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mangOH™ Red

User Guide



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Revision History

| Revision number | Release date | Changes |
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| 1 | February 2017 | Document created |
| 2 | May 2017 | Removed DV2 references, updated to DV3 where needed |

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1: Introduction

This user guide explains how to set up and begin using the mangOH™ Red with CF3 (Common Flexible Form Factor) modules.

Once you have the mangOH Red set up, visit mangoh.io for developer documentation, code samples, and other materials.

Note: Described functionality is for mangOH Red (DV3 version). Photographs of mangOH Red (DV2 version) will be updated in the next release of this document.

mangOH Red Components and Accessories

[Table 1-1](#) details the required and optional components needed to begin using the mangOH Red in your development environment. Some of these components are available in mangOH Red development kits (kit contents are supplier-dependent).

Table 1-1: mangOH Red Required and Optional Components



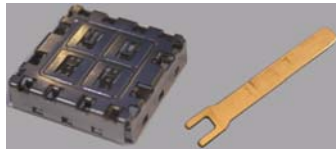





| Item | Details |
|--|---|
| mangOH Red (Included in kit) | Pre-configured development board for CF3 modules  |
| CF3 module(s) (Included in kit) | The module in the kit includes a cellular modem and an application processor running Legato, an open source embedded platform built on Linux for hosting IoT applications (see legato.io for details). See Table 1-2 on page 7 for compatible Sierra Wireless modules.  <hr/> <i>Note: Not all supported Sierra Wireless modules include application processors.</i> <hr/> |
| CF3 module cover and cover removal tool (Included in kit) | Industrial-quality snap-in module cover, plus cover removal tool to disconnect the cover from the mangOH Red <i>Note: The cover and tool shown are for WP-series modules. A similar cover and tool (not displayed) are used for HL-series modules.)</i>  |
| Micro-USB cables (Included in kit) | Connect computer to the mangOH Red for communication and to provide power for non-transmitting tests.  |

Table 1-1: mangOH Red Required and Optional Components (Continued)

| Item | Details |
|---|--|
| Antenna (Included in kit) | Main RF antenna included. Additional antennas may be connected for Diversity and Wi-Fi/Bluetooth.  |
| Micro-SIM card (Included in kit) | <ul style="list-style-type: none"> Sierra Wireless micro-SIM card (included) with initial data allocation User-provided micro-SIM with an active account User-provided test card for use with a call box.  |
| M2 screws (Included in kit) | Two M2 screws included for securing an IoT module |
| GNSS Antenna (Not included in kit) | Optional antenna may be connected for GNSS reception.  |
| Audio cable (3.5 mm) (Not included in kit) | Optional audio cable or headset  |

The mangOH Red schematic (available at mangoh.io), describes all interfaces supported by the mangOH Red. However, some of these signals are not supported by some CF3 modules.

The following table identifies supported Sierra Wireless CF3 modules and identifies signals that (as of publication date of this document) are currently not supported. Refer to <http://source.sierrawireless.com> for current Product Technical Specification Documents.

Table 1-2: mangOH-compatible Sierra Wireless CF3 Modules

| Supported modules | mangOH Signals Not Supported By CF3 Module | | | |
|--|--|--------------------|-----------------|--------------------|
| | Pin | mangOH Signal Name | CF3 Signal Name | Module Signal Name |
| WP7502 WP7504 WP7601 WP7603 WP8548 | 43 | PWM_OUT | EXT_GPS_LNA_EN | EXT_GPS_LNA_EN |
| HL75xx HL76xx HL85xx HiLo xxx HL652BRD | | | | |

2: Setup and Installation

Safe Handling Recommendations

To help prevent accidental damage to the mangOH Red:

- Use safe ESD-handling practices (such as wearing proper ESD straps) to avoid possible ESD damage.
- Avoid touching the CF3 module (J200). These pins can be damaged if caught on clothing or other materials.

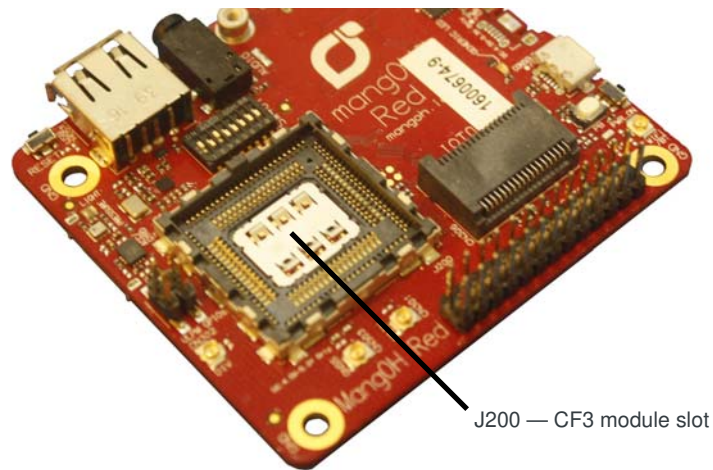


Figure 2-1: Safe Handling Recommendations—CF3 Socket (Do Not Touch)

- Optionally, attach standoffs (not included) to the mounting holes at each corner of the board to avoid damage to components on the bottom side of the board.

