# PP-Module for WLAN Clients


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**National Information Assurance Partnership**

## Revision History

| Version | Date | Comment |
|---|---|---|
| 1.0 | 2022-03-31 | Initial Release |
| 0.5 | 2022-01-20 | Conversion to PP-Module;<br>Updated to include WPA 3 and Wi-Fi 6.<br>WPA 3 is required. WPA 2 can additionally be included in the ST.<br>256 bit keys are required. 128 and 192 bit keys can additionally be included in the ST. |

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# 1 Introduction

## 1.1 Overview

The scope of the Wireless Local Area Network (WLAN) Client PP-Module is to describe the security functionality of a WLAN Client in terms of [CC] and to define functional and assurance requirements for such products. This PP-Module is intended for use with the following Base-PPs:

- General Purpose Operating System (GPOS) Protection Profile, Version 4.2.1
- Mobile Device Fundamentals (MDF) Protection Profile, Version 3.2

These Base-PPs are valid because a WLAN Client is a part of either a commercial operating system that can be installed on a general-purpose computer or an operating system that runs on a purpose-built mobile device.

## 1.2 Terms

The following sections list Common Criteria and technology terms used in this document.

### 1.2.1 Common Criteria Terms

| | |
|---|---|
| Assurance | Grounds for confidence that a TOE meets the SFRs [CC]. |
| Base Protection Profile (Base-PP) | Protection Profile used as a basis to build a PP-Configuration. |
| Collaborative Protection Profile (cPP) | A Protection Profile developed by international technical communities and approved by multiple schemes. |
| Common Criteria (CC) | Common Criteria for Information Technology Security Evaluation (International Standard ISO/IEC 15408). |
| Common Criteria Testing Laboratory | Within the context of the Common Criteria Evaluation and Validation Scheme (CCEVS), an IT security evaluation facility accredited by the National Voluntary Laboratory Accreditation Program (NVLAP) and approved by the NIAP Validation Body to conduct Common Criteria-based evaluations. |
| Common Evaluation Methodology (CEM) | Common Evaluation Methodology for Information Technology Security Evaluation. |
| Distributed TOE | A TOE composed of multiple components operating as a logical whole. |
| Extended Package (EP) | A deprecated document form for collecting SFRs that implement a particular protocol, technology, or functionality. See Functional Packages. |
| Functional Package (FP) | A document that collects SFRs for a particular protocol, technology, or functionality. |
| Operational Environment (OE) | Hardware and software that are outside the TOE boundary that support the TOE functionality and security policy. |
| Protection Profile (PP) | An implementation-independent set of security requirements for a category of products. |
| Protection Profile Configuration (PP-Configuration) | A comprehensive set of security requirements for a product type that consists of at least one Base-PP and at least one PP-Module. |
| Protection Profile Module (PP-Module) | An implementation-independent statement of security needs for a TOE type complementary to one or more Base-PPs. |
| Security Assurance Requirement (SAR) | A requirement to assure the security of the TOE. |
| Security Functional | A requirement for security enforcement by the TOE. |

| | |
|---|---|
| Requirement (SFR) | |
| Security Target (ST) | A set of implementation-dependent security requirements for a specific product. |
| Target of Evaluation (TOE) | The product under evaluation. |
| TOE Security Functionality (TSF) | The security functionality of the product under evaluation. |
| TOE Summary Specification (TSS) | A description of how a TOE satisfies the SFRs in an ST. |

### 1.2.2 Technical Terms

| | |
|---|---|
| Access Point (AP) | A device that provides the network interface that enables wireless client hosts to access a wired network. Once authenticated as trusted nodes on the wired infrastructure, the APs provide the encryption service on the wireless network between the wireless client and the radio frequency (RF) interface of the AP. |
| Administrator | A user that has administrative privilege to configure the TOE. |
| Authentication Credentials | The information the system uses to verify that the user or administrator is authorized to access the TOE or network. Credentials can exist in various forms, such as username/password or digital certificates. |
| Authentication Server (AS) | A server on the wired network that receives authentication credentials from wireless clients and determines their validity. |
| Critical Security Parameter (CSP) | Security related information, e.g. secret and private cryptographic keys, and authentication data such as passwords and Personal Identification Numbers (PINs), whose disclosure or modification can compromise the security of a cryptographic module. |
| Entropy Source | A cryptographic function that provides a seed for a random number generator by accumulating the outputs from one or more noise sources. The functionality includes a measure of the minimum work required to guess a given output and tests to ensure that the noise sources are operating properly. |
| Extensible Authentication Protocol (EAP) | An authentication framework, used in wireless networks, that uses Public Key Infrastructure (PKI) to authenticate both the authentication server and the wireless client. |
| FIPS-Approved Cryptographic Function | A cryptographic operation that is specified for use by FIPS 140. |
| IEEE 802.1X | A standard for port-based network access control that defines an authentication mechanism for WLAN Clients to attach to a wired network. |
| Unauthorized User | A user that has not been granted the ability to use the TOE. |

## 1.3 Compliant Targets of Evaluation

This document specifies SFRs for a WLAN Client. The TOE defined by this PP-Module is a WLAN Client, a component executing on a client machine (often referred to as a "remote access client"). The TOE establishes a secure wireless tunnel between the client device and a WLAN Access System through which all data will traverse.

A WLAN Client allows remote users to use client machines to establish wireless communication with a private network through a WLAN Access System. IP packets passing between the private network and a WLAN Client are encrypted. The WLAN Client protects the confidentiality and integrity of data in transit between itself and the private network, even though it traverses a wireless connection. The focus of the SFRs in this PP-Module is on the following fundamental aspects of a WLAN Client:

- Authentication of the WLAN Client
- Authentication of the Authentication Server
- Cryptographic protection of data in transit
- Implementation of services

The WLAN Client establishes an 802.11 tunnel between the client device and the network infrastructure using IEEE 802.1X with Extensible Authentication Protocol-Transport Layer Security (EAP-TLS) for authentication.

It performs mutual authentication to an AS in the private network as part of the EAP-TLS exchange. The EAP-TLS exchange uses certificates for mutual authentication. The WLAN Client examines the machine certificate transmitted from the AS, checks its validity, and ensures the certificate is signed by a trusted Certificate Authority (CA). The AS will authenticate the WLAN Client certificate at the same time. When the EAP-TLS exchange completes successfully, the network allows the WLAN Client to finish establishing a secure communication tunnel to the private network. The WLAN Client sets up an encrypted, authenticated channel to the WLAN Access System using a 4-way handshake, as specified in IEEE 802.11. Once the channel is established, all communication between the WLAN Client to the WLAN Access System is encrypted with Advanced Encryption Standard (AES) in Cipher Block Chaining-Message Authentication Code Protocol (CCMP) mode and optionally AES in Galois/Counter Mode Protocol (GCMP) mode, as specified in [802.11-2012].

### 1.3.1 TOE Boundary

The WLAN Client (Figure 1), as defined by this PP-Module, is a component executing on a remote access client machine. Note the client is depicted as just a small portion of the WLAN client "machine." As such, the TOE must rely heavily on the TOE's operational environment (host platform, network stack, and operating system) for its execution domain and its proper usage. The TOE will rely on the IT environment to address much of the security functionality related to administrative functions.

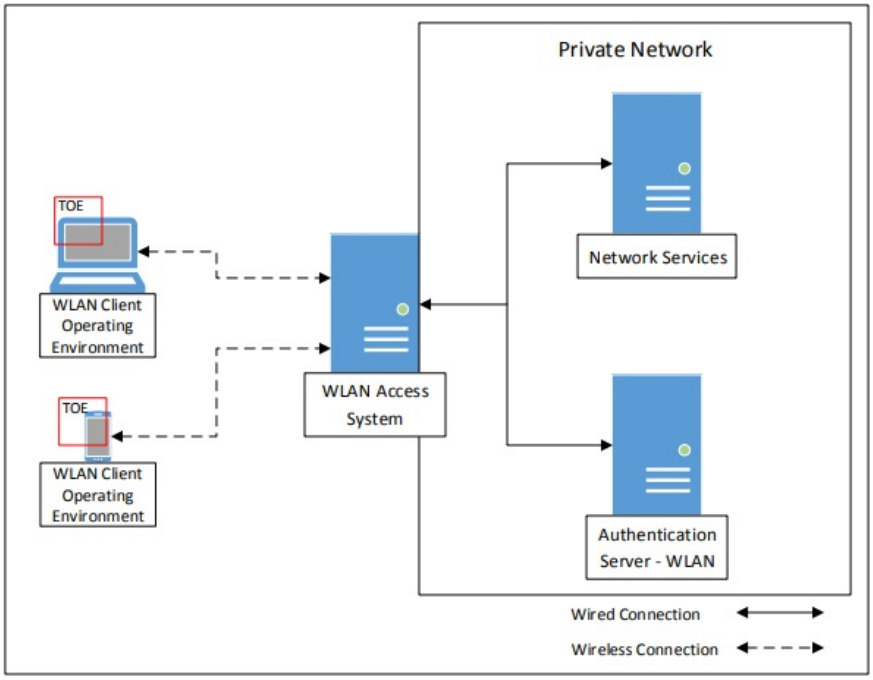



**Figure 1: WLAN Client Operating Environment**

## 1.4 Use-Cases

Requirements in this PP-Module are designed to address the security problems in at least the following use cases. These use cases are intentionally very broad, as many specific use cases exist within these larger categories.

