

# Receiver Toolbox Application for Android™

## 2.1.8 Release

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## Overview

This document comprises the release notes associated with the MPact Receiver Toolbox Application for Android.

These notes are intended as a highlight of the major updates or changes to the code since the prior release and include some additional release history. This document is not a list of software-based features, an archive of every code change, a software test report, or qualification report. This document is provided for information purposes only and is subject to change without notice.

## 1. Current Release Summary

The following are the main details of the current release:

<b>Release Type</b>	<b>Receiver Toolbox Application for Android</b>
<b>FW Number:</b>	<b>Release 2.1.8</b>
<b>Release Date:</b>	<b>July 2023</b>

Highlighted Code Updates: Initial product release

## 2. Hardware Platform Support and Hardware Notes

This application is compatible with Android versions 8 or later:

- The Android device must have the ability to serve as a WiFi hotspot.



- The Android device need not have internet access.
- All applications for access to data and device functions must be accepted.
- This Receiver Toolbox application is intended only for use with Zebra BLE IoT bridges, Beacons and Super Beacons.
- This application is provided as-is and may not be compatible with each hardware and software combination. We only test a sample of hardware devices and suspect not all hardware platforms will be compatible with this application.
- We performed testing with Android 8.1, 9, 10, and 13.

### **3. New/Major Features or Fixes**

This is the initial release and posting of the application.

### **4. Software Installation and Upgrade Instructions**

Zebra support is available for customers with valid support entitlements going back as far as the prior and one before that production release code ("R versions").

Be sure to read and understand the entire Readme.txt file before attempting to install or use the application

#### **Important Note**

**Downloading and installing this software application is your explicit acceptance of the software as-is and your agreement that Zebra is not liable for any damages of any type resulting from installation and / or attempted usage of this application.**

### **6. Usage Notes**

The following pictures show how and when to use the application. Please simply use this software version in place of the one listed in the presentation:



# Zebra's BLE IoT Bridge Bootstrap, Testing and OTA Process With Receiver Toolbox Android Mobile Application

July 2023





## Receiver Toolbox Android Mobile App Capabilities

- Bootstrap “IoT Bridges”, a.k.a. Zebra’s MB5xxx / SB52xx and MB6xxx BLE-to-WiFi devices
- Test End-To-End behaviors of “IoT Bridges”, Zebra Beacons and Superbeacons
- Firmware OTA for “IoT Bridges”





## IoT Bootstrap Process Overview

ZEBRA TECHNOLOGIES



## IoT Bridge Configuration

### The bootstrap process

- The IoT Bridges come from factory “un-configured” (i.e. programmed with the same default config.)

**Question: How do you configure the device with two buttons and two LEDs (no keyboard or screen)...?**

**Answer: You “bootstrap” the device**

- Out-of-the-box bridges have no predefined WiFi network configuration
  - IoT Bridges do not know how to connect to the WiFi network
  - IoT Bridges do not know the SLE / ZLA / MWE / Gateway URL providing beacon filter configuration
  - IoT Bridges do not have the credentials to pull beacon filter configuration
- Bootstrapping is a process where factory defaults are used to configure the IoT Bridges
- The process is the same for both the fixed (MB5xxx / SB52xx) and mobile (MB6xxx) IoT bridges



## IoT Bridge Configuration

### The bootstrap process

- “IoT Bridges” are Zebra’s MB5xxx / SB52xx and MB6xxx BLE-to-WiFi devices
- What is IOT Bridge bootstrapping and why do we need it?
- What information does IOT Bridge gets bootstrapped with?
- How to bootstrap IOT Bridges?
- What happens during IOT Bridge bootstrap process?
- What happens after IOT Bridge is successfully bootstrapped?
- This is work the first time...don’t wait to do this until you need it!





## IoT Bridge Bootstrapping

### IoT Bridge Bootstrapping Process

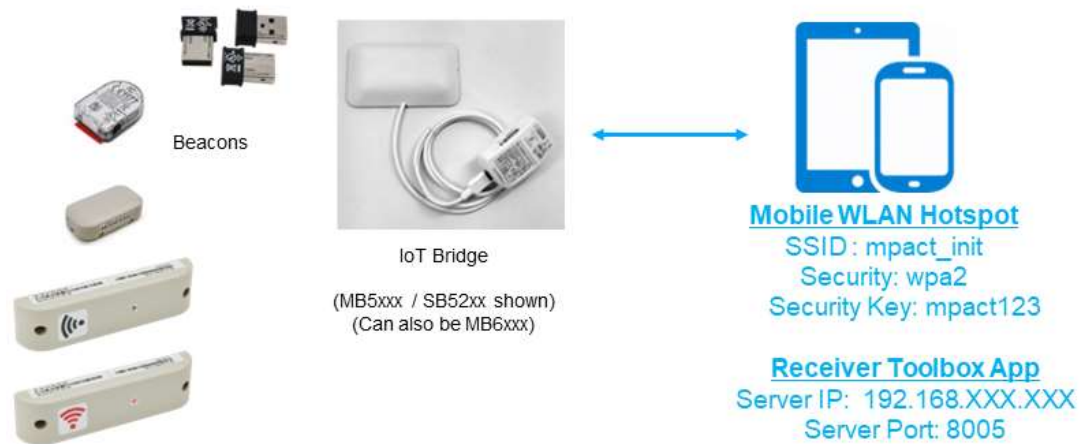
- IoT Bridges validate the bootstrap configuration (badge\_config.json) file
- Store the bootstrap information
- Reboot
- Join the network using the information from badge\_config.json
- Pull the IoT Bridge beacon filter configuration file from server
- Parse and validate the IoT Bridge beacon filter configuration file
- Store beacon filter configuration information
- Start scanning for beacons





