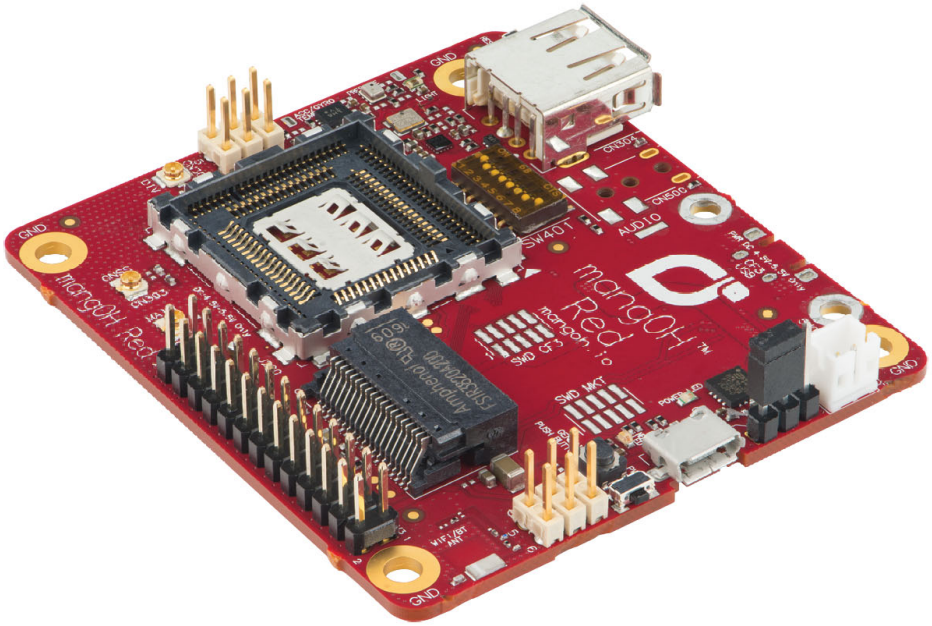
mangOH® Red

Getting Started Guide (non-Octave)



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Rev 1
Contents subject to change

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Due to the nature of wireless communications, transmission and reception of data can never be guaranteed. Data may be delayed, corrupted (i.e., have errors) or be totally lost. Although significant delays or losses of data are rare when wireless devices such as the Sierra Wireless modem are used in a normal manner with a well-constructed network, the Sierra Wireless modem should not be used in situations where failure to transmit or receive data could result in damage of any kind to the user or any other party, including but not limited to personal injury, death, or loss of property. Sierra Wireless accepts no responsibility for damages of any kind resulting from delays or errors in data transmitted or received using the Sierra Wireless modem, or for failure of the Sierra Wireless modem to transmit or receive such data.

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Revision History

Revision number	Release date	Changes
1	March 2020	Combined Windows/Leaf GSGs (rev5) and converted installation content to use Leaf

Contents

1: Get Started

Thanks for purchasing the mangOH® Red development kit! Use this guide to prepare your mangOH Red and computer for IoT development.

Table 1-1: Minimum System Requirements

O/S	• Windows® 7 and higher • (64-bit) Ubuntu 16.04 • macOS X
CPU	Dual core @ 2.6 GHz
RAM	4 GB
HDD	10 GB free space
USB Ports	• Preferred—2 (for full functionality) • Minimum—1

Note: This guide has been tested using the Legato Virtual Machine (64-bit Ubuntu 18.04), available at https://mangoh.io/setting-up-vm, and on Ubuntu 18.04. For assistance with different configurations, visit the mangOH forum at forum.mangoh.io.

When you are ready to begin, work straight through the rest of this guide:

- STEP 1: Register a mangoh.io Account on page 6
- STEP 2: Set Up Your mangOH Red on page 7
- STEP 3: Register on the Mobile Network on page 14
- STEP 4: Connect to AirVantage (The Cloud) on page 17

And then to make the most of your mangOH Red ...

Visit mangoh.io/mangoh-red-resources for mangOH Red guides, tutorials, and more.

Visit forum.mangoh.io to participate in the mangOH community.

2: Register a mangoh.io Account

The mangOH ecosystem of products, tutorials, documentation and more is constantly evolving.

Please register for a mangoh.io account to:

- Get access to mangOH documentation
- Receive notices of new mangOH products, IoT cards, and project code samples
- Receive periodic device-specific notices
- Be automatically included for a chance to win IoT cards in periodic giveaways

If you already have an account, please log in and register your new device so we can provide you with news about your device.

To register for an account:

1. Go to https://mangoh.io and click **Register**.
2. Enter the requested data to create your account.

Note: • E-mail address—This will be your mangOH account login.
• Password—8-29 characters (including at least 1 lowercase letter, 1 uppercase lettter, and 1 number.)
• IoT Applications—Please let us know all the fields you are developing for so we can improve the mangOH ecosystem for you!

3. Click **Register**.
   If all required fields are filled correctly, your account is created and you are logged in automatically.
   Otherwise, the fields that must be updated are indicated. Fix them, re-enter the password fields, and click **Register** again.
4. Now that you're logged into your account, click **Device Registration**.
5. Select mangOH Red as your new mangOH type.
6. Choose the SIM type included in your kit:
   - AT&T—Activate your SIM by clicking the AT&T link to connect to AT&T's IoT Marketplace. See Register and Activate AT&T SIM on page 36 for details.
   - Sierra Wireless—Your SIM will be activated later in this guide when you register for your AirVantage account.
   - Other—Activate your SIM at your SIM card provider's website.

Important: *If your mangOH Red kit contains an HL78xx module, finish registering and then use the mangOH Red HL78xx Getting Started Guide available from https://mangoh.io/mangoh-red-resources-getting-started.*

7. Click **Submit**. Your mangOH account is updated with your device type.

Now you're ready to
Set Up Your mangOH Red on page 7.

3: Set Up Your mangOH Red

3.1 Peel Your mangOH Red

Open your mangOH Red kit and make sure you have all the parts—the mangOH Red kit typically includes:

- (1) mangOH Red board with pre-installed CF3 module (WP76xx, WP77xx, WP8548, etc.)

Note: The module ships with Legato already installed. In this guide, you will install the latest mangOH Red approved build.

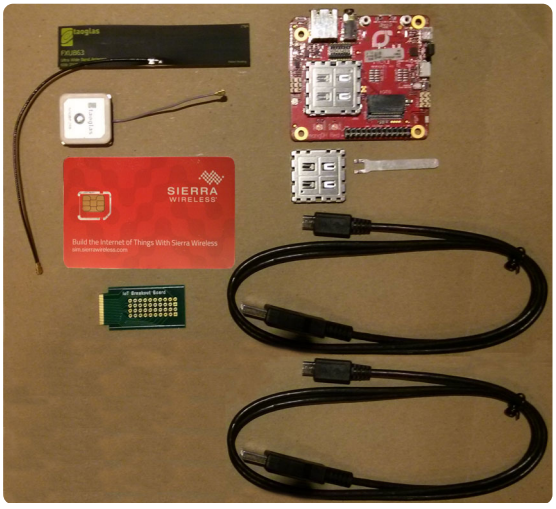
- (2) module covers (for 2.5 mm and 4.0 mm height modules)—One pre-installed with the module, and one for use with a CF3 module of a different height.

Note: The images used in this guide show the 4.0 mm cover.

Cover and 4.0 mm module (e.g. WP8548, WP76xx)

Cover and 2.5 mm module (e.g. WP77xx)

- (1) module cover release tool
- (2) micro-USB cables
- (1 or 2) Ultra Wide Band antennas (taoglas FXUB63)—2nd antenna included if CF3 module supports diversity
- (1) GNSS antenna (taoglas AGGBP.25B)
- (1) micro-SIM card (Sierra Wireless, AT&T, or other provider)
- (1) Breakout board (IoT expansion card format)
- (2) M2 screws for IoT card installation

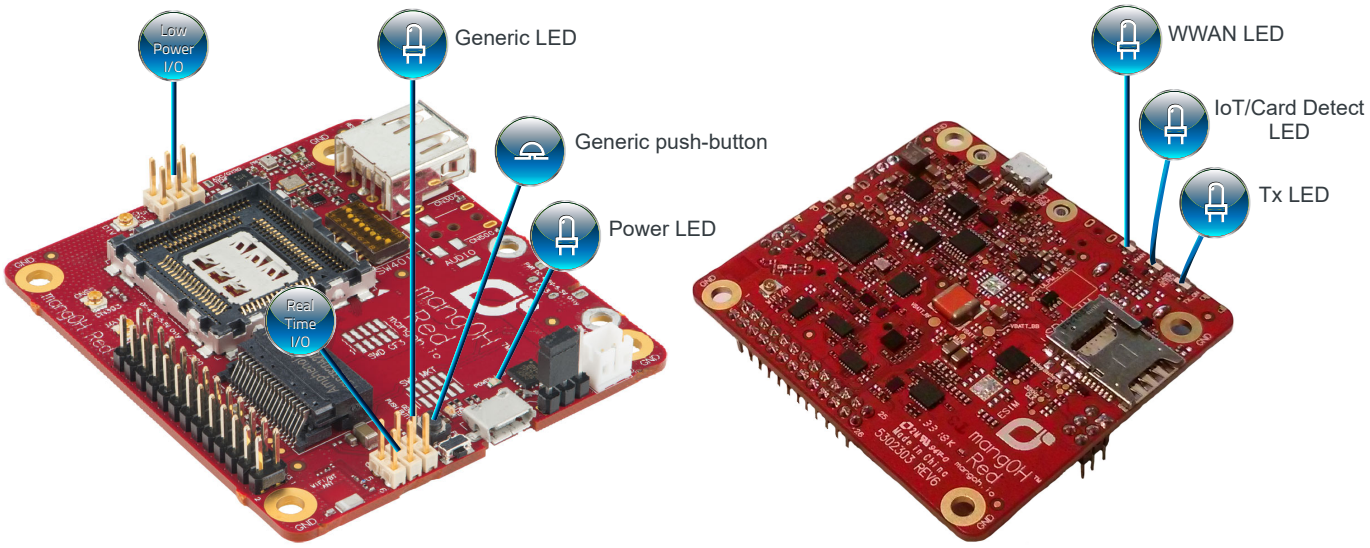


Important: *In this guide, your mangOH Red is powered by your computer. Going forward, a dedicated 2.5 A USB power supply is recommended, since USB ports on many PCs and laptops may not provide sufficient current to power the mangOH during high power bursts.*

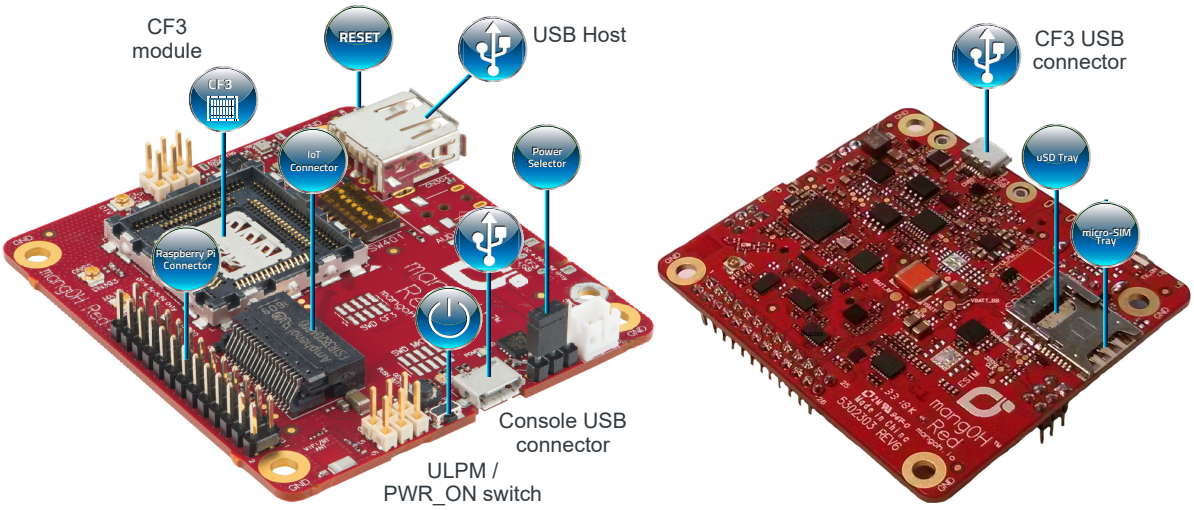
3.2 Quick Components Overview

Many components and connectors are already built into the mangOH Red. Some of these include:

Inputs / Outputs



Modules and Power



3.3 (Windows only) Install CF3 Module Drivers

Windows systems require drivers for the mangOH Red's CF3 module.

