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# **Catena 4450 M102 Assembly Instructions**

## **Engineering Report 950001472**

Rev A

Date: 2017-03-20

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Document Release History

Rev. A

2017/05/18

Original release

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## 1 Introduction

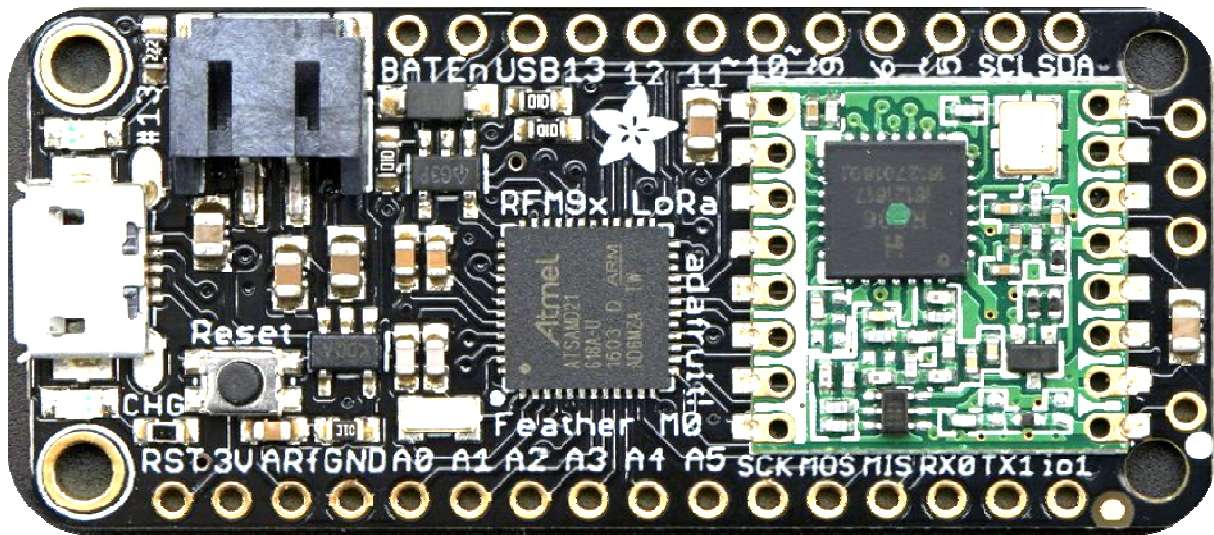
This document outlines the procedure to assemble the Catena 4450 M102.

## 2 Hardware Requirements

### 2.1 Adafruit Feather M0

Adafruit Feather M0 RFM95 LoRa Radio (900MHz) which can be used for either 868MHz or 915MHz transmission/reception. The heart of the Feather M0 is an ATSAM21G18 ARM Cortex M0 processor, clocked at 48 MHz and at 3.3V logic. This chip has a whopping 256K of FLASH and 32K of RAM. This chip comes with built in USB so it has USB-to-Serial program & debug capability built in, hence there is no need for an FTDI-like chip.

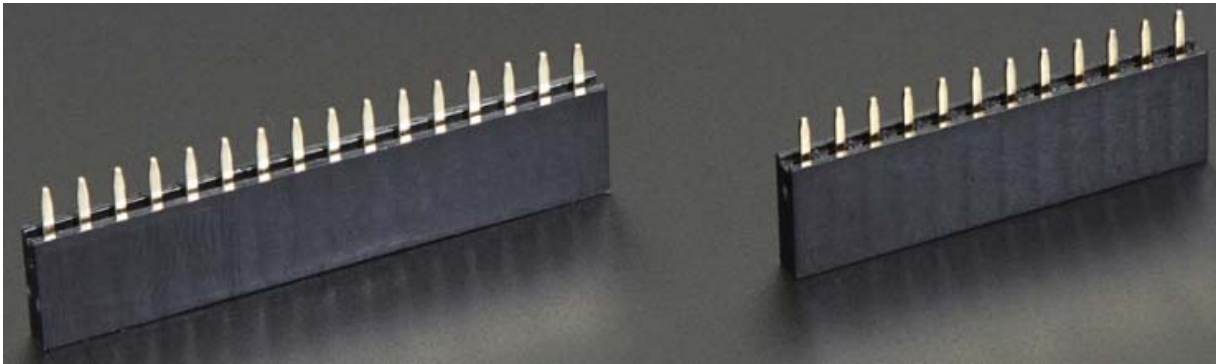
Figure 1 Feather M0 RFM95 LoRa



#### 2.1.1 Female Pin Headers

12-pin and 16-pin female connector of 0.1" pitch is used to mate the Feather M0 and Catena 4450 boards.

