Introduction

This document aims to evaluate the connections and performance of the Battery PCB.

Components

To conduct the tests, the following components are necessary, see Figure 1:

- Lithium-ion battery cell having between 3.3V and 4.1V.
- Battery PCB Rev E
- Medical Graded wall adapter plus 1m USB to uUSB charging cable.
- 4-pin jumper cable
- USB to uUSB 30cm power cable.
- Raspberry Pi 3 unit with micro SD card.
- Display Module containing Power Controller PCB rev C and Display PCB rev C
- 40 pins ribbon cable
- USB tester
- Multimeter

Figure 1. Components and instruments required for PCB QC procedure

NOTE: LEDs in the PCB

There are 4 LEDs in the PCB.

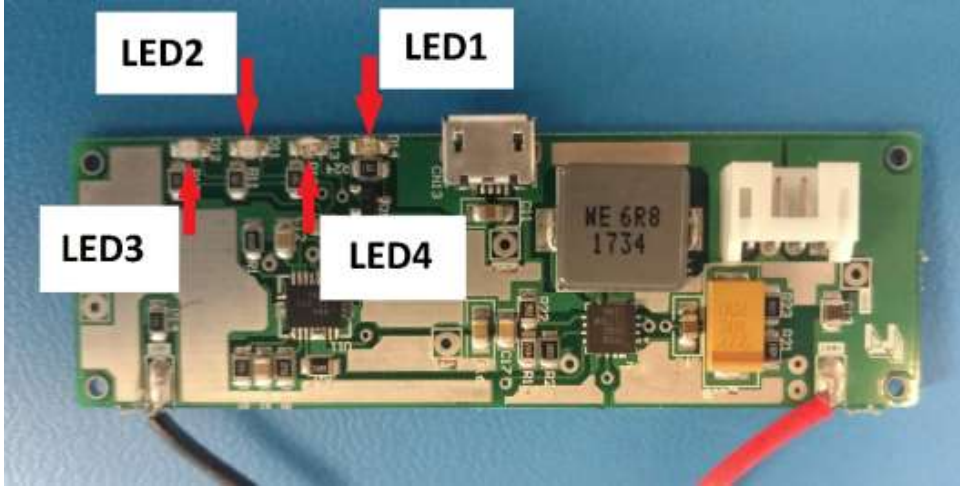| ID	Color	Function
LED1	Red	Low battery
LED2	Orange	Status 1
LED3	Green	Status 2
LED4	Blue	Wall adapter present

Figure 2. Position and color of LEDs in the PCB

Safety Considerations

A) Check Battery Cells

Before starting the procedure, it is important to first check that the battery is in good condition.

1. Check that the battery cell is totally flat and is not swollen (Figure 3).

Figure 3. Example of a bad battery cell (on the bottom) and a healthy battery cell (on the top).

DO NOT PERFORM ANY TEST IF THE BATTERY IS NOT IN GOOD CONDITION.

1. With a multimeter, check that voltage in battery cell is between 3.3V and 4.1V as shown in Figure 4. Please take precautions to be careful to avoid shock when measuring the voltage.
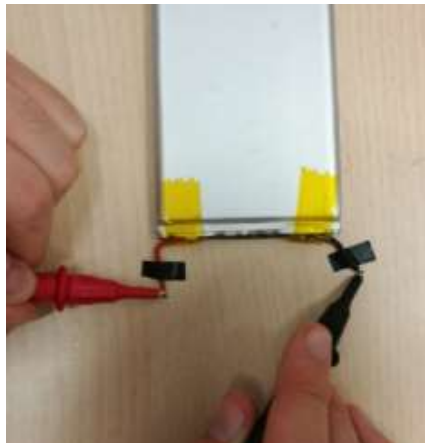

Figure 4. Measuring battery cell voltage.

B) Add Connections to the Batteries and PCB under test

Once we have checked that the battery cell is in good condition, connect the battery cell to the battery PCB.

1. Directly soldering the battery cell to the battery PCB. Solder the red battery cable to point "BAT+" and the black cable to point "BAT-" (Figure 5) to obtain the result shown in Figure 6.

Figure 5. Power and Ground points in Battery PCB

Figure 6. Battery cell soldered to the Battery PCB

1- Charging current through Battery PCB

Connect the medical graded wall adapter, USB tester, and USB cable to micro USB input of Battery PCB, as indicated in Figure 7.

Figure 7. Set up to check Battery PCB charging current from uUSB input.

Check Charging Current

Charging current will be displayed in USB Tester, see Figure 8 for reference.

Does charging current is 1.20 ± 0.1 Amp?
Yes☐   No☐

Figure 8. Number displayed inside red square

Check LEDs

When battery is charging, Blue and Green LEDs shall be ON, as shown in Figure 7.

Does the blue LED turn on?
Yes☐　　No☐
Does the green LED turn on?
Yes☐　　No☐

Checklist for testing charging current through Battery PCB

Summary of all tests for charging current through Battery PCB

Test type	Check (✓/✗)	Observations
1. Charging current through Battery PCB		
Test Charging Current		
1. Is charging current 1.20 ± 0.1 Amp?		
Test LEDs states		
1. Is Blue LED ON while charging		
2. Is Green LED ON while charging		

2. Charging current through Power Controller PCB

Connect the Display Module to the Battery PCB through the 4-wires cable as indicated in Figure 9. The 4-wires cable jumper connector can only be fitted into one position to avoid short circuits.