# IoT Bootstrap Process Overview

## Bootstrap With Receiver Toolbox Android Mobile Application





## IoT Bootstrap Process Overview

### Bootstrap With Receiver Toolbox Android Mobile Application

- The Receiver Toolbox App works with IoT Bridge with firmware **3.0.0.0-007R** or later.
- The badge\_config.json is hosted in the Android mobile App.
- The “Badge Config” page contains wifi and gateway settings for the file badge\_config.json.
  - The unique username-password pairs based on MAC ID is optional.
- The Receiver Toolbox app takes effect upon loading and runs either in the foreground or background until the application is killed.
- The application gives visible pop-up notifications as well.



## IoT Bootstrap Process Overview

### Bootstrap With Receiver Toolbox Android Mobile Application

- App mode is Bootstrap
- Sample wifi settings in the App
- Sample gateway settings in the App
- Sample JSON config file based on the Badge Config settings

The image displays three screenshots of the Receiver Toolbox v2.1.8 Android application interface. The first screenshot shows the 'App Settings' screen with 'App Mode' set to 'Bootstrap'. The second screenshot shows the 'Wifi Settings' screen with fields for SSID (mpact\_init), Security Key (mpact123), Security Type (wpa2), WPA Enterprise User, WPA Enterprise Password, EAP Type, and WPA Enterprise Outer Identity. The third screenshot shows the 'Badge Config' screen displaying a JSON configuration file. The JSON file contains 'wifiProfiles' and 'gatewayConfigs' sections. The 'wifiProfiles' section defines a profile with SSID 'mpact\_init', security key 'mpact123', security type 'wpa2', and WPA Enterprise settings. The 'gatewayConfigs' section defines a gateway configuration with user 'superuser', password 'mpact123', receiver config URL 'http://192.168.1.100:8005/gateway-client/config/v1/receiver', and config pull frequency in minutes of 10. The app interface includes a bottom navigation bar with 'Setting', 'Badge Conf', 'Data', and 'Logs' tabs, and a top bar with 'SAVE PERMANENT' and 'RELOAD' buttons.

```
{
  "wifiProfiles": [
    {
      "ssid": "mpact_init",
      "securityKey": "mpact123",
      "securityType": "wpa2",
      "wpaEnterpriseUser": "",
      "wpaEnterprisePassword": "",
      "eapType": "",
      "wpaEnterpriseOuterIdentity": "",
      "enable": true
    }
  ],
  "gatewayConfigs": [
    {
      "user": "superuser",
      "password": "mpact123",
      "receiverConfigURL": "http://192.168.1.100:8005/gateway-client/config/v1/receiver",
      "configPullFrequencyInMins": 10,
      "enable": true
    }
  ]
}
```



## IoT Bootstrap Process Overview

### Enable Hotspot in the Android System Settings App

- Enable WiFi Hotspot (required)
  - Go to Settings App
  - Wifi SSID and password are as follow:
    - SSID: mpact\_init
    - Security: WPA2-Personal
    - Password: mpact123





## IoT Bootstrap Process Overview

### Bootstrap with unique username-password pairs based on MAC ID

- This is **optional**, for enterprise networks only
- This info is stored in the Data page
- There is no encryption for the data
- Loading data from file:
  - Copy file EnterpriseUsers.csv to the mobile phone folder /Download
  - User can add/update/delete based on existing data
  - User can add new data
  - User can clear local data
    - The data file /Download/EnterpriseUsers.csv won't be deleted

The image displays three sequential screenshots of the Receiver Toolbox v2.1.8 mobile application interface, illustrating the data management process for IoT bootstrap.

