PP-Module for Authentication Servers

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Revision History

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1 Introduction

1.1 Overview

An authentication server provides assertions to a relying party that a particular request for access is from an authentic digital identity associated with various identity attributes, such as a registered account within an information system, or a certified identity as validated by a trusted certification authority or both. The digital identities can represent people, devices or processes. Authentication servers validate various authenticators controlled by the entities represented by the presented digital identity. When the entity is a person, authenticators can provide indications of what the entity knows (e.g., a password, pin or passphrase), what the entity has (e.g., a registered device in the control of the user), or what the entity is (a biometric). NIST SP 800-63-3 Part B provides recommendations about how these authenticators can be leveraged individually or in combinations to provide assurance that the entity is authentic and describes requirements for validation of the authenticators to various assurance levels. A relying party may delegate verification of authenticator(s) to an authentication server; such delegation creates a relationship between the relying party and the authentication server that is referred to as an identity federation. Assertions to a federated relying party can be via bearer assertions or via direct communication with the relying party. The latter mechanism is modeled after that used by Authentication, Access and Accounting (AAA) servers, which used the RADIUS protocol. RADIUS has been largely replaced by DIAMETER, a protocol that addresses many of the security issues with RADIUS. These provide direct, back-end assertions protected by an authenticated and encrypted channel to a Network Access Server that further governs accesses to resources on a network.

This PP-module describes the security functionality of authentication servers supporting RADIUS/DIAMETER and other messaging protocols intended for direct communications with relying parties via authenticated, real-time protected channels.

The scope of this PP-Module is to describe the security functionality of an authentication server 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-PP:

- collaborative Protection Profile for Network Devices, Version 2.2e (NDcPP)

This Base-PP is valid because an authentication server can be deployed as a dedicated network appliance. The use case of deploying the authentication server as an application on a general-purpose computer is outside the scope of this PP-Module. Authentication server products allow enterprises to provide a centralized and standardized method of evaluating user authentication requests made throughout the enterprise. This enables a centralized definition for user identity and credential data and allows for uniform application of authentication policies that define what credentials and user attributes are necessary to gain access to various systems and applications in the enterprise environment.

Note that the NDcPP defines an optional architecture for a “distributed TOE” that allows for security functionality to be spread across multiple distinct components. This PP-Module does not require or prohibit the TOE from being a distributed system when the TOE conforms to the NDcPP; the TOE may be standalone or distributed in this case.

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.
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 Requirement (SFR)	A requirement for security enforcement by the TOE.
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

Assertion	A statement from the TOE to an RP that contains information about a subscriber. Assertions may also contain verified attributes. For the purposes of this PP-Module, Assertions containing authentication status and identity attributes are made by EAP response messages in accordance with EAP-TLS or EAP-TTLS.
Authentication Policy	A policy that specifies which authenticator types are required for a particular entity. The policy may be implicit for all entities, or configurable.
Authenticator	Something the claimant possesses and controls (typically a cryptographic module or password) that is used to authenticate the claimant’s identity.
Authenticator Output	The output value generated by an authenticator. The ability to generate valid authenticator outputs on demand proves that the claimant possesses and controls the authenticator. Protocol messages sent to the verifier are dependent upon the authenticator output, but they may or may not explicitly contain it.
Claimant	A subject whose identity is to be verified using one or more authentication protocols.
Credential	An object or data structure that authoritatively binds an identity - via an identifier or identifiers - and (optionally) additional attributes, to at least one authenticator possessed and controlled by a subscriber.
Federation Protocol	A protocol to establish a trusted relationship with a relying party, and for the purposes of this PP module, to communicate authentication status for entities requesting access to resources managed by the relying party. In this PP-module, Federation Protocols include RADIUS, DIAMETER, and other standard protocols used in direct communication between the relying party and the TOE. Federation protocols that only support bearer assertions are out of scope for this PP-Module.

Relying Party (RP)	An entity that relies upon the subscriber's authenticator(s) and credentials or a verifier's assertion of a claimant's identity, typically to process a transaction or grant access to information or a system.

1.3 Compliant Targets of Evaluation

This PP-Module specifically addresses a dedicated network device that performs entity (device or user) authentication via direct, back-end connections with a relying party. The entity to be authenticated is referred to as the claimant, though different terms have been used for specific protocols (e.g., peer for RADIUS/DIAMETER). The relying party can manage a single resource or provide access control for resources within a network. For example, a Wireless Local Area Network (WLAN) Access System may use the services of a dedicated authentication server during tunnel establishment. In this use case, an authentication server must support IEEE 802.1X Port-Based Network Access Control and must fulfill the IEEE 802.11 authentication server role using Extensible Authentication Protocol (EAP) messaging.

Similarly, the authentication server may be used during Virtual Private Network (VPN) tunnel establishment. The relying party in this case is a VPN Gateway acting as a Network Access Server using passthrough between the VPN client and authentication server (the TOE), also using EAP messaging.

In general, any relying party using a direct authentication federation protocol that supports EAP-TLS or EAP-TTLS messaging is addressed by this PP-Module.

The combination of the NDcPP and this PP-Module is a network device that provides authentication server functionality in addition to all of the security functionality expected of a network device as mandated by the NDcPP.

This PP-Module describes the functional requirements and threats specific to authentication servers. A TOE that conforms to this PP-Module must also conform to the Base-PP.

1.4 TOE Boundary

This document specifies SFRs for an authentication server. An authentication server is designed to authenticate a claimant that attempts to access a relying party – an access gateway to a protected network, or individual resources and services – and provide assertions to one or more relying parties about the authentication state of the claimant. A claimant forwards one or more authenticator outputs to the authentication server; the authentication server verifies the authenticator outputs and may also provide additional identity attributes to allow the relying party to determine whether the claimant meets its authentication policy.

The authentication server defined by this PP-Module is one or more dedicated network appliances; the TOE is not intended to run as an application on a general-purpose computer. The authentication server can be co-located with an access management or privilege management system, or it may be separate from such services. Regardless of the deployment, access control functions and management of non-identity attributes are outside the scope of this PP-Module.

An authentication server may be part of a larger system that also provides authorization information, either as part of an AAA server, an authorization server, or a domain controller. This PP-Module specifies the functional requirements for authentication services only; as in the case where the TOE may be co-located with the relying party, the TOE's logical boundary only includes the authentication server functionality. However, the TOE boundary includes the ability to generate audit events that are specific to the authentication functionality but may be used to support other functions (e.g., AAA servers).

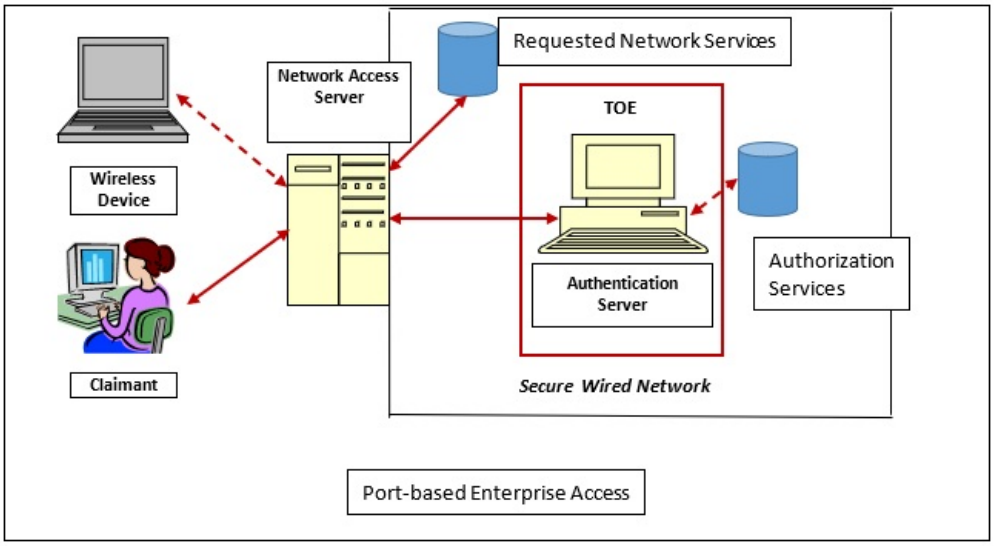


Figure 1: NAS with an Authentication Server

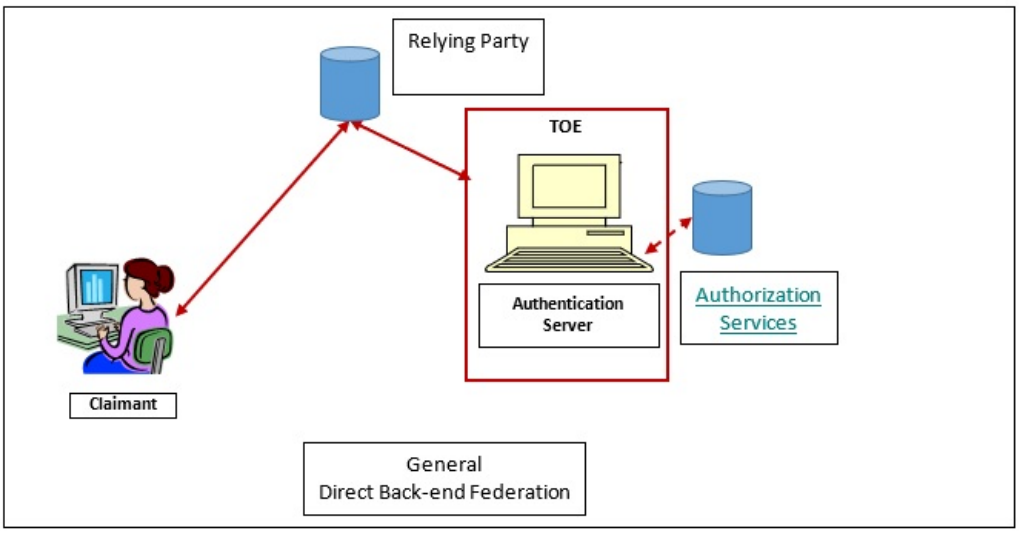


Figure 2: Generic Authentication Server User Case

1.5 Use Cases

This PP-Module defines potential use cases for the authentication server TOE, defined below. The first use case defines the physical embodiment of the TOE, while the latter three define its role in a network infrastructure.