**[USE CASE 1] General-Purpose Operating System**

This use case is for a WLAN Client TOE that is part of a general-purpose operating system. Specifically, the WLAN Client TOE is expected to be part of the operating system itself and not a standalone third-party application that is installed on top of it.

**[USE CASE 2] Mobile Device**

This use case is for a WLAN Client TOE that is part of a mobile operating system that runs on a mobile device. Specifically, the WLAN Client TOE is expected to be part of the mobile operating system itself and not a standalone third-party application that is acquired from the mobile vendor's application store.

# 2 Conformance Claims

**Conformance Statement**

This PP-Module inherits exact conformance as required from the specified Base-PP and as defined in the CC and [CEM] addenda for Exact Conformance, Selection-Based SFRs, and Optional SFRs (dated May 2017).

The following PPs and PP-Modules are allowed to be specified in a PP-Configuration with this PP-Module:

- PP-Module for MDM Agents, Version 1.0
- PP-Module for Bluetooth, Version 1.0
- PP-Module for VPN Client, Version 2.4

**CC Conformance Claims**

This PP-Module is conformant to Parts 2 (extended) and 3 (extended) of Common Criteria Version 3.1, Release 5 [CC].

**Package Claims**

There are no package claims for this PP-Module.

# 3 Security Problem Description

This PP-Module is written to address the situation when an entity desires wireless access to a private network. To allow access to the private network, the entity (machine) must be authenticated before a secure communications channel can be established. The TOE is the entity that seeks to be authenticated and be given access to services offered by the protected network and is the Supplicant in the IEEE 802.1X framework.

## 3.1 Threats

The following threats are specific to WLAN Clients, and represent an addition to those identified in the Base-PPs.

**T.TSF_FAILURE**
: Security mechanisms of the TOE generally build up from a primitive set of mechanisms (e.g., memory management, privileged modes of process execution) to more complex sets of mechanisms. Failure of the primitive mechanisms could lead to a compromise in more complex mechanisms, resulting in a compromise of the TSF.

**T.UNAUTHORIZED_ACCESS**
: A user may gain unauthorized access to the TOE data and TOE executable code. A malicious user, process, or external IT entity may masquerade as an authorized entity in order to gain unauthorized access to data or TOE resources. A malicious user, process, or external IT entity may misrepresent itself as the TOE to obtain identification and authentication data.

**T.UNDETECTED_ACTIONS**
: Malicious remote users or external IT entities may take actions that adversely affect the security of the TOE. These actions may remain undetected and thus their effects cannot be effectively mitigated.

## 3.2 Assumptions

These assumptions are made on the Operational Environment (OE) in order to be able to ensure that the security functionality specified in the PP-Module can be provided by the TOE. If the TOE is placed in an OE that does not meet these assumptions, the TOE may no longer be able to provide all of its security functionality.

**A.NO_TOE_BYPASS**
: Information cannot flow between the wireless client and the internal wired network without passing through the TOE.

**A.TRUSTED_ADMIN**
: TOE Administrators are trusted to follow and apply all administrator guidance in a trusted manner.

## 3.3 Organizational Security Policies

An organization deploying the TOE is expected to satisfy the organizational security policy listed below in addition to all organizational security policies defined by the claimed Base-PP.

This document does not define any additional OSPs.

# 4 Security Objectives

## 4.1 Security Objectives for the TOE

**O.AUTH_COMM**
The TOE will provide a means to ensure that it is communicating with an authorized access point and not some other entity pretending to be an authorized access point, and will provide assurance to the access point of its identity.

**O.CRYPTOGRAPHIC_FUNCTIONS**
The TOE will provide or use cryptographic functions (i.e., encryption/decryption and digital signature operations) to maintain the confidentiality and allow for detection of modification of data that are transmitted outside the TOE and its host environment.

**O.SELF_TEST**
The TOE will provide the capability to test some subset of its security functionality to ensure it is operating properly.

**O.SYSTEM_MONITORING**
The TOE will provide the capability to generate audit data.

**O.TOE_ADMINISTRATION**
The TOE will provide mechanisms to allow administrators to be able to configure the TOE.

**O.WIRELESS_ACCESS_POINT_CONNECTION**
The TOE will provide the capability to restrict the wireless access points to which it will connect.

## 4.2 Security Objectives for the Operational Environment

**OE.NO_TOE_BYPASS**
Information cannot flow between external and internal networks located in different enclaves without passing through the TOE.

**OE.TRUSTED_ADMIN**
TOE administrators are trusted to follow and apply all administrator guidance in a trusted manner.

## 4.3 Security Objectives Rationale

This section describes how the assumptions, threats, and organizational security policies map to the security objectives.

**Table 1: Security Objectives Rationale**

| Threat, Assumption, or OSP | Security Objectives | Rationale |
|---|---|---|
| T.TSF_FAILURE | O.SELF_TEST | The threat T.TSF_FAILURE is mitigated by O.SELF_TEST as this defines a mechanism for ensuring the reliability of the TSF by detecting potential failure conditions. |
| T.UNAUTHORIZED_ACCESS | O.AUTH_COMM | The threat T.UNAUTHORIZED_ACCESS is mitigated in part by O.AUTH_COMM by ensuring the authenticity of any remote endpoint that the TSF connects to. |
| | O.CRYPTOGRAPHIC_FUNCTIONS | The threat T.UNAUTHORIZED_ACCESS is mitigated in part by O.CRYPTOGRAPHIC_FUNCTIONS by ensuring the confidentiality and integrity of data in transit to protect against man-in-the-middle attacks. |
| | O.TOE_ADMINISTRATION | The threat T.UNAUTHORIZED_ACCESS is mitigated in part by O.TOE_ADMINISTRATION by using the TOE platform's authentication mechanism to ensure that only authorized administrators can configure the TOE's behavior. |
| | O.WIRELESS_ACCESS_POINT_CONNECTION | The threat T.UNAUTHORIZED_ACCESS is mitigated in part by this objective because it provides a mechanism to restrict the remote entities that the TOE is permitted to communicate with. |
| T.UNDETECTED_ACTIONS | O.SYSTEM_MONITORING | The threat T.UNDETECTED_ACTIONS is mitigated by O.SYSTEM_MONITORING by enforcing an auditing mechanism that can be used to track security-relevant TOE behavior. |
| A.NO_TOE_BYPASS | OE.NO_TOE_BYPASS | The operational environment objective OE.NO_TOE_BYPASS is realized through A.NO_TOE_BYPASS. |

| | | |
|---|---|---|
| A.TRUSTED_ADMIN | OE.TRUSTED_ADMIN | The Operational Environment objective OE.TRUSTED ADMIN is realized through A.TRUSTED_ADMIN. |

# 5 Security Requirements

This chapter describes the security requirements which have to be fulfilled by the product under evaluation. Those requirements comprise functional components from Part 2 and assurance components from Part 3 of [CC]. The following conventions are used for the completion of operations:

- **Refinement** operation (denoted by **bold text** or ~~strikethrough text~~): is used to add details to a requirement (including replacing an assignment with a more restrictive selection) or to remove part of the requirement that is made irrelevant through the completion of another operation, and thus further restricts a requirement.
- **Selection** (denoted by *italicized text*): is used to select one or more options provided by the [CC] in stating a requirement.
- **Assignment** operation (denoted by *italicized text*): is used to assign a specific value to an unspecified parameter, such as the length of a password. Showing the value in square brackets indicates assignment.
- **Iteration** operation: is indicated by appending the SFR name with a slash and unique identifier suggesting the purpose of the operation, e.g. "/EXAMPLE1."

## 5.1 General Purpose Operating Systems PP Security Functional Requirements Direction

In a PP-Configuration that includes General Purpose Operating Systems PP, the TOE is expected to rely on some of the security functions implemented by the as a whole and evaluated against the General Purpose Operating Systems PP. The following sections describe any modifications that the ST author must make to the SFRs defined in the General Purpose Operating Systems PP in addition to what is mandated by Section 5.3 TOE Security Functional Requirements.

### 5.1.1 Modified SFRs

This PP-Module does not modify any SFRs defined by the General Purpose Operating Systems PP.

### 5.1.2 Additional SFRs

This PP-Module does not define any additional SFRs for any PP-Configuration where the General Purpose Operating Systems PP is claimed as the Base-PP.

## 5.2 Mobile Devices PP Security Functional Requirements Direction

In a PP-Configuration that includes Mobile Devices PP, the TOE is expected to rely on some of the security functions implemented by the as a whole and evaluated against the Mobile Devices PP. The following sections describe any modifications that the ST author must make to the SFRs defined in the Mobile Devices PP in addition to what is mandated by Section 5.3 TOE Security Functional Requirements.

### 5.2.1 Modified SFRs

This PP-Module does not modify any SFRs defined by the Mobile Devices PP.

### 5.2.2 Additional SFRs

This PP-Module does not define any additional SFRs for any PP-Configuration where the Mobile Devices PP is claimed as the Base-PP.