**Screenshot 1 (Left):** The main screen titled "Receiver Toolbox v2.1.8" with an "ADD" button. It lists four entries, each with a MAC ID, User, Password, OuterID, and Description:

MAC ID	User	Password	OuterID	Description
40:83:DE:D9:B6:29	User1	Password1	OuterId1	Description 1
40:83:DE:D9:B6:30	User2	Password2	OuterId2	Description 2
40:83:DE:D9:B6:31	User3	Password3	OuterId3	Description 3
40:83:DE:D9:B6:32	User4	Password4	OuterId4	Description 4

**Screenshot 2 (Middle):** The "Detailed Info" screen for a selected entry (MAC ID: 40:83:DE:D9:B6:29). It shows fields for MacId, WpaEnterpriseUser, User1, WpaEnterprisePassword, Password1, WpaEnterpriseOuterIdentity, OuterId1, Description, and Description 1. Buttons for "ADD/UPDATE" and "DELETE" are visible.

**Screenshot 3 (Right):** The "New Data" screen for adding or updating an entry. It contains input fields for MacId, WpaEnterpriseUser, WpaEnterprisePassword, WpaEnterpriseOuterIdentity, and Description. Buttons for "SAVE" and "CANCEL" are visible.



## IoT Bootstrap Process Overview

### EnterpriseUsers.csv Data File Sample

	A	B	C	D	E
1	MacId	WpaEnterpriseUser	WpaEnterprisePassword	WpaEnterpriseOuterIdentity	Description
2	40:83:DE:D9:B6:29	User1	Password1	OuterId1	Description 1
3	40:83:DE:D9:B6:30	User2	Password2	OuterId2	Description 2
4	40:83:DE:D9:B6:31	User3	Password3	OuterId3	Description 3
5	40:83:DE:D9:B6:32	User4	Password4	OuterId4	Description 4
6	40:83:DE:D9:B6:33	User5	Password5	OuterId5	Description 5
7	40:83:DE:D9:B6:34	User6	Password6	OuterId6	Description 6
8	40:83:de:fe:42:EC	User7	Password7	OuterId7	Description 7

#### Notes:

- Do not change the Row 1 column headers
- You can add as many additional rows as needed
- Do not change txt, font, or cell formatting
- Description column is for reference. It is not used during the bootstrap process





## IoT Bootstrap Process Overview

### Bootstrapping with Android Mobile App

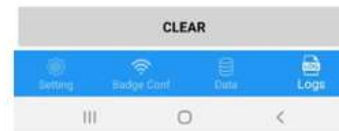
#### Activity Log File

- Captures a record of all major app activity and actions
- Can be used to verify which units were bootstrapped (i.e. pulled the Badge Config file)
- Color codes in the Logs page:
  - **Green**: Successful key message
  - **Red**: Error message
  - **Orange**: Successful special key message
  - **Normal**: Regular info message
- User can copy out the permanent log from the Android device:
  - \Download\ReceiverToolbox.csv
- User can check logs in the app
- User can clear logs in the app
  - The permanent log file won't be deleted



#### Logs in ReceiverToolbox.csv

```
ReceiverToolbox.csv
Timestamp,Action,MAC ID
07/12/23
14:38:40,EnterpriseUsers.csv
does not exist
07/12/23 14:38:57,Loaded 7
records from EnterpriseUsers.csv
07/12/23 14:44:16,Pulled Badge
Config,40:83:DE:D9:B9:F5
07/12/23 14:45:10,Data
Added,78:B8:D6:21:17:8C
07/12/23 14:46:08,Pulled
Specific Badge
Config,78:B8:D6:21:17:8C
```

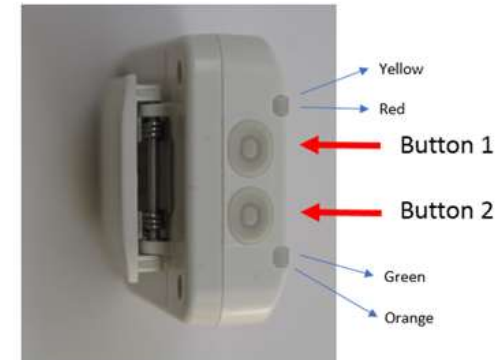




## IoT Bootstrap Process Overview

### Put IoT Bridge in bootstrap mode

- Bootstrap the IoT Bridge with the App
  - Clear the bridges wifi config by long press button 2 for about 35s
  - Wait for the IoT Bridge to reboot to pull the badge configuration
  - All The LEDs blinks when the IoT Bridge is pulling the configuration
  - The IoT Bridge reboots after successful bootstrap process
- Confirm the IoT Bridge is properly configured
  - Check the “Badge Config” message
  - Check the Logs page
  - Check the pop-up message







## IoT Bootstrap Process Overview

### Bootstrapping with Android Mobile App

- The foreground app gives notifications when an IoT Bridge pulls config:
  - Common config
  - Special config based on MAC ID
- Notification shows IoT Bridge's MAC ID
- The same messages are also recorded in the permanent log file ReceiverToolbox.csv

#### Logs in ReceiverToolbox.csv

```
ReceiverToolbox.csv
Timestamp,Action,MAC ID
07/12/23 14:49:23,Pulled
Specific Badge
Config,78:B8:D6:21:17:8C
07/12/23 14:50:37,Pulled Badge
Config,40:83:DE:D9:B9:F5
```





