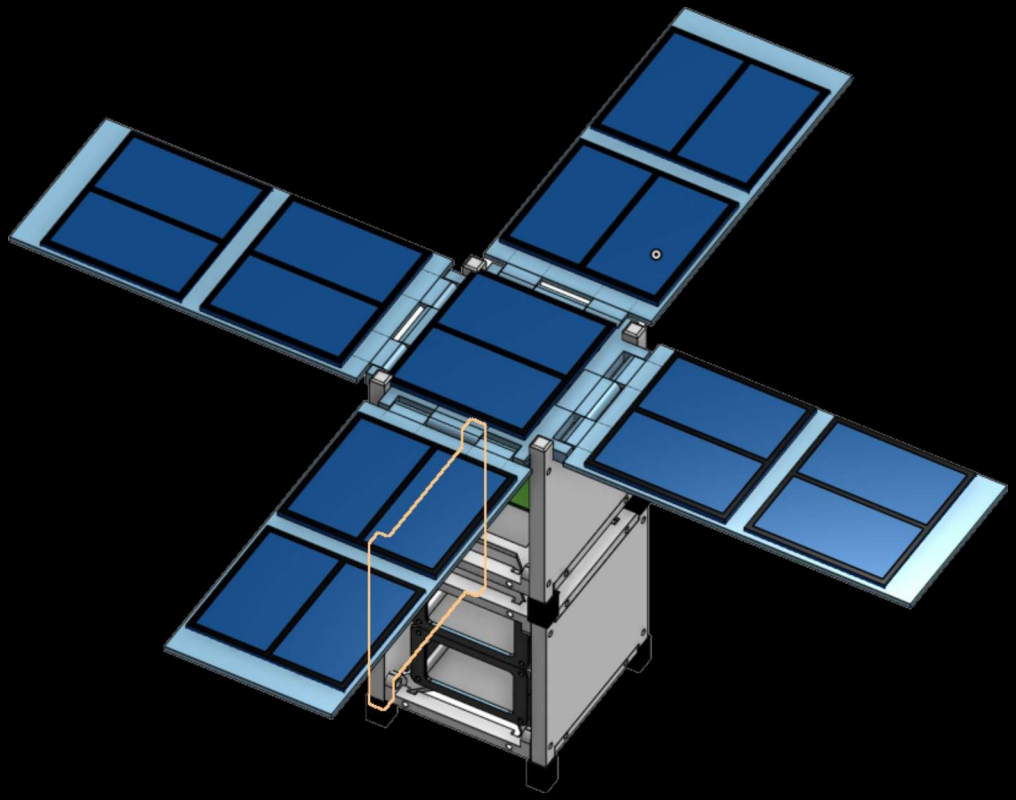
Exploring LoRa



Via TinyGS

Installation WorkShop

Robert Best

CEO & Founder

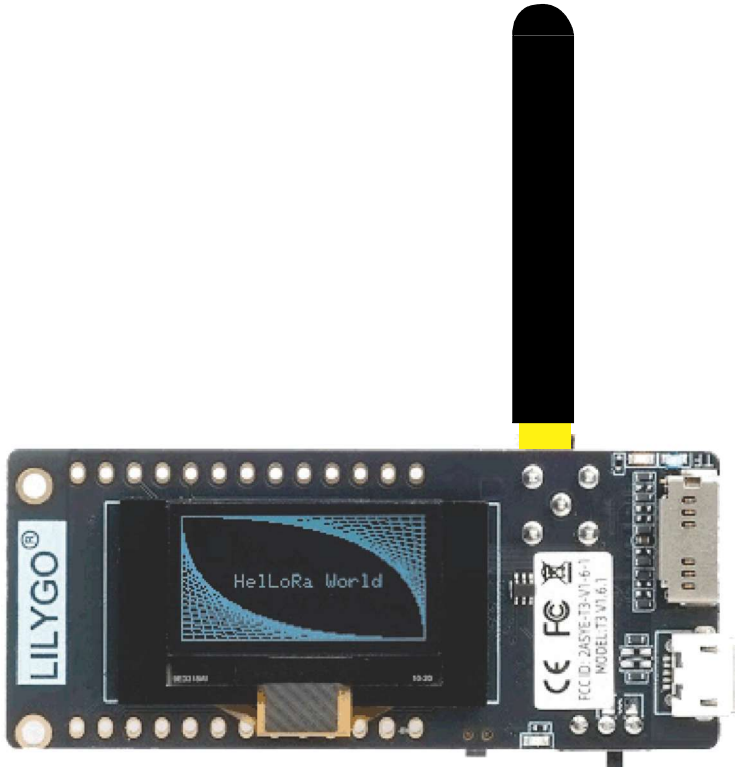
Optical Wavelength Laboratories,Inc.

