SAMSUNG
ARTIK™ Modules

ARTIK BLE On-boarding User Guide

Table of Contents

1 Version History

Revision	Date	Description
V1.0	5/15/2017	First release.
V2.0	6/4/2018	Updated with Ubuntu-based changes. Added user flow

2 Introduction

BLE on-boarding is a method to quickly provision ARTIK Hubs with the credentials to work with other devices in the ARTIK Cloud. The BLE service uses the Secure Device Registration (SDR) described on the ARTIK™ developer Secure your devices page to ensure that the hubs are securely registered and uniquely identified in the ARTIK Cloud. Sample mobile apps for Android and iOS are also available to build the client using the BLE service.

3 Hub Installation

BLE On-boarding software runs only on the ARTIK 710, 710s, 530 and 530s modules. This is distributed as packages. It is available by default from OS release 18.05.00 onwards,

Verify if the package is available,

```
$ apt show ble-onboarding

Package: ble-onboarding
Version: 3.8.2-1
Status: install ok installed
Priority: optional
Section: admin
Maintainer: Vaibhav Singh <vaibhav1.s@samsung.com>
Installed-Size: 8992 kB
Depends: npm, nodejs (>= 4.6.0), artiksee, libartik-sdk (>= 1.8), libartik-sdk (<< 1.9)
Homepage: https://artik.io
Download-Size: unknown
APT-Manual-Installed: yes
APT-Sources: /var/lib/dpkg/status
Description: BLE Onboarding Service for Artik Boards
```

If the package is not available, install it using the instructions provided below,

```
$ apt install ble-onboarding
$ systemctl status ble-onboarding
$ systemctl restart ble-onboarding
```

After installation, the node.js application will be available in folder `/usr/local/ble-onboarding`. The folder also contains two important scripts:

- BLE-Onboarding Launcher
- BLE-Onboarding Service

3.1 BLE Onboarding Launcher

The BLE Onboarding Launcher is responsible for launching the BLE Onboarding service on the hub.

For security reasons, the BLE service on ARTIK hubs is disabled by default, since there is no authentication mechanism in the BLE connection.

A pushbutton (GPIO) is configured to launch the BLE service. This service automatically quits once the on-boarding process has completed successfully or when the timeout period has expired.

Out-of-the box, button SW403 is configured to launch the service. LED400 will glow while the service is running. These defaults can be overridden in the `start-launcher.sh` script using the following environment variables:

```
$ vi /usr/local/ble-onboarding/start-launcher.sh
```

Name	Default Value	Description
LAUNCH_BUTTON_GPIO	GPIO 30 for button 403	The GPIO button that triggers the start of the BLE-onboarding service.
STATUS_LED_GPIO	GPIO 28 for Red LED.	The GPIO to which the status LED is connected indicating that the onboarding Bluetooth service is running. This LED glows immediately after the launch button is pressed.
SERVICE_TIMEOUT_IN_SECONDS	300 seconds	The timeout value for the onboarding service

If the launch button is pressed before the BLE onboarding service has terminated, it will restart with a fresh timeout.

3.2 BLE Onboarding Service

The BLE onboarding service performs the secure device registration on the hub by exposing a BLE profile (see *Appendix*) to a BLE client such as the ARTIK Mobile Onboarding App (see *ARTIK Mobile Onboarding Service*).

Out-of-the-box, the BLE service broadcasts with a peripheral named "ArtikOnBoarding". The Device Information defaults can be updated in the `/usr/local/ble-onboarding/start-service.sh` script using the following environment variables:

