| Revision History | | | |
|---|---|---|---|
| **Rev** | **Description** | **Date** | **Author** |
| 01 | Preliminary specification for RFQ & RFP purpose | March 05, 2015 | Ling Li |
| 02 | Updated sections 4.1, 5.1.3, 5.1.8, 5.3.1, 5.4, 5.5, 6.2.4.2, 6.2.6.1, 6.2.6.2, and 17.2.1 | April 24, 2015 | Ling Li |
| 03 | 1 Added Section 2.1.20<br>2 Updated Sections 4.1 and 17.1<br>3 Added details for major components in section 5.1<br>4 Changed regulatory requirement in section 8.1.5<br>5 Updated section 17.2.1.1 - Battery drop test requirement<br>6 Updated section 17.2.3 – Battery tumble test requirement<br>7 Updated section 17.4 – Battery shock test requirement<br>8 Updated section 17.9 - Battery standalone IP54 | Sept 18, 2015 | Ling Li |
| A | Rev A release<br>1) Updated section 6.2.4.4<br>- Changed Pre-charge current from 160mA to 250mA<br>- Changed Pre-charge time out from 30mins to 40mins<br>2) Added EE & ME design files<br>3) Added label drawings<br>4) Removed Table 11.1 | April 13, 2016 | Ling Li |
| B | 1) Updated section 16.1 - Removed KC mark from battery label.<br>2) Updated mechanical drawings in section 15 - Mechanical changes made for BT1.2 | Dec 19, 2016 | Ling Li |
| C | 1) Updated mechanical drawings in section 15 - Mechanical changes made for BT2.1.<br>2) Changed Zebra order Replacement PN from BTRY-NWTRS-33MA-01 to BTRY-NWTRS-33MA-02 | Dec 20, 2016 | Ling LI |
| D | JIRA# EEDR-396. Updated section 17.6.3 (Temperature shock) | June 18, 2019 | Ling Li |
| E | 1)Updated information for Frenzy extended battery (Battery Model No: BT-000362)<br>2) Added Frenzy standard battery (2nd source) | June 18, 2020 | Ling Li |

## FRENZY BATTERY PACK PART NUMBER LIST

| Description | Model No. | P/N Printed on Label | Zebra Sellable P/N | Batteries/Box |
|---|---|---|---|---|
| WT6X/RS6X , Frenzy standard battery (1st source) | BT000262A01 | BT000262A01 | BTRY-NWTRS-33MA-02 | Single pack (Worldwide) |
| | | BT-000262-02 | BTRY-NWTRS-33MA-IN | Single pack (India) |
| WT6X/RS6X , Frenzy standard battery (2nd source) | BT-000262 | BT-000262-50 | BTRY-NWTRS-33MA-02 | Single pack (Worldwide) |
| | | BT-000262-52 | BTRY-NWTRS-33MA-IN | Single pack (India) |
| WT6X Frenzy extended battery | BT-000362 | BT-000362-00 | BTRY-NGWT-50MA-01 | Single pack (Worldwide) |
| | | BT-000362-02 | BTRY-NGWT-50MA-IN | Single pack (India) |

**Notes**: Master file of this document is stored in Zebra Technologies database (Agile). Double clicking inserted item (Schematics, PCB files, 2D drawing, and others) will open the respective file if using a Word version of this document.



| APPROVAL | NAME | DATE | **Battery Design Requirement Specification** |
|---|---|---|---|
| | | | |
| | | | TITLE: **Li-Ion Battery Pack – Frenzy Program** |

## TABLE OF CONTENTS

# 1 Introduction

This document is used as component requirement specification to address the battery-pack designed for use with wearable devices. This document is only a technical specification which provides general electrical, mechanical, regulatory, packaging, and other requirements to battery assembler, vendors and/or suppliers. This document does not contain any additional information such as manufacturer's guarantee, liability, and etc., as all of such information is contained in related and applicable Zebra Technologies documents.

# 2 Applicable Technologies Documents

The following documents are relevant to this specification and shall be consulted for additional information. Should conflict exist between any of these documents and the battery specification, this battery specification takes precedence.

**Applicable Technologies Documents**

| Item | Document Description | Document No. | Document System |
|---|---|---|---|
| 2.1.1 | Battery Cell Specification | See Pack BOM | Agile |
| 2.1.2 | STI Workmanship Standards (rubber, plastic, overmold, etc.) | SS-03800-57-08 | Agile |
| 2.1.3 | Requirements for Safety Approval Report | FCD-0004 | Zebra SharePoint Site |
| 2.1.4 | LABEL: BOX, PREPRINTED | 63-68886-10 | Agile |
| 2.1.5 | Procedure-Environmental Compliance Specification | SP-12509-01 | Agile |
| 2.1.6 | Hologram Label Specification | - | - |
| 2.1.7 | TST STD: ENVIR GUIDELINE | SS-03800-74 | Agile |
| 2.1.8 | STD Specification for Supplier Packaging and Labeling Document Number | 50-04100-013 | Agile |
| 2.1.9 | N GEN BTRY LABEL DESIGN GUIDELINES | 70-108225-03 | Agile |
| 2.1.10 | N/A | N/A | N/A |
| 2.1.11 | N/A | N/A | N/A |
| 2.1.12 | Regulatory Technical Requirements Document(TRD) | SP-13918-01 | Agile |
| 2.1.13 | Packaging Requirements for Inbound Shipments | 50-04100-013 | Agile |
| 2.1.14 | Battery Programming Guide | See Pack BOM | Agile |
| 2.1.15 | Battery Programming Tool - Li+ Battery Monitor Evaluation Kit | - | Zebra SharePoint Site |
| 2.1.16 | N/A | N/A | N/A |
| 2.1.17 | Battery Label Drawing | See Pack BOM | Agile |
| 2.1.18 | Battery-Pack Assembly | See Pack BOM | Agile |
| 2.1.19 | Battery pack mechanical files (2D, 3D,..) | See Pack BOM | Zebra SharePoint Site |

# 3 Product Development Requirements

Battery-pack design must comply with all standard operating procedures (SOPs) required by the Zebra Technologies, additionally the battery-pack assembler will be asked to supply documentation, data, and present the design throughout development as requested by Statement of Work (SOW). Such deliverables shall be completed and comply with document referenced in section 2.1.3 shortly after program launch.

# 4 General Description

The Frenzy battery-packs (Refer to Figures 4.1a and 4.1b) consist of cylindrical Li-Ion battery cells, battery gas gauge, EEPROM, and protection circuitry within a plastic enclosure. Enhanced electronics allow battery status and state of charge (SOC) to be reported to the host for gas gauging during charging and discharging processes.


**Figure 4.1a Frenzy Standard Battery Pack (Reference only)**

**Figure 4.1b Frenzy Extended Battery Pack (Reference only)**

# 5 Battery Mechanical Description

## 5.1 Major Components

Battery enclosure material selected shall comply with the environmental and regulatory requirements defined in Section 8.0, and the battery-pack assembly shall comply with Flammability Rating of UL94-V1 or better.

## 5.2 Battery - External Features

### 5.2.1 Overall Dimensions – Frenzy Battery-Packs

5.2.1.1 Overall dimensions of the battery-pack are defined by Zebra Technologies including critical dimensions with tolerances

5.2.1.2 Battery vendor will provide detailed 2D mechanical drawing that includes all the internal structure, assembly and critical dimensions and tolerances. Please refer to Sections 2.1.19 and 15.0

5.2.1.3 Battery vendor will provide detailed 3D CAD files for the battery pack. Please refer to Sections 2.1.19 and 15.0

## 5.3 Battery Interface Specification

### 5.3.1 Battery Interface Connector - Pin-out

Standard battery is a common pack for Wearable Terminal (WT) and Ring Scanner (RS), extended battery pack is only designed for Wearable Terminal (WT), both standard and extended battery packs should be able to interface with Frenzy charger accessories.