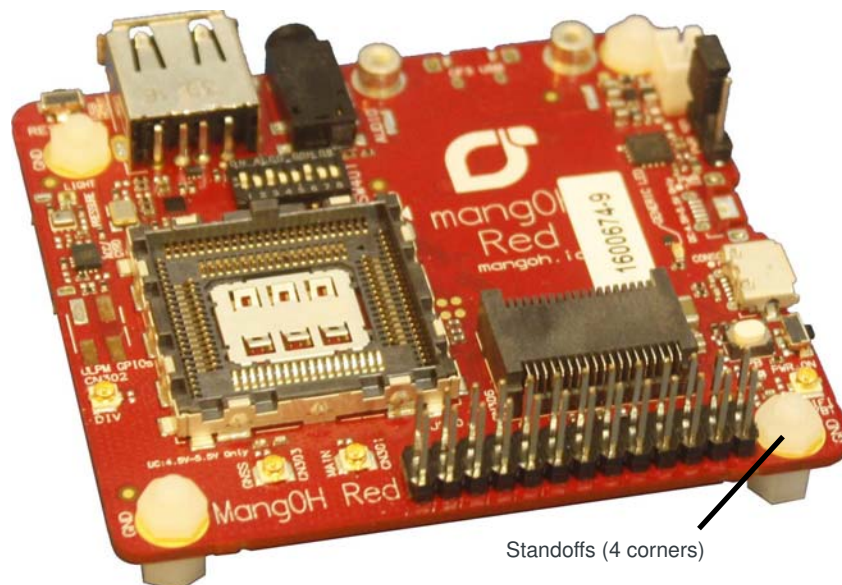


Figure 2-2: Module with Standoffs

Initial Setup

To begin using the mangOH Red, set up your hardware and software:

1. Insert a supported CF3 module in the socket. See [Insert/Remove Embedded Module](#) on page 11.
2. [Select Primary Power Supply](#). See page 15.
3. If you will be establishing a mobile network connection, insert a micro-SIM. See [Inserting a micro-SIM Card](#) on page 19.
4. [Connect Antenna\(s\)](#). See page 17.
5. [Install / Update Windows Driver](#). See page 34.
6. Make sure SW401 pin 1 is ON. This allows the module to power up as soon as power is supplied. (If SW401 pin 1 is OFF, you must press SW402 after power is supplied to power up the module.)

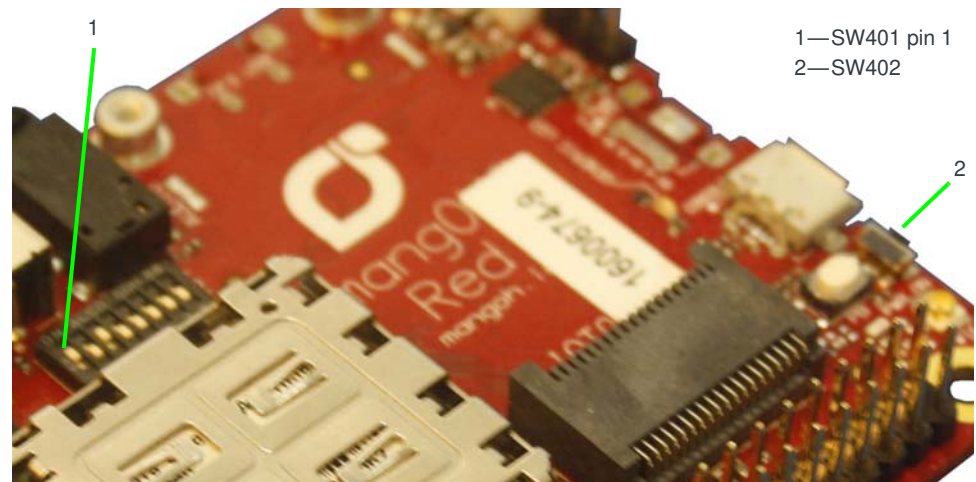


Figure 2-3: Check SW401 Pin 1 Position

7. Power up the mangOH Red—Plug one end of a micro-USB cable into the mangOH Red USB connector that you selected as the power supply in [Step 2](#) and plug the other end into your computer or an AC adapter.

Note: If the mangOH Red is powered from an AC adapter, choose the appropriate micro-USB connector:

- *Console*—This leaves the CF3 connector available to access the CF3 module's ECM port, issue AT commands, and download firmware updates to the Wi-Fi/BT (MediaTek Wi-Fi+Bluetooth) chipset.
 - *CF3 USB*—This leaves the Console connector available to access the consoles of the CF3 module or Wi-Fi/BT chipset (switch-selectable), and to download firmware updates to the CF3 module.
-

If you connected the cable to the correct micro-USB slot, the power LED on the top side of the mangOH Red turns on.

8. Use a second mini-USB cable to connect the remaining mangOH Red USB connector (CF3 USB or Console) to your computer.
9. [Install a Terminal Emulator](#). See page 35.

The mangOH Red is now ready to be used.

- For information on additional hardware features, see [Hardware Setup and Features](#) on page 11.
- For instructions on writing a program, see [Write Your First Program](#) on page 35.

3: Hardware Setup and Features

This chapter describes:

- How to install various components on the mangOH Red
- Available connectors
- How to configure and control features using connectors and switches

Insert/Remove Embedded Module

The mangOH Red has one CF3 module socket. (For a list of supported Sierra Wireless CF3 modules, see [Table 1-2](#) on page 7.)

To insert a CF3 module:

1. Place the mangOH Red face-up.



Figure 3-1: mangOH Red—Top View

2. Hold the module above the socket and line up the polarity marks on the module and socket.



Figure 3-2: CF3 Module Positioning

3. Place the module in the socket. The module should drop into place when you have it aligned properly. Do not insert at an angle as this may damage the socket pins.



Figure 3-3: CF3 Module Inserted

4. Attach the module cover:
 - a. Hold the module cover above the CF3 module and line up the polarity marks on the module and cover.

