

## ChatterBox v1.0 Build

Building a ChatterBox requires specific parts (listed below), some decent soldering skills, and tools, and supplies.



Figure 1: ChatterBox 1.0

This document contains the list of required tools, parts and supplies for assembling a ChatterBox. The steps for assembling and testing the ChatterBox are also shown, followed by the steps required for installing the firmware.


Be sure to take your time when assembling these. Installing a component incorrectly can easily ruin the kit.

Once you have fully assembled the electronics, be sure to perform some continuity tests (instructions are shown), because if you have an incorrectly installed component or a short somewhere, you may fry any or all of the components as soon as you connect power (or worse, start a fire)!

Building the enclosure/case will be covered in a separate document, this is just for the electronics.

## Required Tools

Some examples are shown below, in case you don't already have these tools. But of course, pretty much any similar soldering tools will work.

<b>Soldering Iron</b> <i>You will need a somewhat fine tip.</i>		<a href="https://a.co/d/ecbEr8U">https://a.co/d/ecbEr8U</a>
<b>Nippers</b>		<a href="https://a.co/d/dfnASnU">https://a.co/d/dfnASnU</a>
<b>Allen/Hex Driver 1.5</b> <i>The driver type will be easier than the 90 degree bent type</i>		<a href="https://a.co/d/ccto8cp">https://a.co/d/ccto8cp</a>
<b>Multimeter</b> Doesn't have to be expensive, we just test for continuity		<a href="https://a.co/d/aD4CghG">https://a.co/d/aD4CghG</a>
<b>PCB Holder</b> Optional, but can make things easier, especially for attaching the SMA to the LoRa module, which can be tricky		<a href="https://a.co/d/hNhehUd">https://a.co/d/hNhehUd</a>

## Supplies

Solder  
.032 diameter works well



<https://a.co/d/cfh39xr>

Sticky Dots  
3 per ChatterBox



<https://a.co/d/fU3k9C0>

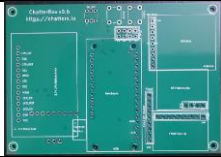






Two Pencils  
This is optional, but for me makes installing the header pins much easier.













<https://a.co/d/itbnM6E>

## Components - One set Per ChatterBox

Do not try to substitute other parts (even same part number/different brand), or they will mismatch pin layouts or sizes on the PCB.

Part Name	Example Image	Product Link
<b>ChatterBox PCB</b>		Not yet available, coming soon.
<b>Adafruit Feather M4 Express with SAMD51</b>		<a href="https://www.adafruit.com/product/3857">https://www.adafruit.com/product/3857</a>
<b>EEMB LP103454 LiPo Battery - 3.7v 2000mAh (check polarity, need "reversed")</b>		<a href="https://a.co/d/hBjfzGx">https://a.co/d/hBjfzGx</a>
<b>Adafruit DS3231 Precision RTC Breakout</b>		<a href="https://www.adafruit.com/product/3013">https://www.adafruit.com/product/3013</a>
<b>Adafruit RFM95W LoRa Radio Transceiver Breakout - 868 or 915 MHz - RadioFruit</b>		<a href="https://www.adafruit.com/product/3072">https://www.adafruit.com/product/3072</a>
<i>Either of the following FRAM breakouts (4 Mbit/512 preferred)</i>		
<b>Adafruit SPI Non-Volatile FRAM Breakout - 2 Mbit / 256 KBytes - MB85RS2MTA</b>		<a href="https://www.adafruit.com/product/4718">https://www.adafruit.com/product/4718</a>
<b>Adafruit SPI Non-Volatile FRAM Breakout - 4 Mbit / 512 KBytes - MB85RS4MT</b>		<a href="https://www.adafruit.com/product/4719">https://www.adafruit.com/product/4719</a>

<p><b>Adafruit 3.5" TFT 320x480 with Capacitive Touch Breakout Board – EYESPI</b></p>		<p><a href="https://www.adafruit.com/product/5846">https://www.adafruit.com/product/5846</a></p>
<p><b>Eyespi connector</b></p>		<p><a href="https://www.adafruit.com/product/5613">https://www.adafruit.com/product/5613</a></p>
<p><b>Eyespi Cable</b></p>		<p><a href="https://www.adafruit.com/product/5239">https://www.adafruit.com/product/5239</a></p>
<p><b>LoRa Antenna 915MHz 2dBi</b> (or similar). Must have <i>male</i> SMA connector. The quality of antenna can make a huge difference in your performance, so don't skimp here.</p>		<p><a href="https://a.co/d/3cVWAY4">https://a.co/d/3cVWAY4</a></p>

