SWARM Evaluation Kit for Satellite Iot Sensors User Guide

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Contents

What's Included

- Tripod

- VHF Satellite Antenna

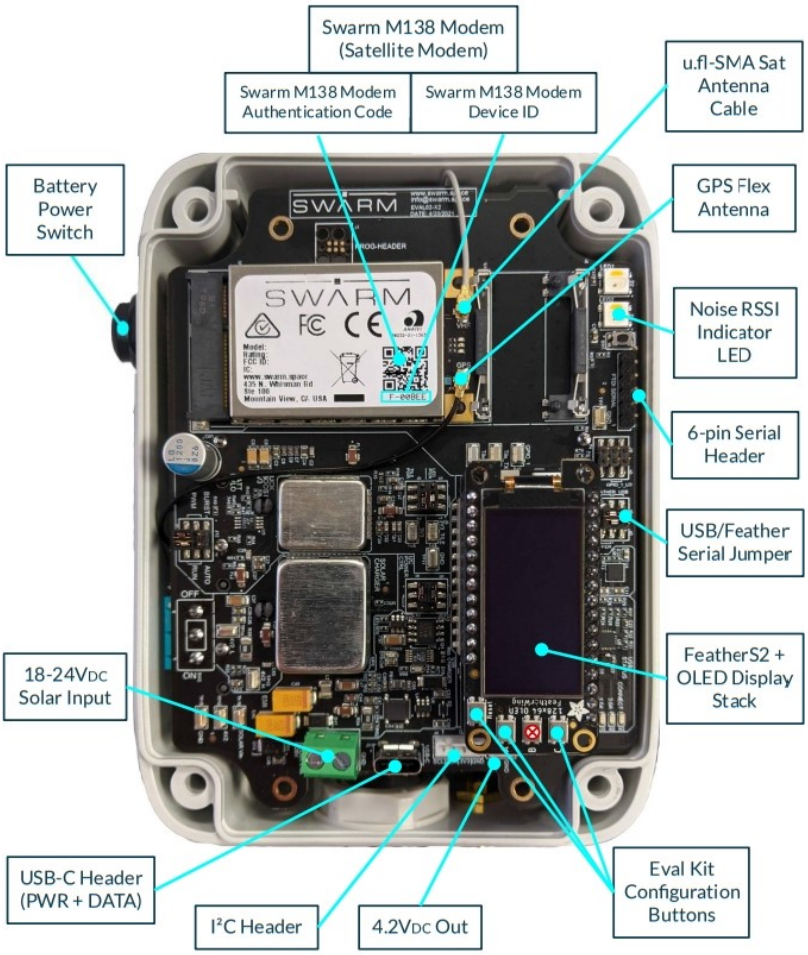
- Eval Board and Solar Panel

- GPS Antenna (spare)

- u.FL Cable (spare)