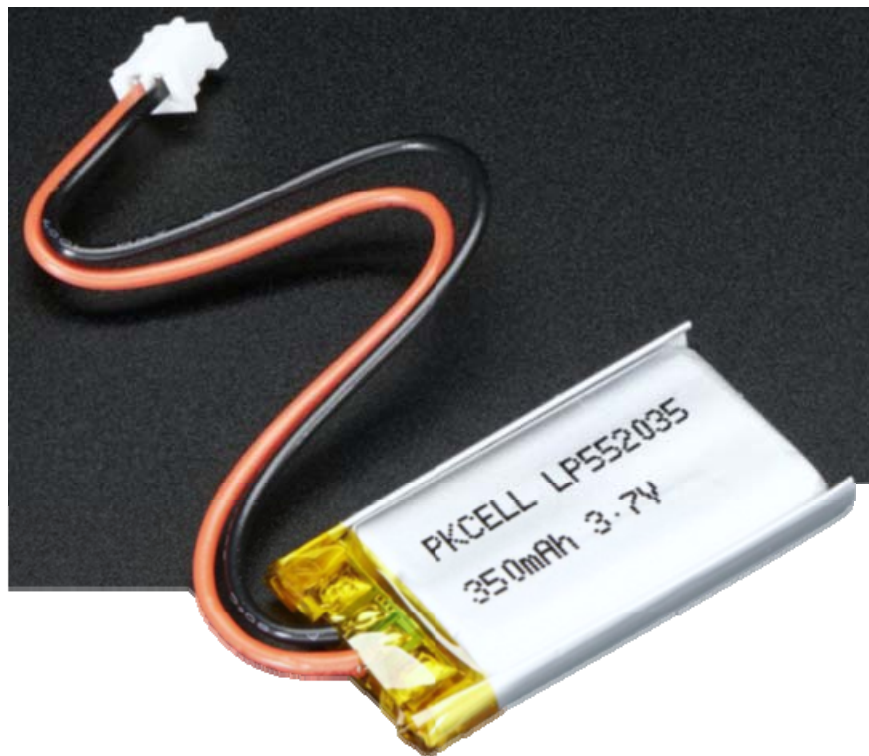
**Figure 2 12-pin & 16pin Female Headers**



### 2.1.2 Lithium Ion Polymer Battery

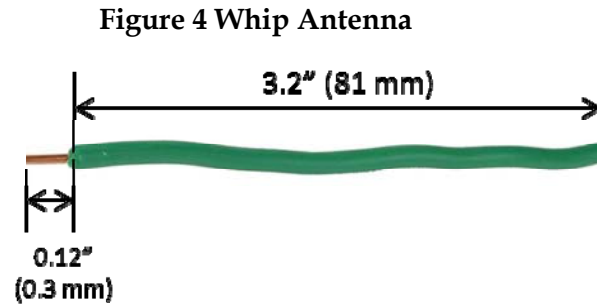
Lithium ion polymer batteries are thin, light and powerful. The output ranges from 4.2V when completely charged to 3.7V. This battery has a capacity of 350mAh for a total of about 1.3Wh. It is connected in the JSTPH jack which will let the Feather run on a rechargeable battery.

**Figure 3 Lithium Ion Battery**



### 2.1.3 Whip Antenna

Whip antenna of  $\frac{1}{4}$  wavelength is single wire insulated 3.2" long. Tinned/Stripped



**Table 1 Antenna Calculation**

| Parameters          | Values          |
|---------------------|-----------------|
| Speed of light C    | 299,792,458 m/s |
| Wire length         | 81 mm           |
| Tolerance           | +/- 0.3 mm      |
| Board thickenss     | 1.5748          |
| Tin length          | 3 mm            |
| Tin tolerance       | +/- 0.03 mm     |
| Slop from soldering | 1.5 mm          |
| Minimum length      | 80.7 mm         |
| Maximum length      | 82.8 mm         |
| Minimum f           | 905.66 MHz      |
| Maximum f           | 928.73 MHz      |

Strip a mm or two off the end of the wire, tin and solder into the ANT pad on the very right hand edge of the Feather M0.

