

Build Your Own Satellite Ground Station - TinyGS

[TinyGS](#) is an open network of Ground Stations distributed around the world to receive and operate LoRa satellites, weather probes and other flying objects, using cheap and versatile modules.

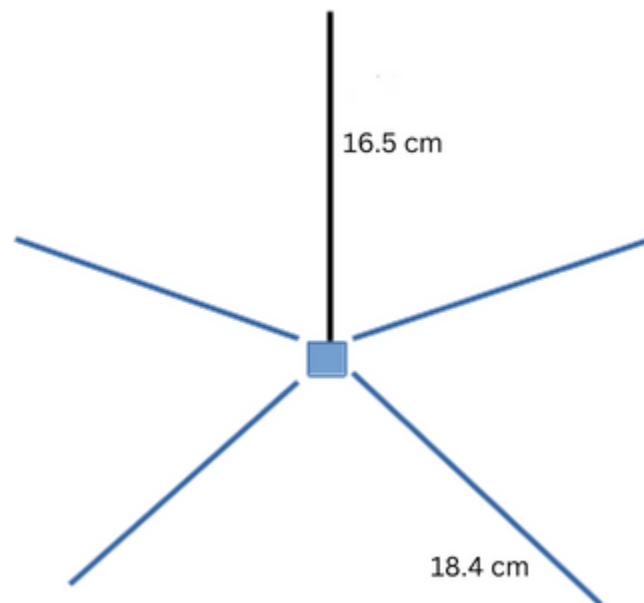
Parts List

- SMA female Flange RF Connector
- 3M Micro USB
- LoRa32 V2.1_1.6 - 433MHZ CH9102F
- 5x Barrier Terminal
- 1m of wire
- SMA Male Plug to SMA Male Plug



1/4-Wave Ground Plane Antenna

This antenna is an unbalanced quarter-wave monopole. Mounted on the perfect ground will present an impedance of 36Ω however, by adding four to six radials, angled at 45° , will increase the impedance to 50Ω which both matches the LoRa board impedance and lowers the radiation angle towards the horizon making communications with satellites more favourable.

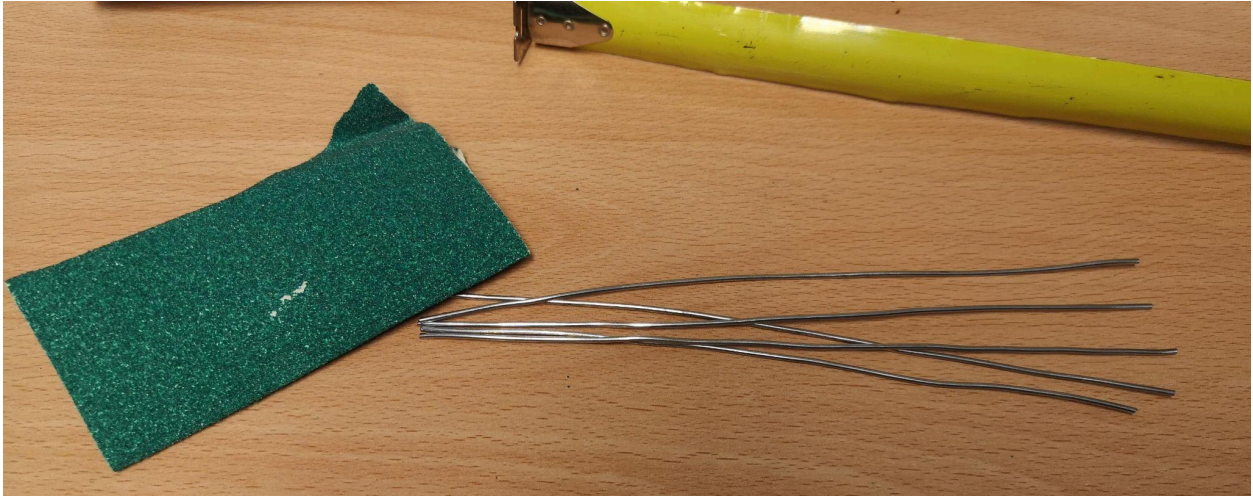


Antenna Building

We will be building a quarter-wave ground plane antenna. A great first antenna. The antenna will resonate at 433 Mhz for our purpose using this [calculator](#) we will use the following parts.