To download the drivers:

1. Go to https://mangoh.io/mangoh-red-resources-software.
2. Click **Download Windows Drivers** to download the driver installation file.
3. Run the downloaded .exe file and follow the prompts to install the drivers.

3.4 (Linux only) Remove modemmanager

Make sure the modemmanager package is removed from your Linux system—this package causes problems with the mangOH Red if it is not removed:

```
$ sudo apt-get remove -y modemmanager
```

3.5 (Virtual Machine Users) Install the mangOH Virtual Machine

If you prefer to develop on a virtual machine on your Mac OS X, Windows or Linux system:

- Follow the instructions at mangoh.io/setting-up-vm to download and install VirtualBox, and load a virtual machine for mangOH development.

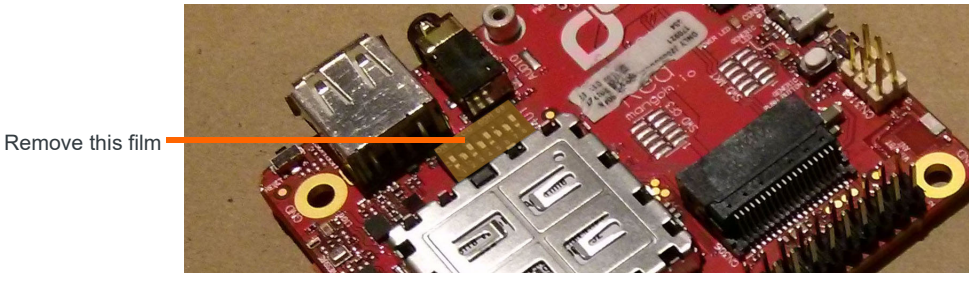
  The mangOH VM is pre-installed with Sierra Wireless' Leaf Workspace Manager.

Note: If the prompt "[sudo] password for mangoh" appears while in the VM, type "mangoh" and press Enter. (The VM's account name and password are both "mangoh".)

3.6 Prepare Your mangOH Red

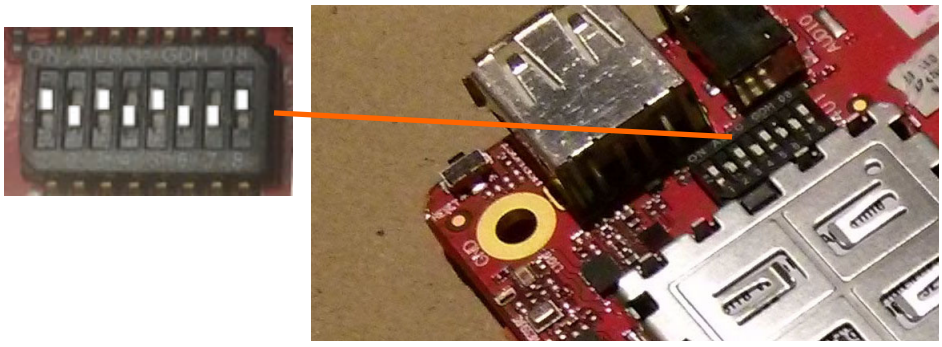
Your mangOH Red comes partially assembled with the CF3 module and cover pre-installed. All you need to do is connect a few components and a power source:

1. Make sure the dipswitches are set correctly:
   a. Remove the protective film from the dip switch block.



b. Make sure the dipswitches are set as follows:

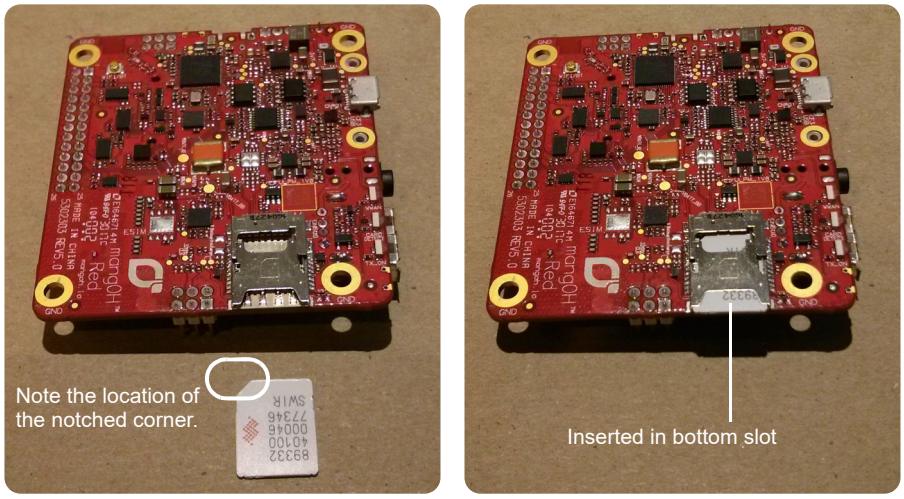
- ON—1,3,5,8
- OFF—2,4,6,7



For switch details (not needed for this tutorial), see Dipswitch Settings on page 35.

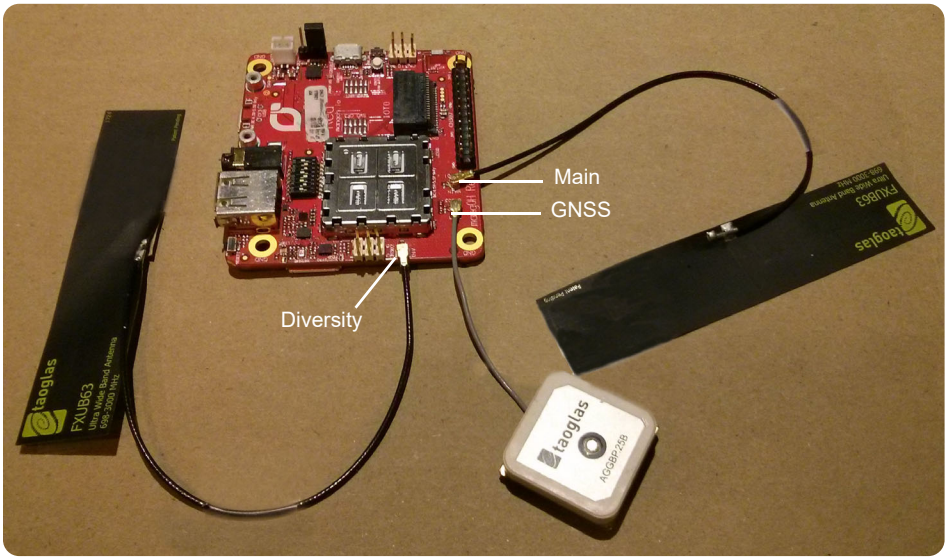
2. Insert a micro-SIM (either the one included with the kit, or one that has been activated by another mobile network provider.)

Note: If you do not have an activated SIM, you can continue the tutorial, but will not be able to complete Register on the Mobile Network on page 14 and Connect to AirVantage (The Cloud) on page 17.



Note: If you need to switch SIMs at a later time, you must disconnect the power or press the Reset button before switching SIMs so the mangOH_Red can detect the SIM while powering on.

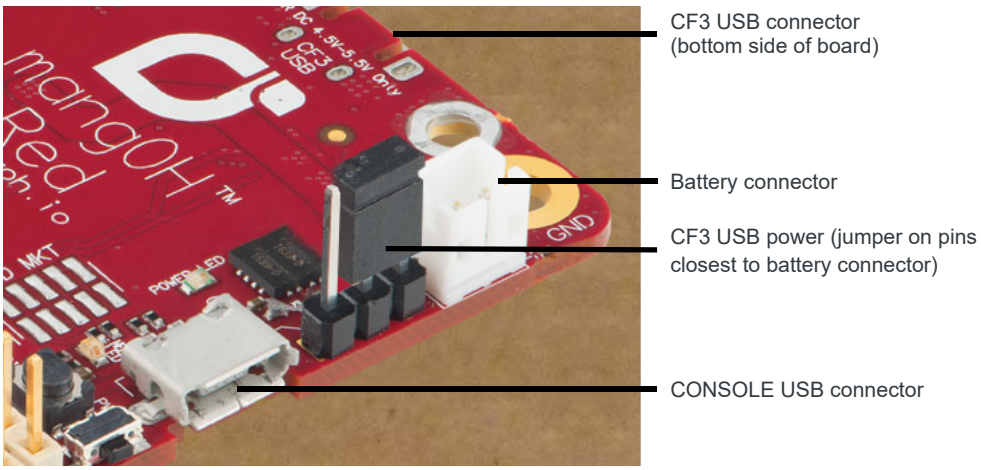
3. Attach the antenna(s)—main, GNSS and (for WP76xx modules) diversity.



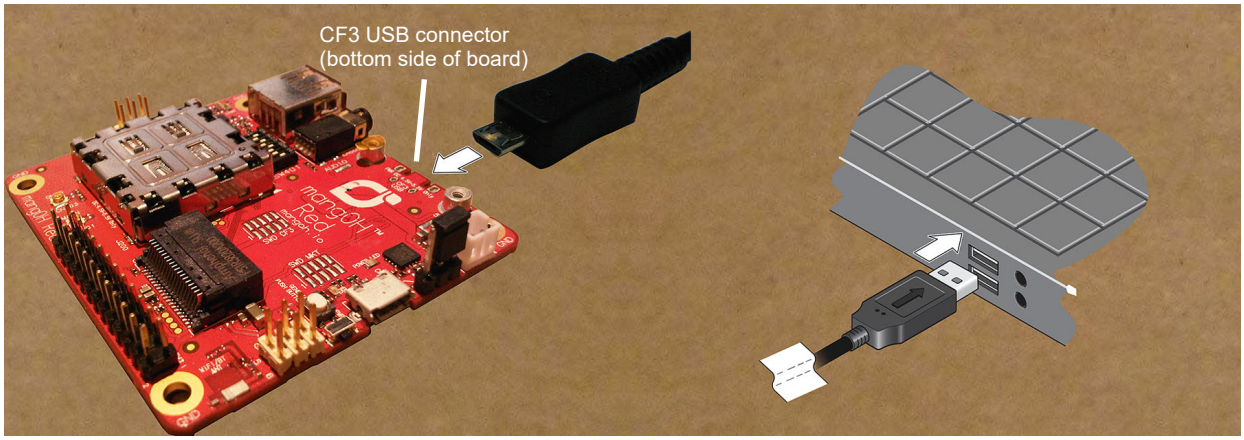
Tip: *If you have trouble connecting an antenna, make sure it is positioned directly on the connector and push straight down. The antenna will not connect at an angle.*

4. Make sure the power select jumper is on the pins closes to the battery connector. (This selects the CF3 USB connector as the power supply.)