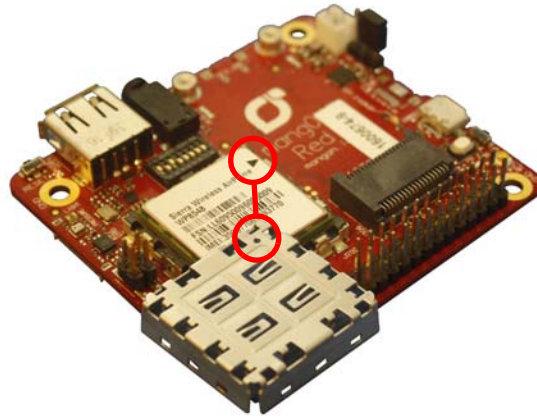


Figure 3-4: Installing Module Cover

- b. Place the cover on the module, then press down carefully until you hear the cover click into place. Make sure all sides of the cover have clicked into place.

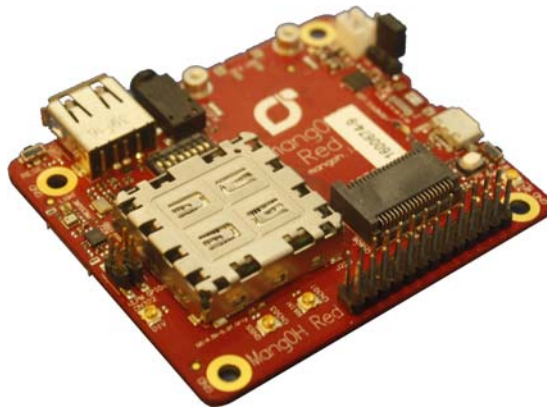


Figure 3-5: Module Cover Installed

To remove a CF3 module:

1. Remove the module cover using the module cover removal tool—Starting at one corner, insert the tool in the pair of holes and carefully pry the cover away from the module.
2. Repeat at the other locations (pairs of pry holes are on each side).



Figure 3-6: Removing the Module Cover

3. Lift the cover off the module.
4. Carefully lift the module straight up out of the socket.

Power Supply Sources

The mangOH Red is powered via either of the board’s micro-USB connectors or an optional backup battery. The micro-USB connectors can connect to a computer’s USB port or, if greater power is required, to an AC adapter.

Table 3-1: mangOH Red Power Supplies

| Supply | | Details |
|---------|-----------------------------|--|
| Primary | CN305—Console USB connector | Provides a serial connection to the mangOH Red. |
| | CN801—CF3 USB connector | Provides access to CF3 interfaces (ECM port, AT port, etc.) |
| Backup | CN802—Battery | An optional Li-ion or Li-polymer (3.7 V nominal) rechargeable battery can be installed to power the board if the primary power supply fails. |

Select Primary Power Supply

Note: If you want to power the mangOH Red with an AC adapter instead of a computer's USB connector, choose the appropriate micro-USB connector:

- *Console*—This leaves the CF3 USB connector available to access the CF3 module's ECM port, issue AT commands, and download firmware updates to the Wi-Fi/BT chipset.
- *CF3 USB*—This leaves the Console USB connector available to access the consoles of the CF3 module or Wi-Fi/BT chipset (switch-selectable), and to download firmware updates to the CF3 module.

To select the primary power supply:

1. Place the mangOH Red face-up and locate the power select (PWR SEL) jumper pins (CN804).

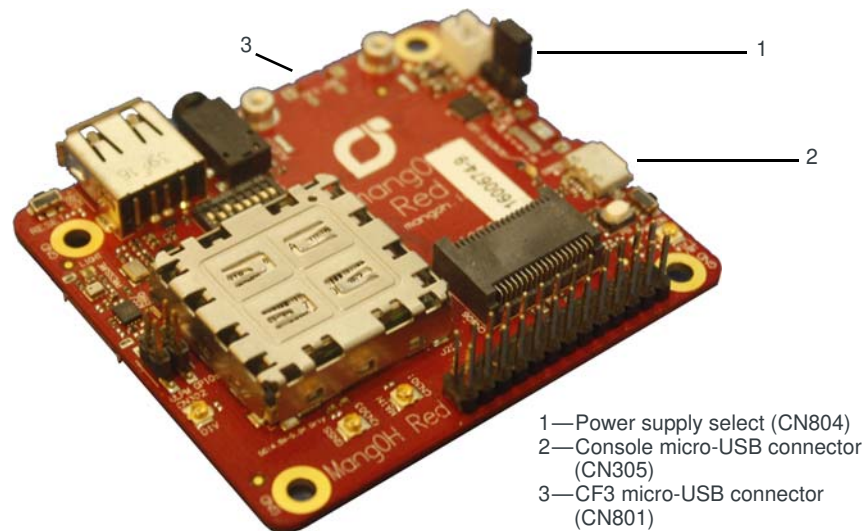
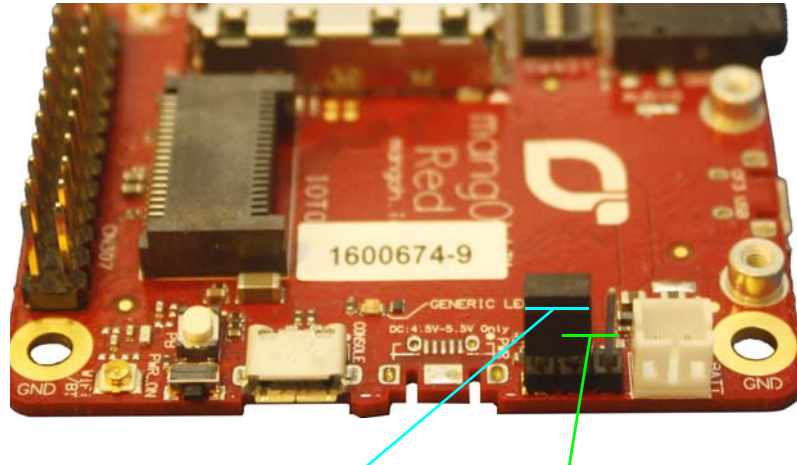


Figure 3-7: Power Supply Select (CN804)

2. Select the power source:
 - *CF3 USB connector*—Place a jumper across the two pins closest to USB connector CN801.
 - *Console USB connector*—Place a jumper across the two pins closest to USB connector CN305.