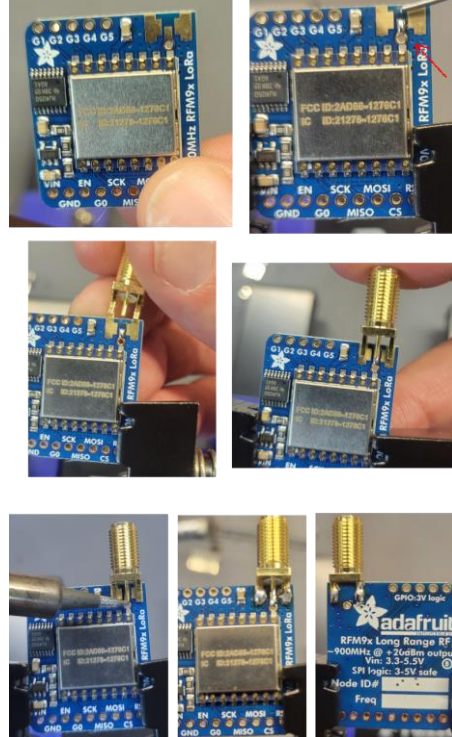
Commodity Items		
Connectors SMA Female PCB Edge Mount Connector		<a href="https://a.co/d/iB6l1ak">https://a.co/d/iB6l1ak</a>
CR1220 Low Drain 3V lithium Battery		<a href="https://a.co/d/9Eq4YvV">https://a.co/d/9Eq4YvV</a>
<i>USB micro charging cable with data transfer, such as one of the following:</i>		
USB micro charging/data cable, magnetic		<a href="https://a.co/d/03gxPzQ">https://a.co/d/03gxPzQ</a>
USB micro charging/data cable		<a href="https://a.co/d/8UdUHtD">https://a.co/d/8UdUHtD</a>
Two 6x6x12mm PCB Momentary Tactile Push Button Switches		<a href="https://a.co/d/ix9cXdQ">https://a.co/d/ix9cXdQ</a>
One .8x5.8x7mm PCB Dip Mounting Tactile Push Button Switch Latching 6 Pin		<a href="https://a.co/d/eWvQEsS">https://a.co/d/eWvQEsS</a>
Push button cap		<a href="https://a.co/d/cXca1ra">https://a.co/d/cXca1ra</a>
1X Header Pins Typically, enough of these come with the components		<a href="https://a.co/d/cQAs9CM">https://a.co/d/cQAs9CM</a>
2X4 Header Pins – one set per ChatterBox. These are not strictly necessary, but are required if you ever plan to run a thermal camera, relay, or other add-ons.		<a href="https://a.co/d/ej4tcf4">https://a.co/d/ej4tcf4</a>

4 M2 25mm bolts		<a href="https://a.co/d/7CgvX2v">https://a.co/d/7CgvX2v</a>
4 M2 nuts		<a href="https://a.co/d/iO1SlZx">https://a.co/d/iO1SlZx</a>
Blue thread lock		<a href="https://a.co/d/7P5kBo7">https://a.co/d/7P5kBo7</a>

# ChatterBox Electronics/PCB Assembly

## PCB Assembly / Soldering

Connect the SMA to the RFMW95



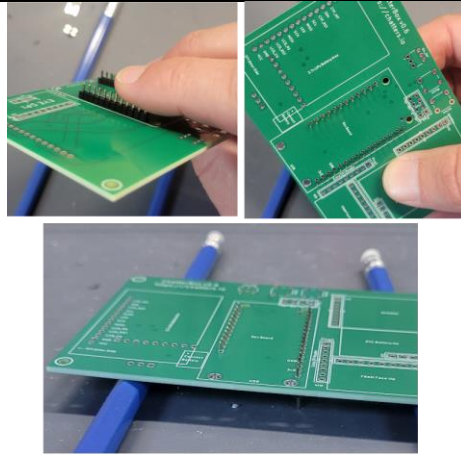
This is the most difficult part in my opinion. I start by placing a small amount of solder on the antenna (center) connection of the RFM95W, let it cool, then slide the SMA into position and reheat the antenna connector through the SMA.

Once that is done, you can the solder all the grounds and the SMA *should* stay in position.

After that, make sure each SMA pin has a good connection and that **the antenna and ground are not shorted**.