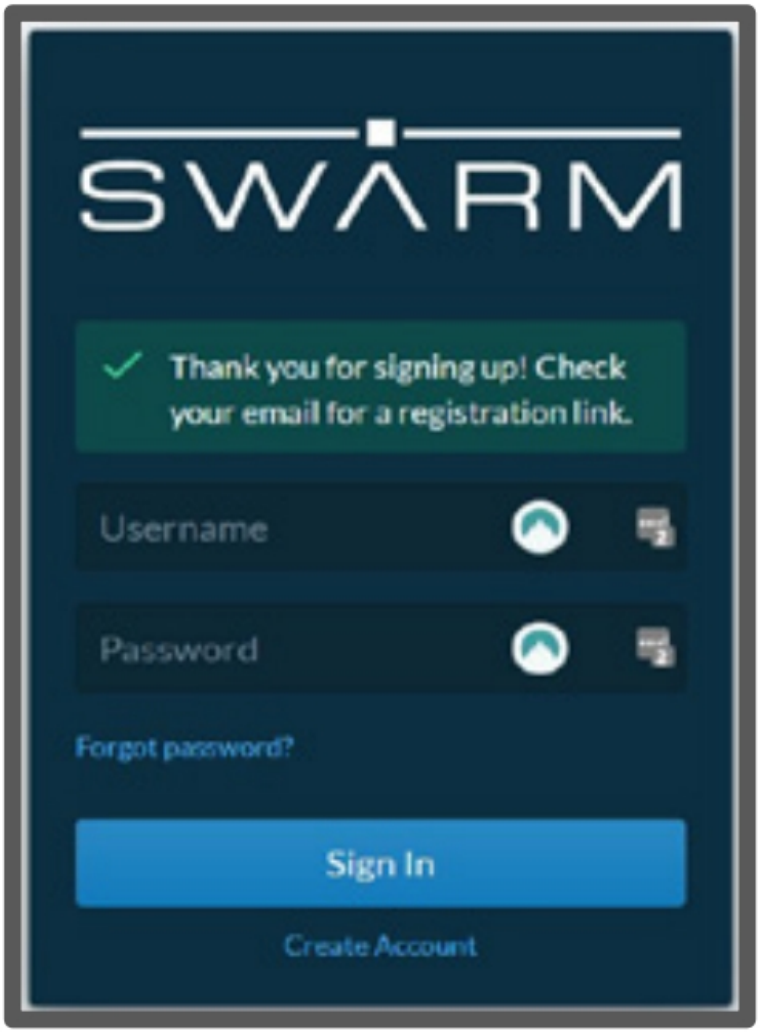
- Screwdriver

Overview

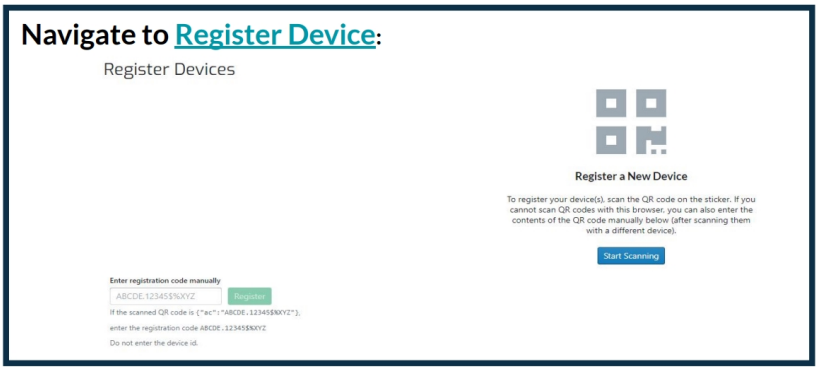


Registering Your Swarm M138

1. **Create your Hive account and sign in:**
   https://bumblebee.hive.swarm.space/hive/ui/sign-up
   After signing up, a registration email will be sent to you.

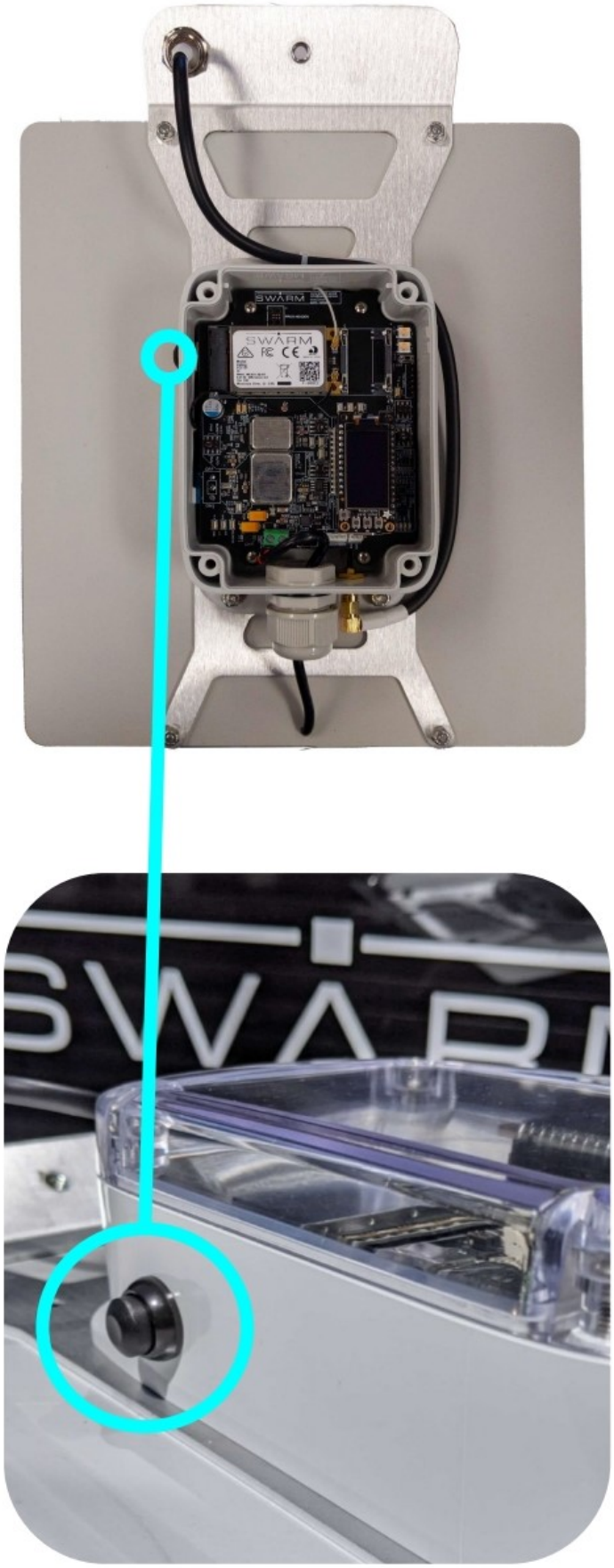


2. **Navigate to Register Device**



3. Click Start Scanning to scan your Swarm M138 Modem QR Code: The Swarm Modem registration code is the QR code on the M138 sticker. If you are unable to use the browser-based scanner, you can also use your camera app to scan the Swarm M138 Modem QR code, and enter the auth code in the Hive manually. See example below:

Powering On The Kit



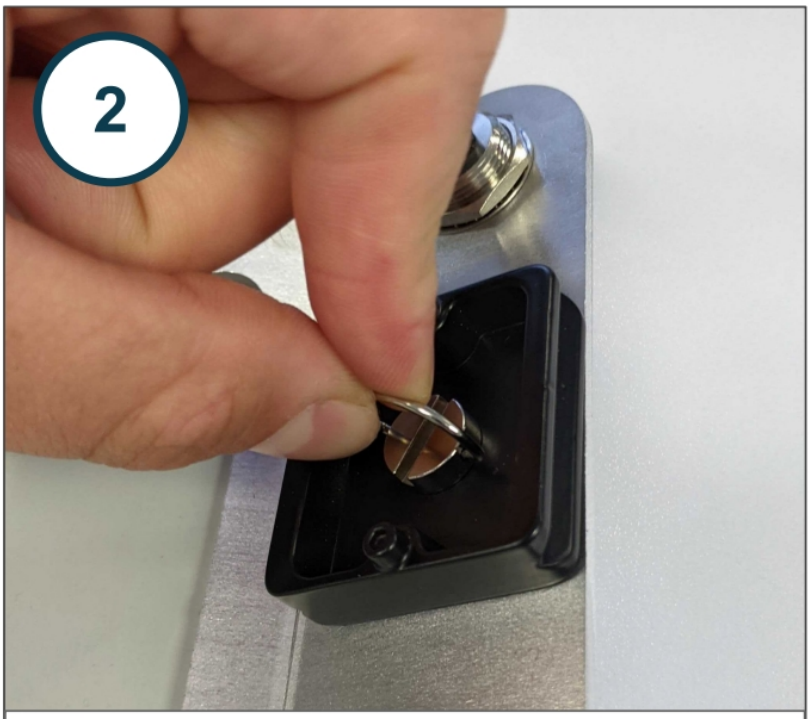
Place the Eval Kit on a flat surface, with solar panel facing down.