**Battery Interface Connector - Pin-out Table**

| Pin Number | Description | Function |
|---|---|---|
| 1 | BATT_NEG | Battery pack negative contact |
| 2 | BATT_NEG | Battery pack negative contact |
| 3 | BATT_DET | Battery detect, this is connected with a resistor (0Ω) to battery negative(BATT_NEG) |
| 4 | PACK_SDA | Battery communication - SMBus or I2C, data line |
| 5 | PACK_SCL | Battery communication - SMBus or I2C clock line |
| 6 | BATT_POS | Battery pack positive contact |
| 7 | BATT_POS | Battery pack positive contact |

## 5.4 Battery Interface Connector

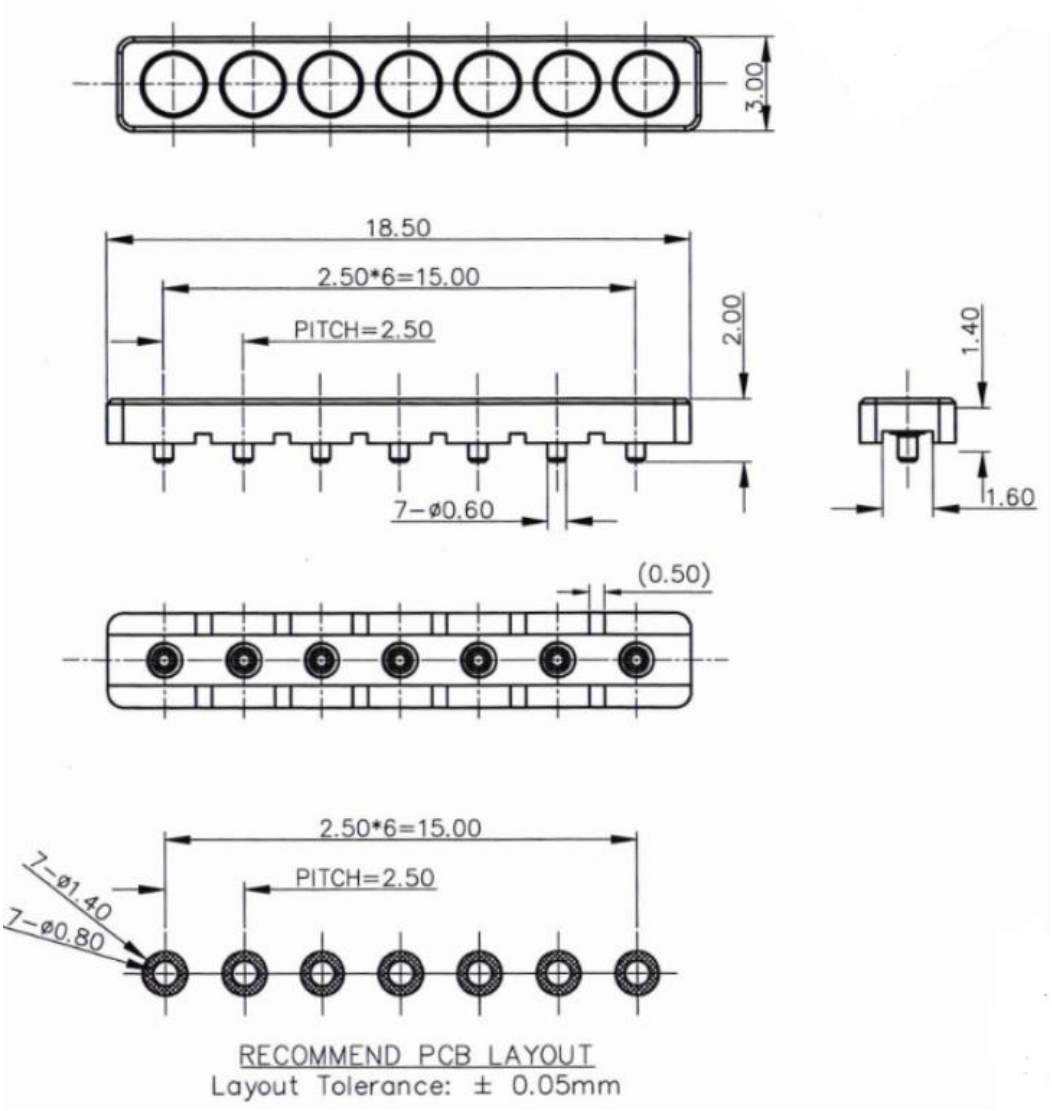



**FIGURE 5.4 C.C.P (P3389FL01-07G250HR)**

## 5.5 Battery Interface Connector

### 5.5.1 Battery Connector Material

1) Housing material: Black HTN 30%GF (UL94V-0)
2) PIN material: Brass 3604

### 5.5.2 Battery Contact Plating

The battery contact plating shall be:
1) Clean parts per ASTM B281 before plating
2) The nickel under plating shall be per ASTM B733 (200 micro inches minimum) SC1, Type 1, Class 5.
3) The Gold Plate shall be per ASTM B488, Type 2, Grade C (130-200 Knoop), Class 1.25 (50 micro inches minimum)

#### 5.5.3 Contact Mating

The battery contacts shall withstand at least 2000 mating and un-mating cycles with minimal deterioration to the contact surface. No loss of connectivity shall be permitted after the specified number of mating and un-mating cycles

The latch component/features on the battery pack shall withstand the first 2,000 install and removal cycles without any degradation to contact integrity.

#### 5.5.4 Contact Interface Engagement

The battery's contact interface engagement must be achieved while the battery is installed in the devices and charging accessories, no internal intermittent electrical connections are allowed. (Pack to device intermittent is allowed during drops/tumble)

### 5.6 Aesthetics

External surfaces must be free from any cosmetic damage, i.e.

1) Molding defects (sink marks, flash, flow marks, distortion)
2) Discoloration & excess glue from assembly
3) Scratches, cracks, marks from handling etc

## 6 Electrical Specification

### 6.1 Definitions

#### 6.1.1 Fully Charged Pack

A fully charged pack is defined as one which has accepted its maximum energy when the charge is terminated with the recommended charging method as specified by the cell manufacturer.

#### 6.1.2 Minimum Operating Voltage (or End of Discharge Voltage)

Minimum operating voltage is defined as the voltage level of a fully depleted battery-pack.

#### 6.1.3 Full Cycle

A Full Cycle consists of the discharge of the battery-pack from a Fully Charged state to its Minimum Operating Voltage followed by a re-charge back to a Fully Charged state.

#### 6.1.4 Minimum Capacity (Cmin)

The pack is first subjected to four Full Cycles. Cmin is then the minimum capacity in mA hours obtained when the battery is 0.2C discharged with a constant current in exactly 5 hours from a Fully Charged Pack to the Minimum Operating Voltage.

#### 6.1.5 Nominal Capacity (Cnom)

The pack is first subjected to four Full Cycles. Cnom is then the mean capacity in mA hours obtained when the battery is 0.2C discharged with a constant current in exactly 5 hours from a Fully Charged Pack to the Minimum Operating Voltage.

#### 6.1.6 Charge Voltage

Charge voltage is defined as the highest voltage level placed across a battery for the purpose of charging.

## 6.2 Battery Electrical Specification

### Battery Electrical Specification

| Item | Description | | Standard Battery(1st Source) | Standard Battery(2nd Source) | Extended Battery |
|---|---|---|---|---|---|
| 6.2.1 | Pack configuration | | 1S1P | 1S1P | 1S2P |
| 6.2.2 | Nominal voltage (pack, V) | | 3.6 | 3.6 | 3.6 |
| 6.2.3.1 | Minimum Capacity (mAh) | | 3200 | 3300 | 4600 |
| 6.2.3.2 | Typical Capacity (mAh) | | 3350 | 3500 | 5000 |
| 6.2.4.1 | Continuous charge current (A) | Maximum | 1.1 | 1.1 | 1.2 |
| 6.2.4.2 | | Standard | 0.95 | 0.85 | 1.0 |
| 6.2.4.3 | Full-charge termination taper current (mA) | | 100 | 150 | 150 |
| 6.2.5 | Charge voltage(V) | | 4.2 +/- 1% | 4.2 +/- 1% | 4.2 +/- 1% |
| 6.2.6 | End of discharge voltage (V) | | 3.0 | 3.0 | 3.0 |
| 6.2.7 | Charge method | | CC/CV | CC/CV | CC/CV |
| 6.2.8.1 | Continuous discharge current (Typical, A) | | 1.6 | 1.6 | 1.6 |
| 6.2.8.2 | Pulsed discharge current (A, Duration < 2 Sec) | | 3 | 3 | 3 |
| 6.2.8.3 | Peak discharge current (A, Duration < 1mS) | | 4 | 4 | 4 |
| 6.2.9 | Internal impedance ((mΩ, at +23˚C ) | | <100 | <100 | <100 |
| 6.2.10.1 | Charge temperature range (˚C) | | 0 to +45 | 0 to +45 | 0 to +45 |
| 6.2.10.2 | Discharge temperature range (˚C) | | -20 to +60 | -20 to +60 | -30 to +60 |
| 6.2.10.3 | Storage temperature range (˚C) (Recommended storage temperature is from +15 ˚C to +20˚C | | -20 to +50 | -20 to +50 | -30 to +50 |
| 6.2.11 | Total pack weight (grams) | | <70 | <70 | <125 |
| 6.2.12.1 | Safety protection threshold | Over-discharge under voltage cut-off (V) | 2.3 | 2.3 | 2.3 |
| 6.2.12.2 | | Over-discharge current(A) | 4.4 | 4.4 | 4.4 |
| 6.2.12.3 | | Over-charge voltage (V) | 4.28 | 4.28 | 4.28 |
| 6.2.12.4 | | Over-charge current (A) | 3.4 | 3.4 | 3.4 |

