

**Revision 0.4****Drafted: 06/27/2014****Author: Steven Chou**

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## CHANGES/REVISION HISTORY

| Rev | Date       | Author      | Page(s)   | Change Description                                                     |
|-----|------------|-------------|-----------|------------------------------------------------------------------------|
| 0.1 | 06/10/2014 | Steven Chou |           | First draft                                                            |
| 0.2 | 06/23/2014 | Charles Kim | 7, 8      | Updated ME section and added Figure 3.1 Mechanical Design Control (DC) |
| 0.3 | 06/23/2014 | Steven Chou | 9, 10, 11 | Updated Battery Cell spec                                              |
| 0.4 | 06/27/2014 | Steven Chou | All       | Incorporated comments from CN team                                     |
|     |            |             |           |                                                                        |

## APPROVALS

| Date | Title                                 | Name                                  | Signature |
|------|---------------------------------------|---------------------------------------|-----------|
|      | Product Development Manager           | Tyson Mackjust                        |           |
|      | Director of Product Development       | Charlie Quong                         |           |
|      | Director of Hardware Engineering      | Vannin Gale                           |           |
|      | VP of Marketing                       | Ross Howe                             |           |
|      | SVP of Sales and Business Development | Darren Shimkus                        |           |
|      | Principle                             | Shawn Dougherty<br>or<br>Daniel Huang |           |

## 1.0 PURPOSE AND SCOPE

### 1.1 Product Marketing Requirements – An Overview

#### Concept:

The mophie spacestation combines the functionality of a mophie space pack and a mophie powerstation. The two major features are power and storage with the added benefits of the powerstation form factor (portability and universal compatibility). The product will ship with a 6000 mAH battery @ 2.4A output in variants of 32, 64, and 128GB of additional storage. As a premium product the design will be similar, yet, more premium than the powerstation w/cables 2014 line. The product will ship with BLE as well accompanying free iOS and Android apps. The current iOS “Space” app will be redesigned to work with the spacestation and a new “Space” android app will be ready at launch.

#### Use cases

The mophie spacestation has the following use cases:

- Supplies up to an additional 60% battery capacity for the iPad Air, 85% battery capacity for the iPad mini retina and 300% battery capacity for iPhone 5/5s
- Supplies additional memory capacities of 32, 64 and 128GB for tablets and smartphones
- Pass-through charging with priority for the connected device
- File transfer from the spacestation to the connected device and vice versa
- File management via included Application – allows for content management between devices (space pack, tablet/smartphone, PC/Macs, iOS/third party apps, cloud solutions via API)
- Compatible with iOS and Android tablets and smartphones

#### Features:

The following list of key features defines the basic functions of the product:

#### Housing:

- Color/finish: Metal top and bottom plates/PMS Process Black Pantone Black C.
- mophie logo lasered
- Single Female USB port
- Single female Lightning or microUSB port (depends on SKU)
- LED indicator light button (to double as data on button a la space pack)
- May use 2x64GB microSD cards to achieve 128GB capacity (multiple slots for higher capacity) to save cost.

**Battery:**

- 6,000 mAh Li-ion polymer battery delivers 100% additional battery (5000 mAh is stated battery size; will actually be closer to 6000)
- Charge indicator button
- 4 white LED indicators and the charge button will function as described below:
  - When the battery button is pressed, the white LEDs will show charge level of the device.
    - 4 LEDs light up: 100% ~ 76%
    - 3 LEDs light up: 75% ~ 51%
    - 2 LEDs light up: 50% ~ 26%
    - 1 LED: 25% ~ 11%
    - 0 LED: 10% ~ 0%
  - When Unit is charged via charging port and included cable, the White LEDs will indicate level of charge. The LED duty cycle is 50% @ 1S (500mS ON and 500mS off)
    - 4 LEDs light up: 100% ~ 76%
    - 3 LEDs light up: 75% ~ 51%
    - 2 LEDs light up: 50% ~ 26%
    - 1 LED: 25% ~ 11%
    - 0 LED: 10% ~ 0%