[USE CASE 1] Dedicated Appliance

The authentication server is integrated on a standalone network appliance. In this use case, conformance to the NDcPP and this PP-Module is sufficient to ensure security. This PP-Module does not cover the use case where the authentication server is an application that is installed on a general-purpose computer.

[USE CASE 2] Standalone Server

The system on which the authentication server is deployed is solely responsible for acting as an authenticator. In this deployment, the authentication server's only network infrastructure role is to communicate with the relying party for receiving challenges and issuing responses.

[USE CASE 3] Relying Party Co-Location

The system on which the authentication server is deployed acts as both the relying party or its proxy and the authentication server. In this deployment, the authentication server's interactions with the relying party are internal-only. Regardless of whether the relying party is a standalone component or the authentication server executable code also provides relying party functionality, the TOE's logical boundary still only includes the authentication server component. Additionally, if the authentication server is a software application that can be deployed independently of the relying party, the required external trusted communications must still be supported; an authentication server cannot use the fact that it can be deployed on the same physical server as the relying party as a way to exempt itself from implementation of IPsec, RadSec or mutually authenticated (D)TLS with an external relying party.

[USE CASE 4] Integrated as an Authorization Server Component

The system on which the authentication server is deployed also acts as an authorization server (e.g., as part of an AAA server) that provides authorization services in addition to the authentication server. Assertions made via the direct connection can also include authorization information, and an unauthorized, but authenticated user may result in a negative response to the relying party. Regardless of whether these are all standalone components or whether the authentication server executable code also provides authorization functionality, the TOE's logical boundary still only includes the authentication server component. As in the case where the authentication server is co-located with the relying party, this deployment does not exempt the TOE from being able to implement all the functionality that this PP-Module requires.

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).

No PPs or PP-Modules may be specified in a PP-Configuration with this PP-Module other than the Base-PP specified in Section 1.1 Overview.

CC Conformance Claims

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

Package Claims

This PP-Module does not claim conformance to any packages.

3 Security Problem Description

The security problem is described in terms of the threats that the TOE is expected to address, assumptions about its operational environment, and any organizational security policies that the TOE is expected to enforce.

3.1 Threats

The following threats that are defined in this PP-Module extend the threats that are defined by the Base-PP.

T.FALSE_ENDPOINTS
A malicious actor may falsely impersonate the TOE or a federated relying party in order to cause the TOE to operate in an insecure manner or to extract security-relevant, or sensitive user data from the TOE or its Operational Environment.

T.INVALID_USERS
A malicious user may supply incorrect or insufficient credential data or an otherwise invalid authentication request that is approved or ignored by the TSF such that protected resources are subject to unauthenticated access.

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. All assumptions for the OE of the Base-PP also apply to this PP-Module.

A.RP_FEDERATION
It is assumed that the TOE is federated with one or more relying parties that transmit authentication requests to it.

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.TRUSTED_RP
The TOE shall provide mechanisms to authenticate itself to a federated RP and authenticate a federated RP before providing an identity assertion.

O.USER_AUTH
The TOE shall provide a mechanism to assess authentication requests and respond with an authentication assertion based on data that is supplied in the request.

O.SECURITY_ASSOCIATION
The TOE shall provide the information to the relying party to enable the relying party to verify that the claimant has possession of an authentication key.

4.2 Security Objectives for the Operational Environment

All objectives for the OE of the Base-PP also apply to this PP-Module.

OE.RP_FEDERATION
The TOE will be deployed in such a manner that it is federated with one or more relying parties that transmit authentication requests to it.

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.FALSE_ENDPOINTS	O.TRUSTED_RP	The TOE's enforcement of mutual authentication allows it and the relying party to identify and reject attempts for each component to be impersonated.
T.INVALID_USERS	O.SECURITY_ASSOCIATION	The TOE's ability to maintain a security association ensures that a mechanism exists for the TSF to assert to an external entity that a given user is valid.
	O.USER_AUTH	The TOE's proper implementation of the claimant authentication ensures that it will accurately process authentication attempts to allow only valid authentication attempts. The TOE's ability to use trusted communications as part of the federation protocol implementation ensures that modification or disclosure of authentication data cannot be used as a method to gain access to credentials or modify an authentication result.
A.RP_FEDERATION	OE.RP_FEDERATION	The OE objective OE.RP_FEDERATION is realized through A.RP_FEDERATION.

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 NDcPP Security Functional Requirements Direction

In a PP-Configuration that includes the NDcPP, the TOE is expected to rely on some of the security functions implemented by the Authentication Server as a whole and evaluated against the NDcPP. The following sections describe any modifications that the ST author must make to the SFRs defined in the NDcPP in addition to what is mandated by Section 5.2 TOE Security Functional Requirements.

5.1.1 Modified SFRs

The SFRs listed in this section are defined in the NDcPP and relevant to the secure operation of the TOE.

5.1.1.1 Identification and Authentication (FIA)

FIA_X509_EXT.1/Rev X.509 Certificate Validation

FIA_X509_EXT.1.1/Rev

This SFR is selection-based in the NDcPP. When the TOE conforms to this PP-Module it is mandatory because of the PP-Module's requirement for implementation of mutually-authenticated TLS or DTLS.

Evaluation Activities

FIA_X509_EXT.1/Rev
TSS
There are no additional TSS evaluation activities for this component beyond what the NDcPP requires.

Guidance
There are no additional guidance evaluation activities for this component beyond what the NDcPP requires.

Tests
There are no additional test evaluation activities for this component beyond what the NDcPP requires.

FIA_X509_EXT.2 X.509 Certificate Authentication

FIA_X509_EXT.2.1

This SFR is selection-based in the NDcPP. When the TOE conforms to this PP-Module it is mandatory because of the PP-Module's requirement for implementation of mutually-authenticated TLS or DTLS.

Evaluation Activities

FIA_X509_EXT.2
TSS
There are no additional TSS evaluation activities for this component beyond what the NDcPP requires.

Guidance
There are no additional guidance evaluation activities for this component beyond what the

NDcPP requires.

Tests
There are no additional test evaluation activities for this component beyond what the NDcPP requires.

FIA_X509_EXT.3 X.509 Certificate Requests

FIA_X509_EXT.3.1

This SFR is selection-based in the NDcPP. When the TOE conforms to this PP-Module it is mandatory because of the PP-Module's requirement for implementation of mutually-authenticated TLS or DTLS.

Evaluation Activities

FIA_X509_EXT.3
TSS
There are no additional TSS evaluation activities for this component beyond what the NDcPP requires.

Guidance
There are no additional guidance evaluation activities for this component beyond what the NDcPP requires.

Tests
There are no additional test evaluation activities for this component beyond what the NDcPP requires.

5.2 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.

5.2.1 Security Audit (FAU)

FAU_GEN.1/AuthSvr Audit Data Generation

FAU_GEN.1.1/AuthSvr

The TSF shall be able to generate an audit record of the following auditable events:

a. Start-up and shutdown of the audit functions;
b. All auditable events for the [*not specified*] level of audit; and
c. [*Auditable events listed in the Auditable Events table (Table 2)*

Requirement	Auditable Events	Additional Audit Record Contents
FCO_NRO.1	Claimant request for which the TOE does not have credential verification data	Identity of the claimant, contents of EAP-response (if present)
FCO_NRR.1	None	
FCS_CKM.3	[*selection: attempt to export plaintext key or CSI via defined interface, none*] Note: if no defined interfaces have access to persistend keys or CSI, select 'none'	If attempt is detected, record process identifier, authorized user's identifier (if any)
FCS_EAPTLS_EXT.1	Protocol failures	If failure occurs, record a descriptive reason for the failure

	Successful authentication of claimant	Identifier of claimant
FCS_RADIUS_EXT.1	Protocol failures	If failure occurs, record a descriptive reason for the failure
	Success/failure of authentication	None
FCS_RADSEC_EXT.1 (selection-based)	None	
FCS_RADSEC_EXT.2 (selection-based)	None	
FCS_STG_EXT.1	None	
FIA_AFL.1/AuthSvr	The reaching of the threshold for the unsuccessful authentication attempts	The claimed identity of the entity attempting to authenticate or the IP where the attempts originated
	Disabling an account due to the threshold being reached	
FIA_HOTP_EXT.1 (selection-based)	Generation of a HOTP seed value	Entity identifier
	Entity HOTP value comparison	Result of comparison - success or failure
FIA_PSK_EXT.1 (selection-based)	None	
FIA_PSK_EXT.2 (selection-based)	None	
FIA_PSK_EXT.3 (selection-based)	None	
FIA_TOTP_EXT.1 (selection-based)	Generation of a TOTP seed value	Entity identifier
	Entity TOTP value comparison	Result of comparison - success or failure
FIA_X509_EXT.1/AuthSvr	Certificate validation failure	Reason for failure
FIA_UAU.6	All use of the authentication mechanism	Origin of the attempt (e.g., IP address)
FMT_SMF.1/AuthSvr	All management actions	Identifier of initiator
FTA_TSE.1	Denial of session establishment due to the session establishment mechanism	Reason for denial, origin of establishment attempt
FTP_ITC.1/NAS	Initiation of the trusted channel	Identification of the initiator
	Termination of the trusted channel	Identification of the initiator
	Failure of the trusted channel functions	Target of failed trusted channels establishment attempt

Table 2: Auditable Events

Application Note: The auditable events defined in Table 2 are for the SFRs that are explicitly defined in this PP-Module and are intended to extend FAU_GEN.1 in the Base-PP.
The events in the Auditable Events table should be combined with those of the NDcPP in the context of a conforming Security Target.

The Auditable Events (Table 2) includes selection-based SFRs. The auditing of selection-based SFRs is only required if that SFR is included in the ST.

Per FAU_STG_EXT.1 in the Base-PP, the TOE must support transfer of the audit data to an external IT entity using a trusted channel.

Evaluation Activities

FAU_GEN.1/AuthSvr
TSS
There are no TSS evaluation activities for this SFR.