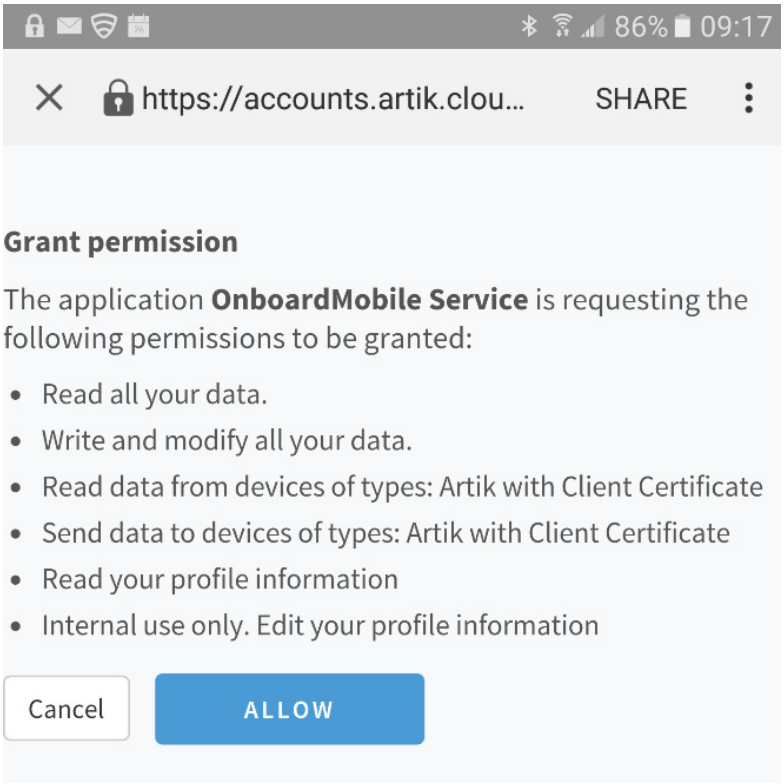
Name	Default	Description
SERVICE_ID	"FFFFFFFF-C0C1-FFFF-C0C1-$BLE_MAC"	This parameter defines the unique ID of the Bluetooth service for onboarding. It is a string parameter; hence need to be defined in quotes.
ONBOARD_VENDOR_ID	"Samsung"	The string parameter that identifies the vendor name.
SDR_DEVICE_TYPE_ID	Preconfigured using the default certificates of the ARTIK	Device Type Id used in the registartion process with the cloud. The ARTIK modules are securely registered on SmartThings cloud to this device type. The default device type is owned by Samsung, customers can modify this device type and onboard it to their custom device type. Customers can OTA only to a device type they own. To attempt OTA to a device, update this parameter to your custom device type To create a custom device type follow this link, https://developer.artik.cloud/documentation/tools/web-tools.html#creating-a-device-type
SDR_VENDOR_ID	Randomly generated 6 digits	This parameter identifies the Vendor ID
ONBOARDING_SERVICE_NAME	"ArtikOnBoarding"	The parameters defines the name of the onboarding service
ACTIONS_LED	38	This parameter identifies the GPIO on which the LED to respond to an Action is connected.

Update the start service script with the custom device type ID and reboot the board. For example:

```
$ vi /usr/local/ble-onboarding/start-service.sh
export SDR_DEVICE_TYPE_ID=dtc5ecf0abccaa428c853e144c964ad727
$ reboot
```

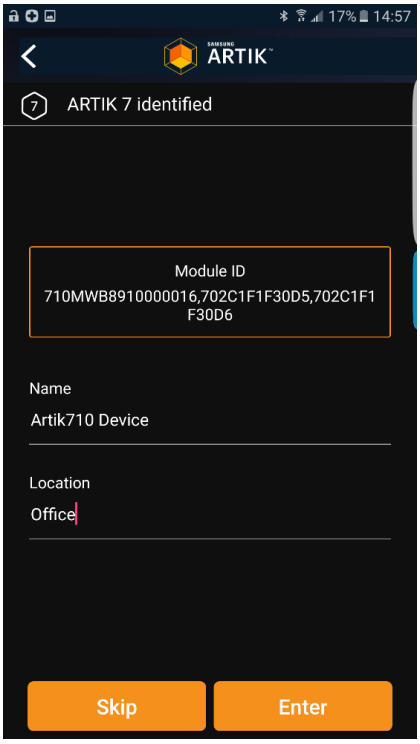
4 ARTIK Mobile Onboarding Service

ARTIK provides mobile apps on Android and iOS to onboard ARTIK Hubs that utilize the BLE-onboarding service. After the app has been installed on the mobile device, the user is required to log in to ARTIK Cloud and grant permissions to the app.