**Firmware:**

- Approximately 10% of battery reserved for the spacestation for data only
- Over the air (OTA) firmware updates available (on the App)
- Data transfer – must be able to play HD video and audio
- Auto-notification to download App when spacestation is initially attached to a tablet/smartphone
- Files able to be viewed on tablet/smartphone directly from space station without transferring or saving of files from the space station to the tablet/smartphone
- When connected to a computer, it must be automatically recognized as a removable drive. If passcode feature is turned ON in the space pack firmware, when connecting to a computer, SS will not automatically recognized as a removable drive unless the user has entered the correct password.
- Auto-charge and auto-data connection. When a device is connected to the space station via female USB port, charging and data to be activated. Data to have 3 minute timeout period if not accessed via iOS or Android app
- Charging to be controllable from app. Charging can be turned on or off via the app.
- Pairing BLE to tablet/smartphone via app
- Auto-reconnect of BLE when back in range of previously connected device

- Hard button use of Power indicator light button to put spacestation in pairing mode

**Other:**

- BLE to turn on spacestation data access when the app is opened up
- Pass-through charging with priority for tablet/smartphone

**Input Charging Rating:**

- Voltage: 5V +/- 5% with Current: 1.8A

**Output Charging Rating:**

- During Pass through: Voltage: 5V +/- 5% with Current: 1A
- During regular charging: Voltage: 5V +/- 5% with Current: 2.4A

**Kit contents:**

- Gift box style packaging with window and flap with hero shot
- USB to Micro USB 2.0 cable
- Quick start guide with legal info and online link for full user manual (user manual not included in box. To be online only)
- spacestation
- One global packaging SKU for Apple and ROC (See Appendix A for languages supported)

**2.0 INDUSTRIAL DESIGN REQUIREMENTS****2.1 Design Requirements**

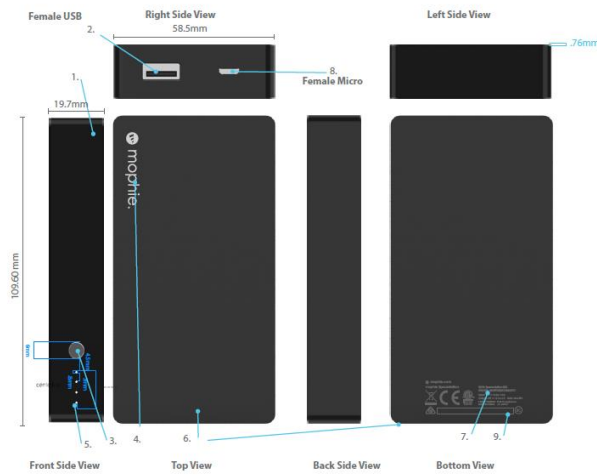
| Description                            | Requirement                                                 |
|----------------------------------------|-------------------------------------------------------------|
| Detailed CMF (Color/Material/Finishes) | See Figure 1                                                |
| Multiple CMF Options or SKU's?         | TBD                                                         |
| Secondary Process Required?            | Yes<br><br>a) Process Black Pantone Black C."<br>b) Anodize |
| Mophie LOGO (size)                     | Laser mark on Aluminum                                      |
| Device label and marking size          | Laser etching on bottom plate                               |
| Power button                           | Stainless polish                                            |
| LED indicator                          | 4 white                                                     |
|                                        |                                                             |

**Figure1:**

mophie Spacestation Concept 6000mAh CMF

CP

REV2 DATE: 05.22.14



| #  | Part Description | Color                              | Material        | Finish                         | Notes                                                                      |
|----|------------------|------------------------------------|-----------------|--------------------------------|----------------------------------------------------------------------------|
| 1. | Body             | PMS Process Black Pantone Black C  | PC/ABS          | PMS Process Black glossy paint |                                                                            |
| 2. | Female USB       | Match PMS blk on the connector tip |                 |                                | flangeless                                                                 |
| 3. | Power button     | silver                             | stainless steel | polished                       | reference spacepack button texture                                         |
| 4. | mophie Logo      |                                    | Aluminum        | Laser etched                   |                                                                            |
| 5. | LED              | white                              |                 |                                | pinhole .8mm                                                               |
| 6. | Top and bottom   | Black Anodized                     | Aluminum        | satn finish                    | chamfer (.2mm refer to CAD) Satn finish and silver color to match Mac Book |
| 7. | Legal info       |                                    |                 | laser etched                   |                                                                            |
| 8. | Female Micro     |                                    |                 |                                |                                                                            |
| 9. | Serial number    |                                    | Aluminum        | laser etched                   |                                                                            |



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## 3.0 MECHANICAL DESIGN REQUIREMENTS

