

AMSAT PROJECT



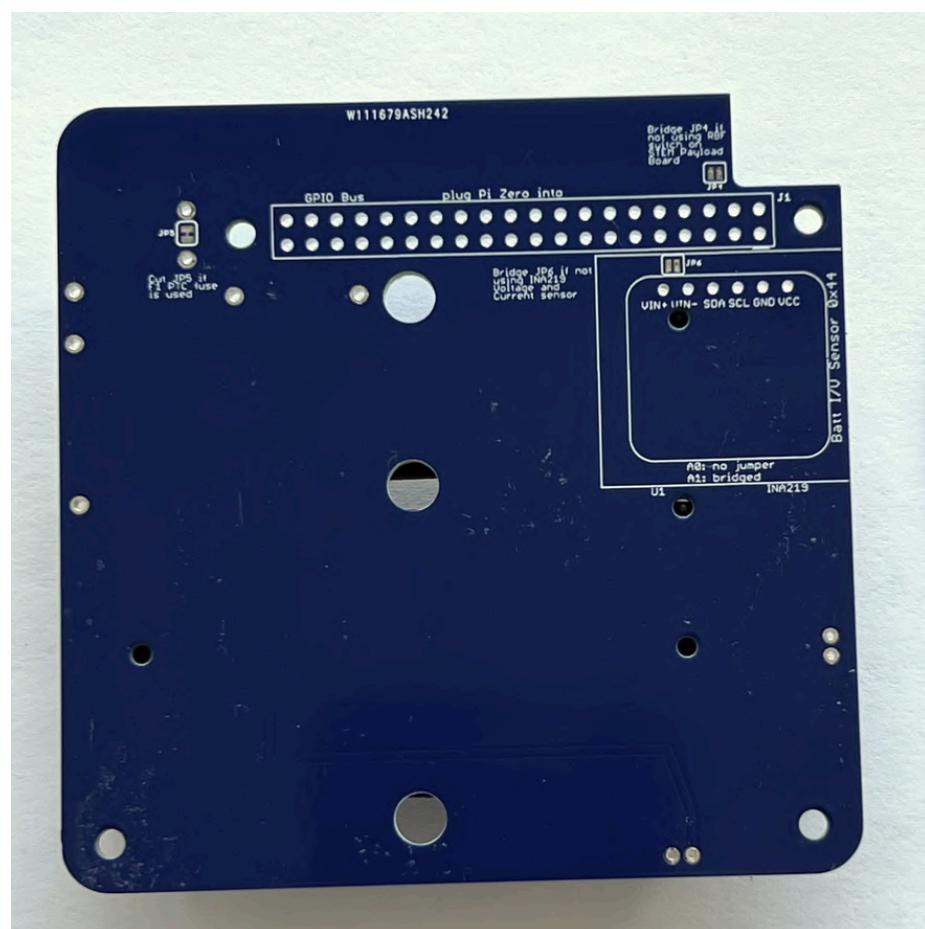
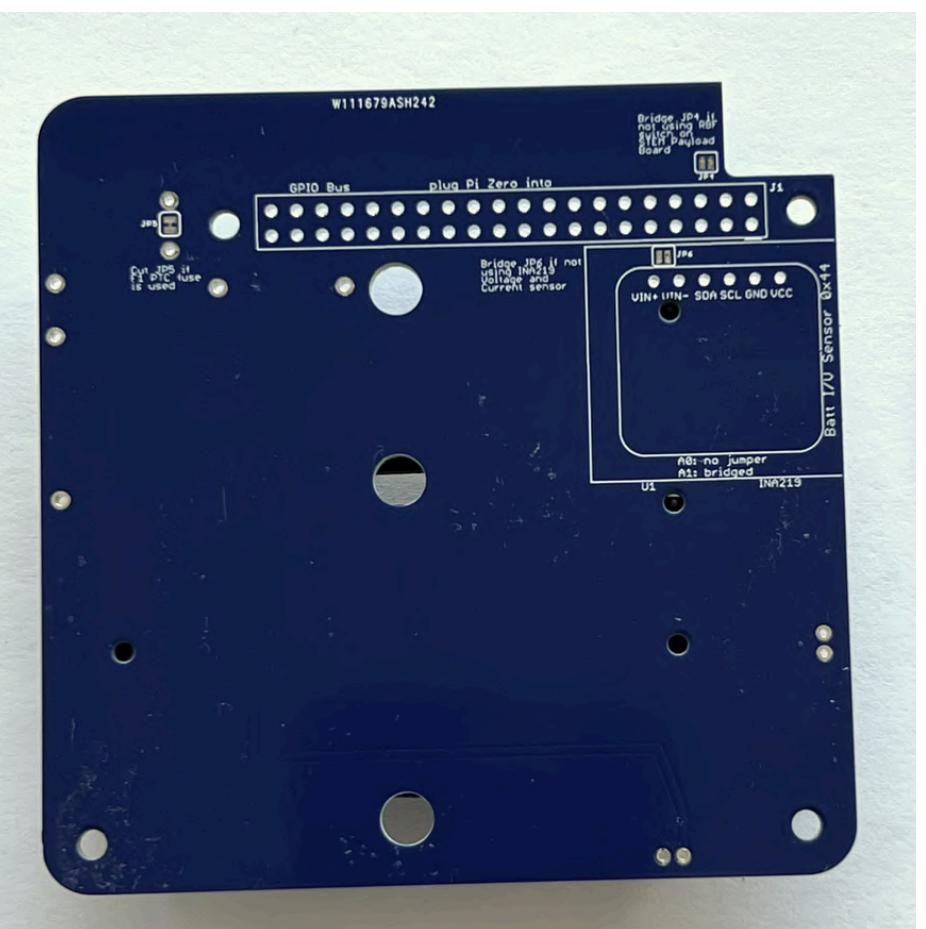
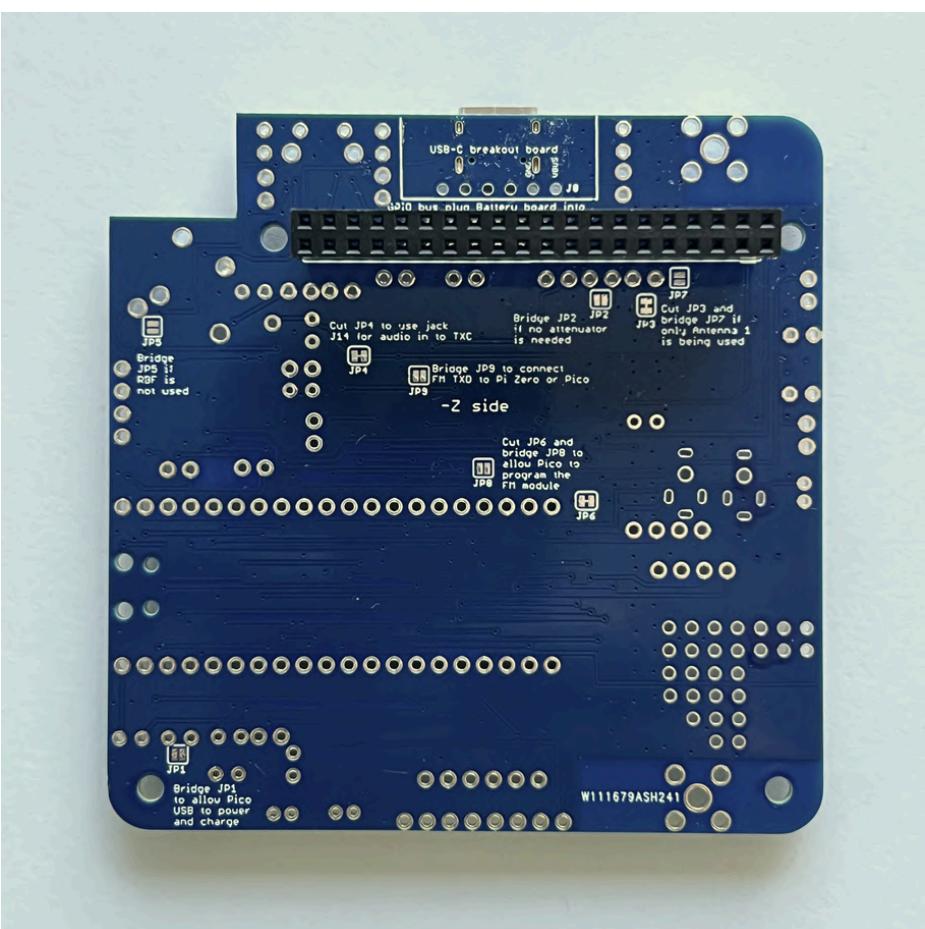
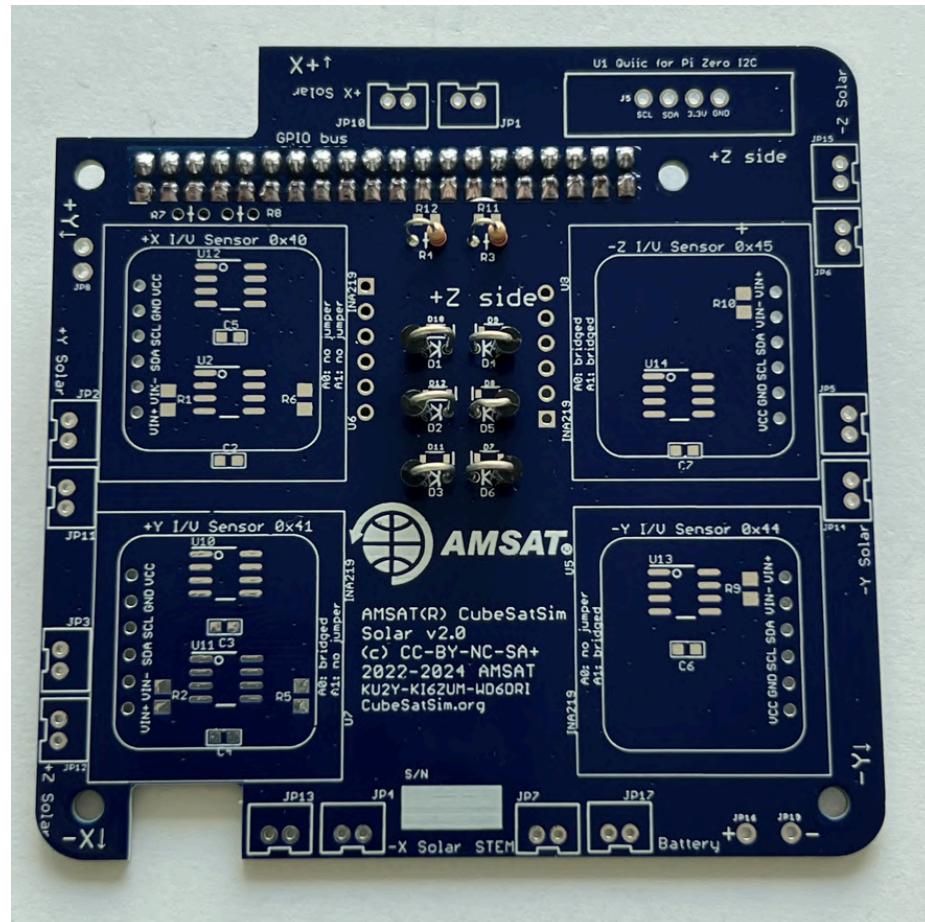