Note: The mangOH Red has two micro-B USB connectors:
- *CF3 USB is used for SSH connections, AT commands, and firmware downloads.*
- *CONSOLE_USB is a serial connection used to access the module's console for diagnostic purposes.*



5. Power up the mangOH Red—Use a micro-USB cable to connect the CF3 USB connector to a powered USB port on your computer.



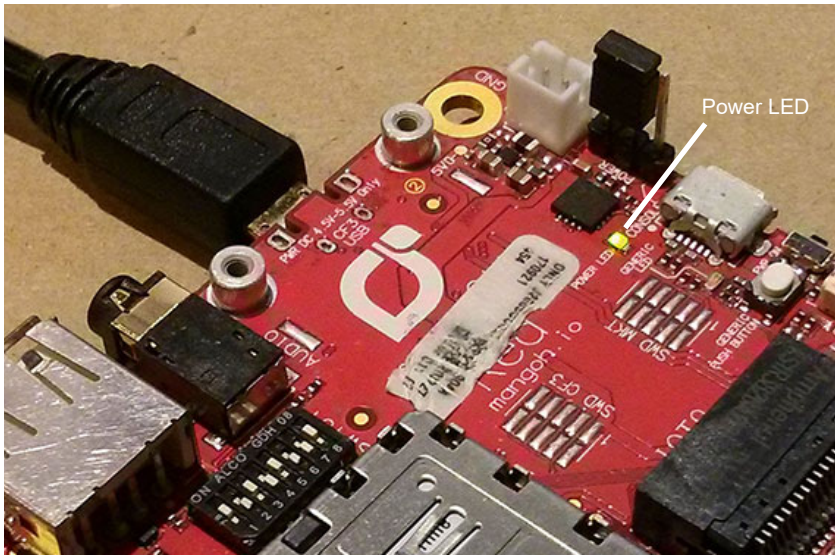
Important: *For mangOH Red Kits with WP7702 modules—If LTE-M coverage is not available, the mangOH Red's WP7702 module will fall back to 2G, which consumes up to 2 A of current for short bursts. In this case, USB power is insufficient (500 mA) and the module may repeatedly brown out and reboot. Use a Li-ion/Li-polymer (3.7 V nominal) battery or 2.5 A USB power supply for sufficient power. (See the mangOH Red User Guide for details.)*

As soon as the mangOH Red is powered:

- The Power LED turns solid green and the CF3 module begins to boot.
- The module will enumerate its interfaces. The time it takes to enumerate will vary depending on your operating system and computer hardware, but will typically take up to 1 minute (on Linux systems) or 2 minutes (on Windows systems). You can test that it has enumerated by pinging the device and waiting for a response:

  ```
  $ ping 192.168.2.2
  ```

  If necessary, press Ctrl+C to cancel the ping request and return to the prompt.



Tip: *If the Power LED does not turn on:*
• Make sure the USB cable is securely connected to the correct micro-B USB connector (as shown in the image).
• Make sure the jumper block is on the correct pins (as shown in the image).

Important: *For future reference, the mangOH Red's power supply (USB port on your dev machine, or a dedicated 2.5 A USB power supply) connects to the board via either USB connector—CF3 USB or CONSOLE USB (depending on the jumper position on the power header).*

If a dedicated USB power supply is connected to the CF3 USB connector, SSH/AT connections are not possible; if it is connected to CONSOLE USB, serial USB connections are not possible.

Going forward, a dedicated 2.5 A USB power supply is recommended, since USB ports on many PCs and laptops may not provide sufficient current to power the mangOH Red during high power bursts.

6. Upgrade the firmware on your mangOH Red's module with the latest approved software image, which includes applications built for mangOH Red:
   a. Go to mangoh.io/mangoh-red-resources-software and download the appropriate firmware image for your module:
      - SPK image—Image to installed using swiflash or fwupdate applications
      - EXE image—Windows-only one-click install
   b. Follow the instructions in Updating the Firmware on a mangOH on page 32.

Now that you've peeled and prepared your mangOH Red, you are ready to Register on the Mobile Network on page 14.

4: Register on the Mobile Network

Now that your mangOH Red is powered on and running, make sure it can register on your SIM provider's mobile network, and configure it for use with AirVantage.

Note: The commands that you enter in the rest of this guide are done on your computer (e.g. on a native Linux system or in the VM) or on the mangOH Red. Development system examples show a '$' command prompt with a brown background, and mangOH Red examples show a '#' command prompt with a blue background.

1. From your computer's command prompt, test the USB connection:

   ```
   $ ping 192.168.2.2
   ```

   You should receive ping responses by 'pinging' the CF3 module (which has a default IP address of 192.168.2.2). Press Ctrl+C to cancel the ping request and return to the command prompt.

```
$ ping 192.168.2.2
PING 192.168.2.2 (192.168.2.2) 56(84) bytes of data.
64 bytes from 192.168.2.2: icmp_seq=1 ttl=64 time=0.596 ms
64 bytes from 192.168.2.2: icmp_seq=1 ttl=64 time=0.518 ms
64 bytes from 192.168.2.2: icmp_seq=1 ttl=64 time=0.409 ms
64 bytes from 192.168.2.2: icmp_seq=1 ttl=64 time=0.648 ms
64 bytes from 192.168.2.2: icmp_seq=1 ttl=64 time=0.407 ms
^C
--- 192.168.2.2 ping statistics ---
5 packets transmitted, 5 received, 0% packet loss, time 2578ms
rtt min/avg/max/mdev = 0.407/0.516/0.648/0.100 ms
```

Replies received, connection working

Ctrl+C pressed to cancel ping

2. Connect to the mangOH Red using your terminal emulator:

   ```
   $ ssh root@192.168.2.2
   ```

3. The following message appears if you are using your CF3 module for the first time (modules are shipped without a password).

```
It is strongly recommended to setup credentials for remote login.
Please select one of the following options:
  1) Setup ssh keys and disable passwords-based authentication via ssh
     (the most secure)
  2) Setup password (better than nothing)
  3) Do nothing
```

   For now, type `3` and press Enter, then type `Y` and press Enter to be reminded the next time you connect. (During this tutorial, do this each time you open an SSH connection to the mangOH Red.)

   Note: After completing this tutorial, you should select an appropriate login authentication method (ssh keys or password) from this menu—see docs.legato.io/latest/basicTarget.html for details.

4. Turn off the CF3 module's radio (it may have been started automatically by other processes):

   ```
   # cm radio off
   ```

5. Set the CF3 module to use IPv4 addressing (this ensures that connections to AirVantage (later in this guide) will work correctly):

   ```
   # cm data pdp ipv4
   ```

6. (WP7702 modules only) If your mangOH Red has a new WP7702 module, by default it has LTE-M1 support enabled. If your mobile network does not provide LTE-M1, the module will fall back to 2G after approximately 5 minutes.

   To configure the module to try to register on 2G (without trying to register on LTE-M1):

   ```
   # cm radio rat GSM
   ```

7. Turn on the radio:

   ```
   # cm radio on
   ```

8. You must be using an activated SIM for the radio to successfully register on the mobile network.

   If you are using:

   - a Sierra Wireless SIM provided with the kit, continue to the next step. (The SIM will be activated by AirVantage in the next chapter.
   - a non-activated SIM—Activate it with your provider, then continue to the next step.
   - an activated SIM—Continue to the next step.

Important: *Typically, your module will register on a network in < 1 minute. However, the very first time your CF3 module and Sierra SIM are used, registration may take from 5–20 minutes.*

9. To set up your AirVantage account in the next chapter, you need the serial number (FSN) and IMEI of your mangOH Red's CF3 module, and the ICCID of your SIM:

   a. To display the module information, enter the following command:

   ```
   # cm info
   ```

   ```
   # cm info
   Device:                         WP7603
   IMEI:                           352959095987162
   IMEISV:                         4
   FSN:                            41933959959959
   Firmware Version:               SWI9X06Y_02.32.02.00 c2e98c jenkins 2019/08/30 07:28:21
   Bootloader Version:             SWI9X06Y_02.32.02.00 c2e98c jenkins 2019/08/30 07:28:21
   ...
   ```

   Example data

   b. To display the Display the SIM card's ICCID value (which will be used when you register for your free AirVantage account):

   ```
   # cm sim info
   ```

   ```
   root@swi-mdm9x28: ~# cm sim info
   Type:                     EXTERNAL SLOT 1
   ICCID:                    89332401000004550147
   Home Network Operator: I TIM
   EID:
   IMSI:                     222013094587037
   Phone Number:
   ```

   Example data

Note: The Home Network Operator is the ISP that provides the network on which the CF3 module is connected. This may be different than the provider of the SIM if you are connecting to a network that your SIM's provider has an agreement with. For example, Sierra Wireless SIMs will connect to a variety of networks as in the example above.

10. Make sure you are using the correct APN for your SIM:

```
# cm data
```

```
root@swi-mdm9x28: ~# cm data
Index:      1
APN:        internet.sierrawireless.com
PDP Type:   IPV4
Connected:  no
```

Example response when Not connected, and APN is set

```
root@swi-mdm9x28: ~# cm data
Index:      1
APN:
PDP Type:   IPV4
Connected:  no
```

Example response when Not connected, and no APN

If you are using:

- Sierra Wireless SIM—The module should automatically set the appropriate APN for the SIM (likely internet.sierrawireless.com, internet.swir, lp.swir, etc.) If no APN is shown, you should use internet.sierrawireless.com.
- AT&T SIM (included with ATT_mangOH_Red kit only)—Your APN should be m2m.com.attz
- Any other SIM—Check with the mobile network provider, or search the Internet for "<provider> APN". For example, "Rogers Wireless APN"

Note: If your mobile network operator uses different APNs for 3G and LTE, make sure to use the correct APN for your CF3 module type. (e.g. WP8548 is a 3G module, and WP7603 is an LTE module.

a. If "cm data" showed the wrong APN, set the correct APN (replace <apn_value>):

```
# cm data apn <apn_value>
```

```
root@swi-mdm9x28: ~# cm data apn internet.sierrawireless.com
root@swi-mdm9x28: ~# cm data
Index:                1
APN:                  internet.sierrawireless.com
PDP Type:          IPV4
Connected:         no
```

Example data

b. Check the connection status again to make sure you set the APN correctly:

```
# cm data
```

```
root@swi-mdm9x28: ~# cm data
Index:                1
APN:                  internet.sierrawireless.com
PDP Type:             IPV4
Connected:            no
```

Example data

c. If the APN is not the value you set, go back to step a.

11. The CF3 module is registered on a mobile network (if using an activated SIM), and the SIM is installed and configured with the correct APN.

Now that you've registered on the network, you can Connect to AirVantage (The Cloud) on page 17 and see how the mangOH Red sends data to the cloud.

5: Connect to AirVantage (The Cloud)

Now that your mangOH Red is working, it's time to send its sensor data to the cloud.

