

WIDEBAND AMPLIFIER WITH AUTOMATIC GAIN CONTROL

EXPERIMENT AND DEMONSTRATION PART

I affirm that I have not given or received any unauthorized help on this report and that this work is my own.



PCB Design phase:

As required in the Design Phase section, the PDF files of the DipTrace schematic and PCB designs have been uploaded and are presented below:

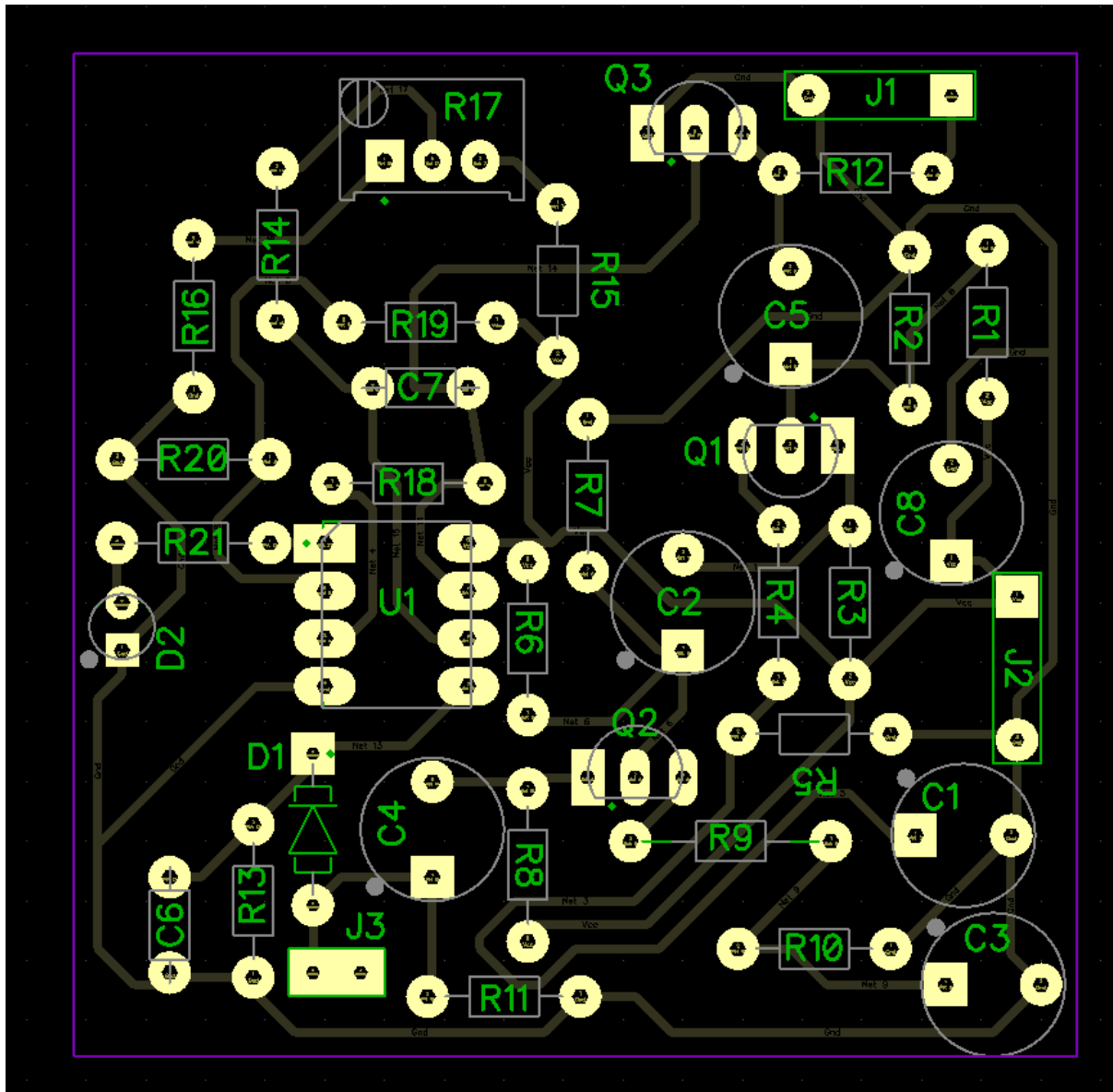


Figure 1 PCB Design of the designed circuit

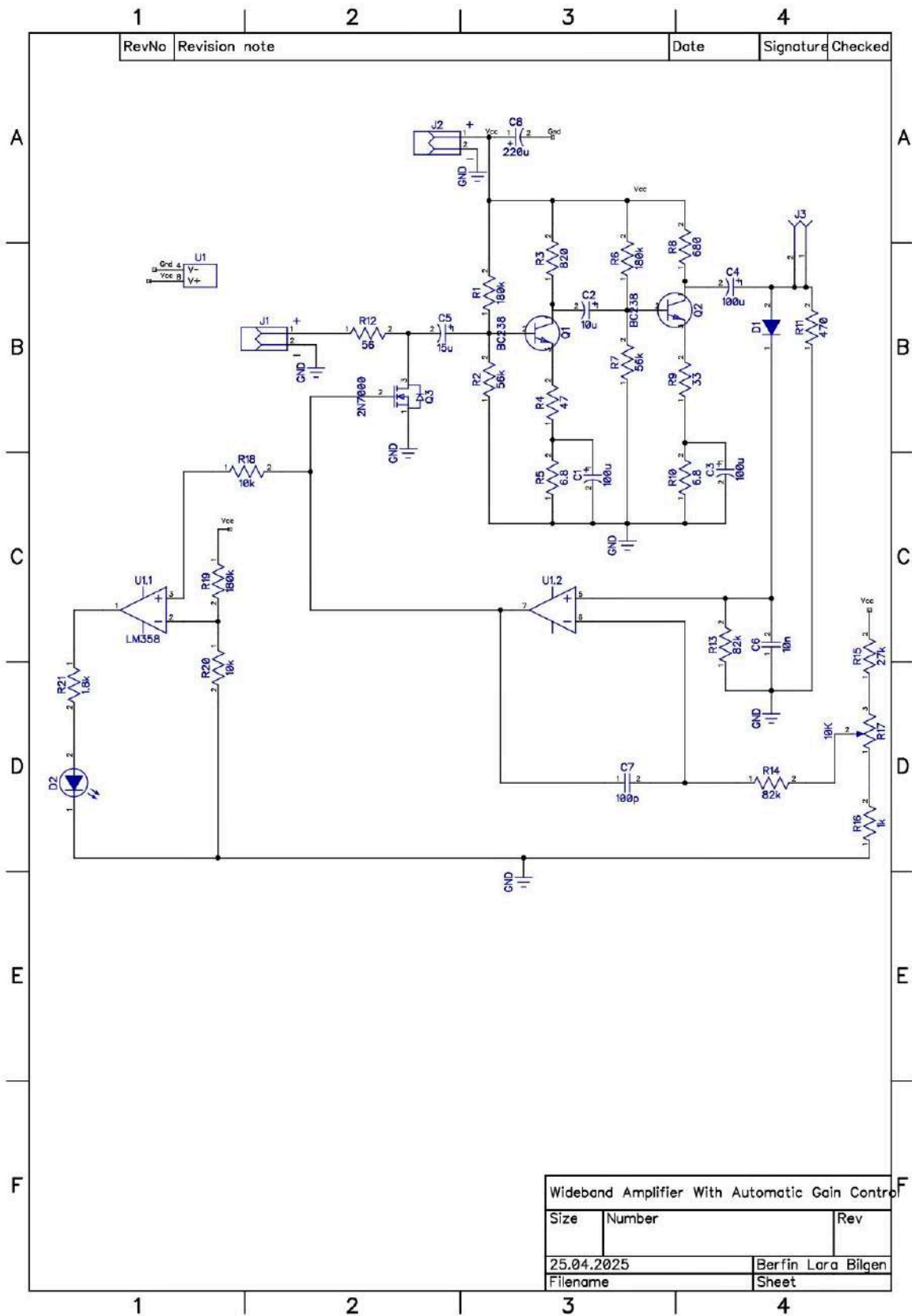


Figure 2 Diptrace schematic of the circuit

After testing the circuit on a breadboard and making the necessary adjustments, the finalized working circuit was implemented on a PCB. The corresponding figure is provided below.

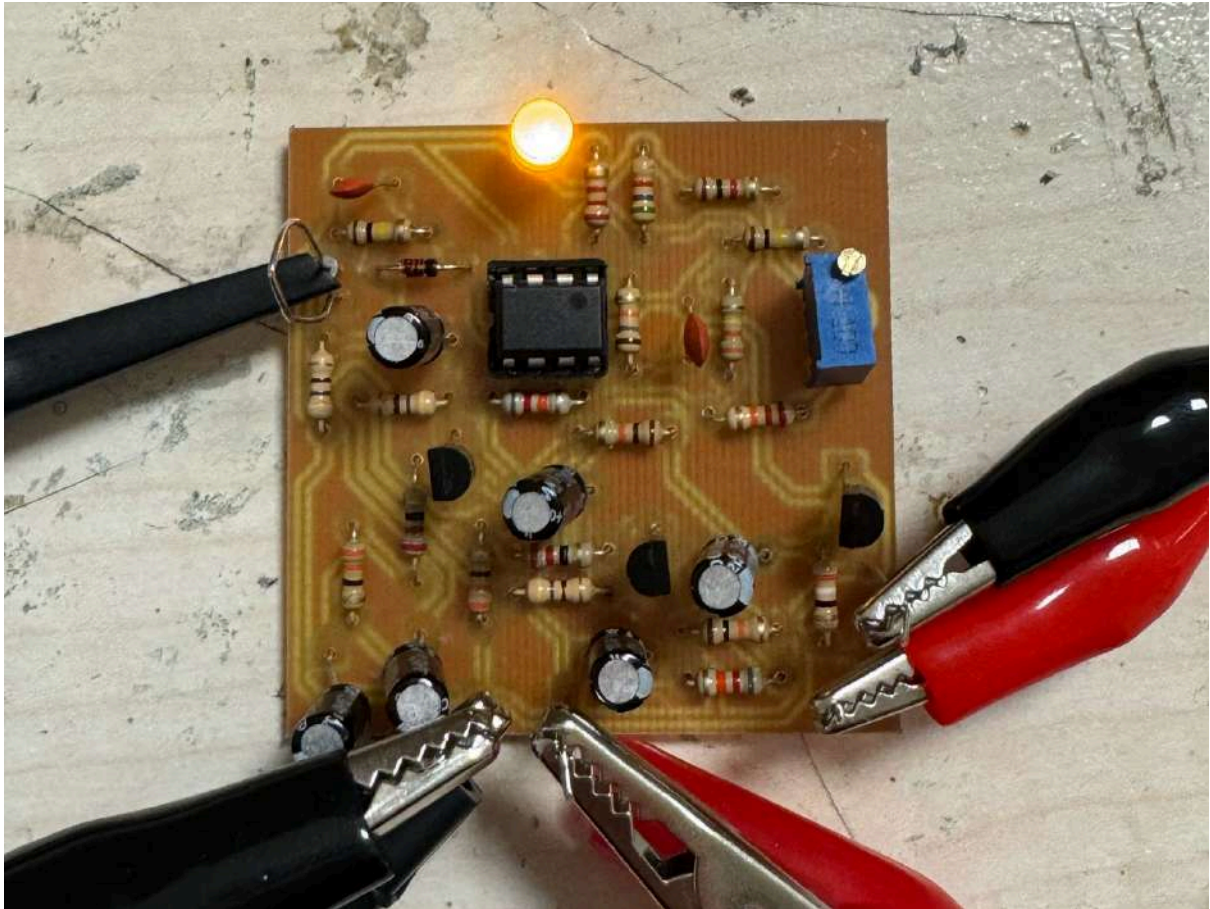


Figure3 PCB after Implementation

In order to show the solders, back of the pcb is also added on figures, is as follows:

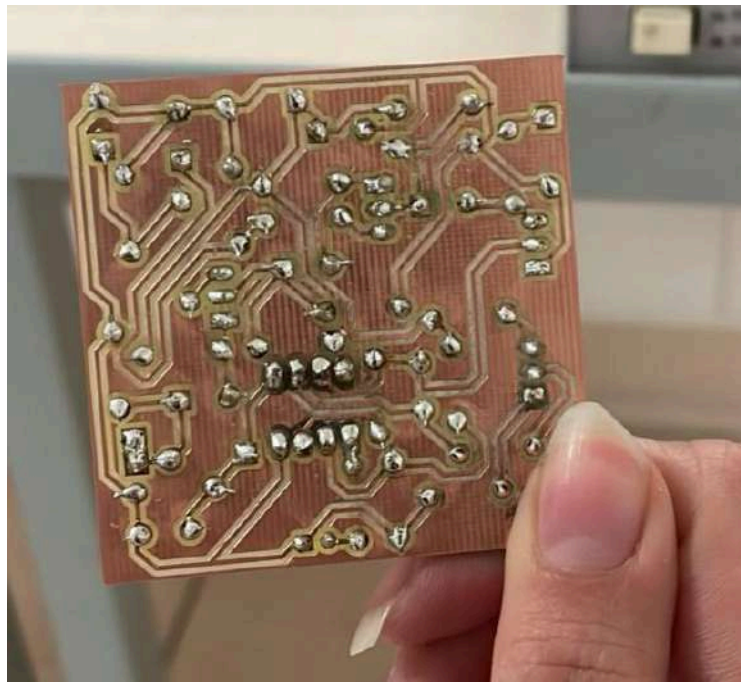


Figure 4 Back of the PCB

Requirements:

1. The peak output voltage is $V_{outp}=1\pm0.1$ V undistorted sinusoidal when the peak input voltage is between $V_{inp}=0.01$ V and 0.1 V, while the frequency is between 200 kHz and 2 MHz:

For this requirement, for both 200kHz and 2MHz, input voltage v_{inp} changed from 10mV and 100mV with 10mV step size and the output youtube observed, figures are the following:

At $f = 200\text{kHz}$

$v_{inp} = 10\text{mV}$

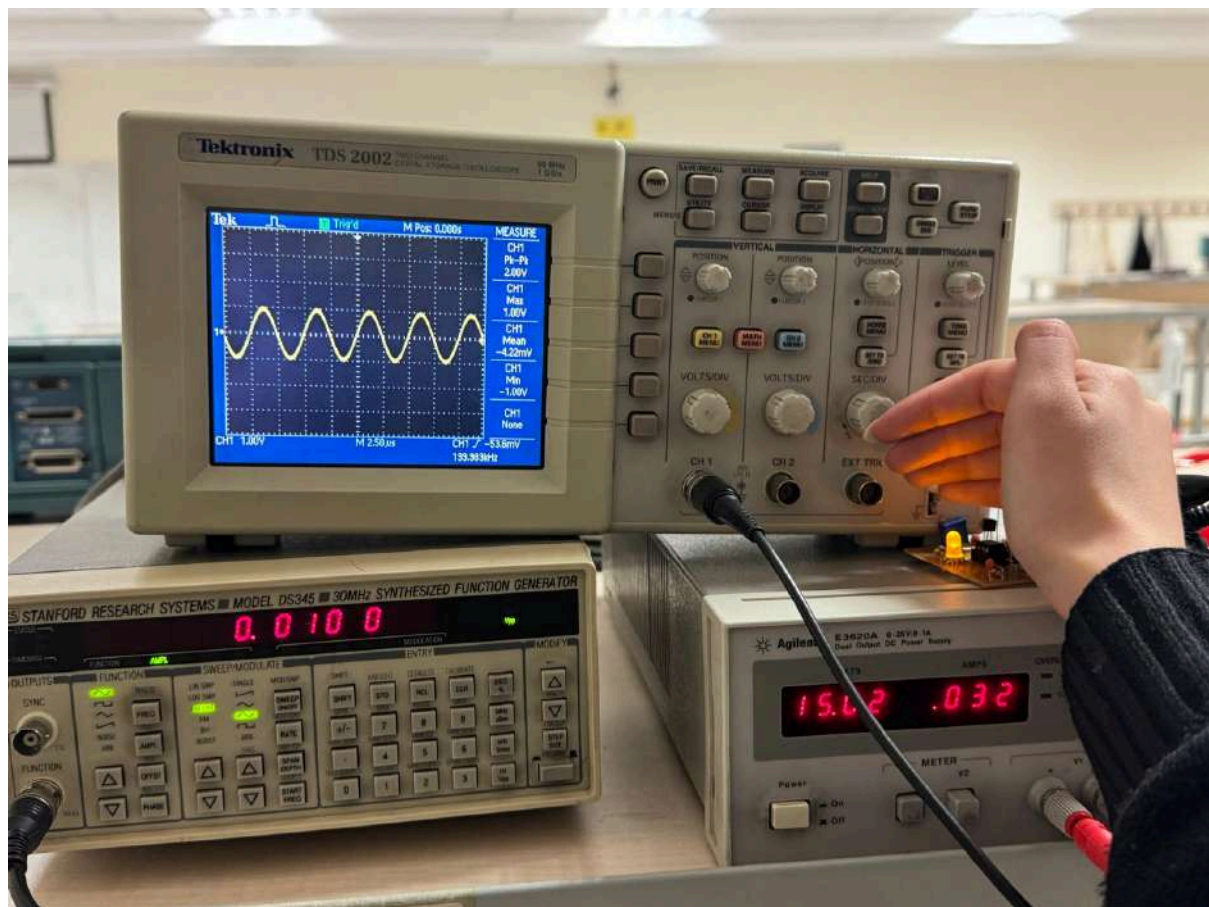


Figure 5 $f=200\text{kHz}$ and $v_{inp} = 10\text{mV}$

Output V_{outp} is exactly 1V when f is 200kHz and v_{inp} is 10mV.