## 5.3 TOE Security Functional Requirements

The following section describes the SFRs that must be satisfied by any TOE that claims conformance to this PP-Module. These SFRs must be claimed regardless of which PP-Configuration is used to define the TOE.

### 5.3.1 Auditable Events for Mandatory SFRs

**Table 2: Auditable Events for Mandatory Requirements**

| Requirement | Auditable Events | Additional Audit Record Contents |
|---|---|---|
| FAU_GEN.1/WLAN | No events specified. | N/A |
| FCS_CKM.1/WPA | No events specified. | N/A |
| FCS_CKM.2/WLAN | No events specified. | N/A |
| FCS_TLSC_EXT.1/WLAN | Failure to establish an EAP-TLS session. | Reason for failure.<br>Non-TOE endpoint of connection. |
| FCS_TLSC_EXT.1/WLAN | Establishment/termination of an EAP-TLS session. | Non-TOE endpoint of connection. |
| FCS_WPA_EXT.1 | No events specified. | N/A |
| FIA_PAE_EXT.1 | No events specified. | N/A |

| | | |
|---|---|---|
| FIA_X509_EXT.1/WLAN | Failure to validate X.509v3 certificate. | Reason for failure of validation. |
| FIA_X509_EXT.2/WLAN | No events specified. | N/A |
| FIA_X509_EXT.6 | Attempts to load certificates. | None. |
| FIA_X509_EXT.6 | Attempts to revoke certificates. | None. |
| FMT_SMF.1/WLAN | No events specified. | N/A |
| FPT_TST_EXT.3/WLAN | Execution of this set of TSF self-tests. | None. |
| FPT_TST_EXT.3/WLAN | **[selection:** *Detected integrity violation, None*]. | **[selection:** *The TSF binary file that caused the integrity violation , None*]. |
| FTA_WSE_EXT.1 | All attempts to connect to access points. | For each access point record the [**selection**: *Complete SSID and MAC, Certificate Check Message and the last [**assignment**: integer greater than or equal to 2] octets*] of the MAC Address Success and failures (including reason for failure). |
| FTP_ITC.1/WLAN | All attempts to establish a trusted channel. | Identification of the non-TOE endpoint of the channel. |

### 5.3.2 Security Audit (FAU)

#### FAU_GEN.1/WLAN Audit Data Generation (Wireless LAN)

FAU_GEN.1.1/WLAN

The TSF shall **[selection: *invoke platform-provided functionality, implement functionality*]** to generate an audit record of the following auditable events:

a. Startup and shutdown of the audit functions;
b. All auditable events for [*not specified*] level of audit; and
c. [*all auditable events for mandatory SFRs specified in Table 2 and selected SFRs in Table 5*].

**Application Note:** If auditing for the WLAN Client cannot be controlled separately from its underlying platform, the "Startup and shutdown of the audit functions" event defined in each Base-PP is sufficient to address that event for this iteration of the SFR.

Auditable events for selection-based SFRs are found in Table 5. If the TOE does not claim a particular selection-based SFR, it is not expected to generate any corresponding audit records for that SFR.

Table 2 includes auditable events for FPT_TST_EXT.3/WLAN. If the TOE does not perform its own self-tests (i.e., "TOE platform" is selected in FPT_TST_EXT.3.1/WLAN and FPT_TST_EXT.3.2/WLAN), the audit record for this event may also be generated by the TOE platform.

FAU_GEN.1.2/WLAN

The **[selection: *TSF, TOE platform*]** shall record within each audit record at least the following information:

a. Date and time of the event, type of event, subject identity, (if relevant) the outcome (success or failure) of the event; and
b. For each audit event type, based on the auditable event definitions of the functional components included in the PP-**Module**/ST, [*Additional Audit Record Contents as specified in Table 2 and Table 5*].

### 5.3.3 Cryptographic Support (FCS)

#### FCS_CKM.1/WPA Cryptographic Key Generation (Symmetric Keys for WPA2/WPA3 Connections)

FCS_CKM.1.1/WPA

The TSF shall generate **symmetric** cryptographic keys in accordance with a specified cryptographic key generation algorithm [***PRF-384 and [selection: PRF-512, PRF-704, no other algorithm] (as defined in IEEE 802.11-2012)***] and specified key sizes [***256 bits and [selection: 128 bits, 192 bits, no other key sizes]***] **using a Random Bit Generator as specified in FCS_RBG_EXT.1**.

**Application Note:** The cryptographic key derivation algorithm required by

IEEE 802.11-2012 (Section 11.6.1.2) and verified in WPA2 certification is PRF-384, which uses the HMAC-SHA-1 function and outputs 384 bits. The use of GCMP was first defined in IEEE 802.11ac-2014 (Section 11.4.5) but subsequently integrated into 802.11-2012. This protocol requires a key derivation function (KDF) KDF based on HMAC-SHA-256 (for 128-bit symmetric keys) or HMAC-SHA384 (for 256-bit symmetric keys). This KDF outputs 704 bits.

This requirement applies only to the keys that are generated/derived for the communications between the access point and the client once the client has been authenticated. It refers to the derivation of the Pairwise Temporal Key (PTK) from the PMK, which is done using a random value generated by the RBG specified in this PP-Module, the HMAC function using SHA-1 as specified in this PP-Module, as well as other information.

### FCS_CKM.2/WLAN Cryptographic Key Distribution (Group Temporal Key for WLAN)

FCS_CKM.2.1/WLAN

The TSF shall **decrypt Group Temporal Key** in accordance with a specified cryptographic key distribution method [*AES Key Wrap (as defined in RFC 3394) in an EAPOL-Key frame (as defined in IEEE 802.11-2012 for the packet format and timing considerations*] **and does not expose the cryptographic keys**.

**Application Note:** This requirement applies to the Group Temporal Key (GTK) that is received by the TOE for use in decrypting broadcast and multicast messages from the access point to which it's connected. 802.11-2012 specifies the format for the transfer as well as the fact that it must be wrapped by the AES Key Wrap method specified in RFC 3394; the TOE must be capable of unwrapping such keys.

### FCS_TLSC_EXT.1/WLAN TLS Client Protocol (EAP-TLS for WLAN)

FCS_TLSC_EXT.1.1/WLAN

The TSF shall implement TLS 1.2 (RFC 5246) and [**selection**: *TLS 1.1 (RFC 4346), no other TLS version*] in support of the EAP-TLS protocol as specified in RFC 5216 supporting the following cipher suites: [**selection**:

- *TLS_RSA_WITH_AES_128_CBC_SHA as defined in RFC 5246*,
- *TLS_RSA_WITH_AES_128_CBC_SHA256 as defined in RFC 5246*,
- *TLS_RSA_WITH_AES_256_CBC_SHA256 as defined in RFC 5246*,
- *TLS_RSA_WITH_AES_256_GCM_SHA384 as defined in RFC 5288*,
- *TLS_DHE_RSA_WITH_AES_128_CBC_SHA256 as defined in RFC 5246*,
- *TLS_DHE_RSA_WITH_AES_256_CBC_SHA256 as defined in RFC 5246*,
- *TLS_DHE_RSA_WITH_AES_256_GCM_SHA384 as defined in RFC 5288*,
- *TLS_ECDHE_ECDSA_WITH_AES_128_CBC_SHA256 as defined in RFC 5289*,
- *TLS_ECDHE_ECDSA_WITH_AES_128_GCM_SHA256 as defined in RFC 5289*,
- *TLS_ECDHE_ECDSA_WITH_AES_256_CBC_SHA384 as defined in RFC 5289*,
- *TLS_ECDHE_ECDSA_WITH_AES_256_GCM_SHA384 as defined in RFC 5289*,
- *TLS_ECDHE_RSA_WITH_AES_128_CBC_SHA256 as defined in RFC 5289*,
- *TLS_ECDHE_RSA_WITH_AES_128_GCM_SHA256 as defined in RFC 5289*,
- *TLS_ECDHE_RSA_WITH_AES_256_CBC_SHA384 as defined in RFC 5289*,
- *TLS_ECDHE_RSA_WITH_AES_256_GCM_SHA384 as defined in RFC 5289*

].

**Application Note:** If any of the ECDHE cipher suites are selected by the ST author, it is necessary to claim the selection-based requirement FCS_TLSC_EXT.2/WLAN.

FCS_TLSC_EXT.1.2/WLAN

The TSF shall generate random values used in the EAP-TLS exchange using the RBG specified in FCS_RBG_EXT.1.

FCS_TLSC_EXT.1.3/WLAN

The TSF shall use X509 v3 certificates as specified in FIA_X509_EXT.1**/WLAN**.

FCS_TLSC_EXT.1.4/WLAN

The TSF shall verify that the server certificate presented includes the Server Authentication purpose (id-kp 1 with OID 1.3.6.1.5.5.7.3.1) in the extendedKeyUsage field.

FCS_TLSC_EXT.1.5/WLAN

The TSF shall allow an authorized administrator to configure the list of CAs that are allowed to sign authentication server certificates that are accepted by the TOE.

**Application Note:** The cipher suites to be tested in the evaluated configuration are limited by this requirement. The ST author should select the optional cipher suites that are supported. It is necessary to limit the cipher suites that can be

used in an evaluated configuration administratively on the server in the test environment.

