

Outdoor LoRa 433/868/915MHz IP67 +12V DC

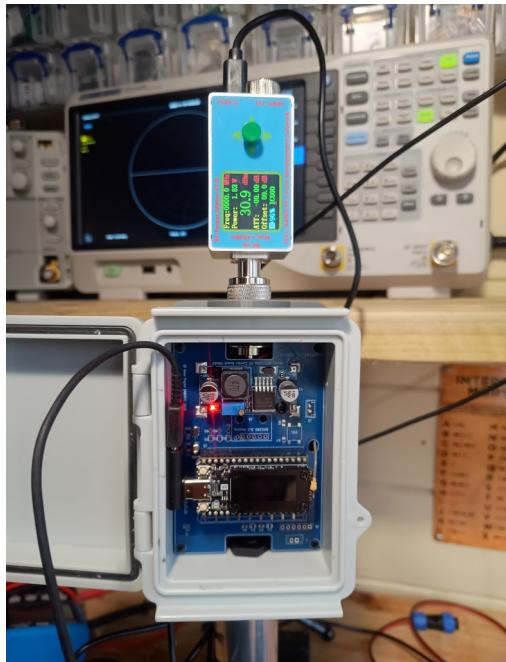


MeshCORE / Meshtastic Repeater (433/868/915MHz)
and
APRS iGate/Digipeater (433MHz)

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Thank you for purchasing the Outdoor +12V DC MeshCORE/Meshtastic repeater 868MHz (EU) / 915MHz (US/AU/NZ) or APRS 433MHz (e.g. Amateur Radio 70cm band) iGate/Digipeater. Below is a short user guide to help you get started.



To get the full version of this guide, please scan the the QR code in the top left corner using your phone's camera.

The Outdoor 12V Meshtastic/MeshCORE repeater (433/868/915MHz) or APRS iGate/Digipeater (433MHz) uses a LoRa Wi-Fi 32 V4 (+28dBm) or V3 (+21dBm) Single Board Computer (SBC) from Chinese company Heltec Automation. At the heart of the Wi-Fi LoRa 32 (V3 or V4) SBC is a 32bit ESP32 microprocessor with integrated Bluetooth and Wi-Fi; and Semtech SX1262 LoRa modem.



Heltec LoRa Wi-Fi 32 (V3)



Heltec LoRa Wi-Fi 32 (V4)

To learn more about the Wi-Fi LoRa 32 (V3 or V4) SBC from Heltec, please scan the the QR code above using your phone's camera.

+12V DC Outdoor Repeater/iGate/Digipeater Hardware Overview

Like all PCBs, the LoRa Wi-Fi 32 (V4 and/or V3) SBC inside your outdoor “12V Meshtastic/MeshCORE repeater or APRS iGate/Digipeater” is itself not designed for outdoor use. It has therefore been enclosed in a sealed plastic IP67 enclosure so that it can be installed outdoors; preferably on a external mast/pole or satellite dish mounting bracket. The IP67 outdoor enclosure is made of plastic which is completely waterproof, but it is not fireproof. Therefore it must not be installed in an indoor or enclosed location; and in particular it must not be installed in a roof or attic space.

With all things radio, height, type of antenna, and minimising cables losses are key to getting good range – both for transmit and receive. Although LoRa is great for **Long Range** (which is where the name **LoRa** comes from) and low power communications (it uses something called Spread Spectrum to achieve this), even it is useless if the antenna is poor, the equipment being used is at ground level (where there are lots of things like buildings in the way to attenuate the signal), or if a substantial proportion of the RF signal is lost between the equipment generating the signal (e.g. the Heltec LoRa board RF front-end) and the antenna. This is particularly true at the UHF frequencies that Meshtastic/MeshCORE and APRS uses (866MHz, 915MHz and 433MHz).