Your mangOH Red kit includes a free mangOH-customized account on the AirVantage IoT Acceleration Platform for your CF3 module. This platform provides a cloud-based service to collect data from your device, and the infrastructure for you to build, connect, and operate your IoT applications in a single platform.

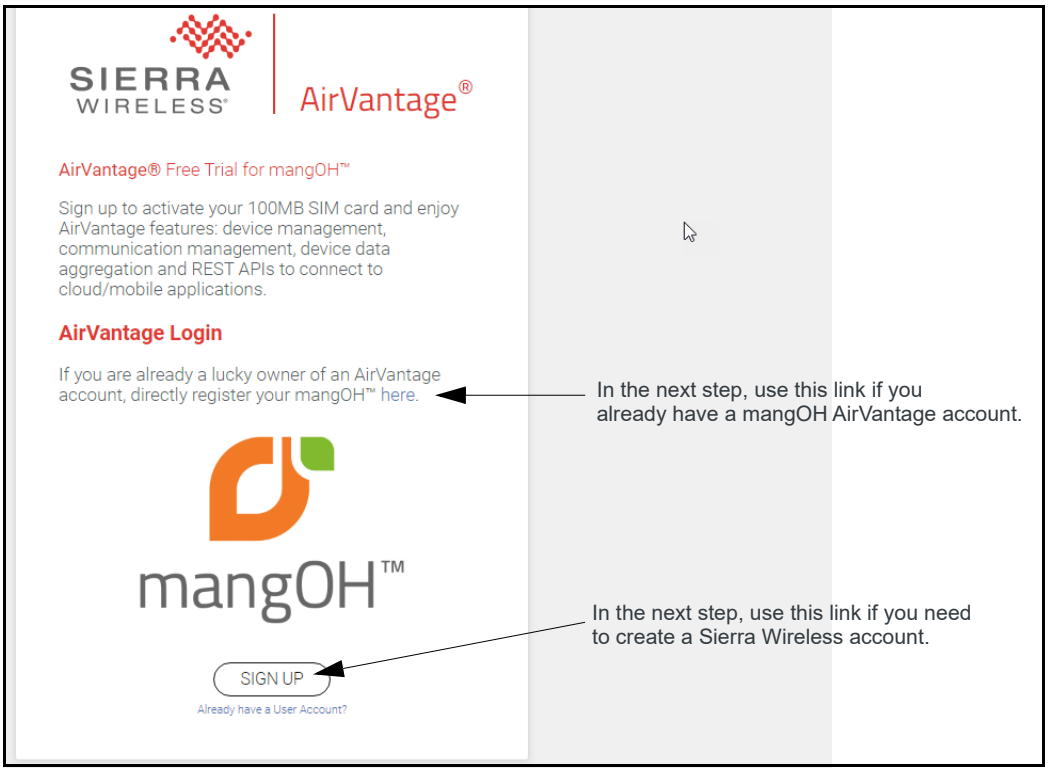
Note: You can register up to five devices on your free account.

5.1 Claim Your Free AirVantage Account

To use AirVantage, you must register your CF3 module and then connect your mangOH Red to the AirVantage server. If you have an AirVantage account for non-mangOH devices, register for a new account for your mangOH device(s) to enable access to the mangOH-specific customizations.

To claim your free AirVantage account:

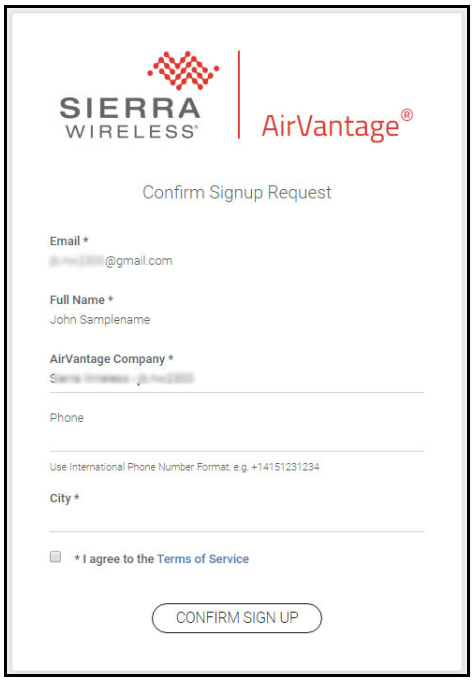
1. Go to https://eu.airvantage.net/accounts/signup?type=Mangoh.



2. Log in to AirVantage:
   - If you have not already created an AirVantage account for mangOH boards, click **SIGN UP**. and go to step 3.
   - If you already have a mangOH AirVantage account, click the **here** link in the AirVantage Login section, sign in, and go to Step 7 on page 19.
3. To create a new Sierra Wireless User Account:
   a. Enter your information and click **SIGN UP** to create the account.
   b. Follow the instructions that appear to complete your Sierra Wireless account activation. (When you receive your activation email, use it within 24 hours to register your Sierra Wireless account.)
   c. Follow the prompts to log in with your new account. An AirVantage Signup Request window will appear.

Note: You can use your Sierra Wireless account to access your AirVantage account, mangOH.io, the Source, and other Sierra Wireless sites.

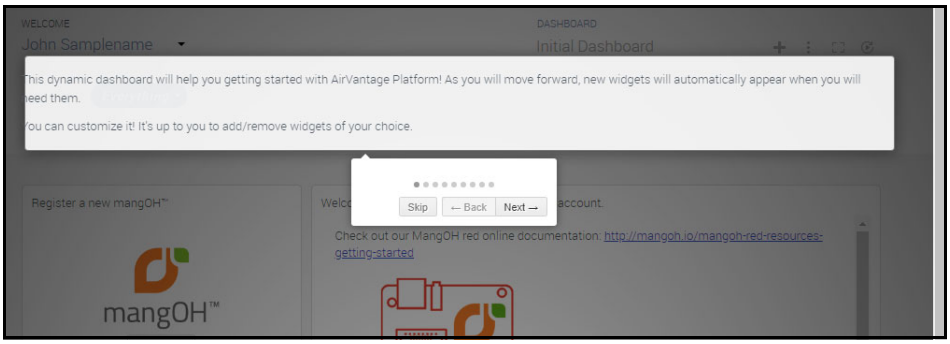
4. Enter the information to create your AirVantage account (Company), which will be used to hold your mangOH device(s), and click **CONFIRM SIGN UP** when finished.



Important: *The company name must be unique (e.g. use a combination of your company name, the project name, your name, etc.)—If the name has been used by any other person to set up their account, you will have to change this to make it unique.*

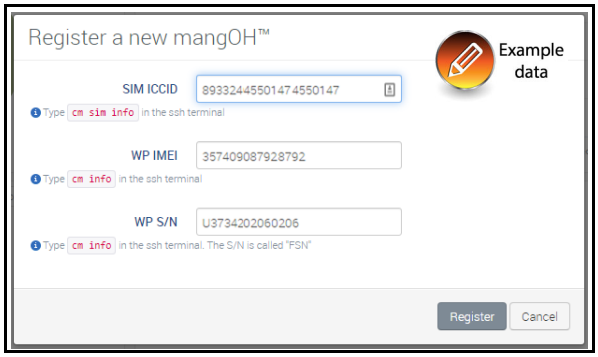
5. An email is sent automatically to your email address with a link to AirVantage. Click the link to access your account for the first time (https://eu.airvantage.net/start).

6. The first time you log in to your AirVantage account, a walkthrough tutorial appears. If you don't want to use it, click **Skip**. Otherwise, click **Next** to step through it.



7. Link your mangOH Red's CF3 module and SIM to your AirVantage account:
   a. In the mangOH tile, click **Register**.

   b. In the Register a new mangOH window, enter your SIM and device information:

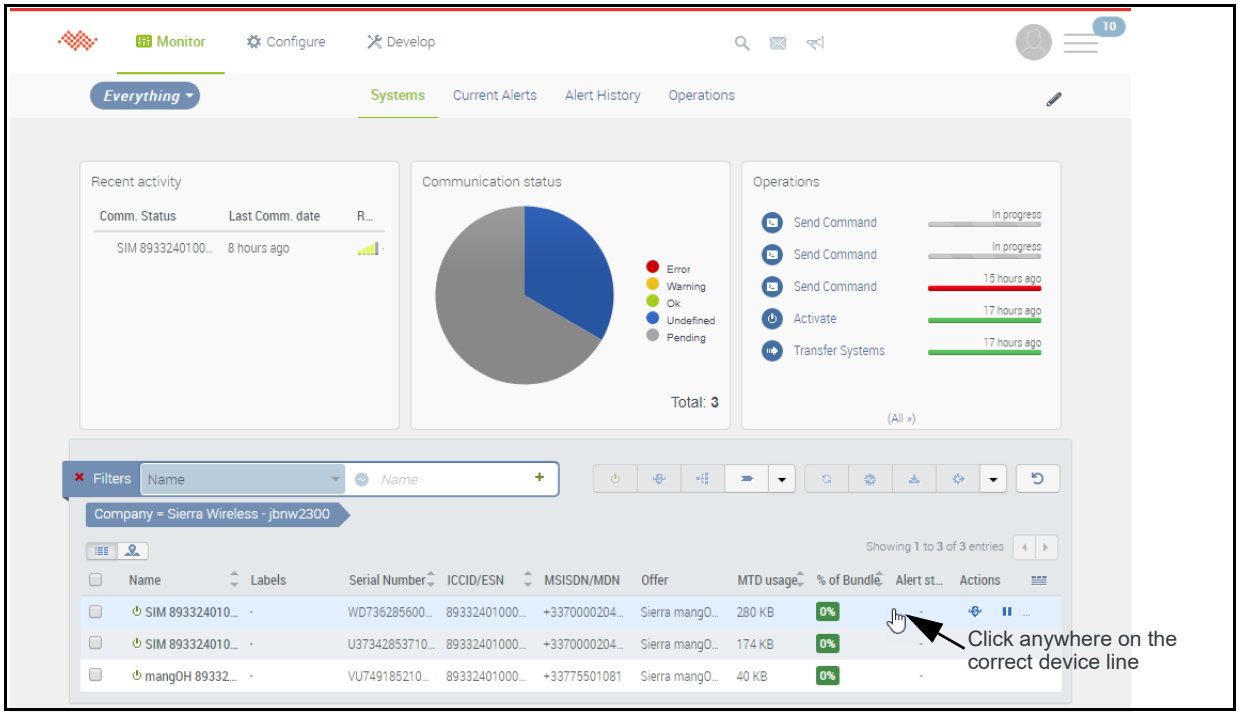


Note: If you are using a Sierra Wireless SIM provided with the kit, it is now activated and your CF3 module will be able to register on a mobile network.