## IoT End-To-End Testing Overview

ZEBRA TECHNOLOGIES



## IoT End-To-End Testing Overview

Demo beacons, bridges and data flows end-to-end

### Easy to configure, demo, & see data flow

- **Requires single Android device with WiFi hotspot**
- **Improved standard BLE toolbox**
  - Configure and manage the BLE beacons
  - Action persistence for SB1100, data log and RF Scanner
  - Works with any Zebra BLE beacon (SB2xxx has own toolbox app)
- **Enhanced Android Bootstrap Application**
  - Easy to use, positive first impression; Can actually “see BLE working”
  - Can be used to confirm BLE hardware is “known good” for troubleshooting
  - Connect to bridge, configure bridge, observe bridge posting beacons
  - Easy demo with SB1100 NFC beacons and MBx000 bridge
- **Demo in less than 4 minutes**



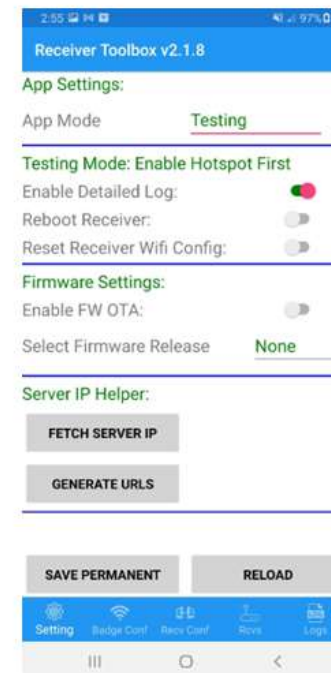
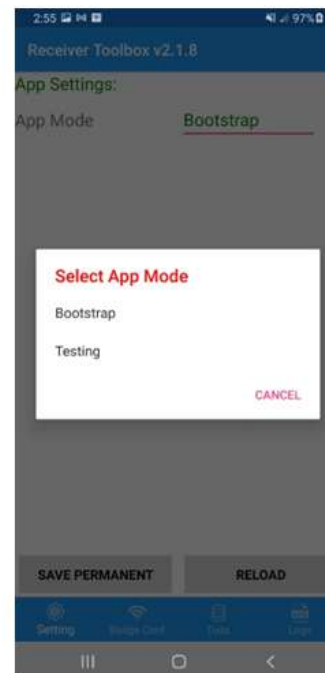
Single, WAN Android Device  
Running Two Zebra Apps



## IoT End-To-End Testing Overview

Select Testing mode in the settings page

- In the App Mode, select Testing
  - Detailed log is enabled by default
  - Reboot and Reset toggles are off by default
  - Firmware OTA option is off by default
  - User can download firmware to the device and select which one to OTA
  - To test IoT bridge behaviors, need enable Hotspot first





## IoT End-To-End Testing Overview

### Enable Hotspot in the Android System Settings App

- Enable Hotspot (Required)
  - Go to Settings App
  - Wifi SSID and password are as follow:
    - SSID: mpact\_init
    - Security: WPA2-Personal
    - Password: mpact123

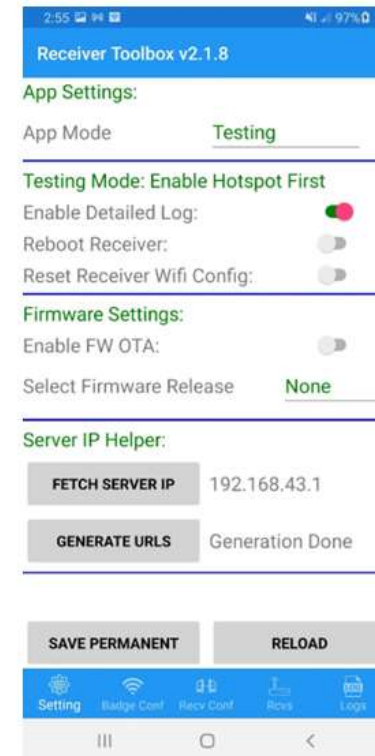




## IoT End-To-End Testing Overview

### Generate IP address for Configs

- Tap “Fetch Server IP” button
  - Make sure it is a valid IP address
- Tap “Generate URLs” button
  - It will update the IP addresses in the badge config and receiver config
- Tap “Save Permanent” to save the settings
- NOTE: If you do not do these steps the app may not operate as expected. You need to fetch the IP and generate the URLs upon opening the app to ensure everything will work





## IoT End-To-End Testing Overview

### Generate IP address for Configs - Continued

- Sample badge config after updating IP address
  - User can always change these fields manually
  - Do not change the “Receiver Config URL”
- Note – The IP address in the “Receiver Config URL” field should be the same with the “Fetch Server IP” result.