Guidance
The evaluator shall ensure that the operational guidance identifies the auditable events and includes representative examples of each event so that the presentation of each event can be identified.

Tests
The evaluator shall test the TOE's ability to correctly generate audit records by having the TOE generate audit records in accordance with the evaluation activities associated with the functional requirements in this PP-Module. When verifying the test results, the evaluator will ensure the audit records generated during testing match the format specified in the administrative guide and that the fields in each audit record have the proper entries.

Note that the testing here can be accomplished in conjunction with the testing of the security mechanisms directly.

5.2.2 Communications (FCO)

FCO_NRO.1 Selective Proof of Origin

FCO_NRO.1.1

The TSF shall be able to generate evidence of origin for transmitted [*identity authentication assertions, [**selection**: authentication requests, IKE authentication phase security associations, [**assignment**: claimant identity attributes], no other data]*] at the request of the [*relying party, [**selection**: external authentication servers in support of pass-through, no other entities]*].

Application Note: The intent of this requirement is for the TOE to provide source of origin (non-repudiation) for assertions and sensitive data associated to claimants it provides to relying parties. The ST author will claim 'authentication requests' and 'external authentication servers…' if the TSF supports pass-through communication with external authentication servers. The ST author claims additional information provided to a relying party via an authenticated channel as appropriate.

FCO_NRO.1.2

The TSF shall be able to relate the [*authenticator*] of the originator of the information, and the [*authentication request*] of the information to which the evidence applies.

Application Note: The intent of this requirement is for the TOE to be able to associate authentication assertions it makes to requests made to it by a relying party. For pass-through functionality, the TOE relates requests and response messages it forwards between external entities via identity information asserted in the EAP headers.

FCO_NRO.1.3

The TSF shall provide a capability to verify the evidence of origin of information to [*recipient*] given [*an authenticated channel is established with a trusted relying party*].

Evaluation Activities

FCO_NRO.1

TSS
The evaluator shall ensure that the ST includes a description of authentication assertions, security associations or sensitive data associated with a claimant that is provided to a relying party, and a description of each protocol that carries such data.

The evaluator shall ensure that the ST includes a description of support for pass-through methods and the method it uses to mutually authenticate to, external authentication servers.

The evaluator shall verify that the descriptions indicate how the TSF authenticates itself to the external entities via those protocols, and that no data is passed via an unauthenticated protocol.

The evaluator shall verify that the ST describes how the TSF handles session interruptions and resumptions to ensure the relying party is able to associate data associated with a claimant to the authentication request by the relying party and the authenticator provided by the claimant.

Guidance
The evaluator shall ensure that any instructions for configuring the TSF to meet the requirements are provided.

Tests
The evaluator shall perform the following tests:

- ***Test 1:***
  - *Step 1: The evaluator shall establish a connection with the TSF from two trusted relying parties RP1 and RP2 and verify that each of RP1 and RP2 are able to authenticate the TOE.*
  - *Step 2: The evaluator shall initiate an authentication request for a claimant C1 via RP1, providing valid authentication data, and verify that RP1 receives an authentication assertion via the authenticated channel indicating C1 is authenticated.*
  - *Step 3: The evaluator shall initiate an authentication request for a claimant C2 via RP2, providing invalid authentication data and confirm that the TOE does not provide an authentication assertion indicating C2 is authenticated via the authenticated channel.*
  - *Step 4: The evaluator shall send correct authentication data associated with claimant C2 via RP1 without sending a new authentication request and observe that the TOE ignores the request.*
- ***Test 2:*** *(conditional on support for pass-through). The intent of this test is to demonstrate the TSF is able to authenticate to external entities for registered users over a pass-through method, and ignores requests for non-registered users.*
  - *Step 1: The evaluator shall follow AGD instructions to configure the TOE to connect to an external authentication server using pass-through functionality, and initiate a request from a trusted relying party that results in the TSF exercising pass-through functionality to authenticate a registered claimant.*
  - *Step 2: The evaluator shall observe that the TSF authenticates to the external authentication server prior to sending any authentication requests.*
  - *Step 3: The evaluator shall then follow AGD guidance to de-register the claimant at the TOE, and ensure the claimant is still registered at the external authentication server. The evaluator shall repeat initiation of the authentication request for the claimant, and observe that the TSF associates the identifier of the request by dropping the request without forwarding.*

FCO_NRR.1 Selective Proof of Receipt

FCO_NRR.1.1

The TSF shall be able to generate evidence of receipt for received [*authentication requests, [**selection**: authentication responses and queries, none]*] at the request of the [*originator*].

Application Note: The intent of this requirement is for the TOE to be able to return a valid response to the relying party upon receipt of an Access-Request. If the TSF supports pass-through functionality, the ST author claims 'authentication responses and queries' in the selection for authentication in communications with external authentication servers.

FCO_NRR.1.2

The TSF shall be able to relate the [*claimant identifier, claimant authenticators*] of the recipient of the information, and the [*identity assertion, information requests and error responses*] of the information to which the evidence applies.

Application Note: The intent of this requirement is for the ST author to list the information supplied by the TOE in response to an authentication request that confirms receipt of the request, and identifies:

- the authentication request that is being responded to;
- the mutually authenticated channel between the trusted relying party and

the TOE.

FCO_NRR.1.3

The TSF shall provide a capability to verify the evidence of receipt of information to [*originator*] given [*establishment of a mutually authenticated channel with a trusted relying party*].

Evaluation Activities

FCO_NRR.1
TSS
The evaluator shall ensure that the ST includes a description of each messaging protocol and the specific messages provided to a relying party in response to authentication requests, to include any affirmative and negative responses, and requests for additional information.

The evaluator shall verify that the descriptions indicate how the TSF indicates the identity of the claimant associated with any responses to a request.

The evaluator shall verify that the ST describes how the TSF handles session interruptions and resumptions to ensure the relying party is able to associate data associated with a claimant to the authentication request by the relying party and the authenticator provided by the claimant.

Guidance
The evaluator shall ensure that any instructions for configuring the TSF to meet the requirements are provided.

Tests
For each messaging protocol supported, the evaluator shall perform the following test:

- ***Test 1:*** *The evaluator shall establish a connection between a trusted relying party and the TOE and send an authentication request for a registered claimant, in accordance with the messaging protocol standard. The evaluator shall confirm the TOE responds to each message sent by the relying party with a message that appropriately identifies the claimant and confirms receipt of the request.*

5.2.3 Cryptographic Support (FCS)

FCS_CKM.3 Cryptographic Key Access

FCS_CKM.3.1

The TSF shall perform [*access control for persistent private and secret keys and security critical parameters required by this PP-Module*] in accordance with a specified cryptographic key access method [*ensuring only authorized security functionality can access plaintext keys or security critical information*] that meets the following: [*keys and security critical information are not exportable in plaintext, keys and security critical information are not viewable in plaintext*].

Application Note: Keys used for assertion signatures, including private keys associated to certificates used to establish a protected channel to relying parties and entities to be authenticated, one-time-password seed keys, and plaintext passwords can undermine or bypass the protections required for TOE functionality. The ST author describes the specific methods used to prevent unauthorized or unnecessary access to these keys and security critical information. This requirement is not intended to cover unanticipated exploits; it is only required that plaintext keys and security critical values not be exportable or viewable by defined interfaces. OTP seed key values are shared using out-of-band methods with the associated entities. This requirement implies that the method to export these values uses encrypted key transport methods.

Evaluation Activities

FCS_CKM.3
TSS
The evaluator shall verify the ST includes a description of all persistent secret and private keys used by the TSF to perform functions in this PP-Module. The evaluator shall verify the ST describes mechanism(s) used to prevent unauthorized exposure of keys.

Guidance
The evaluator shall verify that any configuration required to meet the requirements are described.

Tests

The intent of these tests is to ensure keys are not accessible using common interfaces and functionality of the TSF. It is not intended for the evaluator to attempt to cause a system crash in order to read keys and critical security parameters directly from memory or to modify functionality of the TSF.

The evaluator shall perform the following tests:

- ***Test 1:** The evaluator shall attempt to export each key and critical security parameter using available interfaces and verify the mechanism is effective at preventing exposure of the key in plaintext.*
- ***Test 2:** The evaluator shall assume each of the privileged user roles and attempt to gain read access to each of the keys and critical security parameters via available interfaces.*

FCS_EAPTLS_EXT.1 EAP-TLS Protocol

FCS_EAPTLS_EXT.1.1

The TSF shall implement [**selection**: *EAP-TLS as specified in RFC 5216*, *EAP-TTLS as specified in RFC 5881*] as updated by RFC 8996 with [**selection**: *TLS*, *DTLS*] implemented using mutual authentication in accordance with [**selection**: *FCS_TLSS_EXT.1 and FCS_TLSS_EXT.2*, *FCS_DTLSS_EXT.1 and FCS_DTLSS_EXT.2*].

FCS_EAPTLS_EXT.1.2

The TSF shall generate random values used in the [**selection**: *EAP-TLS*, *EAP-TTLS*] exchange using the RBG specified in FCS_RBG_EXT.1.

FCS_EAPTLS_EXT.1.3

The TSF shall support claimant authentication using certificates and [**selection**: *static PSK*, *HOTP*, *TOTP*, *[**assignment**: other authentication-verification protocols]*, *other authentication-verification protocols via pass-through functionality*, *no other authentication methods*].

FCS_EAPTLS_EXT.1.4

The TSF shall not forward an EAP-success response to the relying party if the client certificate is not valid according to FIA_X509_EXT.1**/Rev**, if the [**selection**: *TLS*, *DTLS*] session is not established, or if any of [**selection**: *PSK*, *HOTP value*, *TOTP value*, *no other authenticator*] required by the authentication policy are not provided or if any of the required authenticators presented in the authentication request is not valid.

Application Note: The ST author should indicate support for EAP-TLS or EAP-TTLS in FCS_EAPTLS_EXT.1.1. In the third selection, 'FCS_TLSS_EXT.1 and FCS_TLSS_EXT.2' or 'FCS_DTLSS_EXT.1 and FCS_DTLSS_EXT.2' is selected according to the TLS or DTLS support indicated in the second selection, with the expectation that the corresponding SFRs from the Base-PP are claimed.