Radials

Cut four wires to a length of 18.4 cm

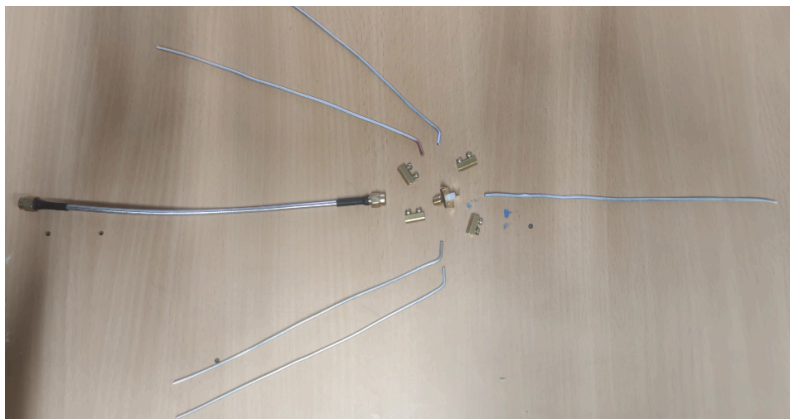


Remove the sharp ends of the wire with sandpaper.

Vertical Monopole

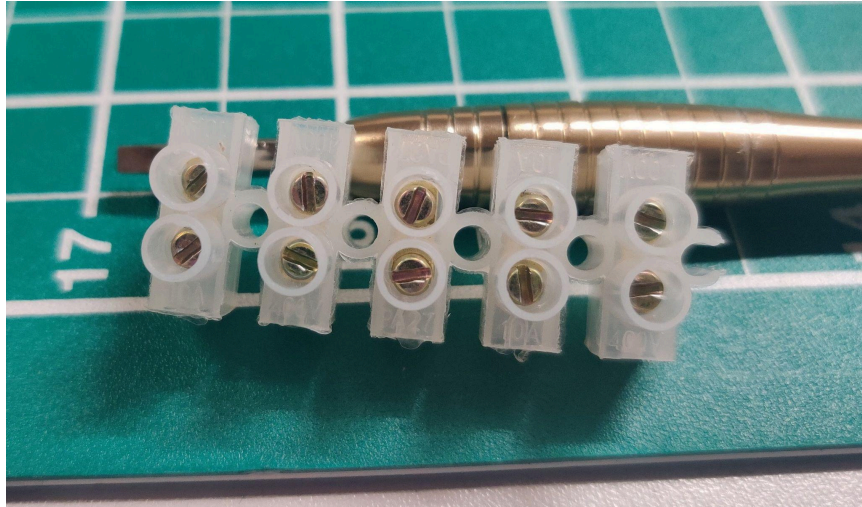
Cut one wire to a length of 16.5 cm.

Remove the sharp ends of the wire with sandpaper.

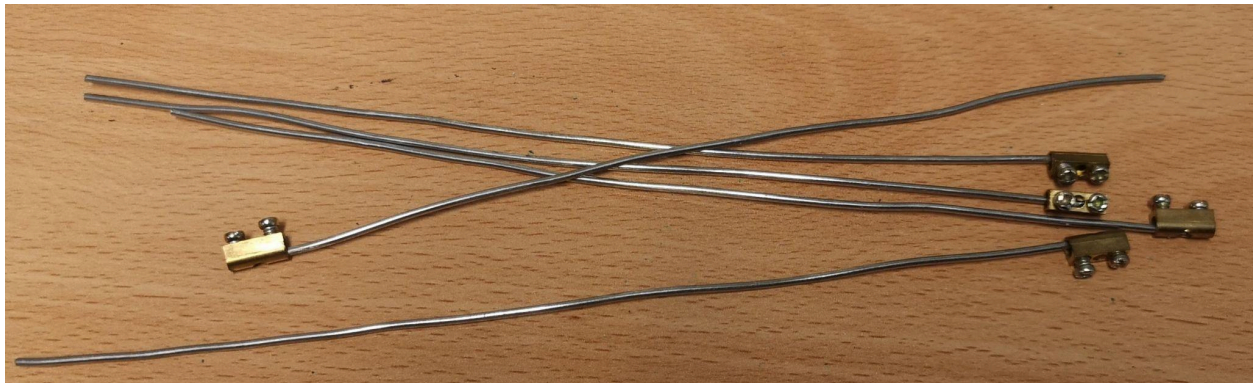


Barrier Terminal

Remove all screws from the barrier terminals. Be sure not to lose any of them. Some may have different screws than shown in the following images.



Put the wires into the barrier terminals until the wire is past the first screw.