## 6.3 Battery Safety Protection Specification

Battery electrical protection shall follow Zebra Technologies Battery Design Safety Policy. Two independent levels of overcharge protection are required for the battery-pack. All components on the protection circuit must be rated for the operating temperature range -30°C to +85°C. The battery shall not cause a fire hazard for any maximum current or overload current condition specified herein.

### 6.3.1 Battery Safety Protection – Level 1

The primary level protection circuit consists of a protection IC and MOSFETs. The primary level protection circuit has over-voltage charge, under-voltage discharge, over-current charge, over-current discharge and 0V charge unavailable protection functions

### 6.3.2 Battery Safety Protection – Level 2

The secondary level protection circuit includes a protection IC and MOSFETs, and this secondary level protection circuit has over-voltage charge and over-current charge protection functions.

# 7 Electrical Characteristics

## 7.1 Standard Test Conditions

The test shall be implemented at +23°C ± 2°C with 65 ±20% relative humidity. However, if temperature and humidity can be shown not to influence the test accuracy, the testing may be carried out at a range of +15°C to +30°C and 25% ~ 85% of relative humidity.

## 7.2 Test Instrumentation

Voltages and currents are to be measured by using equipment with accuracy of better than 0.5%.

## 7.3 Standard Charge

The standard charge means charging with 0.3C constant current and constant voltage limit of 4.2V, and the full charge is terminated after the battery has been charged for 4 hours at room temperature.

## 7.4 Standard Discharge

Standard discharge means discharging with a constant current of 0.2C until the battery cell voltage reaches end of discharge voltage which is defined in section 6.2.6.1.

## 7.5 Battery Safety Specification

**Safety Test Specification**

| Item | Description | Condition | Standard |
|---|---|---|---|
| 7.5.1 | Short circuit test | After fully charged at +23°C ± 2°C, the battery is forced to be in a short-circuit condition by connecting the positive and the negative terminals with a wire of total resistance of less than 0.1Ω | No explosion, no fire, no smoke |
| 7.5.2 | Over charging test | After fully charged at 23°C ± 2°C, the battery is being charged continuously for 24 hours with current defined in Section 6.2.4.2 and voltage defined in Sections 6.2.5.1 | No explosion, no fire, no smoke |
| 7.5.3 | Over discharge test | After discharged with current defined in Section 6.2.8.1B to the end of discharge voltage defined in Section 6.2.6 at +23°C ± 2°C, the battery is discharged with the resistance of 50 Ω for 24 hours. | No explosion, no fire, no smoke |
| 7.5.4 | High temperature storage | After fully charged at +23°C ± 2°C, the battery is stored for 8 hours at +85°C. | No explosion, no fire, no smoke |
| 7.5.5 | Leak Test | After fully charged at +23°C ± 2°C, the battery is stored for 24 hours at +60°C with the humidity of 90 % RH. | No leakage |

# 8 Required Regulatory Approvals

## 8.1 Regulatory Requirements

Cell and battery-packs shall be certified as appropriate to the standards and shall follow Zebra Technologies regulatory technical requirements and environmental compliance specifications referenced in

sections 2.1.3, 2.1.5, and 2.1.12. Please communicate with Zebra regulatory team if additional information is needed.

## 8.2 UL and Safety

### 8.2.1 UL Maximum Abnormal Charge Current

The maximum allowable charge current for each cell in accordance with UL60950-1 shall not exceed the limit identified in the UL1642 certification of the individual cell under normal and single fault conditions. The battery-pack, its chargers, or both must be designed to ensure that this requirement is met.

### 8.2.2 UL 2054 Limited Power Source

The battery shall be UL Recognized or UL listed (Refer to section 5.1.8) and LPS-complaint with a minimum V1 Flammability rating. A complete protection circuit analysis, inclusive of both protection circuits and fuses shall be performed to guarantee LPS can be passed. The analysis shall also validate that the circuitry implemented to address LPS does not interfere with the operating conditions required to support the terminal. Care must be taken to consider the tolerances of all subject components over their operating temperature range.

### 8.2.3 Environmental, Health & Safety

The Supplier/Manufacturer and/or Distributor shall follow Zebra Technologies Environmental Compliance Specifications SP-12509-01 referenced in sections 2.1.5.

## 8.3 Hologram

Hologram is not required at this time.

# 9 Delivery Condition

## 9.1 Battery Delivery Condition

Before shipment, the battery shall undergo the following procedure, as indicated in this section. The battery-pack assembler shall be responsible for verification of incoming cells and maintaining a minimum pack efficiency.

**Battery Delivery Condition (Reference only)**

| Item | Description | Condition |
|---|---|---|
| 9.1.1 | Open circuit voltage check | The OCV should be ~ 3.6V |
| 9.1.2 | Program parameters into non-volatile memory and verify all data is written correctly | TI bq tool |
| 9.1.3 | Current sensor | Calibrate the external current limit resistor before shipment |
| 9.1.4 | Cycle counter check | Clear the counter |
| 9.1.5 | Battery accumulated current: | - |
| 9.1.6 | Battery voltage returned from gas gauge | Match the OCV value reflected in section 9.1.1 |
| 9.1.7 | State of Charge ( SOC) | Shall not exceed 30% of its rated design capacity |
| 9.1.8 | Battery pack in low power mode for shipping & storage | All of ICs are put into low power mode |

## 9.2 Battery Cell Inspections

The pack assembler shall be responsible for performing inspections on the incoming supply of cells to ensure the material is in compliance with the cell specification referenced in section 2.1.1. This inspection must include capacity testing at 0.2C, 1C discharge over the temperature as defined by the cell specification referenced in section 2.1.1.

Any cells that do not meet the Zebra Technologies cell specification must be brought to the attention of Zebra Technologies quality team responsible for the battery-pack. Cells not meeting the specification shall be excluded from pack production.

## 9.3 Cell Matching

The following criteria must be met for the battery-pack production.

### 9.3.1 Cell Grading (Capacity)

Cell vendor shall supply the pack assembler with cells graded by capacity (grade printed on each cell).

### 9.3.2 Cell Date Code

Cell vendor shall supply the pack assembler with cells marked with a date code.

### 9.3.3 Open Circuit Voltage

This is Intentionally Left Blank

## 9.4 Battery-Pack Inspections - Pack Internal Impedance

The internal impedance of battery circuitry shall NOT exceed 50 mΩ.

1) Verification condition: After the battery is fully discharged to the end of discharge voltage defined in Section 6.2.6.1, and let the battery rest for 2 hours at room temperature.
2) Internal impedance of battery circuitry (Z_batt_Circuitry)
3) Total impedance of battery(Z_batt_tol) is captured from the negative lead to the positive lead of the battery while the battery is without a load
4) Battery cell impedance(Z-cell ) is captured cross the cell while being without a load
5) Z_batt_Circuitry= Z_batt_tol - Z-cell
6) Make sure Z_batt_Circuitry ≤50 mΩ

## 9.5 Temperature Sensor Placement

Best efforts shall be employed to place all temperature sensors (Thermistors, semiconductors, etc.) in the battery-pack so that they reflect the temperature measured at the battery cell surface or contacts. In addition, best efforts shall be employed to prevent temperature rises outside the pack and in non-cell components in the pack from influencing the temperature reported by the sensor.