While FCS_TLSC_EXT.1.4/WLAN requires that the TOE perform certain checks on the certificate presented by the authentication server, there are corresponding checks that the authentication server will have to perform on the certificate presented by the client; namely that the extendedKeyUsage field of the client certificate includes "Client Authentication" and that the digital signature bit (for the Diffie-Hellman cipher suites) or the key encipherment bit (for RSA cipher suites) be set. Certificates obtained for use by the TOE will have to conform to these requirements in order to be used in the enterprise.

The FIA_X509_EXT.1 requirements defined in each of the possible Base-PPs define requirements that the underlying platform is expected to implement.

#### FCS_WPA_EXT.1 Supported WPA Versions

FCS_WPA_EXT.1.1

The TSF shall support WPA3 and [**selection**: *WPA2*, *no other*] security type.

**Application Note:** The WLAN client can support connecting to networks of other security types (e.g., open); however, those will not be tested as part of this evaluation and FMT_SMF.1 will ensure that the client can be configured to only connect to WPA3 and, if selected WPA2, networks.

### 5.3.4 Identification and Authentication (FIA)

#### FIA_PAE_EXT.1 Port Access Entity Authentication

FIA_PAE_EXT.1.1

The TSF shall conform to IEEE Standard 802.1X for a Port Access Entity (PAE) in the “Supplicant” role.

**Application Note:** This requirement covers the TOE's role as the supplicant in an 802.1X authentication exchange. If the exchange is completed successfully, the TOE will derive the PMK as a result of the EAP-TLS (or other appropriate EAP exchange) and perform the 4-way handshake with the wireless access system (authenticator) to begin 802.11 communications.

As indicated previously, there are at least two communication paths present during the exchange; one with the wireless access system and one with the authentication server that uses the wireless access system as a relay. The TOE establishes an EAP over LAN (EAPOL) connection with the wireless access system as specified in 802.1X-2020. The TOE and authentication server establish an EAP-TLS session (RFC 5216).

The point of performing 802.1X authentication is to gain access to the network (assuming the authentication was successful and that all 802.11 negotiations are performed successfully); in the terminology of 802.1X, this means the TOE will gain access to the "controlled port" maintained by the wireless access system.

#### FIA_X509_EXT.1/WLAN X.509 Certificate Validation

FIA_X509_EXT.1.1/WLAN

The TSF shall validate certificates for **EAP-TLS** in accordance with the following rules:

- RFC 5280 certificate validation and certificate path validation
- The certificate path must terminate with a certificate in the Trust Anchor Database
- The TSF shall validate a certificate path by ensuring the presence of the basicConstraints extension and that the CA flag is set to TRUE for all CA certificates
- The TSF shall validate the extendedKeyUsage field according to the following rules:
  - Server certificates presented for TLS shall have the Server Authentication purpose (id-kp 1 with OID 1.3.6.1.5.5.7.3.1) in the extendedKeyUsage field
  - Client certificates presented for TLS shall have the Client Authentication purpose (id-kp 2 with OID 1.3.6.1.5.5.7.3.2) in the extendedKeyUsage field.

FIA_X509_EXT.1.2/WLAN

The TSF shall only treat a certificate as a CA certificate if the basicConstraints extension is present and the CA flag is set to TRUE.

**Application Note:** FIA_X509_EXT.1/WLAN lists the rules for validating certificates for EAP-TLS. In contrast to FIA_X509_EXT.1 in the Base-PPs, this iteration does not require revocation checking for the EAP-TLS connection used to establish a Wi-Fi connection. The FIA_X509_EXT.1 requirements defined in each of the possible Base-PPs define requirements that the underlying platform is expected to implement in order to support compliance with RFC 5280.

#### FIA_X509_EXT.2/WLAN X.509 Certificate Authentication (EAP-TLS for WLAN)

FIA_X509_EXT.2.1/WLAN

The TSF shall use X.509v3 certificates as defined by RFC 5280 to support [*[authentication for EAP-TLS exchanges]*].

**Application Note:** RFC 5280 defines certificate validation and certification path validation requirements that must be implemented by the TSF. The FIA_X509_EXT.1 requirements defined in each of the supported Base-PPs define requirements that the underlying platform is expected to implement in order to support compliance with this RFC.

#### FIA_X509_EXT.6 X.509 Certificate Storage and Management

FIA_X509_EXT.6.1

The TSF shall [**selection**: *store and protect, invoke [**assignment**: platform storage mechanism] to store and protect*] certificate(s) from unauthorized deletion and modification.

FIA_X509_EXT.6.2

The TSF shall [**selection**: *provide the capability for authorized administrators to load X.509v3 certificates into the TOE, rely on [**assignment**: platform mechanism] to load X.509v3 certificates into [**assignment**: platform storage mechanism]*] for use by the TSF.

**Application Note:** This PP-Module assumes that any platform mechanism used for X.509 certificate loading is capable of enforcing access control to prevent unauthorized subjects from manipulating the contents of the certificate storage.

### 5.3.5 Security Management (FMT)

#### FMT_SMF.1/WLAN Specification of Management Functions (WLAN Client)

FMT_SMF.1.1/WLAN

The TSF shall be capable of performing the following management functions:

**Table 3: Management Functions**

Status Markers:
M - Mandatory
O - Optional/Objective

| # | Management Function | Impl | Admin | User |
|---|---|---|---|---|
| WL-1 | configure security policy for each wireless network:<br>• [**selection**: *specify the CA(s) from which the TSF will accept WLAN authentication server certificate(s), specify the Fully Qualified Domain Names (FQDNs) of acceptable WLAN authentication server certificate(s)*],<br>• security type,<br>• authentication protocol,<br>• client credentials to be used for authentication,<br>• set wireless frequency band to [**selection**: *2.4 GHz, 5 GHz, 6 GHz*] | M | M | O |
| WL-2 | specify wireless networks (SSIDs) to which the TSF may connect | M | M | O |
| WL-3 | enable/disable disable wireless network bridging capability (for example, bridging a connection between the WLAN and cellular radios to function as a hotspot) authenticated by [**selection**: *pre-shared key, passcode, no authentication*] | M | M | O |
| WL-4 | enable/disable certificate revocation list checking | O | O | O |
| WL-5 | disable ad hoc wireless client-to-client connection capability | O | O | O |
| WL-6 | disable roaming capability | O | O | O |
| WL-7 | enable/disable IEEE 802.1X pre-authentication | O | O | O |

| | | | | |
|---|---|---|---|---|
| WL-8 | loading X.509 certificates into the TOE | O | O | O |
| WL-9 | revoke X.509 certificates loaded into the TOE | O | O | O |
| WL-10 | enable/disable and configure PMK caching:<br>• set the amount of time (in minutes) for which PMK entries are cached,<br>• set the maximum number of PMK entries that can be cached | O | O | O |

**Application Note:** For installation, the WLAN Client relies on the underlying platform to authenticate the administrator to the client machine on which the TOE is installed.

For the function "configure the cryptoperiod for the established session keys," the unit of measure for configuring the cryptoperiod must be no greater than an hour. For example: units of measure in seconds, minutes and hours are acceptable and units of measure in days or greater are not acceptable.

### 5.3.6 Protection of the TSF (FPT)

#### FPT_TST_EXT.3/WLAN TSF Cryptographic Functionality Testing (WLAN Client)

FPT_TST_EXT.3.1/WLAN

The [**selection**: *TOE*, *TOE platform*] shall run a suite of self-tests during initial start-up (on power on) to demonstrate the correct operation of the TSF.

FPT_TST_EXT.3.2/WLAN

The [**selection**: *TOE*, *TOE platform*] shall provide the capability to verify the integrity of stored TSF executable code when it is loaded for execution through the use of the TSF-provided cryptographic services.

**Application Note:** While the TOE is defined as a software package running on a platform defined by the claimed Base-PP, it is still capable of performing the self-test activities required above. However, if the cryptographic algorithm implementation is provided by the underlying platform, it may be the case where the TSF self-testing is a check to verify that the underlying platform has successfully completed its own self-tests prior to the TSF attempting to use the implementation. It should be understood that there is a significant dependency on the host platform in assessing the assurance provided by these self-tests since a compromise of the underlying platform could potentially result in the self-tests functioning incorrectly.

### 5.3.7 TOE Access (FTA)

#### FTA_WSE_EXT.1 Wireless Network Access

FTA_WSE_EXT.1.1

The TSF shall be able to attempt connections only to wireless networks specified as acceptable networks as configured by the administrator in FMT_SMF.1.1/WLAN.

**Application Note:** The intent of this requirement is to allow the administrator to limit the wireless networks to which the TOE is allowed to connect.

### 5.3.8 Trusted Path/Channels (FTP)

#### FTP_ITC.1/WLAN Trusted Channel Communication (Wireless LAN)

FTP_ITC.1.1/WLAN

The TSF shall **use 802.11-2012, 802.1X, and EAP-TLS** to provide a **trusted** communication channel between itself and **a wireless access point** that is logically distinct from other communication channels and provides assured identification of its end points and protection of the channel data from modification or disclosure.

FTP_ITC.1.2/WLAN

The TSF shall permit [*the TSF*] to initiate communication via the trusted channel.