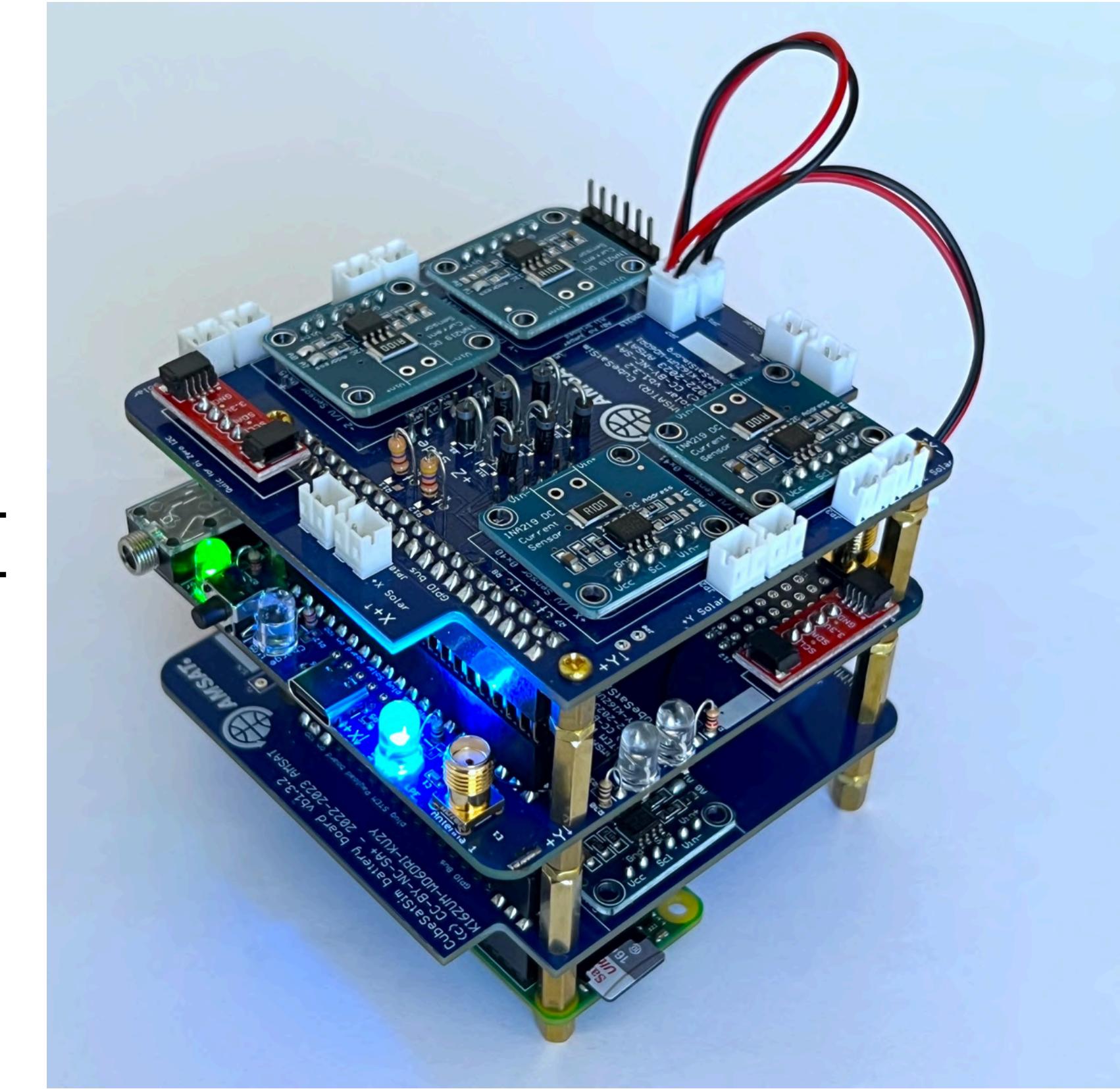
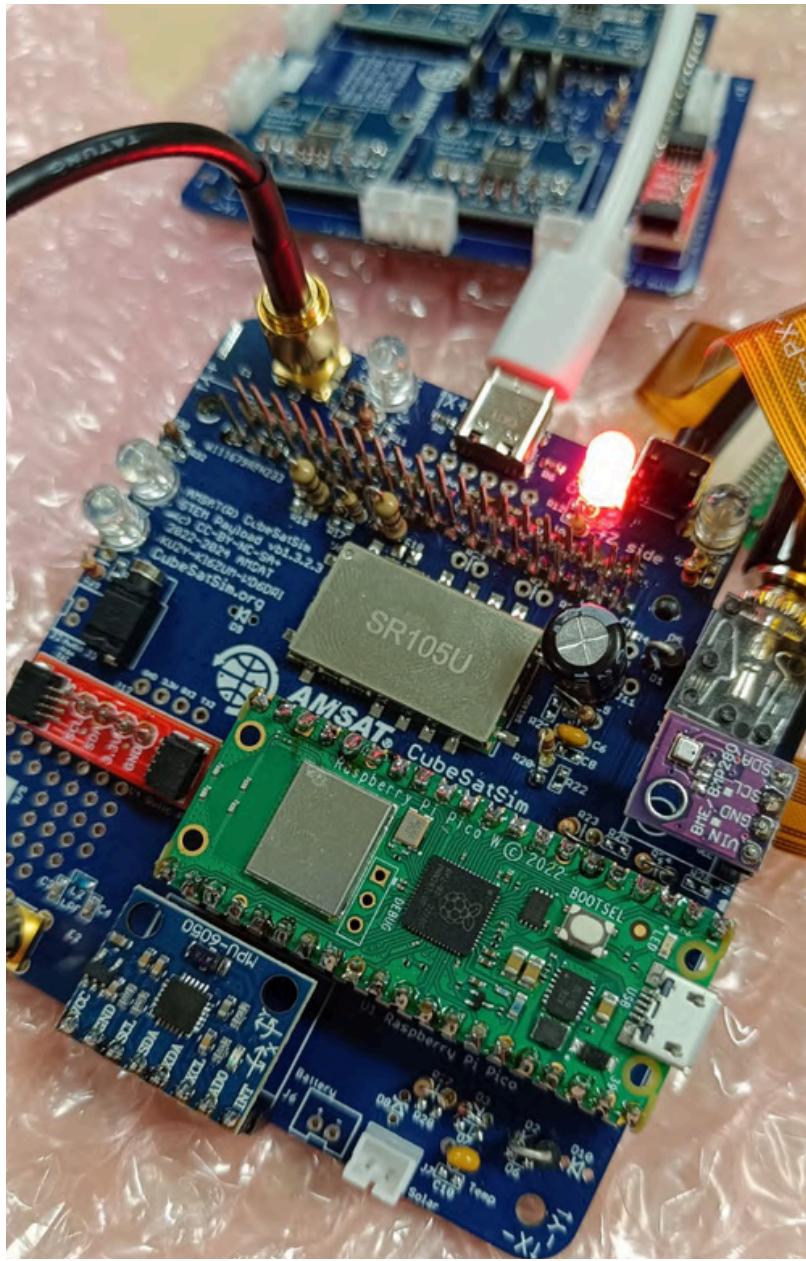
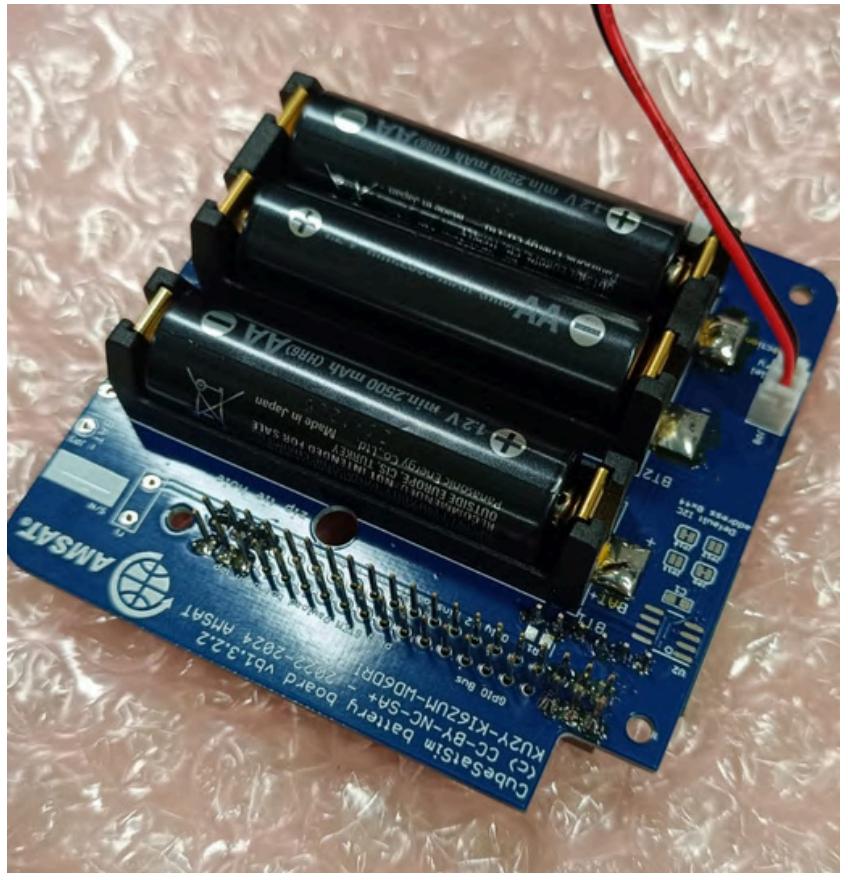
BEAVER WORKS