Locate the external power button on the side of your Eval Kit.
Press and latch the switch to power on.

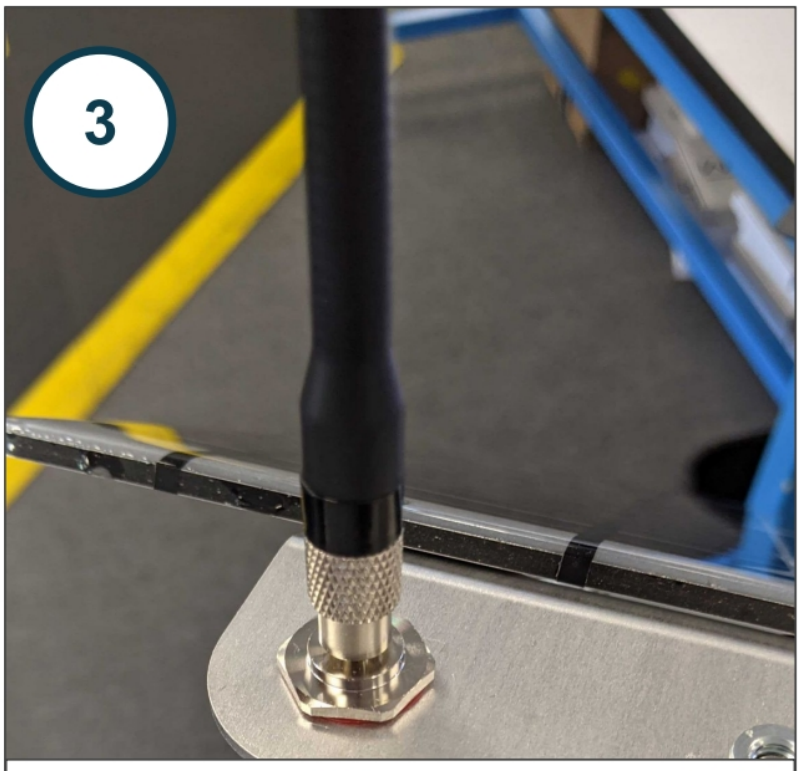
Eval Kit Assembly

1. Remove the tripod mounting attachment by loosening the latch at the top of the tripod.

2. Screw the tripod mount into the threaded hole on bottom of the Eval Kit solar bracket.



3. Install ¼ wave VHF antenna onto the solar bracket bulkhead, hand-tight.



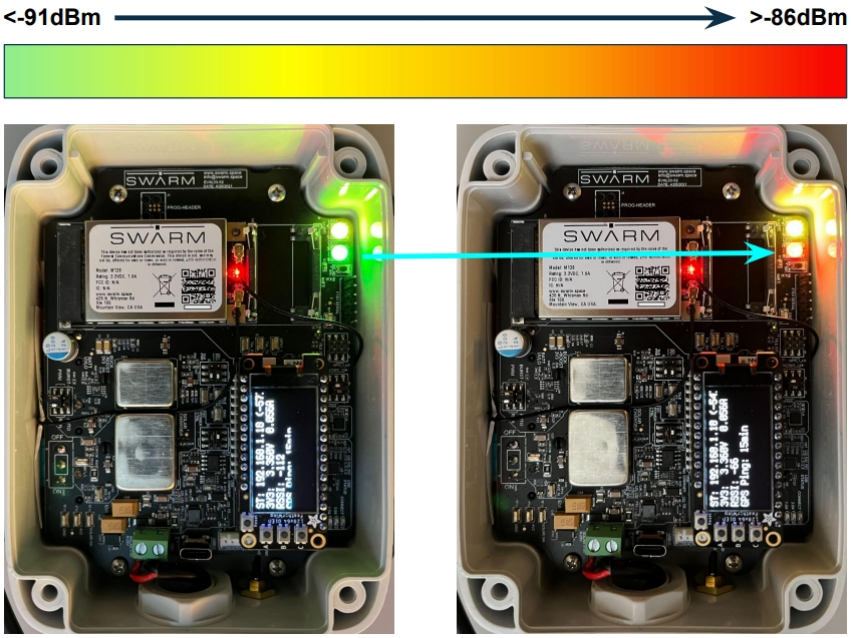
4. Reinstall the tripod attachment (with Eval Kit) to the Tripod, extend tripod legs.

RSSI LED Indicator

The Eval Kit provides an LED indicator of the background noise RSSI. An RSSI value of <-95dBm is ideal for successful transmission. The OLED also displays the actual background noise RSSI value.

To lower your noise RSSI, isolate the Eval kit in an area with low RF interference (outside, in a more remote location is ideal).

