

## Introduction

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This document describes two Atmel® ATWINC3400 BLE services that BLE peripherals, such as mobile phones, may make use of.

The first service, the *Wi-Fi® Scan Service*, allows a BLE peripheral to retrieve a list of Wi-Fi networks (access points) that are in range of the ATWINC3400.

The second service, the *Wi-Fi Connect Service*, allows a BLE peripheral to configure the ATWINC3400's Wi-Fi radio to connect to an access point by providing information such network name, security type, and passphrase to the ATWINC3400 over a BLE connection.

Methods for creating an application using these services, either individually (e.g. Wi-Fi site survey), or in combination (e.g. easy setup of a Wi-Fi connection for an out-of-box ATWINC3400), are beyond the scope of this document.

Both of these services run independently without any reliance on each other or dependencies other services.

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# 1 Document Terminology

This document follows Section 13.1 of the IEEE® Standards Style Manual, which dictates use of the words “shall”, “should”, “may”, and “can” in the development of documentation, as follows:

The word shall is used to indicate mandatory requirements strictly to be followed in order to conform to the standard and from which no deviation is permitted (shall equals is required to).

The use of the word must is deprecated and shall not be used when stating mandatory requirements; must is used only to describe unavoidable situations.

The use of the word will is deprecated and shall not be used when stating mandatory requirements; will is only used in statements of fact.

The word should is used to indicate that among several possibilities one is recommended as particularly suitable, without mentioning or excluding others; or that a certain course of action is preferred but not necessarily required; or that (in the negative form) a certain course of action is deprecated but not prohibited (should equals is recommended that).

The word may is used to indicate a course of action permissible within the limits of the standard (may equals is permitted).

The word can is used for statements of possibility and capability, whether material, physical, or causal (can equals is able to).

## 2 Overview

This document shows how Wi-Fi scan is performed, and how the results can be used for a subsequent Wi-Fi connection to a specific access point.

### 2.1 Conformance

If a device claims conformance to these services, all capabilities indicated as mandatory for these services shall be supported in the specified manner (process-mandatory). This also applies for all optional and conditional capabilities for which support is indicated. All mandatory capabilities, and optional and conditional capabilities for which support is indicated, are subject to verification as part of the Bluetooth® qualification program.

### 2.2 Service Dependency

The Scan and Connect services are not dependent upon any other services.

### 2.3 Bluetooth Specification Release Compatibility

This specification is compatible with any Bluetooth core specification [1] that includes the Generic Attribute Profile (GATT) specification and the Bluetooth Low Energy Controller specification.

### 2.4 GATT Sub-procedure Requirements

Requirements in this section represent a minimum set of requirements for a Wi-Fi Connect Service (Server). Other GATT sub-procedures may be used if supported by both Client and Server.

The table below summarizes additional GATT sub-procedure requirements beyond those required by all GATT Servers.

| GATT sub-procedure               | Requirements |
|----------------------------------|--------------|
| Write Characteristic Value       | M            |
| Notifications                    | M            |
| Read Characteristic Descriptors  | M            |
| Write Characteristic Descriptors | M            |

### 2.5 Transport Dependencies

This service shall operate over an LE transport.

### 2.6 Error Codes

This service does not define any application error codes that are used in Attribute Protocol.

### 2.7 Byte Transmission Order

All characteristics used with this service shall be transmitted with the least significant octet first (i.e., little endian). The least significant octet is identified in the characteristic definitions in [1.2].

### 3 Scan Service Declaration

The Wi-Fi Scan Service shall be instantiated as a «Primary Service».

The service UUID shall be set to «Wi-Fi Scan Service». The UUID value assigned to «Wi-Fi Scan Service» is 'fb8c0001-d224-11e4-85a1-0002a5d5c51b'.

### 4 Scan Service Characteristics

The following characteristics are exposed in the Wi-Fi Scan Service. Unless otherwise specified, only one instance of each characteristic is permitted within this service.

| Characteristics name                            | Requirement | Mandatory properties | Optional properties | Security permissions |
|---|-------------|----------------------|---------------------|----------------------|
| Scanning Mode                                   | M           | Read, Write, Notify  |                     | None                 |
| AP Count  | M           | Read                 |                     | None                 |
| AP Details (there are multiple characteristics) | M           | Read                 |                     | None                 |

Notes: 1. Security permissions of "None" means that this service does not impose any requirements.  
2. Properties not listed as Mandatory or Optional are excluded.

#### 4.1 Scan Scanning Mode

The Scanning Mode characteristic is used to command a Wi-Fi scan and report the current scan mode.

##### 4.1.1 Scan Characteristic Behavior

When the Client Characteristic Configuration descriptor is configured for notification and the scan mode is changed, this characteristic shall be notified while in a connection.

The Scanning Mode characteristic sets the Wi-Fi scan mode when written.

| Value | Meaning    |
|-------|------------|
| 0x01  | Start Scan |

The Scanning Mode characteristic is used to describe the current scan mode when read.

| Value | Meaning          |
|-------|------------------|
| 0x00  | Initialize Value |
| 0x01  | Scan Running     |
| 0x02  | Scan Done        |

The "Initialize Value" is the default startup value; once a "Start Scan" is issued, the read value will be "Scan Running", then "Scan Done", where it will stay until further scans are requested.

##### 4.1.2 Characteristic Descriptors

###### 4.1.2.1 Client Characteristic Configuration Descriptor

The Client Characteristic Configuration descriptor shall be included in the Scanning Mode characteristic.