Lincoln Laboratory | School of Engineering



Tecnun
Universidad
de Navarra







```
Output Serial Monitor X
Message (Enter to send message to 'Raspberry Pi Pico' on 'COM6')
OK BME280 22.95 1011.43 15.15 42.25 MPU6050 -2.72 -1.21 0.81 0.01 -0.01 1.01 GPS 0.0000 0.0000 0.00 TMP -1257.00
Squelch: 0
OK BME280 22.94 1011.39 15.48 42.22 MPU6050 -2.95 -1.15 0.81 0.00 -0.02 1.03 GPS 0.0000 0.0000 0.00 TMP -1257.00
Squelch: 0
OK BME280 22.93 1011.39 15.48 42.21 MPU6050 -2.70 -1.02 1.19 0.01 -0.02 1.02 GPS 0.0000 0.0000 0.00 TMP -1257.00
Squelch: 0
OK BME280 22.94 1011.42 15.21 42.19 MPU6050 -2.46 -1.22 0.87 0.00 -0.02 1.01 GPS 0.0000 0.0000 0.00 TMP -1257.00
Squelch: 0
OK BME280 22.93 1011.41 15.30 42.18 MPU6050 -2.31 -1.37 0.79 0.01 -0.02 1.04 GPS 0.0000 0.0000 0.00 TMP -1257.00
Squelch: 0
OK BME280 22.93 1011.40 15.43 42.18 MPU6050 -2.67 -1.01 1.04 0.00 -0.02 1.02 GPS 0.0000 0.0000 0.00 TMP -1257.00
Squelch: 0
OK BME280 22.93 1011.41 15.33 42.17 MPU6050 -2.70 -1.16 0.96 0.00 -0.02 1.03 GPS 0.0000 0.0000 0.00 TMP -1257.00
Squelch: 0
```

Transmission Modes

1. APRS (Automatic Packet Reporting System)

Digital comm protocol used to send real-time data, like GPS coordinates, weather info or telemetry using packets over radio.

2. FSK (Frequency Shift Keying)

Digital modulation. Telemetry and data transmission. Simple and resistant to noise. Low-speed digital communication.

3. BPSK (Binary Phase Shift Keying)

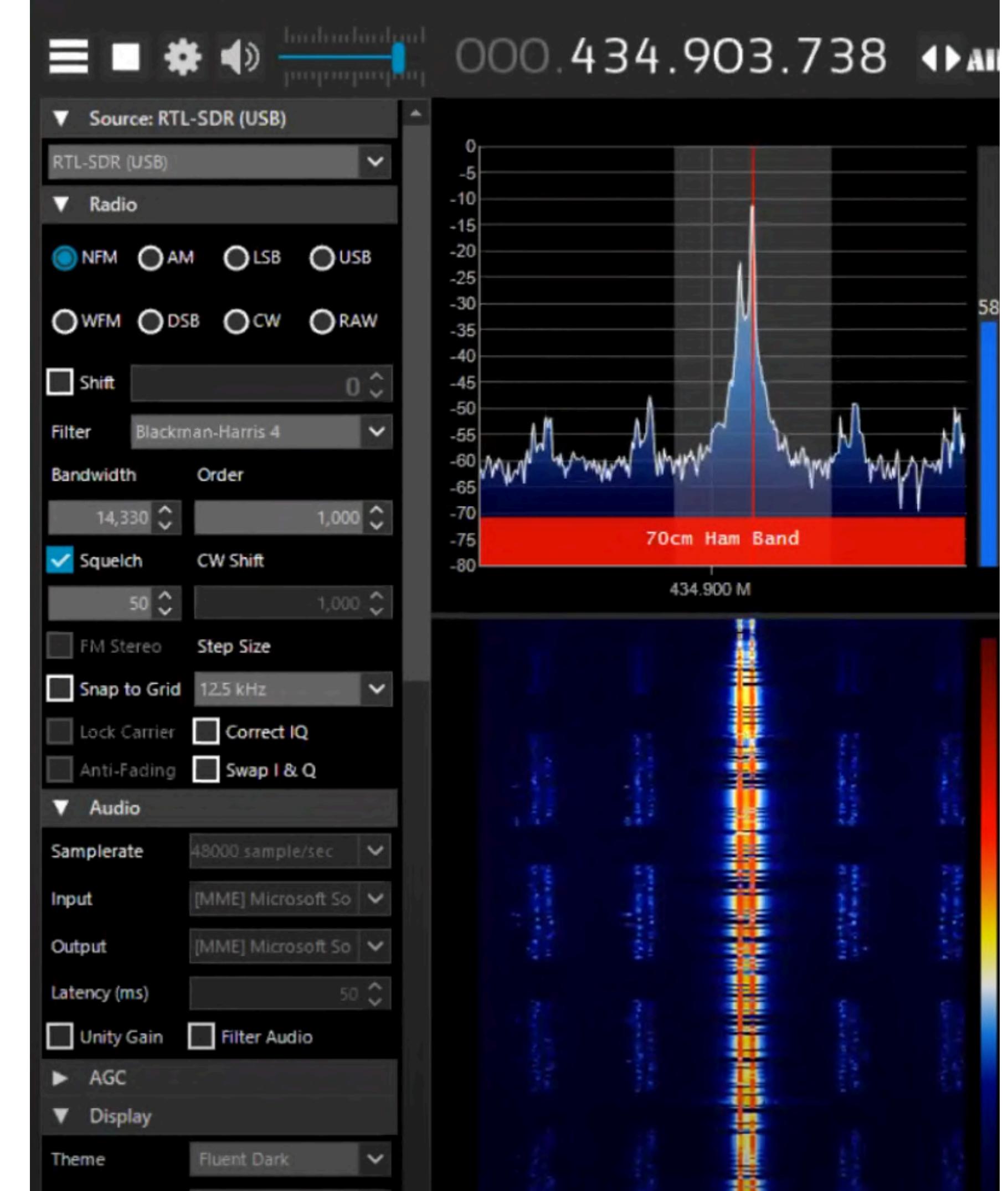
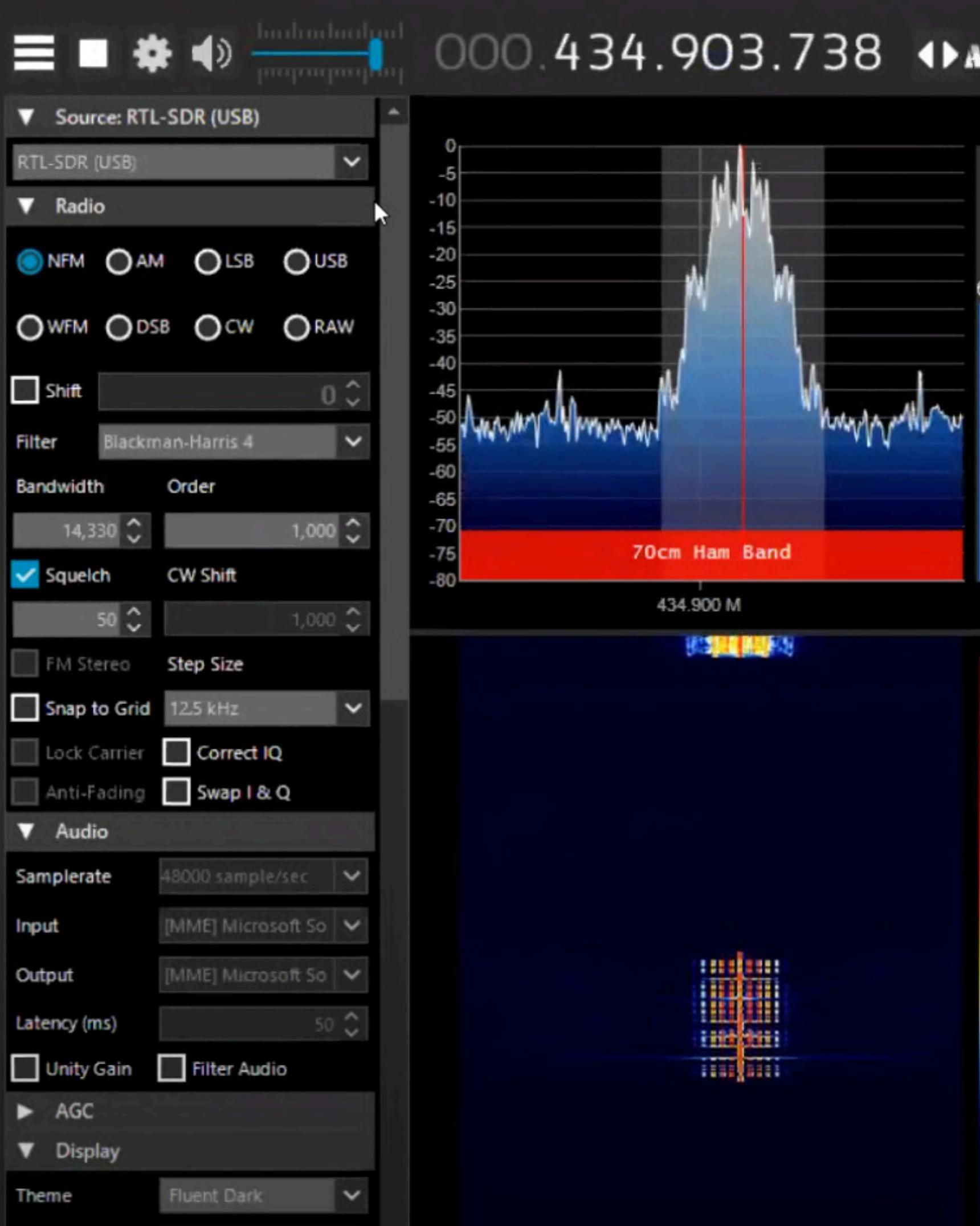
Phase modulation, data representation in 0° and 180° to convey binary info. More efficient than FSK for higher data rates. More bandwidth-efficient.