Noise RSSI [dBm]	Background Noise Level
>-90	Bad (Unlikely to work)
-93	Marginal
-97	OK
-100	Good
<-105	Great



Managing Transmission – Custom

There are multiple possible methods to send messages through the Eval Kit:

GPS Pinger

The GPS Pinger feature will automatically queue messages containing the Eval Kit's GPS location, speed, solar input, battery charge level, and more.
By default, the pinger is set to queue a message every 60 minutes. This can be configured between 15-720 minutes, or disabled by the User (see user command page).

This method does not require WiFi to be enabled.

Email Web App

When connected to the Eval Kit access point in Access Point (AP)
mode, the Email Web App can be accessed at the web address 192.168.4.1
Users can queue messages on the Eval Kit of up to 192 bytes using the web App. When transmitted by the Kit, the message will be sent to the specified “To: (email)” address.
This method requires WiFi to be enabled.

Telnet

In Access Point (AP) Mode, users connect to the Eval Kit AP (default name swarm-xxxx with password 12345678), and communicate to address 192.168.4.1 to queue messages and send other commands.
In Station (STA) Mode, users specify the network to connect the Eval Kit to, connect to that network on another device, and communicate with the Kit using the new displayed IP address.
This method requires WiFi to be enabled.

USB-C

Users can connect a USB-C cable from their device to the Eval Kit to communicate over a serial connection.
To enable USB-C Data, the J7 SERIAL CTRL jumper (#2) must be moved from FEATHER to USB.
Once connected, Users can queue messages and send commands directly to the Swarm M138 Modem in the Eval Kit. The USB-C source will also charge the batteries in the Eval Kit.
This method does not require WiFi to be enabled.

Message Transmission

GPS Pinger

The Eval Kit will automatically queue messages (default 60 min interval) containing your GPS location, speed, solar input, battery charge level, information while powered on.

You can now place your kit outdoors with a clear view of the sky (with minimal obstructions), and observe the RSSI indicator LED on the board. If leaving the Kit for an extended period of time, orient the solar panel to face the Equator.

When the LED indicator shows GREEN, your kit has an optimal background noise RSSI level for a successful transmission.

The Eval Kit will have best transmission results outdoors and ~ 5 km away from cities (where RF noise is common).

GPS Pinger – Hive Map Feature

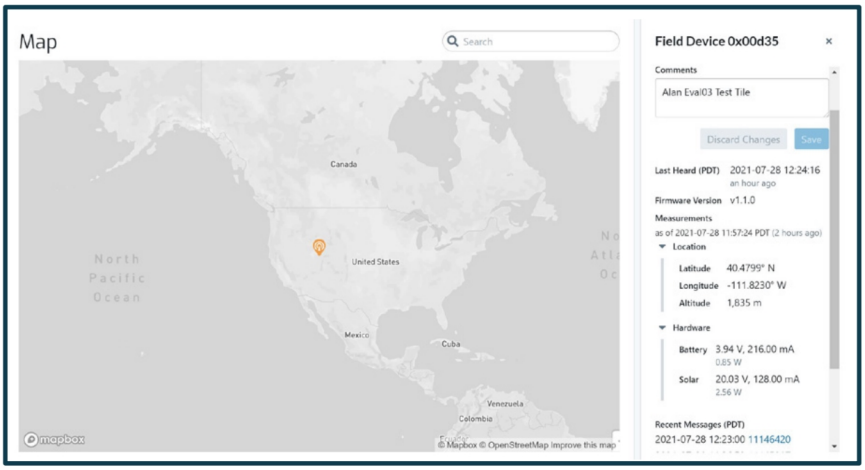
The Swarm Map Beta is an included service in the Swarm Hive to monitor device health and track the location of your devices. The most recent recorded GPS point (taken from your Eval Kit pinger messages) is displayed on the map.

Map functionality can be expanded to include any of Swarm's modems (using **firmware version v1.1.0 or newer**) by sending messages using **APPID: 65535** through the Swarm Network in a JSON-structured message:

{"ln":-111.823,"si":0.128,"bi":0.216,"sv":20.032,"lt":40.4799,"bv":3.944,"d":16
7498644,"n":261,"a":1835.0,"s":2.0,"c":290.0,"r":-103,å"ti":0.04}

- **ln:** Longitude
- **si:** Solar current (A)
- **bi:** Battery current (A)
- **sv:** Solar voltage (V)
- **lt:** Latitude
- **bv:** Battery voltage (V)
- **d:** Date and time as Epoch seconds (ex: 1625771690 = Thursday, July 8, 2021 12:14:50 PM GMT-07:00 DST)
- **n:** Number of messages that have been sent since last power-up
- **a:** Altitude (m)
- **s:** Speed (km/h)
- **c:** Course (degrees)
- **r:** Last RSSI value (dBm)
- **ti:** Modem current (A)

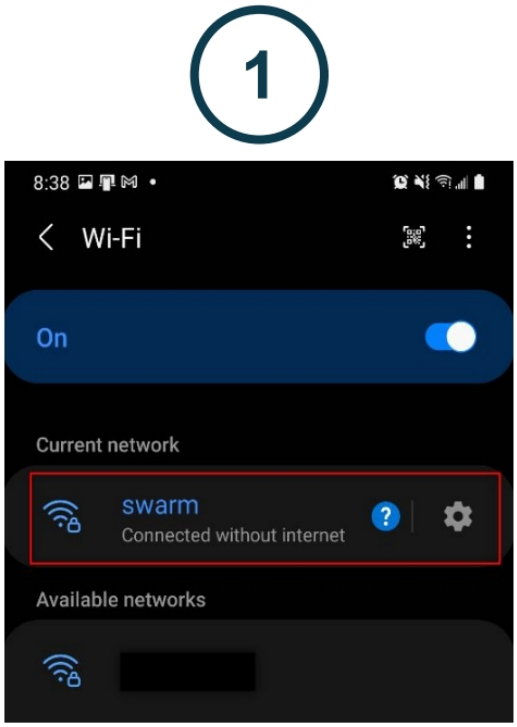
This GPS location report is accurate up to 4 decimal places in Decimal Degrees, around 11 meters.