The selection in FCS_EAPTLS_EXT.1.2 matches the first selection in FCS_EAPTLS_EXT.1.1.

The ST author claims any additional supported authentication methods in FCS_EAPTLS_EXT.1.3. Each supported method is claimed independently, even if combinations of the methods are required for individual claimant authentication. For any authentication methods that are only supported by pass-through functionality, the ST author should claim 'other authentication-verification protocls via pass-through functionality' without claiming the corresponding method in the same selection. Pass-through functionality can typically support any authentication method, including ones not specified in the SFR.

Evaluation Activities

FCS_EAPTLS_EXT.1
TSS
The evaluator shall examine the ST to ensure the EAP protocol is described in accordance with the claimed RFC and, for each supported mode, the evaluator ensures the ST describes the following:

- *The mechanism to authenticate a claimant uses (D)TLS with client certificate authentication in combination with any other supported authenticator outputs, and any configurable features.*
- *The source of randomness meets FCS_RBG_EXT.1 for use in key and nonce generation for the underlying (D)TLS channel and supported authentication methods.*

The evaluator shall also verify that the ST contains a description of the user access policy, including which authenticator outputs are required under the default configuration and which features of the user access policy are configurable.

Guidance
The evaluator shall ensure that the operational guidance includes any instructions for configuring the TOE to support the claimed functions.

If any features of the access control policy are configurable (e.g. the supported authentication mechanism), the evaluator shall confirm that the operational guidance describes how to configure these features.

Tests
The evaluator shall perform the following tests:

- ***Test 1:*** *TLS/DTLS testing is performed as part of FCS_TLSS_EXT.1 and .2 or FCS_DTLSS_EXT.1 and .2. When TLS/DTLS cannot be invoked directly using available TOE interfaces, the test procedures are modified in the following manner:*
  - *When required to send a client handshake to the TOE, the evaluator shall establish a connection with the test relying party and sends the specified TLS client handshake messages in response to requests from the test relying party.*
  - *The evaluator ensures the test relying party encapsulates the TLS handshake messages received from the test client and forwards the EAP messages to the TOE. Alternatively the evaluator may use a test relying party to modify client handshake messages as specified. When required to observe TLS server responses produced by the TOE, the evaluator shall ensure the test relying party properly extracts the TLS messages from the EAP messages, and shall observe the response received at the test TLS client to verify that the TOE responds as indicated in test procedures. Alternatively, the evaluator may extract and reconstruct TLS responses received within the EAP messages received from the TOE at the test relying party.*
- ***Test 2:*** *EAP testing: For each EAP mode supported, the evaluator shall perform any configuration of the TOE necessary to select the desired mode according to AGD instructions, and perform the following tests:*
  - *Test 2a: The evaluator shall determine the user access policy enforced by the TOE (if the TOE has a configurable user access policy, the evaluator may configure the TOE according to operational guidance to require claimant authentication using only a certificate to simplify subsequent test procedures). The evaluator shall initiate an authentication request from a test relying party to the TOE for a valid claimant registered with the TOE. The evaluator shall observe that once the EAP identity is established, the TOE sends an EAP request indicating the expected EAP mode (EAP-TLS or EAP-TTLS) and having the start-bit set.*

    The evaluator shall ensure a TLS client hello message from the valid claimant at a test client is EAP encapsulated by the test relying party and provided to the TOE. The evaluator shall observe that the TOE responds with an EAP encapsulated hello messages to include a certificate request message.

    The evaluator shall ensure the test client successfully completes the TLS handshake, and the test relying party properly encapsulates the TLS messages, to include the client finished message, and observes that the TOE that the TOE responds in a manner indicating the TLS channel was successfully established. Note – if the user access policy is to only require certificate verification, then the expected response is an EAP-success message. If the user access policy requires additional factors as supported under EAP-TTLS, additional EAP-TTLS messages are sent to the test relying party to request additional factors from the test client that are encrypted under the TLS tunnel established between the claimant and the TOE. In this case the evaluator observes these requests at the test client to confirm the certificate verification was successful.
  - *Test 2b: The evaluator shall initiate an authentication request from the test relying party for a valid claimant registered with the TOE, different than the claimant used for Test 2a if performed. The evaluator shall send appropriate encapsulated TLS handshake messages to the TOE, to include a valid certificate response, but send an EAP-encapsulation of a modified client finished message to the TOE. The evaluator shall observe that the TOE does not send an EAP-success message; the TOE is allowed either to send an EAP-request message to initiate a new TLS handshake or an EAP-Failure message.*
  - *Test 2c [conditional on support for additional authentication factors under EAP-TTLS]: For each combination of authentication factors supported by the TOE's user authentication policy, the evaluator shall follow the operational guidance to configure the TOE's user access policy to require the desired combination. The evaluator shall initiate an authentication request from a test client with a registered claimant having valid credentials for all factors. The evaluator shall observe that the TOE responds to the authentication request with an exchange of EAP-requests to successfully establish a mutually authenticated TLS/DTLS tunnel and that on completion, the TOE provides additional EAP-requests that when decrypted at the test client results in prompts for additional factors.*

    For each additional factor in the combination, the evaluator shall input an incorrect value for requested authentication factors and observe that the TOE responds with an EAP-request that prompts the claimant to re-enter the value. The evaluator shall then input the correct value and observe that the TOE responds with an EAP-request

resulting in a prompt for the next factor. The evaluator shall continue, in turn entering first, invalid, and then valid entries until all factors have been successfully provided. The evaluator shall confirm that on successful submission of valid factors, the TOE sends an EAP-Success message to the test relying party.

FCS_RADIUS_EXT.1 Authentication Protocol

FCS_RADIUS_EXT.1.1

The TSF shall implement the [**selection**: *RADIUS protocol as specified in RFC 2865, DIAMETER protocol as specified in RFC 6733, [**assignment**: other direct identity federation protocol]*] for communication of identity and authentication information with a relying party.

FCS_RADIUS_EXT.1.2

The TSF shall implement encapsulated EAP in accordance with FCS_EAPTLS_EXT.1.

FCS_RADIUS_EXT.1.3

The TSF shall provide [**selection**: *a key indicator, an encrypted parameter, an encrypted value*] for a key held by the successfully authenticated claimant derived from the supported EAP mode and provided to the relying party in accordance with the protocol indicated in FCS_RADIUS_EXT.1.1.

Application Note: The ST author describes how the TSF communicates with a relying party at the application layer to receive authentication requests and provide identity assertions. RADIUS and DIAMETER protocols are used with AAA servers when the relying party is a NAS, but other direct access identity federation protocols that support FCS_EAPTLS_EXT.1 and identify a key held by the authenticated claimant that can be confirmed by the relying party are acceptable. If other protocols are claimed, the ST author includes the RFCs and indicates the messages used for authentication requests and assertions.

The ST author indicates which keys held by the authenticated claimant are available to the relying party for key-holder verification. For RADIUS/DIAMETER, the encrypted key is the derived from the EAP-TLS/EAP-TTLS master key established during the TLS handshake, and used by the relying party as the AUTH MSK/security association for the IPsec session established between the network access server and the authenticated claimant. More generally, a key indicator can be a reference identifier for a shared secret key, or a public key, certificate, or other identifier associated with a private asymmetric key controlled by the authenticated claimant.

Evaluation Activities

FCS_RADIUS_EXT.1
TSS
The evaluator shall review the ST to ensure the supported protocols are described and that the description includes the following:

- *Types of claimant-held keys that can be used by the relying party for key-holder verification in accordance with the supported EAP mode claimed in FCS_EAPTLS_EXT.1*
- *How information provided by the TOE to the relying party allows the relying party to perform key-holder verification using the key*
- *How key related information provided by the TOE is protected in transit to the relying party.*

Guidance
The evaluator shall verify that all configurable features of the TSF are described and instructions are provided to meet the requirements.

Tests
The evaluator shall perform the following test in conjunction with testing for FCS_EAP-TLS_EXT.1 after successful authentication:

- ***Test 1:** For each type of claimant held key supported, the evaluator shall confirm that communication between the test client and the test relying party encrypted using the indicated key is successful.*

FCS_RADIUS_EXT.1 Authentication Protocol

FCS_RADIUS_EXT.1.1

Persistent private and secret keys shall be stored within the TSF [**selection**:

- *encrypted within a hardware protected key*
- *in a hardware cryptographic module*
- *within an isolated execution environment protected by a hardware key*

].

Evaluation Activities

FCS_RADIUS_EXT.1
TSS
The evaluator shall verify the TSS includes a description of protected key storage.

Guidance
The evaluator shall verify that the operational guidance includes any information needed to configure the TOE to meet this requirement.

Tests
There are no test EAs for this component.

5.2.4 Identification and Authentication (FIA)

FIA_AFL.1/AuthSvr Authentication Failure Handling (Claimant)

FIA_AFL.1.1/AuthSvr

The TSF shall detect when [*an administrator configurable positive integer **of successive***] unsuccessful authentication attempts occur related to [*claimants attempting to authenticate*].

FIA_AFL.1.2/AuthSvr

When the defined number of unsuccessful authentication attempts has been [*met*], the TSF shall [**selection, choose one of**: *prevent the offending remote entity from successfully authenticating until [**assignment**: action] is taken by a local Administrator, prevent the offending claimant from successfully authenticating until an administrator-defined time period has elapsed*].

Application Note: This requirement applies to claimant authentication attempts in support of an authentication service provided for a federated relying party. This requirement does not apply to login to the TOE by privileged users for administrative accesses; these cases are addressed by the Base-PP iteration of this SFR. Responses to authentication queries to aid the claimant in providing acceptable authenticators is not considered a preventative action and are allowed prior to reaching the lockout threshold. The “action” taken by a local administrator is implementation specific and is defined in the operational guidance (for example, lockout reset or password reset). The ST author chooses one of the selections for handling of authentication failures depending on how the TOE has implemented this handler.

Evaluation Activities

FIA_AFL.1/AuthSvr
TSS
The evaluator shall examine the TSS to verify that it contains a description of how successive unsuccessful authentication attempts by claimants are detected and tracked. The evaluator shall verify that the TSS describes the method by which the offending claimant is prevented from successfully being authenticated by the TOE, and the actions necessary to restore this ability.