Fiber optic test equipment manufacturer

Located South Eastern Wisconsin.

OWL-inc.com

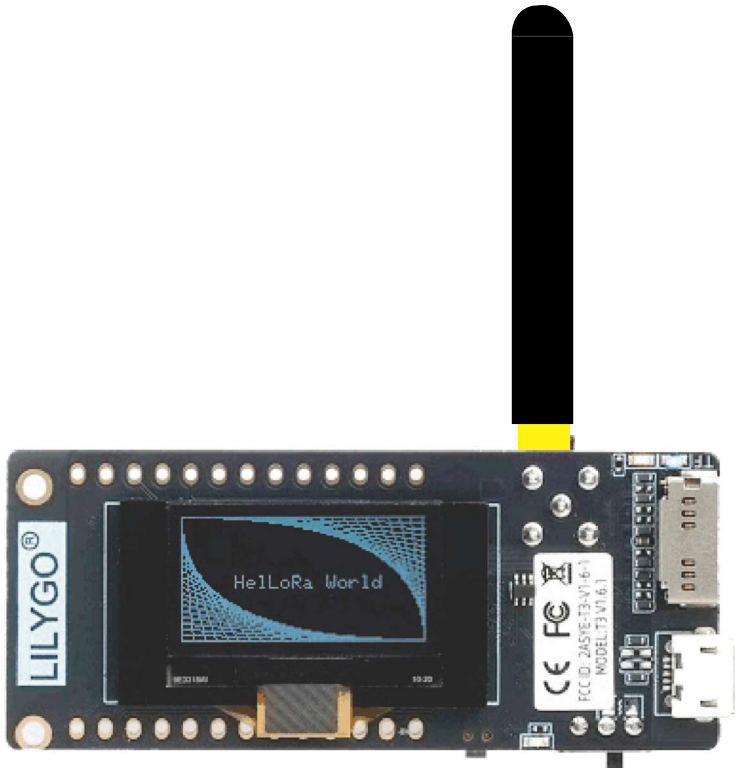
LoRa (Long Range)
is a wireless communication technology designed for sending small amounts of data over long distances using low power.



Lilygo lora32 t3_v1.6.1

Core Concept: **LoRa uses chirp spread spectrum (CSS) modulation**

a form of radio modulation that spreads a signal across a wider bandwidth.
This gives it exceptional range (up to 15–20 km in open areas)
and high resistance to interference.



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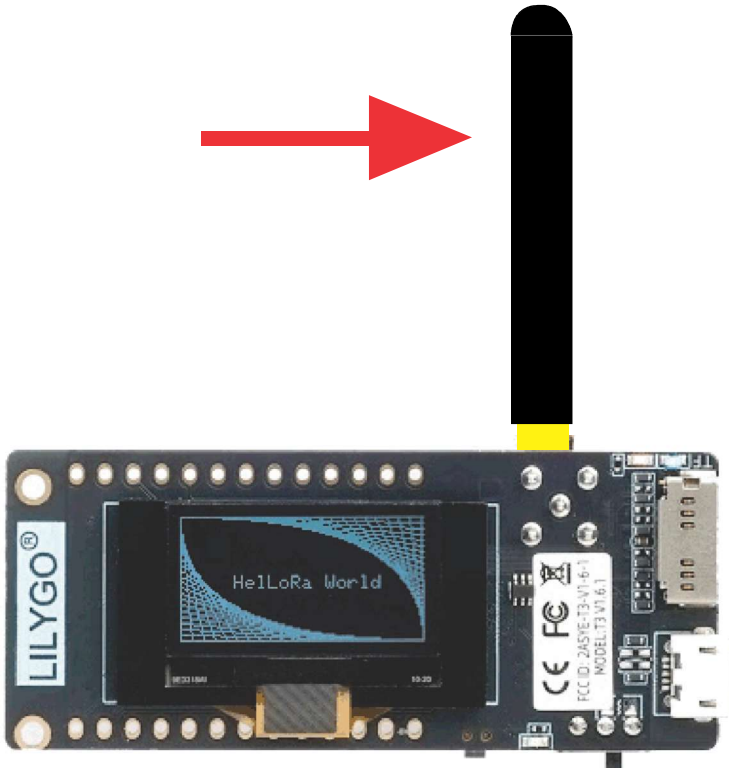
Core Features Frequency

Bands: Usually 433 MHz, 868 MHZ (EU), or 915 MHZ (US)Range:
2–15 km (urban vs. rural)Data Rate: 0.3 kbps – 50 kbps (low but power-efficient)

Modulation: Chirp Spread Spectrum (CSS) – very resistant to interference and noise

Power Usage: Extremely low; ideal for battery-powered or solar IoT nodes Topology: Star network; connects end-nodes to gateways that link to a server

Notice: always have rubber duck antenna on when powered on.