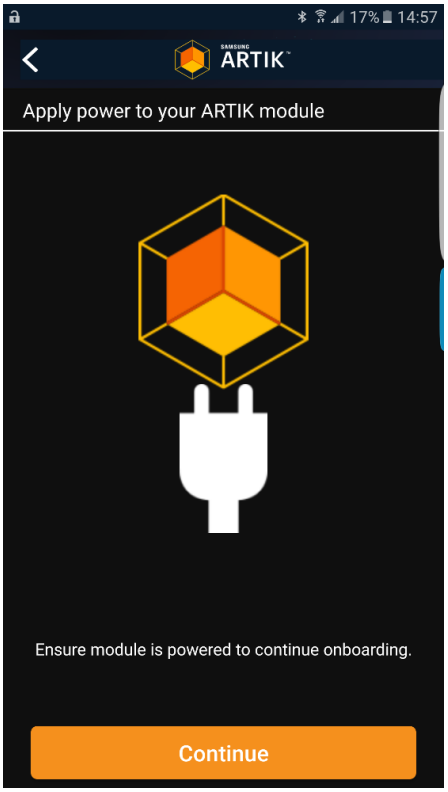


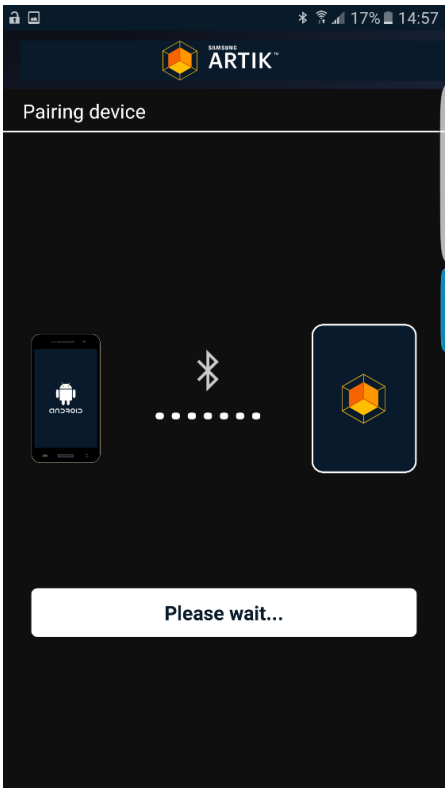
After granting permissions, the user can onboard an ARTIK Hub by either scanning a QR code or by manually entering the Serial Number, Mac ID 1 and Mac ID 2.

After the QR code has been scanned, the hub is identified and the user is prompted to enter a user friendly name and a location.



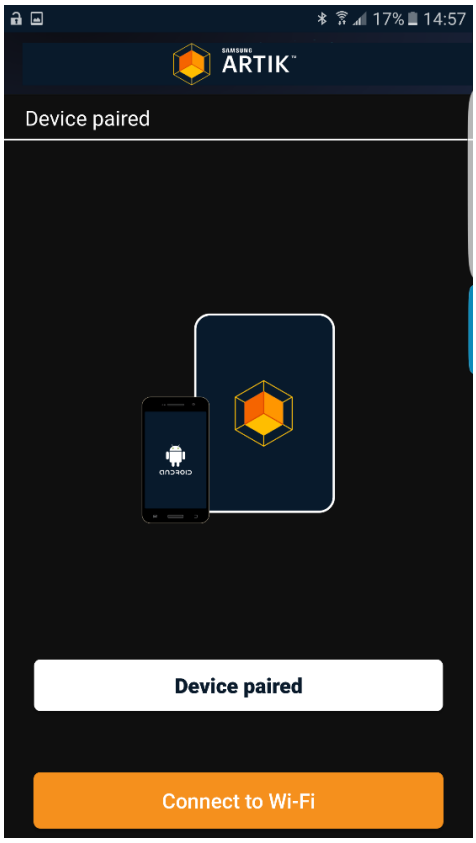
At this point, the mobile app is ready to connect to the hub via Bluetooth. Ensure that Bluetooth is enabled on the mobile device and that the hub is powered on and set into Bluetooth broadcasting mode (by pressing the SW403 button).



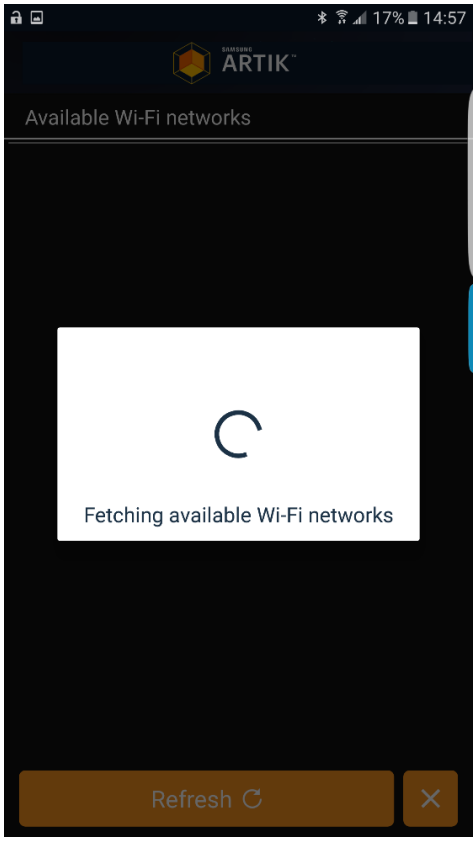


Once the hub is paired with the mobile device, the hub is ready to be provisioned with Wi-Fi.