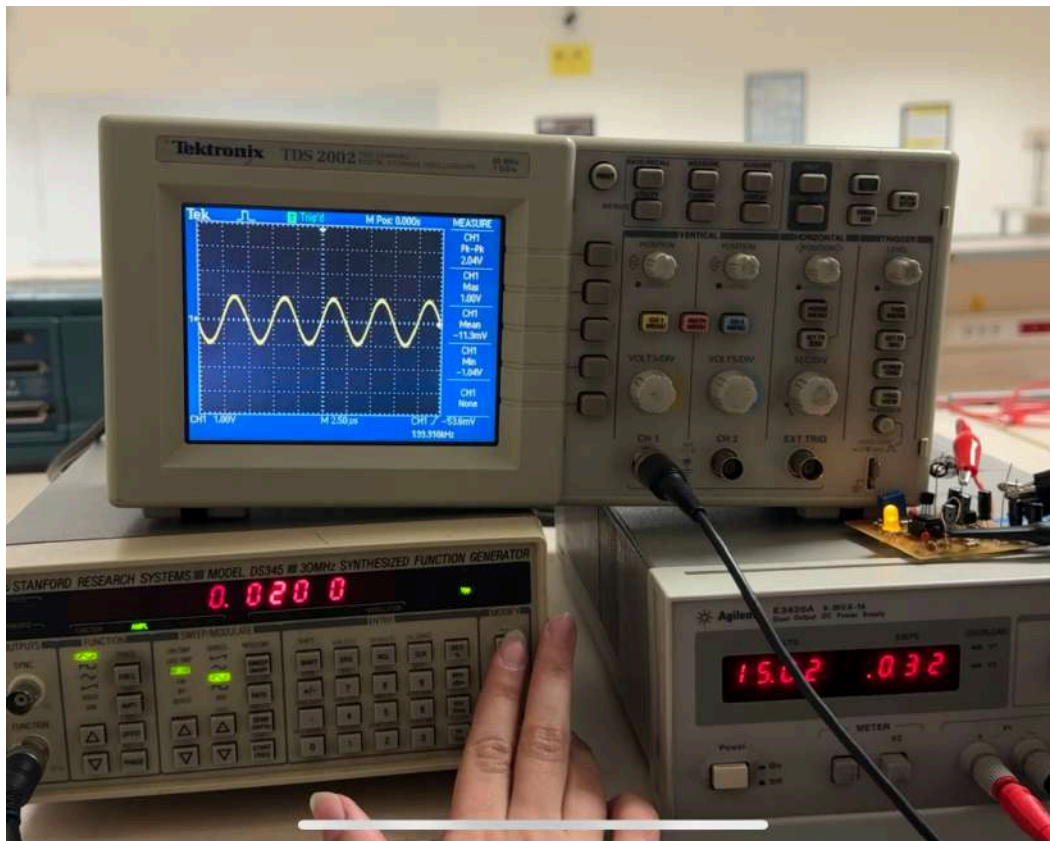


Figure 6 vin at 20mV

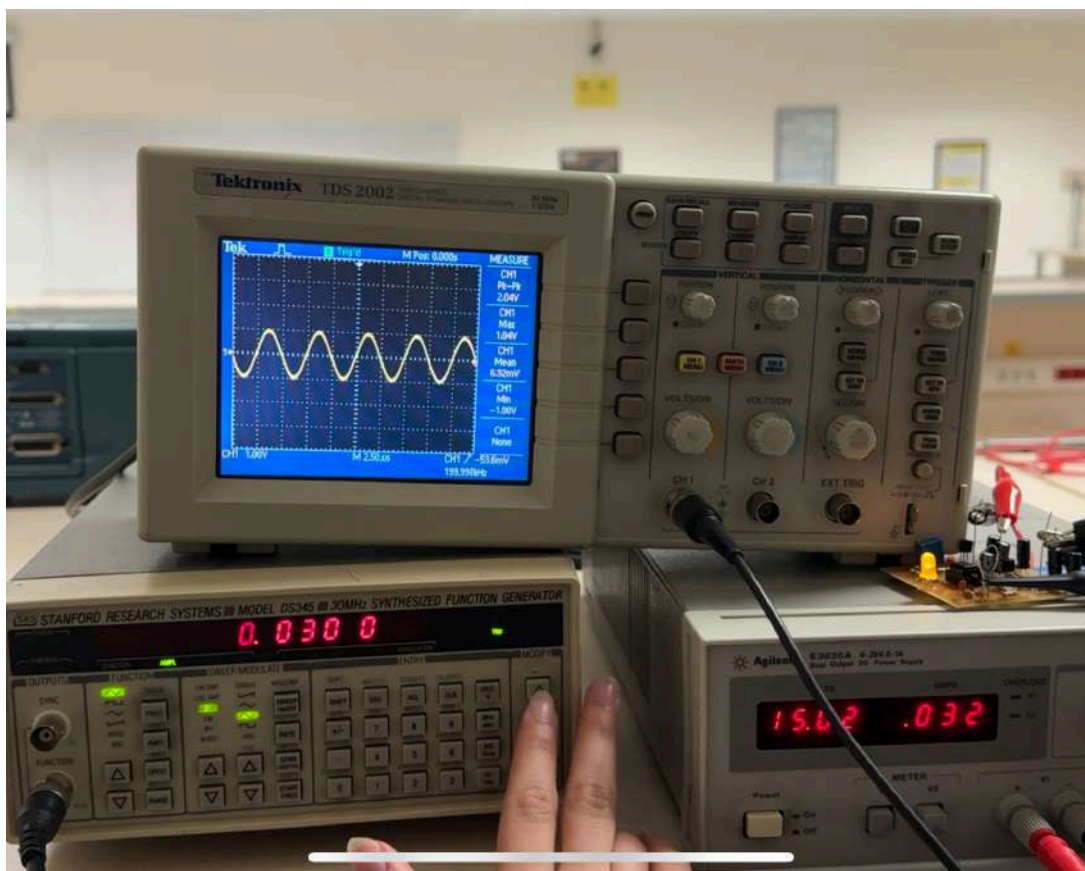


Figure 7 vin at 30mV

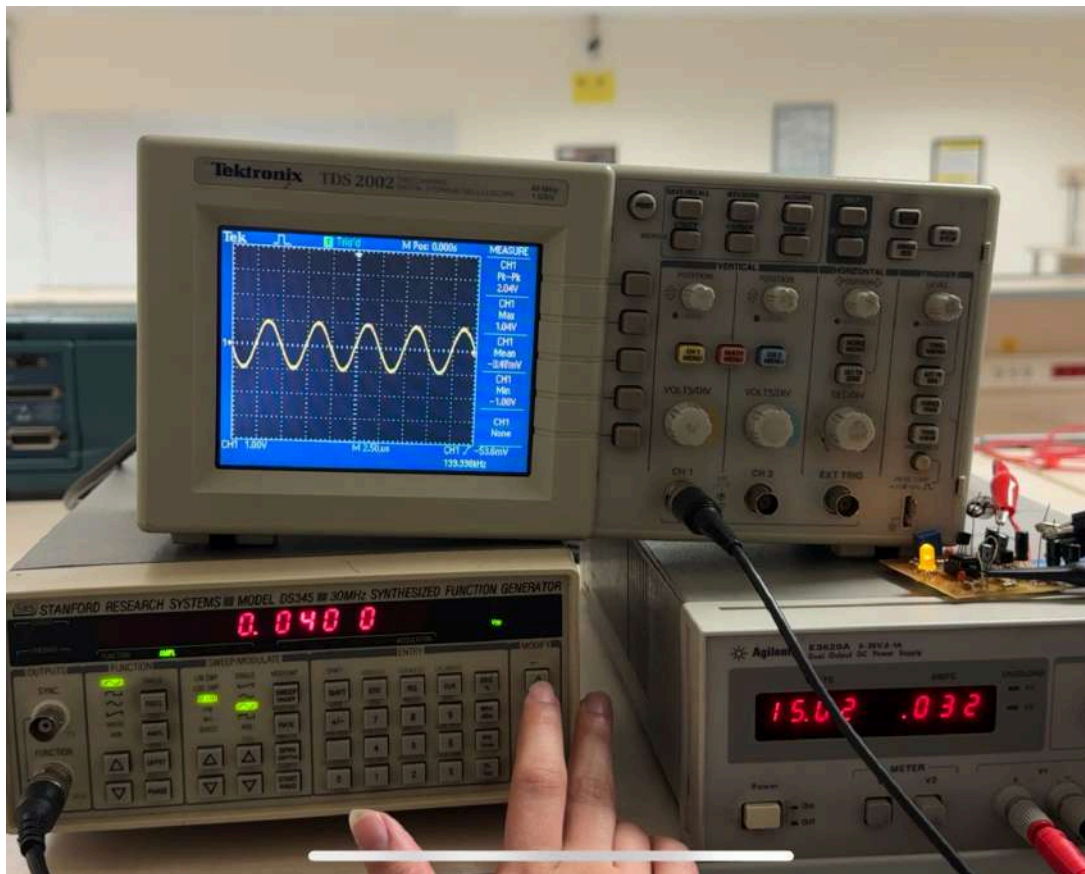


Figure 8 vin at 40mV

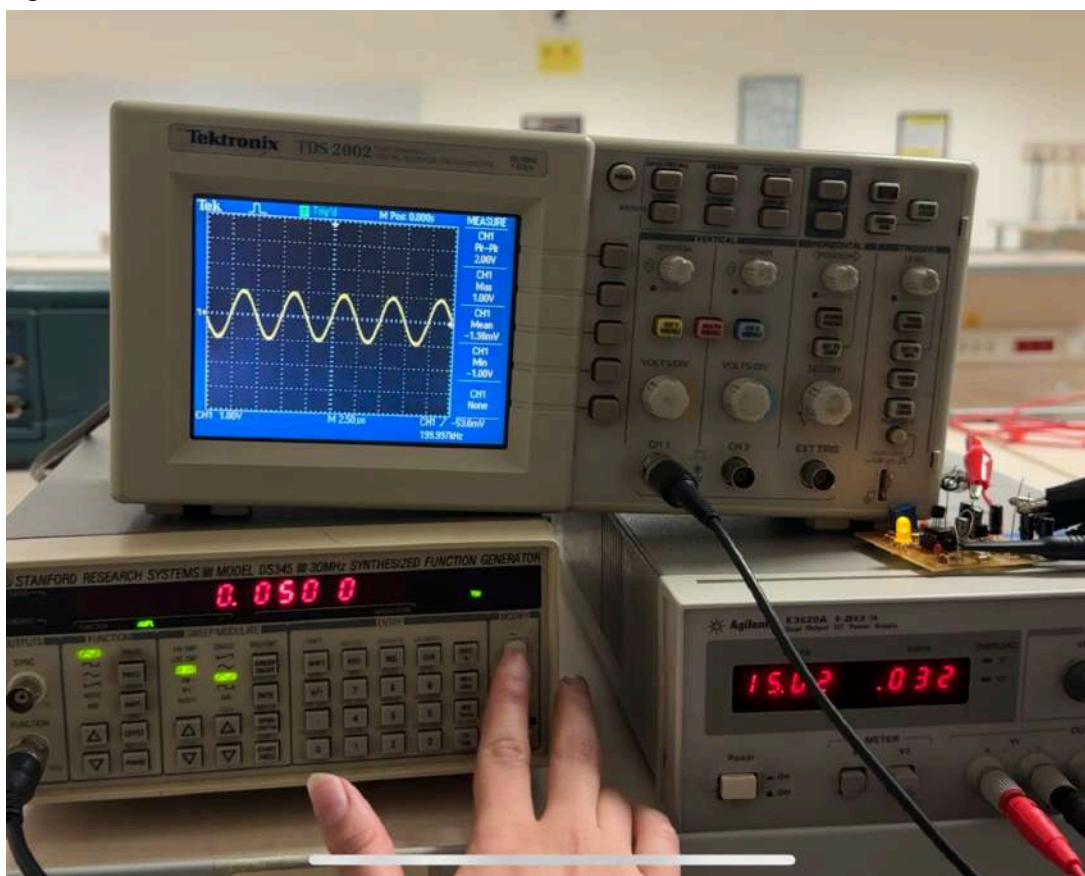


Figure 9 vin at 50mV

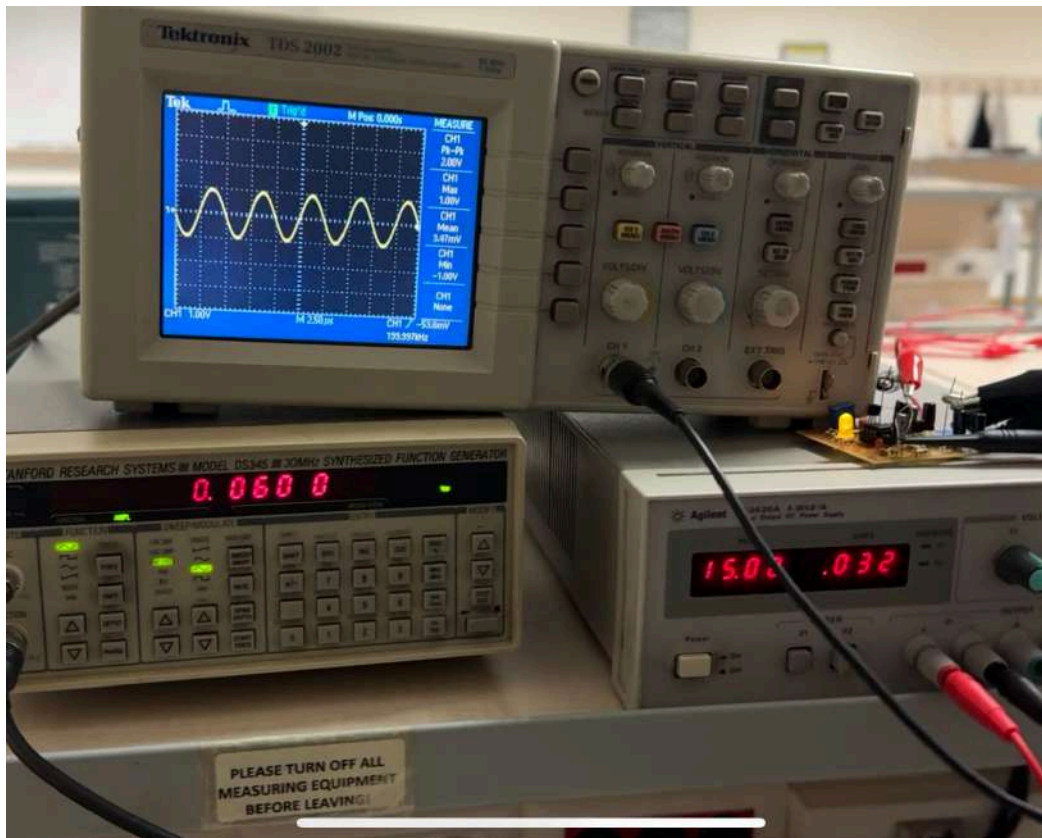


Figure 10 vin at 60mV