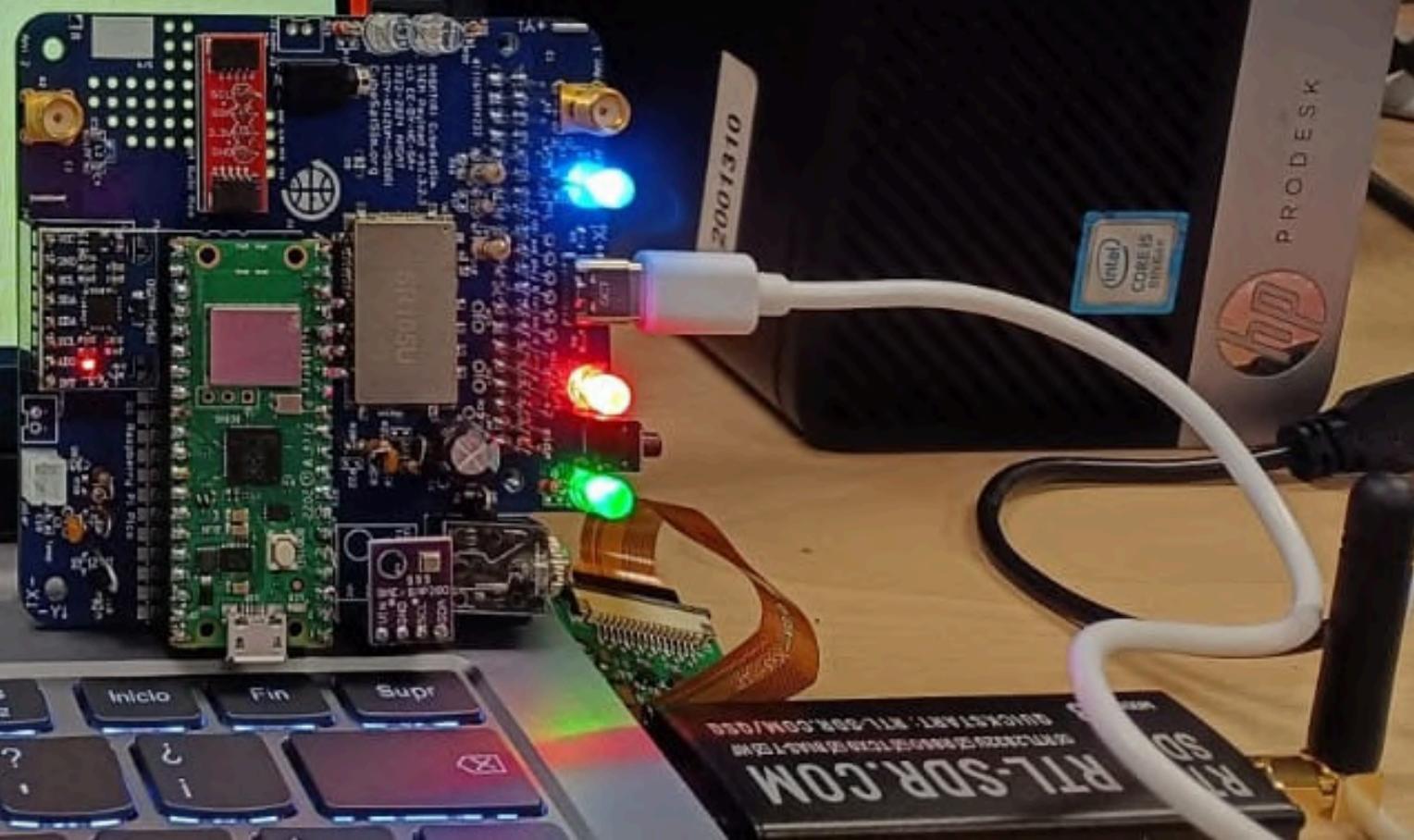
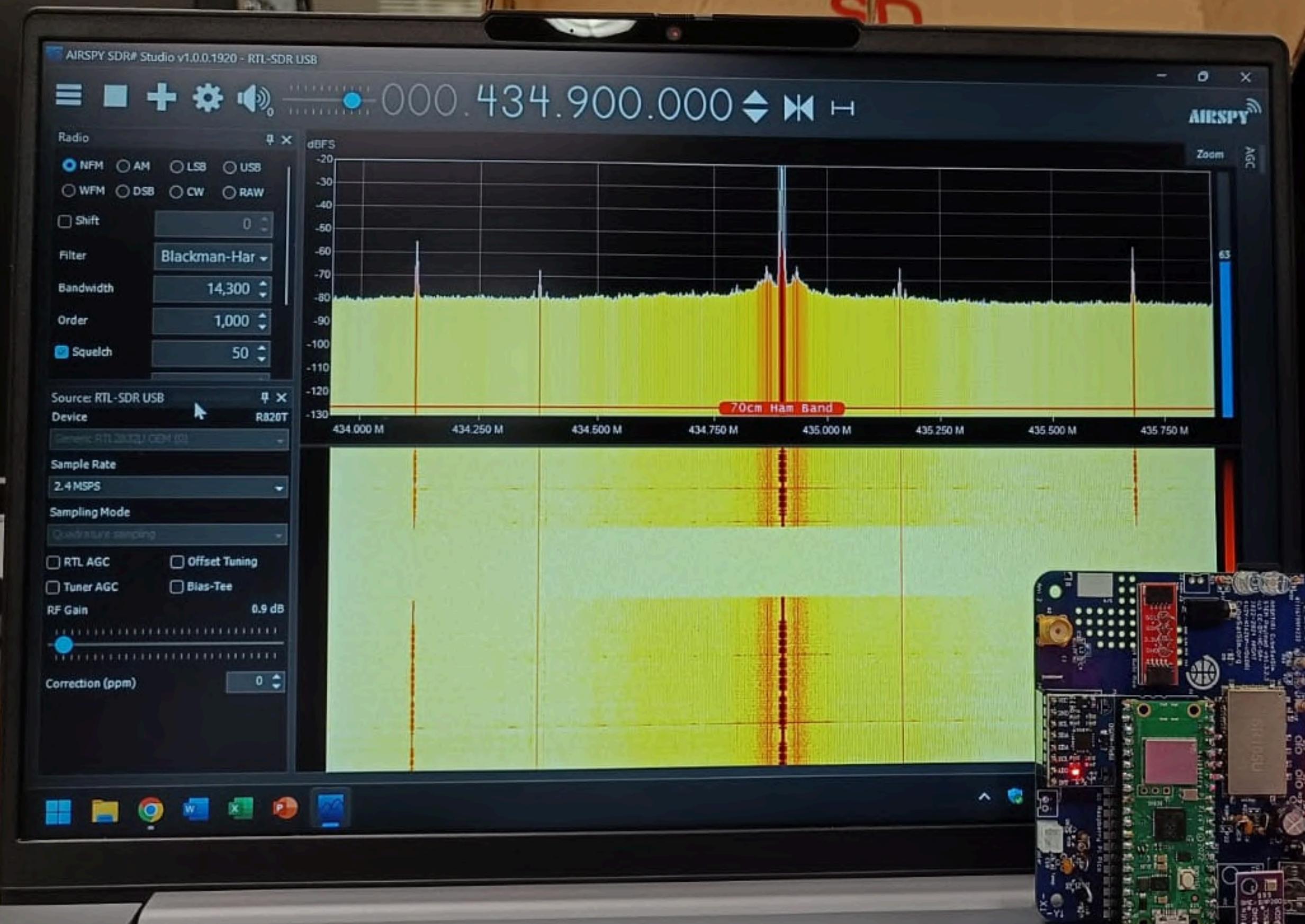
4. SSTV (Slow Scan Television)

Analog transmission mode that sends images over radio frequencies. Sending images from space to ground stations.