1—Console USB select (left + center pins) 2—CF3 USB select (center + right pins)

Figure 3-8: Power Source Select (Console USB select shown)

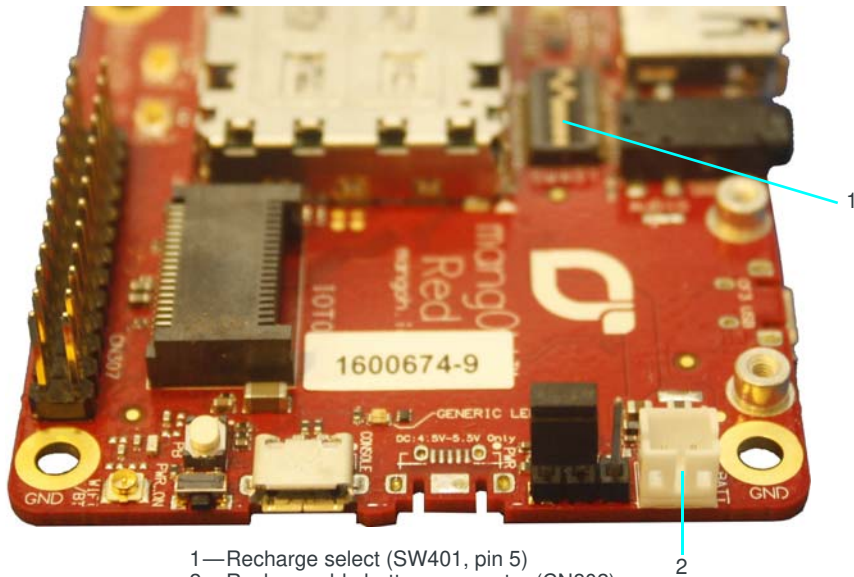
Connect Battery Backup

Optionally, you can connect a rechargeable Li-Ion/Li-Polymer battery to the mangOH Red to provide uninterrupted power in the event that the primary power supply fails.

If SW401 pin 5 is ON, the mangOH Red recharges the battery and then provides a trickle charge to maintain the battery's full charge.

To connect a rechargeable Li-Ion/Li-Polymer battery to the mangOH Red:

1. Connect the battery to CN802.



1—Recharge select (SW401, pin 5)
2—Rechargeable battery connector (CN802)

Figure 3-9: Battery Backup Connector

2. If you want the battery to recharge while connected to the board, set switch SW401 pin 5 to ON.

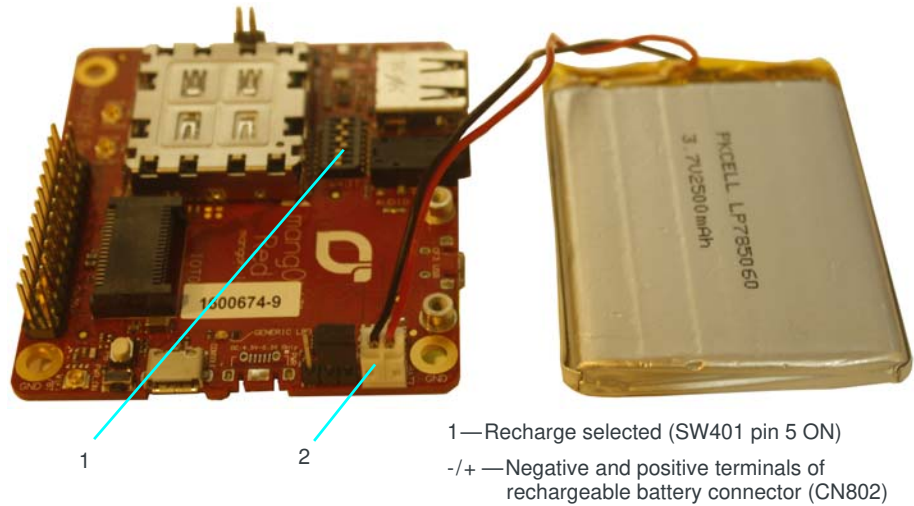


Figure 3-10: mangOH Red With Rechargeable Battery Connected

Caution: If a rechargeable battery is not connected to the board, make sure to set switch SW401 pin 5 to OFF.

Caution: The board is designed to use a rechargeable Li-Ion or Li-polymer battery. Regular (non-rechargeable) batteries are NOT recommended. However, if a regular battery is used, switch SW401 pin 5 MUST be set to OFF, otherwise the battery and possibly the board will be damaged.

Connect Antenna(s)

The mangOH Red includes three antenna connectors for the CF3 module.

Table 3-2: Antenna Connectors

| Type | Connector ^a | Details |
|-----------|------------------------|---|
| Main | CN301 | Required to establish a mobile network data connection |
| Diversity | CN302 | Used only if CF3 module supports diversity. |
| GNSS | CN303 | <ul style="list-style-type: none"> Required to enable access to GNSS functionality Active 3.3 V bias voltage |

a. U.FL connectors

Note: The mangOH Red includes an integrated antenna for the Wi-Fi/BT chipset.

