



# Sprint<sup>®</sup> Magic Box TREBL

In partnership with



## Design Requirements Document

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# Table of Contents

|           |   |           |
|-----------|---|-----------|
| <b>1.</b> | <b>Document overview</b>                | <b>5</b>  |
| 1.1.      | Abstract                                | 5         |
| 1.2.      | Security and proprietary information    | 5         |
| <b>2.</b> | <b>Physical Design</b>                  | <b>5</b>  |
| <b>3.</b> | <b>Hardware Specification</b>           | <b>5</b>  |
| <b>4.</b> | <b>Installation</b>                     | <b>10</b> |
| 4.1       | Unpacking and Checking the unit         | 10        |
| 4.2       | Finding the Best Location               | 10        |
| 4.3       | Initial Setup                           | 10        |
| <b>5.</b> | <b>Configuration</b>                    | <b>12</b> |
| 5.1       | LTE Installation:                       | 12        |
| 5.1.1     | Installation Sequence                   | 12        |
| 5.1.2     | Successful Installation                 | 12        |
| 5.1.3     | Failed Installation                     | 12        |
| <b>6.</b> | <b>Sprint TREBL Companion App Flow:</b> | <b>13</b> |
| 6.1       | Launch Screen :                         | 13        |
| 6.2       | On Boarding Flow                        | 13        |
| 6.2.1     | Welcome Screen :                        | 14        |
| 6.2.2     | Sound by Harman/Kardon:                 | 14        |
| 6.2.3     | Integrated with Alexa:                  | 14        |
| 6.2.4     | Know Your Device:                       | 14        |
| 6.3       | Terms and Conditions Screen:            | 14        |
| 6.4       | Connection Flow                         | 15        |
| 6.4.1     | Let's Connect:                          | 15        |
| 6.4.2     | Setup Mode On:                          | 16        |
| 6.4.3     | TREBL Connection:                       | 16        |
| 6.5       | AP Connection:                          | 16        |
| 6.6       | Device connection Status:               | 16        |
| 6.7       | LTE Installation                        | 17        |
| 6.7.1     | LTE Installation progress               | 17        |
| 6.7.2     | Installation Failed :                   | 18        |
| 6.8       | Network Setting                         | 18        |
| 6.9       | Dashboard Mockup Screen:                | 20        |
| 6.10      | DashBoard                               | 21        |
| 6.11      | Menu                                    | 21        |
| 6.11.1    | Dashboard                               | 22        |
| 6.11.2    | MY TREBL                                | 22        |
| 6.11.3    | Network Setting                         | 23        |

|            |   |           |
|------------|---|-----------|
| 6.11.4     | Notification                                | 23        |
| 6.11.5     | Amazon Alexa                                | 24        |
| 6.11.6     | Help  | 24        |
| 6.11.7     | About                                       | 25        |
| <b>7.</b>  | <b><i>Warning and Cautions</i></b>          | <b>26</b> |
| 7.1        | Human Exposure to Radio Frequencies         | 26        |
| 7.2        | Radio Interference                          | 26        |
| 7.3        | Modifications                               | 26        |
| 7.4        | General                                     | 26        |
| 7.5        | Important Safety Instructions               | 26        |
| 7.6        | Safety                                      | 26        |
| 7.7        | Service Information                         | 27        |
| 7.8        | UL Information                              | 27        |
| <b>8.</b>  | <b><i>FCC Notice</i></b>                    | <b>28</b> |
| 8.1        | Federal Communication Commission Notice     | 28        |
| 8.2        | Radiation Exposure Statement:               | 28        |
| <b>9.</b>  | <b><i>Maximum Output TX Total Power</i></b> | <b>29</b> |
| <b>10.</b> | <b><i>Power Consumption</i></b>             | <b>30</b> |
| <b>11.</b> | <b><i>Customer Care Help Desk</i></b>       | <b>31</b> |
| <b>12.</b> | <b><i>Management</i></b>                    | <b>32</b> |
| 12.1       | eSIM Card                                   | 32        |
| <b>13.</b> | <b><i>Hardware Security</i></b>             | <b>33</b> |
| 13.1       | Factory Generation of Device Key            | 33        |
| 13.2       | eSIM  | 33        |

# 1. Document overview

## 1.1. Abstract

This purpose of this document is to define the overall Product requirements and design of Sprint’s MagixBox TREBL. This document is meant for Harman, Sercomm and Sprint Internal Teams to understand the Product implementation and requirements and execute them accordingly.

## 1.2. Security and proprietary information

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# 2. Physical Design

Physical dimensions are as follows:

- H X W X D = 205.99 mm X 199.87 mm X 199.87 mm
- Weight: ~4.5 Kgs.



# 3. Hardware Specification

The table below lists the MagixBox TREBL’s hardware specifications as well as the supported 3GPP specifications.

Table 3-1: Hardware Specifications

| Category   | Specification  |
|--|--|
| <b>Buttons</b><br><br>Note: Buttons will be back lit and will have laser-engraving underneath the top surface. | Button - 1: Amazon Action button,<br>- Long Press will take initiate “Setup mode”,<br><br>- Normal Press will initiate Alexa “listening mode”, when Alexa is configured and MagicBox is connected to internet,<br><br>- Normal press will announce “Magic Box is not connected to internet, Use companion app to configure MagicBox”, when MagicBox is not connected to internet |
|  | Button - 2: Microphone mute  |
|  | Button - 3: Volume up  |
|  | Button - 4: Volume down, Long Press will mute speaker  |
|  | Button – 5: Bluetooth button, Long Press will initiate Bluetooth pairing   |
|  | Hard Reset: Pin hole reset, trigger factory reset for all modules including audio and LTE. Sercomm to provide API to Artik board on press of reset.  |
| <b>LED</b>   | LED strip of 5 lights: Used for visual notification<br>• Power Cell<br>• Femto Cell<br>• UE/Relay backhaul<br>• Wi-Fi<br>• Voice Assistant   |
| <b>Power</b>   | <b>Input</b>   |
|  | Power Adapter: 110V-AC   |
|  | Magic Box+: 12V - 7A DC  |
|  | Power Adapter is labeled   |
|  | Power Adapter to have LED indication for power status.   |
|  | <b>Cord</b>  |
|  | 10 feet long   |
|  | Black color  |
|  | No Sprint branding on cord   |
| Power Supply cord from HK MB connector to power supply is between 3 and 5 feet                                 |  |
| <b>Environment</b>   | Operating: Ambient Temperature Range:<br>-5 Degree C to +40 Degree C of operation  |
|  | Storage should be -10 to +45 Degree C  |
|  | Resistant from External Ice Formation, Ingress of Dust and Ingress of Water: IP 54 rated   |
| <b>Dimensions</b>  | Weight of Box: 3 KG (approx)   |
|  | Volume: 8.24 Liters (approx.)  |
| <b>Antenna</b>   | Magic Box will contain 15 antenna serving various purpose, details are mentioned in Antenna Specifications   |
| <b>Bluetooth</b>   | Bluetooth 4.2 (BLE + Classic)  |