Receiver Toolbox v2.1.8

Wifi Settings:

SSID: mpact\_init

Security Key: mpact123

Security Type: wpa2

WPA Enterprise User:

WPA Enterprise Password:

EAP Type:

WPA Enterprise Outer Identity:

Gateway Settings:

User: superuser

Password: mpact123

Receiver Config URL: http://192.168.43.1:8005/getconfig

Config Pull Frequency in Mins: 1

SHOW CONFIG

Badge Config

```
{
  "wifiProfiles": [
    {
      "ssid": "mpact_init",
      "securityKey": "mpact123",
      "securityType": "wpa2",
      "wpaEnterpriseUser": "",
      "wpaEnterprisePassword": "",
      "eapType": "",
      "wpaEnterpriseOuterIdentity": "",
      "enable": true
    }
  ],
  "gatewayConfigs": [
    {
      "user": "superuser",
      "password": "mpact123",
      "receiverConfigURL": "http://192.168.43.1:8005/getconfig",
      "configPullFrequencyInMins": 1,
      "enable": true
    }
  ]
}
```

GO BACK





## IoT End-To-End Testing Overview

### Generate IP address for Configs - Continued

- Note – The “Server IP Address” field should be the same with the “Fetch Server IP” result.
- Sample receiver config after updating IP address
  - User can always change these fields manually
  - For the profile ranging from 1 to 65535, it covers the whole major range
- Hardcoded Zebra UUIDs in receiver config:
  - FE913213-B311-4A42-8C16-47FAEAC938DB
  - FE913213-B311-4A42-8C16-47FAEAC938EF
  - FE913213-B311-4A42-8C16-47FAEAC938CC
  - FE913213-B311-4A42-8C16-47FAEAC938AA

Receiver Toolbox v2.1.8

Receiver Settings:

Scan Interval In Milliseconds  
500

WiFi Transmission Interval  
6

Heartbeat Interval In Seconds  
30

Time Pull Interval In Minutes  
2

Server IP Address  
192.168.43.1

Rssi Low  
-80

Rssi High  
-30

Profile Low  
1

Profile High  
65535

Suppress Repeats  
True

SHOW CONFIG

Receiver Config

```
{
  "scanIntervalInMilliseconds": 500,
  "wifiTransmissionInterval": 6,
  "heartbeatIntervalInSeconds": 30,
  "timePullIntervalInMinutes": 2,
  "beaconProcessList": [
    {
      "uuid":
        "FE913213-B311-4A42-8C16-47FAEAC938CC",
      "type": "impact"
    },
    {
      "uuid":
        "FE913213-B311-4A42-8C16-47FAEAC938DB",
      "type": "impact"
    },
    {
      "uuid":
        "FE913213-B311-4A42-8C16-47FAEAC938EF",
      "type": "ibeacon"
    },
    {
      "uuid":
        "FE913213-B311-4A42-8C16-47FAEAC938AA",
      "type": "impact"
    }
  ],
  "profiles": [
    {
      "name": "Asset Beacons",
      "profileLow": 1,
      "profileHigh": 65535,
    }
  ]
}
```

GO BACK



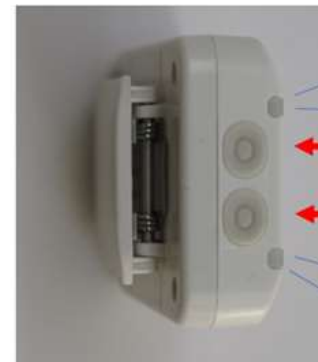


## IoT End-To-End Testing Overview

### Bootstrap the IoT Bridge

- Bootstrap the IoT Bridge with the App
  - Clear the bridges wifi config by long press button 2 for about 35s
  - Wait for the IoT Bridge to reboot to pull badge configuration
  - Wait for the IoT Bridge to reboot to pull receiver configuration
- Confirm the IoT Bridge is properly configured
  - Check the “Badge Config” message
  - Check the “Receiver Config” message
  - Check the Logs page
  - Check the pop-up message