#### 4.2 AP Count

The AP Count characteristic is used to convey how many entries in the AP Details characteristic are valid.

#### 4.2.1 Characteristic Behavior

The AP Count characteristic consists of a single value in the range 0-15, which is the number of consecutive entries in the AP Details characteristic (starting from entry 0) that are currently valid and populated.

### 4.3 AP Details Characteristic

The AP Details characteristic is used to provide the details of a single Wi-Fi access point.

#### 4.3.1 Characteristic Behavior

The AP Details characteristic consist of a list of information, which describes the scan result for a single Wi-Fi access point. The following table describes the data structure used and the byte order transmitted.

| Field       | Length   | Meaning  | Byte order and alignment                         |
|-------------|----------|--|--|
| State       | 1        | Current state of AP details entry:<br>0 = No details<br>1 = Stale details<br>2 = Current details | n/a  |
| Channel     | 1        | Wi-Fi channel number   | n/a  |
| Freq. band  | 1        | Frequency band:<br>0 = 2.4GHz<br>1 = 5GHz  | n/a  |
| RSSI        | 1        | Received signal strength indication in dB  | n/a  |
| SSID Length | 1        | Number of UINT8 elements in SSID field   | n/a  |
| SSID        | Up to 32 | The SSID of the AP detected  | The first UINT8 of the SSID is transmitted first |

## 5 Connect Service Declaration

The Wi-Fi Connect Service shall be instantiated as a «Primary Service».

The service UUID shall be set to «Wi-Fi Connect Service». The UUID value assigned to «Wi-Fi Connect Service» is '77880001-d229-11e4-8689-0002a5d5c51b'.

## 6 Connect Service Characteristics

The following characteristics are exposed in the Wi-Fi Connect Service. Unless otherwise specified, only one instance of each characteristic is permitted within this service.

| Characteristics name | Requirement | Mandatory properties | Optional properties | Security permissions |
|----------------------|-------------|----------------------|---------------------|----------------------|
| Connection state     | M           | Read, Write, Notify  |                     | None                 |
| AP parameters        | M           | Read, Write          |                     | Encrypted link       |

Notes: 1. Security Permissions of "None" means that this service does not impose any requirements.  
2. Properties not listed as Mandatory or Optional are Excluded.

### 6.1 Connection State

The Connection State characteristic is used to command a Wi-Fi Connect and report the current scan mode.

#### 6.1.1 Characteristic Behavior

When the Client Characteristic Configuration descriptor is configured for notification and the Wi-Fi connection state changes, this characteristic shall be notified while in a BLE connection.

The Connection State characteristic sets the Wi-Fi connection mode when written.

| Value | Meaning    |
|-------|------------|
| 0x00  | Disconnect |
| 0x01  | Connect    |

The Connection State characteristic is used to describe the current connection state in notifications and when read.

| Value | Meaning      |
|-------|--------------|
| 0x00  | Disconnected |
| 0x01  | Connecting   |
| 0x02  | Connected    |

#### 6.1.2 Characteristic Descriptors

##### 6.1.2.1 Client Characteristic Configuration Descriptor

The Client Characteristic Configuration descriptor shall be included in the Connection State characteristic.

### 6.2 AP Parameters Characteristic

The AP Parameters characteristic is used to set the connection parameters used to connect to a specified AP.

## 6.2.1 Characteristic Behavior

The AP Parameters characteristic consist of a list of information, which describes the connection parameters for a single Wi-Fi access point. The following table describes the data structure used and the byte order transmitted.

| Field             | Length | Meaning  | Byte order and alignment                               |
|-------------------|--------|--|--|
| Security type     | 1      | Method used by the detected AP to secure the Wi-Fi network. See section 6.1.2.1 for a list of permitted values for this field. | n/a  |
| SSID length       | 1      | Length of the SSID provided in SSID field. Less than or equal to 32.   | n/a  |
| SSID              | 32     | The SSID of the detected AP, padded with 0x00. No UINT8 of the SSID itself shall be equal to 0x00.                             | The first UINT8 of the SSID is transmitted first       |
| Passphrase length | 1      | Length of the passphrase provided in Passphrase field. Less than or equal to 63.   | n/a  |
| Passphrase        | 63     | The passphrase of the detected AP, padded with 0x00. No UINT8 of the passphrase itself shall be equal to 0x00.                 | The first UINT8 of the passphrase is transmitted first |

### 6.2.1.1 Security Type

The following table describes the permitted values for the Security Type field.

| Value0 | Meaning  |
|--------|--|
| 1      | Wi-Fi network is not secured (in this case Passphrase Length field must contain 0) |
| 2      | Wi-Fi network is secured with WPA/WPA2 personal                                    |
| 3      | Wi-Fi network is secured with WEP  |

## 7 Acronyms and Abbreviations

| Acronyms and abbreviations | Meaning                       |
|----------------------------|-------------------------------|
| AP                         | Access Point                  |
| GAP                        | Generic Access Profile        |
| GATT                       | Generic Attribute Profile     |
| LE                         | Low Energy                    |
| UUID                       | Universally Unique Identifier |
| PSK                        | Pre-Shared Key                |
| SSID                       | Service Set Identifier        |

## 8 References

1. [Bluetooth Core Specification v4.0](#).
2. Characteristic and Descriptor descriptions are accessible via the [Bluetooth SIG Assigned Numbers](#).

## 9 Revision History

| Doc Rev. | Date    | Comments                  |
|----------|---------|---------------------------|
| 42683A   | 03/2016 | Initial document release. |



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