|               |  |
|---------------|--|
| Zigbee        | No of Antenna: 1<br>Type: Dipole<br>Material: PCB<br>Frequency range: 2400 - 2500 MHz<br>ZigBee (802.15.4)   |
| SIM card      | <b>Lab:</b>  |
|               | LAB/NRT devices will have 3FF removable UICC slots to use lab specific UICCs   |
|               | <b>Production:</b> MFF2 SIM (soldered) for production  |
| MAC Address   | Single MAC address for the complete board  |
| Serial Number | SN rule: C+XX(Product ID) +YYMM(2 digits Year+2 digits Month)+nnnnn (5 digits incremental hex number)<br><br><b>Product ID for MagicBox: C88</b><br>Ex: C88180612345 |
| System        | MB GPS will process AGPS data from Sprint provided file server   |
|               | Device will do Plug and Play and receive new configuration at every Power Cycle, including the case where a device moves between power cycles                        |
|               | Device has a System Watchdog Timer<br>Software + Hard ware   |
|               | Disabled unused access ports   |
|               | FCC Approved   |

### LTE Femto Specification

The following table lists the LTE Femto specifications:

| Category             | Specification   |
|----------------------|---|
| Chipset Info         | FSM9016 + FTR8930 + DDR3L1GB + AR8033                               |
| Transmit Power       | 2x 21dBm Max Indoor LTE Sector Tx Power                             |
| Antenna Gain (Femto) | Band 41 Indoor Antenna Gain: $\geq 5\text{dBi}$                     |
| Tx Range             | eNB Tx Dynamic Range: $\geq 26\text{dB}$                            |
| Tx Emissions         | eNB Spurious Emissions: meet Category B as defined in 3GPP TS36.104 |
| Rx Sensitivity       | eNB Rx Sensitivity: meets Local Area as per TS36.104                |
| Rx Selectivity       | eNB Adjacent Channel Selectivity (ACL): as per TS36.104             |
| Frequency Accuracy   | +/-0.1ppm eNB Frequency Accuracy                                    |
| UE category          | Support for UE Category up to 4                                     |
| Bandwidth            | Bandwidth support Single channel, B41, 10/15/20MHz                  |
| Transmission Mode    | Transmission Mode 3, 4  |

|                                  |  |
|----------------------------------|--|
| Frame Type                       | TDD Frame Configuration 1 (DL: UL 60:40) |
|                                  | TDD Frame Configuration 2 (DL: UL 80:20) |
|                                  | Special Sub-Frame 7                      |
| Error Control                    | HARQ                                     |
| Channel quality                  | Enhanced Link Adaptation                 |
| Handover                         | S1 Seamless Handover                     |
|                                  | X2 Seamless Handover                     |
|                                  | Lossless Handover (Packet Forwarding)    |
| RLC Mode                         | RLC-AM                                   |
|                                  | RLC-UM                                   |
|                                  | RLC-TM                                   |
| Sync                             | Sync from GPS                            |
|                                  | Sync from Network Listen                 |
| LTE security                     | AES Integrity Protection                 |
|                                  | SNOW3G Integrity Protection              |
|                                  | IPSEC                                    |
|                                  | CMPv2                                    |
| LTE Network Planning             | Soft Frequency Reuse (SFR) / Static ICIC |
|                                  | PLMN Support (up to six)                 |
|                                  | Handover Restriction List (HRL)          |
|                                  | Multi Frequency Band Indicator (MFBI)    |
| Quality of Service               | DSCP Marking                             |
| Public Warning System            | Public Warning System (PWS) Support      |
| S1-AP Procedure                  | S1 Reset                                 |
|                                  | Location Reporting                       |
|                                  | S1-Flex                                  |
| Internet Protocol (IP) addresses | IPv6                                     |
| Legacy network support           | CSFB to 1x (R8)                          |
| VoLTE                            | VoLTE: RoHC                              |
|                                  | VoLTE: Signaling Prioritization          |
|                                  | VoLTE: Emergency Call Support & eCID     |
|                                  | VoLTE: Short PDCP                        |
|                                  | VoLTE: 16 VoLTE users                    |
| Congestion control               | Access Class Barring                     |
| NS Signaling                     | NS Signaling NS-01                       |
|                                  | NS Signaling NS-04                       |
| Event Type                       | A1 Events                                |
|                                  | A2 Events                                |
|                                  | A3 Events                                |
|                                  | A4 Events                                |
|                                  | A5 Events                                |



|                                |                                |
|--------------------------------|--------------------------------|
| Internet Protocol (IP) support | IPv4 Support                   |
|                                | IPv6 Support                   |
| Max UE's                       | 16 active UEs                  |
| Antenna Gain                   | WiFi Antenna Gain: $\geq 2$ dB |
|                                | GPS Antenna Gain: $\geq 2$ dB  |
| Receiver GPS                   | GPS Receiver as per spec       |
| X2 AP procedure                | Load information over X2       |
| Congestion control             | Load based scheduling          |

### LTE Relay Specification

The following table lists the LTE relay specifications:

| Category                 | Specifications  |
|--------------------------|---|
| SIM Card                 | Standard SIM Card (3FF) for Lab and MFF2 for production |
| Chipset Info             | GDM7243A + GRF7243A + QCA8337                           |
| Band support:            | B41 Low (2500MHz-2600MHz)                               |
| TDD: 41                  | B41 High (2620MHz-2690MHz)                              |
| FDD: 25                  | B25 (UL:1850Mhz-1915Mhz; DL:1930Mhz-1995Mhz)            |
| TX Power                 | B41:23dBm   |
|                          | B25:20dBm   |
| Antenna Gain (UE)        | B41: 4dBi   |
|                          | B25: 6dBi   |
| Modulation               | UL: QPSK, 16QAM, 64QAM                                  |
|                          | DL: QPSK, 16QAM, 64QAM, 256QAM                          |
| CA                       | 2CA, B25 any combination, noncontiguous                 |
|                          | 2CA, B41 Low any combination, Contiguous/noncontiguous  |
|                          | 2CA, B41 High any combination, Contiguous/noncontiguous |
|                          | 3CA, B25 any combination, noncontiguous                 |
|                          | 3CA, B41 Low any combination, Contiguous/noncontiguous  |
|                          | 3CA, B41 High any combination, Contiguous/noncontiguous |
| MIMO                     | 4x2 DL MIMO   |
|                          | 4x4 DL MIMO (single carrier support only)               |
|                          | 4x8 DL MIMO   |
|                          | SISO UL   |
|                          | 2/4 TX CDD (UL)   |
| Bandwidth                | 5/10/15/20Mhz   |
| UE category              | 12  |
| 3GPP Release             | R12   |
| Disabled JTAG Interfaces | Yes   |
| Secure Bootable          | Yes   |

|                       |   |
|-----------------------|---|
| IPv6 Support          | Yes   |
| Peak UE DL Throughput | DL=B41/580 Mbit/s , 4CA 256QAM<br>B25/600 Mbit/s (3CA 256QAM) |
| DL Transmission Mode  | DL Transmission Mode 1 -9                                     |
| Frame Type            | Frame Type 1 FDD  |
|                       | Frame Type 2 TDD, 5ms periodicity                             |
| Tx/Rx                 | B41: 4T8R   |
|                       | B25: 2T8R   |
| Scanning              | DeNB Selection and Ranking                                    |
|                       | PDCL --> Donor Selection Algorithm                            |