Guidance
The evaluator shall examine the operational guidance to verify that it describes how to configure the threshold for unsuccessful claimant authentication attempts and how to perform any actions that affect claimants that are limited in this manner (e.g. instructions for configuring the lockout period or for manually unlocking the offending claimant).

Tests
The evaluator shall perform the following tests in conjunction with testing for FCS_EAPTLS_EXT.1 test 2a and, if applicable, test 2c for each claimant authentication method:

- ***Test 1:** The evaluator shall follow the operational guidance to configure a number of failed attempts that will cause lockout behavior to be enforced against a claimant. The evaluator shall establish a registered user and provide invalid input for the authentication method repeatedly to reach the configured limit. The evaluator shall then observe the configured penalty is imposed.*
- ***Test 2:** If the administrator action selection is claimed in FIA_AFL.1.2/AuthSvr, the*

evaluator shall ensure that following the operational guidance for restoring access to a locked-out claimant will subsequently allow that claimant to be authenticated.

If the time period selection is claimed in FIA_AFL.1.2/AuthSvr, the evaluator shall follow the operational guidance to configure a certain lockout time for claimants that are locked out due to excessive authentication failures. The evaluator shall cause a claimant to be locked out in this manner, wait for a time period that is just less than the configured value, and verify that an authentication attempt using valid credentials still does not result in successful access. The evaluator shall then repeat this behavior but wait for just after the configured time period has elapsed to show that an authentication attempt using valid credentials results in successful access.

FIA_X509_EXT.1/AuthSvr X.509 Certificate Validation (Claimant)

FIA_X509_EXT.1.1/AuthSvr

The TSF shall validate certificates in accordance with the following rules:

- RFC 5280 **version 3** certificate validation and certification path validation supporting **[selection: *a minimum path length of [assignment: value greater than or equal to 3], no prior constraints on path length*]**
- The certification path must terminate with a CA certificate **trusted by the TSF specifically for claimant authentication.**
- The TSF shall validate a certification path by ensuring that all CA certificates in the certification path contain the basicConstraints extension with the CA flag set to TRUE.
- The TSF shall validate the revocation status of **each certificate in the certificate path [selection:**
  - ***containing an OCSP provider in the AIA extension using the Online Certificate Status Protocol (OCSP) as specified in RFC 6960***
  - ***containing a CRL distribution point in the CRLDP extension or AIA extension using [selection: a Certificate Revocation List (CRL) as specified in RFC 5280 Section 6.3, a Certificate Revocation List (CRL) as specified in RFC 5759 Section 5]***

  ].
- The TSF shall validate the extendedKeyUsage field **is present and contains key usage values** according to the following rules: **[selection:**
  - ***Certificates do not assert anyExtendedKeyUsage (OID 2.5.29.37.0)***
  - ***Client certificates associated with authenticated entities presented for [selection: TLS, DTLS] shall have the Client Authentication purpose (id-kp 2 with OID 1.3.6.1.5.5.7.3.2) in the extendedKeyUsage field.***
  - ***[selection:***
    - ***Server certificates presented for [selection: TLS, DTLS] shall have the Server Authentication purpose (id-kp 1 with OID 1.3.6.1.5.5.7.3.1) in the extendedKeyUsage field.***
    - ***Certificates presented for IPsec shall have the ipsec-IKE purpose (id-kp 17 with OID 1.3.6.1.5.5.7.3.17)***
    - ***OCSP certificates presented for OCSP responses shall have the OCSP Signing purpose (id-kp 9 with OID 1.3.6.1.5.5.7.3.9) in the extendedKeyUsage field.***

    ]

  ].
- **The TSF shall validate that each CA certificate in the certification path indicating a path length constraint in the basicConstraints extension does not have more than the specified number of subordinate CA certificates in the certification path from the end-entity certificate to the CA certificate indicating the constraint, not counting the CA certificate itself or any self-issued certificates in the certification path.**
- **The TSF shall process name constraints of type Directory Name and [selection: *rfc822Name, dnsName, UPN Name (Ohter Name = id-ms-san-sc-logon-upn), [assignment: other name type], no other name type*] by verifying that each name of a supported name type present in the end-entity certificate subject field or subjectAlternateName extension, is allowed in each CA certificate in the certification path, is not disallowed by any of the CA certificates in the certification path, and that each name type included in the end-entity certificate and constrained by a CA certificate in the certification path is**

processed.

- **The TSF shall process the following certificate extensions: [selection:**
  - ***Certificate Policy extension in accordance with RFC 5280 and [selection:***
    - ***Policy mapping extension in accordance with RFC 5280***
    - ***Policy constraints extension in accordance with RFC 5280***
    - ***Inhibit anyPolicy extension in accordance with RFC 5280***
    - ***No other policy related extension***

    ] in support of claimant authentication and [assignment: other intended purposes and limitations of policy related extension processing]
  - ***[assignment: other standard extensions]***
  - ***no other extensiosn***

  ].

Application Note: The ST author claims supported certificate validity checking options for each rule. For name constraints, all supported name types used to match names presented in a certificate to registered users and the associated standard matching method are described.

The ST author claims supported certificate policies. 'Policy Constraints...' is claimed if the TOE's authentication policy depends on the certificate policies for claimant certificates. Other policy related extensions within the selection are claimed if supported. The extension inhibitPolicyMapping is not claimed if the TSF does not support certificate chains of length 4 or more. The Policy related extensions, if supported, are primarily used in this PP-Module for claimant authentication, but are allowed for other certificate authentications. The ST author specifies the intended use and any limits of support for these extensions or specifies 'no other purposes or constraints' in the assignment of this selection.

The ST author specifies any additional supported X509 extensions, and the associated extension processing rules used to determine claimant identity attributes or conditions that can be used in the TOE's authentication policy.

FIA_X509_EXT.1.2/AuthSvr

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.

Evaluation Activities

FIA_X509_EXT.1/AuthSvr

TSS

The evaluator shall ensure the TSS describes where the check of validity of the certificates takes place. The evaluator ensures the TSS also provides a description of the certificate path validation algorithm.

Guidance

The evaluator shall ensure that instructions for any configurable features of the validation process are included. If the ST includes provisions for exception processing of certificate revocation status information, the evaluator shall ensure the operational guidance contains instructions on how the indicated options are configured.

If the TOE supports processing of the policy constraints extension and the TOE requires configuration to validate the policy of a claimant certificate, the evaluator shall verify that the operational guidance includes instructions for configuring this behavior.

Tests

The evaluator shall perform the following tests. The tests for the extendedKeyUsage rules, name constraints and policy constraints, if supported, are performed in conjunction with the uses that require those rules.

- ***Test 1:*** *The evaluator shall demonstrate that validating a certificate without a valid certification path results in the function failing, for each of the following reasons, in turn:*
  - *by establishing a certificate path in which one of the issuing certificates is not a CA certificate*
  - *by omitting the basicConstraints field in one of the issuing certificates*
  - *by setting the basicConstraints field in an issuing certificate to have CA=False*
  - *by omitting the CA signing bit of the key usage field in an issuing certificate*
  - *by setting the path length field of a valid CA field to a value strictly less than the certificate path*

  .

The evaluator shall then establish a valid certificate path consisting of valid CA certificates, and demonstrate that the function succeeds. The evaluator shall then remove trust in one of the CA certificates, and show that the function fails.

- ***Test 2:*** *The evaluator shall demonstrate that validating an expired certificate results in the function failing.*
- ***Test 3:*** *The evaluator shall test that the TOE can properly handle revoked certificates – conditional on the revocation method that is selected; if multiple methods are selected, then the test is repeated for each method. The evaluator tests revocation for each certificate in the trust chain which advertises certificate status information. The evaluator shall ensure that a valid certificate is used, and that the validation function succeeds. The evaluator shall then attempt the test with a certificate that will be revoked (for each method chosen in the selection) and verify that the validation function fails.*
- ***Test 4:*** *If any OCSP option is selected, the evaluator shall present a delegated OCSP certificate that does not have the OCSP signing purpose and verify that validation of the OCSP response fails. If CRL is selected, the evaluator shall configure the CA to sign a CRL with a certificate that does not have the cRLsign key usage bit set and verify that validation of the CRL fails.*
- ***Test 5:*** *[conditional] If the TOE supports EC certificates, then the evaluator shall establish a valid, trusted certificate chain consisting of an EC leaf certificate, an EC Intermediate CA certificate not designated as a trust anchor, and an EC certificate designated as a trusted anchor, where the elliptic curve parameters are specified as a named curve. The evaluator shall confirm that the TOE validates the certificate chain.*
- ***Test 6:*** *[conditional] If the TOE supports EC certificates, then the evaluator shall replace the intermediate certificate in the certificate chain for Test 5 with a modified certificate, where the modified intermediate CA has a public key information field where the EC parameters uses an explicit format version of the Elliptic Curve parameters in the public key information field of the intermediate CA certificate from Test 5, and the modified Intermediate CA certificate is signed by the trusted EC root CA, but having no other changes. The evaluator shall confirm the TOE treats the certificate as invalid.*
- ***Test 7:*** *The evaluator shall test the following name constraints:*
  - *Test 7a: For each name type supported, the evaluator shall establish a valid certificate for a registered entity. The evaluator shall ensure the certificate has a valid path length of at least 3, consisting of a trusted root, an issuing CA that is not a trust anchor, and the leaf certificate representing the entity. The evaluator shall ensure that the leaf certificate includes a single name of the supported name type and no other DN or SAN entries. The evaluator shall initiate an application requiring authentication of that entity using the certificate and verify the TSF successfully authenticates the entity.*
  - *Test 7b: For each leaf certificate used in test 7a, the evaluator shall establish a new leaf certificate that includes the same name and name type, but which is issued by a different subordinate CA asserting an allowed-list that does not include the name for the name-type. The evaluator shall ensure the subordinate CA is included in a valid chain to the same trusted root. The evaluator shall initiate the same application attempt as in test 7a for the new certificate and observe that the TSF indicates the certificate is invalid.*
  - *Test 7c: For each leaf certificate used in test 7a, the evaluator shall establish a new leaf certificate that includes the same name and name type, but which is issued by a different subordinate CA asserting a deny-list matching the name for the name type. The evaluator shall ensure the subordinate CA is included in a valid certificate path to the same trusted root. The evaluator shall initiate the same application attempt as in test 7a using the new certificate and observe that the TSF indicates the certificate is invalid.*
- ***Test 8:*** *[conditional] If the TOE supports processing of the policy constraints extension, then for each distinct purpose and within the constraints indicated in the ST (claimant authentication and any other supported subject types), the evaluator shall follow the operational guidance as necessary to configure the TOE to require the subject's certificate to assert a specific certificate policy. The evaluator shall perform the following sub-tests:*
  - *Test 8a: The evaluator shall establish a certificate for the subject asserting the certificate policy OID required, issued by a Certification Authority also specifying the required certificate policy. The evaluator shall present the established certificate for authentication and verify that the TSF successfully validates the certificate.*
  - *Test 8b: The evaluator shall repeat test 8a using a certificate asserting the required policy but issued by a Certification Authority only asserting the 'anyPolicy' OID (value {2 5 29 32 0}) in its policy constraints extension. The evaluator shall observe that the TSF successfully validates the certificate.*
  - *Test 8c: [conditional] If the ST indicates support for the policy mapping extension, the evaluator shall repeat test 8a using a certificate asserting a new policy OID that does not match the required policy OID, which is issued by a CA asserting the new policy OID in the policy constraints extension, and which is in turn issued by a CA asserting the required OID in its certificate constraints extension and containing a policy mapping extension including the mapping of the asserted policy to the required policy. The evaluator shall observe that the TSF successfully validates the certificate.*