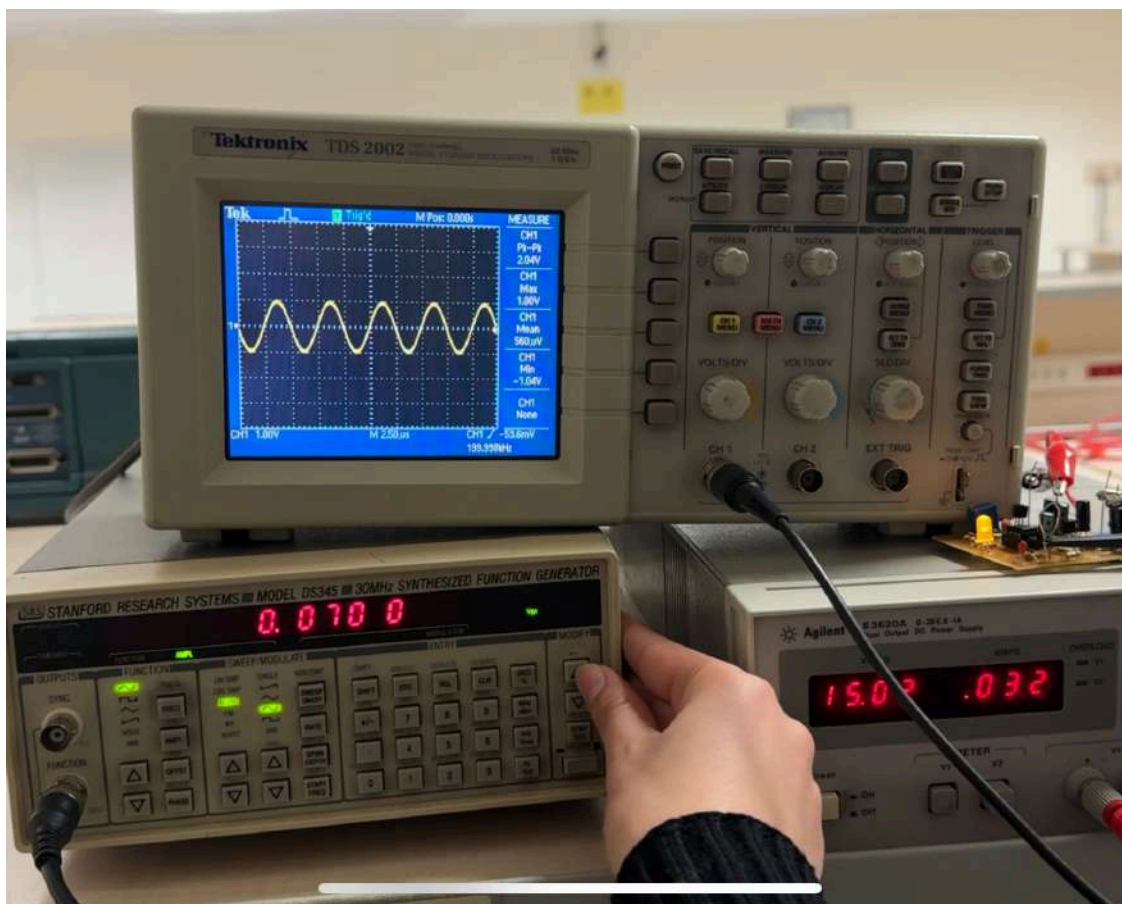


Figure 11 vin at 70mV

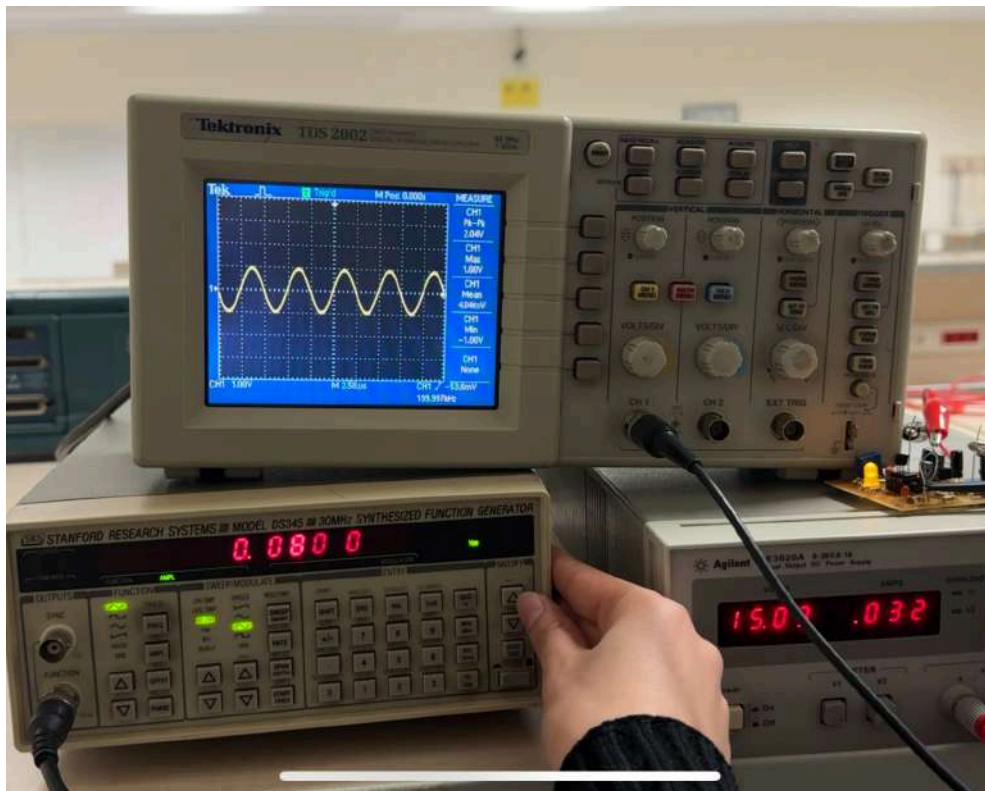


Figure 12 v_{in} at 80mV

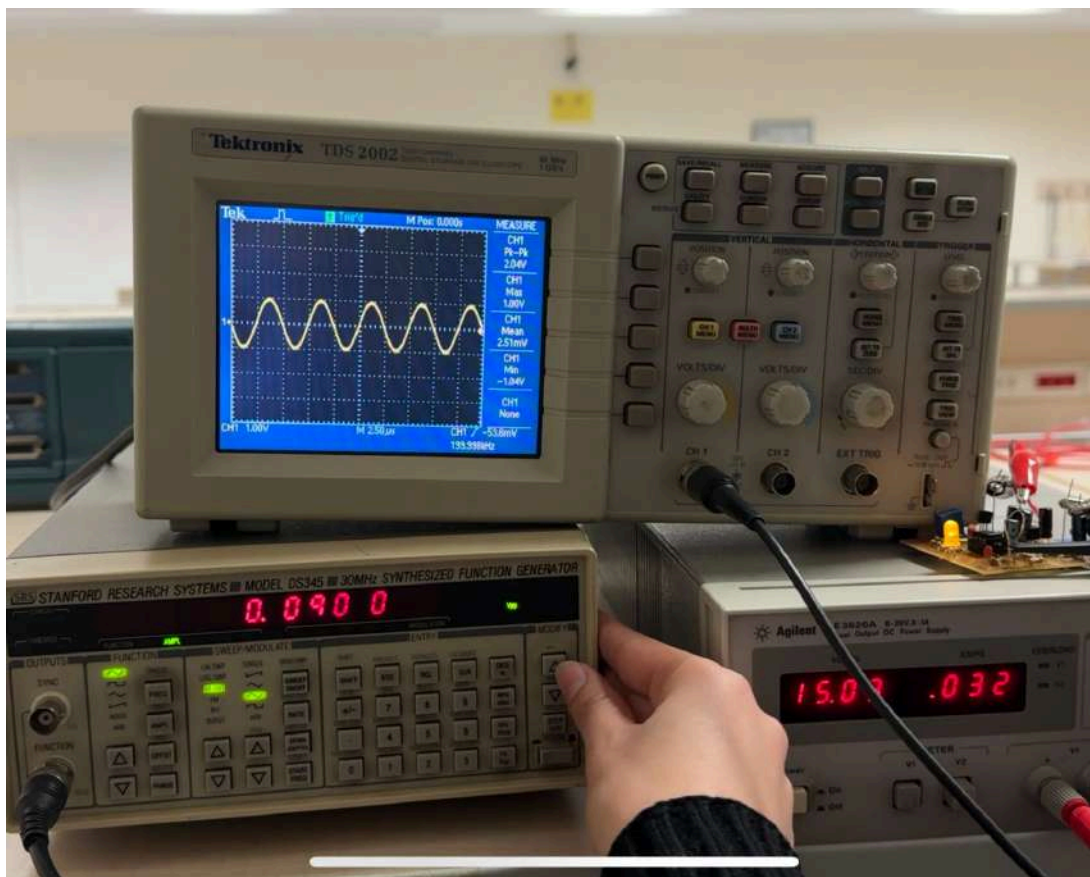


Figure 13 v_{in} at 90mV

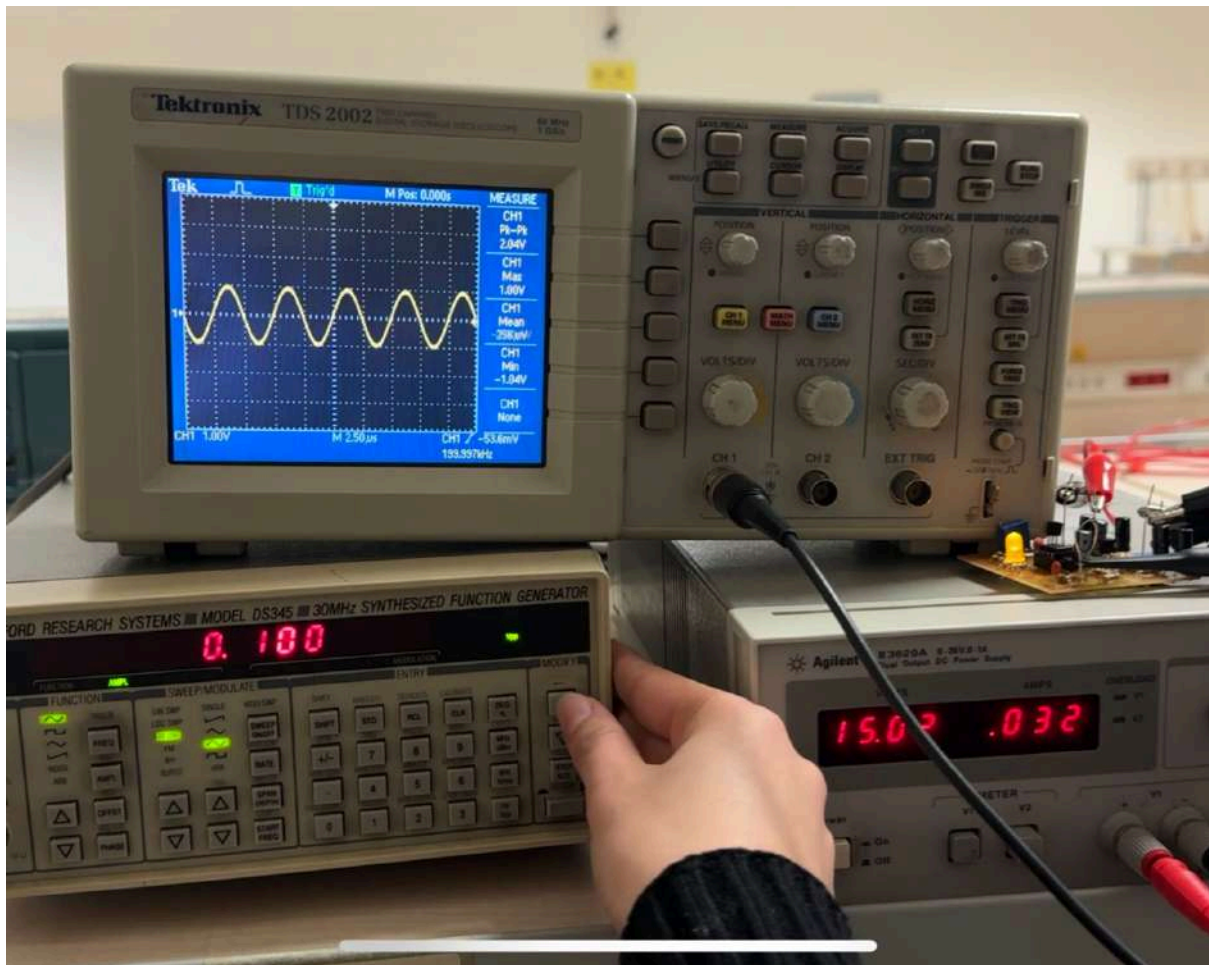


Figure 14 v_{in} at 100mV

Output V_{outp} is exactly 1V when f is 200kHz and v_{inp} is 100mV.