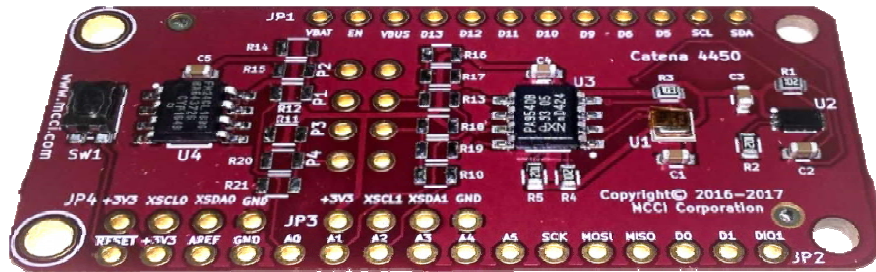
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#### 2.2 Catena 4450

Catena 4450 is a sensor shield board for Adafruit Feather M0. It has BME280 (Pressure /Humidity/ Temperature Sensor) , BH1750 (Lux Sensor) , I2C Multiplexer and FRAM.

**Figure 5 Catena 4450**



##### 2.2.1 1x04 Screw Terminals

The 1x4 screw terminal blocks have a pitch of 0.1" (2.54mm), which can be used as alternatives to standard male or female headers of 0.1". They helps in connecting external sensors to the 4450.

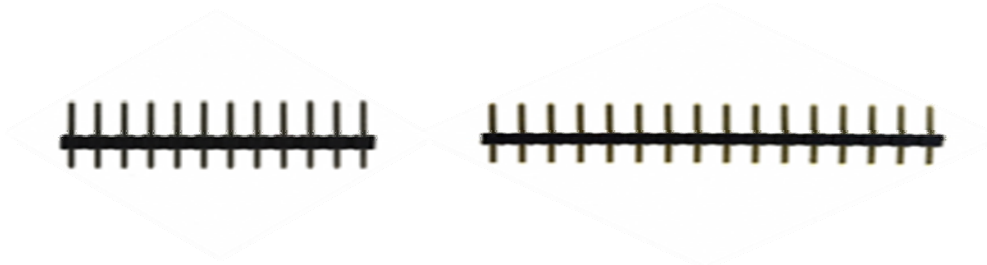
**Figure 6 1x04 Screw Terminals**



##### 2.2.2 Male Pin Headers

12-pin & 16-pin male headers have a pitch of 0.1" (2.54mm). These two pin headers are essential to mate with the Female Pin headers of Adafruit Feather M0 and Catena 4450.

**Figure 7 12-pin & 16-pin Male Headers**





### 2.3 Bottom Board

The dimension of this board is similar to Feather M0. It also has 4 drill holes at the corners as available in the Feather M0. This board helps to hold the Lipo battery and also provides additional mechanical support..

**Figure 8 Bottom Board**



### 2.4 Screws

M2.5 Metric Thread Size (2.5mm) Torx Pan Head (DIN 7985) stainless steel screw is used for fastening.

**Figure 9 Screws**



### 2.5 Standoffs

Nickel Standoffs are being used for Catena 4450 M102 as mechanical support.