## 4. Installation

The Sprint TREBL unit is placed on the windowsill to receive the signal from outdoors and boost it indoors. The following steps instruct on the proper positioning and setup of the Sprint Magic Box unit for optimal service.

### 4.1 Unpacking and Checking the unit

- Carefully unpack the Sprint TREBL unit from the box.
- Inspect the unit for any damage and check that all the accessories are in the box.
- Remove the Power Supply (included) from the packaging.

### 4.2 Finding the Best Location

Choose an appropriate window at the suitable side of a building is vital to get the best performance

- The Sprint TREBL has a built-in capability to survey the 4G signal from suitable provider cell towers & also use GPS to accurately determine its location. It can do this for multiple windows in the same or on multiple floors, ideally in all four directions of the building.
- Connect the power supply to the underside of the AU 587 and place it at the 1st window (ideally in the middle of the window).
- Wait for the RF survey to complete
- Go to the next window and repeat the survey process
- Test as many windows as possible in all four directions as possible
- Once you finish testing all locations, select the best location out of all surveyed locations and press "Install Here" in the location

### 4.3 Initial Setup

The Sprint TREBL turns on automatically when the power supply unit is connected to the underside of the unit.

1. Place the Sprint TREBL on a suitable windowsill and verify that the unit's rear side is positioned against the glass as close to the glass as possible (as in the figure 1 below).
2. Shortly the following will be occurred while the unit is starting up.

**VGI Sound:** Your Sprint TREBL is getting Activated  
**LED Pattern:** Sprint TREBL LED shows 'Pulsing white light' pattern

## 5. Configuration

After solid white LED pattern Sprint TREBL is looking for sprint network after find the Sprint network following process start

### 5.1 LTE Installation:

#### 5.1.1 *Installation Sequence*

**VGI Sound:** Sprint TREBL Installation is in progress. Please install the companion app on your mobile or tablet

**LED Pattern:** Solid blue light getting covered up by solid white light with increasing progress

#### 5.1.2 *Successful Installation*

**VGI Sound:** Sprint TREBL setup is complete, to configure Alexa please use the Companion App

**LED Pattern:** Sprint TREBL LED shows 'Solid White light'

#### 5.1.3 *Failed Installation*

**VGI Sound:** Seems there is an error. Please refer the companion app for error code and troubleshooting

**LED Pattern:** Red light blinking twice and then solid red color

If LTE installation is failed user can download the Sprint TREBL companion App from the App store and able to configure Wi-Fi

## 6. Sprint TREBL Companion App Flow:

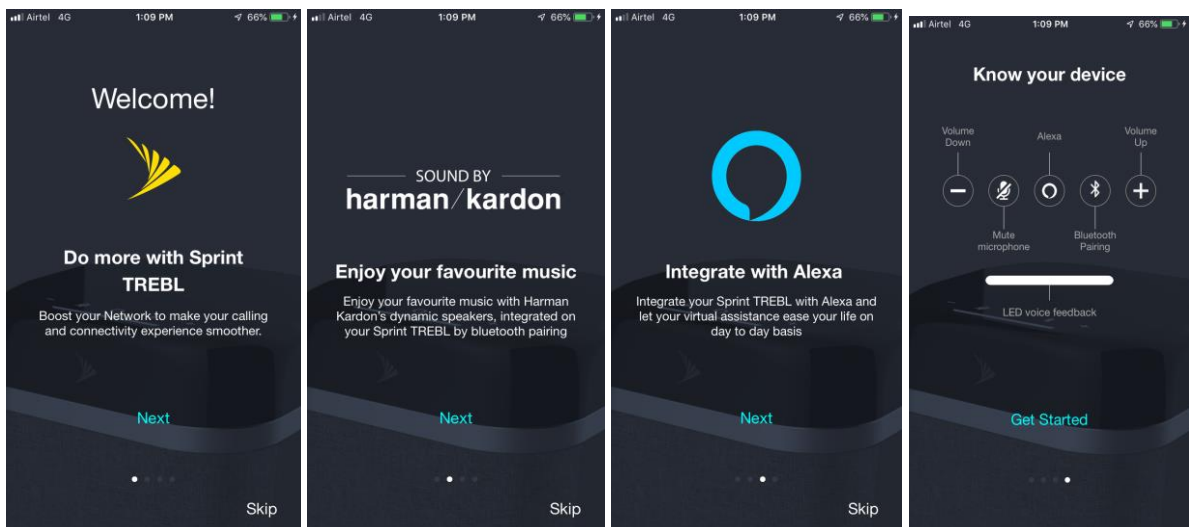
### 6.1 Launch Screen :

Launch screen shows Sprint TREBL Logo while launching the APP. It is the first screen after launch APP and it appears for 2-3 second to user



### 6.2 On Boarding Flow

In On Boarding flow user navigate from below mentioned four screens



### **6.2.1 Welcome Screen :**

Welcome screen appears after launch screen that provide a message to user Sprint TREBL help to boost your network and improve the connectivity experience.

### **6.2.2 Sound by Harman/Kardon:**

After tap on next button in welcome screen or swipe left Sound by Harman/Kardon screen Appears which provide the message to user that Harman Kardon Speaker Integrated in Sprint TREBL and user can enjoy the music after connected from the bluetooth.

### **6.2.3 Integrated with Alexa:**

After tap on next button in Sound by Harman/Kardon screen or swipe left Integrated with Alexa screen Appears which provide the message to user that user can configure Alexa in Sprint TREBL using this companion App.