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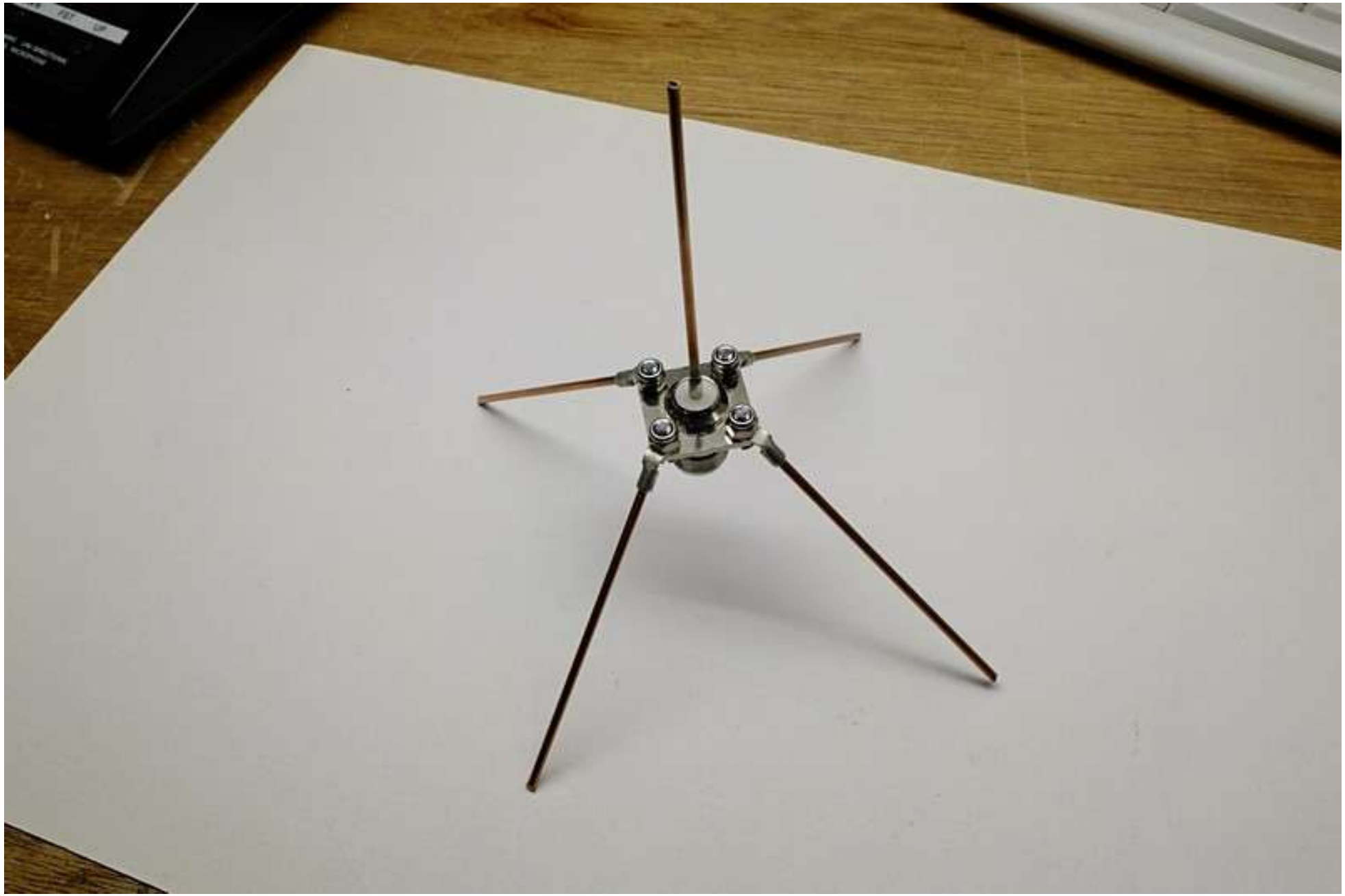
Let’s assemble a Lora Ground Station for the TinyGS website.