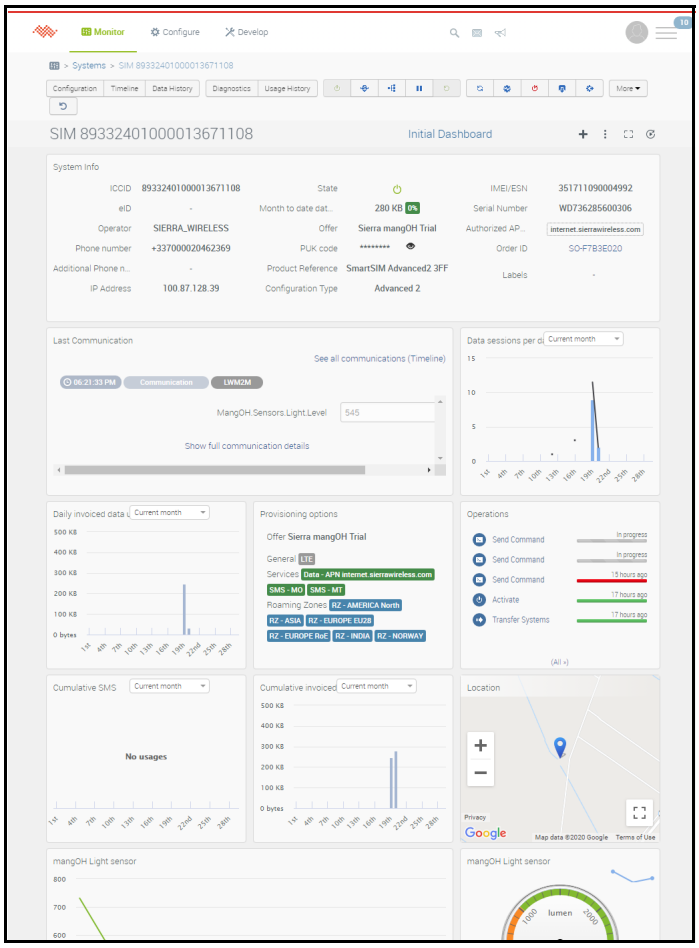
8. Now that your 'system' (module + SIM combination) is registered, go to the system dashboard and make any final required configuration adjustments:
   a. Click **Monitor**, then select **Systems** to display your registered devices.

b. Click anywhere in the line showing your device to display the system's dashboard (System Details).

Note: (All the devices registered on your account appear in this list; make sure to click the correct device.)

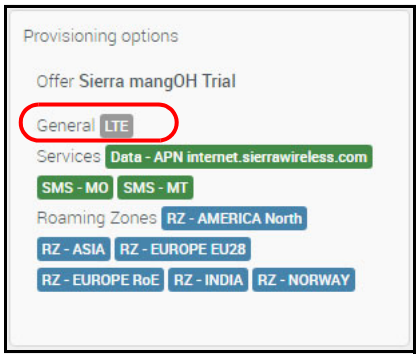


The dashboard appears, showing information about the system, recent communications, and widgets for the sensor data sent by your mangOH Red.



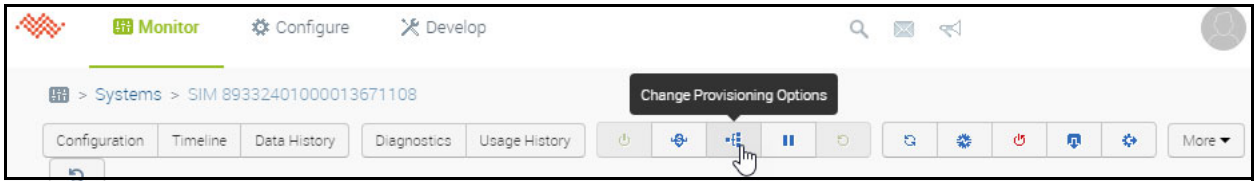
Note: The communication and sensor widgets are initially blank because you have not connected your mangOH Red to AirVantage yet.

c. If you are using the Sierra Wireless SIM included with the kit, check the **General** field in the Provisioning options tile:

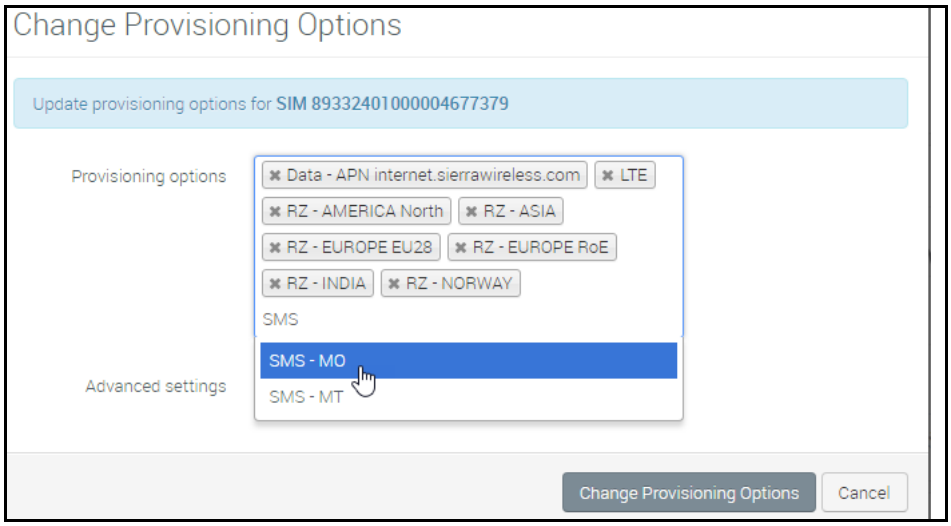


- If General=LTE, no change is required.

- If General=LTE-Only:
  i. Click the **Change Provisioning Options** icon in the toolbar:



  ii. In the **Provisioning options** box, begin typing "SMS - MO" and select the option when it appears.



  iii. Repeat and select **SMS-MT**.

  iv. Click **Change Provisioning Options**.
  This change will take a few minutes to take effect, and the General option will change to "LTE".

9. Keep your browser open to the AirVantage dashboard and continue to Send Sensor Data to AirVantage, below.

5.2 Send Sensor Data to AirVantage

Now that your "system" is registered on AirVantage, connect your mangOH Red to the AirVantage server and begin transmitting sensor data:

1. On your computer, open a terminal window.
2. Connect to the mangOH Red:
   ```
   $ ssh root@192.168.2.2
   ```
3. The mangOH Red platform includes two applications to collect sensor data and communicate it (send/receive) to AirVantage—redSensor activates the mangOH Red's sensors, and redCloud communicates the sensor data to the IoT cloud.
   By default, redSensor should be running (sensors active) and, to conserve data, redCloud is stopped by default.

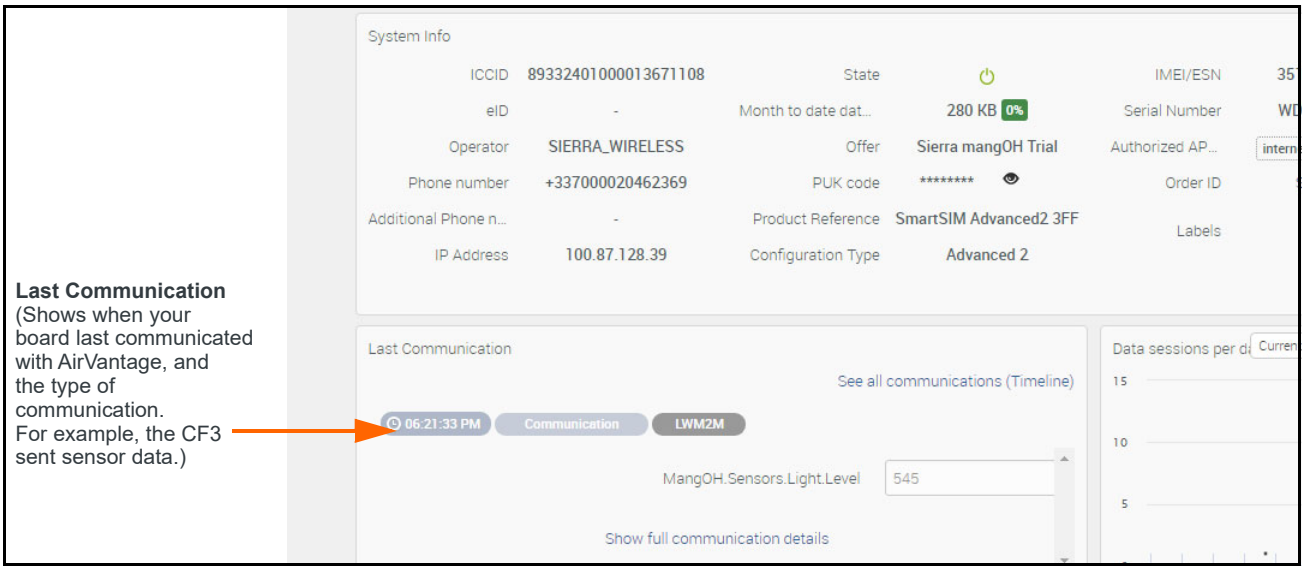
Start redCloud to start sending data to AirVantage, and confirm that it is running:

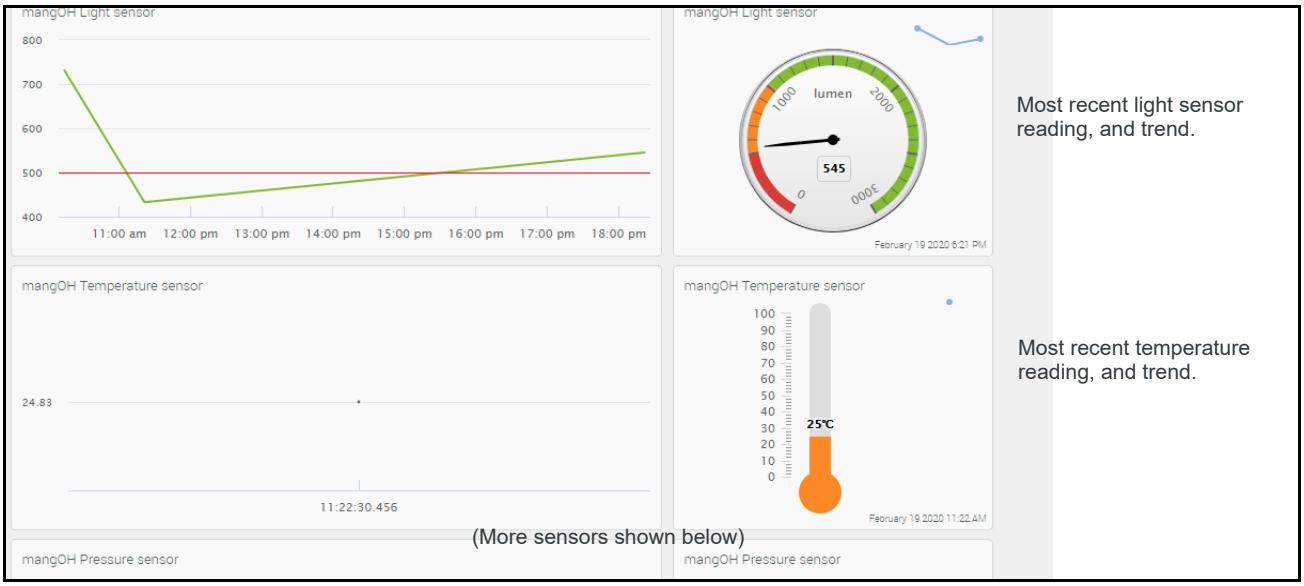
```
# app start redCloud
# app status
```

```
root@swi-mdm9x28: ~# app status
[running] atAirVantage
[running] atQmiLinker
[running] atService
...
[running] powerMgr
[running] qmiAirVantage
[running] redCloud
[running] redSensor
...
```

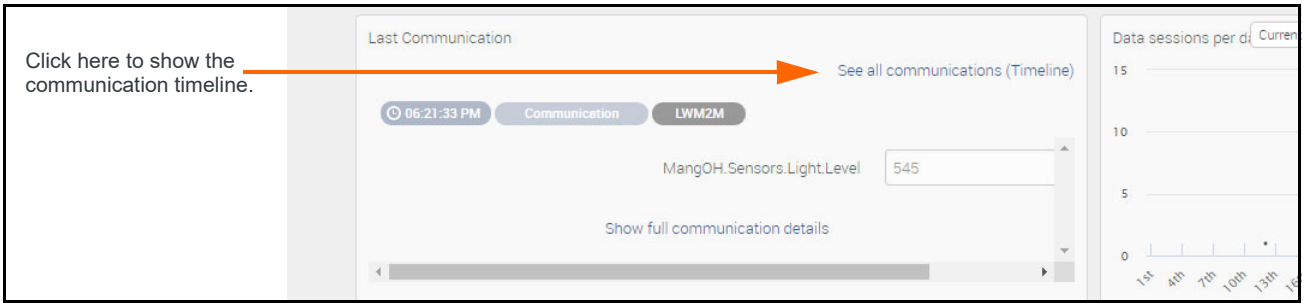
4. In your browser, refresh the dashboard screen.