BUTTON 2



Yellow  
Red  
Button  
Button  
Green  
Orange

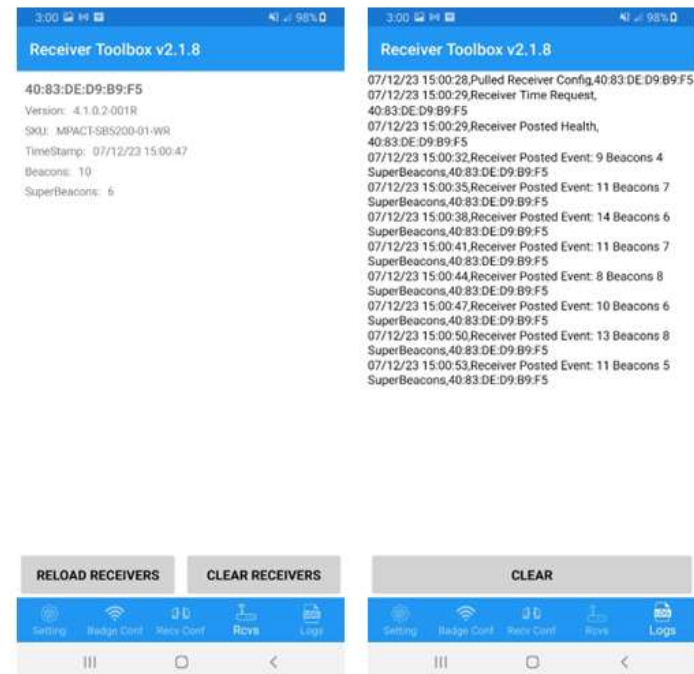




## IoT End-To-End Testing Overview

### Wait for the IoT Bridge to post

- Check the Logs page for event posts and health posts
- Check the Receivers page for the summary of receivers

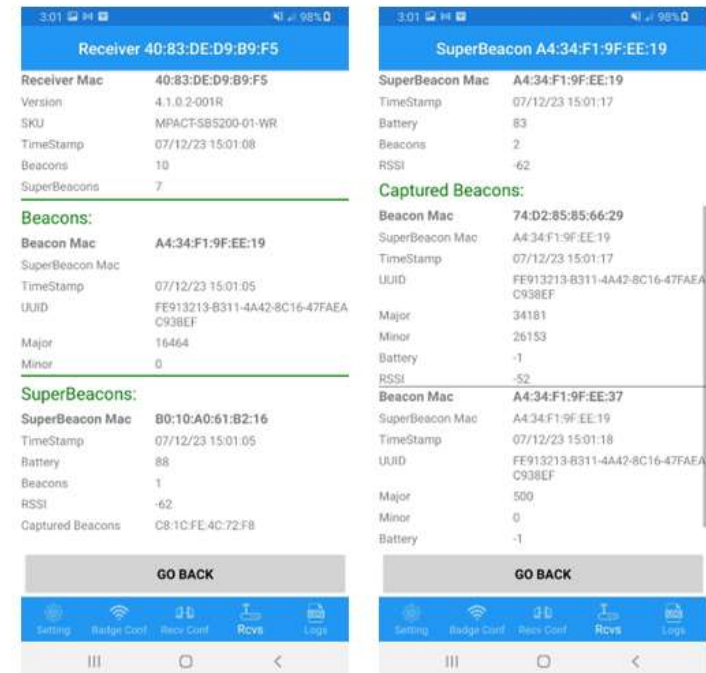




## IoT End-To-End Testing Overview

Explore the detailed info of the receiver, beacons, Superbeacons

- Tap the receiver field to show the receiver details (can be one or more receivers)
- Check the Receivers page for the summary of receivers (including FW version)
- Touch and roll/scroll up and down to show detailed beacons info
- Tap the Superbeacon field to show the detailed Super beacon info (if super beacons are used)





## IoT Firmware OTA Overview

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## IoT Firmware OTA Overview

### Prepare firmware release files in the mobile device

- Prepare the firmware release files and folders on the Android Device
  - Get the firmware release files from Zebra
  - Create a “firmware” folder under the /Download folder
  - Put the firmware files in a folder (i.e. 4.1.0.2-001R), and copy the folder under the /Download/firmware folder
  - Stop the Receiver Toolbox App and restart it to reload the firmware releases
- The images on the right show the directory structure and firmware release files under the firmware release folder 4.1.0.2-001R