The best way to overcome these losses and hence maximise range, is to mount the electronics generating (and receiving) the RF signal as close to the antenna as possible (so that losses in any RF cables are as small as possible), use a antenna with some gain, and mount the complete assembly outdoors and as high as possible. For this reason the 12V outdoor repeater/iGate/Digipeater you have purchased has been designed so that the electronics generating (and receiving) the RF signal are co-located with a +5.5dBi or +3.0dBi gain antenna, in the same waterproof IP67 enclosure. The electronics are contained inside the waterproof IP67 enclosure, and the antenna is mounted on the outside, with a short length of coaxial cable (10cm) between them. This way the RF feeder losses are kept to an absolute minimum, and the gain of the antenna extends the range. The complete outdoor unit (IP67 case, electronics and +5.5dBi/+3.0dBi gain antenna) can then be mounted in an elevated location using the external 1.5" (38mm) mounting brackets – typically to a standard aluminium mast or satellite mounting bracket. The aluminium mast or satellite mounting brackets are not supplied with your 12V Meshtastic/MeshCORE repeater or APRS iGate/Digipeater, but are readily available from many online retailers. Just make sure the diameter of the external pole that you mount your 12V Meshtastic/MeshCORE repeater or APRS iGate/Digipeater on is 38mm in diameter.

Obviously once you have mounted your 12V Meshtastic/MeshCORE repeater or APRS iGate/Digipeater in a elevated outdoor location, it will need some power. This why the unit is shipped with a ten meter +12V DC power cable as shown below:



The ten meter 12V DC power cable supplied with your 12V Meshtastic/MeshCORE repeater or APRS iGate/Digipeater comes with a outdoor SP13 connector on one end, and a indoor 2.1mm x 5.5mm socket on the other. The SP13 connector is waterproof (IP68) and should be plugged into

your 12V outdoor Meshtastic/MeshCORE repeater or APRS iGate/Digipeater (remember to tighten up the blue plastic nut or it will pull out). At the other end of the +12V power cable is a standard 2.1mm x 5.5mm DC jack socket which is not waterproof (i.e. it should only be used indoors) and should be plugged into a standard AC mains (230V/110V) to +12V DC wall adapter. These can be sourced from many reputable online retailers, such as Amazon, CPC (UK), Pi-hut (UK) or Home Depot (US). Please ensure it has a 5.5mm x 2.1mm connector (Jack) on the end, has 12V DC out (**not** 5V, 9V or 24V), and is capable of sourcing at least 1.5A.

Pre-installed Software (868MHz/915MHz/433MHz)

If you purchased the +12V DC “MeshCORE/Meshtastic repeater”, either 868MHz or 915MHz version, it will come pre-installed with the latest version of MeshCORE. However, it can easily re-flashed with the latest version Meshtastic firmware if required.

If you purchased the 12V “APRS iGate/Digipeater” version (433MHz), it will come with latest version of APRS iGate/Digipeater software from Richard Gunzman (CA2RXU).

As MeshCORE seems to be the most popular firmware of late (January 2026), below you will find instructions on how re-flash MeshCORE when a new version of firmware is released. If you wish to install Meshtastic, your should still read the MeshCORE instructions as they are almost identical.

MeshCORE/Meshtastic (868MHz/915MHz) Web Flasher

As mentioned above, the 868MHz and 915MHz version (aka as the “HF” version) of the Heltec Wi-Fi LoRa (V3 or V4) board installed inside your 12V MeshCORE/Meshtastic repeater is supported by both Meshtastic and MeshCORE firmware . MeshCORE comes installed by default (unless you requested otherwise during purchase) but you can easily upgrade it to Meshtastic if you so wish. For both MeshCORE and Meshtastic, the authors of the software/firmware have provided a very handy web base application to make upgrading to the latest firmware as pain free as possible. For MeshCORE the web flash utility is available here:

<https://flasher.meshcore.co.uk/>

and for Meshtastic, the web flash utility is available here:

<https://flasher.meshtastic.org/>

Installing MeshCORE (868MHz/915MHz)

As MeshCORE seems to be the most popular firmware for new installations ,in this section we will go through how to flash MeshCORE. The first step is to remove the Heltec LoRa Wi-Fi (V3 or V4) board from the IP67 case, and then plug it into a Windows or Linux PC using a USB-A to USB-C cable. I recommend taking a photograph of everything before you do this, so you can consult the photograph when it is time to put it back – so you don’t get it the wrong way around!