Testing shall be run to validate that the temperature sensor accurately reflects that of the warmest point on the cell with minimal influence from other components.

## 9.6 Tab Welding

Tab to cell connections shall include a minimum of four weld nuggets per connection.

# 10 Packaging and Shipping

## 10.1 Battery Supplier Packing and Shipping

All of batteries must be shipped in accordance with documents referenced in sections 2.1.8, 2.1.10, and 2.1.13.

## 10.2 IATA Requirement

Shipping shall meet IATA and/or other applicable international, federal, state, and local regulation requirement

## 10.3 Master Battery Carton

Master battery carton label shall be in compliance with Zebra Technologies packing and labeling standard referenced in section 2.1.8.

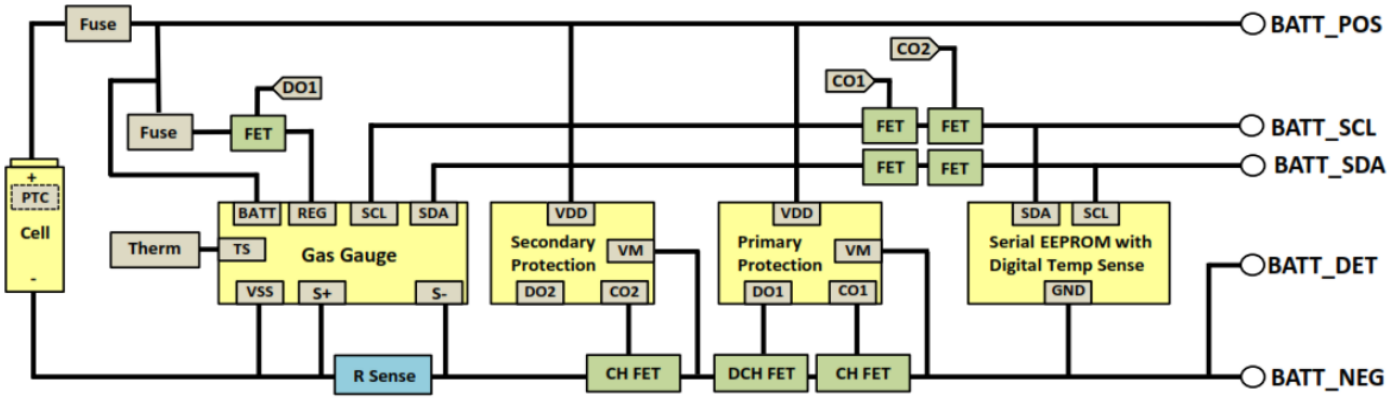
## 10.4 Battery Label Requirement

1) Battery label shall be in compliance with Zebra Technologies label design guidelines referenced in section 2.1.9.
2) Battery label drawing is controlled by Zebra Technologies.
3) Battery regulatory label dimension: Please refer to section 16.0
4) Battery pack should have enough area for an asset control label if customers need to add this label. The asset control label on the battery should be visible while the battery is sitting in chargers.

## 11 Battery Gas Gauge Configuration –Flash Settings

- This section intentionally left blank

## 12 Battery-Pack Functional Block Diagram




## 13 Schematic and Bill of Materials

### 13.1 Schematic Files - Standard Battery and Extended Battery

Refer to specific supplier documentations in Agile.

### 13.2 Pack Assembly (Bill-of-Material) - Standard Battery and Extended Battery

Refer to specific supplier documentations in Agile.

### 13.3 Battery Gas Gauge and Protection Board -Bill-of-Material

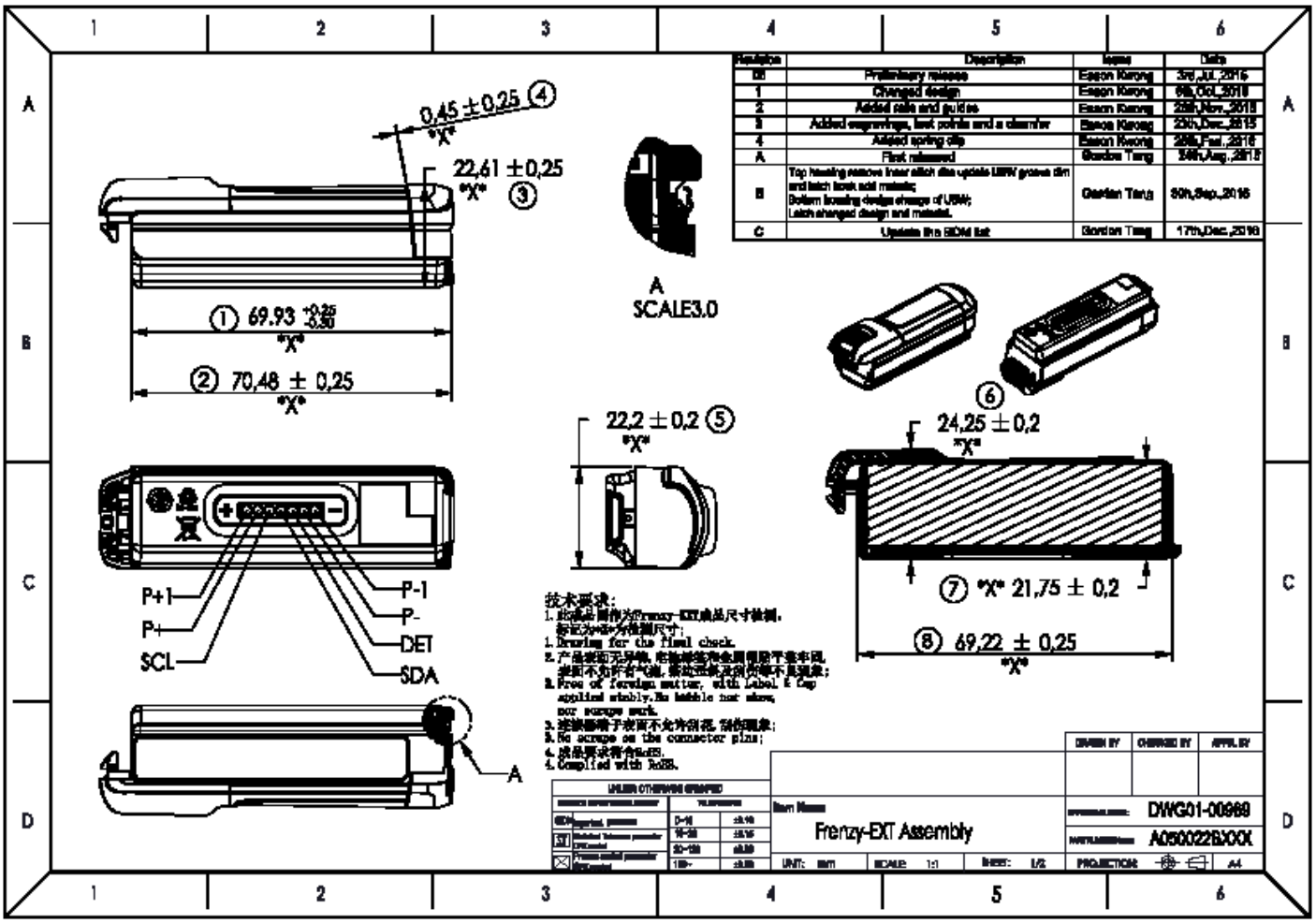
Refer to specific supplier documentations in Agile.

## 14 PCB Artwork

Refer to specific supplier documentations in Agile.