Email Web App

Ensure the Kit is powered on, and the OLED display shows **AP: 192.168.4.1**

1. Using your PC or cell phone, access your WiFi network preferences:



    1. **a.** Locate and connect to the **swarm-xxxx** network in your device's network preferences.
        1. A notification of "Connected without inaternet" or similar is expected.
    2. **b.** Enter default password **12345678.**
    3. **c.** Note that you can change the SSID and password – see Feather Commands section
2. Once connected, access the user messaging app by scanning the QR code below or by navigating to 192.168.4.1 in your device web browser. You will see a messaging UI appear with the Swarm logo – this may take a minute to load.

http://192.168.4.1

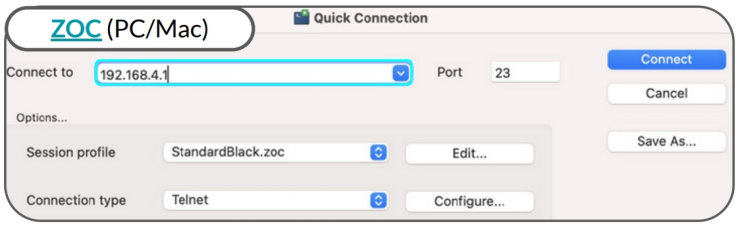
3. Once the web messaging app has loaded, you can fill out the 4 required fields to send an email message of up to 192 bytes through your Swarm Eval Kit.

1. **a.** When the M138 Modem has queued the message, you'll see a fading 'Message Sent!'
    1. Messages are kept on the Modem for **48 hours** by default (configurable).
2. **b.** The "Message Statuses" box will show **'Message Sent'** once you've successfully uplinked your message to a Swarm satellite.
    1. Messages will send in the order that they are queued.
    2. Continue through the guide for more information on successfully transmitting on the network.

Access Point (AP) Mode

1. Using your PC or cell phone, access your WiFi network preferences:
    1. **a.** Locate and connect to the **swarm-xxxx** network in your device's network preferences.
        1. **i.** A notification of "Connected without internet" or similar is expected.
    2. **b.** Enter default password **12345678.**
    3. **c.** Note that you can change the SSID and password – see Feather Commands section
2. Using a Telnet-enabled tool, connect to the default address **192.168.4.1** using port 23 to communicate with the Eval Kit.

    Example Tools below:

    JuiceSSH for Android

    iTerminal for iOS

3. You can now simply queue a message on the Eval Kit by using the $TD (TransmitData) command. Determine what you would like to send as your first message (within quotes), and calculate the checksum for the message.

For example:

- Command: $TD
- Message string (in quotes): "Hello World!"
- Message checksum: *31

The **full command to the Swarm modem** will then be: $TD "Hello World!"*31

If the message is accepted, a **$TD OK** response will be received, and the message will be queued for transmission, and stored in the Swarm modem memory. See section 7 of the **Swarm M138 Modem Product**

Manual for more details and other commands.

Station (STA) Mode

Users can to change the Eval Kit to Station (STA) mode, to connect to a common access point such as a home WiFi network.

You'll need to send commands via a Serial or Telnet terminal while connected to the Eval Kit to change to STA mode.

1. Open a Serial or Telnet connection from your device to the Kit
    1. **a.** If connected via USB-C, use serial terminal (Putty/ZOC)

       ***Note: Ensure the Feather/USB serial connection jumper is configured for the type of connection being made. Click here for reference to the jumper configuration.**

       For serial, use baud rate 115200, config 8-N-1, with flow control None
    2. **b.** If connected wirelessly, use Telnet to the Feather IP address
        1. You can use ZOC for this on Windows/macOS
2. Send the following commands to the feather:
    1. **a. @set ssid YourSSID**
        1. Response: Successfully set ssid to YourSSID
    2. **b.** @set pw YourSSIDPassword
        1. Response: Successfully set pw to YourSSIDPassword
    3. **c. @set mode sta**
        1. Response: Successfully set mode to sta
    4. **d. @reset**
        1. Response: No response, Feather will reboot and a new IP address will be displayed
        2. ST: xxx.xxx.xxx.xxx will now be displayed on OLED screen.
3. Switch your computer or phone WiFi connection to YourSSID
4. Re-connect via Telnet using the new displayed IP address
5. You're now ready to send commands to the Eval kit in STA mode!
    1. See the Swarm M138 Modem Product Manual for various command options.