Warning: Under no circumstances should you attempt to connect your Heltec LoRa Wi-Fi (V3 or V4) board up to your computer (via USB-C) when it is mounted on the PCB; and particularly when it is also being powered via the 12V (SP13). Doing so will result in irreversible damage to the main +5v to+ 3v3 LDO regulator on the Heltec LoRa Wi-Fi board. Remove the Heltec LoRa Wi-Fi board from the carrier PCB first before attempting any upgrade or configuration over USB.

With the Heltec LoRa Wi-Fi (V3 or V4) board plugged in your Windows or Linux PC, go to the MeshCORE firmware web flasher at the link above and select “Heltec v3” or “Heltec v4” (depending on which version you have) as shown below:



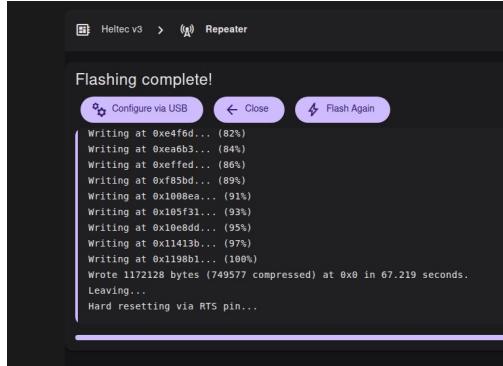
You next need to decide what “role” or mode you want it to operate in. At this stage I recommend reading the MeshCORE documentation to understand what the various “roles” are.

<https://github.com/meshcore-dev/MeshCore/blob/main/docs/faq.md>

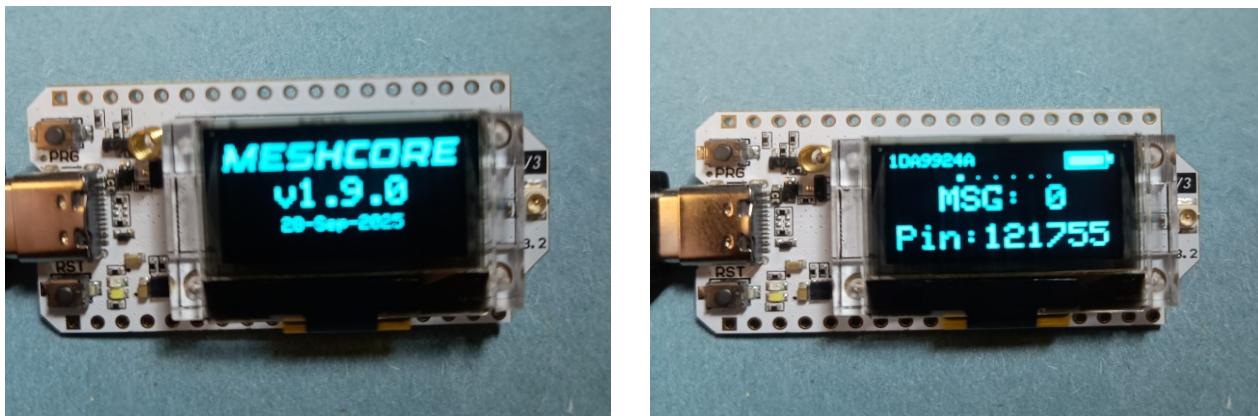
The options are as show below:

Next you should be presented with a page which looks similar to the one above. It will recommend the latest firmware and then invite you to “Flash!” the firmware. If you are switching from Meshtastic, before you do this I recommend selecting “Erase device” to ensure that any Meshtastic configuration is erased completely before it attempts to install MeshCORE. If you don’t do this, “Loading ...” will be display on the OLED forever. I recommend doing the same if switching from MeshCORE to Meshtastic. The Meshtastic web flasher has the same option

When you click “Flash!” (remember “Erase device” selected) the MeshCORE web flash utility will ask what “serial” port it should be using to communicate with the Heltec LoRa Wi-Fi (V3 or V4) board. Just select the one that has “CP2102 UART to USB bridge” written next to it, and then click “Connect”. It should then start flashing MeshCORE on to your Heltec LoRa Wi-Fi (V3 or V4) board.