5. CW (Continuous Wave)

Simplest and oldest forms of communication, using Morse code. A continuous wave signal is either on or off. Highly efficient for long-distance communication with low power. Ideal for satellite beacons or emergency signals from AMSAT satellites.





AMSAT Telemetry Analysis Tool

File Decoder Spacecraft Help

Input CubeSatSim-BPSK CubeSatSim-FSK

Source

Telem Format: FSK 200bps (Fox1)

Stop

RTL SDR

0.240 MHz

AF

IQ

Center Frequency 434840.0 kHz

 Retune center / Switch modes

R820T USB SDR

Sample Rate: 0.240 MHz | Freq Correction (ppm): 0 Bias T

Gain Master: Automatic Mixer: Automatic LNA: Automatic VGA: 312

Spacecraft Tracked

1/CubeSatSim-BPSK Tracked

1/CubeSatSim-FSK Not Tracked

 Auto Start

Audio Options

 View Filtered Audio Monitor Filtered Audio Squelch when no telemetry

Output

Silence Speaker

Altavoces (Realtek(R) Audio)

Sample rate: 48000 | Symbols: 70



Eye Diagram

8.6 SNR

Errors: 0

Era:

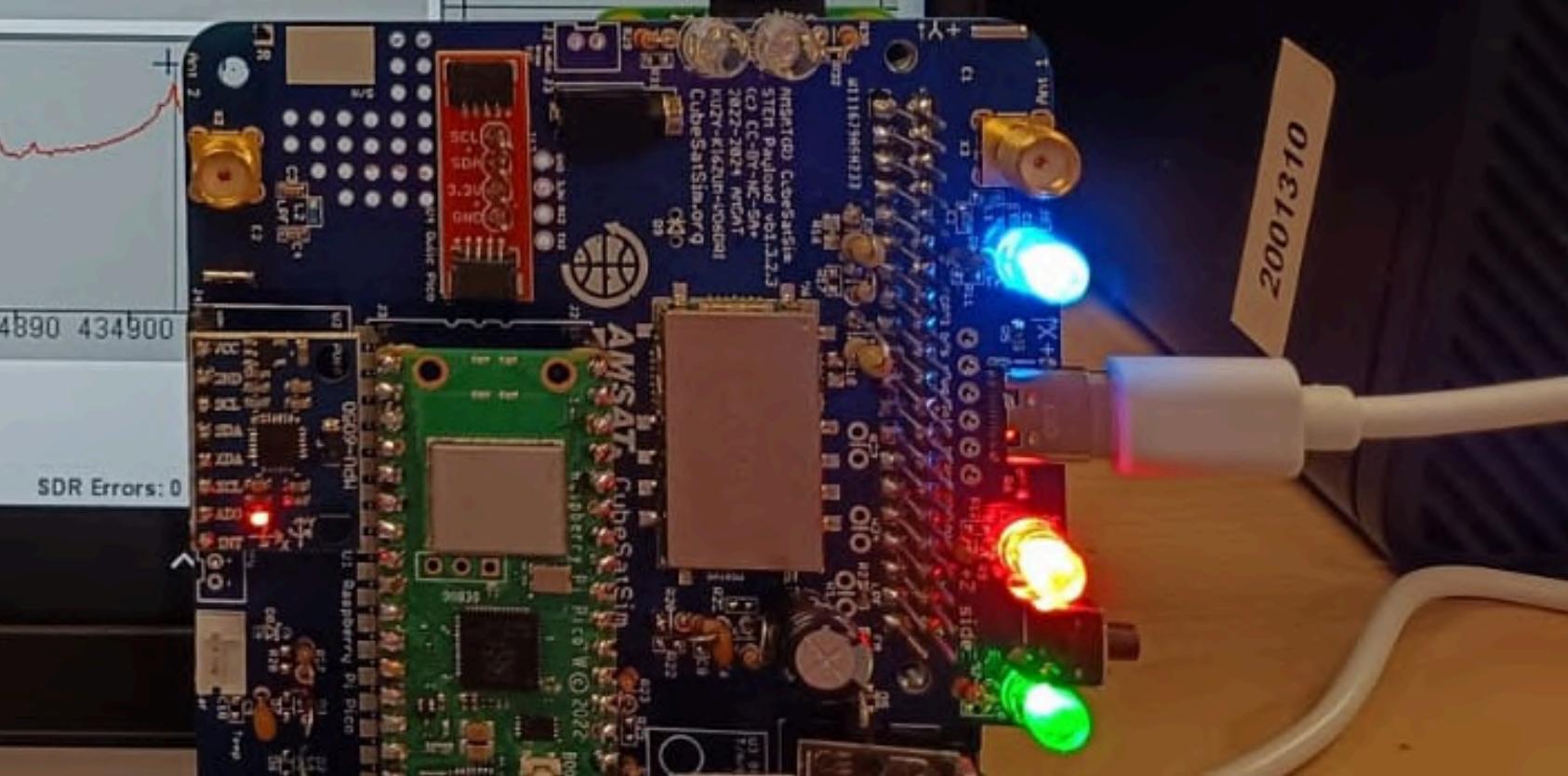


Show Peak SNR

Version

1.12z3 - 27 Oct 2022

Logs: C:\Users\CUBESAT\Desktop\AMSAT\Ground Station\FoxTelem_1.12z3_decoded



Input

CubeSatSim-BPSK

CubeSatSim-FSK

Health

Measurements

Satellite CubeSatSim-FSK(EM) Mode: TRANSPONDER

Telemetry Payloads De

Latest Realtime: Epoch: 20 Uptime: 578

Max: Epoch: 20 Uptime: 532

Min: Epoch: 20 Uptime: 455

Radio

	RT	MIN	MAX
RSSI (dBm)	0	0	0
TX Antenna	Deployed		
RX Antenna	Deployed		

Computer Hardware

	RT	MIN	MAX
IHU Temp (Pi) (C)	39.0	39.0	40.1
I2C Bus 1	OK		
I2C Bus 3	FAIL		
Camera	OK		

Computer Software

	RT	MIN	MAX
Spacecraft Spin (rpm)	0.0	0.0	0.0
Safe Mode	OFF		
Ground Commands	0		
Simulated Telemetry	ON		

Battery

	RT	MIN	MAX
Cell A+B+C Voltage ...	4.50	4.11	4.51
Current (mA)	0.0	-397.0	0.0

PSU

	RT	MIN	MAX
Voltage (V)	0.00	0.00	0.00
Current (mA)	0.0	0.0	0.0

Experiments

	RT	MIN	MAX
STEM Payload Status	OK		
BME280 Temp (C)	26.6	26.5	27.0
BME280 Pressure (Pa)	1009.0	1009.0	1009.0
BME280 Altitude (m)	34.6	34.1	35.0
BME280 Humidity (%)	38.4	37.6	39.1
Diode Temp (C)	-28.1	-28.1	-28.1
Sensor 2 (signed short)	-204.8	-204.8	-204.8

+Z Panel

	RT	MIN	MAX
Voltage (V)	0.95	0.90	1.10
Current (mA)	0.0	0.0	27.0
Rotation (dps)	-10	1	10
Acceleration (g)	0.25	0.28	1.02