To connect an antenna to the Main, Diversity or GNSS antenna connector:

1. Place the mangOH Red face-up.

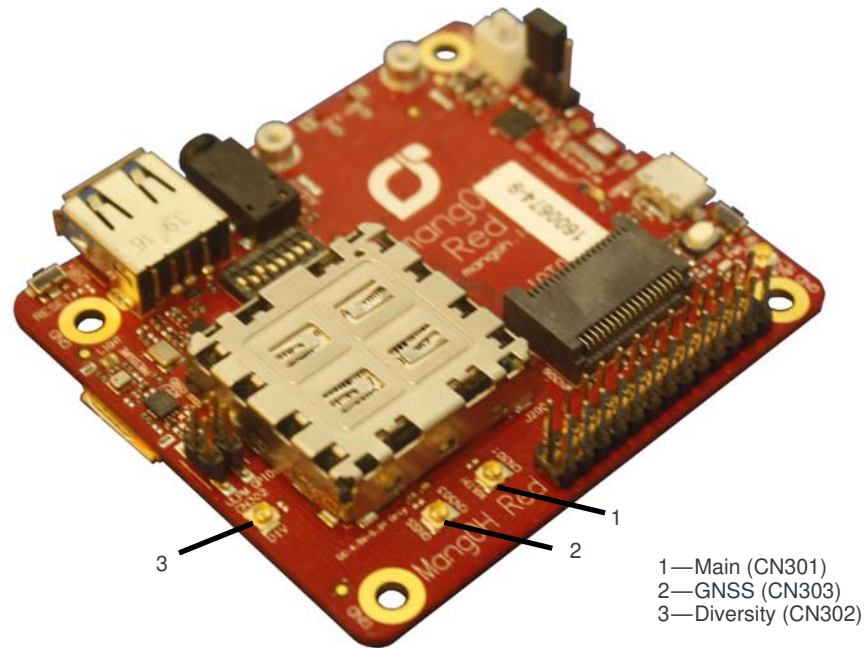


Figure 3-11: Antenna Connector Locations

2. Attach the antenna cable's female connector to the board's male connector and press firmly to get a secure connection.
(Note that female connectors are rated for a limited number of reconnects before the connector wears out, so should be left connected if possible. Use a U.FL extraction tool to put less strain on the connector during removal.)

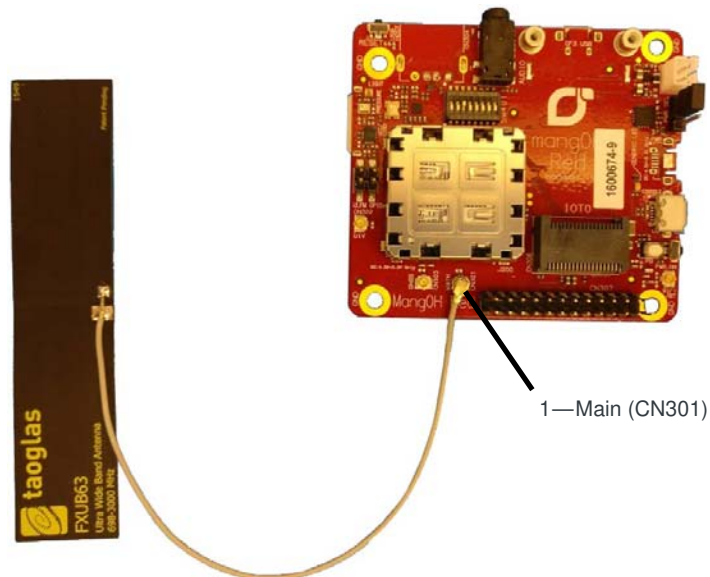


Figure 3-12: Main Antenna Connected

SIM, SD, and IoT Expansion Cards

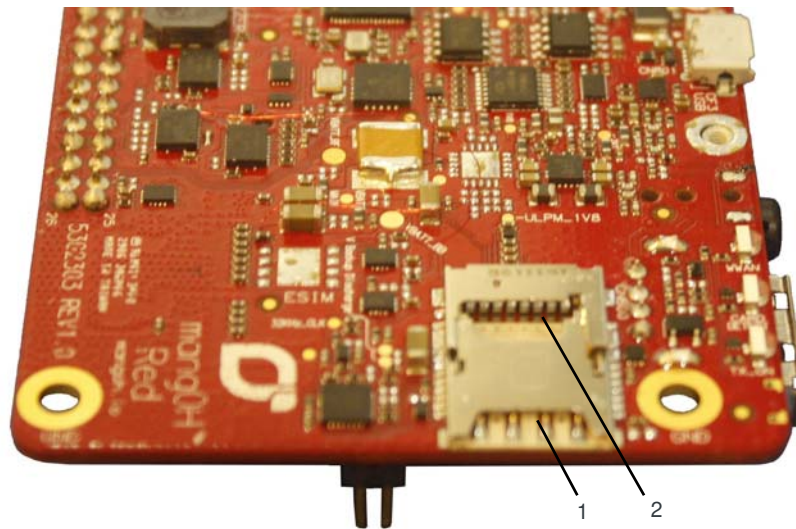
Inserting a micro-SIM Card

To establish a mobile network connection with a CF3 module, you must install a micro-SIM in the connector on the bottom side of the mangOH Red. Use either of the following:

- Live SIM card with active account (e.g. the Sierra Wireless SIM provided with the kit, or another carrier's activated card), *or*
- Test SIM card for use with a call box (for example, an Agilent 8960 or Rohde & Schwarz CMU200)

To install a SIM card:

1. Place the Dev Kit face-down (as shown).



- 1—micro-SIM (CN600—bottom)
2—micro-SD (CN600—top)

Figure 3-13: SIM Connector and micro-SD Locations

2. Insert the SIM card with contacts face-down into the desired slot—note the location of the notched corner of the card in [Figure 3-14](#).

