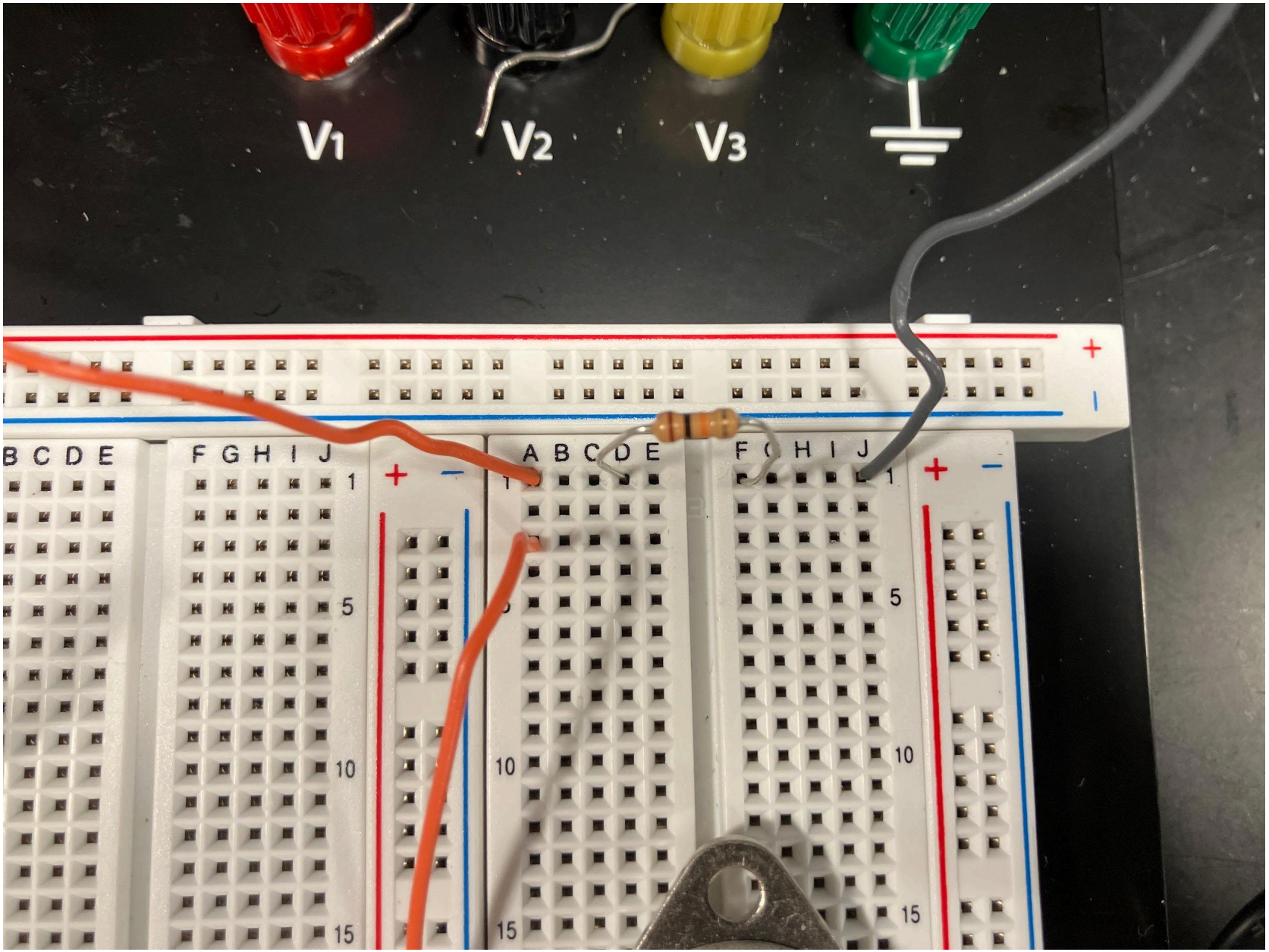

Pk-Pk(1):No signal
Pk-Pk(2): 36mV
Avg(2): 1.92mV
Ampl(2): 10mV
Coupling DC
Imped 1M Ohm
BW Limit
Fine
Invert
Probe
Agilent Technologies
Global Specialties