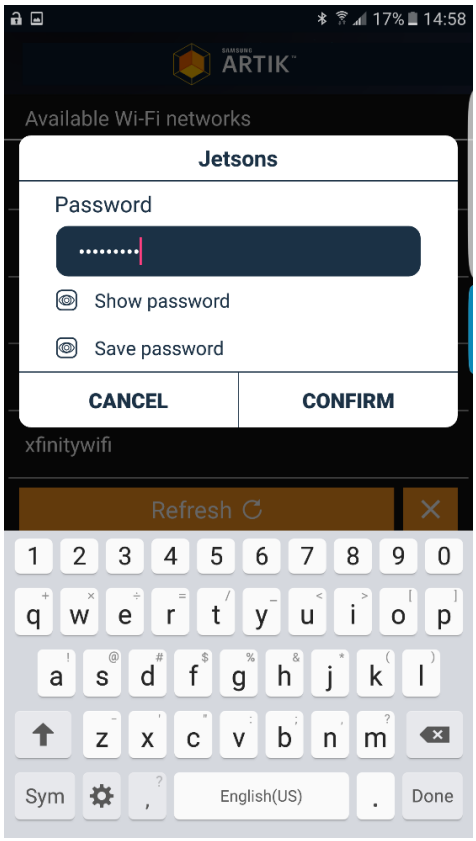
Click the Connect to Wi-Fi button to initiate the process.



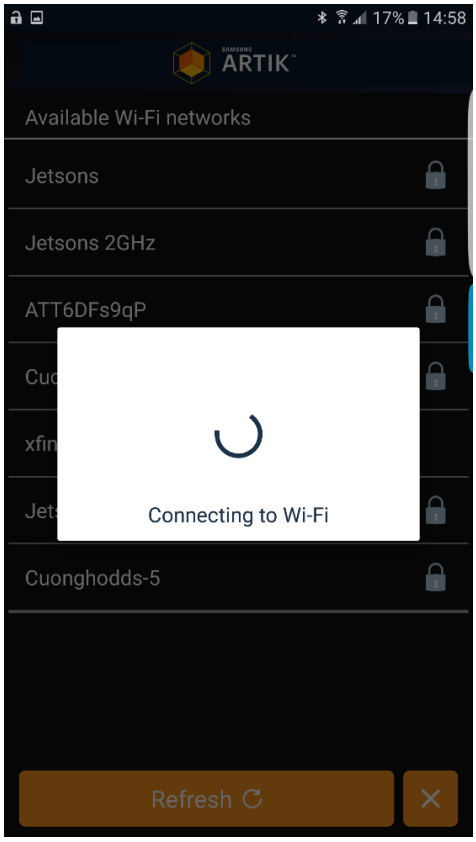
At this point, the mobile app displays a list of wireless access points (APs) detected by the hub.



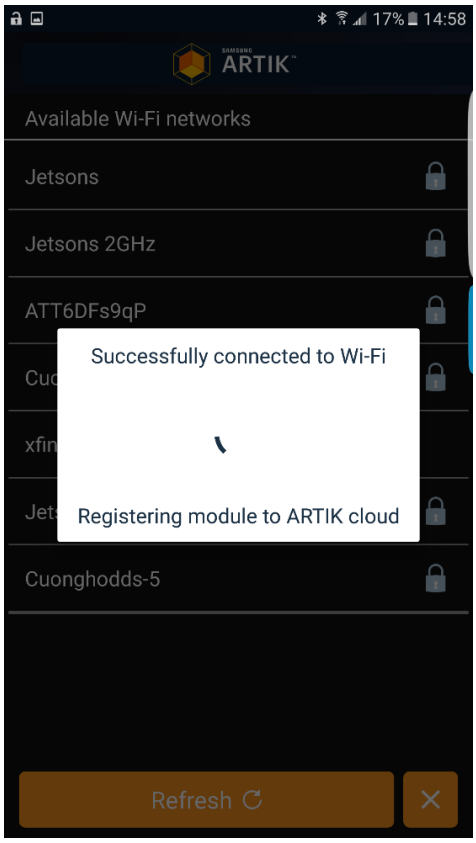
Select the AP relevant to the hub and enter a password if the AP is secured.



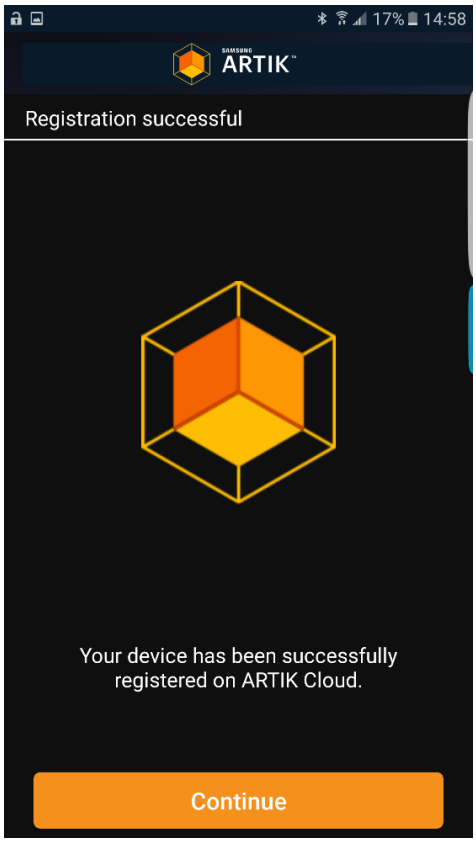
After confirming the password, the mobile app sends the Wi-Fi information to the hub and the hub attempts to connect to the AP.