USB-C Connection

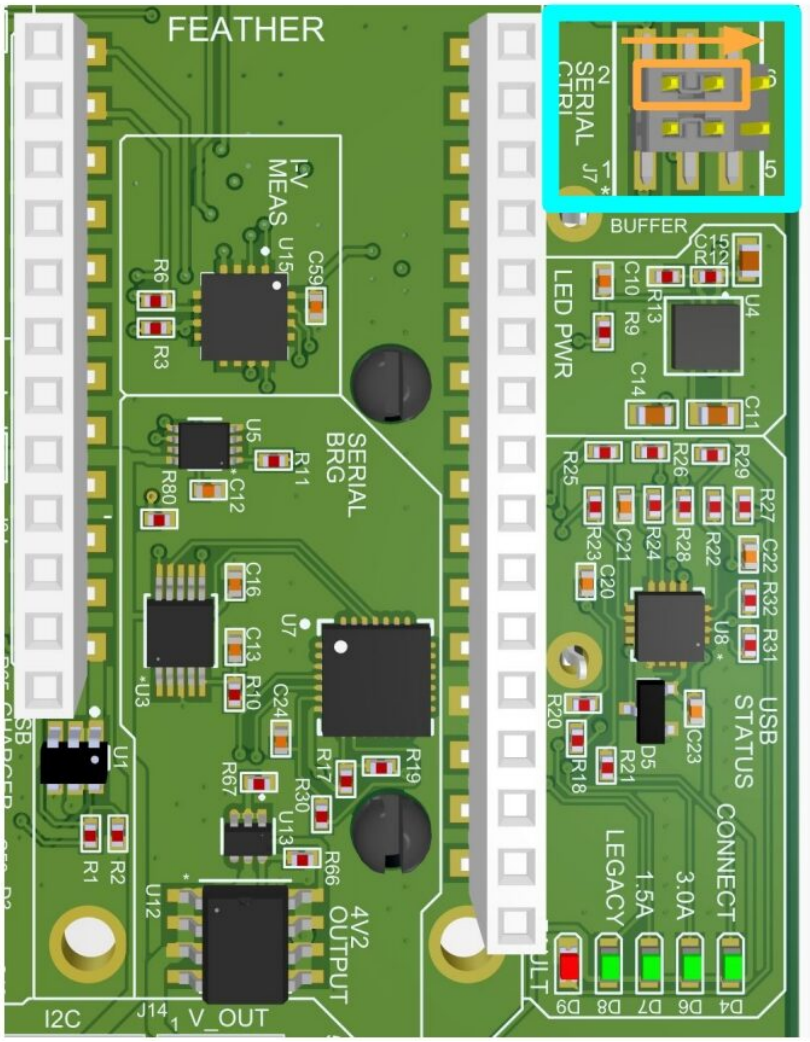
With a USB-C cable connected from a host device (laptop) to the Eval Kit USB-C Port, users can communicate directly with the Swarm Modem while charging the Eval Kit batteries.

To enable this, power off the Eval Kit, and move the SERIAL CTRL Jumper J7 (#2) to the right position, from FEATHER to USB (see bottom image).

Power on the Eval Kit once again – note that the Feather will not be accessible in this mode, and the OLED display will not be active.

Using a Serial Monitor tool (such as ZOC), connect to the Swarm Modem using the identified USB/ COM port, baud rate 115200, config 8-N-1, with Flow ControlNone.

You can now send commands and receive responses to/from the Swarm Modem. See the Swarm M138 Modem Product Manual for more details.

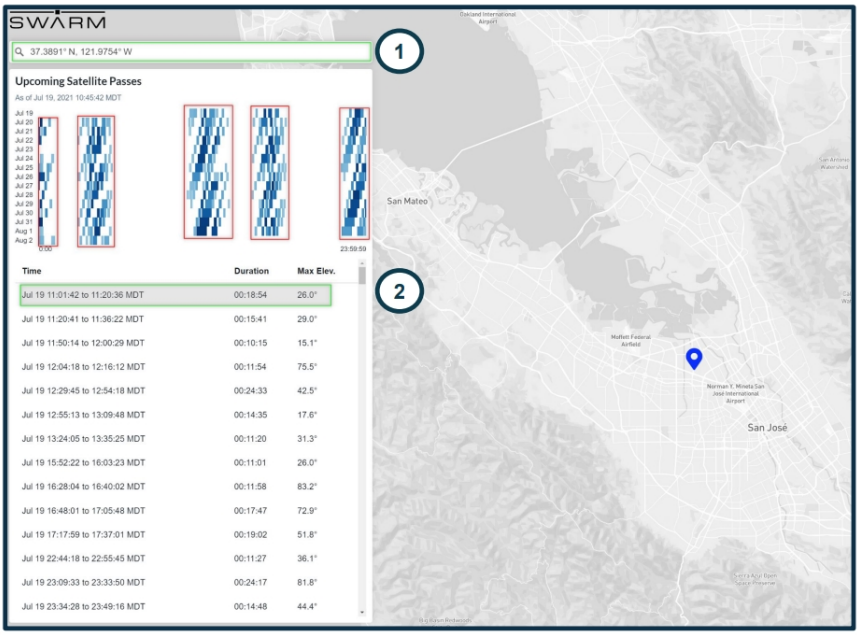


Swarm Pass Checker

Using the Swarm Satellite Pass Checker Tool, enter your location to see the next available satellite passes overhead.

Find an upcoming pass of at least 10 minutes, during which time you will attempt to transmit your queued messages to the Swarm Network. Higher elevation passes are generally better for transmission success.

1. Enter your address or postal code in the search bar
2. Find a suitable pass window, based on the local time and pass duration
3. Place the Kit outdoors with a view of the sky, and wait for transmission!