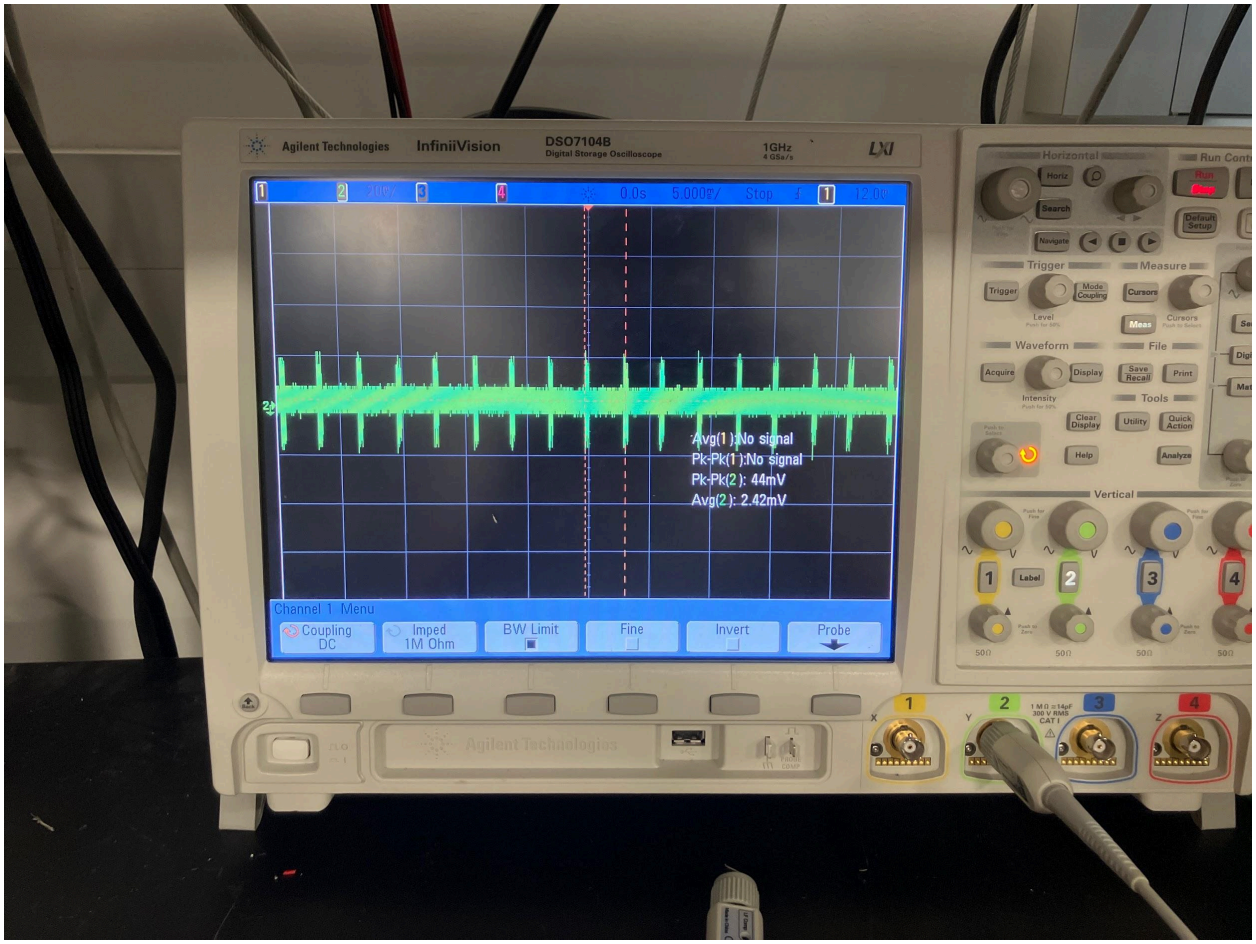


Resistor test; adding 900m ohms to channel 1

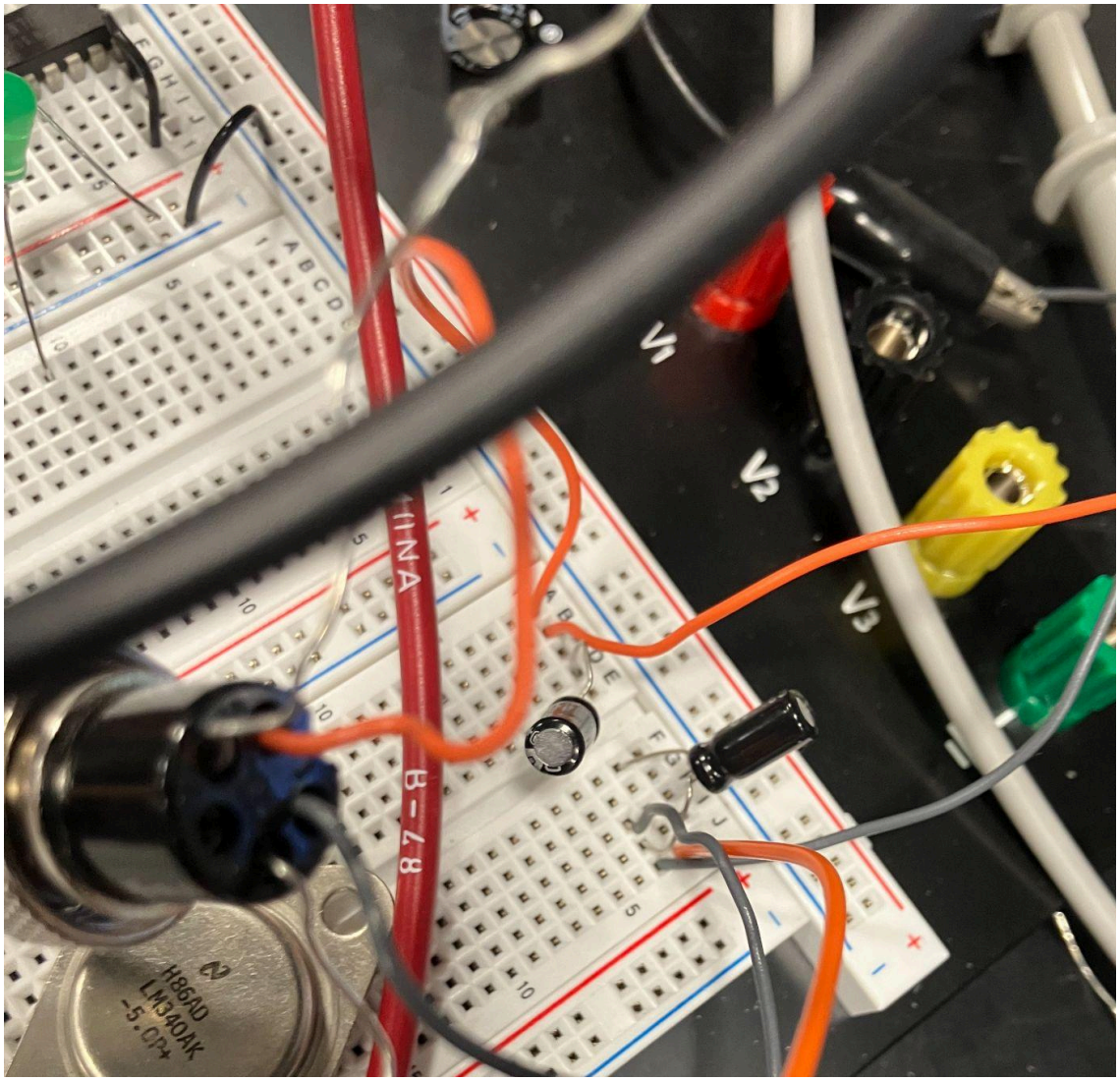

V1
V2
V3


Agilent Technologies
InfiniiVision
DSO7104B
Digital Storage Oscilloscope
1GHz
4 GSa/s
LXI
20mV/
20mV/
0.0s
5.000ns/
Stop
120mV
Measure Current Mean Min Max Std Dev Count
Avg(1): 4.81mV 4.8807mV 4.55mV 5.18mV 106.85uV 429
Pk-Pk(1): 21mV 21.399mV 19mV 28mV 1.7041mV 429
Pk-Pk(2): 21mV 21.037mV 18mV 24mV 1.2911mV 429
Avg(2): 2.59mV 2.6162mV 1.56mV 5.25mV 319.54uV 429
Avg(1): 4.81mV
Pk-Pk(1): 21mV
Pk-Pk(2): 21mV
Avg(2): 2.59mV
Source 2
Select: Avg
Measure Avg
Settings
Clear Meas
Statistics
Agilent Technologies