**Figure 10 Standoffs**

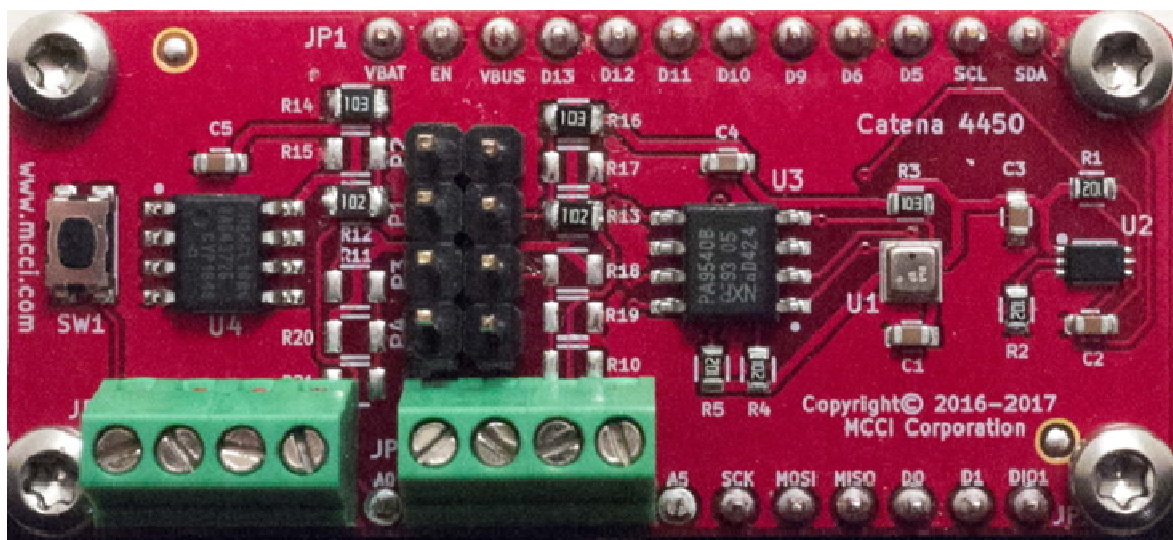


### 3 Catena 4450 M102 assembly instructions

1. Catena 4450 M102 is the same as Catena 4450 with only few things are to be added. The additional features are listed below :
  - R14,R16,R18,R20 are to be soldered with  $4K7\Omega$  resistors.
  - R10,R11,R12,R13 are to be soldered with  $100\Omega$  resistors.
  - JP3 and JP4 are to be soldered with 1x4 screw terminals.
  - P1,P2,P3,P4 pins are to be soldered with 1x2 male pin header.
    - It is used to select the function of JP3 and JP4 pins.
    - If the pins are not connected together or open it will act as IO line.
    - If the pins are connected with Jumper, it will act as I2C lines (SCL/SDA).
  - JP1 and JP2 are to be soldered with 12-pin & 16-pin Male Headers respectively, which helps to mate 4450 with Adafruit Feather M0 board.

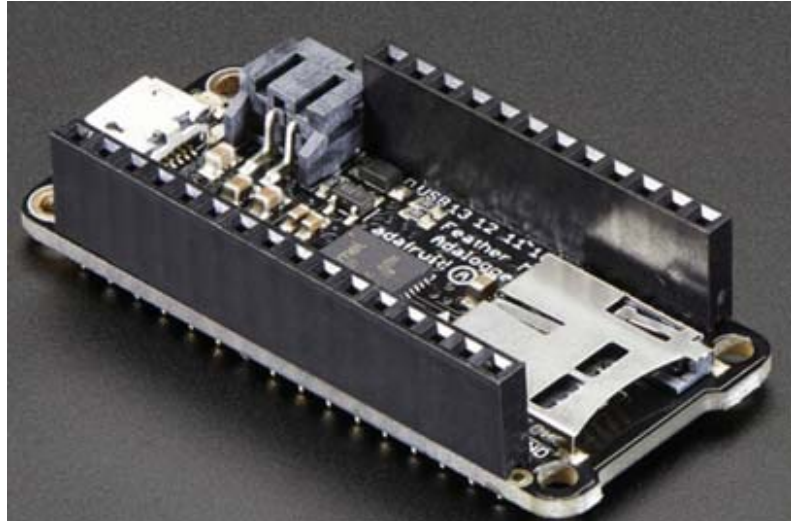
(Note: For part numbers of the components, Please refer the Catena 4450 M102 Top level BOM document)

Figure 11 Catena 4450 after soldering components



2. After soldering the components, the Catena 4450 board is mated with Feather M0 RFM95 LoRa which has 12-pin & 16pin Female Headers.