Starting with a DiY Antenna

Using parts like these

to make a Quarter Wave Ground Plane Antenna



For 433MHz (70cm) Band

Calculating Antenna element lenghts

$$c = f\,\lambda$$

$$f = 433\ \text{MHz}$$

$$\lambda = \frac{c}{f}$$

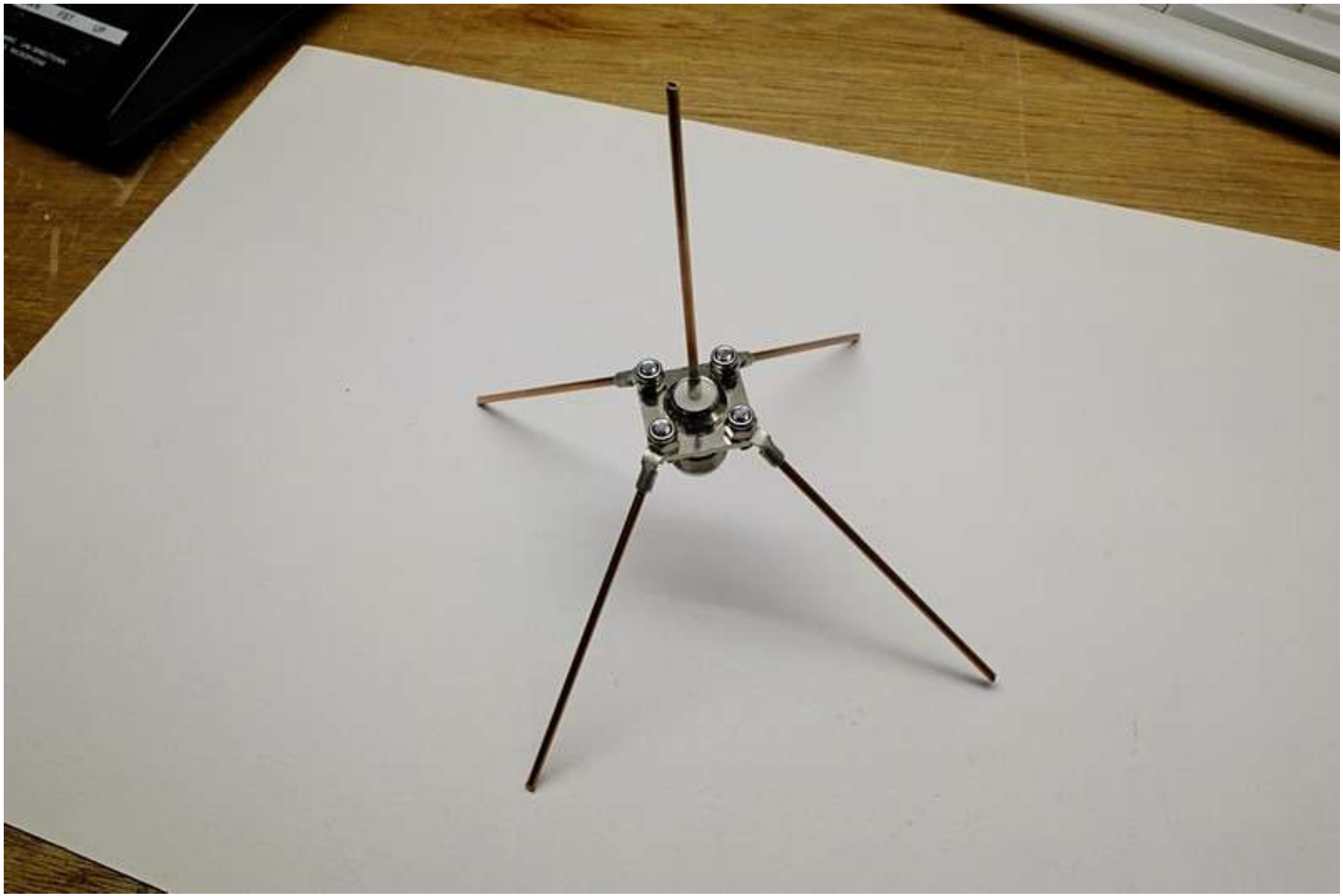
$$\lambda = \frac{2.998 \times 10^{8}\ \frac{m}{sec}}{433 \times 10^{6}\ Hz} = 0.692\text{m}$$

$$0.692\text{m} = 692\text{mm}$$

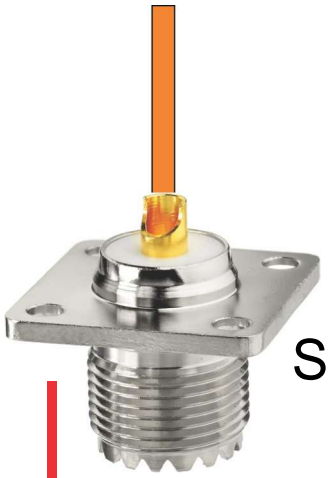
Quarter Length ~172mm

To attach the radials to the flange of the SO-239
use small bolt/nut/lockwasher sets in 4-40 size