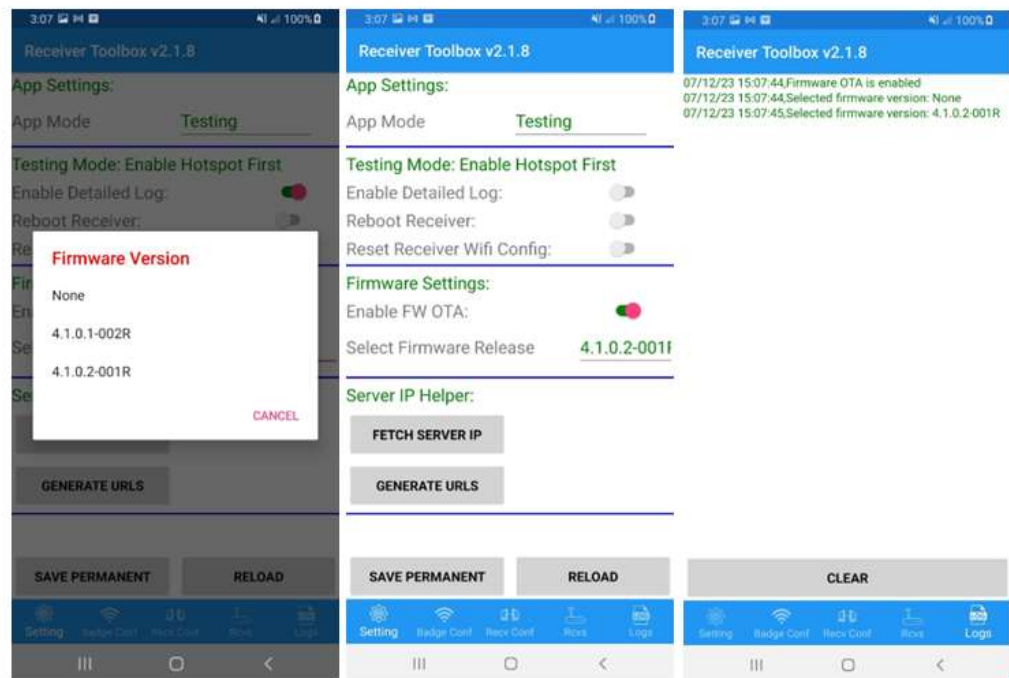
4.1.0.2-001R\_BLE-FIRMWARE\_71B23A9C\_81F25ADD.bin  
4.1.0.2-001R\_BOOTLOADER-HIGH\_43C11D8E\_EC7EEE38.bin  
4.1.0.2-001R\_GE-MB5000-01-WR-HIGH\_218CAB61\_785C7125.elf  
4.1.0.2-001R\_MPACT-MB5000-01-WR-HIGH\_FC746FE8\_23E33023.elf  
4.1.0.2-001R\_MPACT-MB6000-01-WR-HIGH\_553D7D82\_75A5151E.elf  
4.1.0.2-001R\_MPACT-SB5200-01-WR-HIGH\_7FEE2165\_1A352CA9.elf  
4.1.0.2-001R\_WIFI-FW\_D4824FE8\_4A30605F.bin



## IoT Firmware OTA Overview

### Enable firmware OTA in the Setting page

- Turn on the “Enable FW OTA” switch
  - Option to turn off the “Enable Detailed Log” switch to show only OTA related log messages
- Select the firmware release for OTA
- The Logs page show the selected firmware release as well



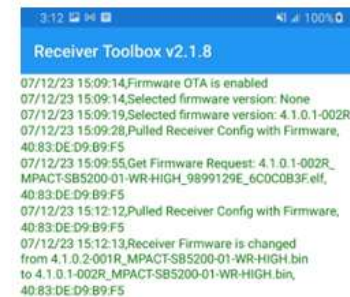




## IoT Firmware OTA Overview

### Wait for the IoT Bridge to OTA

- The IoT Bridge should go into firmware OTA mode in a few minutes
  - The IoT Bridge blinks all LEDs when downloading the firmware files
  - The IoT Bridge's LEDs are constantly ON when upgrading the firmware
- Monitor the Logs page for the processes
  - The log messages show the OTA steps
  - There is a log message shows the IoT Bridge upgrades from an old release to a new one

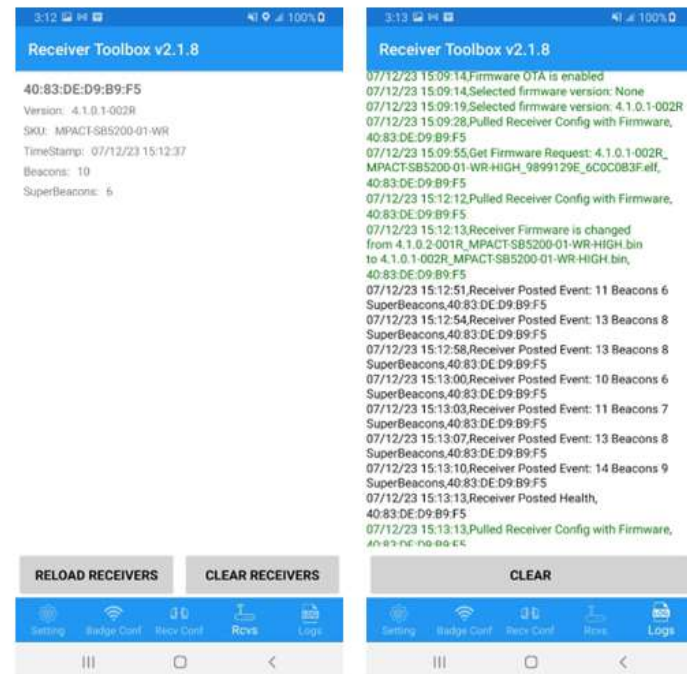




## IoT Firmware OTA Overview

### Verify the IoT Bridge new firmware version

- Verify the IoT Bridge's new firmware version
  - Check in the Receivers page
  - Check in the Logs page
- Verify the IoT Bridge is posting beacon and health events
  - Check in the Receivers page
  - Check in the Logs page (Need turn on the “Enable Detailed Log” switch)
- Note – You must have beacons broadcasting to get beacon posts.