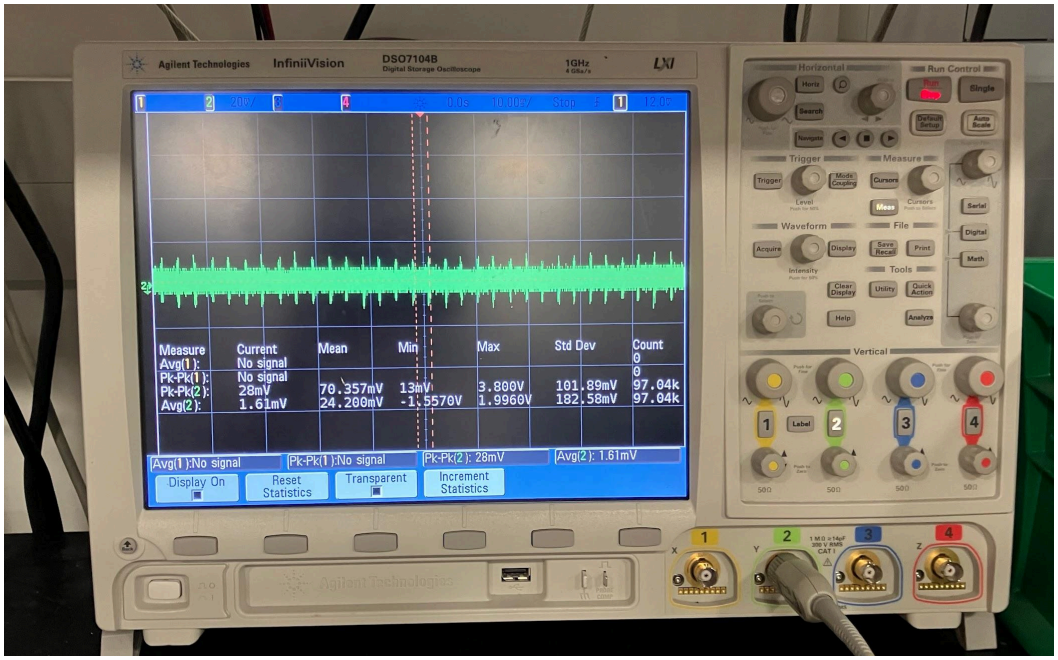

V1
V2
V3
B C D E
F G H I J
A B C D E
F G H I J
1
5
10
15
+
−



Good test run with 10uF



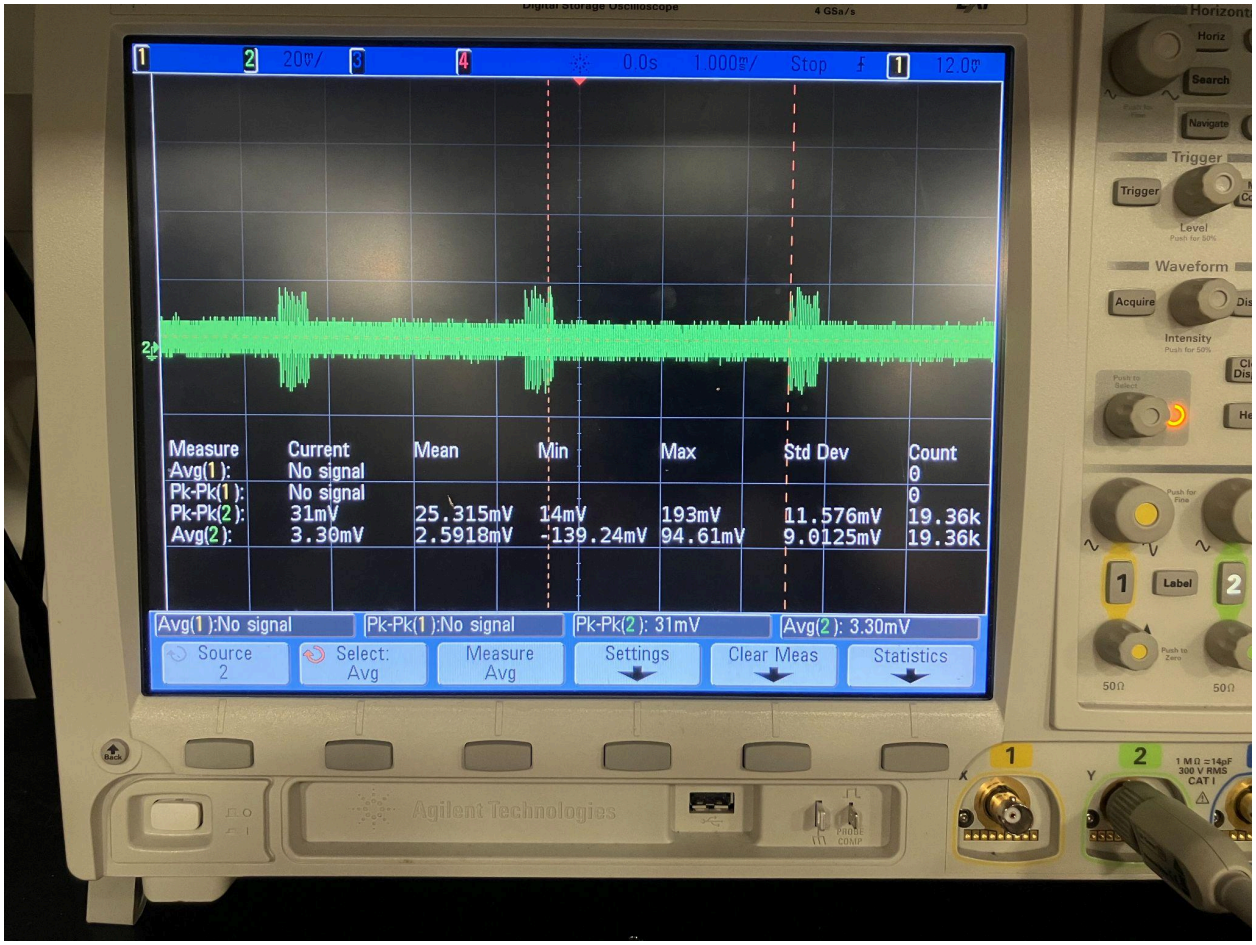
1. Short circuit test (first .2A; second .4A)


Agilent Technologies
InfiniiVision
DSO7104B
Digital Storage Oscilloscope
Measure Current Mean Min Max Std Dev Count
Avg(1): No signal 0
Pk-Pk(1): No signal 0
Pk-Pk(2): 28mV 70.357mV 13mV 3.800V 101.89mV 97.04k
Avg(2): 1.61mV 24.200mV -1.5570V 1.9960V 182.58mV 97.04k
Avg(1):No signal
Pk-Pk(1):No signal
Pk-Pk(2): 28mV
Avg(2): 1.61mV
Display On
Reset Statistics
Transparent
Increment Statistics