At $f = 2\text{MHz}$:

Output V_{outp} is 1.04V when f is 2MHz and v_{inp} is 10mV, is demonstrated on the following figure.

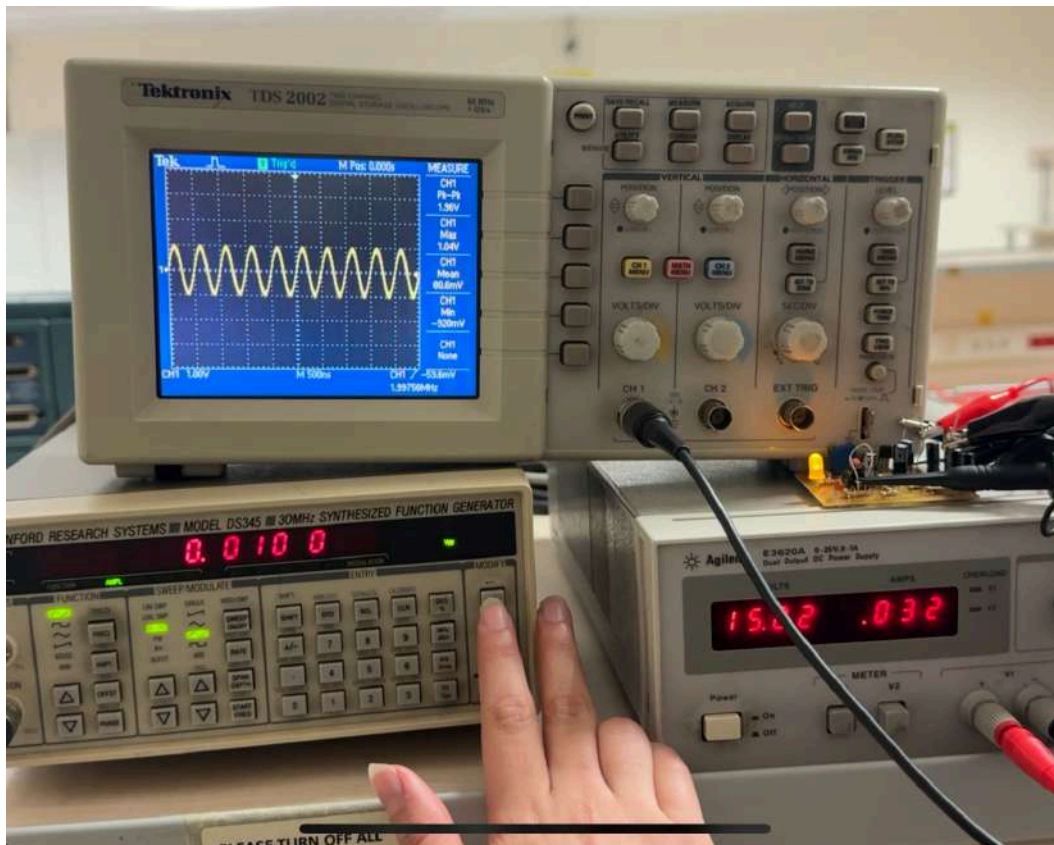


Figure 15 vinp at 10mV

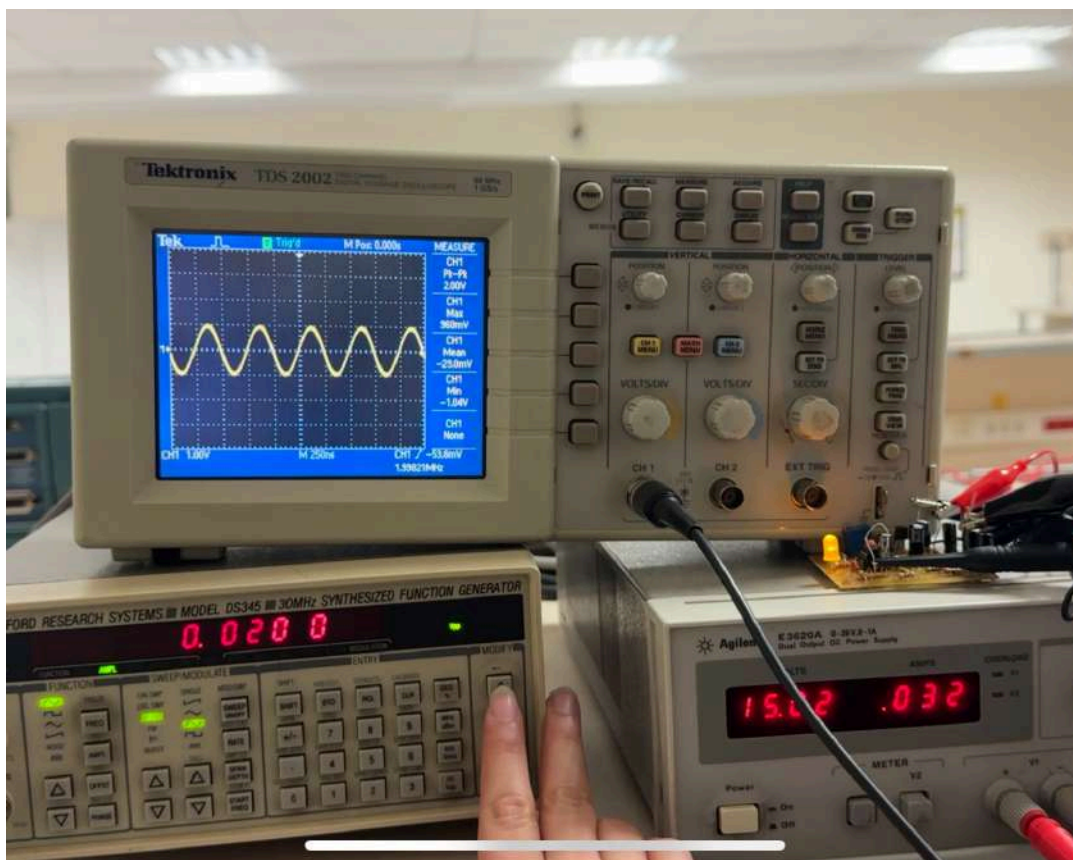


Figure 16 vinp at 20mV

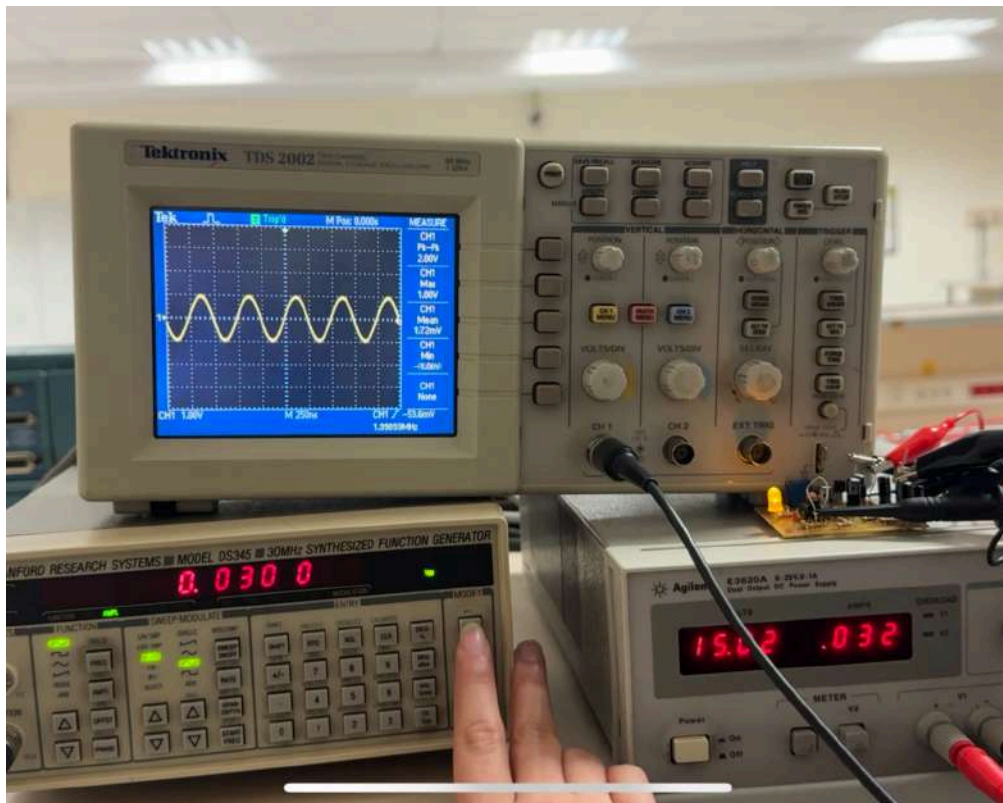


Figure 17 v_{inp} at 30mV

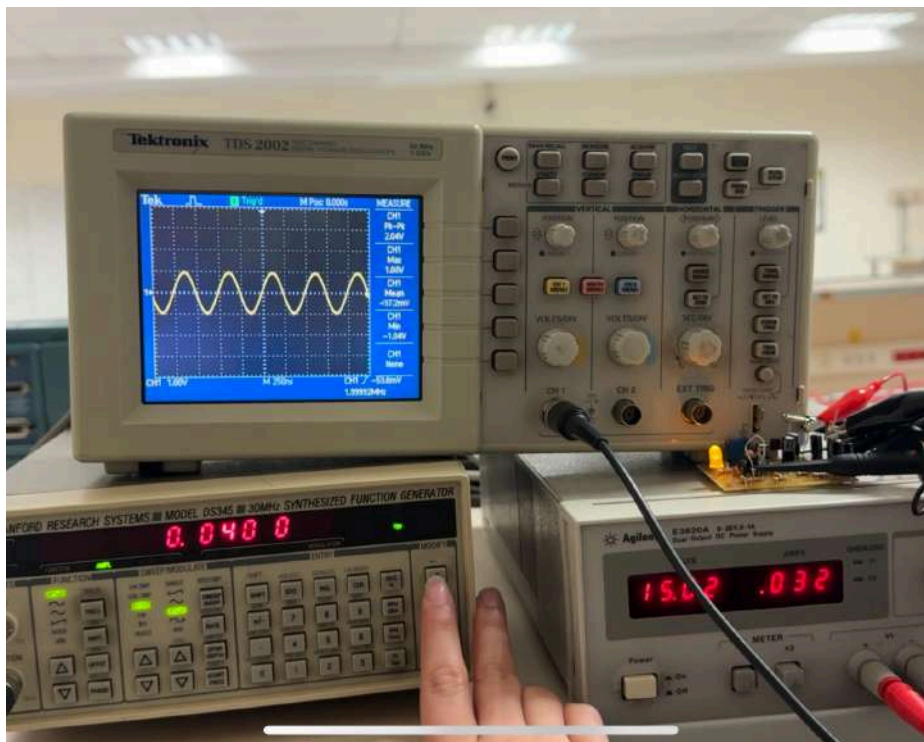


Figure 18 v_{inp} at 40mV

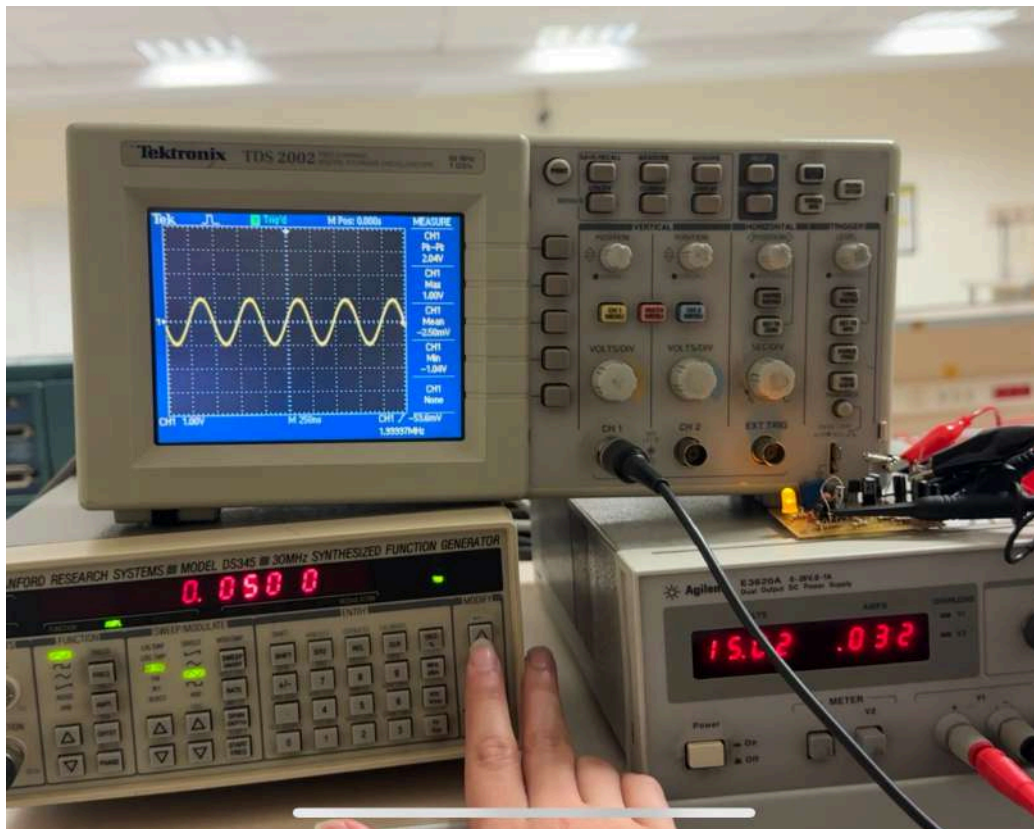


Figure 19 vinp at 50mV

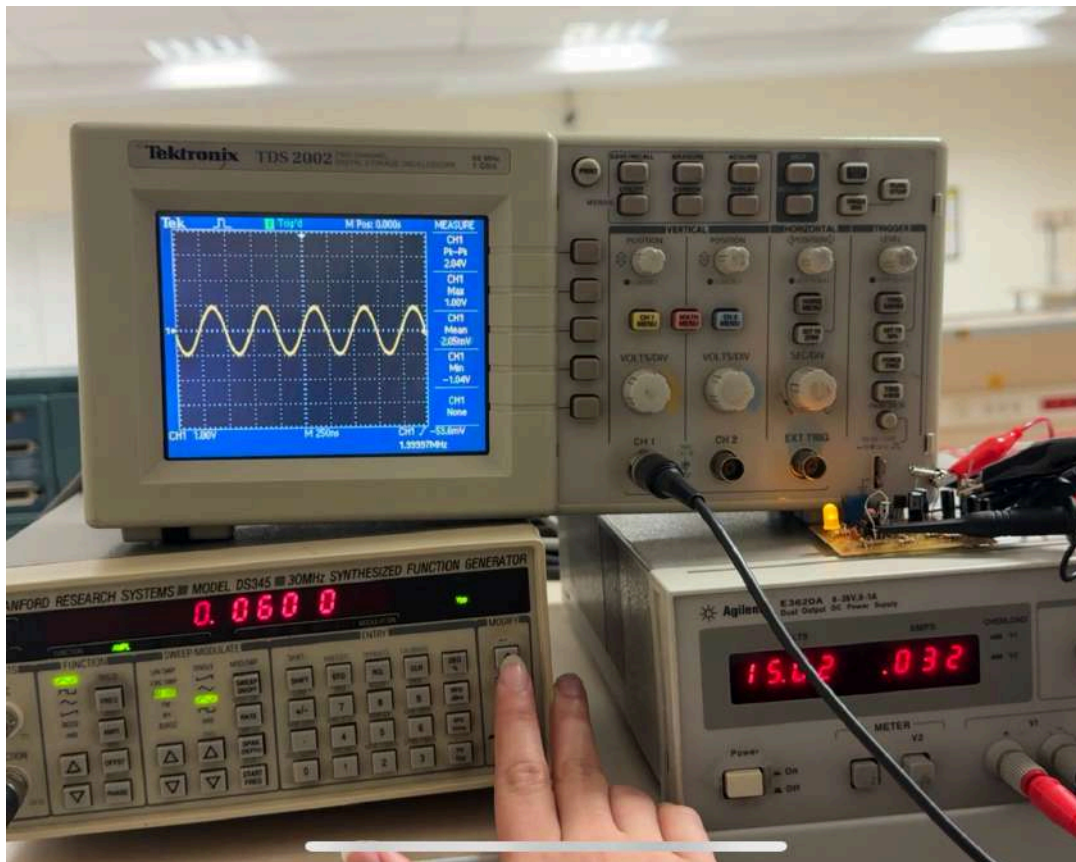


Figure 20 vinp at 60mV

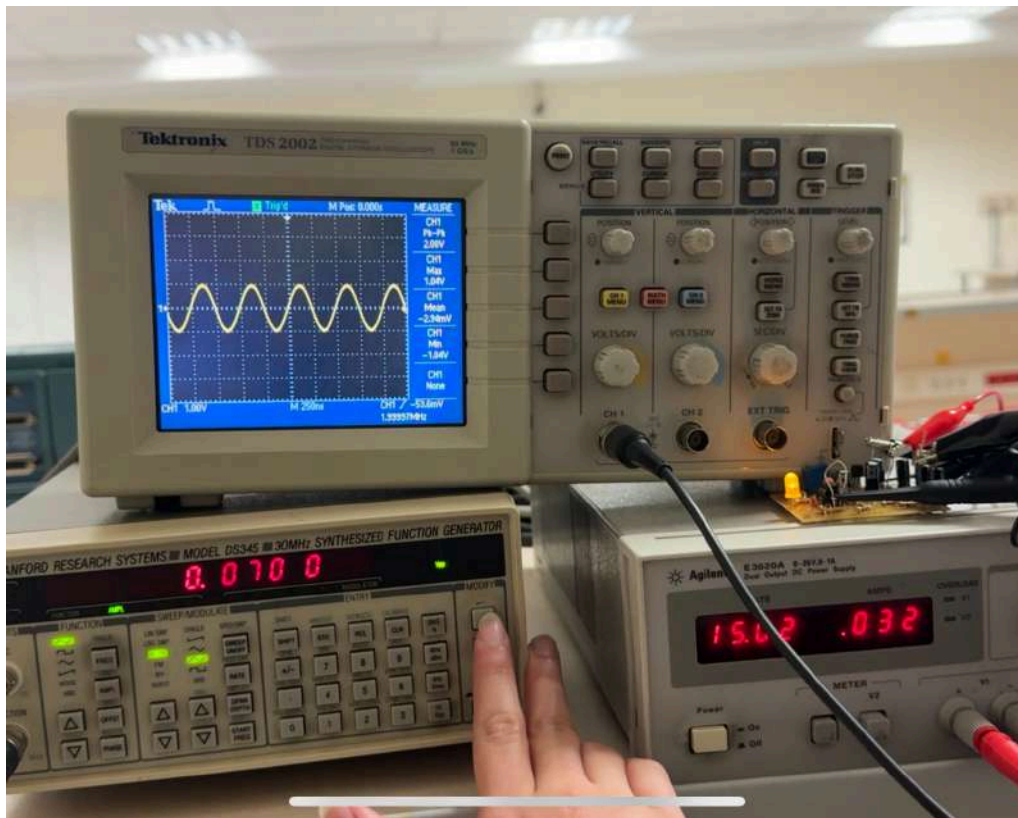