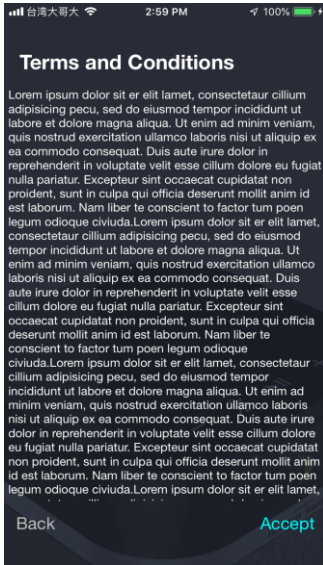
### **6.2.4 Know Your Device:**

After tap on next button in Integrated with Alexa screen or swipe left Know Your Device screen Appears which provide the information of following device buttons to user

- Volume Down
- Mute Micophone
- Alexa
- Bluetooth Pairing
- Volume up

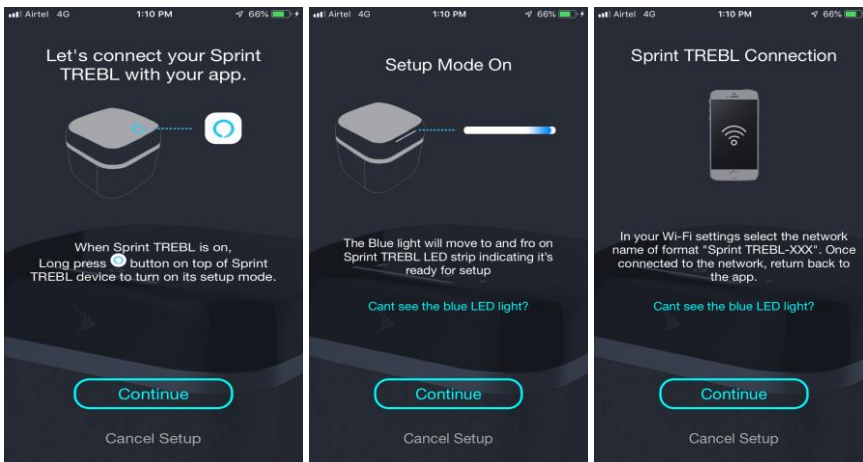
## **6.3 Terms and Conditions Screen:**

After tap on Get Started Button on Know your device Screen Terms and Conditions Screen Appears to user which shows all terms and conditions of using companion App



## 6.4 Connection Flow

After accepting Terms and condition user enter on the connection flow to connect Sprint TREBL to companion App



### Connection Flow to Connect Sprint TREBL

Connection flow user navigate from three screen

#### 6.4.1 **Let's Connect:**

This Screen provide the message to user how to enable setup mode by long press Alexa button in Sprint TREBL

### 6.4.2 Setup Mode On:

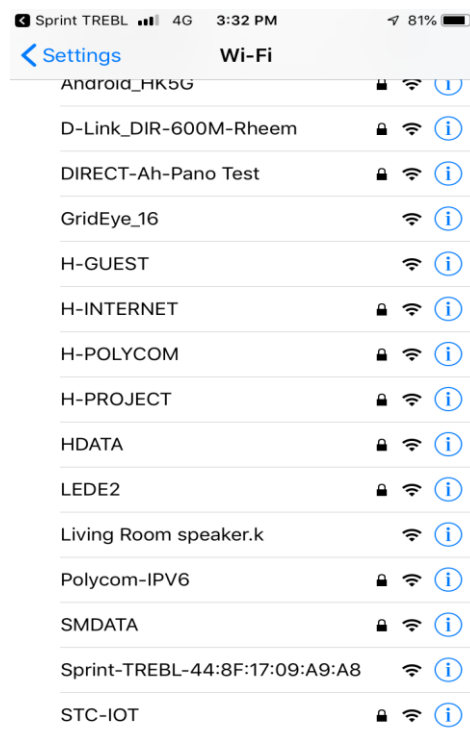
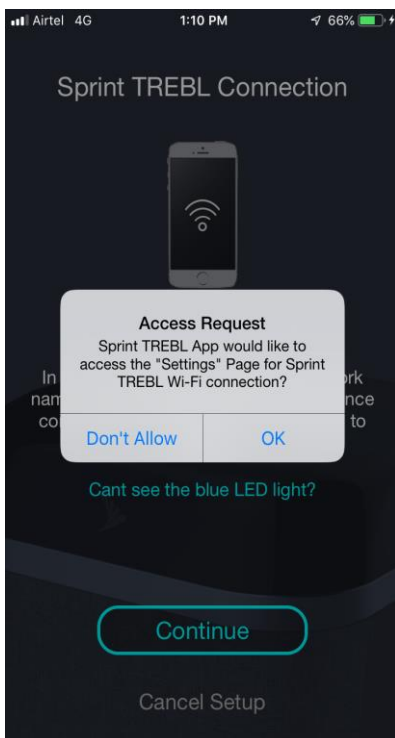
After tap on continue button user navigate to Setup Mode on Screen which provide a message to user how to identify that the setup mode is enable or not by checking to and fro motion of blue light.

### 6.4.3 TREBL Connection:

After tap on continue button of Setup Mode On Screen user navigate to TREBL Connection Screen which provide the SSID (HK TREBL-XXX) information of Sprint TREBL to user so user can identify Sprint TREBL in Wi-Fi List.

### 6.5 AP Connection:

After connection flow user needs to connect Sprint TREBL Wi-Fi from the Wi-Fi list and navigate back in App



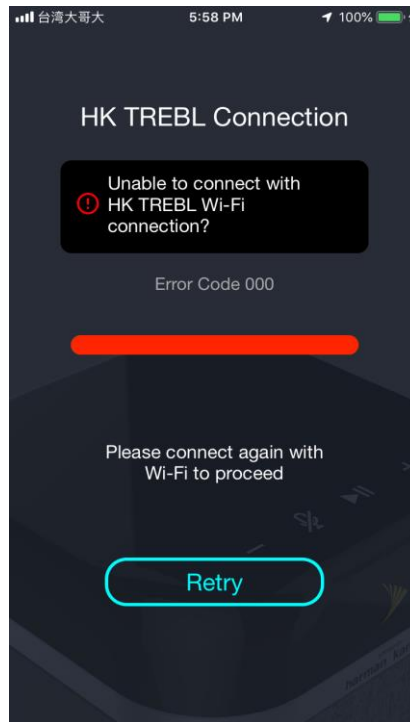
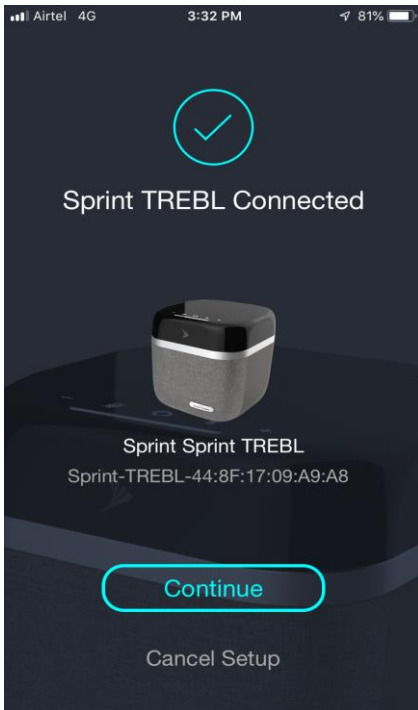
### 6.6 Device connection Status:

After connecting Sprint TREBL AP mode while user navigate back to App Device connection status screens provides connection status (connected / Failure)

1. Successfully Connected

2 . Connection Failure

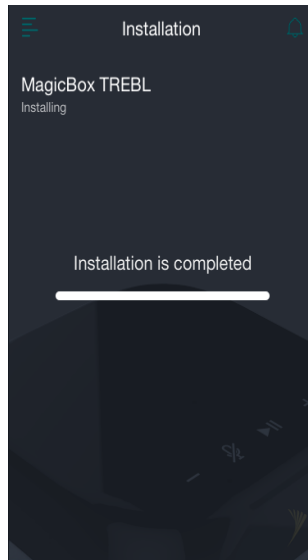
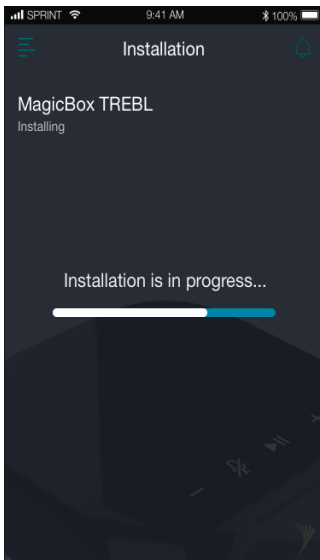




## 6.7 LTE Installation

### 6.7.1 LTE Installation progress

After tap on Continue button in device connected screen. App check first the LTE installation status if it is less than 100 so user navigate to installation screen that show the progress for LTE Insatallion in Sprint TREBL

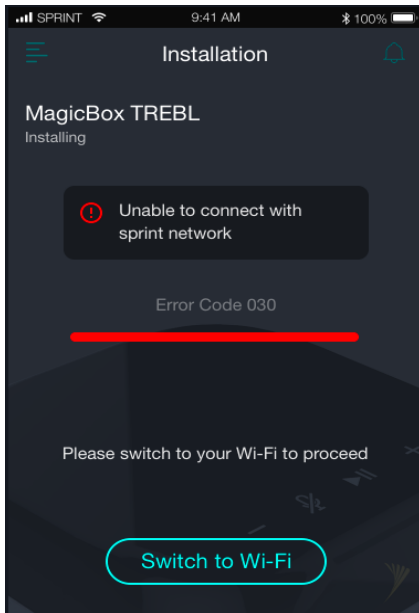


## Installation in progress

## Installation Complete

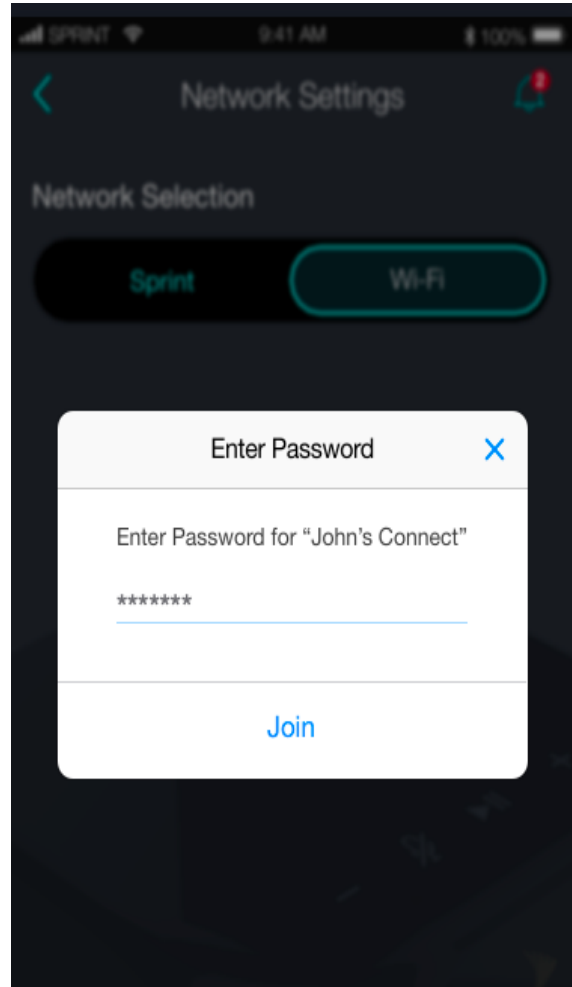
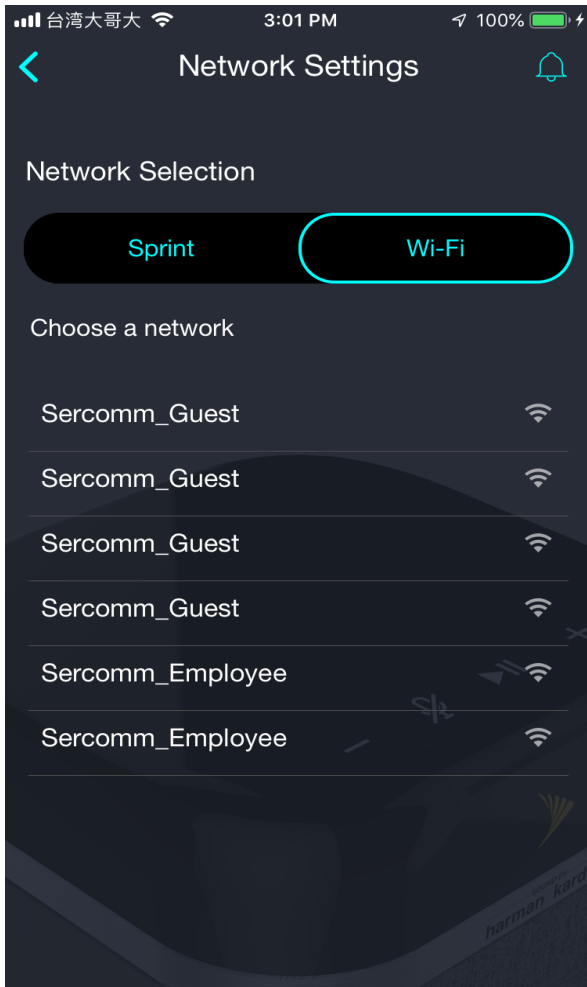
### 6.7.2 *Installation Failed :*

if any issue occurred during installation user navigate to installation failed Screen.