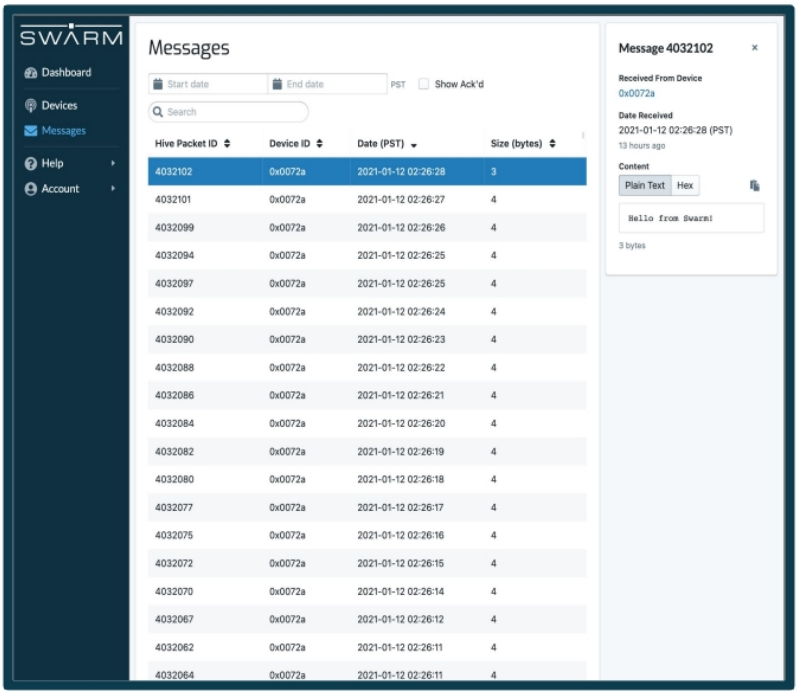
Access Point (AP) Mode

When your device has successfully transmitted through the Swarm Network, you will see your messages displayed in the Swarm Hive.

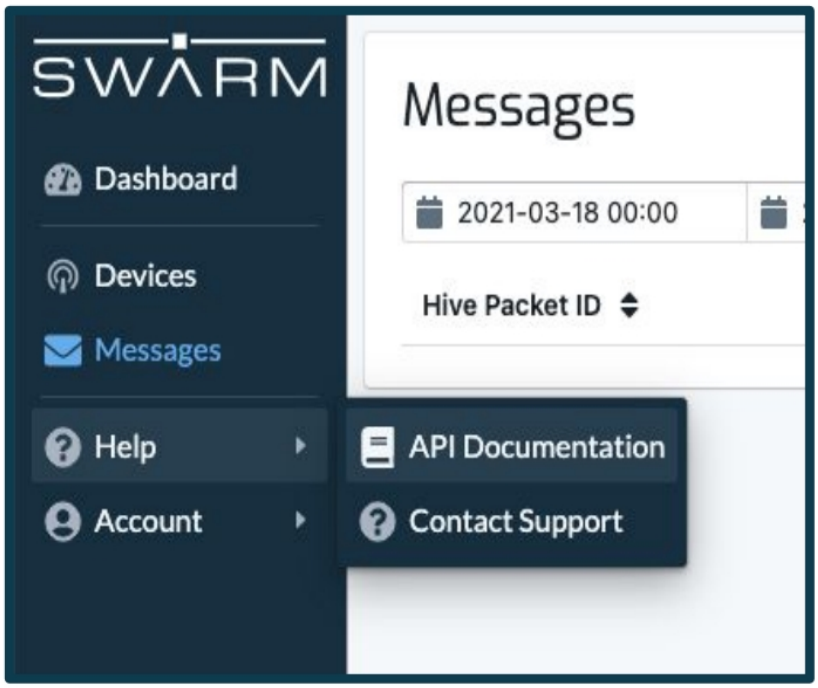
If you are monitoring the Swarm Modem's log with a Telnet or Serial connection, the Swarm Modem will report when a message has been transmitted to a Swarm Satellite with the **$TD SENT** report.

Unsent messages will remain in the Swarm Modem's queue for 48 hours by default before they expire.

Using your credentials, log into the Swarm Hive to view your message dashboard, account information, and device settings.
The delay for the message to transmit from the Satellite to the Hive during this early access phase could take up to 1 hour.



To pull and interact with your data in the Swarm Hive, visit our REST API **integration guide.**
You can also access our Swagger UI documentation page from Hive → API Docs

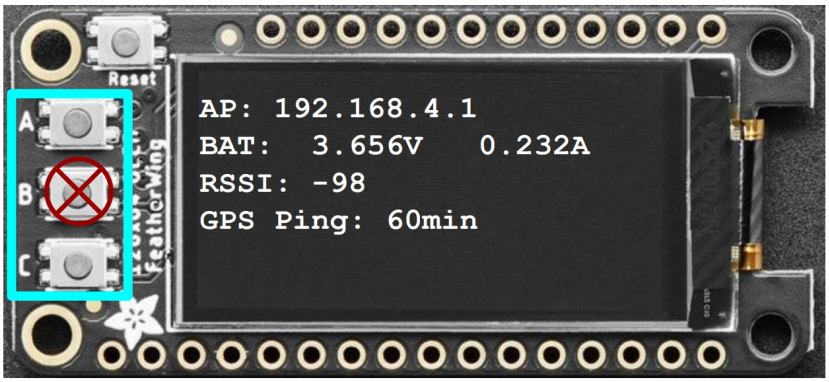


Kit Interactivity – FeatherS2 Commands

Command	**Functionality**	**Example**
@set mode <ap, sta>	Set Eval Kit wifi mode to access point or station mode. *Default: ap*	**@set mode sta**
@set wifi <enabled, disabled>	Enable or disable wifi functionality and neopixels. It will change the mode and then immediately reset the feather. *Default: enabled*	**@set wifi disabled**
@set ssid \<ssid\>	Set the ssid to create when in ap mode, or to connect to in station mode. *Default: swarm-xxxx (from MAC address)*	**@set ssid EvalKitAP** **@set ssid MyHomeWifi**
@set pw \<password\>	Set the password to create when in AP mode, or to connect to in STA mode. *Default: 12345678*	**@set pw EvalKitPW** **@set pw MyHomePW**