Figure 21 V_{in} at 70mV

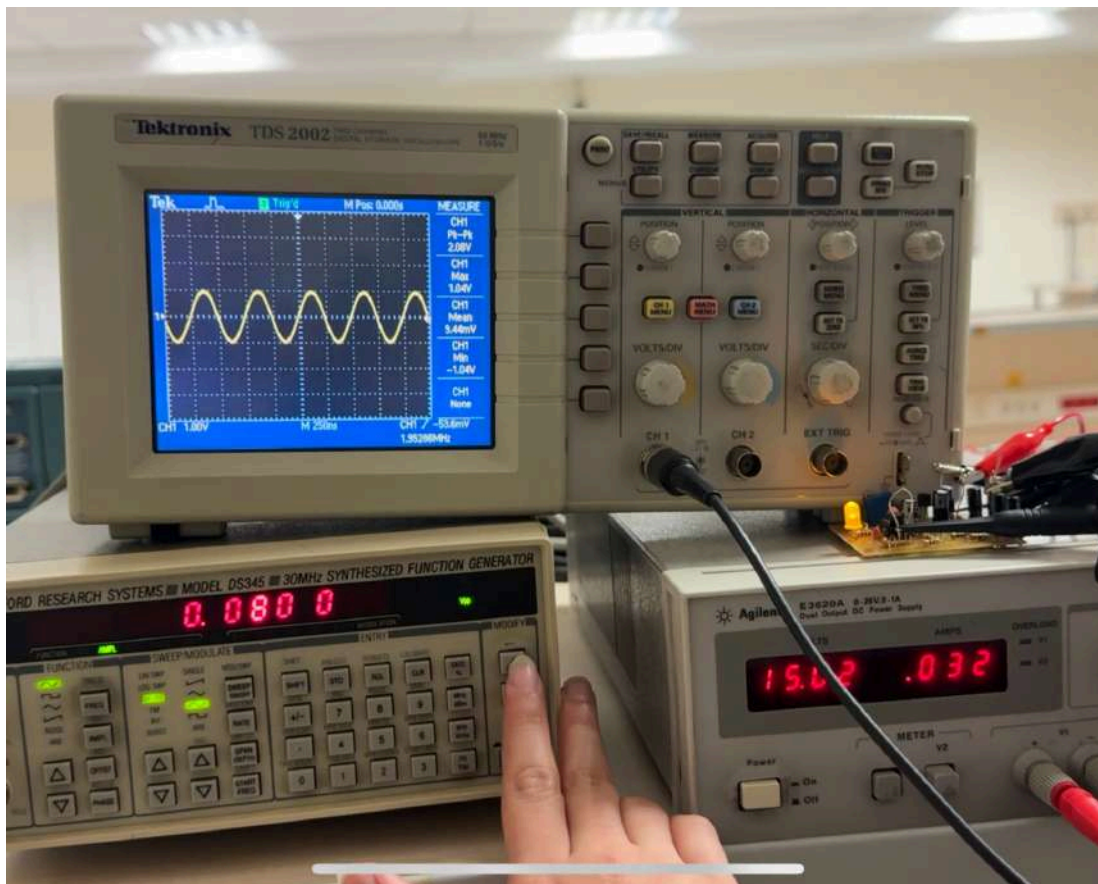


Figure 22 V_{in} at 80mV

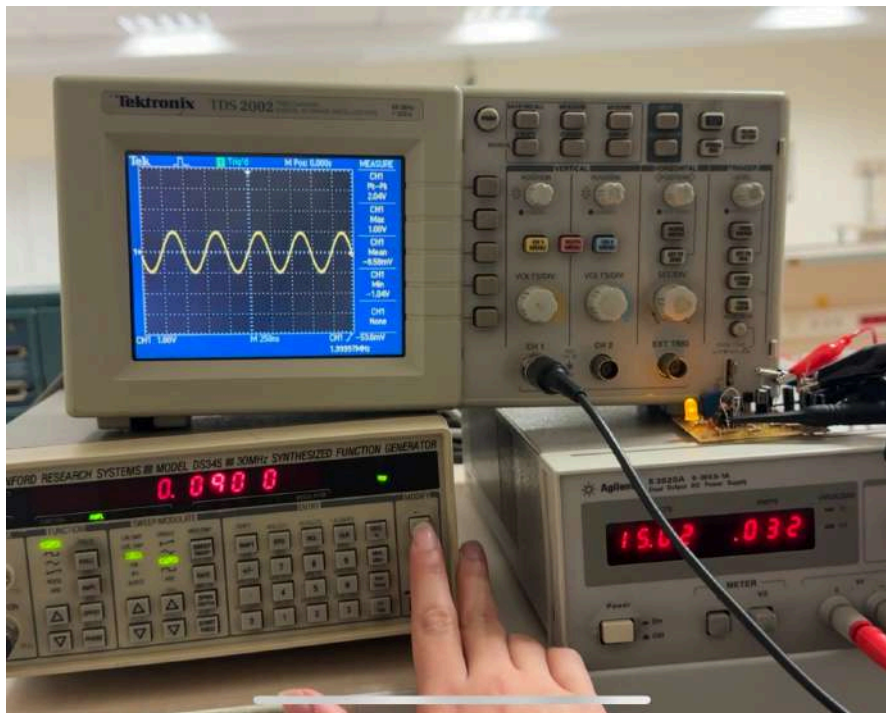


Figure 23 v_{inp} at 90mV

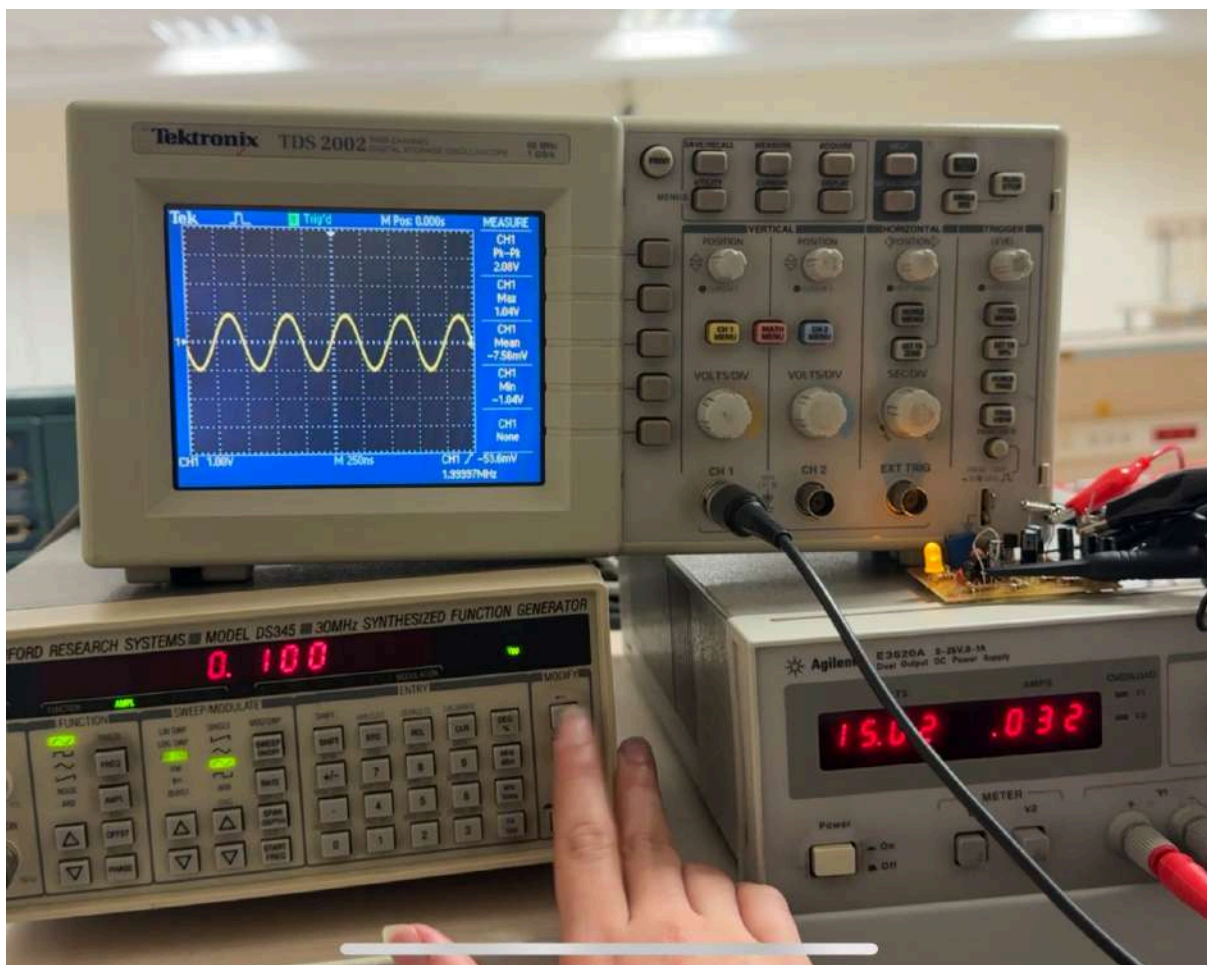


Figure 24 v_{inp} at 100mV

Output V_{out} is 1.04V when f is 2MHz and v_{inp} is 100mV.

2. The power supply current, I_{CC} , is less than 100mA:

It can be seen from the figure that the power supply current I_{CC} is less than 100mA at, in fact all conditions, the following figure $f=200\text{kHz}$ and $v_{inpp}=20\text{mV}$, is **32mA**.