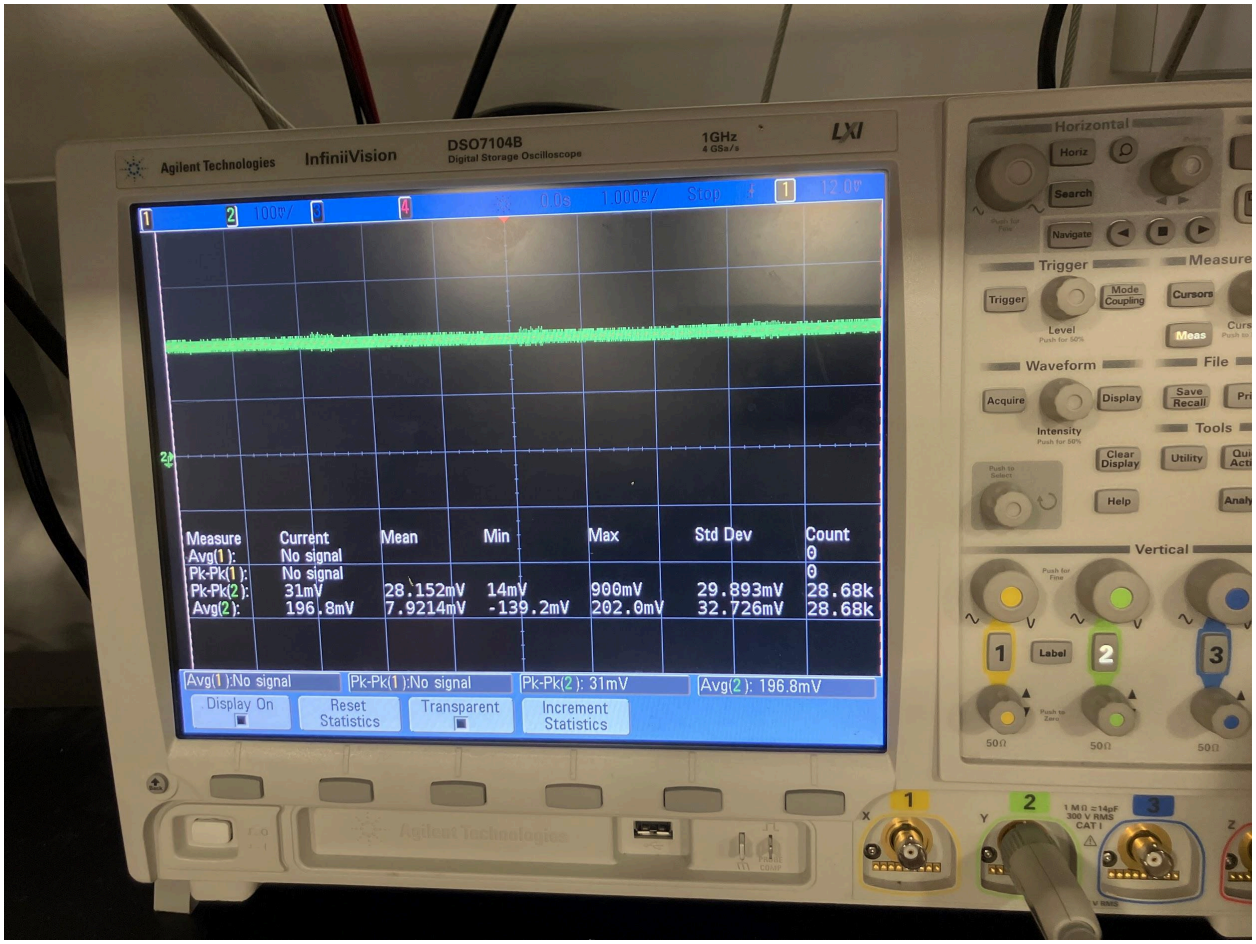

Measure Current Mean Min Max Std Dev Count
Avg(1): No signal 0
Pk-Pk(1): No signal 0
Pk-Pk(2): 26mV 70.311mV 13mV 3.800V 101.85mV 97.14k
Avg(2): 1.84mV 24.177mV -1.5570V 1.9960V 182.49mV 97.14k
Avg(1):No signal
Pk-Pk(1):No signal
Pk-Pk(2): 26mV
Avg(2): 1.84mV
Display On
Reset Statistics
Transparent
Increment Statistics