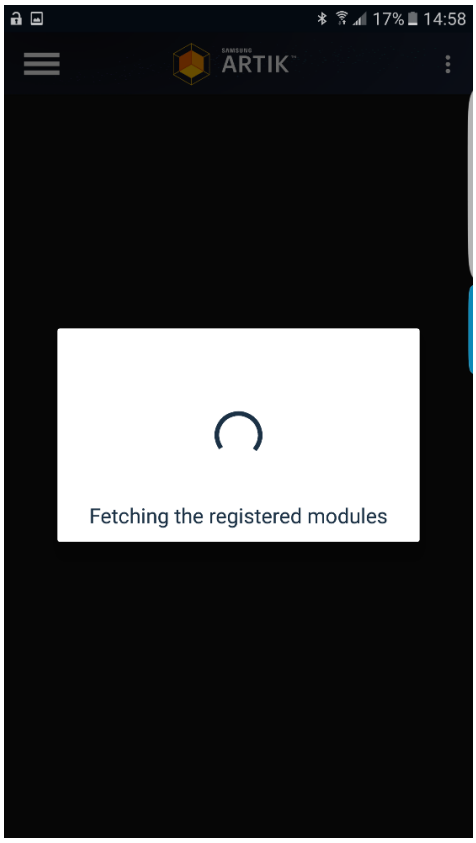
Once the hub connects to Wi-Fi, it initiates Secure Device Registration with ARTIK Cloud.



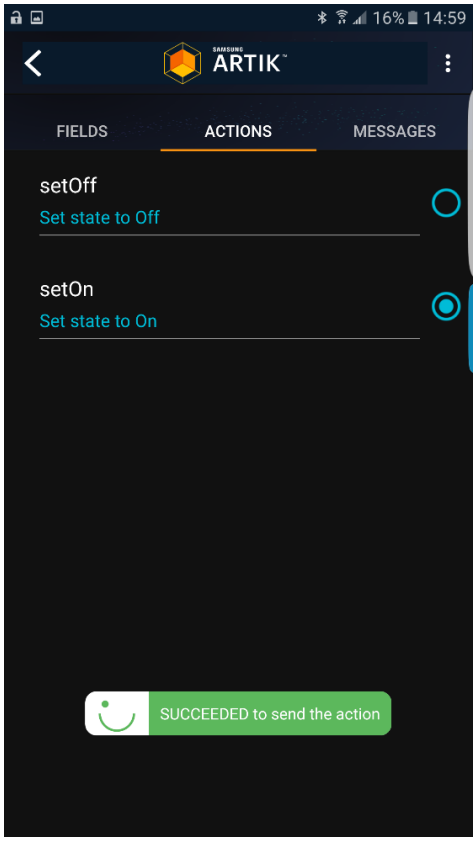
After the Secure Device Registration completes successfully, the hub is connected to ARTIK Cloud.



Clicking Continue will display the user's devices registered with ARTIK Cloud.



The user can test the device by sending an Action (setOn). Once the action is sent successfully, the LED401 turns on the 710 hub.



5 Appendix

This section describes the ARTIK BLE Profile that can be used to build a client similar to the ARTIK mobile Onboarding app on Android and iOS described in the previous section.

5.1 BLE Custom Profile

The ARTIK BLE service exposes certain GATT characteristics that are used by a BLE client for setting up Wi-Fi on the Hub and for performing SDR.

5.1.1 BLE Service

The primary service has a UUID of "`FFFFFFFF-C0C1-FFFF-C0C1-$BLEMAC`" where `$BLEMAC` is replaced by the 12-character Bluetooth adapter MAC address. Including the MAC address in the service UUID can help to distinguish various ARTIK hubs. This Service UUID is also present in the broadcast advertisement packets sent every 10 ms.