Final Quarter Wave for 433MHz



(70cm Band)



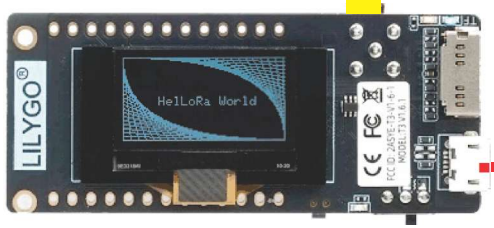
SO-239 Chassis Mount

SO-239 to SMA Converter

NOTICE: Avoid any SMA connector that says:
SMA-RP
"**RP**" is **R**everse **P**olarity
RP is for a different industry
RP will not mate with normal SMA

SMA RG-174 cable

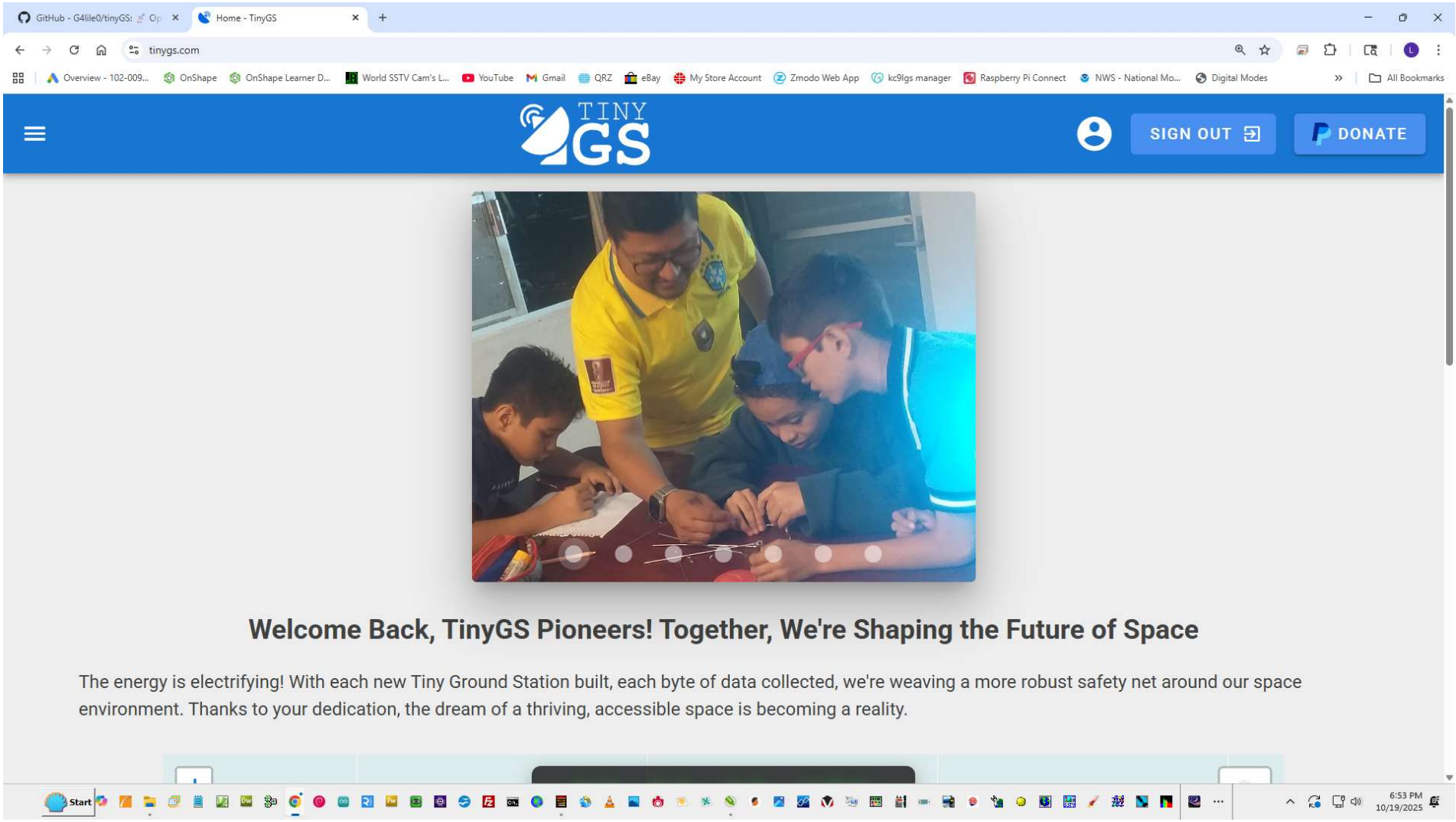
SMA out to SMA in



Lilygo lora32 t3_v1.6.1

USB Micro
to Computer
for data and power

To run the Tiny Ground Station go to https://TinyGS.com



Scroll all the way to the bottom of the page and click the link:

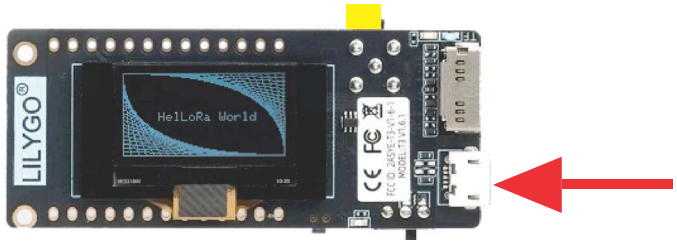
https://github.com/G4lile0/tinyGS

Scroll way down the GitHub Page until you see:

https://installer.tinygs.com

Install

Use our brand new web installer to setup your board for first time.
Just go to **https://installer.tinygs.com** and follow the instructions there
The first time you flash your board you can use the web installer using Google Chrome web browser on Linux, Windows or MacOS.
Follow instructions there.

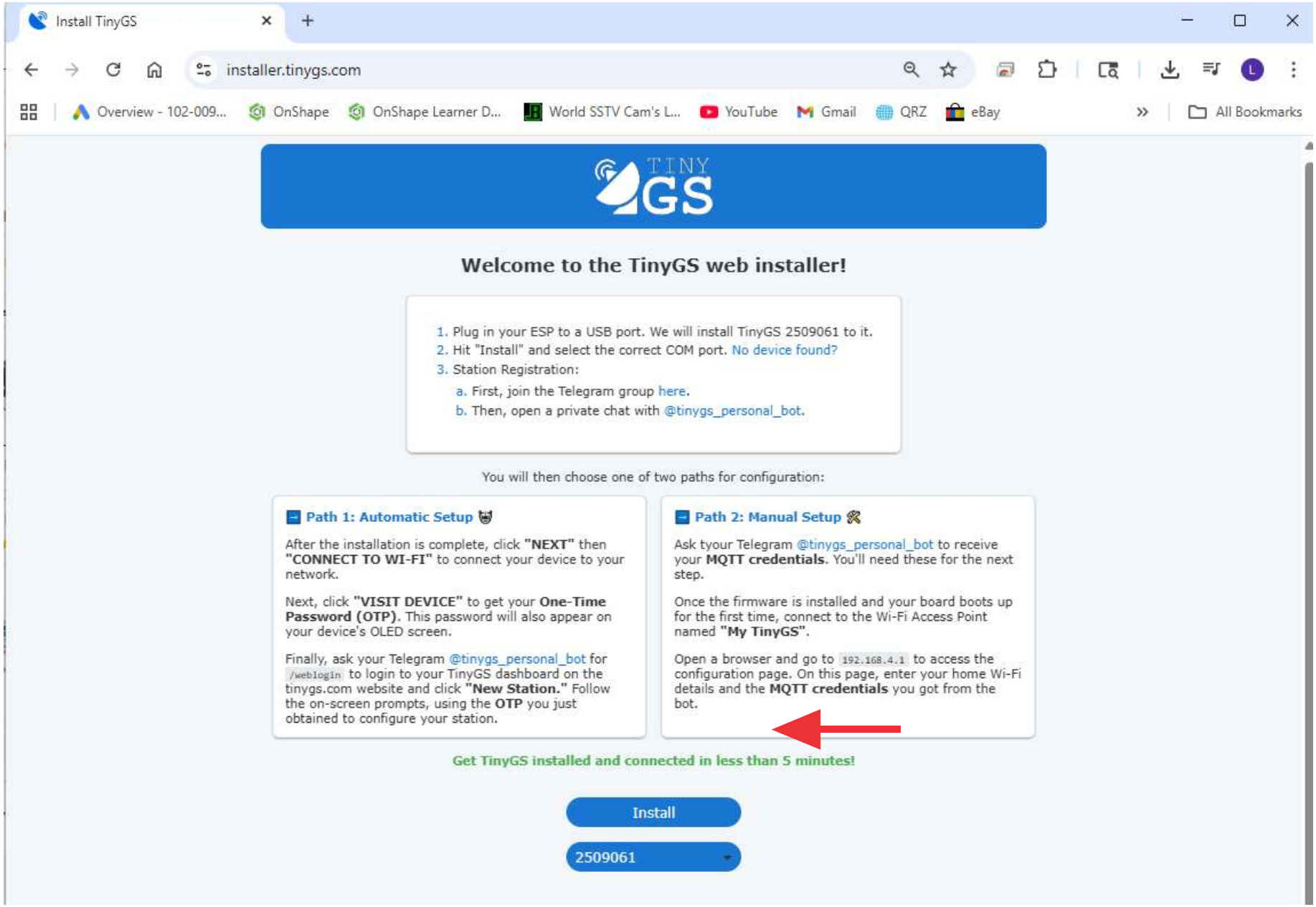


Make sure your computer is attached to micro USB port.

Your USB cable must be able to support both power and data.

https://installer.tinygs.com

Follow the instructions on this page very carefully



The installation is a bit complex.
TinyGS installer assumes you have some understanding of WiFi networks.
You will most likely need help from a seasoned “hacker”.

The end goal will be to merge the Lillygo Module to your WiFi Network.

Your network being connected to the internet will then work with TinyGS website.