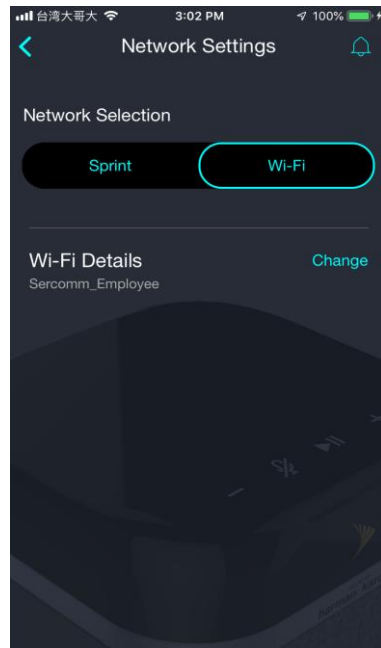
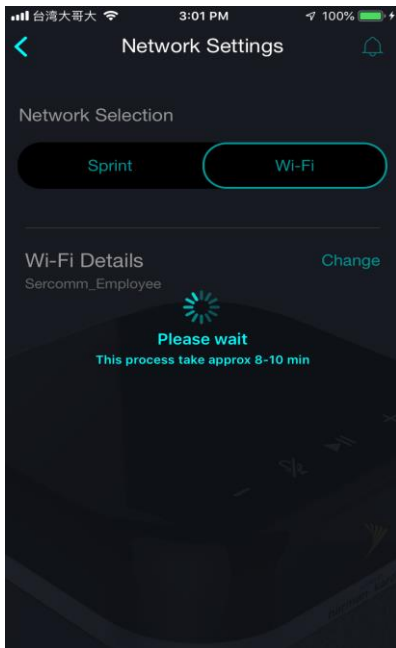


## 6.8 Network Setting

After installation Failed user have option to configure Wi-Fi and when user tap on switch to Wi-Fi option in Installation failed screen user navigate to network setting screen

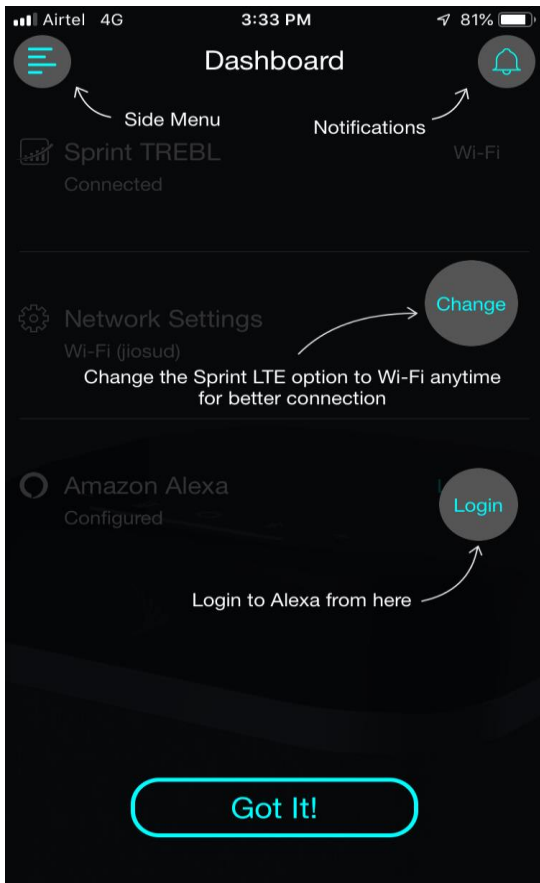


When user select any Wi-Fi . user need to enter password if the Wi-Fi is protected, for open Wi-Fi it configure directly and after successful Wi-Fi configurartion. user navigate to Alexa entry screen which is option to user configure Alexa .



**6.9 Dashboard Mockup Screen:**

If user don't want alexa configuration now after tapping back button its re direct to Dashboard Mock up Screen



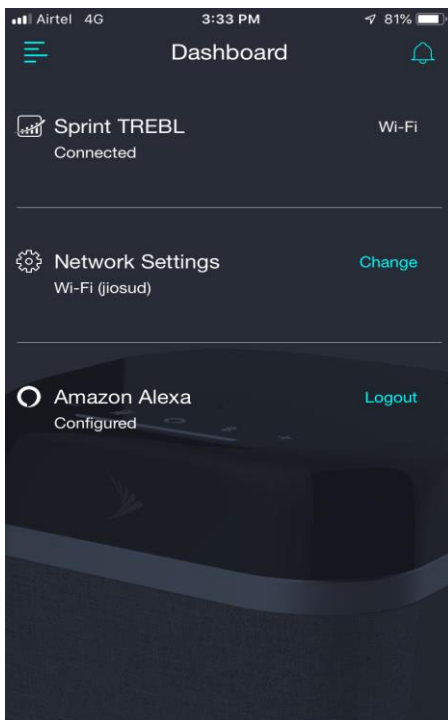
Mockup screen provide the information of for following Dashboard button functions .

- Side menu
- Notifiaction
- Change
- Login

### 6.10 DashBoard

When user tap on got it button on Mock screen Dashboard appears. Which provide the following status of Sprint TREBL

- TREBL Connection Status
- Network Setting option
- Amazon Alexa

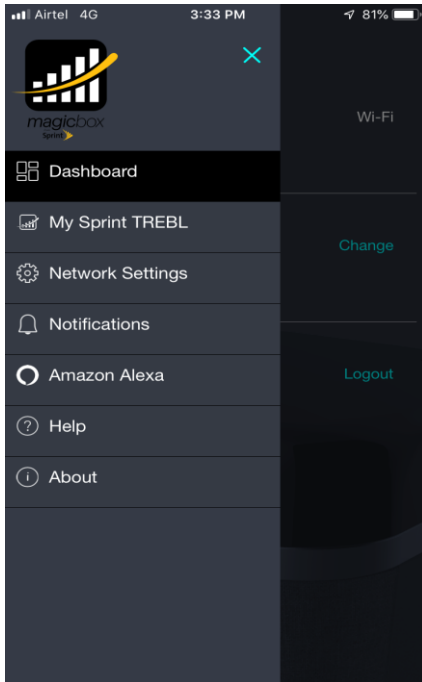


### 6.11 Menu

When user tap on hamburger icon it show s menu with following options

- Dashboard
- My TREBL
- Network Settings
- Notification
- Amazon Alexa

- Help About



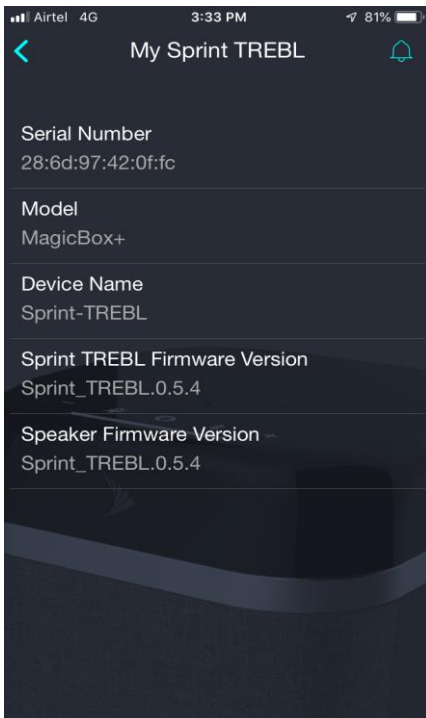
### 6.11.1 **Dashboard**

When user tap on Dashboard it re- direct to Dashboard screen. this option is selected by Default