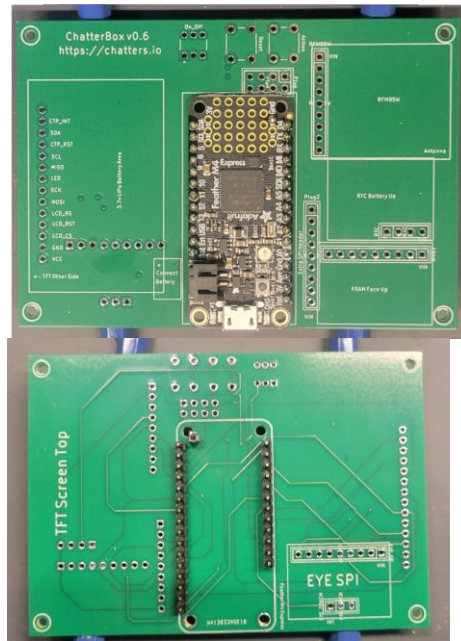


Connect the main (M4) board to the PCB

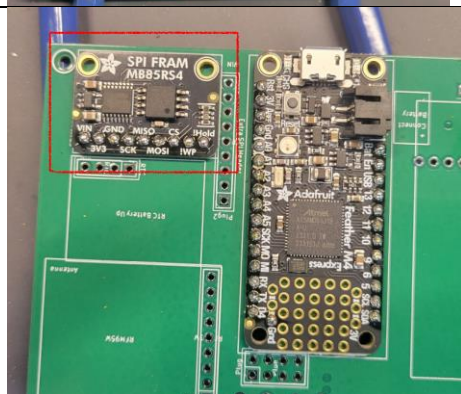


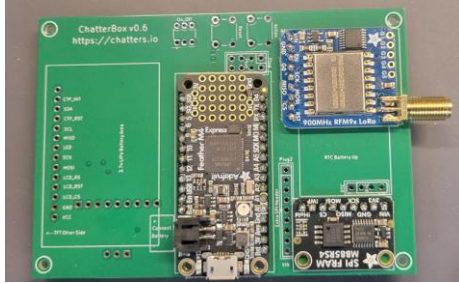
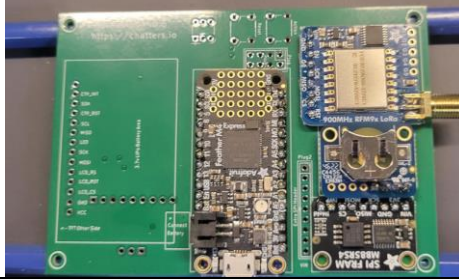
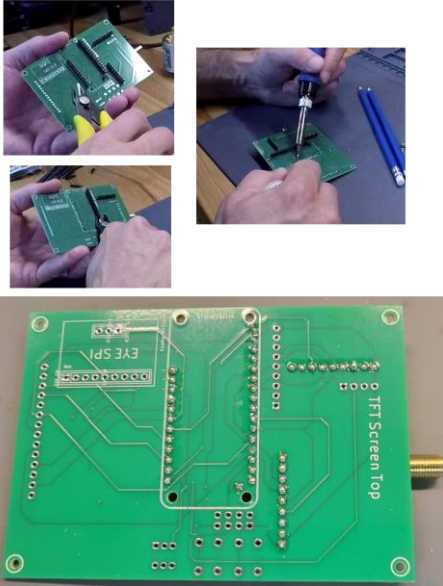

I find it easier to slide the header pins into position and let the PCB sit on top of 2 pencils, which leaves just the right amount of PIN length for the main board. You may find your own technique here that works better.

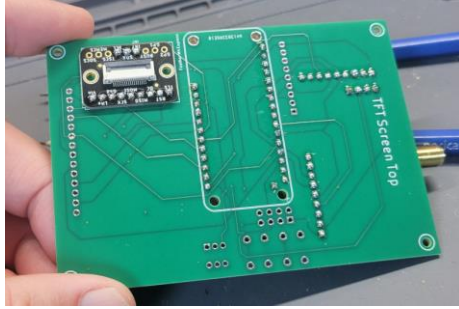
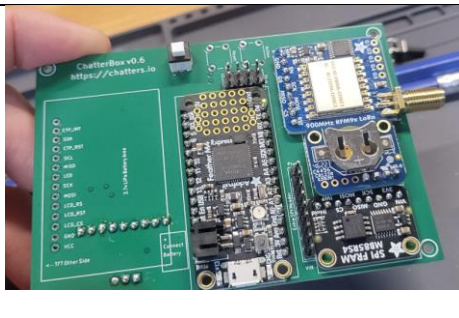

Don't forget the extra ground pin!