Your Module should be properly attached to the Quarter Wave Ground Plane Antenna.
The Antenna needs to be placed outside with a reasonable view of the sky.

Your Lillygo module will then receive LoRa packets carrying MQTT protocol.

While TinyGS modules can transmit data, they are not designed or powerful enough to transmit directly to CubeSats.

The Transmit capabilities of your module can network with other Modules in your local town or neighborhood. These MESH networks are like Mesh-tastic.

On 433MHz your are required to have a minimal Technician class Amatuer radio license

In the USA you can have a 900MHz model that is license free.
The reason we use 433 MHZ modules is because there are very many CubeSats on this frequency.

You can still transmit indirectly to CubeSats via **LoRaWan** access points throughout the TinyGS Network.

It’s just the outgoing radio waves will not be coming from your house.

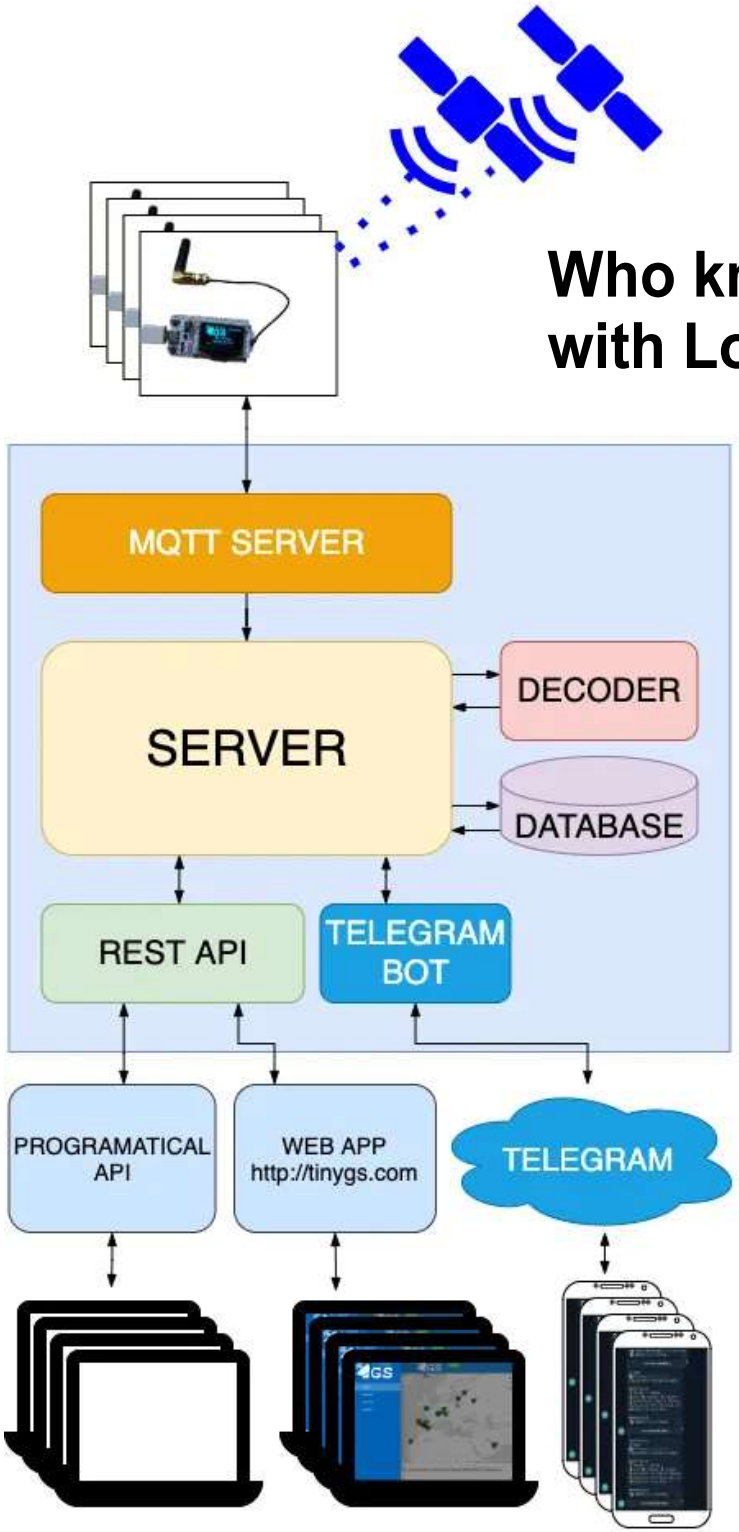
Such transmissions at 433MHz still require an FCC licence.