You will know when the flashing process is complete, when you see “Hard resetting via RTS pin” displayed in the terminal window. Also, depending on what “role” you selected, you will see information being displayed on the OLED display. For example, in the “Companion Bluetooth” or “Companion USB” roles, when the flashing process is complete you should see “MESHCORE v1.10.0” (or whatever is the latest) pop up on the OLED display, followed by a Pin number.



Flashing the firmware is now complete, so you can now re-install the Heltec LoRa Wi-Fi (V3 or V4) board into the carrier PCB in the IP67 case. Here is a picture of the unpopulated PCB showing the silk-screen of the Heltec board before components were fitted:



Observe that in this version (PBA0073 v1.2), on one side (left here) there is a USB-C symbol etched on to the PCB silk-screen layer. Use the USB-C symbol to orientate the Heltec LoRa Wi-Fi (V3 or V4) board when re-installing it, and make sure all 18 upper, and all 18 lower pins are inserted and aligned correctly.

On some other versions of the board (e.g. PBA0068 v1.1), the Heltec LoRa Wi-Fi (V3 or V4) board was the other way around (USB-C to the right) so use the photograph you took before removing it to make sure you put it back correctly. Use the white “USB-C” symbol on the PCB to guide you.

If you have any concerns about re-inserting the Heltec LoRa Wi-Fi (V3 or V4) board, before powering up please e-mail me.

At this stage you now need to download the MeshCORE app from the following link:

<https://meshcore.co.uk/apps.html>

I recommend reading the instructions on the MeshCORE Wiki on how to use it properly before proceeding:

<https://github.com/meshcore-dev/MeshCore/blob/main/docs/faq.md>

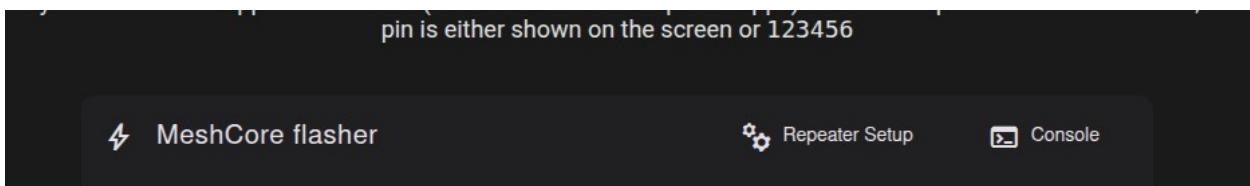
Once you've read through the MeshCORE Wiki, you next need to tell the MeshCORE app how to communicate (over Bluetooth or USB) with the MeshCORE software now running on the Heltec LoRa Wi-Fi (V3 or V4) board.

If you selected “**Companion Bluetooth**” mode/role during flashing, you next need to go into your phone settings, enable search for Bluetooth devices, and then select the MeshCORE device it discovers. You will then be prompted to enter the Pin (that is display on the OLED display of the Heltec LoRa Wi-Fi (V3 or V4) board) when prompted to do so. You should now be able to use the MeshCORE app to manage your MeshCORE node.

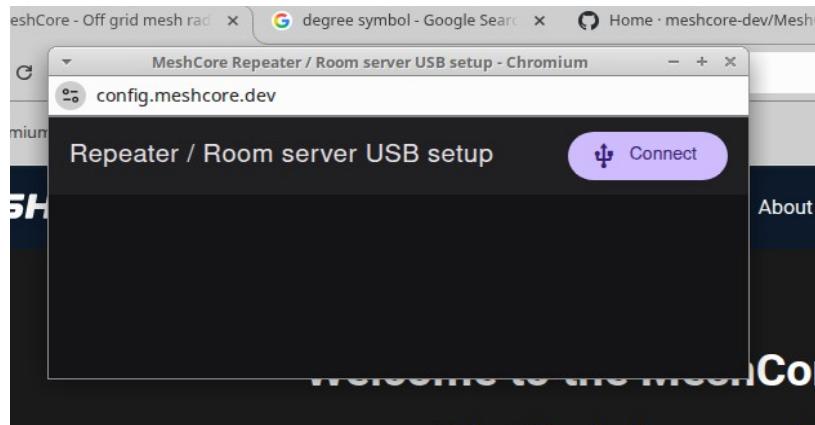
If you installed “**Repeater**” mode, the final stage is to configure your MeshCORE node to act as a repeater. To begin go to the MeshCORE firmware flash utility:

<https://flasher.meshcore.co.uk/>

and at the top you will see a “Repeater Setup” button like so:

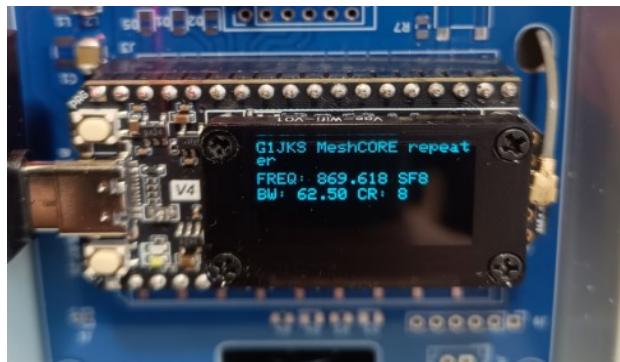


When you select this, the following window will pop up:



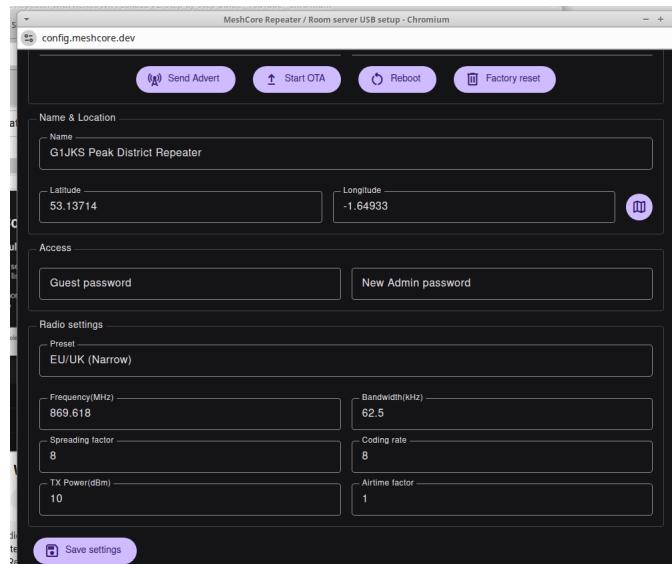
At this stage I recommend disconnecting the USB-C cable from the Heltec Wi-Fi LoRa (V3 or V4) board and then re-inserting it to force a complete reboot. The first time it boots it will display the message “Please wait” on the OLED display, as it generates a new public/private key pair.

Please be patient and wait for this to complete before proceeding.



When the “Please wait” message is replaced with “Heltec Repeater” as shown above, click the “Connect” button on the pop up browser Configuration window and you will then be ask what “serial” port it should be using to communicate with the Heltec LoRa Wi-Fi (V3 or V4) board. Just select the one that has “CP2102 UART to USB bridge” written next to it, and then click “Connect”.