Important: CN600 is a dual-connector—the lower slot is for the micro-SIM, and the upper slot is for a microSD card.

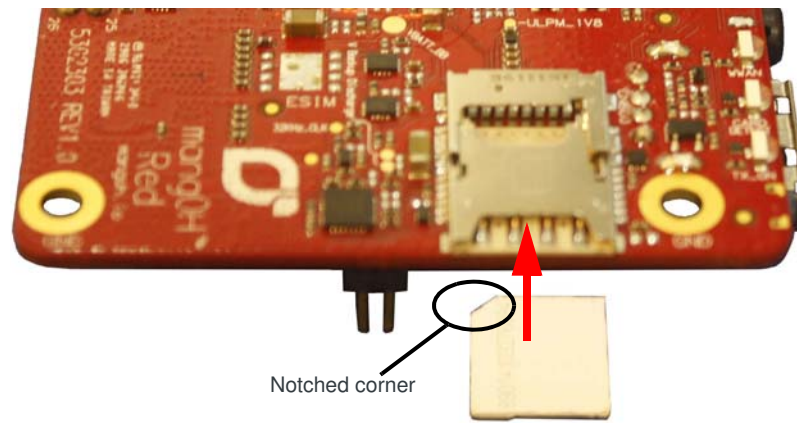


Figure 3-14: SIM—Inserting

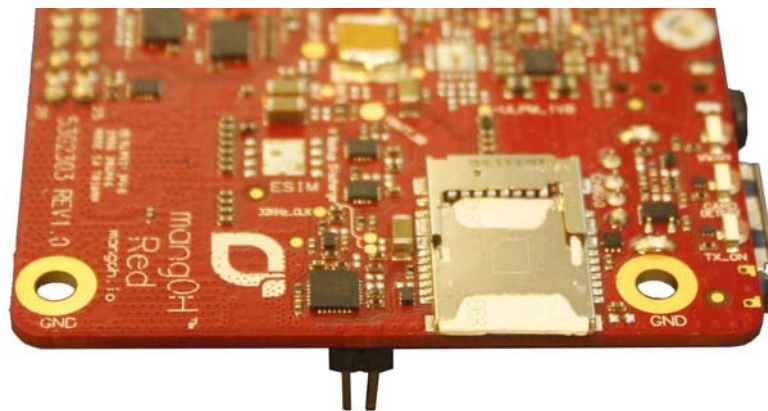
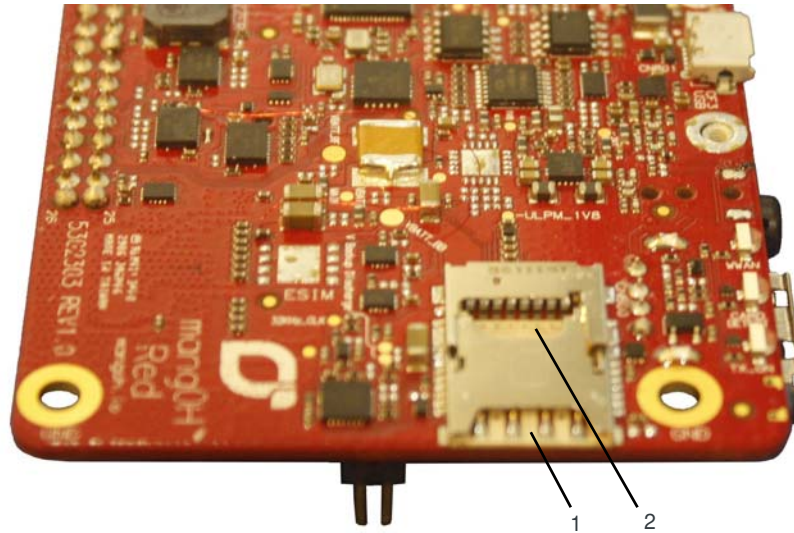


Figure 3-15: SIM—Inserted

Inserting a microSD Card

To install a microSD card:

1. Place the Dev Kit face-down (as shown).



- 1—micro-SIM (CN600—bottom)
2—microSD (CN600—top)

Figure 3-16: micro-SIM/microSD Connector Location

2. Insert the microSD card with contacts face-down into the top slot of CN600.

Important: CN600 is a dual-connector—the upper slot is for the microSD card, and the lower slot is for a micro-SIM.

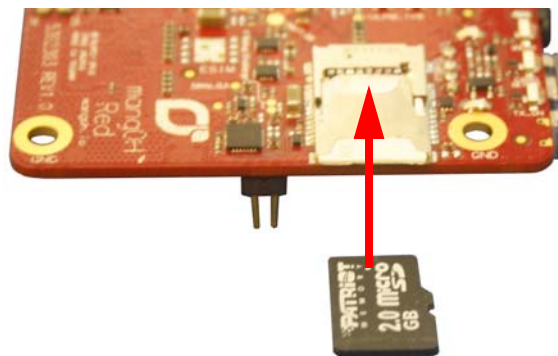


Figure 3-17: microSD—Inserting

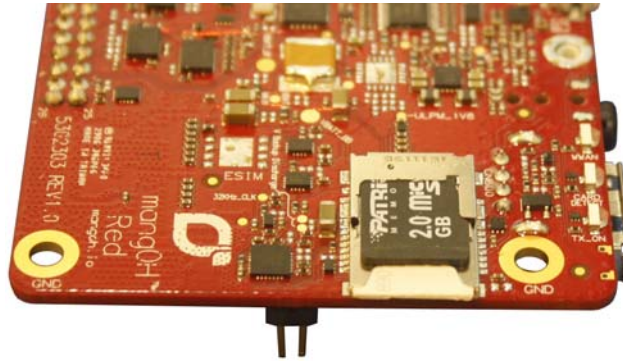


Figure 3-18: microSD—Inserted

Inserting/Removing an IoT Expansion Card

The mangOH Red includes one IoT Expansion Card slot.