### 3.1 Hardware System Design

| Number | Descriptions                                 |
|--------|----------------------------------------------|
| 1      | Main Body                                    |
| 2      | Cover Top & Bottom, Aluminum (1.0mm 6061-T6) |
| 3      | Power button                                 |
| 4      | VHB tape for adhesion                        |
| 5      | 2 X 3000 mAh battery                         |
| 6      | 2 PCBA                                       |
| 7      | Screws (mount PCBA)                          |
| 8      | Thermal transfer material                    |
| 9      | Conformable thermal conductive pad           |
| NOTE   | Refer to 3D CAD for detail                   |

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NOTES: UNLESS OTHERWISE SPECIFIED:

1. REFER TO ENGINEERING SPEC 2019-01.
2. DIMENSIONS SHOWN WITHIN XXX ARE CRITICAL AND MUST MEET TOLERANCE REQUIREMENTS.
3. ALL DIMENSIONS APPLY AFTER SECONDARY PROCESS (I.E. SOFT TOUCH).
4. ADHESIVE ARE NOT INCLUDED IN BOX.

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| WILL ZENG | 6/23/14 | A    | 0    | 0     |
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DIMENSIONS ARE: MM  
TOLERANCES ARE

| Descriptions                   | Requirement                                                                               |
|--------------------------------|-------------------------------------------------------------------------------------------|
| Power button                   | TBD. 0.5 to 1 lbf                                                                         |
| LED brightness                 | Cool white at 1000 lux intensity                                                          |
| Light leakage                  | Must not be seen through nearby opening                                                   |
| Ultra Sonic Weld (USW)         | Must pass Drop Test (Refer to test plan)                                                  |
| UV paint                       | Must pass 2H hardness @500gf and chemical test (Refer to test plan)                       |
| Housing construction           | Must pass probe test of 20Kg for 1 minute (Refer to test plan)                            |
| Housing construction           | Must with stand drop test and still functional. Minor crack may occur less than 1mm wide. |
| Housing Plastic                | Must meet Flame retardant 94-V1 minimum (Refer to test spec)                              |
| All metal parts and hardware's | Must pass salt spray test (Refer to test spec)                                            |

|                                |                                                              |
|--------------------------------|--------------------------------------------------------------|
| All adhesive and glue          | Must pass thermal cycle test (Refer to test spec)            |
| Housing Plastic                | Must meet Flame retardant 94-V1 minimum (Refer to test plan) |
| All metal parts and hardware's | Must pass salt spray test (Refer to test plan)               |
| All adhesive and glue          | Must pass thermal cycle test (Refer to test plan)            |

## 4.0 ELECTRICAL DESIGN REQUIREMENTS

### 4.1 Electrical Design Requirements

| Description                                                                                                | Requirement                                                                                                       |
|------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------|
| Battery Output Voltage                                                                                     | 3.8V/cell; 6000mAh Li-ion (polymer) battery                                                                       |
| Input Charging                                                                                             | Voltage: 5.1V +/- 0.5% with Current: 1.8A                                                                         |
| Output Charging                                                                                            | Voltage: 5.1V +/- 0.1% with Current: 2.4A                                                                         |
| Charging (general)                                                                                         | Pass through charging with priority for connected device                                                          |
| Syncing                                                                                                    | Yes, data path must be allowed from input to the applicable charging device (ex. phone and tablets)               |
| Compatibility                                                                                              | Compatible with charging outlets: BC1.2, Samsung wall chargers, computer, wall and Car charger (500mA or greater) |
| Hardware Interface                                                                                         | Input: USB-A connector<br>Output: Lightning or MicroUSB Connector                                                 |
| PCB Type (Single Sided, Double Sided Silver thru hole, Double Sided Plated thru hole, Double Sided Carbon) | Double Sided Silver thru hole; 4-layer                                                                            |
| Power Converter Type (Input/output)                                                                        | Buck/Boost; DC-DC                                                                                                 |
| ESD Protection (e.g. USB Receptacle)                                                                       | Yes; SMD diode(s)                                                                                                 |

|                      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
|----------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| LED Power indicators | <p>4 White LED indicators and the charge button will function as described below:</p> <ul style="list-style-type: none"> <li>When the battery button is pressed, the White LEDs will show charge level of the device. <ul style="list-style-type: none"> <li>4 LEDs light up: 100% ~ 76%</li> <li>3 LEDs light up: 75% ~ 51%</li> <li>2 LEDs light up: 50% ~ 26%</li> <li>1 LED light up: 25% ~ 11%</li> <li>No LED: 10% ~ 0%</li> </ul> </li> <li>When Unit is charged via charging port and included cable, the white LEDs will indicate level of charge. The LED duty cycle is 50% @ 1S (500mS ON and 500mS off) <ul style="list-style-type: none"> <li>4 LEDs light up: 100% ~ 76%</li> <li>3 LEDs light up: 75% ~ 51%</li> <li>2 LEDs light up: 50% ~ 26%</li> <li>1 LED light up: 25% ~ 11%</li> <li>No LED: 10% ~ 0%</li> </ul> </li> </ul> |
|----------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