Connect the FRAM to the PCB



<p>Connect the RFM95W to the PCB</p>		<p>First, stack 3 sticky dots in the center of the RFM95 area of the PCB, as they help hold things in place while also keeping space needed.</p> <p>Next put the header pins into position and slide the RFM95W over the header pins.</p>
<p>Connect the realtime clock to the PCB</p>		<p>Only 4 of the RTC clock pins are connected to the board, the others are not used. VIN, Ground, SDA, and SCL are used.</p> <p>The battery retainer should be oriented facing you as shown.</p>
<p>Trim header pins on the underside of the PCB</p>		<p>Carefully trim the header pins on the bottom of the PCB and solder each from the underside.</p> <p>Be careful not to pull on or twist the pins, but just cleanly cut them without damaging the PCB.</p> <p>Cut and solder one row at a time, rather than cutting all at once. Otherwise, the components will be loose while you try to solder them, which can be difficult.</p>
<p>Solder the RTC into place and trim any pins</p>		<p>Place the RTC into place and solder the underside of the PINs. Trim the top pins if they are protruding.</p>

<p>Connect the EYESPI connector</p>		<p>Install the EYESPI connector on the OPPOSITE side of the PCB, as shown here. <b>Be sure to line up the <i>int</i> pin with the int marking on the board.</b></p> <p>Solder the pins on both sides of the PCB and trim as necessary.</p>
<p>Connect the Power Switch and header pins</p>		<p>Connect the power switch (the hollowed-out side of the switch should be facing UP toward the antenna connector of the board). Solder it into place.</p> <p>Also solder into place the 1x9 and 2x4 pin headers as shown.</p>
<p>Connect the push buttons</p>		<p>Place the two momentary switches onto the board flat and straight, and solder them into place.</p> <p>It's OK for the button pins/legs to protrude a little, but you might want to trim down to where the solder begins.</p>

## Continuity Tests

Do not be tempted to skip this part, or you may be unpleasantly surprised by smoke when you power up your device! If these tests are not performed, you may also encounter other frustrating issues, like the firmware hanging or things like that. Put your multimeter into continuity test mode with audible “beep” to make these tests easy.

### Check For Shorts

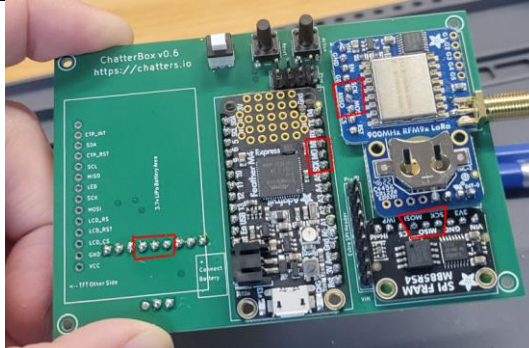
We don't want shorts anywhere, especially not between 3v and ground!



A fast way to check for shorts is to simply check 3v+ground first, then go all the way around the PCB, checking that each set of side-by-side pins does not have a short.

The only side-by-side pins that should have continuity are 3v3 and AREF.

### Check the SPI Connections



All SCK pins should have continuity with one another throughout the board.

The same goes for MISO and MOSI.

### Check the I2C Connections



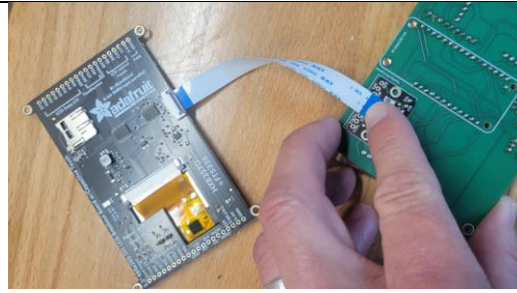
All SDA pins should have continuity with other SDA pins throughout the board.

All SCL pins should be connected throughout the board.

This is usually all I check, but if you want to check everything, you can check other pins.

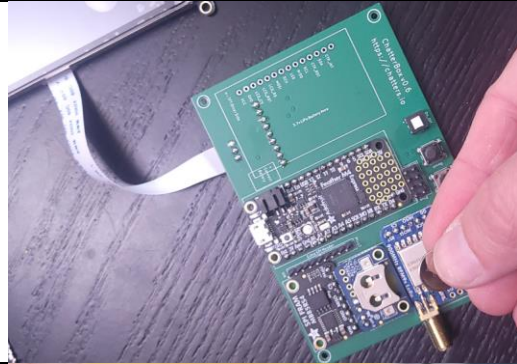
## Final Setup

Attach the screen



Near your computer (within distance of the USB cord connection), **NOT ON A METAL OR CONDUCTIVE SURFACE**, connect the screen to the ChatterBox using the ribbon cable as shown here.