2. With 0.9 ohm

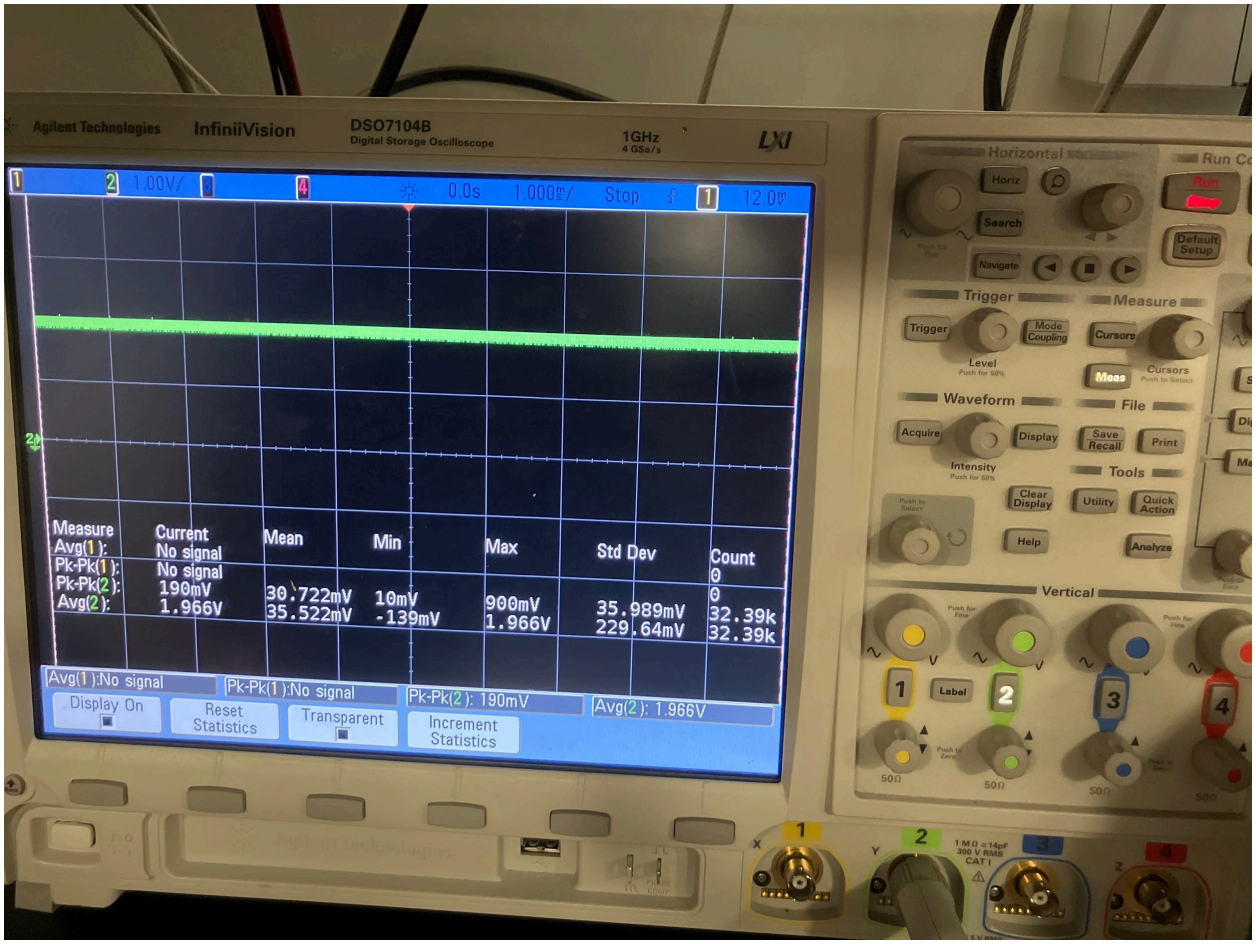
Open (only v+v-)



Short (+ to V+ I+; - to V- I-)


Agilent Technologies
InfiniiVision
DSO7104B
Digital Storage Oscilloscope
1GHz
4 GSa/s
LXI
Horizontal
Horiz
Search
Navigate
Trigger
Measure
Trigger
Mode Coupling
Cursors
Level
Meas
Waveform
File
Acquire
Display
Save Recall
Intensity
Tools
Clear Display
Utility
Help
Vertical
Label
50Ω
Measure Current Mean Min Max Std Dev Count
Avg(1): No signal 0
Pk-Pk(1): No signal 0
Pk-Pk(2): 31mV 28.152mV 14mV 900mV 29.893mV 28.68k
Avg(2): 196.8mV 7.9214mV -139.2mV 202.0mV 32.726mV 28.68k
Avg(1):No signal
Pk-Pk(1):No signal
Pk-Pk(2): 31mV
Avg(2): 196.8mV
Display On
Reset Statistics
Transparent
Increment Statistics

3. With 10 ohm


Agilent Technologies
InfiniiVision
DSO7104B
Digital Storage Oscilloscope
1GHz
4 GSa/s
LXI
1.00V/
0.0s
1.000ns/
Stop
12.0ns
Measure
Current
Mean
Min
Max
Std Dev
Count
Avg(1):
No signal
Pk-Pk(1):
No signal
0
Pk-Pk(2):
190mV
30.722mV
10mV
900mV
35.989mV
0
Avg(2):
1.966V
35.522mV
-139mV
1.966V
229.64mV
32.39k
32.39k
Avg(1):No signal
Pk-Pk(1):No signal
Pk-Pk(2): 190mV
Avg(2): 1.966V
Display On
Reset Statistics
Transparent
Increment Statistics
Horizontal
Horiz
Search
Navigate
Default Setup
Trigger
Measure
Trigger
Level
Mode Coupling
Cursors
Meas
Waveform
File
Acquire
Intensity
Display
Save Recall
Print
Tools
Clear Display
Utility
Quick Action
Help
Analyze
Vertical
Label
50Ω