  Note that installing a root CA trusted by the TOE with the required policy constraints

and policy mapping extensions may be required if the TSF limits the path length of certificate chains.

- *Test 8d: [conditional] If the ST indicates support for both policy mapping and policy constraints extensions and also supports certificate chains of length 4 or more, the evaluator shall establish a certificate for the subject asserting a new policy OID that does not match the required policy OID, which is issued by a CA asserting the new policy OID, which in turn is issued by a CA which includes the policy mapping extension mapping the required policy OID to the new policy OID, which is in turn issued by a CA with the extension policy constraints with the inhibitPolicyMapping field having value 0. The evaluator shall present the certificate to the TSF for authentication and observe that the TSF indicates the certificate is invalid.*
- *Test 8e: [conditional] If the ST indicates support for both policy mapping and policy constraints extensions, the evaluator shall select a policy OID not required for authentication in the TOE's current configuration. The evaluator shall establish a certificate for the subject that does not assert the (non-required) policy, which is issued by a CA also asserting the new policy OID, which in turn, is issued by a CA asserting the 'anyPolicy' OID and having a critical policy constraints extension with explicitPolicy field with value 0. The evaluator shall present the certificate to the TSF for authentication and observe that the TSF indicates the certificate is invalid.*
- *Test 8f: The evaluator shall establish a certificate for the subject asserting the required policy but issued by a Certification Authority that does not include any certificate policy related extensions. The evaluator shall present the certificate for authentication and observe that the TSF indicates the certificate is invalid.*
- *Test 8g: The evaluator shall establish a certificate for the subject asserting the required certificate policy issued by a Certification Authority that includes only asserts a single, non-matching policy OID in its policy related extensions (i.e. the CA certificate does not include the matching OID, 'anyPolicy' assertions or assert an OID that is mapped to the required OID via policy matching extensions by previous Certification Authorities in the certificate chain, if supported). The evaluator shall present the certificate to the TSF for authentication and observe the TSF indicates the certificate is invalid.*
- *Test 8h: [conditional] If the ST indicates the inhibitAnyPolicy extension is supported, the evaluator shall establish a certificate for the subject asserting the required policy issued by a CA asserting the 'anyPolicy' OID, which is in turn issued by a CA with an inhibitAny extension with value 0. The evaluator shall present the certificate to the TSF for authentication and observe the TSF indicates the certificate is invalid.*

  Note that installing a root CA trusted by the TOE with the inhibitAny extension may be required if the TSF limits the path length of certificate chains.

FIA_UAU.6 Re-Authenticating

FIA_UAU.6.1

The TSF shall re-authenticate the **administrative** user under the conditions [*when the user changes their password, [**selection**: following TSF-initiated session locking, [**assignment**: other conditions], no other conditions]*].

Evaluation Activities

FIA_UAU.6
TSS
There are no TSS evaluation activities for this component.

Guidance
The evaluator shall ensure that the operational guidance includes instructions on how an administrator of the TOE can change their own password.

Tests
The evaluator will access the TOE using a particular administrative account and then attempt to change the password of that account as directed by the operational guidance. While making this attempt, the evaluator will verify that re-authentication is required.
If other re-authentication conditions are specified, the evaluator shall cause those conditions to occur and verify that the TSF re-authenticates the authenticated user.

5.2.5 Security Management (FMT)

FMT_SMF.1/AuthSvr Specification of Management Functions (Authentication Server)

FMT_SMF.1.1/AuthSvr

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

- Ability to configure claimant verification data
- Ability to manage relying party trust store data
- Ability to enable, disable, and determine and modify the behavior of all the security functions of the TOE identified in this PP-Module to include [**assignment**: *list of supported functions*]
- [**selection**:
  - *Ability to configure IPsec functionality*
  - *Ability to configure DTLS functionality*
  - *Ability to configure TLS functionality*
  - *Ability to manage claimant authentication policy*
  - *No other functions*

  ]

.

Application Note: This SFR defines additional management functions for the TOE beyond what is defined in the Base-PP as FMT_SMF.1.

Evaluation Activities

FMT_SMF.1/AuthSvr
TSS
The evaluator shall verify that the TSS identifies all of the security-relevant management functions that apply to the security functions the TOE claims from this PP-Module.

Guidance
For each claimed management function, the evaluator shall ensure that the operational guidance contains instructions for how to configure the function.

Tests
For each claimed management function, the evaluator shall follow the operational guidance to configure the behavior of that function and ensure that applying the configuration settings have the intended effect. Note that some or all of these functions may be tested in the course of performing the test activities for other claimed SFRs.

5.2.6 TOE Access (FTA)

FTA_TSE.1 TOE Session Establishment

FTA_TSE.1.1

The TSF shall be able to deny **claimant** session establishment based on [*invalid certificate, [**selection**: [**assignment**: other identity attributes], no other attributes]*].

Application Note: The intent of this SFR is to describe any circumstances that would cause a claimant's authentication request to be rejected. All compliant TOEs will reject authentication requests based on invalid credentials. A compliant TOE may also impose additional limitations such as suspended accounts or time of day restrictions, depending on the capabilities of the TSF's authentication mechanism.

Evaluation Activities

FTA_TSE.1
TSS
The evaluator shall examine the TSS to determine that all of the attributes on which a claimant session can be denied are specifically defined.

Guidance
The evaluator shall examine the operational guidance to verify that it contains instructions for configuring each of the attributes identified in the TSS.

Tests
The evaluator shall successfully have a claimant be authenticated by the TOE. For each attribute claimed in the SFR, the evaluator shall configure the TOE to deny user access based on a specific value of that attribute. The evaluator shall then attempt to establish a new session in contravention to the attribute setting while still providing valid authentication data. The evaluator shall observe that the access attempt fails.

5.2.7 Trusted Path/Channels (FTP)

FTP_ITC.1/NAS Inter-TSF Trusted Channel (Relying Party Communications)

FTP_ITC.1.1/NAS

The TSF shall provide **[selection: *an IPsec, a RadSec, a mutually authenticated TLS, a mutually authenticated DTLS*]** communication channel between itself and **a relying party** 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/NAS

The TSF shall permit [*the TSF, **or the relying party***] to initiate communication via the trusted channel.

FTP_ITC.1.3/NAS

The TSF shall initiate communication via the trusted channel for [*responses to authentication request messages received from the relying party*].

Evaluation Activities

FTP_ITC.1/NAS
TSS
The evaluator shall examine the TSS to determine that, for all communications with authorized IT entities identified in the requirement, each communications mechanism is identified in terms of the allowed protocols for that IT entity. The evaluator shall also confirm that all protocols listed in the TSS are specified and included in the requirements in the ST.

Guidance
The evaluator shall confirm that the guidance documentation contains instructions for establishing and reestablishing the allowed protocols with each authorized IT entity.

Tests
For each claimed trusted channel mechanism, the evaluator shall configure the TOE to interact with a relying party using that channel and verify using packet captures that the claimed mechanism is used.

5.3 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 3: SFR Rationale

Objective	Addressed by	Rationale
O.TRUSTED_RP	FCS_EAPTLS_EXT.1	TBD
	FIA_PSK_EXT.1/Auth	TBD
	FTP_ITC.1/NAS	TBD
O.USER_AUTH	FIA_AFL.1/AuthSvr	TBD
	FIA_UAU.6	TBD
	FTA_TSE.1	TBD
O.SECURITY_ASSOCIATION	FCS_EAPTLS_EXT.1	TBD

5.4 TOE Security Assurance Requirements

This PP-Module does not define any SARs beyond those defined within the Base-PP 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 NDcPP as well. This PP includes 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-PP. 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 Collaborative Protection Profile for NDs

6.1.1 Consistency of TOE Type

When this PP-Module is used to extend the NDcPP, the TOE type for the overall TOE is still a network device. The TOE boundary is simply extended to include authentication server functionality that is provided by the network device.

6.1.2 Consistency of Security Problem Definition

PP-Module Threat, Assumption, OSP	Consistency Rationale
T.FALSE_ENDPOINTS	This threat is similar to the T.WEAK_AUTHENTICATION_ENDPOINTS threat in the NDcPP but it applies specifically to the NAS, which is an environmental component that is defined specifically in this PP-Module.
T.INVALID_USERS	This threat is similar to the T.UNAUTHORIZED_ADMINISTRATOR_ACCESS threat in the NDcPP but it applies to user authentication brokered by the TSF rather than to administrator authentication to the TOE itself. It is also similar to the T.UNTRUSTED_COMMUNICATION_CHANNELS threat in the NDcPP except that it applies specifically to the RADIUS communications and the protocols used to secure those, which is an interface that is defined specifically in this PP-Module.
A.RP_FEDERATION	The NDcPP does not define any assumptions for the intended network architecture that the TOE is deployed into. Therefore, an assumption that the network can be set up in such a way that the TOE will have direct connectivity with one or more relying parties does not violate any assumptions of the NDcPP.