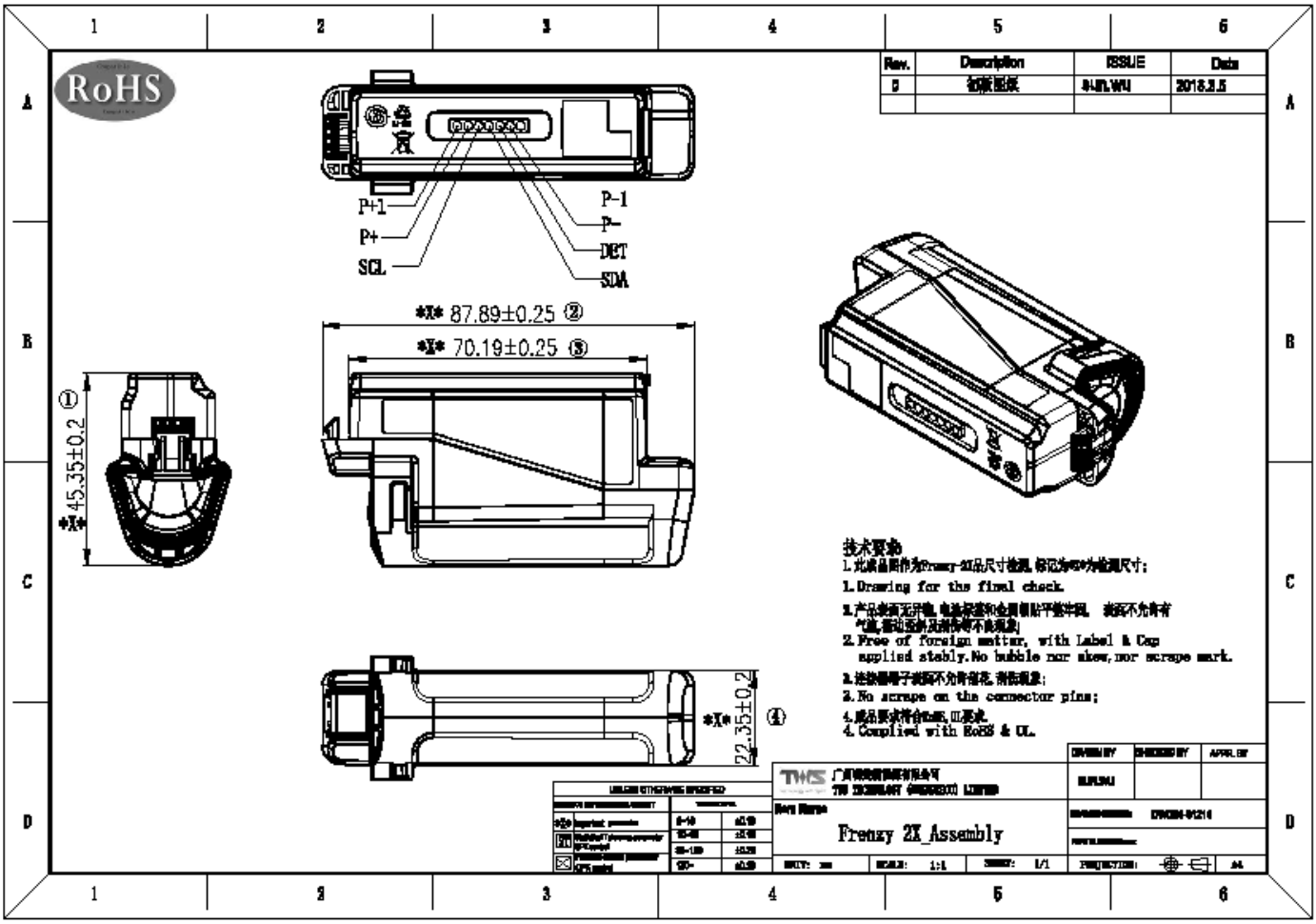
# 15 Mechanical Drawings

## 15.1 Battery-Pack Assembly Drawing – Standard Battery Pack




| Revision | Description | Issue | Date |
|---|---|---|---|
| 00 | Preliminary release | Eason Kwong | 3rd,Jul.,2015 |
| 1 | Changed design | Eason Kwong | 6th,Oct.,2015 |
| 2 | Added rails and guides | Eason Kwong | 25th,Nov.,2015 |
| 3 | Added segmentings, test points and a chamfer | Eason Kwong | 23rd,Dec.,2015 |
| 4 | Added spring clip | Eason Kwong | 28th,Feb.,2016 |
| A | First released | Gordon Tang | 24th,Aug.,2016 |
| B | Top housing remove inner stitch dim update LWW groove dim and latch hook add materia; Bottom housing design change of USW; Latch changed design and material. | Gordon Tang | 30th,Sep.,2016 |
| C | Update the BOM list | Gordon Tang | 17th,Dec.,2016 |

### 15.2 Battery-Pack Assembly Drawing – Extended Battery Pack




## 16 Battery Label Drawings

### 16.1 Battery-Pack Label Drawing

Refer to specific supplier documentations in Agile.

### 16.2 Battery Inner Box Label Drawing

Refer to specific supplier documentations in Agile.

## 17 Verification Requirement- Mechanical and Environmental

The battery-pack shall be capable of full electrical and mechanical performance during and after being subjected to an environmental testing sequence as conducted per the Quality Test Plan in accordance with the environmental test standard guidelines specified in Section 2.1.7.

Unless otherwise stated in this specification, all of verification testing shall be carried out to the standard climatic conditions in accordance with IEC 68-1:

1) Ambient temperature: +15 °C to +35 °C
2) Relative humidity: 25 % to 75%
3) Atmospheric pressure: 86 kPa (860 mbar) to 106 kPa (1060 mbar)

## 17.1 Verification Test: Unit Allocation Matrix

### 17.1.1 Verification Test Unit Allocation Matrix – Standard Battery

| Battery Standalone Tests | | FRENZY Battery_3350mAh | Battery Unit Allocation | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 |
| Section | Group | Test | | | | | | | | | | | | | | | | | | | | | |
| 17.1.1_Init | Baseline | Initial Baseline (Pre-Test) | a | a | a | a | a | a | a | a | a | a | a | a | a | a | a | a | a | a | a | a | a |
| 17.1.1-A | Group A | | | | | | | | | | | | | | | | | | | | | | |
| 17.1.1-A1 | Group A | Thermal Shock | b | b | b | b | b | b | b | b | b | b | b | b | b | b | b | b | b | b | b | b | b |
| 17.1.1-A2 | Group A | Vibration | c | c | c | | | | | | | | | | | | | | | | | | |
| 17.1.1-A3 | Group A | ESD | d | d | d | | | | | | | | | | | | | | | | | | |
| 17.1.1-B | Group B | | | | | | | | | | | | | | | | | | | | | | |
| 17.1.1-B1 | Group B | Low Temperature Storage | | | | c | c | c | | | | | | | | | | | | | | | |
| 17.1.1-B2 | Group B | High Temperature Storage | | | | d | d | d | | | | | | | | | | | | | | | |
| 17.1.1-C | Group C | | | | | | | | | | | | | | | | | | | | | | |
| 17.1.1-C1 | Group C | Tumble EN60068-2-31 (Repeated Fall) | | | | | | | c | c | c | | | | | | | | | | | | |
| 17.1.1-C2 | Group C | Drop (Impact Shock) -30°C | | | | | | | | | | c | c | c | | | | | | | | | |
| 17.1.1-C3 | Group C | Drop (Impact Shock) +23°C | | | | | | | | | | | | | c | c | c | | | | | | |
| 17.1.1-C4 | Group C | Drop (Impact Shock) +50°C | | | | | | | | | | | | | | | | c | c | c | | | |
| 17.1.1-D | Group D | | | | | | | | | | | | | | | | | | | | | | |
| 17.1.1-D1 | Group D | RF Susceptibility | | | | | | | | | | | | | | | | | | | c | c | c |
| 17.1.1-E | Group E | | | | | | | | | | | | | | | | | | | | | | |
| 17.1.1-E1 | Group E | Dust EN60529 (IP5X) | | | | | | | | | | | | | | | | | | | d | d | d |
| 17.1.1-E2 | Group E | Spray / Immersion EN60529 (IPX4) | | | | e | e | e | | | | | | | | | | | | | | | |
| 17.1.1_Final | Final Baseline | | | | | | | | | | | | | | | | | | | | | | |
| 17.1.1-Post | Baseline | Final Baseline (Post-Test) | f | f | f | f | f | f | d | d | d | d | d | d | d | d | d | d | d | d | e | e | e |
| 17.1.1-Teardown | Baseline | Mechanical Teardown Post Test | g | g | g | g | g | g | e | e | e | e | e | e | e | e | e | e | e | e | f | f | f |