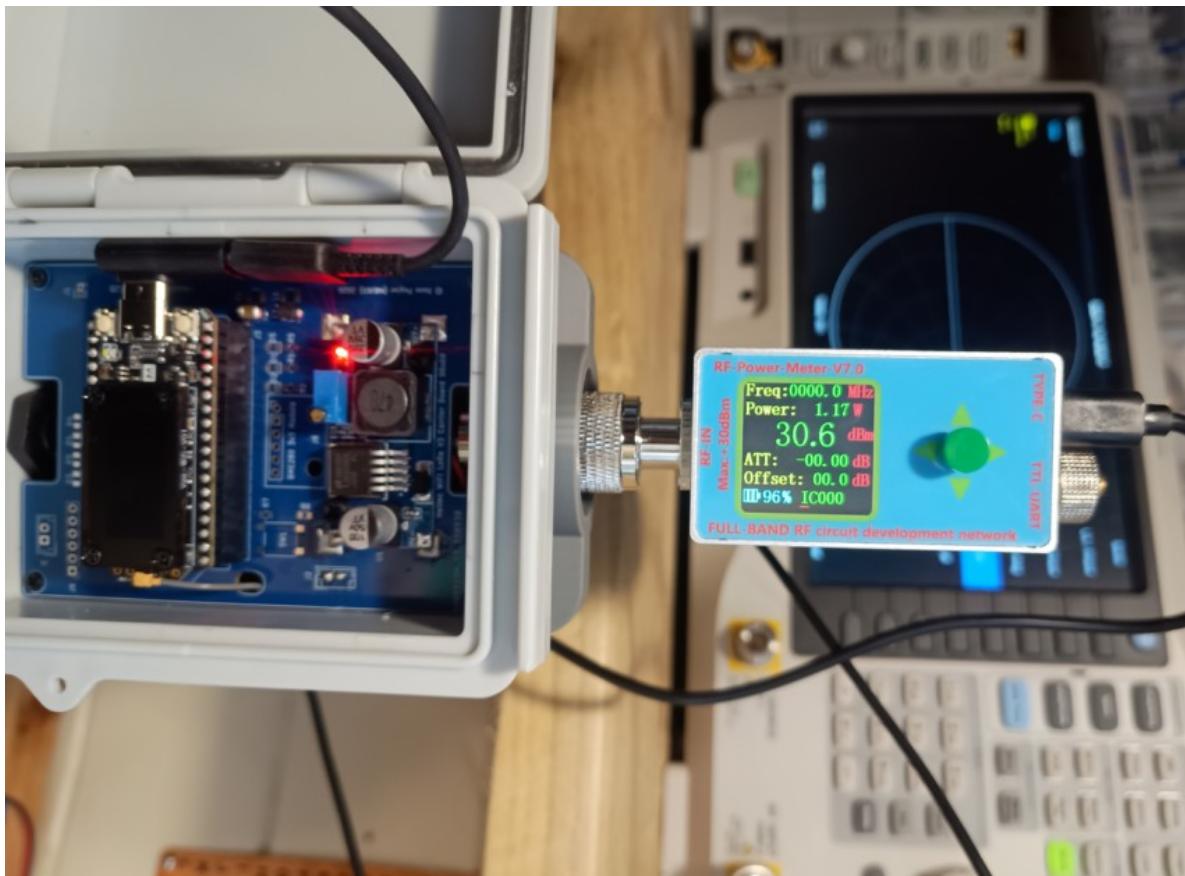
You should then be presented with the “Repeater / Room server USB setup page” as shown below:



This is the utility that is used to configure your MeshCORE repeater. There's lots to choose from here, but the main options to change are the "Name", which is the name of your MeshCORE repeater, the location (Latitude and Longitude) of your MeshCORE repeater and the Radio Settings; the latter being the most important. For the EU/UK the current recommend settings are EU/UK (Narrow) which configures the SX1262 LoRa modem inside your Heltec LoRa Wi-Fi (V3 or V4) board to frequency 869.618MHz, 62.5MHz bandwidth, Spreading Factor (SF) 8, Coding Rate (CR) 8 and TX power level of +10dBm (10mW). If you are not in the UK or EU it will probably be different, so please check. For more information on what all this mean (Spreading Factor, Coding Rate etc.), and in particular an explanation of the modulation scheme used by LoRa (called Chirp Spread Spectrum) I recommend reading the second paragraph on page 4 of the following document from the RSGB:

https://github.com/G1JKS/GB1HAB/blob/main/RSGB_LoRA_ARPS_Balloon_Tracker_1.8.pdf

For the Heltec LoRa Wi-Fi (V3) board the TX Power level (in dBm) can be set to anything up to +21dBm (125mW); and for the Heltec LoRa Wi-Fi (V4) board anything up to +28dBm (630mW). However, my understanding is that both the V3 and V4 board, the maximum value you can set in the "TX Power (dBm) box" is 22. On the V3 board this results in +22dBm output power (approximately 125mW) and on the V4 this results in +28dBm output power (approximately 630mW). However, when I tested the V4 board in my lab (MeshCORE v1.10.1), the power level was actually slightly over +30dBm (1000mW or 1W). See below:



I do however urge caution when setting the power level here, as you need to check what is legal for your country. For example, Ofcom (the UK Spectrum regulator) document IR2030 specifies the maximum output power in the License Exempt Short Range Device (SRDs) 868MHz band for the UK, is 500mW (EIRP). It may be different in your own country, please check.