**Figure 12 Feather M0 board with Female Pin Headers (Model)**



3. Lithium Ion Battery is connected to the JSTPH jack of Feather M0.

**Figure 13 Feather M0 JSTPH Jack**

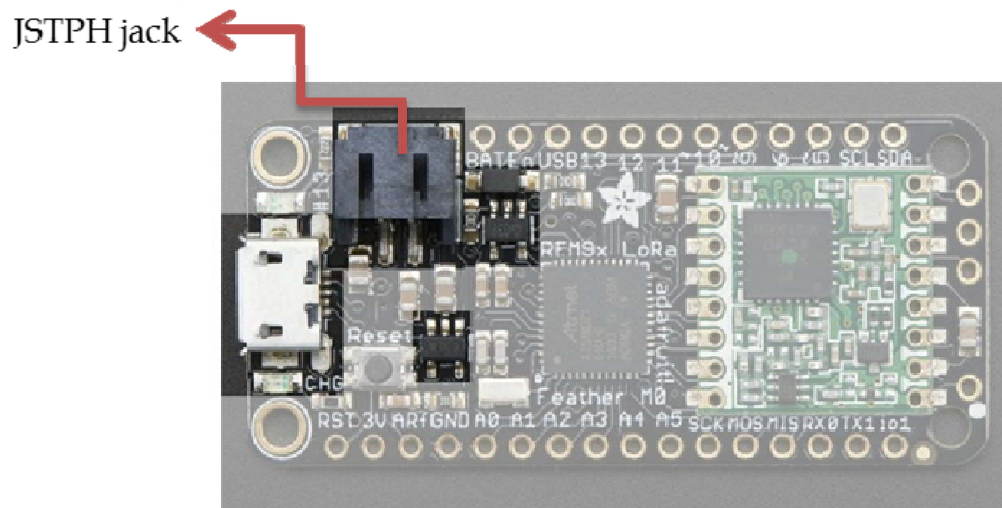
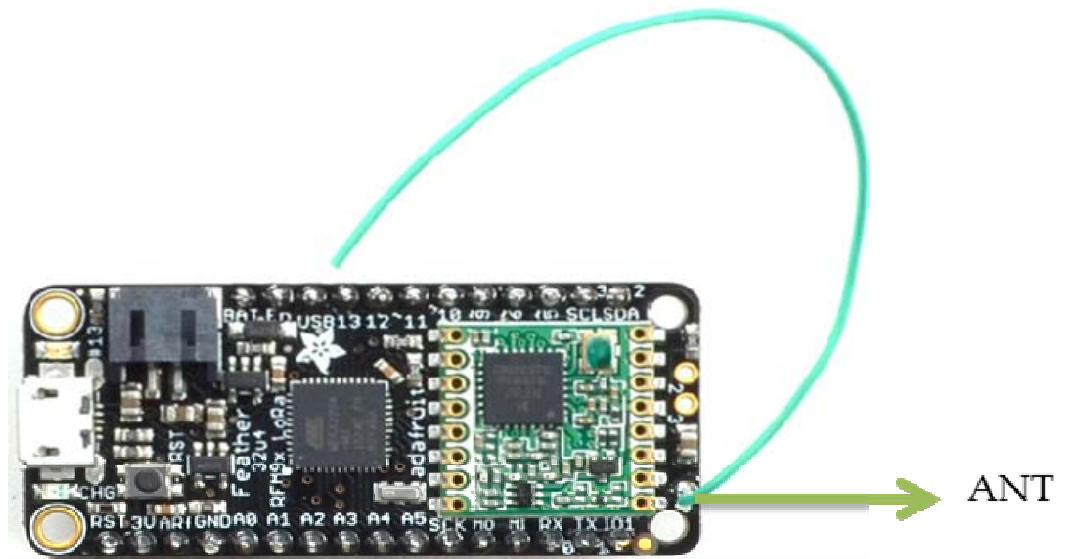


Figure 13 shows the Lipoly JST jack where the battery is to be connected. There is also a CHG LED ,which will be turned on while the battery is on charge.

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- Whip Antenna is to be soldered in the ANT pad of Feather M0 as shown in Figure 14

**Figure 14 Feather M0 with Whip Antenna**



- Bottom Board is placed beneath Feather M0 board.
- The 3 boards are connected using Screws and Standoffs.

The overall assembly is given in Figure 15.

**Figure 15 Fully Assembled Catena 4450 M102 Unit**