FTP_ITC.1.3/WLAN

The TSF shall initiate communication via the trusted channel for [*wireless access point connections*].

**Application Note:** The intent of the above requirement is to use the cryptographic protocols identified in the requirement to protect communications between the TOE and the Access Point.

The requirement implies that not only are communications protected when they are initially established, but also on resumption after an outage. It may be the case that some part of the TOE setup involves manually setting up tunnels to

protect other communication, and if after an outage the TOE attempts to re-establish the communication automatically with (the necessary) manual intervention, there may be a window created where an attacker might be able to gain critical information or compromise a connection. The following tests are only intended to cover the WLAN communication channel (not other communication channels that may be available on the TOE such as mobile broadband).

## 5.4 TOE Security Functional Requirements Rationale

The following rationale provides justification for each security objective for the TOE, showing that the SFRs are suitable to meet and achieve the security objectives:

**Table 4: SFR Rationale**

| Objective | Addressed by | Rationale |
|---|---|---|
| O.AUTH_COMM | FCS_TLSC_EXT.1/WLAN | FCS_TLSC_EXT.1/WLAN supports the objective by requiring the TSF to use EAP-TLS to establish a secure connection to a wireless access point, including authentication of the access point. |
| | FIA_PAE_EXT.1 | FIA_PAE_EXT.1 supports the objective by requiring the TSF to act as the supplicant for 802.1X authentication. |
| | FIA_X509_EXT.1/WLAN | FIA_X509_EXT.1/WLAN supports the objective by defining how the TSF determines the validity of presented X.509 certificates. |
| | FIA_X509_EXT.2/WLAN | FIA_X509_EXT.2/WLAN supports the objective by requiring the TSF to implement X.509 certificate authentication as the mechanism for authentication EAP-TLS connections. |
| | FTP_ITC.1/WLAN | FTP_ITC.1/WLAN supports the objective by requiring the TSF to implement trusted protocols that include authentication of the remote endpoints. |
| | FCS_TLSC_EXT.2/WLAN (selection-based) | FCS_TLSC_EXT.2/WLAN supports the objective by optionally requiring the TSF to support only certain elliptic curves if the TOE implements any EAP-TLS cipher suites that rely on ECDHE as the key establishment method. |
| O.CRYPTOGRAPHIC_FUNCTIONS | FCS_CKM.1/WPA | FCS_CKM.1/WPA supports the objective by requiring the TSF to generate symmetric keys used for WPA2 and WPA3 in a specified manner. |
| | FCS_CKM.2/WLAN | FCS_CKM.2/WLAN supports the objective by requiring the TSF to decrypt group temporal keys used for IEEE 802.11. |
| | FCS_WPA_EXT.1 | FCS_WPA_EXT.1 supports this objective by defining the WPA versions that are supported. |
| O.SELF_TEST | FPT_TST_EXT.3/WLAN | FPT_TST_EXT.3/WLAN supports the objective by requiring the TSF to perform self-tests to ensure that it is operating in a known state. |
| O.SYSTEM_MONITORING | FAU_GEN.1/WLAN | FAU_GEN.1/WLAN supports the objective by requiring the TSF to generate audit records for security-relevant WLAN behavior. |
| O.TOE_ADMINISTRATION | FIA_X509_EXT.6 | FIA_X509_EXT.6 supports the objective by requiring the TSF to securely store certificates in a repository that an administrator can interact with, whether that repository is provided by the WLAN client itself or by a platform storage mechanism defined by the Base-PP portion of the TOE. |
| | FMT_SMF.1/WLAN | FMT_SMF.1/WLAN supports the objective by requiring the TSF to implement management functionality for security-relevant WLAN behavior. |
| O.WIRELESS_ACCESS_POINT_CONNECTION | FTA_WSE_EXT.1 | FTA_WSE_EXT.1 supports the objective by requiring the TSF to restrict connectivity to allowed wireless networks. |

## 5.5 TOE Security Assurance Requirements

This PP-Module does not define any SARs beyond those defined within the Base-PPs to which it can claim conformance. It is important to note that a TOE that is evaluated against this PP-Module is inherently evaluated against the General Purpose Operating Systems PP, and Mobile Devices PP as well. These PPs include a number of EAs associated with both Security Functional Requirements (SFRs) and SARs. Additionally, this PP-Module includes a number of SFR-based EAs that similarly refine the SARs of the Base-PPs. The evaluation laboratory will evaluate the TOE against the chosen Base-PP and supplement that evaluation with the necessary SFRs that are taken from this PP-Module.

# 6 Consistency Rationale

## 6.1 Protection Profile for General Purpose Operating Systems

### 6.1.1 Consistency of TOE Type

When this PP-Module is used to extend the GPOS PP, the TOE type for the overall TOE is still a general-purpose operating system. The TOE boundary is simply extended to include the WLAN Client functionality that runs on the operating system.

### 6.1.2 Consistency of Security Problem Definition

| PP-Module Threat, Assumption, OSP | Consistency Rationale |
|---|---|
| T.TSF_FAILURE | The Base-PP defines threats for local attacks and remote attacks, both of which could cause a failure of the TSF. This PP-Module adds a generic TSF failure threat in the event that the WLAN Client fails through unintended system behavior rather than a direct malicious attack. |
| T.UNAUTHORIZED_ACCESS | The Base-PP defines threats for local attacks and remote attacks. The threat of unauthorized access to the WLAN Client is a specific threat that results from successful exploitation of one of these Base-PP threats. |
| T.UNDETECTED_ACTIONS | The Base-PP defines threats for local attacks and remote attacks. It does not define a threat specifically for undetected actions but it does map the local attack and remote attack threats to a TOE objective for accountability. Therefore, the threat of undetected actions is consistent with the Base-PP because this is a subset of the threats defined in the Base-PP, or a mechanism to increase the likelihood that these threats will successfully be exploited. |
| A.NO_TOE_BYPASS | This assumption relates to the deployment of the TOE in relation to the network resources that it interacts with. It does not enforce any restrictions on the TOE's deployment that are contrary to what the Base-PP requires. |
| A.TRUSTED_ADMIN | The Base-PP defines A.PROPER_USER and A.PROPER_ADMIN assumptions that serve the same purpose as A.TRUSTED_ADMIN in this PP-Module. |

### 6.1.3 Consistency of Objectives

The objectives for the TOEs are consistent with the General Purpose Operating Systems PP based on the following rationale:

| PP-Module TOE Objective | Consistency Rationale |
|---|---|
| O.AUTH_COMM | This objective is specifically for a communications interface that is defined by the PP-Module, but it is consistent with the general O.PROTECTED_COMMS objective specified in the Base-PP. |
| O.CRYPTOGRAPHIC_FUNCTIONS | The TOE implements this objective in part by relying on the cryptographic functionality specified in the Base-PP to address the Base-PP's O.PROTECTED_COMMS objective. The PP-Module uses these cryptographic functions for the same purpose as the Base-PP. |
| O.SELF_TEST | The Base-PP defines a general O.INTEGRITY objective; this PP-Module defines O.SELF_TEST as a specific method of guaranteeing the integrity of the TOE. |
| O.SYSTEM_MONITORING | The Base-PP defines an O.ACCOUNTABILITY objective for system auditing. The O.SYSTEM_MONITORING objective in this PP-Module serves the same purpose. |
| O.TOE_ADMINISTRATION | The Base-PP defines an O.MANAGEMENT objective for TOE administration. The O.TOE_ADMINISTRATION objective in this PP-Module serves the same purpose. |
| O.WIRELESS_ACCESS_POINT_CONNECTION | This objective relates to behavior that applies to a communications interface defined in this PP-Module and therefore does not relate to the Base-PP's functionality. |

The objectives for the TOE's OE are consistent with the General Purpose Operating Systems PP based on the following rationale:

| PP-Module OE |
|---|

| Objective | Consistency Rationale |
|---|---|
| OE.NO_TOE_BYPASS | This objective relates to the deployment of the TOE in relation to the network resources that it interacts with. It does not enforce any restrictions on the TOE's deployment that are contrary to what the Base-PP requires. |
| OE.TRUSTED_ADMIN | The Base-PP defines OE.PROPER_USER and OE.PROPER_ADMIN objectives that serve the same purpose as OE.TRUSTED_ADMIN in this PP-Module. |