5.1.2 BLE Characteristics

Name	UUID	Description	Read, Write, Notify	Type	Values
STATUS	FFFFFFFF-C0C1-FFFF-C0C1-201401000001	Wi-Fi and SDR Status	Read	String (22)	DISCONNECTED INITIALIZING INITIALIZED CONNECTING CONNECTED FAILED RECVD_PIN RECVD_TOKEN
LONG_STATUS	FFFFFFFF-C0C1-FFFF-C0C1-201401000002	Detailed Status	Read	String (22)	NONE Set SSID Set Auth Type Wrong Auth Type Set PSK Conn or Set Channel Authenticating Getting IP Address Connection Completed No PSK Required Received Challenge Received Token Registration Error Invalid Token Invalid SSID Invalid Password Unable to Get IP Address No Internet Invalid Wifi Module State Wifi Scan Finished
SSID	FFFFFFFF-C0C1-FFFF-C0C1-201401000003	Wi-Fi AP SSID	String (22)	Read, Write	<User Provided>
AUTH	FFFFFFFF-C0C1-FFFF-C0C1-201401000004	Authentication Type of AP – OPEN or SECURE	String (6)	Read, Write	OPEN SECURE
PASSPHRASE	FFFFFFFF-C0C1-FFFF-C0C1-201401000005	Passphrase of AP	String (22)	Write	<User Provided>
VENDOR_ ID	FFFFFFFF-C0C1-FFFF-C0C1-201401000008	Vendor ID. Default “Samsung”	String (32)	Read	<Matches start-service.sh>
WIFI_STATUS	FFFFFFFF-C0C1-FFFF-C0C1-201401000010	Wi-Fi Status	String (32)	Read	<Wi-Fi Connection status on ARTIK Hub>
IP_ADDRESS	FFFFFFFF-C0C1-FFFF-C0C1-201401000011	IP Address on ARTIK Hub	String (16)	Read	<IP Address on ARTIK Hub>

Name	UUID	Description	Read, Write, Notify	Type	Values
WIFI_LIST	FFFFFFFF-C0C1-FFFF-C0C1-201401000012	Returns the list of APs available to the module	String (512)	Read	Format: { "ssid": "<SSID>", "bssid": "<BSSID>", "security": "<OPEN|SECURE>", "signal": <SIGNAL> }
CHALLENGE_PIN	0000FFF1-0000-1000-8000-00805F9B34FB	Challenge pin obtained during SDR registration process.	String (5)	Read	<Obtained by BLE Service after SDR begins>
DEVICE_TOKEN	0000FFF2-0000-1000-8000-00805F9B34FB	ARTIK Cloud Device Token	String (32)	Read	<Device Token obtained from SDR Flow>
DEVICE_TYPE_ID	0000FFF3-0000-1000-8000-00805F9B34FB	ARTIK Cloud Device Type ID	String (32)	Read	<Matches SDR_DEVICE_TYPE_ID in start-service.sh>
VENDOR_DEVICE_ID	0000FFF4-0000-1000-8000-00805F9B34FB	Vendor Device ID	String (22)	Read	<Matches SDR_VENDOR_ ID in start-service.sh>
START_REGISTRATION	0000FFF5-0000-1000-8000-00805F9B34FB	Starts SDR on Hub	Integer (1)	Write	0x01
COMPLETE_REGISTRATION	0000FFF6-0000-1000-8000-00805F9B34FB	Completes SDR on Hub	Integer (1)	Write	0x01

5.1.3 Process Sequence

The process sequence for on-boarding of an ARTIK Hub is initiated by the BLE client. The client (such as a Mobile app) is already required to have logged into ARTIK Cloud and has already obtained the MAC address of the hub (see: QR code scanning).

The following sequence takes place during the on-boarding of an ARTIK Hub:

1. The BLE client scans for BLE devices and matches the service UUID with the MAC address.
2. The BLE client reads the “`WIFI_LIST`” characteristic to obtain the list of Access Points as seen by the Hub. The response is sent, one AP at a time, in the format shown below. The BLE client has to re-read the characteristic until it finds the "end" AP as shown below.

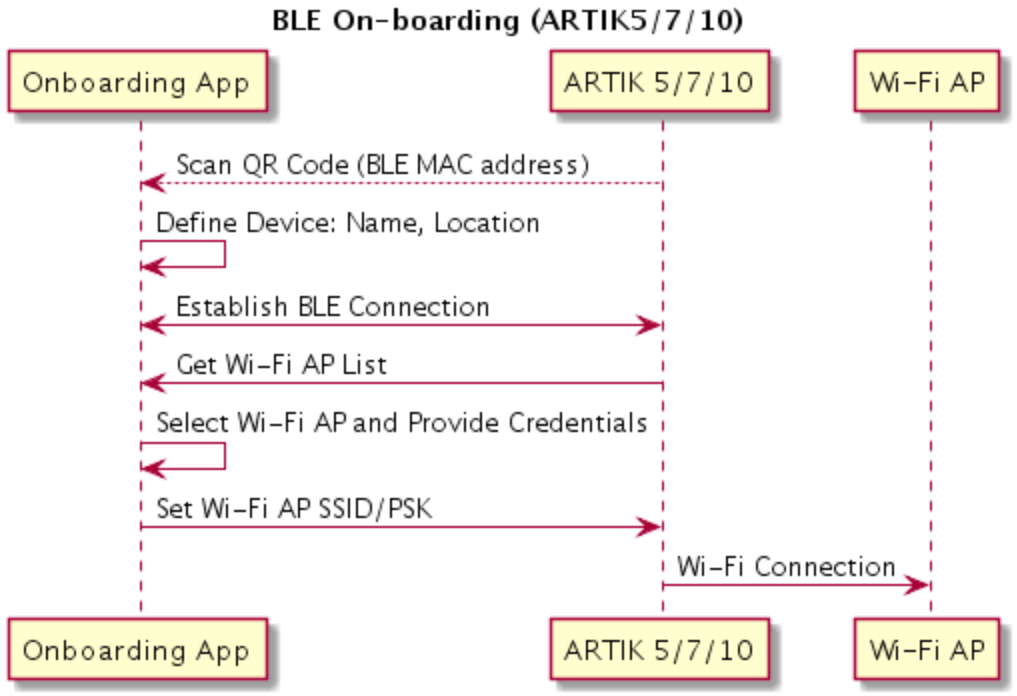
Code Block 1 Wifi List response examples:

```
{
        "ssid": "open-ap123",
        "bssid": "00:37:b7:08:b5:d6",
        "security":"Open",
        "signal":-46.00
}
Or
{
        "ssid": "secure-ap234",
        "bssid": "d0:84:b0:57:c2:ee",
        "security":"Secure",
        "signal":-50.00
}
Or
{
        "ssid": "end",
        "bssid": "end",
        "security":"end",
        "signal":0
}
```