@set interval \<minutes\>	Set the interval for the gps pinger feature. 0 will disable the GPS pinger. Acceptable range is 15 to 720 minutes. *Default: 60min*	**@set interval 120**
@show	Print the wifi mode, ssid, password, and interval to be c ommitted.	**@show**
@show <battery, 3v3, sol ar>	Print the battery, 3v3, and solar voltage and current.	**@show solar**
@reset	Restart the feather (commits changes).	**@reset**
@factory	Reset the NVM to its default state and restart the feathe r. You must **@reset** for changes to take effect.	**@factory**

Kit Interactivity – OLED Buttons



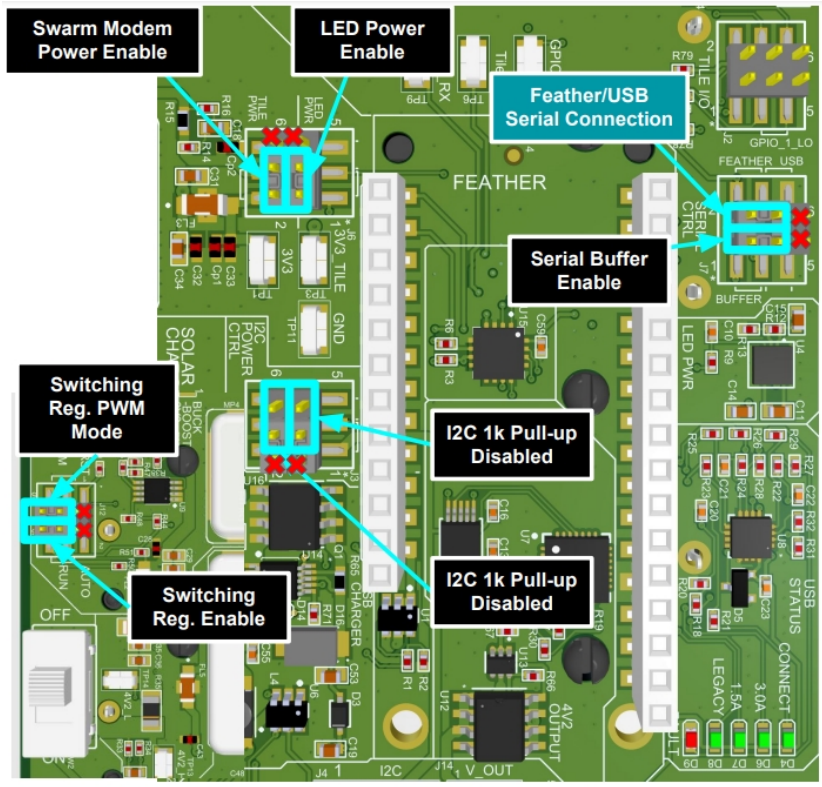
Three buttons on the OLED installed in the Eval Kit provide the user various functionality described below:

Button	Functionality	Description
A	Wifi Enable/Disable	You can disable the WiFi in order to limit current dr aw for extended battery life. This also disables the colored RSSI indicator. A button press is followed by a feather reset. **No telnet functionality exists while WiFi is disa bled.**
B	None	This pin is internally tied to the RSSI indicator pin and is not configurable
C	GPS Pinger Enable/Disable	This button will disable or enable the GPS pinger.
Reset	Resets Feather/OLED	Pressing this button will reset the feather
Reset + A	Factory Reset	To reset the feather to factory default, press and re lease **Reset**, and then hold **A** for 15 seconds. Han dy combo!

Development

Default Jumper Configuration

The image below shows the default jumper configuration for the Eval Kit. Note that the Serial Jumper J7 (#2) can be switched to allow for Feather/USB serial access to the Swarm Modem.



External Power

Your Eval Kit can be powered from an external power source or USB-C if the user is not wanting to run off of the provided solar panel. This can be useful for low light conditions or extended uninterrupted testing.

An additional pass-through is available in the Eval Kit enclosure cable gland.

Removing the solar panel leads from the green screw terminal block, and replace with a DC power supply. This input will charge the Eval Kit batteries, and is optimized for an 18V-24V input.

The OLED display will then report the INA3221 reading of the external power input as “SOL: xx xx”

***Note: No jumper changes are required for external power input**

Resources/Troubleshooting

Please send us your comments/questions regarding the Eval Kit directly by email at **techsupport@swarm.space**.

Below are some additional helpful resources for using your Eval Kit:

FCC Statement of Compliance

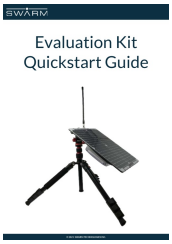
Swarm Technologies, Inc.
435 N. Whisman Rd.
Ste 100
Mountain View, CA 94043
Model: EVAL03

Contains FCC ID: 2AVE9-M138
Contains IC: 25817-M138

This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) This device must accept any interference received, including interference that may cause undesired operation.

This Class B digital apparatus complies with Canadian ICES-003.

Documents / Resources

	SWARM Evaluation Kit for Satellite Iot Sensors [pdf] User Guide Evaluation Kit for Satellite Iot Sensors, Evaluation Kit, Satellite Iot Sensors, Iot Sensors

References

- Swarm Hive Login