The key take aways are:

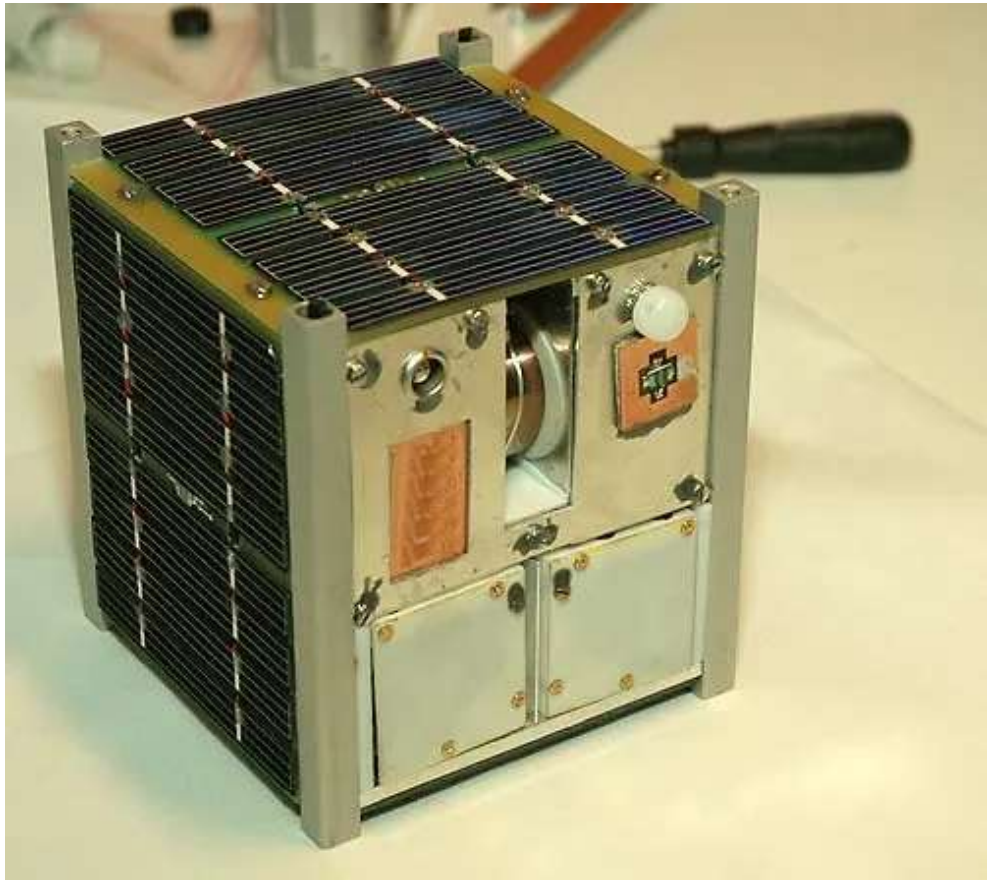
Setup up LoRa on TinyGS .

Play and explore the CubeSats and features TinyGS has to offer.

Then you will have made you first entry to Lora based CubeSats .



Who knows where the end results of such playing with LoRa and CubeSats will take you?



The End

This presentation can be found at:

https://space-hobbies.com