Caution: Handle IoT Expansion Cards carefully to make sure components are not accidentally damaged. Hold them by their edges to avoid possible ESD damage.

To install an IoT Expansion Card:

1. Remove power from the mangOH Red (disconnect the micro-USB cable from the computer or AC adapter).

Note: You must remove the power because IoT Expansion Cards are not hot-swappable—the card will be recognized when power is reapplied.

2. Check the expansion card to make sure you know which side is the top. (Expansion cards must not be inserted upside-down.)
3. Slide the expansion card straight into the IoT Connector (CN306).
4. Use two M2 screws (included) to secure the expansion card to the standoffs.

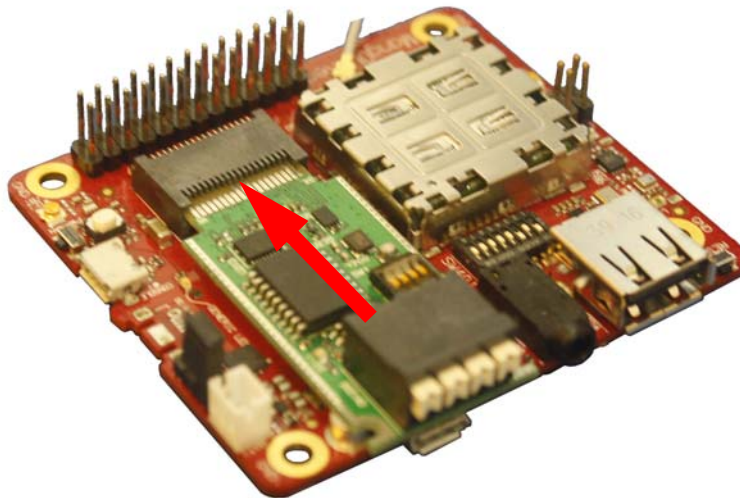


Figure 3-19: IoT Expansion Card Insertion

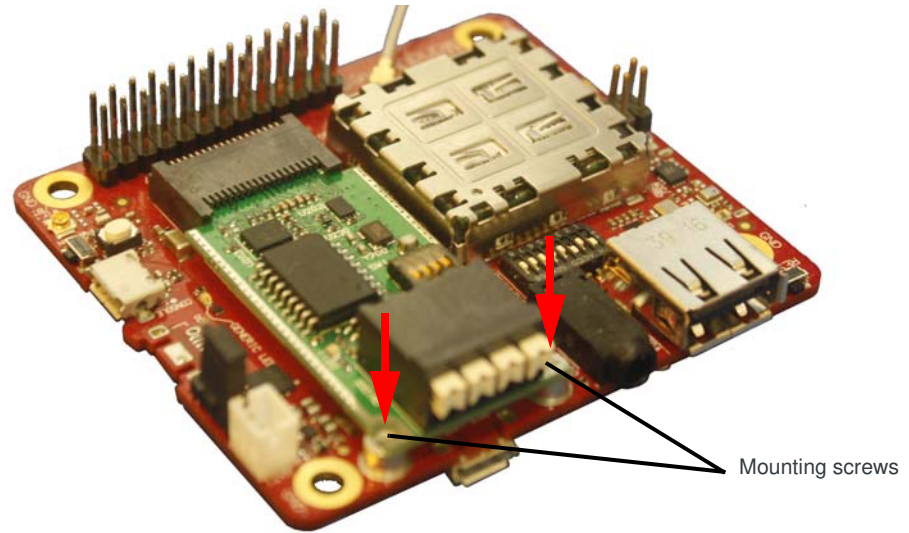


Figure 3-20: IoT Expansion Card Inserted

To remove an IoT Expansion Card:

1. Remove the two screws.
2. Pull the expansion card straight out, using safe ESD-handling practices (such as wearing proper ESD straps).

For detailed IoT Expansion Card slot interface information, refer to the mangOH Red Developer's Guide. For detailed information about expansion cards, refer to the IoT Expansion Card Specification.

Peripheral Connectors

Raspberry Pi Connector

CN307 is a 26-pin connector that provides access to primary Raspberry Pi Rev B pin functions.