#### 4.2 Battery Cell Requirements

The table below outlines baseline requirements for the battery cell used in this product:

| Description                                | Requirement                                                                                                                                                                                                                                                                                                                                          |
|--------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Appearance                                 | The surface is clear and no scratch                                                                                                                                                                                                                                                                                                                  |
| Maximum Cell Dimensions                    | 74.35*51.5*11.8 mm                                                                                                                                                                                                                                                                                                                                   |
| Max Cell Dimensions(after swell)           | TBD                                                                                                                                                                                                                                                                                                                                                  |
| Weight                                     | TBD                                                                                                                                                                                                                                                                                                                                                  |
| Nominal Capacity                           | 6000mAh                                                                                                                                                                                                                                                                                                                                              |
| Marked Capacity(Minimum Rated)             | 6000mAh (0.5C)                                                                                                                                                                                                                                                                                                                                       |
| Typical Rated capacity                     | 6000mAh (0.5C)                                                                                                                                                                                                                                                                                                                                       |
| Charge time                                | Approx.4 hours from input of 5V at 1.8A                                                                                                                                                                                                                                                                                                              |
| Nominal Cell Charge Voltage                | 4.35V±0.05V                                                                                                                                                                                                                                                                                                                                          |
| Nominal Cell Discharge (Operating) Voltage | 3.8V                                                                                                                                                                                                                                                                                                                                                 |
| Nominal Cell Discharge Cut-Off Voltage     | 3.1V                                                                                                                                                                                                                                                                                                                                                 |
| Nominal Cell Charge Current                | 3A                                                                                                                                                                                                                                                                                                                                                   |
| Nominal Cell Discharge Current             | 4.6A                                                                                                                                                                                                                                                                                                                                                 |
| Basic Charging Characteristics             | Charging shall consist of charging at a constant current rate of 3A until the cell voltage reaches 4.35V. The cell shall then be charged at constant voltage of 4.35V while tapering the charge current. Charging shall be terminated when the charging current has tapered to 250mA. These characteristics should stay consistent when charging the |

|                                                       |                                                                                                                                                    |
|-------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------|
|                                                       | call between 0°C and 40°C                                                                                                                          |
| Basic Discharging Characteristics                     | Cells shall be able to discharge at a constant current of 4600mA, 3.1 V, at 23±2°C and humidity of 65±20%.                                         |
| Nominal Cell Cycle Life                               | 500 0.5C-discharging cycles (residue ≥ 80% of initial capacity)                                                                                    |
| Overcharge Protection?                                | Yes                                                                                                                                                |
| Overcharge Detection                                  | Yes                                                                                                                                                |
| Over-Discharge Protection?                            | Yes                                                                                                                                                |
| Over-Discharge Detection                              | Yes                                                                                                                                                |
| Over-Current Protection?                              | Yes                                                                                                                                                |
| Over-Current Detection                                | Yes                                                                                                                                                |
| Overcharge Protection Test Criteria                   | TBD                                                                                                                                                |
| Over-Discharge Protection Test Criteria               | TBD                                                                                                                                                |
| Short-Circuit Protection Test Criteria                | TBD                                                                                                                                                |
| PCM Input Voltage's Dynamic Range                     | 2.7V – 4.5V                                                                                                                                        |
| Active Protection Components ( <i>Or Equivalent</i> ) | Seiko S8211CAM-M5T1S (SOT23-5);<br>Panasonic MTMC8E2A0LBF (WMini8-F1);<br>Panasonic FC8V22040L (WMini8-F1);<br>Analog Power AMCC920NE (DFN3x3-8L). |
| Ex-Factory Cell Capacity                              | 100%                                                                                                                                               |
| Minimum Remaining Capacities. Shelf Time              | 1-month in 20±5°C & 70-80% RH Storage: 90%;<br>6-monthsin 20±5°C & 70-80% RH Storage: 70%;<br>12 months in 20±5°C & 70-80% RH Storage: 50%.        |
| Relative Cell Capacity vs. Temperature                | -10°C (70%); 0°C (80%); 25°C (100%); 45°C (95%); 60°C (90%)                                                                                        |
| Leakage Shutdown Capability?                          | Required                                                                                                                                           |
| Minimum Required Declarations/Certifications          | Directive 2006/66/EC, MSDS, UN38.3                                                                                                                 |

See Battery Pack Specification for more detail.