### 6.11.2 **MY TREBL**

When user tap on My TREBL option it navigates to MY TREBL screen which contains following information of configured sprint TREBL

- Serial Number
- Model
- Device Name
- TREBL firmware version
- Speaker firmware version

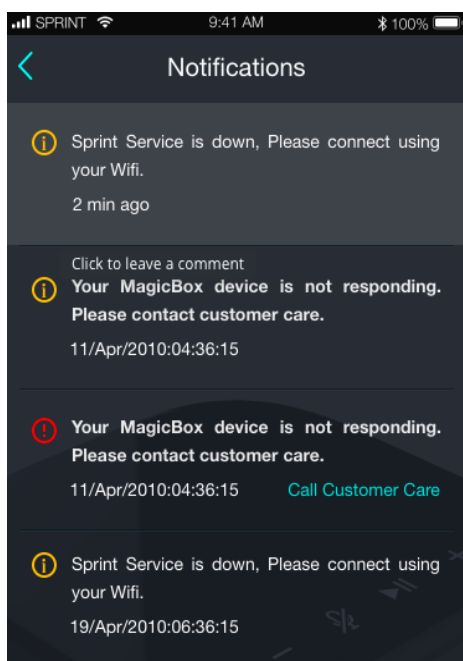


### 6.11.3 Network Setting

When user tap on Network setting it re direct to Network Setting screen

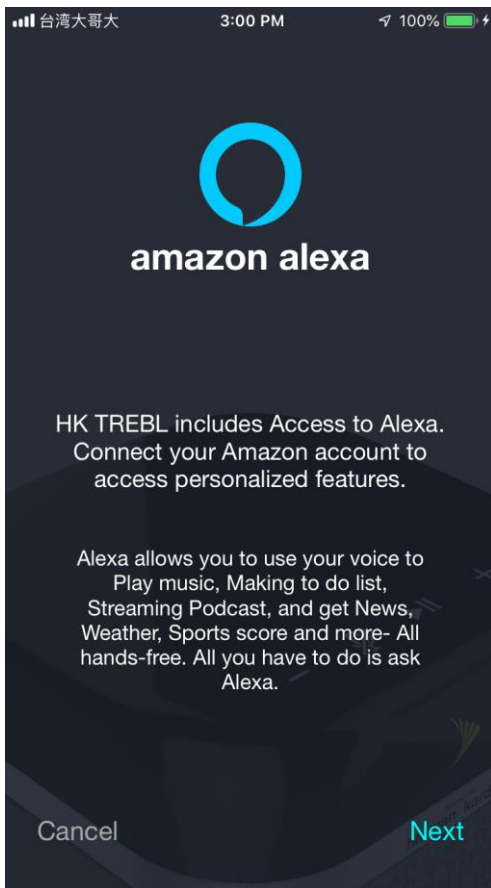
### 6.11.4 Notification

When user tap on Notification screen it showing all notification recover from the sprint TREBL device



### 6.11.5 **Amazon Alexa**

When user tap in Amazon Alexa option it redirects to Alexa entry screen. if Alexa is already configured it shows Alexa logout popup.



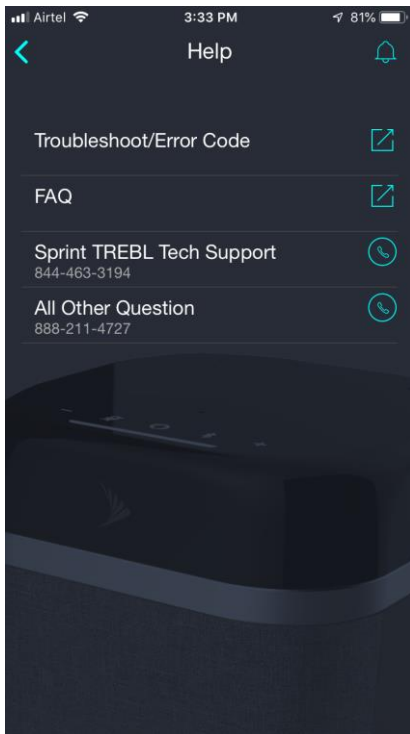
### 6.11.6 **Help**

When user tap on help button it re direct to help screen with following options

- Troubleshoot / Error code
- FAQ
- TREBL Tech Support
- All other Question

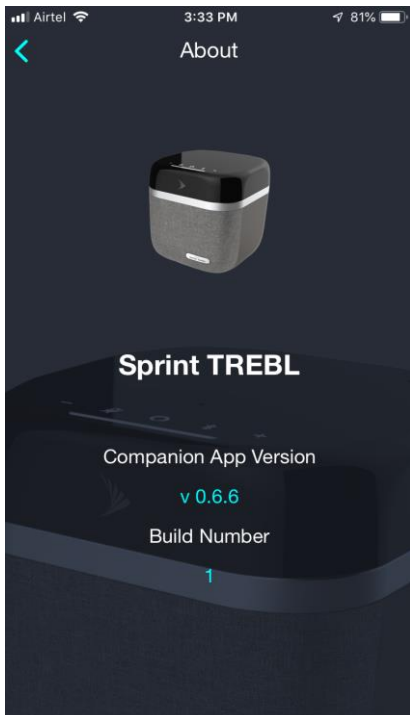
Which provide option to user for call to Customer care for related queries and help





### 6.11.7 **About**

When user tap on About it shows the current version of APP and build number.



## 7. Warning and Cautions

### 7.1 Human Exposure to Radio Frequencies

The Sprint TREBL antennas should be installed with a minimum distance of 20 CM from your body.

### 7.2 Radio Interference

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 internal vehicle radio communications.

Please ensure a maximum separation between the Sprint TREBL antenna and other antennas.

### 7.3 Modifications

Any changes and modifications to this device that are not expressly approved by Sprint Networks may void the user's authority to operate the equipment.