Figure 9. Note the position of 4-way cable.

Connect the micro USB end of the power cable to the Display Module to start charging the battery, see Figure 10 for reference.

Figure 10. Connections to charge the Battery through Power Controller PCB.

Check Charging Current

In this configuration the charging current will be lower than when the Lithium cell is been charged from the Battery PCB due to Voltage drops in the cables.

Does charging current is 1.20 ± 0.2 Amp?
Yes☐   No☐

Check LEDs

When battery is charging, Blue and Green LEDs shall be ON, as shown in Figure 10.

Does the blue LED turn on?
Yes☐   No☐
Does the green LED turn on?
Yes☐   No☐

Checklist for testing charging current through Power Controller PCB

Summary of all tests for charging current through Power Controller PCB

Test type	Check (✓/✗)	Observations
1. Charging current through Power Controller PCB		

Test Charging Current		
1. Is charging current 1.20 ± 0.2 Amp?		
Test LEDs states		
1. Is Blue LED ON while charging		
2. Is Green LED ON while charging		

3. Power provided by Battery PCB

Following test will check Battery PCB output voltage and current.

Connect Raspberry Pi and Display Module 40 pins connectors through 40 pins ribbon cable. Plug USB tester to Power Controller PCB and to 30cm Raspberry Pi power cable. All connections for this test are depicted in Figure 11. To start the system, press ON-OFF button in Display Module
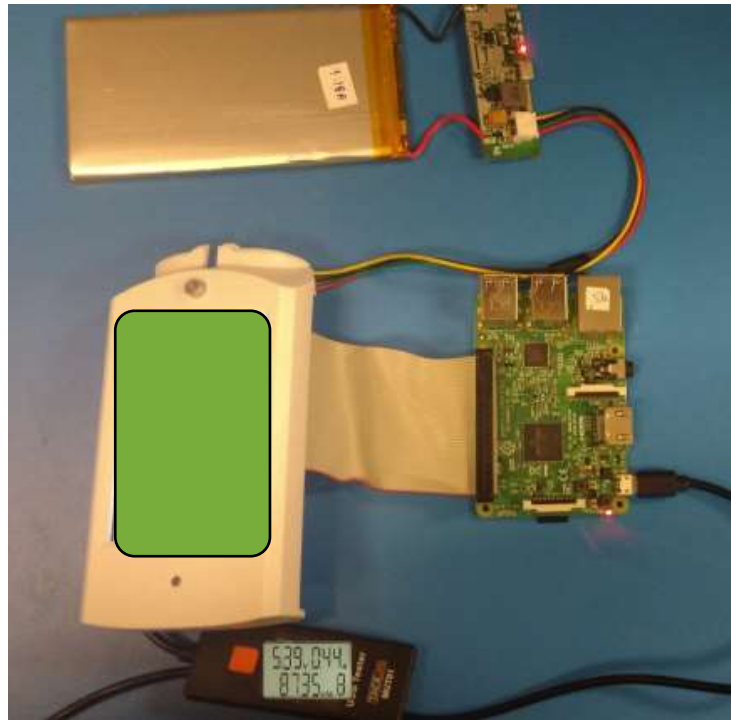
Check Power

Check Voltage and Current values in the USB Tester.

Does the Voltage is higher than 5.3V?
Yes☐   No☐

Does the current is higher than 0.45 Amp?
Yes☐   No☐

Checklist for testing output power of Battery PCB

Summary of all tests for power output of Battery PCB

Test type	Check (√/✗)	Observations
2. Power output of Battery PCB		
Test Charging Current		
1. Is output Voltage higher than 5.3V		
2. Is output current higher than 0.45 A?		

Summary Check List

1. Charging current through Battery PCB

Test type	Check (✓/✗)	Observations
2. Charging current through Battery PCB		
Test Charging Current		
3. Is charging current 1.20 ± 0.1 Amp?		
Test LEDs states		
3. Is Blue LED ON while charging		
4. Is Green LED ON while charging		

2. Charging current through Power Controller PCB

~~Test type~~	~~Check (✓/✗)~~	~~Observations~~
~~3. Charging current through Power Controller PCB~~		
~~Test Charging Current~~		
~~2. Is charging current 1.20 ± 0.2 Amp?~~		
~~Test LEDs states~~		
~~4. Is Blue LED ON while charging~~		
~~5. Is Green LED ON while charging~~		

~~3. Power provided by Battery PCB~~

~~Test type~~	~~Check (✓/✗)~~	~~Observations~~
~~4. Power output of Battery PCB~~		
~~Test Charging Current~~		
~~3. Is output Voltage higher than 5.3V~~		
~~4. Is output current higher than 0.45 A?~~		

PCB batch:

Operator:

Date:

PCB number:

Result of the test: **Passed** ☐   **Fail**   ☐