## 5.0 QUALITY CONTROL PLAN

### 5.1 Quality Design Requirements

Must meet mophie General Workmanship Standard

| Descriptions                  | Requirement               |
|-------------------------------|---------------------------|
| Gap between Cap and Main Body | 0.2 mm max                |
| Part mismatch                 | 0.1 mm max                |
| Part flash                    | .05 mm max                |
| Paint scratch / durability    | See Test Plan for testing |
| USW gap                       | 0.1 mm                    |
| Sink Mark                     | See Standard              |
| Color match                   | Match approved sample     |
| CMF match                     | Match approved sample     |

### 5.2 Environmental Test Requirements

| Description                               | Requirement                                                                                                                                                                                                                        |
|-------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Operating temperature range               | 0°C to + 40°C                                                                                                                                                                                                                      |
| Storage (Non-operating) temperature range | -20°C to +60°C                                                                                                                                                                                                                     |
| Temperature Shock                         | will be subjected from 0°C to 50°C for 4 cycles at a rate of 1°C per minute with a dwell time of 1 hour at high and low temperature (as shown below). Functional tests will be randomly performed while unit is inside the chamber |
| Humidity (operating)                      | 40±3°C, 95% relative humidity, and non-condensing for 96 hours with batteries or power. Functional tests will be randomly performed while unit is inside the chamber.                                                              |
| Altitude                                  | Must withstand a 10,000-feet altitude test (by simulation). Packaged products must withstand a 20,000-feet altitude test (by simulation)                                                                                           |
| Vibration                                 | Must withstand the vibration/stress test. The test is performed at amplitude of 3.15 mm and frequency of 7-500 Hz, for 10 minutes (per axis)                                                                                       |
| Unit Drop test (transit drop)             | Must withstand multiple free-fall drops on a hardwood floor (e.g. a 1.00" thick oak layer) with the surface(s) or edge(s) without obstruction. See Test Plan for details                                                           |
| Chemical resistance                       | See Test Plan for list of chemicals and test methods                                                                                                                                                                               |

### 5.3 Functional Test Requirements

| Description        | Requirement |
|--------------------|-------------|
| Refer to test plan | N/A         |

### 5.4 Critical Dimension Requirements

| Description                        | Requirement                                        |
|------------------------------------|----------------------------------------------------|
| 2D drawings for plastic parts      | See part prints and Incoming Quality Control (IQC) |
| Finish notes for secondary process | See part prints and IQC                            |

|                              |                         |
|------------------------------|-------------------------|
| Assembly notes and Checklist | See part prints and IQC |
|------------------------------|-------------------------|

## 6.0 STANDARD COMPLIANCE

### 6.1 Certifications required for this product:

| Certification               | Requirement |
|-----------------------------|-------------|
| RoHS                        | Yes         |
| FCC                         | Yes         |
| CE                          | Yes         |
| C-Tick                      | Yes         |
| IEC60950-1                  | Yes         |
| UL1642                      | Yes         |
| WEEE                        | Yes         |
| Prop 65 (CA), KC, PSE, TISI | Yes         |
| UN38.3                      | Yes         |

### 6.2 ESD Protection

Standard products must meet 8kV air discharge. Products that have metal casing must meet 4kV contact discharge, as well as 8kV air. All ESD tests shall be performed using the test systems as specified by the IEC 61000-4-2 2001 standard.

### 6.3 EMC Compliance

All EMC tests shall be performed by following the IEC 61000-4-2 2001 standard.

### 6.4 RoHS Compliance (Restriction of Hazardous Substances)

The product should be RoHS compliant. The product shall not contain any of the following six harmful substances:

- ❖ Lead
- ❖ Mercury
- ❖ Hexavalent Chromium
- ❖ Cadmium
- ❖ PBB (Polybrominated Biphenyl)
- ❖ PBDE (Polybrominated Diphenyl Ether)

### ***FCC Notice***

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.

NOTE 1: This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

NOTE 2: Any changes or modifications to this unit not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.