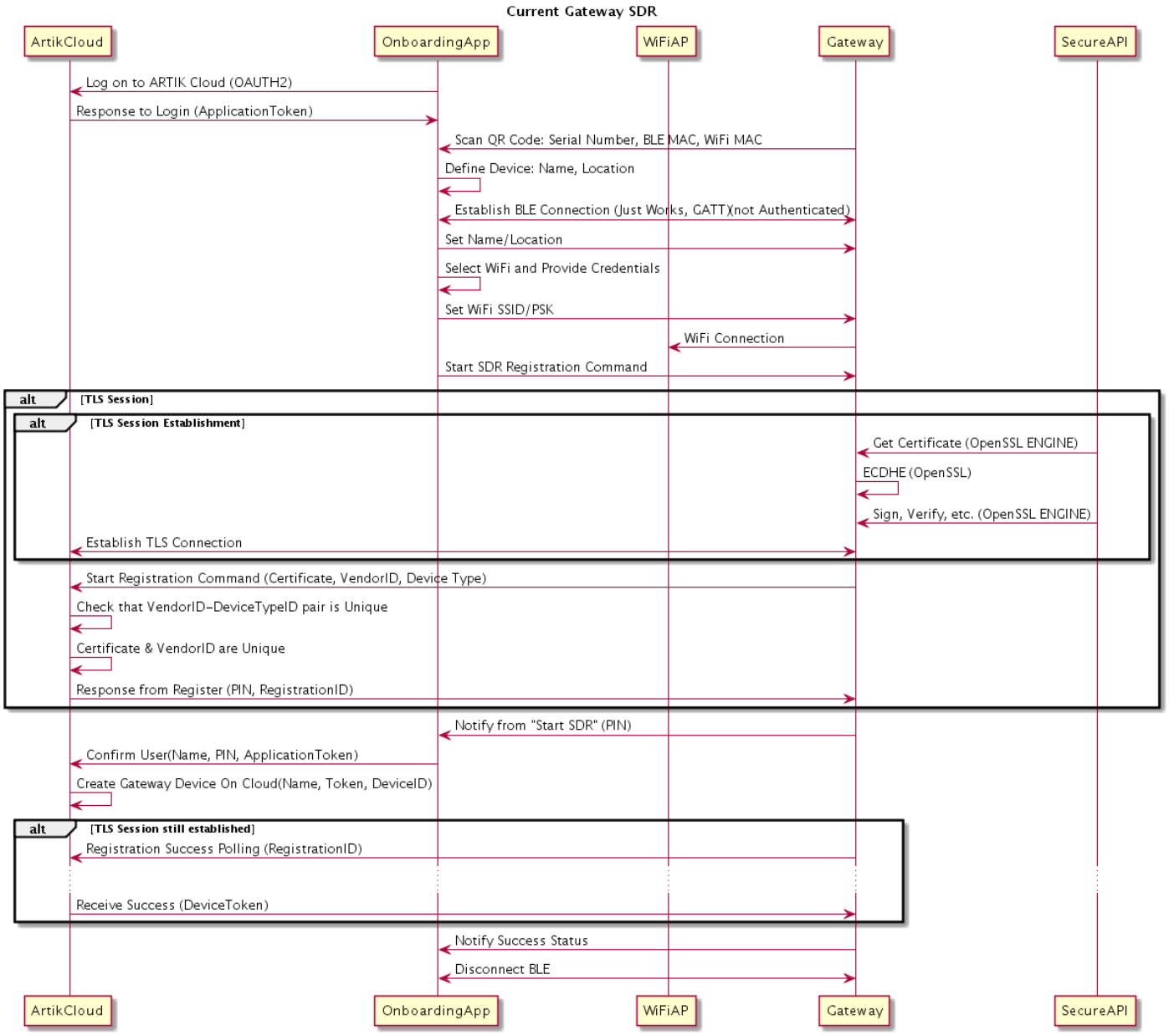
This list is presented to the User who chooses an Access Point to which the ARTIK Hub will try to connect.