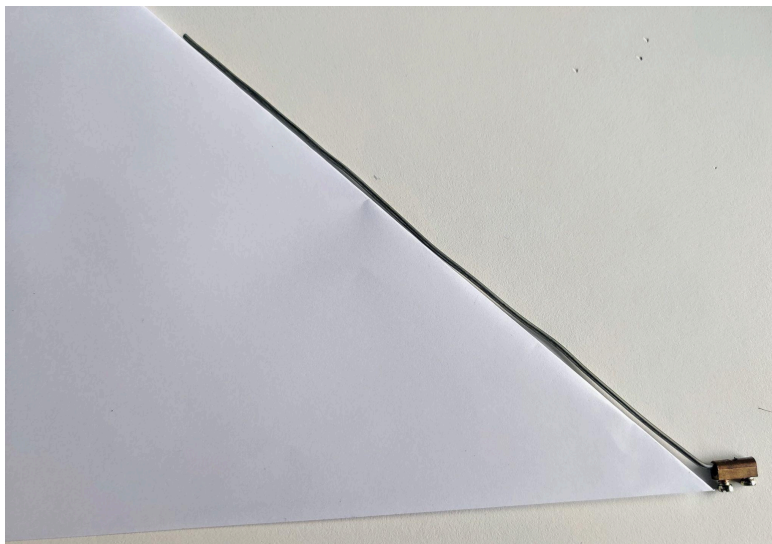
Bending Wires

For the antenna to be the correct impedance we need to bend the four radials at an angle of 45° . These are the four wires of length 18.4 cm.

Fold a sheet of paper from the corner to the other edge to create a 45° template.

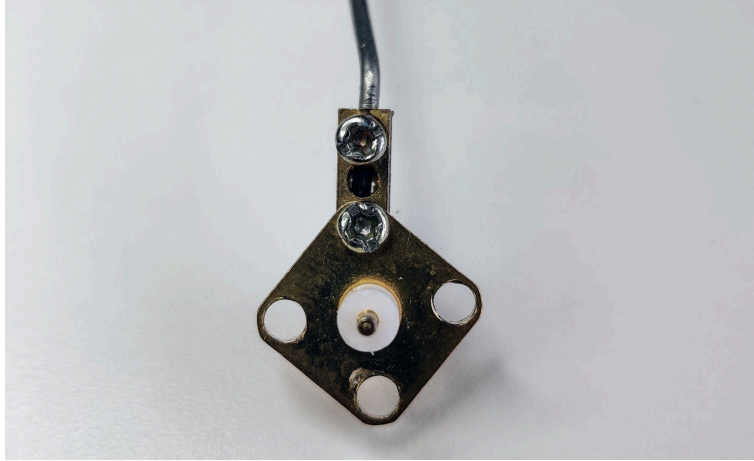


Use pliers to bend the wire at the point it exits the Barrier Terminal on the four radials.

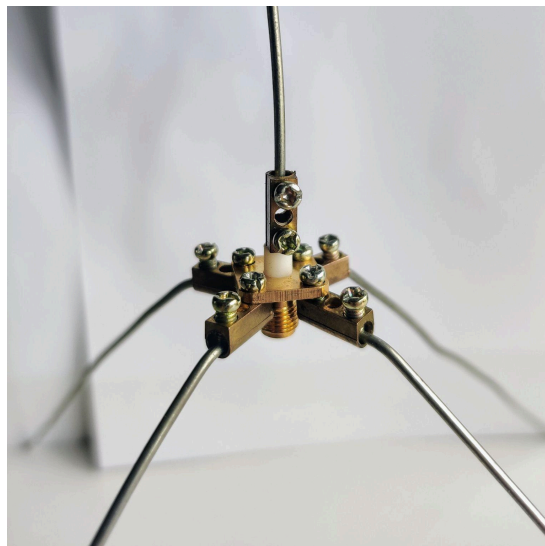


Final Assembly

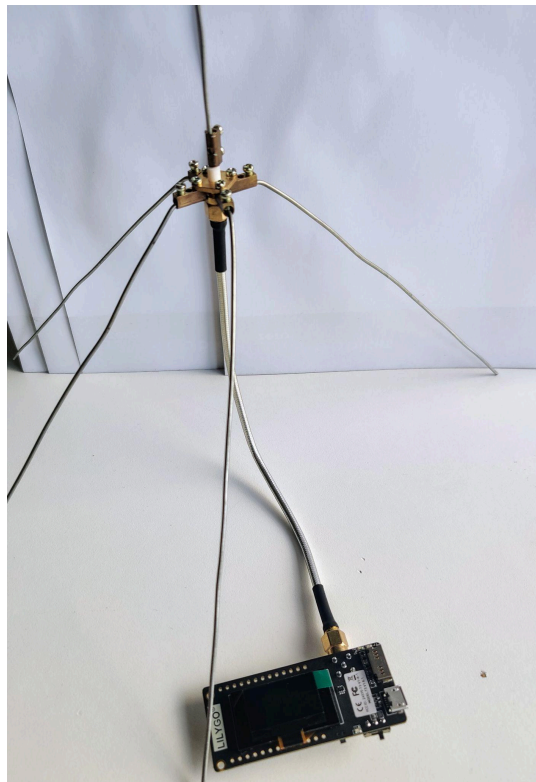
We will now be attaching the radials to the SMA female jack 4-hole. Remove the other screw from the barrier terminals. Place the screw through the top of the SMA jack and place it in the barrier terminal as shown below.