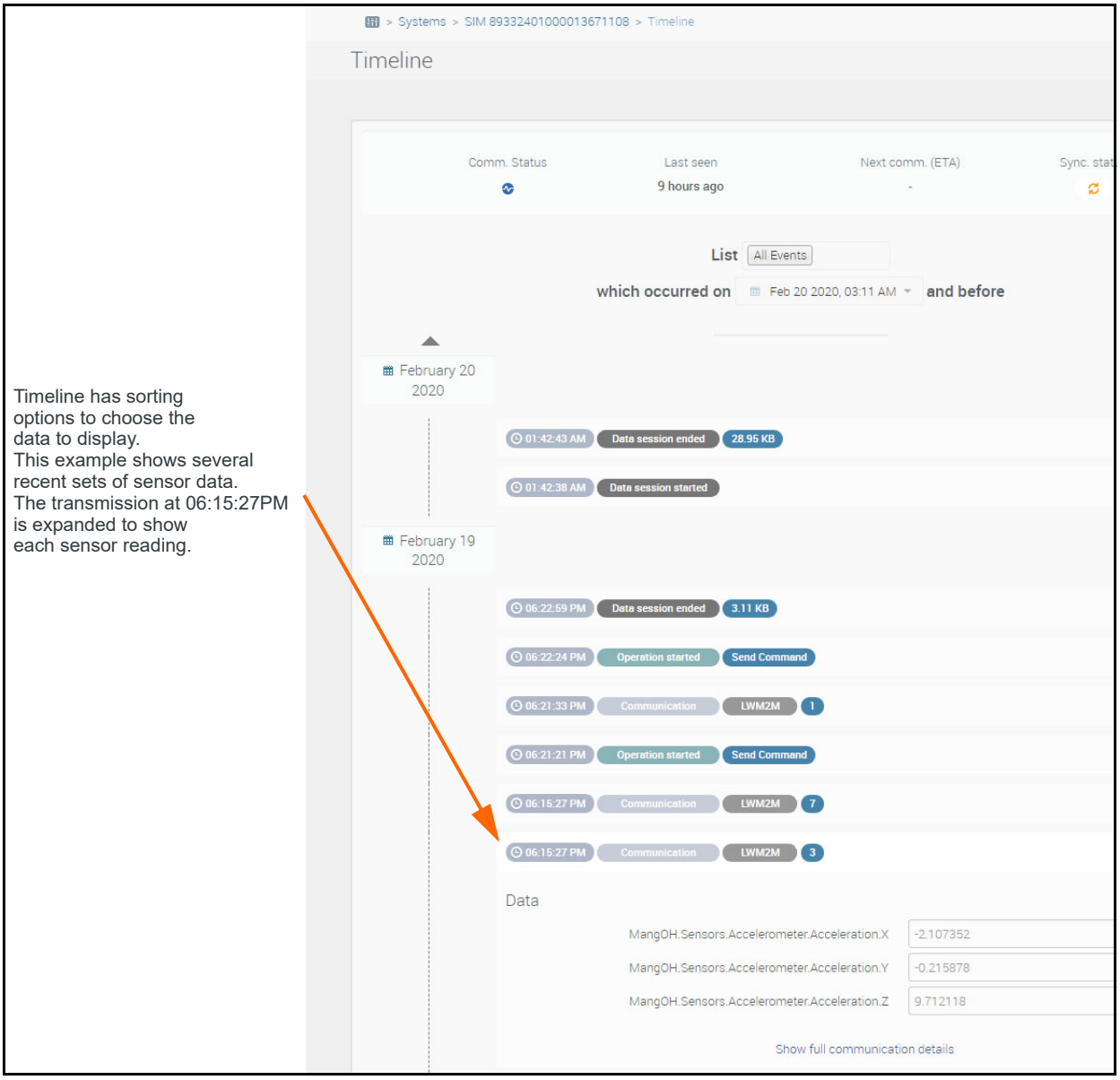
   The Last Communication section shows your Registration connection or sensor data (whichever was most recently received) and the sensor widgets will show the readings that are detailed in the communication entries.




mangOH Light sensor
800
700
600
500
400
11:00 am
12:00 pm
13:00 pm
14:00 pm
15:00 pm
16:00 pm
17:00 pm
18:00 pm
mangOH Light sensor
lumen
1000
2000
0
3000
545
February 19 2020 6:21 PM
Most recent light sensor reading, and trend.
mangOH Temperature sensor
24.83
11:22:30.456
mangOH Temperature sensor
100
90
80
70
60
50
40
30
20
10
0
25°C
February 19 2020 11:22 AM
Most recent temperature reading, and trend.
(More sensors shown below)
mangOH Pressure sensor
mangOH Pressure sensor

5. All data sent between your mangOH Red and AirVantage can be viewed in the communications Timeline. To view details (e.g. specific sensor readings, events, etc.), in the Last Communication Section, click **See all communications (Timeline)**.





6. You have now successfully transmitted data to the cloud. You can now stop sending sensor data from the device (if desired, to stop using your data allocation):

```
# app stop redCloud
```

7. Make sure redCloud has stopped:

```
# app status
```

```
root@swi-mdm9x28: ~# app status
[running] atAirVantage
[running] atQmiLinker
[running] atService
...
[running] powerMgr
[running] qmiAirVantage
[stopped] redCloud
[running] redSensor
...
```

Note: The data connection closes automatically when redSensorToCloud is stopped.

You have now registered and connected your device to AirVantage, and completed the mangOH Red Getting Started tutorial. For more information on the mangOH platform, visit mangoh.io.

To begin developing simple applications or modifying existing applications, work through the examples in Prepare Your System For Development on page 27.

A: Prepare Your System For Development

A

Now that your mangOH Red is ready for use, prepare your development system to work with it using Sierra Wireless' Leaf development workspace manager, which is designed to create and manage your mangOH development environment.

A.1 Install and Configure Leaf Workspace Manager

Leaf is pre-installed on the mangOH VM. If you will be developing on a native Linux system, you will have to install it yourself ((Linux only) Install Leaf Workspace Manager).

A.1.1 (Linux only) Install Leaf Workspace Manager

The Leaf installation process automatically downloads, installs and configures all necessary components for the development environment.

To install Leaf on your development machine:

1. Download Leaf into a temporary folder (e.g. "/tmp" in this example):

   ```
   $ wget https://downloads.sierrawireless.com/tools/leaf/leaf_latest.deb -O
         /tmp/leaf_latest.deb
   ```

2. Install Leaf.

   ```
   $ sudo apt install /tmp/leaf_latest.deb
   ```

3. Configure Leaf to add mangOH Git remotes, which enable Leaf to search for mangOH targets. (This only needs to be done once, the configuration is persistent.)

   In the following command, replace <alias_red> and <alia_yellow> with meaningful names:

   ```
   $ leaf remote add <alias_red> https://downloads.sierrawireless.com/man-
         gOH/leaf/mangOH-red.json --insecure
   $ leaf remote add <alias_yellow> https://downloads.sierrawireless.com/man-
         gOH/leaf/mangOH-yellow.json --insecure
   ```

   ```
   $ leaf remote add mangoh_red https://downloads.sierrawireless.com/mangOH/leaf/mangOH-red.json --
   insecure
   $ leaf remote add mangoh_yellow https://downloads.sierrawireless.com/mangOH/leaf/mangOH-yellow.json
   --insecure
   ```

   Note: The download connection is secured via TLS (Transport Layer Security). The "--insecure" option in this command simply tells Leaf not to use GPG (GNU Privacy Guard) to verify downloaded files. This is intentional.

A.1.2 Configure Your mangOH Development Environment

Note: (VM only) If the prompt "[sudo] password for mangoh" appears, type "mangoh" and press Enter. (The VM's account name and password are both "mangoh".)

To configure your development environment using Leaf:

1. Create a 'workspace' (working directory) for your mangOH development, and then go to that directory. (e.g. create ~/myWorkspace to match the tutorial examples in https://docs.legato.io/latest/confLeaf.html.)

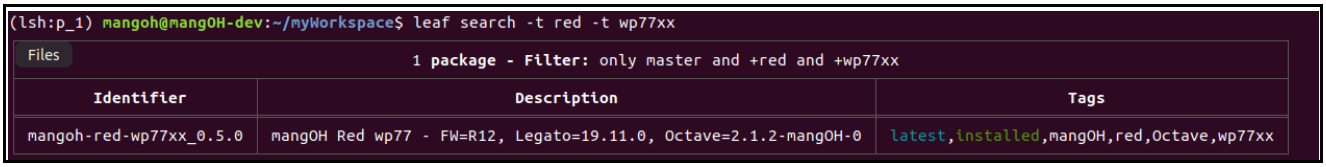
   ```
   $ mkdir ~/myWorkspace
   $ cd ~/myWorkspace
   ```

2. Create a Leaf profile for to develop specifically for your mangOH Red and its CF3 module (other profiles can be created later):

   a. Search the leaf remotes for packages for your device. Use the leaf search command using appropriate tags (from the table) to refine your search—examples are shown after the table.

   For example, to find all Leaf packages for mangOH Red boards using WP76 modules:

   ```
   $ leaf search -t mangOH -t red -t wp76xx
   ```



Tip: *All matching packages are listed with descriptions plus the search tags assigned to the packages. To see more detailed information about each package, do the search with the '-v' (verbose) flag.*
e.g. $ leaf search -t mangOH -v

General command format:		
`$ leaf search [-t <tag>] [-t <tag>] ...`		
Typical tag types	**<tag> values**	**Notes**
Platform	mangOH	Packages built specifically for mangOH boards.
mangOH type	red yellow green	Packages for specific mangOH boards.
Module type	wp750x wp76xx wp77xx wp85	Packages for specific CF3 modules.
Build status	stable	Packages that have been released to the Source.
	dev	Firmware build using newer Legato release (not released to the Source)

Examples

- Find all packages: `$ leaf search`
- Find all packages for mangOH boards: `$ leaf search -t mangOH`
- Find all packages for mangOH Red: `$ leaf search -t mangOH -t red`
- Find all packages for mangOH Red using WP76 modules: `$ leaf search -t mangOH -t red -t wp76xx`

b. Set up the current directory as a Leaf workspace and automatically create a profile for the target package, using the <packageIdentifier> from the previous step (e.g. mangoh-red-wp76xx_0.5.0) and give the profile a descriptive <profileName>. This automatically downloads and installs the specified target package.

```
$ leaf setup <profileName> -p <packageIdentifier>
```

```
$ leaf setup p1_red76 -p mangoh-red-wp76xx_0.5.0
Cannot find workspace, initialize one in /home/mangoh/myWorkspace? (Y/n)
y
  -> Execute: leaf init
Workspace initialized /home/mangoh/myWorkspace
...
...
[10/10] Installing mangoh-red-wp76xx_0.5.0
$
```

i. When the prompt "Cannot find workspace, initialize one in ...", press Enter (or type `y` and press Enter).