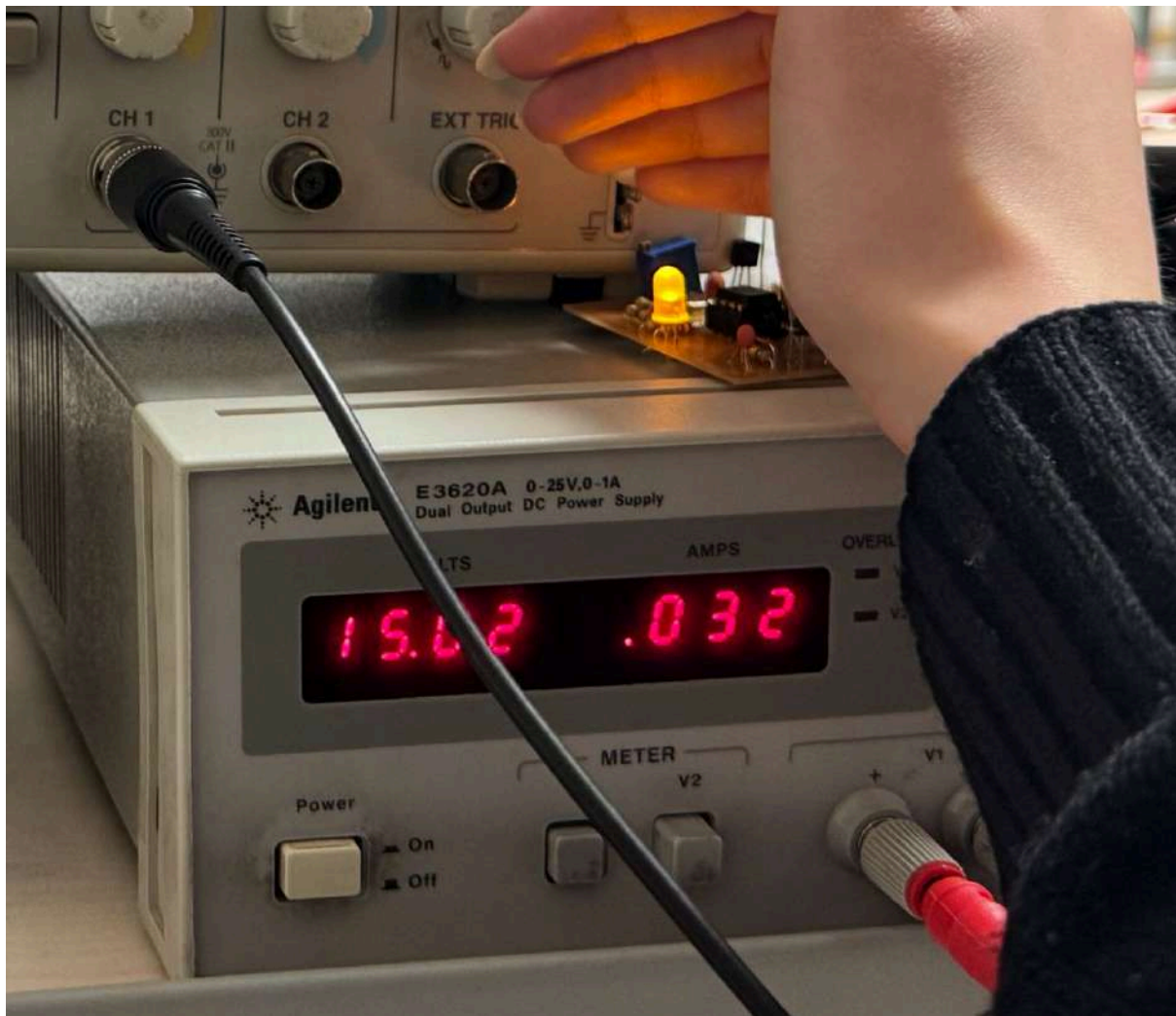


Figure 25 Power supply current is 32mA

3. LED turns ON when the peak output voltage is $V_{outp}=1\pm0.1\text{ V}$. It should turn off if the peak output is less than $V_{outp}<0.9\text{ V}$:

Since the minimum input voltage that the signal generator can produce is 10 mV and it is not possible to obtain a lower output by further reducing the input, the frequency was increased until the output voltage V_{outp} fell below 900 mV, thereby satisfying the criterion for the LED to turn off when $V_{outp}<0.9\text{ V}$.