EIRP (Effective Isotropic Radiated Power) is the combined output power of the transmitter, minus any cable insertion loss, plus the gain of the antenna. If you purchased a 12V MeshCORE or Meshtastic repeater, with the Heltec LoRa Wi-Fi V4 board inside, when setting the TX Power level in the configuration utility, it is important to include the +5.5dBi antenna gain in the calculation for the EIRP. If you set the power level to +28dBm, by entering 22 in the TX Power (dBm) box, if one assumes the 10cm internal IPEX to N-Type cable has negligible insertion loss, the additional +5.5dBi gain of the antenna will result in an EIRP of +33.5dBm, which is approximately 2200mW (2.2W). This clearly exceeds what is allowed in the UK, Europe and probably in your country; so please check. For more details on what is, and what is not permitted in the 868MHz band in the UK, please see the following link for more details.

<https://tinyurl.com/bdfcwp7b>

The spectrum regulator for your country will also have such a document, so please check it.

Finally, for more information on how to configure a MeshCORE repeater, please take a look at this video on YouTube:

<https://www.youtube.com/watch?v=DhgY0K-iA60>

Installing Meshtastic (868MHz/915MHz)

If after doing all the above, you decide you want to go back to Meshtastic, it too comes with a firmware web flasher utility. You can find it here:

<https://flasher.meshtastic.org/>

It uses the same “esptool.js” JavaScript tool to install firmware as MeshCORE, so the instructions for Meshtastic are almost identical for those above for MeshCORE. The only difference is Meshtastic does not have different firmware for different “roles”. There is only one version of firmware and the role/mode (e.g. client, router) is configured from the Meshtastic app.

Warning: Under no circumstances should you attempt to connect your Heltec LoRa Wi-Fi (V3 or V4) board up to your computer (via USB-C) when it is mounted on the PCB; and particularly when it is also being powered via the 12V (SP13). Doing so will result in irreversible damage to the main +5v to+ 3v3 LDO regulator on the Heltec LoRa Wi-Fi board. Remove the Heltec LoRa Wi-Fi board from the carrier PCB first before attempting any upgrade or configuration over USB.

Installing CA2RXU's APRS iGate/Digipeater (433MHz)

If you purchased the 12V “APRS” iGate/Digipeater version (433MHz) it will come with latest version of APRS iGate/Digipeater software from Richard Gunzman (CA2RXU). This also has a firmware web flasher utility, which you can find here:

[Richard Gunzman \(CA2RXU\) APRS iGate firmware web flasher utility](#)

Warning: Under no circumstances should you attempt to connect your Heltec LoRa Wi-Fi (V3 or V4) board up to your computer (via USB-C) when it is mounted on the PCB; and particularly when it is also being powered via the 12V (SP13). Doing so will result in irreversible damage to the main +5v to+ 3v3 LDO regulator on the Heltec LoRa Wi-Fi board. Remove the Heltec LoRa Wi-Fi board from the carrier PCB first before attempting any upgrade or configuration over USB.

Details of how to configure an APRS iGate or Digipeater can be download from the following link:

https://drive.google.com/file/d/1-jafzOWis_qOaNUL4WGVCFKjh_uCJtB6/view

Best of luck, and any issues get in touch; my e-mail address is at the top of the page. However, before you do, please take the time to read the various online documentation which you can find here:

<https://meshtastic.org/>

<https://meshcore.co.uk/>

https://github.com/richonguzman/LoRa_APRS_iGate

73 Dave (G1JKS / M0JKS)