| Battery in System Tests (*Low temperature operating test at -20°C) | | FRENZY Battery_3350mAh | Battery Unit Allocation | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Battery in WT | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 |
| | | Battery in NG507 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 | 31 | 32 | 33 | 34 | 35 | 36 | 37 | 38 | 39 | 40 | 41 | 42 |
| | | Battery in Charging Cup - BBBB | 43 | 44 | 45 | | | | | | | | | | | | | | | | | | |
| | | Charging Cup - WB | 46 | 47 | 48 | | | | | | | | | | | | | | | | | | |
| | | Chaging Cup - RB | 49 | 50 | 51 | | | | | | | | | | | | | | | | | | |
| Section | Group | Test | | | | | | | | | | | | | | | | | | | | | |
| 17.1.2_Init | Baseline | Initial Baseline (Pre-Test) | a | a | a | a | a | a | a | a | a | a | a | a | a | a | a | a | a | a | a | a | a |
| 17.1.2-A | Group A | | | | | | | | | | | | | | | | | | | | | | |
| 17.1.2-A1 | Group A | Thermal Shock | b | b | b | b | b | b | b | b | b | b | b | b | b | b | b | b | b | b | b | b | b |
| 17.1.2-A2 | Group A | Vibration | c | c | c | | | | | | | | | | | | | | | | | | |
| 17.1.2-A3 | Group A | Operating Temperature Cycle | d | d | d | | | | | | | | | | | | | | | | | | |
| 17.1.2-A4 | Group A | ESD | e | e | e | | | | | | | | | | | | | | | | | | |
| 17.1.2-B | Group B | | | | | | | | | | | | | | | | | | | | | | |
| 17.1.2-B1 | Group B | Low Temperature Operating* | | | | c | c | c | | | | | | | | | | | | | | | |
| 17.1.2-B2 | Group B | High Temperature & Humidty Operating | | | | d | d | d | | | | | | | | | | | | | | | |
| 17.1.2-C | Group C | | | | | | | | | | | | | | | | | | | | | | |
| 17.1.2-C1 | Group C | Tumble EN60068-2-31 (Repeated Fall) | | | | | | | c | c | c | | | | | | | | | | | | |
| 17.1.2-C2 | Group C | Drop (Impact Shock) -30°C | | | | | | | | | | c | c | c | | | | | | | | | |
| 17.1.2-C3 | Group C | Drop (Impact Shock) +23°C | | | | | | | | | | | | | c | c | c | | | | | | |
| 17.1.2-C4 | Group C | Drop (Impact Shock) +50°C | | | | | | | | | | | | | | | | c | c | c | | | |
| 17.1.2-E | Group E | | | | | | | | | | | | | | | | | | | | | | |
| 17.1.2-E1 | Group E | Dust EN60529 (IP6X) | | | | e | e | e | | | | | | | | | | | | | | | |
| 17.1.2-E2 | Group E | Spray / Immersion EN60529 (IPX5) | | | | | | | | | | | | | | | | | | | c | c | c |
| 17.1.2-E3 | Group E | Insertion Testing (Product, PC Card) | | | | | | | | | | | | | | | | | | | d | d | d |
| 17.1.2_Final | Final Baseline | | | | | | | | | | | | | | | | | | | | | | |
| 17.1.2_Post | Baseline | Final Baseline (Post-Test) | f | f | f | f | f | f | d | d | d | d | d | d | d | d | d | d | d | d | e | e | e |
| 17.1.2-Teardown | Baseline | Mechanical Teardown Post Test | g | g | g | g | g | g | e | e | e | e | e | e | e | e | e | e | e | e | f | f | f |

### 17.1.2 Verification Test Unit Allocation Matrix – Extended Battery

| Battery Standalone Tests | | WT6000 2X Battery | Battery Unit Allocation | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 |
| Requested | Group | Test | | | | | | | | | | | | | | | | | | | | | |
| Yes | Baseline | Initial Baseline (Pre-Test) | a | a | a | a | a | a | a | a | a | a | a | a | a | a | a | a | a | a | a | a | a |
| Yes | Group A | | | | | | | | | | | | | | | | | | | | | | |
| Yes | Group A | Thermal Shock | b | b | b | b | b | b | b | b | b | b | b | b | b | b | b | b | b | b | b | b | b |
| Yes | Group A | Vibration | c | c | c | | | | | | | | | | | | | | | | | | |
| Yes | Group A | ESD | d | d | d | | | | | | | | | | | | | | | | | | |
| Yes | Group B | | | | | | | | | | | | | | | | | | | | | | |
| Yes | Group B | Low Temperature Storage | | | | c | c | c | | | | | | | | | | | | | | | |
| Yes | Group B | High Temperature Storage | | | | d | d | d | | | | | | | | | | | | | | | |
| Yes | Group C | | | | | | | | | | | | | | | | | | | | | | |
| Yes | Group C | Tumble EN60068-2-31 (Repeated Fall) | | | | | | | c | c | c | | | | | | | | | | | | |
| Yes | Group C | Drop (Impact Shock) -30°C | | | | | | | | | | c | c | c | | | | | | | | | |
| Yes | Group C | Drop (Impact Shock) +23°C | | | | | | | | | | | | | c | c | c | | | | | | |
| Yes | Group C | Drop (Impact Shock) +50°C | | | | | | | | | | | | | | | | c | c | c | | | |
| Yes | Group D | | | | | | | | | | | | | | | | | | | | | | |
| Yes | Group D | RF Susceptibility | | | | | | | | | | | | | | | | | | | c | c | c |
| Yes | Group E | | | | | | | | | | | | | | | | | | | | | | |
| Yes | Group E | Dust EN60529 (IP5X) | | | | | | | | | | | | | | | | | | | d | d | d |
| Yes | Group E | Spray / Immersion EN60529 (IPX4) | | | | e | e | e | | | | | | | | | | | | | | | |
| Yes | Final Baseline | | | | | | | | | | | | | | | | | | | | | | |
| Yes | Baseline | Final Baseline (Post-Test) | f | f | f | f | f | f | d | d | d | d | d | d | d | d | d | d | d | d | e | e | e |
| Yes | Baseline | Mechanical Teardown Post Test | g | g | g | g | g | g | e | e | e | e | e | e | e | e | e | e | e | e | f | f | f |

| Battery in System Tests | | WT6000 2X Battery | Battery Unit Allocation | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Battery in WT | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 |
| | | Battery in Charging Cup - BBBB | 22 | 23 | 24 | | | | | | | | | | | | | | | | | | |
| | | Charging Cup - WB | 25 | 26 | 27 | | | | | | | | | | | | | | | | | | |
| Requested | Group | Test | | | | | | | | | | | | | | | | | | | | | |
| Yes | Baseline | Initial Baseline (Pre-Test) | a | a | a | a | a | a | a | a | a | a | a | a | a | a | a | a | a | a | a | a | a |
| Yes | Group A | | | | | | | | | | | | | | | | | | | | | | |
| Yes | Group A | Thermal Shock | b | b | b | b | b | b | b | b | b | b | b | b | b | b | b | b | b | b | b | b | b |
| Yes | Group A | Vibration | c | c | c | | | | | | | | | | | | | | | | | | |
| Yes | Group A | Operating Temperature Cycle | d | d | d | | | | | | | | | | | | | | | | | | |
| Yes | Group A | ESD | e | e | e | | | | | | | | | | | | | | | | | | |
| Yes | Group B | | | | | | | | | | | | | | | | | | | | | | |
| Yes | Group B | Low Temperature Operating [1] | | | | c | c | c | | | | | | | | | | | | | | | |
| Yes | Group B | High Temperature & Humidty Operating | | | | d | d | d | | | | | | | | | | | | | | | |
| Yes | Group C | | | | | | | | | | | | | | | | | | | | | | |
| Yes | Group C | Loose Cargo Pkg (Unit Level) | f | f | f | | | | | | | | | | | | | | | | | | |
| Yes | Group C | Tumble EN60068-2-31 (Repeated Fall) | | | | | | | c | c | c | | | | | | | | | | | | |
| Yes | Group C | Drop (Impact Shock) -30°C | | | | | | | | | | c | c | c | | | | | | | | | |
| Yes | Group C | Drop (Impact Shock) +23°C | | | | | | | | | | | | | c | c | c | | | | | | |
| Yes | Group C | Drop (Impact Shock) +50°C | | | | | | | | | | | | | | | | c | c | c | | | |
| Yes | Group E | | | | | | | | | | | | | | | | | | | | | | |
| Yes | Group E | Dust EN60529 (IP6X) | | | | e | e | e | | | | | | | | | | | | | | | |
| Yes | Group E | Spray / Immersion EN60529 (IPX5) | | | | | | | | | | | | | | | | | | | c | c | c |
| Yes | Group E | Insertion Testing (Product, PC Card) | | | | | | | | | | | | | | | | | | | d | d | d |
| Yes | Final Baseline | | | | | | | | | | | | | | | | | | | | | | |
| Yes | Baseline | Final Baseline (Post-Test) | f | f | f | f | f | f | d | d | d | d | d | d | d | d | d | d | d | d | e | e | e |
| Yes | Baseline | Mechanical Teardown Post Test | g | g | g | g | g | g | e | e | e | e | e | e | e | e | e | e | e | e | f | f | f |