## Receiver Toolbox Troubleshooting

### Some suggestions

- The assumption is that the app is loaded and you're able to open and start it.
- The demo is simply not working ?
  - Is the BLE radio on, is the WiFi hotspot on, is the hotspot configured correctly, did you fetch the IP address and generate the service URLs, did you select Testing mode?
  - Are you sure the beacons are configured correctly and broadcasting – confirm their configuration and operation using the RF Receiver mode and log using the Enhanced Toolbox application.
  - Is the bridge getting power? Do the LEDs flash when the USB cable is inserted?
- The bridge is not getting bootstrapped
  - Ensure the bridge has USB power
  - Ensure the bridge is in factory defaults mode by resetting its wifi config with button 2
  - Did the bridge connect to hotspot and pull the bootstrap config? Check the LEDs and view the log



## Receiver Toolbox Troubleshooting

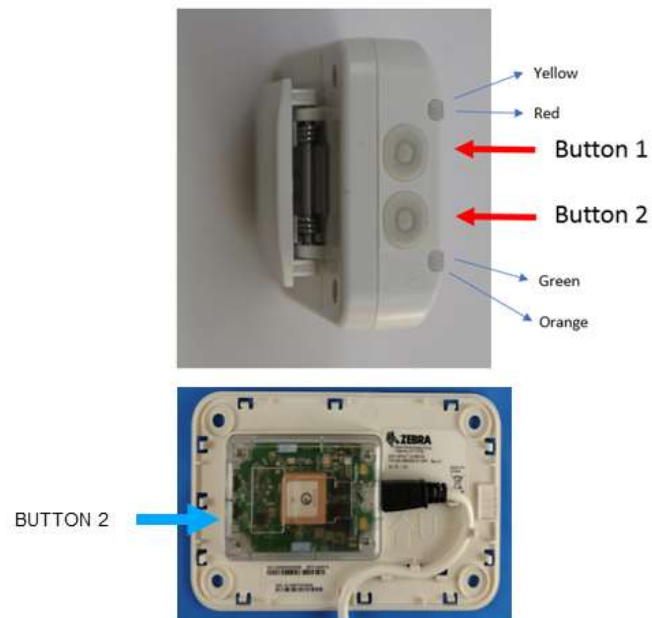
### Some suggestions

- Observe the LED patterns for information on the unit state and action.
  - All LEDs blink a few times on bootup
  - The yellow LED is constantly ON when the bridge is trying to connect to wifi / hotspot
  - After the bridge connects to wifi / hotspot, all the LEDs blink when the bridge is trying to bootstrap
  - The red LED blinks 6 times if the bridge can't talk to server, during both bootstrap and End-To-End testing



## GENERAL BOOTSTRAP PROCESS DETAILS

### Buttons, Button pushes and Re-Bootstrapping



#### Button 2 – Restart, Off, Factory Default

- Hold for 10-20 seconds (reboot)
- Hold for 20-30 seconds (switch off, all LEDs blink after 20 seconds)
- Hold for 30-40 seconds (restore to factory default, reboot automatically)



## BOOTSTRAP PROCESS DETAILS

### Special characters usage in badge\_config.json

Special and control characters must be denoted by escaping them.

Special Character	Character	Escaped Notation
Quotation mark	"	\ " (the \ is added in front of the ")
Backslash or Reverse Solidus	\	\\
Forward slash or Solidus	/	\/
Backspace	\b	\\b
Form feed	\f	\\f
New line	\n	\\n
Carriage return	\r	\\r
Horizontal tab	\t	\\t

## Special characters usage in badge\_config.json ...

- Bootstrap Configuration information can get complicated and confusing with special characters.
- Things To **Avoid**
  - Do not have single quotes and double quotes next to one another (`"'\"'`")
  - Do not have sequence of forward and backward slashes together (`"\\\"//\""`)
  - Do not have sequence of double quotes (`"\"\"\"\""`)
  - Do not have sequence of spaces (`" "`)
  - Do not have spaces, tabs and carriage returns together (`" \r\t "`)
- **BEST PRACTICE:** Always verify JSON strings in a tool such as <https://jsonlint.com>





## BOOTSTRAP PROCESS DETAILS

### Sample special characters in password

Sample Un-Escaped Password (“incorrect”)

```
5>/NK5MogOc6lrt}m3\.:dN/rbR:zzpylGy5niZqVh"A~W5.h<},2b2?T'?w'Xf2
```

Fully Escaped Sample Password (“correct”)

```
5>/NK5MogOc6lrt}m3\\.:dN/rbR:zzpylGy5niZqVh"A~W5.h<},2b2?T'?w'Xf2
```

Added the “\” in front the special characters to “escape” them.

Escaping makes the password valid as intended





Thanks...



## **7. Technical Publications**

Please refer to the Manuals portion of the Zebra Bluetooth Low Energy (BLE) Devices Support section under the Location Solutions portion of the Support and Downloads tab of Zebra.com for the associated user guide, Schema document and other technical publications to help with the configuration and operation of the IoT Bridges

**--- END ---**

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