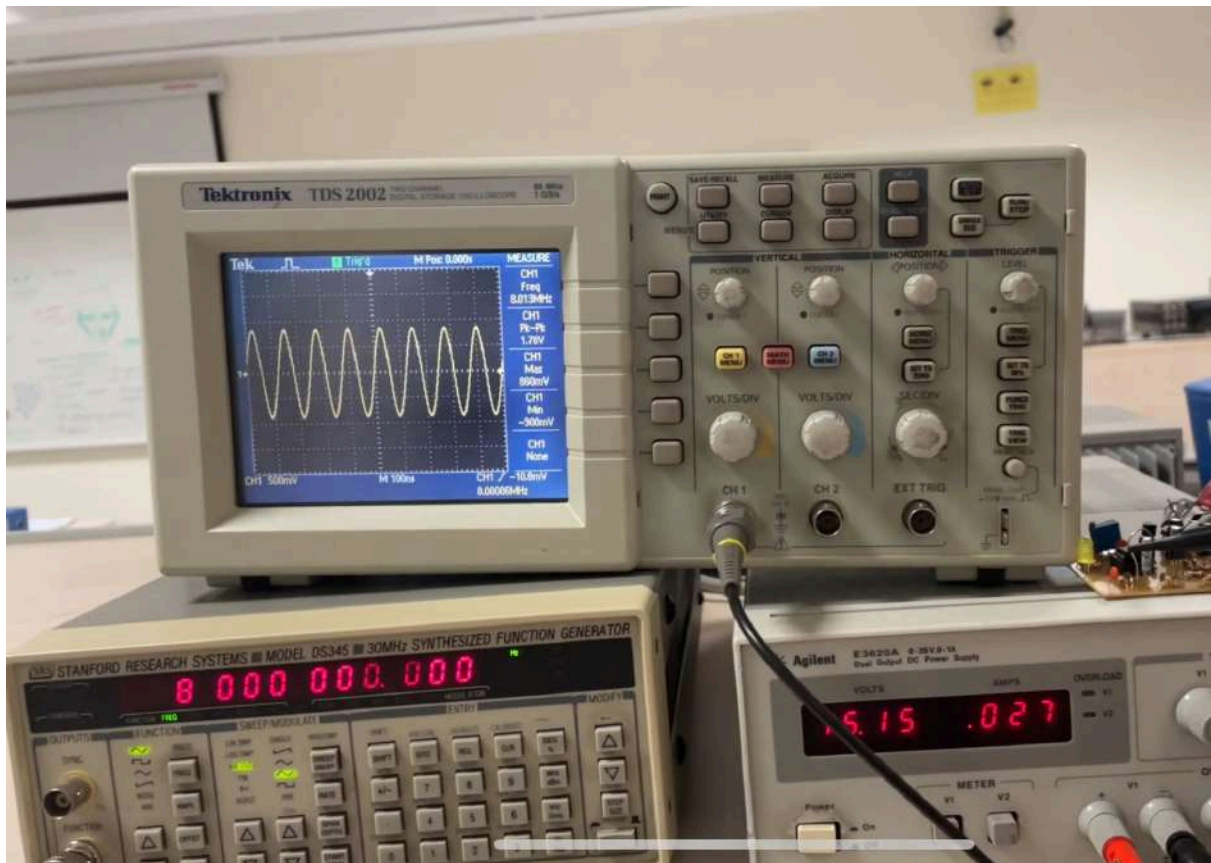


Figure 26 LED turning of at $V_{outp} < 0.9V$

At $f = 8\text{MHz}$, the output V_{outp} falls to 860mV (less than 900mV) which leads LED to turn off, LED is off in the figure as well.

Extra: Finding V_{inpmax} at $f = 200\text{kHz}$ and 2MHz :

In order to fill the chart, the values of V_{inpmax} 's which makes v_{outp} in the interval 1 ± 0.1 are found:

For $f = 200\text{kHz}$:

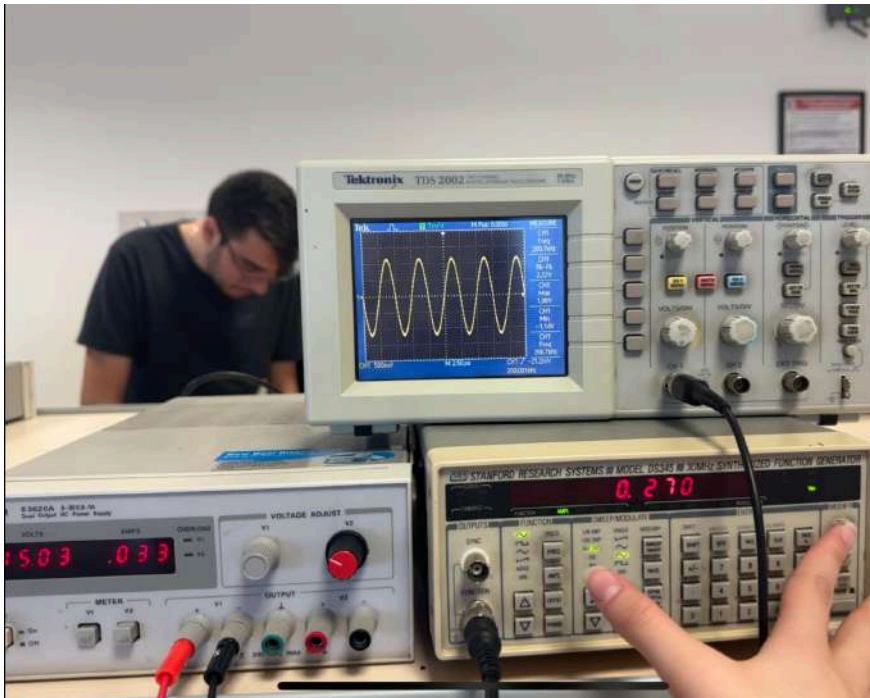


Figure 27 V_{inmax} for 200kHz

As seen in the figure, the maximum value of V_{inmax} for which V_{outp} still remains within the range of 1 ± 0.1 V is 270 mV.

For $f=2$ MHz:

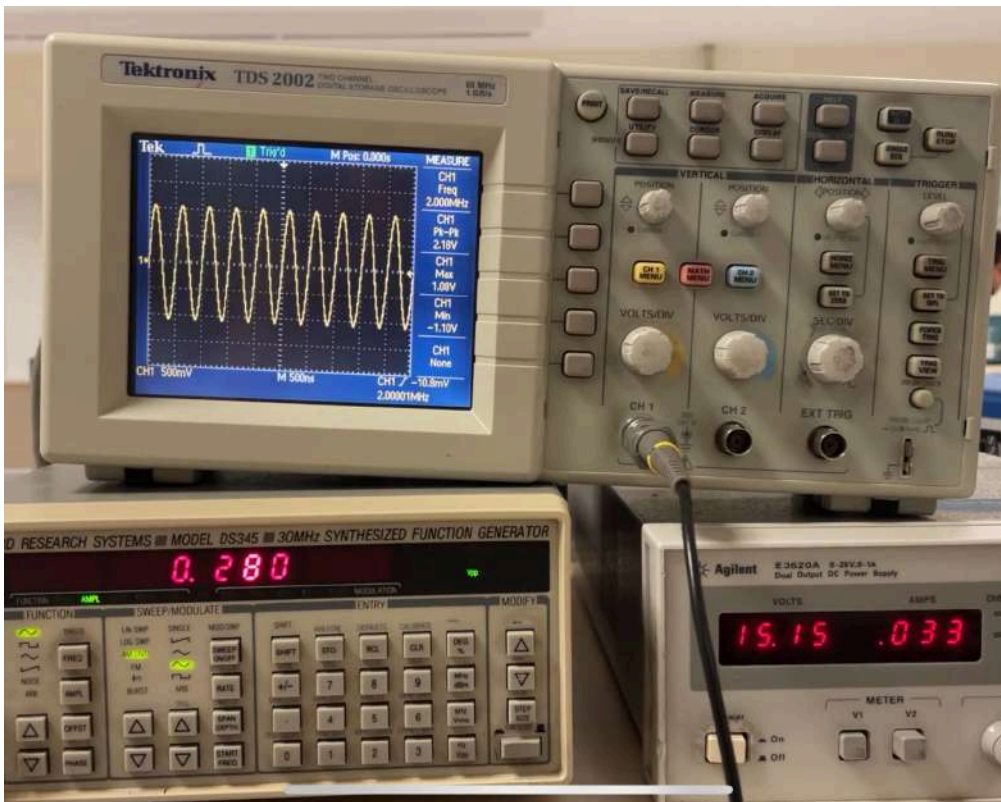


Figure 28 V_{inmax} for 2MHz

As seen in the figure, the maximum value of V_{inpmax} for which V_{outp} still remains within the range of 1 ± 0.1 V is **280 mV**.

Since the smallest signal provided by the signal generator is 10 mV, a value of 10 mV was used for V_{inpmin} .

The completed final version of the chart can be seen in the figure below:

	V_{inp} (mV)	V_{outp} (V)	LED ON/OFF	I_{CC} (mA)
0.2MHz	10	1.02 V	ON	32 mA
0.2MHz	$V_{inpmin} = 10$	1.02V	ON	32mA
0.2MHz	100	1.02 V	ON	32 mA
0.2MHz	$V_{inpmax} = 270$	1.10V	ON	33mA
2MHz	10	1.04V	ON	32mA
2MHz	$V_{inpmin} = 10$	1.02V	ON	32mA
2MHz	100	1.02V	ON	32mA
2MHz	$V_{inpmax} = 280$	1.07V	ON	33mA

Figure 29 Completed Chart