Install the RTC Battery.

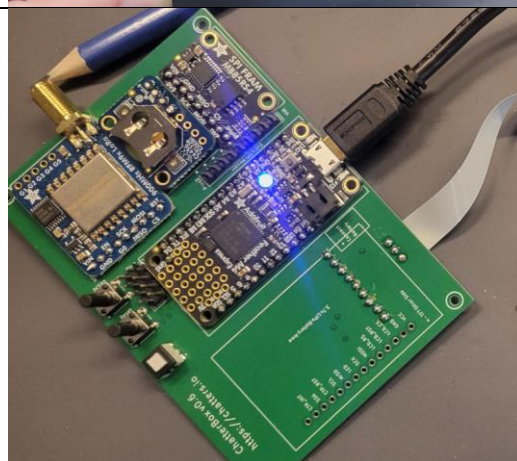


Push the power button to the 'on' position



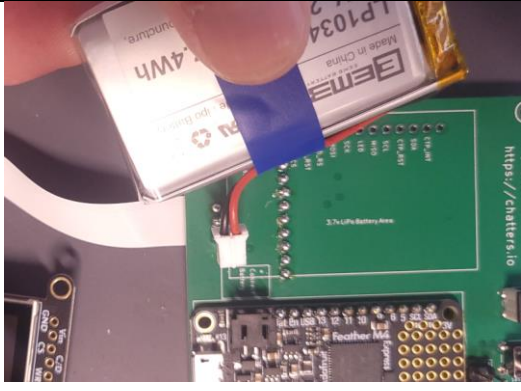
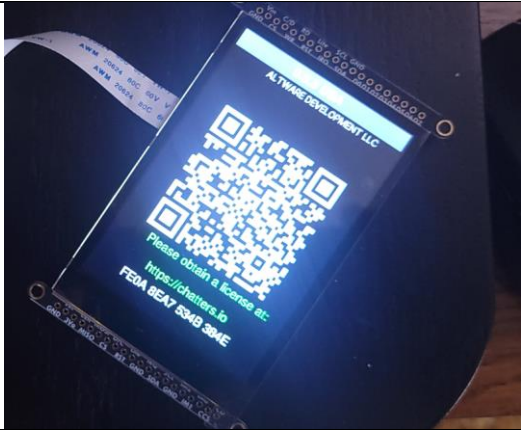
Button locked down is "on" if you installed it properly. If you installed it backwards, up might be the "on" position.

Plug the USB micro

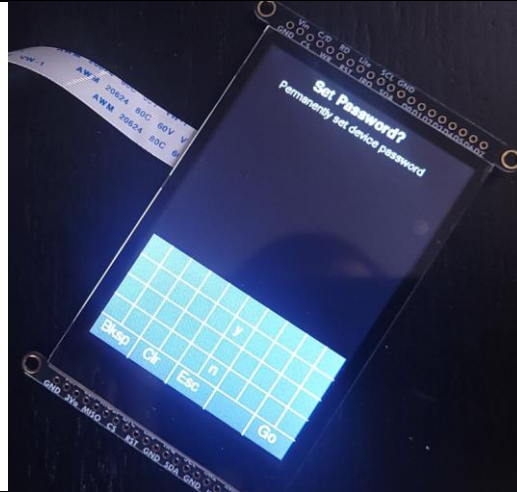


If all is successful, some lights will come on and the screen will flash repeatedly.

If nothing happens except for a yellow light, make sure the power button is on and that you have the USB connected to your computer.

<p>Install the LiPo battery</p>		<p>Tape the wire to the side of the LiPo battery as shown, to ease installation.</p> <p><b>Ensure polarity is correct as shown, red wire to + on PCB. Sometimes batteries come with the polarity reversed, this may fry your board!</b></p>
<p>Install the firmware</p>	<p>Follow the instructions here to get the firmware installed:  <a href="https://chatters.io/firmware">https://chatters.io/firmware</a></p>	
<p>Check that firmware was installed properly</p>		<p>You should be seeing a QR code on the screen</p>
<p>Obtain a license code and enter it into the device.</p>	<p>Use your phone to scan the QR code and follow the link. You will receive a license code for your device. The license is specific to your device, so you'll need to repeat this step for other ChatterBoxes.</p> <p>To enter the license code, touch the screen and you should be prompted for the key.</p> <p>Note that 1's tend to look like l's. Don't worry about upper/lower case and don't add the spaces.</p>	

Enter the license code



You should receive “Device Unlocked!” message, followed by a prompt to name your device.