Note: This prompt appears only for the first profile you create, because the Leaf workspace must be initialized before first use.

ii. If the prompt "Profile is out of sync ... Do you want to continue?" appears, press Enter or (type `y` and press Enter).

iii. If the prompt "It is recommended to have the latest version of swiflash swicwe ... Do you want to execute this command" appears, press Enter (or type `Y` and press Enter).

iv. If a prompt to accept the license appears, press Enter to display and then read the license. Press `q` to quit the viewer, then type `Y` and press Enter to accept the license to continue.

Note: At any time, you can create additional profiles (for the same module series using different packages, or for other module types and their packages). To create additional profiles, repeat Step 2 for each profile.

Important: *Do not make any manual changes to ~/leaf—that folder is managed by Leaf and contains files shared between all workspaces and profiles.*

A.2 Build/Install the mangOH Development Package

1. Enter the leaf shell to load the development environment with the most-recently used profile (e.g. the one you just created). The shell now knows where the development environment components (e.g. Legato, toolchains, etc.) are located.

```
$ leaf shell
```

```
$ leaf shell
Leaf Shell /bin/bash started in Leaf environment.

(lsh:p1_red76):$
```

Note: Examples in this chapter show the profile in use as "p1_red76".

Tip: *The leaf shell command prompt indicates the profile in use—in the example above, "(lsh:p1_red76)" indicates profile 'p1_red76' is in use. If you leave the your workspace (e.g. go outside of ~/myWorkspace in these examples) the profile will not be active and the prompt will show "(lsh) $")*

Note: To return to the regular shell at any time, enter 'exit' at the leaf shell command prompt.

2. Go to your Leaf workspace:

   ```
   (lsh:p1_red76)$ cd ~/myWorkspace
   ```

3. If this is your first time building the mangOH package, get the mangOH Development Package source files (this creates a mangOH directory in your current directory):

   ```
   (lsh:p1_red76):$ git clone --recursive git://github.com/mangOH/mangOH
   ```

4. Go to the mangOH directory (which was created by the git clone command):

   ```
   (lsh:p1_red76):$ cd ~/myWorkspace/mangOH
   ```

5. Either package the mangOH Red applications with firmware components that correspond to your leaf profile, or build just the mangOH Red applications for your module:
   - Build mangOH Red applications and package them with firmware:

     ```
     (lsh:p1_red76):$ make red_spk
     ```

     The package (red_wp76xx.spk) is created in ./build and is ready to load on the mangOH Red.
   - Build mangOH Red applications only:

     ```
     (lsh:p1_red76):$ make red
     ```

     The package (mangOH.wp76xx.update) is created in ./build/update_files and is ready to load on the mangOH Red.

6. Load the update on the mangOH Red:
   - If loading the mangOH Red application packaged with firmware (e.g. red_wp76xx.spk):
     i. Enter the appropriate command to load the package:
     - To load from a Linux system:

       ```
       (lsh:p1_red76):$ swiflash -m <module_series> -i <update_file>
       ```

       ```
       (lsh:p1_red76):$ swiflash -m WP76XX -i build/red_wp76xx.spk
       Detecting USB of the target
       DONE
       Communicating with the target
       DONE
       Switching to firmware download mode
       ............DONE
       Downloading the firmware
       ..................DONE
       Rebooting the module
       ........DONE
       Firmware Download SUCCESS
       ```

- To load from the VM:

```
(lsh:p1_red76):$ fwupdate download <update_file> 192.168.2.2
```

```
(lsh:p1_red76):$ fwupdate download build/red_wp76xx.spk 192.168.2.2
Connecting to service ...
Download started ...
Download successful
Installing & Reboot ...
packet_write_wait: Connection to 192.168.2.2 port 22: Broken pipe
Connection interrupted, target is likely rebooting.
(lsh:p1_red76):$
```

ii. Press the reset button to restart the device. The device will boot with the new firmware.

- If loading the mangOH Red application only (e.g. red_wp76xx.update)

```
(lsh:p1_red76):$ update $LEAF_WORKSPACE/mangOH/build/update_files/<update-
                 file> 192.168.2.2
```

For example, if the CF3 module in your mangOH Red is a WP7603, use:

```
(lsh:p1_red76):$ update $LEAF_WORKSPACE/mangOH/build/update_-
                 files/red.wp76xx.update 192.168.2.2
```

```
(lsh:p1_red76):$ update ~/mangOH/build/update_files/red/mangOH.wp76xx.update 192.168.2.2
Applying update from file '/home/mangoh/mangOH/build/update_files/red.wp77xx.update' to device
at address '192.168.2.2'.
Unpacking package: 100% ++++++++++++++++++++++++++++++++++++++++++++++++++
...
Applying update: 100% ++++++++++++++++++++++++++++++++++++++++++++++++++
SUCCESS
Done
```

The mangOH Red is now updated with the software package (and firmware, if you built an .spk).

Tip: *For additional leaf-related commands, run "leaf help". For detailed information about the Leaf Workspace Manager including command details, instructions, tutorials, etc., visit https://docs.legato.io/latest/confLeaf.html.)*

B: Updating the Firmware on a mangOH

Firmware images for your mangOH Red can be in two formats—.spk and .exe.

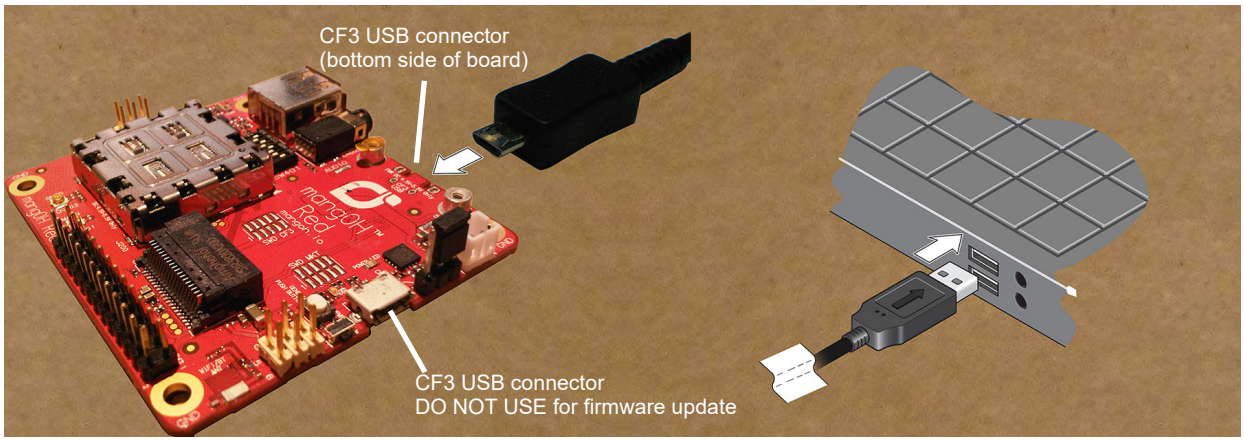
The latest images (in both formats) for various module types are available at:
mangoh.io/mangoh-red-resources-software

You can also build your own .spk file as described in Build/Install the mangOH Development Package on page 29.

There are a few ways to update the firmware on a mangOH board's CF3 module:

- Platform independent (uses .spk)
- From Linux (uses .spk)
- From VM (uses .spk)
- From Windows (uses .exe)

The firmware on a mangOH board is updated over the mangOH's CF3 USB port.



Platform-independent

This approach has the advantage of working using a Linux or Windows PC to perform the update. The disadvantage of this method is that it requires the user to login to the device via ssh or console and this is a bit inconvenient and may not even be possible if a bad firmware was installed previously.

To install an image to the mangOH Red's module:

1. Use a micro-USB cable to connect the mangOH's USB (not console) port to a powered USB port on your computer.
2. Locate the firmware .spk file that is to be installed and copy it to the mangOH (replace <spk_file_path> with the pathname for the .spk file to install):

   ```
   $ scp <spk_file_path> root@192.168.2.2:/tmp
   ```

   ```
   $ scp build/red_wp76xx.spk root@192.168.2.2:/tmp
   red_wp76xx.spk              100%   66MB   4.5MB/s   00:14
   $
   ```

3. Log in to the mangOH:

   ```
   $ ssh root@192.168.2.2
   ```

4. Install the firmware update:

```
# fwupdate download /tmp/<spk_file>
```

```
# fwupdate download /tmp/red_wp76xx.spk
Connecting to service ...
Download started ...
Download successful
Installing & Reboot ...
```

5. Press the reset button to restart the device. The device will boot with the new firmware.

Linux

To install an image from a Linux system to the mangOH Red's module:

1. Use a micro-USB cable to connect the mangOH's USB (not console) port to a powered USB port on your computer running Linux.
2. Locate the firmware .spk file that is to be installed and install it on the mangOH:
   - Replace <module_series> with your CF3 module type (WP750X, WP76XX, WP77XX, WP85XX).
   - Replace <update_file_path> with the pathname for the .spk file to install:

```
$ swiflash -m <module_series> -i <update_file_path>
```

```
$ swiflash -m WP76XX -i build/fw_image_to_install.spk
Detecting USB of the target
DONE
Communicating with the target
DONE
Switching to firmware download mode
............DONE
Downloading the firmware
.................DONE
Rebooting the module
........DONE
Firmware Download SUCCESS
```

Note: This may take several minutes to run. If the download fails, repeat the swiflash command. If you still have difficulties, use "swiflash --help" for usage information or refer to source.sierrawireless.com/resources/airprime/software/swiflash for details.

3. Press the reset button to restart the device. The device will boot with the new firmware.

VM

To install an image from the VM to the mangOH Red's module:

1. Use a micro-USB cable to connect the mangOH's USB (not console) port to a powered USB port on your computer.
2. Enter the leaf shell:

```
$ leaf shell
```

3. Go to your Leaf workspace:

```
(lsh:p1_red76)$ cd ~/myWorkspace
```

4. In the command below, replace <spk_file_path> with the pathname for the .spk file to install.

```
$ fwupdate download <spk_file_path> 192.168.2.2
```

```
$ fwupdate download build/fw_image_to_install.spk 192.168.2.2
Connecting to service ...
Download started ...
Download successful
Installing & Reboot ...
packet_write_wait: Connection to 192.168.2.2 port 22: Broken pipe
Connection interrupted, target is likely rebooting.
$
```

Note: This will take several minutes to run. If the download fails, repeat the fwupdate command. If you still have difficulties, use "fwupdate --help" to display usage information.

5. Press the reset button to restart the device. The device will boot with the new firmware.

Windows

To install an image from Windows to the mangOH Red's module:

1. Use a micro-USB cable to connect the mangOH's USB (not console) port to a powered USB port on your computer running Windows.
2. Locate the firmware .exe file that is to be installed.
3. Log in to the mangOH.

```
$ ssh root@192.168.2.2
```

Note: If ssh is not available at the command line level, use an ssh client to connect to 192.168.2.2 as the root user.