-X Panel

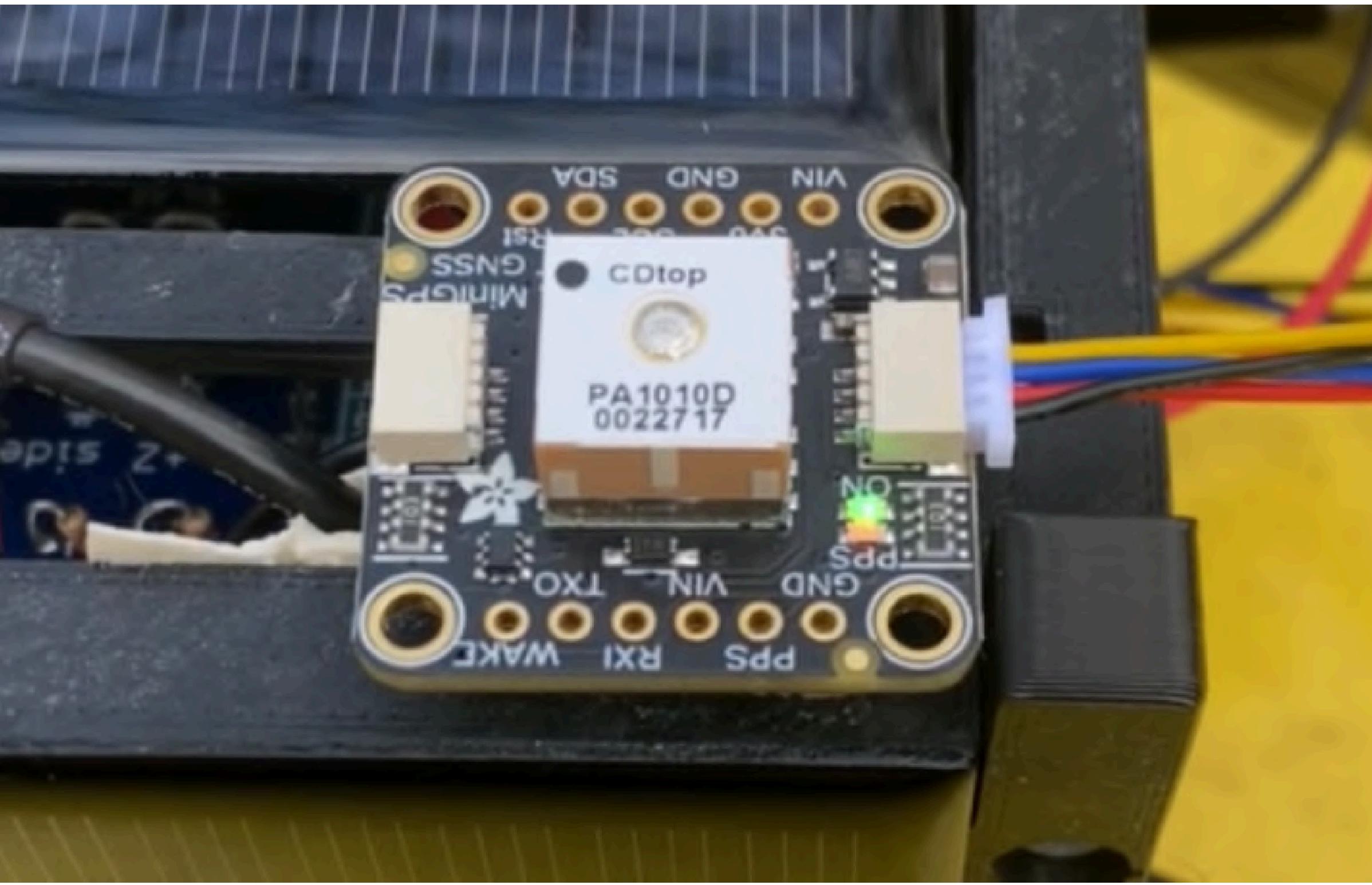
	RT	MIN	MAX
Voltage (V)	1.08	0.90	4.56
Current (mA)	0.0	0.0	283.0

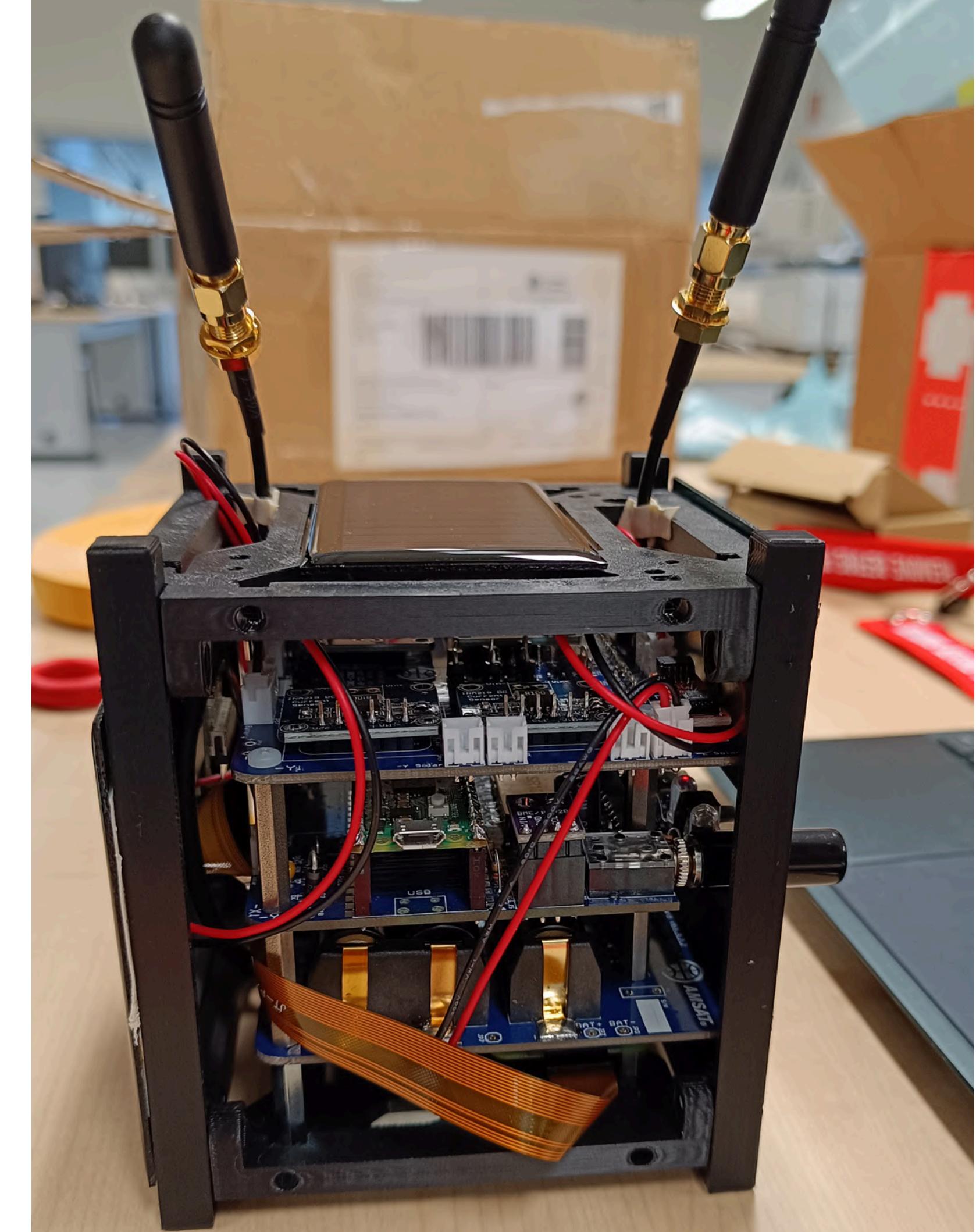
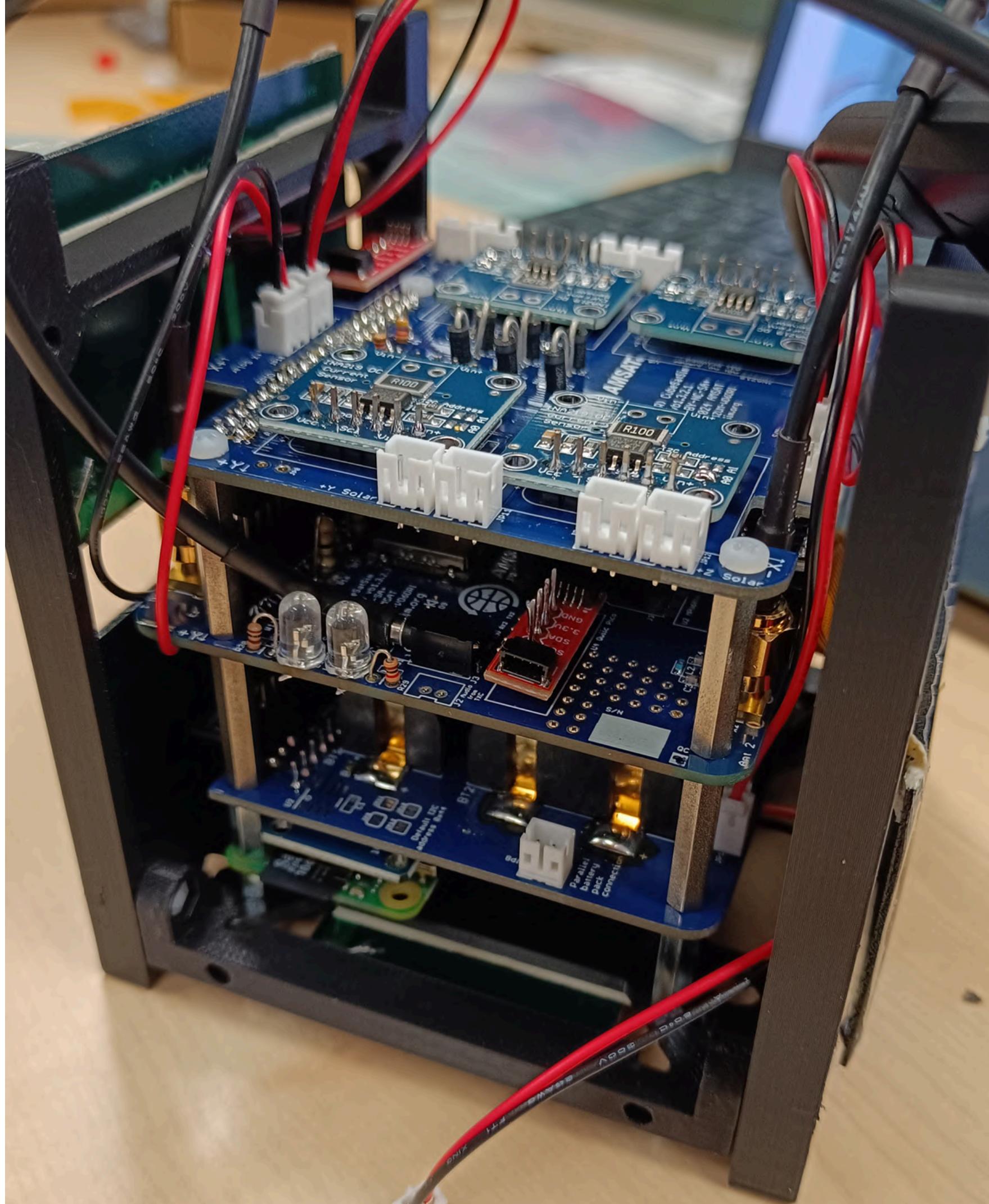
-Y Panel