Turn off the power (power switch) and disconnect the device.

You may go through all the setup if you wish, but it’s easier once the device is in its case.

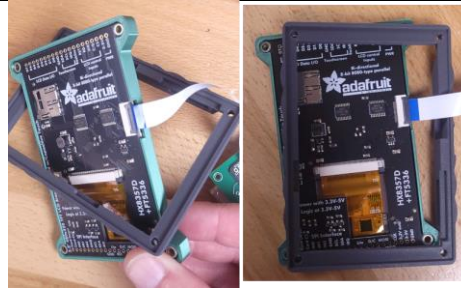
## Installing the Components into the Case

Snap the light window into place and press the power button into place



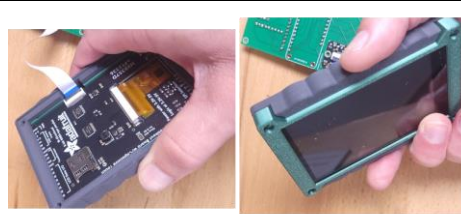
The clear light window may need to be snapped into place, unless it's already been done for you.

Place the screen into the screen frame



This may be a somewhat tight fit. A little tight is OK. If it's too tight, you might want to file off the corners of the screen's PCB just slightly.

Slide the case mid-grip into place

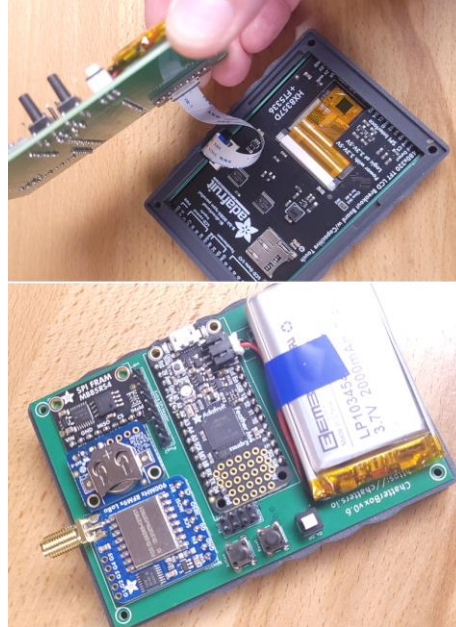


If it's easier, you can disconnect and reconnect the screen connector ribbon while doing this. Otherwise, you can push the screen and frame through the mid-grip and then slide the mid-grip into place from underneath.

Note there is a special cutout for the screen ribbon that you can see on the mid-grip, which helps you orient the mid-grip correctly.



Push the case back into place



You will need to make sure the battery and buttons are aligned properly and then push the case back over top of the PCB and components (carefully).

Install M2 bolts through the front of the case to align everything (not tight).



Sometimes I find it necessary to align things and then use a handheld drill with a very small drill bit to ensure the bolt has a nice path in each of the 4 holes.

Screw the bolts into the front of the case until the threads of the bolt begin to appear through the back side of the case.

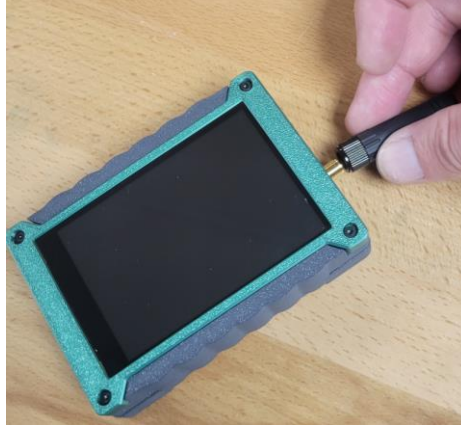
Add the thread locker and nuts



Add a drop of blue thread locker to each nut, hold the nut against the bolt on the back side of the ChatterBox, and use the allen/hex wrench to slowly tighten the bolt. Repeat for all 4 bolts.

Don't overtighten, we just want snug. The thread locker is what will hold the nut in place, rather than overly tight pressure.

Install your antenna



Power up and go through setup



Setup instructions are at:  
<https://chatters.io/setup>