### 7.4 General

- Only qualified personnel should be allowed to install, replace, and service the equipment.
- The device cannot be sold retail, to the general public or by mail order. It must be sold to operators.
- Installation must be controlled.
- Installation must be performed by licensed professionals.
- Installation requires special training. The Sprint TREBL unit should be installed ONLY by those who are familiar with local building and safety codes and, wherever applicable, are licensed by the appropriate government regulatory authorities. Failure to do so may void Sprint product warranty and may expose the end user or the service provider to legal and financial liabilities. Sprint and its resellers or distributors are not liable for injury, damage or violation of regulations associated with the installation of outdoor units or antennas.
- The Sprint TREBL unit does not provide protection from hazard energy in case of single fault condition.
- Power supply shall be limited up to 4A in normal and single fault condition.

### 7.5 Important Safety Instructions

- Read and Save these instructions
- This Installation Guide contains instructions and warnings that should be followed during installation, and operation.
- Failure to follow these instructions could cause bodily injury and/or product failure

### 7.6 Safety

- Read this guide and follow all operating and safety instructions.
- Supply cord is not shipped with the unit and is to be provided by user. Installation is to be performed by a qualified electrician according to local codes. Installation to be done in accordance with the National Electrical Code (NEC), ANSI/NFPA 70, the Canadian Electrical Code (CEC), Part I, CAN/CSA C22.1, and when applicable, the National Electrical Safety Code, IEEE C2.
- Sprint TREBL User Guide
- DUG01476-SP Sprint Commercial and Internal Use 17

- Static sensitive components inside - do not remove the lid or base: No user serviceable parts inside.
- Position the power cord to avoid possible damage; do not overload circuits.
- Do not place this product on or near a direct heat source and avoid placing objects on the terminal.
- Use only a damp cloth for cleaning. Do not use liquid or aerosol cleaners. Disconnect the power before cleaning.
- It is the user's responsibility to install this device in accordance with the local electrical codes.
- Installation of the Sprint TREBL unit should be performed by someone familiar with the product.
- The circuit breaker where connected should be easily accessible in case you have to disconnect the device.
- When installed in the final configuration, the product must comply with the applicable Safety Standards and regulatory requirements of the country in which it is installed. If necessary, consult with the appropriate regulatory agencies and inspection authorities to ensure compliance.

## 7.7 Service Information

Refer all repairs to qualified service personnel. Do not modify any part of this device, as this will void the warranty.

Disconnect the power to this product and return it for service if the following conditions apply:

- a. The unit does not function after following the operating instructions outlined in this manual.
- b. The product has been dropped or the housing is damaged.

Locate the serial number of the terminal and record this on your registration card for future reference. Also record the MAC address, located on the product sticker.

## 7.8 UL Information

- The circuit where the equipment is connected must be properly grounded according with NEC and other local safety code requirements.

- Reminder to all the BWA system installers: Attention to Section 820-40 of the NEC which provides guidelines for proper grounding and, in particular, specifies that the cable ground shall be connected to the grounding system of the building, as close to the point of cable entry as is practical.

## 8. FCC Notice

### 8.1 Federal Communication Commission 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.

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 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.

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

This transmitter must not be co-located or operating in conjunction with any other antenna or transmitter.

Operations in the 5.15-5.25GHz band are restricted to indoor usage only.

### 8.2 Radiation Exposure Statement:

This equipment complies with FCC radiation exposure limits set forth for an uncontrolled environment. This equipment should be installed and operated with minimum distance 20cm between the radiator & your body.

Note: The country code selection is for non-US model only and is not available to all US model. Per FCC regulation, all Wi-Fi product marketed in US must fixed to US operation channels only.

## 9. Maximum Output TX Total Power

**Table 1: Sprint Magic Box Gold eNB FCC Maximum Output TX Total Power**

| Frequency Band (MHz) | TX (dBm) | EIRP (dBm) | Antenna Gain (dBi) | Variant                |
|----------------------|----------|------------|--------------------|------------------------|
| 2496-2690            | 26.91    | 37.41      | 10.5               | Magic Box Gold (AU587) |

**Caution:** Do not set maximum output TX power to higher than local regulations.

## 10. Power Consumption

| Duplex | Tx Total Power at RF Port (dBm) | Nominal Power Consumption (W) |
|--------|---------------------------------|-------------------------------|
| TDD    | 27                              | 55                            |

### Antenna Usage

Sprint Magic Box Gold unit has four (4) RF ports that are connected to two (2) dual-port antennas arrays. Each antenna array is mounted on opposite sides internally within the Airspan product housing. This is so that one antenna array faces forwards and one antenna array faces outwards for optimized coverage.

## 11. Customer Care Help Desk

Sprint *Customer Care Help Desk* offers prompt and efficient customer support services.

To create and update issue logs, send e-mails to Customer Care Help Desk. Once you submit your issue, the system generates a new issue and sends an issue number for your reference. The system uses this issue number to categorize and store e-mails under the appropriate issue.

To help *Customer Care Help Desk* identify your issue, include the issue number and your *Customer Care Helpdesk* account details in all further communications.

### **Worldwide Headquarters**

Sprint Headquarters 6200 Sprint Pkwy.  
Overland Park,  
KS 66251

## 12. Management

- Software is upgraded locally and remotely.
- Designed for local and remote management

## 11. Sprint TREBL



### 11.1 Physical Dimensions

- H X W X D = 205.99 mm X 199.87 mm X 199.87 mm
- Weight: ~4.5 Kgs.

### 12.1 eSIM Card

The Sprint TREBL provides an embedded eSIM and a standard SIM card holder for the operator-provided SIM, (installed during assembly).

### 11.4 Power Supply

The Sprint TREBL is powered via an AC main (line power) adapter which provides local DC power to the unit:

- Input
  - Power Adapter: 110V-AC
  - 12V - 5A DC
- Cord
  - 10 feet long
  - Black color



## 13. Hardware Security

### 13.1 Factory Generation of Device Key

Each device has a private key and associated certificate which is used to authenticate itself when initiating communications. This private key is generated in the factory, and so is the corresponding vendor certificate. This capability necessary in order to support large scale plug and play deployments.

This device key is stored on the Sprint TREBL to allow it to authenticate to the network. If the private key is compromised, then the device can be masqueraded by an attacker towards the operator's core network. Therefore, it is stored in an encrypted form.

In later releases a device-specific key will be introduced, this is a random number blown into on-SoC eFuses during manufacture. This offers two points of additional protection namely: the key is not discoverable by decompiling the code (an attacker will need to run code on the device in order to read the eFuses); and the key can only be used to obtain the private key of a single device (because each encryption key is unique).

### 13.2 eSIM

The system provides an embedded SIM (eSIM) to the board instead of using a removable SIM; this removes the temptation to steal the SIM. Additionally, the operator can ensure that these SIMs can only be used with the Relay APN, which would make them unusable with an ordinary mobile phone (because relay traffic uses nested GTP-U tunnels).