## 17.2 Battery Drop and Tumble Verification Test Requirement

Functional and electrical performance specifications shall be met with no mechanical defects such as cracking, weld separation, bent or broken contacts, etc. Free-drop or tumble testing shall be performed once the pack has returned to room temperature.

Battery may sustain normal mechanical wear during drop (scratches, dents, and deformation) without affecting the mechanical fit of the function with the terminal or accessory.

Mechanical Extended Target testing requirements shall be followed and verified. Battery may test to failure or acceptable level whichever comes first. If battery failure is observed during Extended Target testing, it is required to record test data and provide failure analysis report.

Extended Target tests shall be used for internal evaluation purposes only! This information shall not be used in any future marketing material or be communicated to the field.

**17.2.1 Drop Test Requirement - Battery Standalone**
**17.2.1.1 Normal Drop Test Requirement - Battery Standalone**
Testing Temperatures shall cover -30°C, +23°C, and +50°C, a minimum of 3 samples shall be used at each of three temperatures.

Battery pack shall be subjected to 1.2 meters free-fall drop onto polished concrete on each of its six faces two times, a total of 12 free-drops per pack. (Note: The battery-packs shall be put back into chamber for a minimum of 30 minutes after every test cycle to ensure tested sample back to the specified testing temperature.) After the drop tests the battery-pack shall be fully functional and show no signs of permanent damage (other than surface scuffing).

**17.2.2 Drop Test Requirement - Battery in Device (WT and Ring Scanner)**
**17.2.2.1 Normal Drop Test Requirement – Battery in Ring Scanner**
Testing Temperatures shall cover -30 °C, +23 °C, and +50 °C. At each temperature a minimum of 3 devices shall be tested. Each device with battery installed shall be subjected to 36 free-falls onto polished concrete from a height of 1.8 meters by following Drop Test Work Instruction provided by master program team (Note: The device shall be put back into chamber for a minimum of 30 minutes after every test cycle to ensure it is tested at the specified temperature.)

After the drop tests the battery-pack shall be fully functional and show no signs of permanent damage. It is preferable that the battery-pack should not disconnect from the device.

**17.2.2.2 Extended Target Drop Test Requirement – Battery in Ring Scanner**
Not Applicable

**17.2.2.3 Normal Drop Test Requirement – Battery in WT**
Testing Temperatures shall cover -30 °C, +23 °C, and +50 °C. At each temperature, a minimum of 3 devices shall be tested. Each device with battery installed shall be subjected to 36 free-falls onto polished concrete from a height of 1.2 meters by following Drop Test Work Instruction provided by master program team (Note: The device shall be put back into chamber for a minimum of 30 minutes after every test cycle to ensure it is tested at the specified temperature.)

After the drop tests the battery-pack shall be fully functional and show no signs of permanent damage, and the battery-pack shall not disconnect from the device.

**17.2.2.4 Extended Target Drop Test Requirement - Battery in WT**
Testing Temperatures shall cover only +23 °C. A minimum of 3 devices shall be tested. Each device with battery installed shall be subjected to 36 free-falls onto polished concrete from a height of 1.6 meters by

following Drop Test Work Instruction provided by the master program team (Note: The device shall be put back into chamber for a minimum of 30 minutes after every test cycle to ensure it is tested at the specified temperature.)

After the drop tests the battery-pack shall be fully functional and show no signs of permanent damage, and the battery-pack shall not disconnect from the device.

**17.2.3 Tumble Test Requirement – Battery Standalone**
Testing Temperatures shall be room temperature. The battery pack shall be subjected to a tumble durability test for characterization purposes.

**17.2.3.1 Normal Tumble Test Requirement**
Battery pack shall be subjected to 250 tumbles (1 tumble = 1 hit) at 0.5 meters using IEC 600068-2-32: Part 2 - Test Ed: Free Fall, test method. After the tumble tests the battery-pack shall be fully functional and show no signs of permanent damage (other than surface scuffing).

**17.2.3.2 Extended Target Tumble Test Requirement**
Battery pack shall be subjected to 250 tumbles (1 tumble = 1 hit) at 1 meter using IEC 600068-2-32: Part 2 - Test Ed: Free Fall, test method. After the tumble tests the battery-pack shall be fully functional and show no signs of permanent damage (other than surface scuffing).

**17.2.4 Tumble Test Requirement – Battery in WT and Ring Scanner**
Testing Temperatures is about +23 °C.

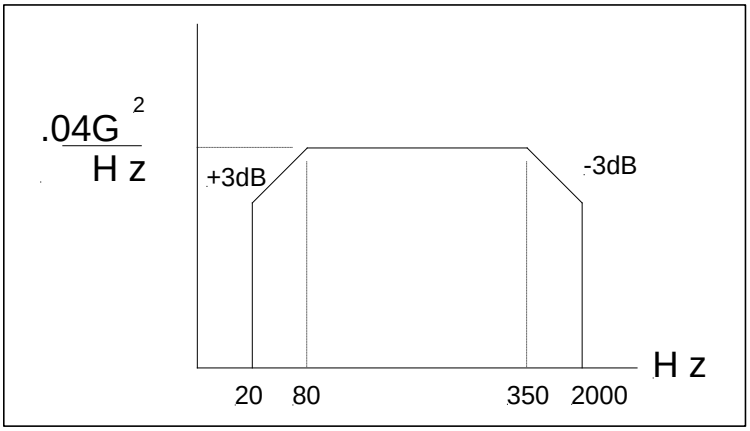
1) The terminal with the battery installed shall be subjected to 1000 tumbles (1 tumble = 1 hit) at 0.5 meters. Battery need to be replaced with new battery after every 250 tumbles, and the battery in device should survive 250 tumbles. Battery pack shall not disconnect from the device during tumble testing.
2) Functional and electrical performance specifications shall be met with no mechanical defects such as cracking, weld separation, bent or broken contacts, etc..
3) Battery may sustain normal mechanical wear during tumble test (scratches, dents, and deformation) without affecting the mechanical fit of the function with the terminal or accessory.

## 17.3 Vibration Test Requirement

**17.3.1 Vibration Test Requirement - Battery Standalone**

The battery-pack shall suffer no performance degradation, nor deterioration of components, after having been exposed to the specified mechanical vibration.

Functional and electrical performance specifications shall be met with no mechanical defect after exposure to a random vibration profile for one (1) hour in each of the three (3) mutually perpendicular axes as defined in the figure below.




**17.3.2 Vibration Test Requirement - Battery in Ring Scanner**

Please refer to Frenzy Ring Scanner PRD

**17.3.3 Vibration Test Requirement - Battery in WT**

Please refer to Frenzy WT PRD

### 17.4 Shock Test Requirement

**17.4.1 Shock Test Requirement - Battery Standalone**

Not Applicable

**17.4.2 Shock Test Requirement - Battery in Ring Scanner**

Not Applicable

**17.4.3 Shock Test Requirement - Battery in WT**

Not Applicable

### 17.5 System Mechanical Fit

Insert battery-pack in host terminals and charge accessories verifying that battery-pack fits in the system and that the battery-pack makes reliable electrical contact for operating.