Raspberry Pi-compatible connector

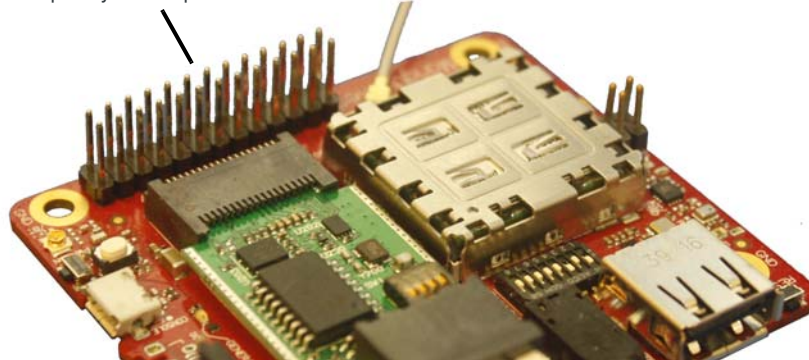


Figure 3-21: Raspberry Pi Connector

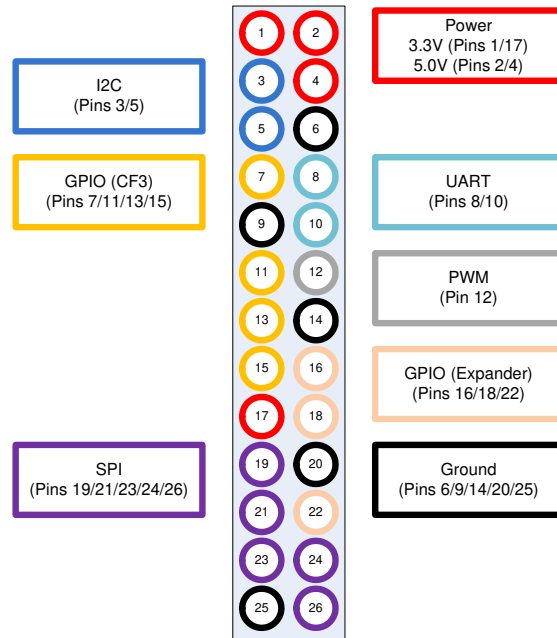


Figure 3-22: Raspberry Pi Connector Signal Groups

Audio Connection

The mangOH Red includes a 3.5 mm audio jack (CN500) for use with audio-enabled CF3 modules. If supported by the CF3 module, the jack can be used to make a voice call.

By default, the audio jack is connected to the onboard mangOH codec, and is configured for use with a CTIA/AHJ-compatible headset. For details, see [Table 3-4](#) on page 29.

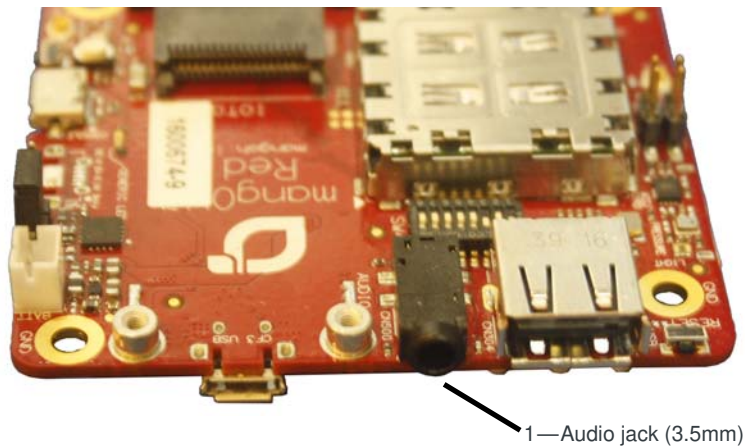


Figure 3-23: Audio Output Jack

USB Host Connection

The mangOH Red includes a USB 2.0 Host port (CN304) for attaching a peripheral device, memory stick, etc.

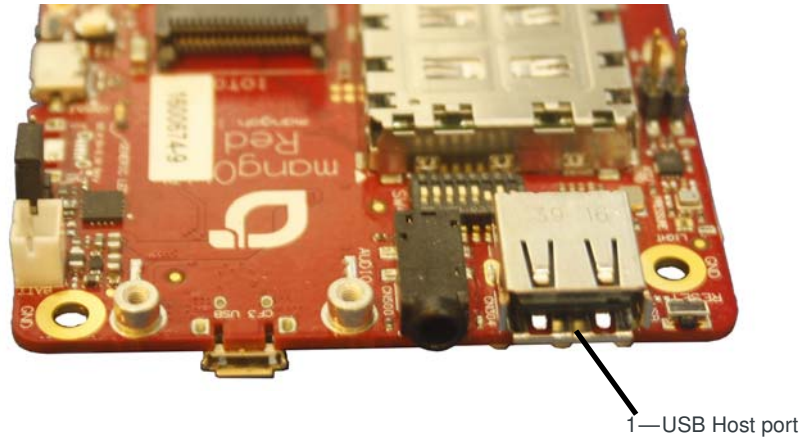


Figure 3-24: USB Host Port

Control Connections

Console USB Connector

The mangOH Red includes a micro-USB 2.0 connector (CN305) for console access. By default, this port is enabled and configured to connect to the CF3 module's two-wire UART interface (UART2).

The connection can be used to access the CF3 module's Linux console (on Smart CF3 modules), the Wi-Fi/BT chipset's console, and to install firmware downloads on the CF3 module or Wi-Fi/BT chipset.

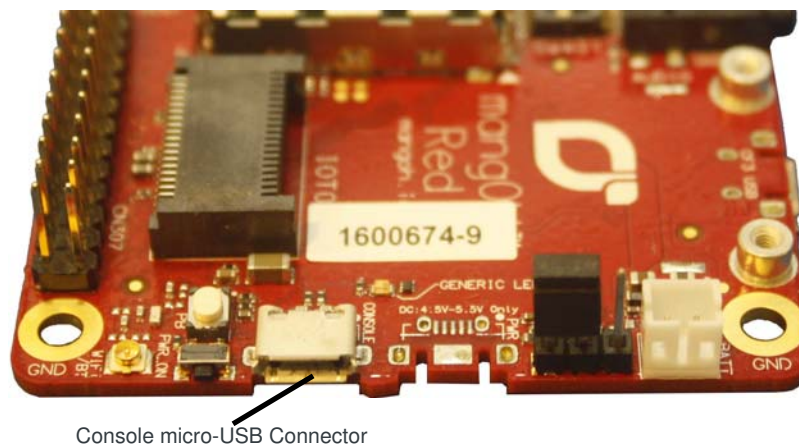


Figure 3-25: Console USB Output Connection