### 6.1.4 Consistency of Requirements

This PP-Module identifies several SFRs from the General Purpose Operating Systems PP that are needed to support WLAN Clients functionality. This is considered to be consistent because the functionality provided by the General Purpose Operating Systems PP is being used for its intended purpose. The rationale for why this does not conflict with the claims defined by the General Purpose Operating Systems PP are as follows:

| PP-Module Requirement | Consistency Rationale |
|---|---|
| **Modified SFRs** | |
| This PP-Module does not modify any requirements when the General Purpose Operating Systems PP is the base. | |
| **Additional SFRs** | |
| This PP-Module does not add any requirements when the General Purpose Operating Systems PP is the base. | |
| **Mandatory SFRs** | |
| FAU_GEN.1/WLAN | The Base-PP defines its own auditing mechanism; this PP-Module can use that mechanism or implement its own to generate audit records for security-relevant events that are specific to this PP-Module. |
| FCS_CKM.1/WPA | This SFR requires the TOE to generate cryptographic keys that are only used by the PP-Module's functionality. It invokes Base-PP functionality to do this in a manner that the Base-PP permits. |
| FCS_CKM.2/WLAN | This SFR requires the TOE to perform a decryption operation using AES Key Wrap, which is a function that the Base-PP provides. |
| FCS_TLSC_EXT.1/WLAN | This SFR requires the TOE to implement EAP-TLS; this protocol relies on the same cryptographic functionality that the Base-PP uses to implement TLS. |
| FCS_WPA_EXT.1 | This SFR requires the TOE to specify the WPA versions it supports; this is functionality that is specific to the PP-Module and does not affect any Base-PP functionality. |
| FIA_PAE_EXT.1 | This SFR defines the ability of the TOE to implement IEEE 802.1X. This behavior relates entirely to the PP-Module and does not affect the ability of the Base-PP to implement its security functionality. |
| FIA_X509_EXT.1/WLAN | This SFR defines the TOE's X.509 certificate validation specifically when validating EAP-TLS certificates. The Base-PP also defines an iteration of this SFR but the PP-Module requires a separate iteration because EAP-TLS certificates have specific handling requirements that are not present in the Base-PP because the Base-PP does not define implementation of the EAP-TLS protocol. |
| FIA_X509_EXT.2/WLAN | This SFR defines the TOE's use of X.509 certificates in EAP-TLS. This function uses the same certificate validation functionality that the Base-PP defines. |
| FIA_X509_EXT.6 | This SFR defines behavior for implementing certificate storage. The SFR allows for the possibility that existing platform storage can be used, so it does not conflict with the Base-PP if that portion of the TOE already implements its own storage mechanism. |
| FMT_SMF.1/WLAN | This SFR defines the management activities that are specific to this PP-Module. This behavior relates entirely to the PP-Module and does not affect the ability of the Base-PP to implement its security functionality. |
| FPT_TST_EXT.3/WLAN | This SFR defines self-test behavior for the WLAN Client. This behavior relates entirely to the PP-Module and does not affect the ability of the Base-PP to implement its security functionality. |
| FTA_WSE_EXT.1 | This SFR requires the TOE to restrict the wireless networks that it can connect to. This behavior relates entirely to the PP-Module and does not affect the ability of the Base-PP to implement its security functionality. |
| FTP_ITC.1/WLAN | This SFR defines the protocols that the TOE uses for secure wireless |

| | |
|---|---|
| | communications. This behavior relates entirely to the PP-Module and does not affect the ability of the Base-PP to implement its security functionality. |
| **Optional SFRs** | |
| This PP-Module does not define any Optional requirements. | |
| **Selection-based SFRs** | |
| FCS_TLSC_EXT.2/WLAN | This SFR requires the TOE to validate a specific TLS extension when establishing EAP-TLS communications. This behavior relates entirely to the PP-Module and does not affect the ability of the Base-PP to implement its security functionality. |
| **Objective SFRs** | |
| This PP-Module does not define any Objective requirements. | |
| **Implementation-based SFRs** | |
| This PP-Module does not define any Implementation-based requirements. | |

## 6.2 Protection Profile for Mobile Devices

### 6.2.1 Consistency of TOE Type

When this PP-Module is used to extend the MDF PP, the TOE type for the overall TOE is still a mobile device. The TOE boundary is simply extended to include the WLAN Client functionality that runs on the mobile device's Rich OS.

### 6.2.2 Consistency of Security Problem Definition

| PP-Module Threat, Assumption, OSP | Consistency Rationale |
|---|---|
| T.TSF_FAILURE | The Base-PP defines the T.FLAWAPP threat for the threat that application failures may pose to the device as a whole. The T.TSF_FAILURE threat from this PP-Module is a specific example of the T.FLAWAPP threat, though it relates to the WLAN Client as an intrinsic part of the mobile device rather than a third-party application installed on top of it. The Base-PP also defines the T.PERSISTENT threat, which is another specific case of TSF failure. |
| T.UNAUTHORIZED_ACCESS | The Base-PP defines threats for network eavesdropping and network attacks. Exploiting either threat could allow an attacker to exploit the T.UNAUTHORIZED_ACCESS threat defined by this PP-Module. |
| T.UNDETECTED_ACTIONS | The Base-PP defines threats for persistent access to the TOE and flawed applications on the TOE. It does not define a threat specifically for undetected actions but the threat of undetected actions defined by this PP-Module could increase the likelihood that the Base-PP threats can be successfully exploited. |
| A.NO_TOE_BYPASS | This assumption relates to the deployment of the TOE in relation to the network resources that it interacts with. It does not enforce any restrictions on the TOE's deployment that are contrary to what the Base-PP requires. |
| A.TRUSTED_ADMIN | The Base-PP defines the A.TRUSTED_ADMIN assumptions that expects administrators will configure the TOE correctly, which also implies they are non-malicious. |

### 6.2.3 Consistency of Objectives

The objectives for the TOEs are consistent with the Mobile Devices PP based on the following rationale:

| PP-Module TOE Objective | Consistency Rationale |
|---|---|
| O.AUTH_COMM | This objective is specifically for a communications interface that is defined by the PP-Module, but it is consistent with the general O.COMMS objective specified in the Base-PP. |
| O.CRYPTOGRAPHIC_FUNCTIONS | The TOE implements this objective in part by relying on the cryptographic functionality specified in the Base-PP to address the Base-PP's O.COMMS objective. The PP-Module uses these cryptographic functions for the same purpose as the Base-PP. |
| O.SELF_TEST | The Base-PP defines a general O.INTEGRITY objective; this PP-Module defines O.SELF_TEST as a specific method of guaranteeing the integrity of the TOE. |

| | |
|---|---|
| O.SYSTEM_MONITORING | The Base-PP defines an O.INTEGRITY objective that includes system auditing as a method of asserting the TOE's integrity. The O.SYSTEM_MONITORING objective in this PP-Module serves the same purpose. |
| O.TOE_ADMINISTRATION | The Base-PP defines an O.CONFIG objective for TOE administration. The O.TOE_ADMINISTRATION objective in this PP-Module serves the same purpose. |
| O.WIRELESS_ACCESS_POINT_CONNECTION | This objective relates to behavior that applies to a communications interface defined in this PP-Module and therefore does not relate to the Base-PP's functionality. |

The objectives for the TOE's OE are consistent with the Mobile Devices PP based on the following rationale:

| PP-Module OE Objective | Consistency Rationale |
|---|---|
| OE.NO_TOE_BYPASS | This objective relates to the deployment of the TOE in relation to the network resources that it interacts with. It does not enforce any restrictions on the TOE's deployment that are contrary to what the Base-PP requires. |
| OE.TRUSTED_ADMIN | The Base-PP defines the OE.CONFIG objective that expects administrators will configure the TOE correctly, which also implies they are non-malicious. |

### 6.2.4 Consistency of Requirements

This PP-Module identifies several SFRs from the Mobile Devices PP that are needed to support WLAN Clients functionality. This is considered to be consistent because the functionality provided by the Mobile Devices PP is being used for its intended purpose. The rationale for why this does not conflict with the claims defined by the Mobile Devices PP are as follows:

| PP-Module Requirement | Consistency Rationale |
|---|---|
| **Modified SFRs** | |
| This PP-Module does not modify any requirements when the Mobile Devices PP is the base. | |
| **Additional SFRs** | |
| This PP-Module does not add any requirements when the Mobile Devices PP is the base. | |
| **Mandatory SFRs** | |
| FAU_GEN.1/WLAN | The Base-PP defines its own auditing mechanism; this PP-Module can use that mechanism or implement its own to generate audit records for security-relevant events that are specific to this PP-Module. |
| FCS_CKM.1/WPA | This SFR requires the TOE to generate cryptographic keys that are only used by the PP-Module's functionality. It invokes Base-PP functionality to do this in a manner that the Base-PP permits.This SFR requires the TOE to generate cryptographic keys that are only used by the PP-Module's functionality. It invokes Base-PP functionality to do this in a manner that the Base-PP permits. |
| FCS_CKM.2/WLAN | This SFR requires the TOE to perform a decryption operation using AES Key Wrap, which is a function that the Base-PP provides. |
| FCS_TLSC_EXT.1/WLAN | This SFR requires the TOE to implement EAP-TLS; this protocol relies on the same cryptographic functionality that the Base-PP uses to implement TLS. |
| FCS_WPA_EXT.1 | This SFR requires the TOE to specify the WPA versions it supports; this is functionality that is specific to the PP-Module and does not affect any Base-PP functionality. |
| FIA_PAE_EXT.1 | This SFR defines the ability of the TOE to implement IEEE 802.1X. This behavior relates entirely to the PP-Module and does not affect the ability of the Base-PP to implement its security functionality. |
| FIA_X509_EXT.1/WLAN | This SFR defines the TOE's X.509 certificate validation specifically when validating EAP-TLS certificates. The Base-PP also defines an iteration of this SFR but the PP-Module requires a separate iteration because EAP-TLS certificates have specific handling requirements that are not present in the Base-PP because the Base-PP does not define implementation of the EAP-TLS protocol. |
| FIA_X509_EXT.2/WLAN | This SFR defines the TOE's use of X.509 certificates in EAP-TLS. This function uses the same certificate validation functionality that the Base-PP defines. |
| FIA_X509_EXT.6 | This SFR defines behavior for implementing certificate storage. The SFR allows for the possibility that existing platform storage can be used, so it does not conflict with the Base-PP if that portion of the TOE already implements its own |