17.5.1 The standard battery shall fit in the WT6000 and the RS6000 per the above statement
17.5.2 The extended battery shall fit in the WT6000, and shall not fit in the RS6000 per the above statement (no electrical contact shall be made in the RS6000)
17.5.3 The standard battery and the extended battery shall fit in the accessory charging stations per the above statement
17.5.4 If the extended battery is installed within the WT6000, the WT6000 shall fit in the accessory cradle.

## 17.6 Battery Temperature Condition

### 17.6.1 Storage Temperature

The battery-pack shall be capable of meeting all electrical and mechanical functional requirements after being exposed to storage temperatures in the range of (-40°C to +70°C) for 240 hours at full charge with a maximum of 5% irreversible capacity loss from the Nominal Capacity. Storage shall be performed at the extremities of the range. The capacity of the battery shall be tested before and after storage and compared to determine losses (as opposed to only testing after storage and comparing to the spec.).

As shipped from the factory, the battery-pack shall be capable of withstanding continuous exposure of temperatures range from 0°C to +25°C for up to 12 months with a maximum of 5% irreversible capacity loss from the Nominal Capacity and without damage due to self-discharge. 12-months storage performance may be validated by analysis.

### 17.6.2 Operating Temperature

The battery operating temperatures are referenced in Sections 6.2.12, 6.2.13, and 6.2.14

### 17.6.3 Temperature Shock

Fully charged batteries shall be subjected to thermal shock over the temperature extremes of -40°C and +70°C for 10 cycles. The duration for each cycle is 2.5 hours, defined at 1.25 hours hot and 1.25 hours cold. The preferred transfer rate (between the compartments) shall be less than 15 seconds, the accepted transfer rate (between the compartments) shall be less than 60 seconds. The chamber shall be allowed to return to room temperature (~+23°C), with time for the pack to stabilize before the samples are removed. The battery-pack shall be capable of meeting all electrical and mechanical functional requirements after exposure to thermal shock with the exception of capacity.

## 17.7 Electro-Magnetic Environment

### 17.7.1 Electrostatic Discharge (ESD)

The battery-pack shall be capable of withstanding electrostatic discharge of +/-20 KV air, +/-10 KV contact with no permanent loss of function as per EN61000-4-2. (Ceramic capacitors used for ESD suppression must be of X5R or X7R rating).

### 17.7.2 RF Susceptibility

The battery shall experience no sudden fluctuations in voltage and no loss of information in the appropriate electronics (if the battery has data storage capability) when exposed to radiated field strengths of up to 10 Volts/meter with 80% amplitude modulation in the frequency range of 80 MHz to 2.7 GHz per EN61000-4-3.

## 17.8 High Temperature Humidity

Batteries that are fully charged according to section 6.1 shall be exposed at +60 °C and 95% relative humidity for 168 hours. Battery-pack's capacity shall be at least 80% of initial capacity after humidity test

## 17.9 Sealing

a) Battery pack in device (WT or NG507): IP65 should be achieved and met.

b) Battery pack (Standalone): IP54 should be achieved and met.

### 17.10 Critical Dimensions

The battery-pack must remain within all critical dimensions (including tolerances) as outlined in section 5.2. No swelling shall be evident on the exterior of the pack during accelerated qualification and life testing of the product.

### 17.11 Chemical Exposure and Chemical Resistance Requirement

#### 17.11.1 Chemical Exposure and Chemical Resistance - Battery Standalone

Not Applicable

#### 17.11.2 Chemical Exposure and Chemical Resistance – Battery in System

While a battery is used in Frenzy system, the battery can be exposed to chemicals listed in Section 2.1.20

#### 17.11.2.1 Chemical Exposure and Chemical Resistance - Battery in Ring Scanner

Please refer to Frenzy Ring Scanner PRD

#### 17.11.2.2 Chemical Exposure and Chemical Resistance - Battery in WT

Please refer to Frenzy WT PRD

#### 17.11.2.3 Chemical Exposure and Chemical Resistance - Battery in Charger Accessories

Please refer to Frenzy Charging Accessories PRD

## 18 Vendor Product Submission

Product submission shall consist of Manufacturing Plan, First Article Inspection, Qualification Testing, and a Production Test Plan. Certificates of Compliances shall be submitted, when appropriate, as evidence of First Article Inspection. Acceptance may be verified by either inspection, analysis (documentation) and / or testing. The battery-pack vendor shall supply both a qualification test plan and test results.

### 18.1 First Article Acceptance

Sample parts from the first production lot shall be inspected for critical dimensions and cosmetic defects including weld gap, weld uniformity, etc. Units are subjected to destructive testing to verify weld strength and internal workmanship.

The vendor shall perform a First Article Inspection verifying all parameters in this specification. The vendor has responsibility to ensure the parts meet the critical dimension criteria, and shall supply Zebra Technologies with a Certificate of Compliance confirming the verification.

### 18.2 Qualification Testing

The battery-pack vendor shall supply a qualification test plan and test data to ensure compliance with the Electrical, Environmental, and Mechanical requirements specified herein. All test results are to be submitted to Zebra Technologies for review and approval prior to production release of the battery-pack.

### 18.3 Production Testing

The battery-pack vendor shall supply a production test plan to Zebra Technologies for review and approval prior to production release of the battery-pack.

At a minimum, the test plan must include:

1) Testing of safety, temperature measurement and data storage electronics
2) End of line Open Circuit Voltage Test
3) End of line Load Test
4) 100% of production material is to be tested as per this test plan

## 19 Additional Vendor Responsibilities

The battery-pack is envisioned as a "turn-key" solution from the selected supplier encompassing cell procurement, tooling design for plastics, battery intelligence and all associated testing. Some battery-pack designs will require development cooperation with Zebra Technologies Engineering.

The supplier shall be responsible for the following:

### 19.1 Technical Development

#### 19.1.1 Engineering Support

The supplier shall provide concurrent engineering support during the prototype and production phases of the program

#### 19.1.2 Technical Reviews

The supplier shall conduct a minimum of three (3) technical reviews at their facility or at Zebra Technologies' facility, as directed by Zebra Technologies. All mechanical and tooling design review material shall be delivered to Zebra Technologies three (3) working days prior to any reviews.

#### 19.1.3 Drawings and Associated Engineering Data

The supplier shall produce and maintain any tool design databases that are necessary to fabricate hardware identical to that developed under the subcontract. Tooling Drawings and databases are the property of Zebra Technologies and are to be maintained by the supplier for the life of the program.

#### 19.1.4 Engineering Data Updates and Revisions

Until documentation delivery, the supplier shall update and maintain engineering data to current engineering, manufacturing and purchasing requirements. After completion of the detailed design review all configuration changes must be approved, in writing and in advance, by Zebra Technologies.

## 19.2 Manufacturing

### 19.2.1 Capacity Analysis

The supplier shall perform a manufacturing capacity analysis, including expected process yields for all process steps, and submit a ramp up plan for the project and maintenance plan for all tools and fixtures.

### 19.2.2 Capability Analysis

A capability study of the production process, tools and fixtures is required. This shall include a detailed review of critical function areas and dimensions, inserts, steel safe areas and tool/fixture life expectancy. An agreement on tolerances shall be mutually established prior to any database release.

### 19.2.3 Documentation Requirements

The supplier shall provide a documented control plan, DFMEA & PFMEA and work or assembly instructions for the production and assembly process.

# 20 Zebra Technologies Supplied Items

Zebra Technologies shall supply this battery-pack specification and a SOW with drawing documentation sufficient to define the functional performance and interface requirements needed for the project. Zebra Technologies shall provide the Vendor with Zebra Technologies Products and hardware necessary to perform all tests and verifications necessary.

# 21 Vendor Deliverables

Upon completion of the design phase of the project the supplier is responsible for, but not limited to, delivery of the following:

1) A complete set of drawings of the plastics, contacts and any other components used on the battery-pack
2) A complete set of assembly drawings of the pack, including 3-D modeling drawings
3) A complete set of schematics, BOM's and Flex circuit and/or PCB artwork, including component placement drawings
4) A detailed set of tooling design drawings and specifications
5) An electronic copy of all drawing data bases
6) One (1) copy of all project notes for Zebra Technologies compass folder
7) First article inspection reports for all parts
8) Copies of all test procedures
9) Copies of all test data taken
10) All programs, software and databases
11) All materials requested in support of Zebra Technologies Product Safety compliance.
12) Others