3. Once the user selects the AP, the BLE client writes the info to the SSID, AUTH and PASSPHRASE characteristics in that order strictly. The AUTH characteristic can have the values "`OPEN`" or "`SECURE`".
4. Once the PASSPHRASE characteristic has been written, the BLE service tries to connect to the Wi-Fi SSID and, once connected, updates the STATUS characteristic with the message "`CONNECTED`".
5. The BLE client polls the STATUS characteristic, and fixes any errors (incorrect passphrase) and retries until the value reads as "`CONNECTED`".
6. After a successful connection, the BLE client writes the hex value 0x01 to start Secure Device Registration.
7. The BLE service registers the device to the Cloud and updates the CHALLENGE_PIN characteristic. The BLE Client reads this characteristic and verifies the same with the ARTIK cloud, thus completing the registration process. The BLE client writes the hex value 0x01 to the COMPLETE_REG characteristic.
8. After a completed registration, the BLE service fetches the ARTIK Cloud Device ID and Device Token and updates the read characteristics – DEVICE_ID and DEVICE_TOKEN, thus allowing the BLE client to obtain the information.

The user flow is as follows:



The steps to register a device securely are listed below.



NOTE In the above flow, steps shown in “alt” boxes are optional.

Legal Information

INFORMATION IN THIS DOCUMENT IS PROVIDED IN CONNECTION WITH THE SAMSUNG ARTIK™ DEVELOPMENT ENVIRONMENT AND ALL RELATED PRODUCTS, UPDATES, AND DOCUMENTATION (HEREINAFTER "SAMSUNG PRODUCTS"). NO LICENSE, EXPRESS OR IMPLIED, BY ESTOPPEL OR OTHERWISE, TO ANY INTELLECTUAL PROPERTY RIGHTS IS GRANTED BY THIS DOCUMENT. THIS DOCUMENTATION IS PROVIDED FOR REFERENCE PURPOSES ONLY, AND ALL INFORMATION DISCUSSED HEREIN IS PROVIDED ON AN “AS IS” BASIS, WITHOUT WARRANTIES OF ANY KIND. SAMSUNG ELECTRONICS CO., LTD. AND ITS AFFILIATES (COLLECTIVELY, “SAMSUNG”) ASSUMES NO LIABILITY WHATSOEVER, INCLUDING WITHOUT LIMITATION CONSEQUENTIAL OR INCIDENTAL DAMAGES, AND SAMSUNG DISCLAIMS ANY EXPRESS OR IMPLIED WARRANTY, ARISING OUT OF OR RELATED TO YOUR APPLICATION AND/OR USE OF THIS DOCUMENT OR THE SAMSUNG PRODUCTS INCLUDING LIABILITY OR WARRANTIES RELATED TO FITNESS FOR A PARTICULAR PURPOSE, MERCHANTABILITY, OR INFRINGEMENT OF ANY PATENT, COPYRIGHT, OR OTHER INTELLECTUAL PROPERTY RIGHT.

SAMSUNG RESERVES THE RIGHT TO CHANGE PRODUCTS, INFORMATION, DOCUMENTATION AND SPECIFICATIONS WITHOUT NOTICE. THIS INCLUDES MAKING CHANGES TO THIS DOCUMENTATION AT ANY TIME WITHOUT PRIOR NOTICE. SAMSUNG ASSUMES NO RESPONSIBILITY FOR POSSIBLE ERRORS OR OMISSIONS, OR FOR ANY CONSEQUENCES FROM THE USE OF THE DOCUMENTATION CONTAINED HEREIN.

Unless otherwise agreed to between the parties, Samsung Products are not intended for use in medical, life support, critical care, safety equipment, or similar applications where product failure could result in loss of life or personal or physical harm, or any military or defense application, or any governmental procurement to which special terms or provisions may apply. For updates or additional information about Samsung ARTIK™, contact the Samsung ARTIK™ team via the Samsung ARTIK™ website at www.artik.io.

This document and all information discussed herein remain the sole and exclusive property of Samsung. All brand names, trademarks and registered trademarks belong to their respective owners. Unless specifically identified as such, Samsung’s use of third party trademarks does not indicate any relationship, sponsorship, or endorsement between Samsung and the owners of these trademarks. Any references by Samsung to third party trademarks is to identify the corresponding third party goods and/or services and shall be considered nominative fair use under the trademark law.