| | |
|---|---|
| | storage mechanism. |
| FMT_SMF.1/WLAN | This SFR defines the management activities that are specific to this PP-Module. This behavior relates entirely to the PP-Module and does not affect the ability of the Base-PP to implement its security functionality. |
| FPT_TST_EXT.3/WLAN | This SFR defines self-test behavior for the WLAN Client. This behavior relates entirely to the PP-Module and does not affect the ability of the Base-PP to implement its security functionality. |
| FTA_WSE_EXT.1 | This SFR requires the TOE to restrict the wireless networks that it can connect to. This behavior relates entirely to the PP-Module and does not affect the ability of the Base-PP to implement its security functionality. |
| FTP_ITC.1/WLAN | This SFR defines the protocols that the TOE uses for secure wireless communications. This behavior relates entirely to the PP-Module and does not affect the ability of the Base-PP to implement its security functionality. |
| **Optional SFRs** | |
| This PP-Module does not define any Optional requirements. | |
| **Selection-based SFRs** | |
| FCS_TLSC_EXT.2/WLAN | This SFR requires the TOE to validate a specific TLS extension when establishing EAP-TLS communications. This behavior relates entirely to the PP-Module and does not affect the ability of the Base-PP to implement its security functionality. |
| **Objective SFRs** | |
| This PP-Module does not define any Objective requirements. | |
| **Implementation-based SFRs** | |
| This PP-Module does not define any Implementation-based requirements. | |

# Appendix A - Optional SFRs

## A.1 Strictly Optional Requirements

This PP-Module does not define any Strictly Optional SFRs.

## A.2 Objective Requirements

This PP-Module does not define any Objective SFRs.

## A.3 Implementation-dependent Requirements

This PP-Module does not define any Implementation-dependent SFRs.

# Appendix B - Selection-based Requirements

## B.1 Auditable Events for Selection-based SFRs

**Table 5: Auditable Events for Selection-based Requirements**

| Requirement | Auditable Events | Additional Audit Record Contents |
|---|---|---|
| FCS_TLSC_EXT.2/WLAN | No events specified. | N/A |

## B.2 Cryptographic Support (FCS)

**FCS_TLSC_EXT.2/WLAN TLS Client Support for Supported Groups Extension (EAP-TLS for WLAN)**

> ***The inclusion of this selection-based component depends upon selection in FCS_TLSC_EXT.1.1/WLAN.***

FCS_TLSC_EXT.2.1/WLAN

The TSF shall present the Supported Groups extension in the Client Hello with the following NIST curves: [**selection**: *secp256r1*, *secp384r1*, *secp521r1*].

**Application Note:** This requirement must be claimed if any cipher suites beginning with 'TLS_ECDHE' are selected in FCS_TLSC_EXT.1.1/WLAN.

This requirement does not limit the elliptic curves the client may propose for authentication and key agreement. Rather, it asks the ST author to define which of the NIST curves from FCS_COP.1/SIGN (defined in each supported Base-PP) and FCS_CKM.1/WPA and FCS_CKM.2/WLAN (each defined in this PP-Module) can be used for TLS key establishment.

# Appendix C - Extended Component Definitions

This appendix contains the definitions for all extended requirements specified in the Module.

## C.1 Extended Components Table

All extended components specified in the Module are listed in this table:

**Table 6: Extended Component Definitions**

| Functional Class | Functional Components |
|---|---|
| Identification and Authentication (FIA) | FIA_PAE_EXT Port Access Entity Authentication<br>FIA_X509_EXT X.509 Certificate Use and Management |
| Protection of the TSF (FPT) | FPT_TST_EXT TSF Self-Test |
| TOE Access (FTA) | FTA_WSE_EXT Wireless Network Access |
| Cryptographic Support (FCS) | FCS_TLSC_EXT TLS Client Protocol |

## C.2 Extended Component Definitions

### C.2.1 Identification and Authentication (FIA)

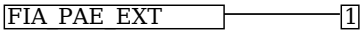
This Module defines the following extended components as part of the FIA class originally defined by CC Part 2:

#### C.2.1.1 FIA_PAE_EXT Port Access Entity Authentication

**Family Behavior**

Components in this family define requirements for TOE support of IEEE 802.1X authentication.

**Component Leveling**




FIA_PAE_EXT.1, Port Access Entity Authentication, describes the ability of the TOE to act as a supplicant for 802.1X authentication.

**Management: FIA_PAE_EXT.1**

The following actions could be considered for the management functions in FMT:

- Enable/disable IEEE 802.1X pre-authentication.
- Enable/disable PMK caching.
- Set the amount of time (in minutes) for which PMK entries are cached.
- Set the maximum number of PMK entries that can be cached.

**Audit: FIA_PAE_EXT.1**

There are no auditable events foreseen.

**FIA_PAE_EXT.1 Port Access Entity Authentication**

Hierarchical to: No other components.

Dependencies to: No dependencies.

**FIA_PAE_EXT.1.1**

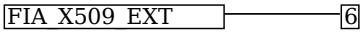
The TSF shall conform to IEEE Standard 802.1X for a Port Access Entity (PAE) in the “Supplicant” role.

#### C.2.1.2 FIA_X509_EXT X.509 Certificate Use and Management

**Family Behavior**

Components in this family define requirements for the use of X.509 certificates.

**Component Leveling**




FIA_X509_EXT.6, X.509 Certificate Storage and Management, requires the TOE to implement the ability to store X.509 certificates.

**Management: FIA_X509_EXT.6**

The following actions could be considered for the management functions in FMT:

- Loading of X.509 certificates into the TOE.
- Revocation of loaded X.509 certificates.

#### Audit: FIA_X509_EXT.6

The following actions should be auditable if FAU_GEN Security audit data generation is included in the PP/ST:

- Basic: Attempts to load certificates.
- Basic: Attempts to revoke certificates.

#### FIA_X509_EXT.6 X.509 Certificate Storage and Management

Hierarchical to: No other components.

Dependencies to: No dependencies.

##### FIA_X509_EXT.6.1

The TSF shall [**selection**: *store and protect, invoke [**assignment**: platform storage mechanism] to store and protect*] certificate(s) from unauthorized deletion and modification.

##### FIA_X509_EXT.6.2

The TSF shall [**selection**: *provide the capability for authorized administrators to load X.509v3 certificates into the TOE, rely on [**assignment**: platform mechanism] to load X.509v3 certificates into [**assignment**: platform storage mechanism]*] for use by the TSF.

### C.2.2 Protection of the TSF (FPT)

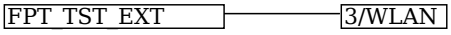
This Module defines the following extended components as part of the FPT class originally defined by CC Part 2:

### C.2.2.1 FPT_TST_EXT TSF Self-Test

#### Family Behavior

Components in this family define requirements for self-testing to verify the functionality and integrity of the TOE.

#### Component Leveling




FPT_TST_EXT.3/WLAN, TSF Cryptographic Functionality Testing (WLAN Client), requires the TOE or its platform to perform power on self-tests to verify its functionality and the integrity of its stored executable code.

#### Management: FPT_TST_EXT.3/WLAN

No management functions are foreseen.

#### Audit: FPT_TST_EXT.3/WLAN

The following actions should be auditable if FAU_GEN Security audit data generation is included in the PP/ST:

- Basic: Execution of TSF self-tests.
- Basic: Detected integrity violation.

#### FPT_TST_EXT.3/WLAN TSF Cryptographic Functionality Testing (WLAN Client)

Hierarchical to: No other components.

Dependencies to: FCS_COP.1 Cryptographic Operation

##### FPT_TST_EXT.3.1/WLAN

The [**selection**: *TOE, TOE platform*] shall run a suite of self-tests during initial start-up (on power on) to demonstrate the correct operation of the TSF.

##### FPT_TST_EXT.3.2/WLAN

The [**selection**: *TOE, TOE platform*] shall provide the capability to verify the integrity of stored TSF executable code when it is loaded for execution through the use of the TSF-provided cryptographic services.

### C.2.3 TOE Access (FTA)

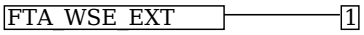
This Module defines the following extended components as part of the FTA class originally defined by CC Part 2:

### C.2.3.1 FTA_WSE_EXT Wireless Network Access

#### Family Behavior

Components in this family define requirements for specifying wireless networks that the TOE can connect to.

#### Component Leveling




FTA_WSE_EXT.1, Wireless Network Access, describes the ability of the TOE to apply administrative limits on the wireless networks that it can connect to.

#### Management: FTA_WSE_EXT.1

The following actions could be considered for the management functions in FMT:

- Specify allowed wireless networks based on Service Set Identifier (SSID).

#### Audit: FTA_WSE_EXT.1

The following actions should be auditable if FAU_GEN Security audit data generation is included in the PP/ST:

- Basic: All attempts to connect to access points.