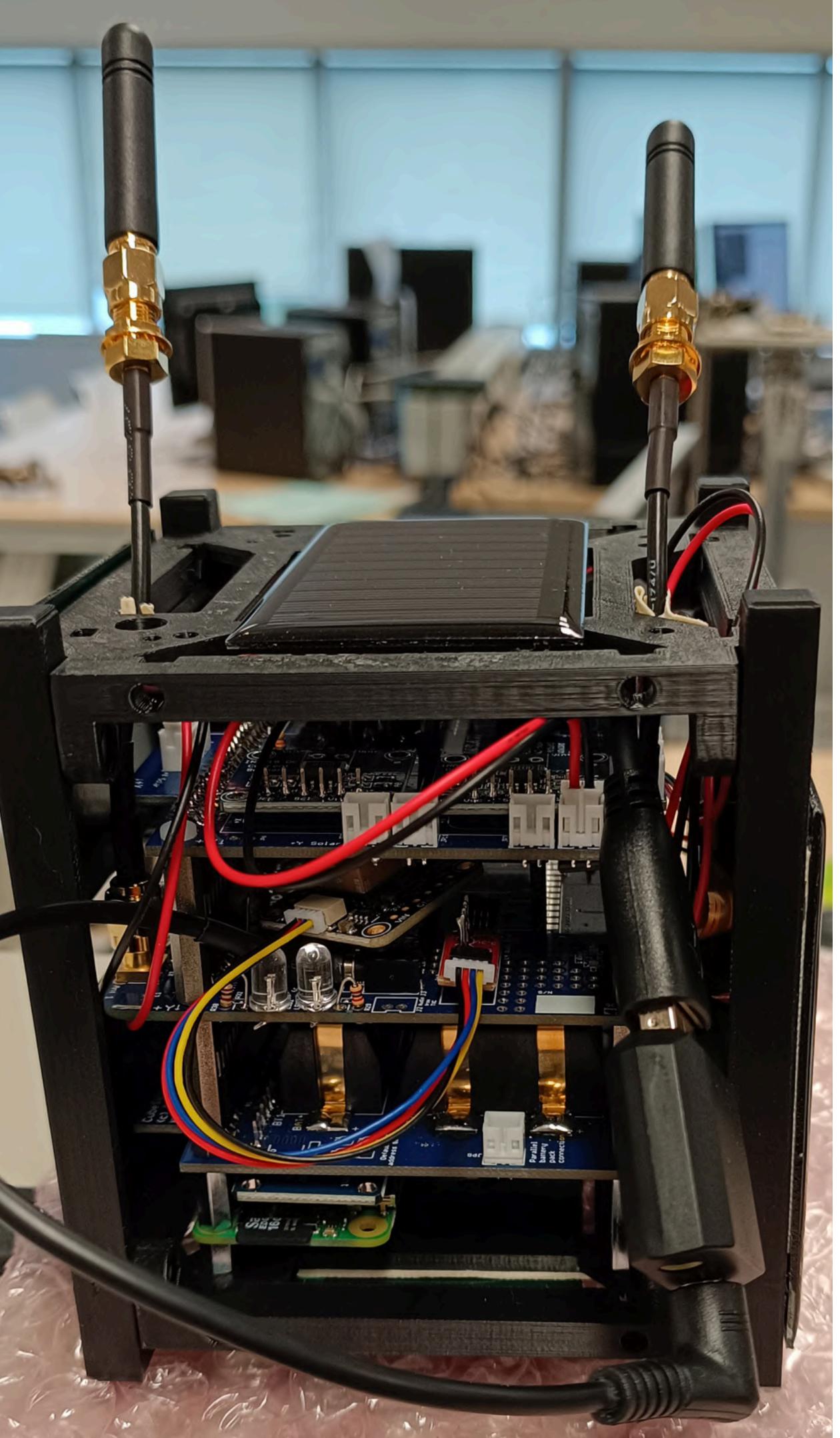
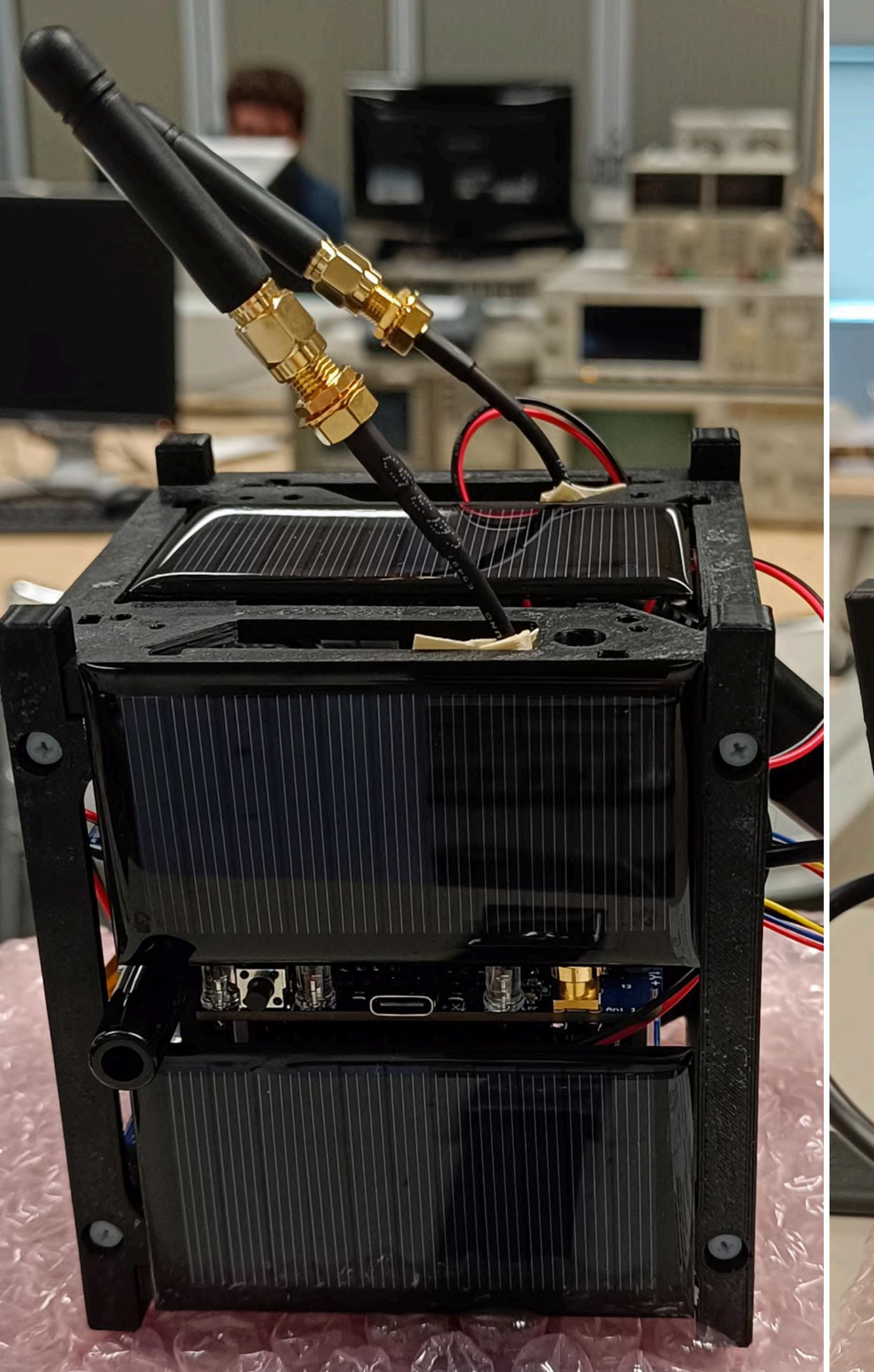
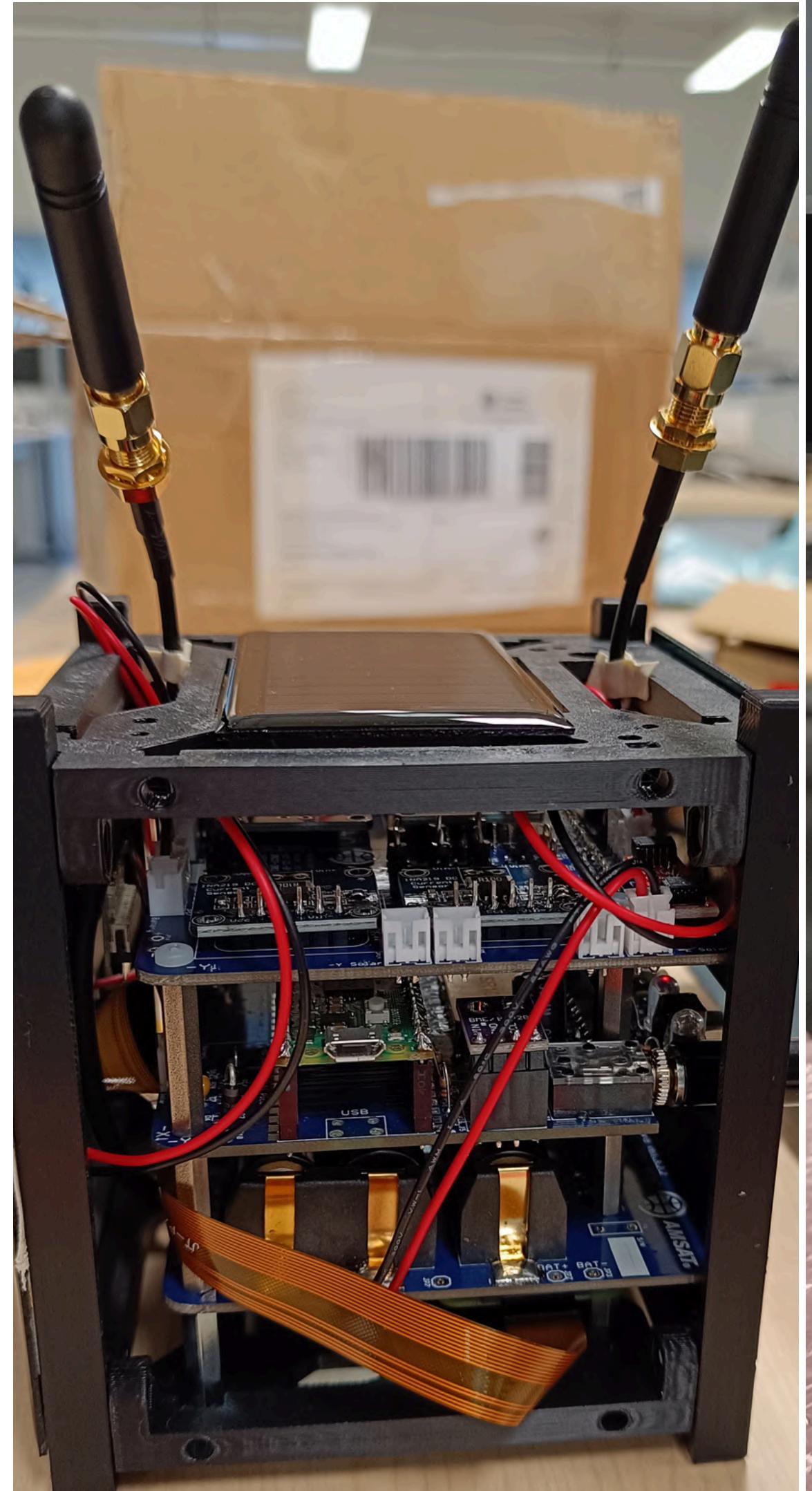
	RT	MIN	MAX
Voltage (V)	1.03	0.91	4.80
Current (mA)	0.0	0.0	274.0