6.1.3 Consistency of Objectives

The objectives for the TOEs are consistent with the NDcPP based on the following rationale:

PP-Module TOE Objective	Consistency Rationale
O.TRUSTED_RP	The NDcPP does not define any TOE objectives; instead, it maps SFRs directly to threats. The TOE objectives defined by this PP-Module are therefore assumed not to conflict with the NDcPP by virtue of the fact that the SFRs used to satisfy these objectives do not conflict with the NDcPP SFRs.
O.USER_AUTH	The NDcPP does not define any TOE objectives; instead, it maps SFRs directly to threats. The TOE objectives defined by this PP-Module are therefore assumed not to conflict with the NDcPP by virtue of the fact that the SFRs used to satisfy these objectives do not conflict with the NDcPP SFRs.
O.SECURITY_ASSOCIATION	The NDcPP does not define any TOE objectives; instead, it maps SFRs directly to threats. The TOE objectives defined by this PP-Module are therefore assumed not to conflict with the NDcPP by virtue of the fact that the SFRs used to satisfy these objectives do not conflict with the NDcPP SFRs.

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

PP-Module OE Objective	Consistency Rationale
OE.RP_FEDERATION	The Base-PP does not define where in a particular network architecture a network device must be deployed since it is designed to be generic to various types of network devices. This PP-Module defines the expected architectural deployment specifically for a network device that acts as an authentication server.

6.1.4 Consistency of Requirements

This PP-Module identifies several SFRs from the NDcPP that are needed to support Authentication Servers functionality. This is considered to be consistent because the functionality provided by the NDcPP is being used for its intended purpose. The PP-Module also identifies a number of modified SFRs from the NDcPP that are used entirely to provide functionality for Authentication Servers The rationale for why this does not conflict with the claims defined by the NDcPP are as follows:

PP-Module Requirement	Consistency Rationale
Modified SFRs	
FIA_X509_EXT.1/Rev	This PP-Module modifies the Base-PP's definition of the SFR by making it mandatory rather than selection-based.
FIA_X509_EXT.2	This PP-Module modifies the Base-PP's definition of the SFR by making it mandatory rather than selection-based.
FIA_X509_EXT.3	This PP-Module modifies the Base-PP's definition of the SFR by making it mandatory rather than selection-based.
Additional SFRs	
This PP-Module does not add any requirements when the NDcPP is the base.	
Mandatory SFRs	
FAU_GEN.1/AuthSvr	This SFR iterates the FAU_GEN.1 SFR defined in the Base-PP to define auditable events for the functionality that is specific to this PP-Module.
FCO_NRO.1	This SFR applies to implementation of the supported authentication protocol, which is beyond the original scope of the Base-PP.
FCO_NRR.1	This SFR applies to implementation of the supported authentication protocol, which is beyond the original scope of the Base-PP.
FCS_CKM.3	TBD
FCS_EAPTLS_EXT.1	This SFR applies to implementation of EAP-TLS; the Base-PP defines implementation requirements for (D)TLS, but EAP-TLS is beyond the original scope of the Base-PP.
FCS_RADIUS_EXT.1	This SFR applies to implementation of authentication protocols, which is beyond the original scope of the Base-PP.
FCS_RADIUS_EXT.1	This SFR is consistent with the FPT_SKP_EXT.1 requirement of the Base-PP but requires the TSF to implement a specific method of protecting key data rather than a general statement that such data is not stored in plaintext.
FIA_AFL.1/AuthSvr	This SFR defines functional behavior enforced on external users being authenticated by the TOE, which is functionality that is not covered by the Base-PP.
FIA_X509_EXT.1/AuthSvr	The Base-PP defines X.509 validation requirements for external entities presenting certificates to the TOE. This PP-Module defines a separate iteration of this function to define the certificate validation behavior that is enforced against claimants requesting to be authenticated by the TOE. It is substantially refined from its original definition to address issues specific to the handling of claimant certificates.
FIA_UAU.6	This SFR defines support for re-authentication of administrators, which expands on the authentication functionality defined in the Base-PP.
FMT_SMF.1/AuthSvr	This SFR defines additional management functionality that is specific to the PP-Module’s product type and would therefore not be expected to be present in the Base-PP.
FTA_TSE.1	This SFR relates to the handling of claimants being authenticated by the TOE, which is functionality that is beyond the original scope of the Base-PP.
FTP_ITC.1/NAS	This SFR iterates the FTP_ITC.1 SFR defined in the Base-PP to define trusted communication channels for the functionality that is specific to this PP-Module.
Optional SFRs	
FCS_CKM.2/DISTRIB	This SFR defines an additional use for the cryptographic and self-protection mechanisms defined in the Base-PP.
Selection-based SFRs	
FCS_RADSEC_EXT.1	This SFR defines the implementation of RadSec and the peer authentication method that it uses. This relies on the TLS requirements defined by the Base-PP and may also use the X.509v3 certificate validation methods specified in the Base-PP, depending on the selected peer authentication method.

FCS_RADSEC_EXT.2	This SFR defines the implementation of RadSec when pre-shared key authentication is used. This functionality is outside the original scope of the Base-PP, but it relies on the TLS client protocol implementation, cryptographic algorithms, and random bit generation functions defined by the Base-PP.
FCS_RADSEC_EXT.3	This SFR defines the implementation of RadSec when pre-shared key authentication with RSA is used. This functionality is outside the original scope of the Base-PP, but it relies on the TLS client protocol implementation, cryptographic algorithms, and random bit generation functions defined by the Base-PP.
FIA_PSK_EXT.1	This SFR defines parameters for pre-shared key generation. The Base-PP supports pre-shared keys as a potential authentication method for IPsec. This PP-Module does not prevent this from being used but does define restrictions on how pre-shared keys may be generated and what constitutes an acceptable key. This may also be used for RadSec, which is outside the original scope of the Base-PP.

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

A.1.1 Cryptographic Support (FCS)

FCS_CKM.2/DISTRIB Cryptographic Key Distribution (802.11 Keys)

FCS_CKM.2.1/DISTRIB

The TSF shall distribute **the IEEE 802.11** keys in accordance with a specified key distribution method: [*trusted channel protocol specified in FPT_ITT.1(Base-PP)*] that meets the following: [*standards specified in the various iterations of FCS_COP.1*] **and does not expose the cryptographic keys**.

Application Note: This requirement applies to any key necessary for successful IEEE 802.11 connections not covered by FCS_CKM.2/GTK. In cases where a key must be distributed to other APs, this communication must be performed via a mechanism of commensurate cryptographic strength. Because communications with any component of a distributed TOE are required to be performed over a trusted connection, the transfer of these keys will be protected.
FCS_COP.1 and FPT_ITT.1 are defined in the NDcPP.

Evaluation Activities

FCS_CKM.2/DISTRIB
TSS
The evaluator will examine the TSS to determine that it describes which keys are distributed outside the TOE, where they are sent, and the purpose for this transfer.

Guidance
If this function is dependent on TOE configuration, the evaluator will confirm that the operational guidance contains instructions for how to configure that the keys are adequately protected.

Tests
This requirement will be tested in conjunction with the tests for the cryptographic primitives, the secure protocols, and FPT_ITT.1 (Base-PP).

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 Cryptographic Support (FCS)

FCS_RADSEC_EXT.1 RadSec

FCS_RADSEC_EXT.1.1

The TSF shall implement RADIUS over TLS as specified in RFC 6614 to communicate securely with a RADIUS server.

FCS_RADSEC_EXT.1.2

The TSF shall perform peer authentication using [**selection**: *X.509v3 certificates, pre-shared keys*].

Application Note: This SFR is applicable if "RADIUS over TLS" is selected in FTP_ITC.1.1.

If X.509v3 certificates is selected in FCS_RADSEC_EXT.1.2, then FCS_TLSC_EXT.2 from the NDcPP must be claimed. If pre-shared keys is selected in FCS_RADSEC_EXT.1.2, then FCS_RADSEC_EXT.2 and FIA_PSK_EXT.1 in this PP-Module must be claimed.

Evaluation Activities

FCS_RADSEC_EXT.1
TSS
The evaluator will verify that the TSS description includes the use of RADIUS over TLS, as described in RFC 6614.
If X.509v3 certificates is selected, the evaluator will ensure that the TSS description includes the use of client-side certificates for TLS mutual authentication.

Guidance
The evaluator will verify that any configuration necessary to meet the requirement must be contained in the guidance.

Tests
The evaluator will demonstrate the ability to successfully establish a RADIUS over TLS connection with a RADIUS server. This test will be performed with X.509v3 certificates if selected and performed with pre-shared keys if selected.

FCS_RADSEC_EXT.2 RadSec using Pre-Shared Keys

The inclusion of this selection-based component depends upon selection in FCS_RADSEC_EXT.1.2.

FCS_RADSEC_EXT.2.1

The TSF shall implement [**selection**: *TLS 1.2 (RFC 5246), TLS 1.1 (RFC 4346)*] and no earlier TLS versions when acting as a RADIUS over TLS client that supports the following ciphersuites: [**selection**:

- *TLS_PSK_WITH_AES_128_CBC_SHA*
- *TLS_PSK_WITH_AES_256_CBC_SHA*
- *TLS_DHE_PSK_WITH_AES_128_CBC_SHA*
- *TLS_DHE_PSK_WITH_AES_256_CBC_SHA*
- *TLS_RSA_PSK_WITH_AES_128_CBC_SHA*
- *TLS_RSA_PSK_WITH_AES_256_CBC_SHA*
- *TLS_PSK_WITH_AES_128_GCM_SHA256*
- *TLS_PSK_WITH_AES_256_GCM_SHA384*
- *TLS_DHE_PSK_WITH_AES_128_GCM_SHA256*
- *TLS_DHE_PSK_WITH_AES_256_GCM_SHA384*
- *TLS_RSA_PSK_WITH_AES_128_GCM_SHA256*
- *TLS_RSA_PSK_WITH_AES_256_GCM_SHA384*

].