#### FTA_WSE_EXT.1 Wireless Network Access

Hierarchical to: No other components.

Dependencies to: FMT_SMF.1 Specification of Management Functions

##### FTA_WSE_EXT.1.1

The TSF shall be able to attempt connections only to wireless networks specified as acceptable networks as configured by the administrator in FMT_SMF.1.1/WLAN.

## C.2.4 Cryptographic Support (FCS)

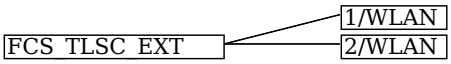
This Module defines the following extended components as part of the FCS class originally defined by CC Part 2:

### C.2.4.1 FCS_TLSC_EXT TLS Client Protocol

#### Family Behavior

Components in this family define requirements for the implementation of the TLS protocol when the TOE is acting as a client.

#### Component Leveling




FCS_TLSC_EXT.1/WLAN, TLS Client Protocol (EAP-TLS for WLAN), describes the ability of the TOE to implement the EAP-TLS protocol as a client.

FCS_TLSC_EXT.2/WLAN, TLS Client Support for Supported Groups Extension (EAP-TLS for WLAN), describes the ability of the TOE to present certain values in the Supported Groups extension when attempting to establish a TLS connection as a client.

#### Management: FCS_TLSC_EXT.1/WLAN

There are no specific management functions identified.

#### Audit: FCS_TLSC_EXT.1/WLAN

The following actions should be auditable if FAU_GEN Security audit data generation is included in the PP/ST:

- Basic: All attempts to establish a trusted channel.
- Basic: Detection of modification of channel data.

#### FCS_TLSC_EXT.1/WLAN TLS Client Protocol (EAP-TLS for WLAN)

Hierarchical to: No other components.

Dependencies to: FCS_CKM.1 Cryptographic Key Generation
FCS_CKM.1 Cryptographic Key Generation
FCS_CKM.2 Cryptographic Key Distribution
FCS_COP.1 Cryptographic Operation
FCS_RBG_EXT.1 Random Bit Generation
FIA_X509_EXT.1 X.509 Certificate Validation

FMT_SMR.1 Security Roles

**FCS_TLSC_EXT.1.1/WLAN**

The TSF shall implement TLS 1.2 (RFC 5246) and [**selection**: *TLS 1.1 (RFC 4346), no other TLS version*] in support of the EAP-TLS protocol as specified in RFC 5216 supporting the following cipher suites: [**assignment**: *list of supported cipher suites*].

**FCS_TLSC_EXT.1.2/WLAN**

The TSF shall generate random values used in the EAP-TLS exchange using the RBG specified in FCS_RBG_EXT.1.

**FCS_TLSC_EXT.1.3/WLAN**

The TSF shall use X509 v3 certificates as specified in FIA_X509_EXT.1.

**FCS_TLSC_EXT.1.4/WLAN**

The TSF shall verify that the server certificate presented includes the Server Authentication purpose (id-kp 1 with OID 1.3.6.1.5.5.7.3.1) in the extendedKeyUsage field.

**FCS_TLSC_EXT.1.5/WLAN**

The TSF shall allow an authorized administrator to configure the list of CAs that are allowed to sign authentication server certificates that are accepted by the TOE.

**Management: FCS_TLSC_EXT.2/WLAN**

There are no specific management functions identified.

**Audit: FCS_TLSC_EXT.2/WLAN**

There are no auditable events foreseen.

**FCS_TLSC_EXT.2/WLAN TLS Client Support for Supported Groups Extension (EAP-TLS for WLAN)**

Hierarchical to: No other components.

Dependencies to: FCS_TLSC_EXT.1 TLS Client Protocol

**FCS_TLSC_EXT.2.1/WLAN**

The TSF shall present the Supported Groups extension in the Client Hello with the following NIST curves: [**assignment**: *list of supported groups*].

# Appendix D - Implicitly Satisfied Requirements

This appendix lists requirements that should be considered satisfied by products successfully evaluated against this Module. These requirements are not featured explicitly as SFRs and should not be included in the ST. They are not included as standalone SFRs because it would increase the time, cost, and complexity of evaluation. This approach is permitted by [CC] Part 1, 8.2 Dependencies between components.

This information benefits systems engineering activities which call for inclusion of particular security controls. Evaluation against the PP provides evidence that these controls are present and have been evaluated.

This PP-Module has no implicitly satisfied requirements. All SFR dependencies are explicitly met either through SFRs defined by the PP-Module, SFRs inherited from the Base-PPs, or SFRs that are hierarchical to the listed dependency.

# Appendix E - Entropy Documentation and Assessment

The TOE does not require any additional supplementary information to describe its entropy sources beyond the requirements outlined in the Base-PPs.

# Appendix F - Acronyms

| Acronym | Meaning |
|---|---|
| AES | Advanced Encryption Standard |
| AP | Access Point |
| AS | Authentication Server |
| Base-PP | Base Protection Profile |
| CA | Certification Authority |
| CBC | Cipher Block Chaining |
| CC | Common Criteria |
| CCEVS | Common Criteria Evaluation and Validation Scheme |
| CCMP | Counter mode CBC-MAC Protocol |
| CCTL | Common Criteria Test Laboratory |
| CEM | Common Evaluation Methodology |
| CSP | Critical Security Parameter |
| EAP | Extensible Authentication Protocol |
| EAPOL | EAP over LAN |
| EP | Extended Package |
| FIPS | Federal Information Processing Standards |
| FP | Functional Package |
| FQDN | Fully Qualified Domain Name |
| GPOS | General-Purpose Operating System |
| GTK | Group Temporal Key |
| HMAC | Hash-Based Message Authentication Code |
| IEC | International Electrotechnical Commission |
| IEEE | Institute of Electrical and Electronics Engineers |
| ISO | International Organization for Standardization |
| IT | Information Technology |
| KDF | Key Derivation Function |
| LAN | Local Area Network |
| MAC | Message Authentication Code (cryptography) or Media Control Address (system property) |
| MDF | Mobile Device Fundamentals |
| NIAP | National Information Assurance Partnership |
| NVLAP | National Voluntary Laboratory Accreditation Program |
| OE | Operational Environment |
| OSP | Organizational Security Policy |
| PAE | Port Access Entity |
| PIN | Personal Identification Number |
| PKI | Public Key Infrastructure |
| PMK | Pairwise Master Key |
| PP | Protection Profile |
| PP | Protection Profile |

| | |
|---|---|
| PP-Configuration | Protection Profile Configuration |
| PP-Module | Protection Profile Module |
| PRF | Pseudo-Random Function |
| PTK | Pairwise Temporal Key |
| RBG | Random Bit Generator |
| RF | Radio Frequency |
| RFC | Request for Comment |
| SAR | Security Assurance Requirement |
| SFR | Security Functional Requirement |
| SFR | Security Functional Requirement |
| SHA | Secure Hash Algorithm |
| SSID | Service Set Identifier |
| ST | Security Target |
| ST | Security Target |
| TLS | Transport Layer Security |
| TOE | Target of Evaluation |
| TOE | Target of Evaluation |
| TSF | TOE Security Function |
| TSF | TOE Security Functionality |
| TSFI | TSF Interface |
| TSS | TOE Summary Specification |
| TSS | TOE Summary Specification |
| WLAN | Wireless Local Area Network |
| WPA | Wireless Protected Access |
| cPP | Collaborative Protection Profile |

# Appendix G - Bibliography


| Identifier | Title |
|---|---|
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| [802.1X-2020] | 802.1X-2020 - IEEE Standard for Local and metropolitan area networks--Port-Based Network Access Control |
| [CC] | Common Criteria for Information Technology Security Evaluation - <br>• Part 1: Introduction and General Model, CCMB-2017-04-001, Version 3.1 Revision 5, April 2017. <br>• Part 2: Security Functional Components, CCMB-2017-04-002, Version 3.1 Revision 5, April 2017. <br>• Part 3: Security Assurance Components, CCMB-2017-04-003, Version 3.1 Revision 5, April 2017. |
| [CEM] | Common Evaluation Methodology for Information Technology Security - Evaluation Methodology, CCMB-2017-04-004, Version 3.1, Revision 5, April 2017. |
| [GPOS] | Protection Profile for General Purpose Operating Systems, Version 4.2.1, April 22, 2019 |
| [MDF] | Protection Profile for Mobile Device Fundamentals, Version 3.2, March 4, 2021 |
| [RFC 3394] | RFC 3394 - Advanced Encryption Standard (AES) Key Wrap Algorithm |
| [RFC 4346] | RFC 4346 - The Transport Layer Security (TLS) Protocol Version 1.1 |
| [RFC 5216] | RFC 5216 - The EAP-TLS Authentication Protocol |
| [RFC 5246] | RFC 5246 - The Transport Layer Security (TLS) Protocol Version 1.2 |
| [RFC 5280] | RFC 5280 - Internet X.509 Public Key Infrastructure Certificate and Certificate Revocation List (CRL) Profile |
| [RFC 5288] | RFC 5288 - AES Galois Counter Mode (GCM) Cipher Suites for TLS |
| [RFC 5289] | RFC 5289 - TLS Elliptic Curve Cipher Suites with SHA-256/384 and AES Galois Counter Mode (GCM) |