-Z Panel

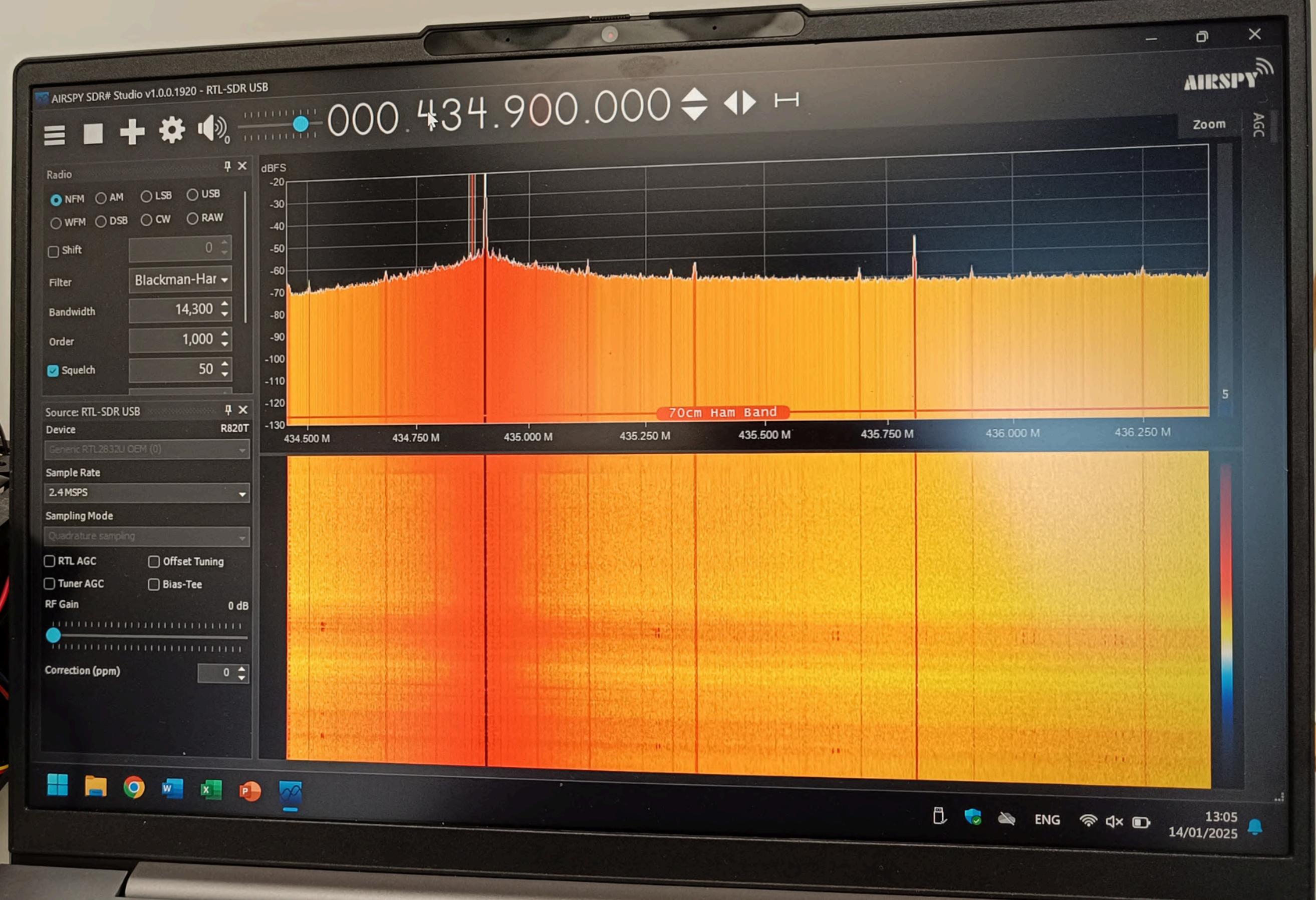
	RT	MIN	MAX
Voltage (V)	1.08	0.90	1.10
Current (mA)	0.0	0.0	27.0











```
C:\Users\user>ssh pi@192.168.1.58
The authenticity of host '192.168.1.58 (192.168.1.58)' can't be established.
ED25519 key fingerprint is SHA256:cgU3Gxts/5EGpgyDes01IfMwWTbQfe76p8ylbeoIl0s.
This key is not known by any other names.
Are you sure you want to continue connecting (yes/no/[fingerprint])? yes
Warning: Permanently added '192.168.1.58' (ED25519) to the list of known hosts.
pi@192.168.1.58's password:
```

```
C:\Users\user>ssh pi@cubesatsim.local
pi@cubesatsim.local's password:
Linux cubesatsim 6.1.21+ #1642 Mon Apr  3 17:19:14 BST 2023 armv6l
```

```
The programs included with the Debian GNU/Linux system are free software;
the exact distribution terms for each program are described in the
individual files in /usr/share/doc/*/*copyright.
```

```
Debian GNU/Linux comes with ABSOLUTELY NO WARRANTY, to the extent
permitted by applicable law.
```

```
Last login: Mon Jan 13 16:37:51 2025 from 2a0d:3344:2081:7710:6d60:4081:967b:79ae
```

```
SSH is enabled and the default password for the 'pi' user has not been changed.
This is a security risk - please login as the 'pi' user and type 'passwd' to set a new password.
```

```
pi@cubesatsim:~ $ |
```

Improvement points

1. Github of the project:

<https://github.com/CUBESAT-AMSAT-TECNUN/CUBESAT-AMSAT>

2. GPS: configure and integrate it

3. Energy management: Solar cells + Bateries ?

4. Camera:

How to take, configure and proccess photos with the camera.

5. Interface:

Telemetry: Gps, Temperature, Pression, Humidity...

6. Drone test

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