4. Stop legato:

```
# legato stop
```

```
# legato stop
Stopping Legato..
DONE.
```

Note: The software in the firmware .exe file does not wait long enough for a device that is running Legato to enter the mode where it is ready for programming. By stopping Legato before running the .exe, the device will be able to enter programming mode quickly enough when the .exe is run.

5. On your PC, double-click the firmware .exe file to install it on the mangOH.
6. Press the reset button to restart the device. The device will boot with the new firmware.

Troubleshooting

- If the platform-independent method doesn't work, any of the other methods.
- If the Linux, VM or Windows methods are not working:
  a. Try moving the TP1_BOOT DIP switch (SW401 dipswitch 7) into the ON position and then press the reset button before initiating programming.
  b. Once programming has begun, move the TP1_BOOT DIP switch back to the OFF position.

C: Hardware Tips

C.1 Dipswitch Settings

The multi-function dipswitch block (SW401) is used to control module signals.

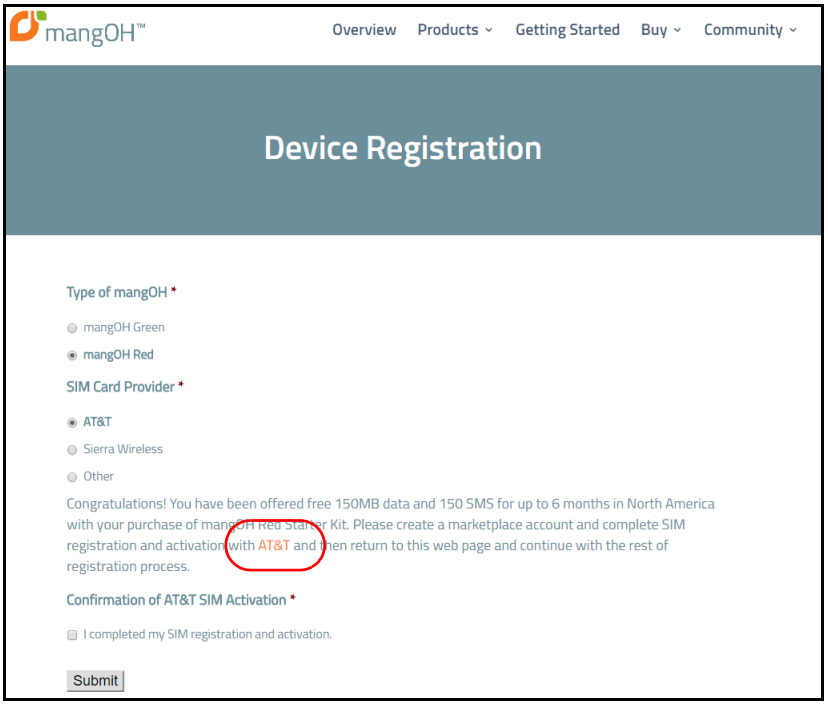
Note: *The 'Default' switch positions are the settings recommended when using this guide.*

Signal	Dip	On/Off	State
1	PWR_ON	On (Default)	Enable CF3 module's POWER_ON signal
		Off	Disable POWER_ON signal
2	WIFI_UART1_TX	On	Enable CF3 module's firmware download (recovery) mode. *Note: Similar functionality to TP1_BOOT*
		Off (Default)	Normal operation
3	VCC_3V7_ULPM	On (Default)	While in ULPM, sensors receive power
		Off	While in ULPM, sensors are not powered
4	HL_MODE	On	When combined with LowPower_RESET, indicates that board is in HL mode.
		Off (Default)	When combined with LowPower_RESET, indicates that board is in WP mode.
5	BATT_TS+	On (Default)	Enable backup battery charging.
		Off	Disable backup battery charging.
6	CONS_DIR	On	Console USB connector accesses the Wi-Fi/Bluetooth module's console. *Note: To download firmware to the Wi-Fi module, set CONS_DIR OFF and WIFI_UART1_TX ON.*
		Off (Default)	Console USB connector access the CF3 module's console.
7	TP1_BOOT	On	Enable CF3 module's TP1 (boot) signal functionality. Pull the signal low to enter download mode for firmware updates.
		Off (Default)	CF3 module functions normally.
8	LowPower_RESET	On (Default)	When combined with HL_MODE, indicates that board is in WP mode.
		Off	When combined with HL_MODE, indicates that board is in HL mode.

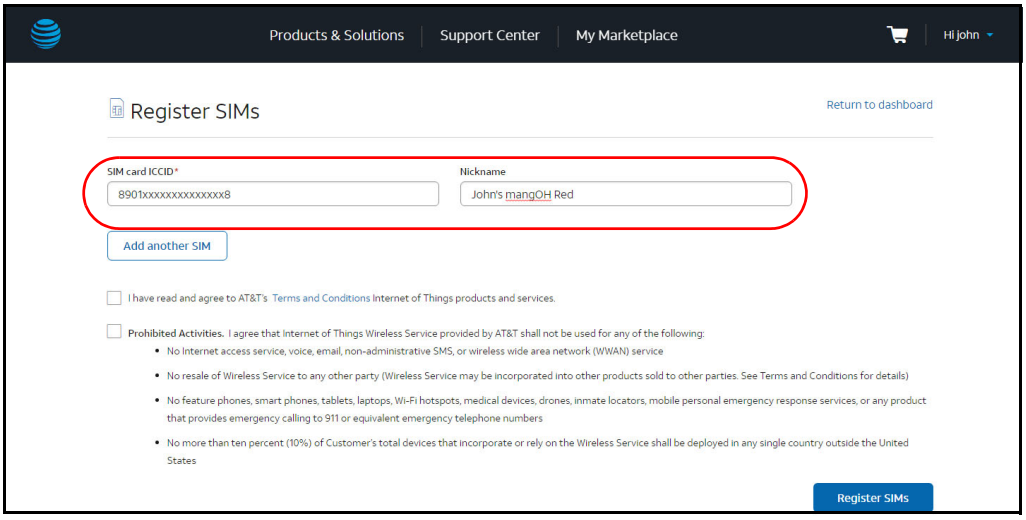
D: Register and Activate AT&T SIM

To register and activate an AT&T SIM for use with mangOH Red:

1. After selecting AT&T as the SIM Card Provider on the mangOH Red Device Registration page, click the AT&T link, or open https://marketplace.att.com/app/register-sims in a new tab or window.



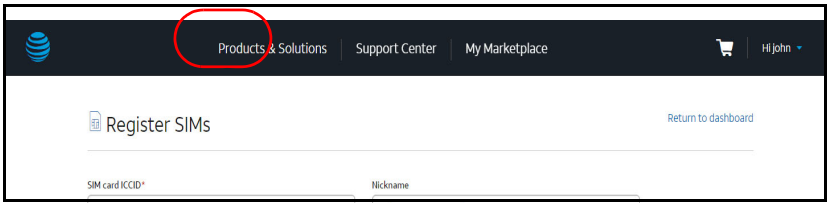
2. Log in to your AT&T marketplace account (or create an account if you do not yet have one).
3. On the Register SIMs screen, enter your SIM's ICCID (found on the back of the card).



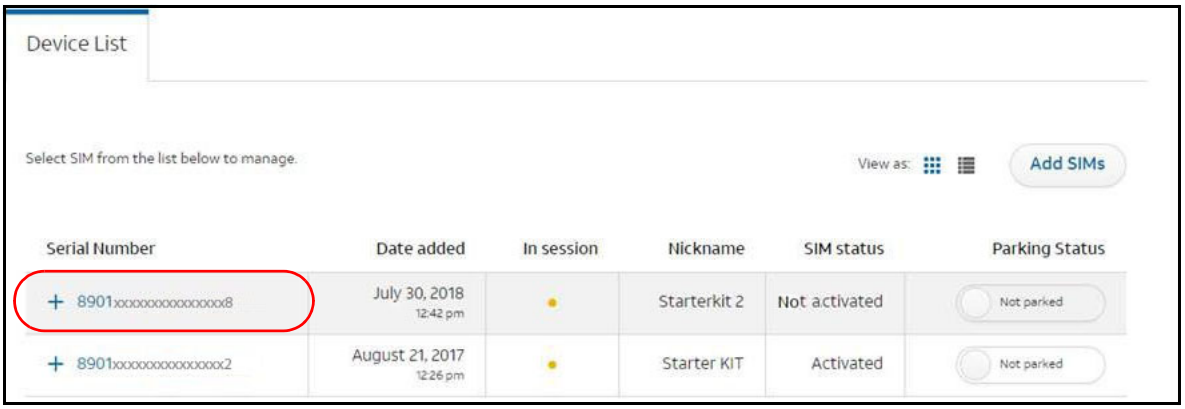
4. Optionally, add a Nickname to identify the card. (Useful if you have more than one card registered.)

Note: To register multiple SIMs, click Add another SIM to display additional SIM card ICCID and Nickname fields.

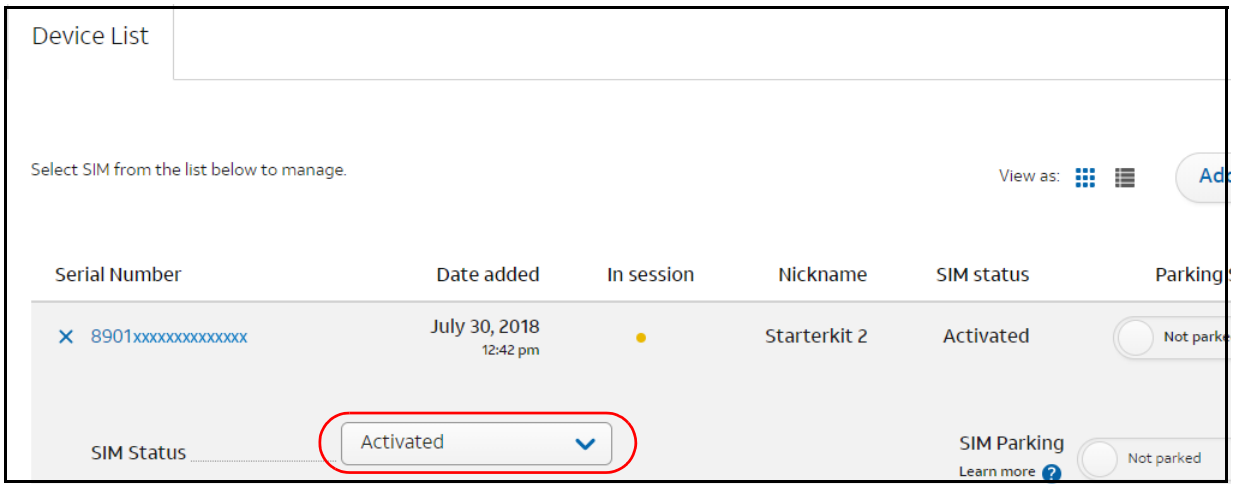
5. Click Register SIMs.
6. Click Dashboard to show your registered SIMs.



7. Activate your SIM(s). For each SIM that you want to activate:
   a. Click the Serial Number of the card to show the SIM details.



   b. In the SIM Status field, select Activated.



8. Go back to the tab or window showing the mangOH Device Registration page and select "I completed my SIM registration and activation".