Repeat the process for the other three radials.



Now place the Vertical Monopole on top of the SMA connector and tighten the screw.



Now connect our flex SMA Plug to our antenna and LoRa board.

Software Configuration

The TinyGS project provides a firmware flashing tool on their website that is cross-platform and very easy to use. It uses a Chrome browser. To save you from needing a laptop for this build I have already loaded the firmware onto the device.

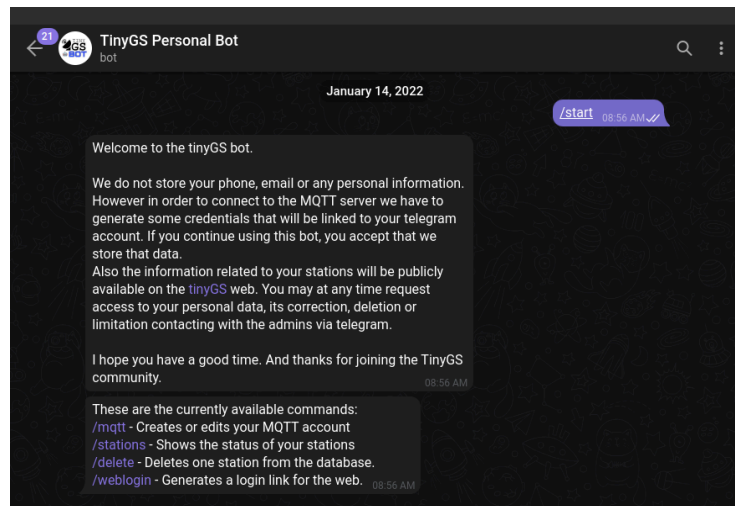
Telegram

We will be using Telegram in order to get our username and password to join the TinyGS network. Create an account if you don't already have one <https://telegram.org/>

Next, you need to join the main Telegram channel for TinyGS via the following link <https://t.me/joinchat/DmYSEIZahiJGwHX6jCzB3Q>

Once you have joined the TinyGS group you will then need to message the `tinygs_personal_bot` account. You can access this account via the pinned messages in the general channel. Or by visiting this link https://t.me/tinygs_personal_bot

We are looking to send @tinygs_personal_bot /start a message. This will open an interaction with the TinyGS bot. It will look something like the below image. You will need to click the /mqtt link. This will create the credentials for your account.



LoRa Board Setup

Plug the USB cable and your board will power on. The board will now create a WiFi access point, and the name of this network will be shown on the screen.

Join this WiFi network with another device. The captive portal should auto-load when you try and access the internet on your phone/laptop or visit the IP address listed on the screen.



Station dashboard

Configure parameters

Upload new version

Restart Station

Select **Configure parameters** and make the following changes:

System Configuration

- Ground Station Name: **Unique_Name**
- Generate a password: # Create this to login again with user: **admin**
- WiFi SSID: **<WiFi SSID>**
- WiFi Password: **<WiFi password>**
- Latitude:
- Longitude:
- Time Zone: **Europe/Dublin**

MQTT Credentials

- MQTT Username: # From The Telegram Bot message
- MQTT Password: # From Telegram Bot message

Your device will now try and connect to the WiFi settings you have entered. If all the details are correct you will receive a message from the TinyGS Bot saying your station is online.

Troubleshooting

The device is not joining the local WiFi Network

Are you trying to connect to a 5GHz network? The device will only work with 2.4GHz networks.

The device is not connecting to the internet.

Check your MQTT credentials. Did you copy them correctly?

The device is showing up in the middle of the ocean.

You have forgotten to update the location details.

I am no longer at the event, how can I use the device?

If the device can no longer find the WiFi network, it will create an ad hoc network and allow you to enter the details again.

I have forgotten my device password.

Use the firmware flashing tool and reflash the device.

How do I put the station outside?

A simple waterproof box from your local hardware store will keep the device safe.



Links

This workshop is only possible with all the work done by the TinyGS community. Please show them your support <https://tinygs.com/>

This Wiki page goes into detail about all the settings.

<https://github.com/G4lile0/tinyGS/wiki/Ground-Station-configuration>

If you would like to contact me jeffreyroe@tog.ie or @tdr112:matrix.org

This guide takes elements and photos from the write-up by EI4LF who did this workshop in the past. Visit their full write-up. <https://www.obriain.com/ei4lf/primers/LoRa/>