Application Note: If any of the TLS_RSA_PSK ciphersuites are selected by the ST author, it is necessary to claim the selection-based requirement FCS_RADSEC_EXT.3.

The above ciphersuites are only for use when the TSF is acting as a RADIUS over TLS client, not for other uses of the TLS protocol. The ciphersuites to be tested in the evaluated configuration are limited by this requirement. The ST author should select the ciphersuites that are supported. If "X.509v3 certificates" is selected in FCS_RADSEC_EXT.1.2, the ciphersuites selected in (and tested by) FCS_TLSC_EXT.2.1 are also supported for RADIUS over TLS client use.

FCS_RADSEC_EXT.2.2

The TSF shall be able to [**selection**: *accept*, *generate using the random bit generator specified in FCS_RBG_EXT.1*] bit-based pre-shared keys.

Evaluation Activities

FCS_RADSEC_EXT.2
TSS
The evaluator will check the description of the implementation of this protocol in the TSS to ensure that the ciphersuites supported are specified. The evaluator will check the TSS to ensure that the ciphersuites specified are identical to those listed for this component. The evaluator will also verify that the TSS contains a description of the denial of old SSL and TLS versions.
The evaluator will examine the TSS to ensure it describes the process by which the bit-based pre-shared keys are generated (if the TOE supports this functionality) and confirm that this process uses the RBG specified in FCS_RBG_EXT.1.

Guidance
The evaluator will verify that any configuration necessary to meet the requirement must be contained in the guidance.
The evaluator will also check the guidance documentation to ensure that it contains instructions on configuring the TOE so that RADIUS over TLS conforms to the description in the TSS (for instance, the set of ciphersuites advertised by the TOE may have to be restricted to meet the requirements).

The evaluator will confirm the operational guidance contains instructions for either entering bit-based pre-shared keys or generating a bit-based pre-shared key (or both).

Tests

FCS_RADSEC_EXT.3 RadSec using Pre-Shared Keys and RSA

The inclusion of this selection-based component depends upon selection in FCS_RADSEC_EXT.2.1.

FCS_RADSEC_EXT.3.1

When the TSF negotiates a TLS_RSA_PSK cipher suite, the TSF shall verify that the presented identifier matches the reference identifier per RFC 6125 section 6.

Application Note: This requirement must be claimed if any ciphersuites beginning with 'TLS_RSA_PSK' are selected in FCS_RADSEC_EXT.2.1.
The rules for verification of identity are described in Section 6 of RFC 6125. The reference identifier is typically established by configuration (e.g. configuring the name of the authentication server). Based on a singular reference identifier's source domain and application service type (e.g. HTTP, SIP, LDAP), the client establishes all reference identifiers which are acceptable, such as a Common Name for the Subject Name field of the certificate and a (case-insensitive) DNS name for the Subject Alternative Name field. The client then compares this list of all acceptable reference identifiers to the presented identifiers in the TLS server's certificate.

The preferred method for verification is the Subject Alternative Name using DNS names, URI names, or Service Names. Verification using the Common Name is required for the purposes of backwards compatibility. Additionally, support for use of IP addresses in the Subject Name or Subject Alternative name is discouraged as against best practices but may be implemented. Finally, support for wildcards is discouraged but may be implemented. If the client supports wildcards, the client must follow the best practices regarding matching; these best practices are captured in the evaluation activity.

FCS_RADSEC_EXT.3.2

When the TSF negotiates a TLS_RSA_PSK cipher suite, the TSF shall [**selection**: *not establish the connection*, *request authorization to establish the connection*, *[**assignment**: other action]*] if the presented server certificate is deemed invalid.

Application Note: This requirement must be claimed if any ciphersuites beginning with 'TLS_RSA_PSK' are selected in FCS_RADSEC_EXT.2.1. Validity is determined by the identifier verification, certificate path, the expiration date, and the revocation status in accordance with RFC 5280. Certificate validity is tested in accordance with testing performed for FIA_X509_EXT.1/Rev in the NDcPP.

Evaluation Activities

FCS_RADSEC_EXT.3

TSS

The evaluator will ensure that the TSS describes the client's method of establishing all reference identifiers from the administrator and application-configured reference identifier, including which types of reference identifiers are supported (e.g., Common Name, DNS Name, URI Name, Service Name, or other application-specific Subject Alternative Names) and whether IP addresses and wildcards are supported. The evaluator will ensure that this description identifies whether and the manner in which certificate pinning is supported or used by the TOE.

Guidance

The evaluator will verify that the operational guidance includes instructions for setting the reference identifier to be used for the purposes of certificate validation in TLS.

Tests

The evaluator will perform the following tests:

- ***Test 1:*** *The evaluator will attempt to establish the connection using a server with a server certificate that contains the Server Authentication purpose in the extendedKeyUsage field and verify that a connection is established. The evaluator will then verify that the client rejects an otherwise valid server certificate that lacks the Server Authentication purpose in the extendedKeyUsage field and a connection is not established. Ideally, the two certificates should be identical except for the extendedKeyUsage field.*
- ***Test 2:*** *The evaluator will present a server certificate that does not contain an identifier in either the Subject Alternative Name (SAN) or Common Name (CN) that matches the reference identifier. The evaluator will verify that the connection fails.*
- ***Test 3:*** *The evaluator will present a server certificate that contains a CN that matches the reference identifier, contains the SAN extension, but does not contain an identifier in the SAN that matches the reference identifier. The evaluator will verify that the connection fails. The evaluator will repeat this test for each supported SAN type.*
- ***Test 4:*** *The evaluator will present a server certificate that contains a CN that does not match the reference identifier but does contain an identifier in the SAN that matches. The evaluator will verify that the connection succeeds.*
- ***Test 5:*** *[conditional] If the TOE does not mandate the presence of the SAN extension, the evaluator will present a server certificate that contains a CN that matches the reference identifier and does not contain the SAN extension. The evaluator will verify that the connection succeeds. If the TOE does mandate the presence of the SAN extension, this test will be omitted.*
- ***Test 6:*** *[conditional] If wildcards are supported by the TOE, the evaluator will perform the following tests:*
  - *The evaluator will present a server certificate containing a wildcard that is not in the left-most label of the presented identifier (e.g. foo.*.example.com) and verify that the connection fails.*
  - *The evaluator will present a server certificate containing a wildcard in the left-most label but not preceding the public suffix (e.g. *.example.com). The evaluator will configure the reference identifier with a single left-most label (e.g. foo.example.com). The evaluator will verify that the connection succeeds. The evaluator will configure the reference identifier without a left-most label as in the certificate (e.g. example.com) and verify that the connection fails. The evaluator will configure the reference identifier with two left-most labels (e.g. bar.foo.example.com) and verify that the connection fails.*
  - *The evaluator will present a server certificate containing a wildcard in the left-most label immediately preceding the public suffix (e.g. *.com). The evaluator will configure the reference identifier with a single left-most label (e.g. foo.com) and verify that the connection fails. The evaluator will configure the reference identifier with two left-most labels (e.g. bar.foo.com) and verify that the connection fails.*
- ***Test 7:*** *[conditional] If wildcards are not supported by the TOE, the evaluator will present a server certificate containing a wildcard and verify that the connection fails.*
- ***Test 8:*** *[conditional] If URI or Service name reference identifiers are supported, the evaluator will configure the DNS name and the service identifier. The evaluator will present a server certificate containing the correct DNS name and service identifier in the URIName or SRVName fields of the SAN and verify that the connection succeeds. The evaluator will repeat this test with the wrong service identifier (but correct DNS name) and verify that the connection fails.*

B.2 Identification and Authentication (FIA)

FIA_PSK_EXT.1 Pre-Shared Key Composition

The inclusion of this selection-based component depends upon selection in FCS_RADSEC_EXT.1.2.

FIA_PSK_EXT.1.1

The TSF shall be able to use pre-shared keys for [**selection**: *RADIUS over TLS (RadSec), IPsec, WPA3-SAE, WPA3-SAE-PK, IEEE 802.11 WPA2-PSK,* ***[assignment****: other protocols that use pre-shared keys]*].

FIA_PSK_EXT.1.2

The TSF shall be able to accept text-based pre-shared keys that:

- are 22 characters and [**selection**: ***[assignment****: other supported lengths], no other lengths*];
- are composed of any combination of upper and lower case letters, numbers, and special characters (that include: “!”, “@”, “#”, “$”, “%”, “^”, “&”, “*”, “(“, and “)”).

FIA_PSK_EXT.1.3

The TSF shall be able to [**selection**: *accept, generate using the random bit generator specified in FCS_RBG_EXT.1*] bit-based pre-shared keys.

Application Note: This requirement must be included if IPsec or another protocol that uses pre-shared keys is claimed, and pre-shared key authentication is selected (e.g., "Pre-shared Keys" is selected in FCS_IPSEC_EXT.1.13 or "pre-shared keys" is selected in FCS_RADSEC_EXT.1.2). The intent of this requirement is that all protocols will support both text-based and bit-based pre-shared keys.

For the length of the text-based pre-shared keys, a common length (22 characters) is required to help promote interoperability. If other lengths are supported, they should be listed in the assignment; this assignment can also specify a range of values (e.g., "lengths from 5 to 55 characters") as well.

For FIA_PSK_EXT.1.3, the ST author specifies whether the TSF merely accepts bit-based pre-shared keys or is capable of generating them. If it generates them, the requirement specifies that they must be generated using the RBG provided by the TOE.

Evaluation Activities

FIA_PSK_EXT.1
TSS
The evaluator will verify that the TSS describes

1. *the protocols that can use pre-shared keys and that these are consistent with the selections made in FIA_PSK_EXT.1.1.*
2. *the allowable values for pre-shared keys and that they are consistent with the selections made in FIA_PSK_EXT.1.2.*
3. *the way bit-based pre-shared keys are procured and that it is consistent with the selections made in FIA_PSK_EXT.1.3.*

Guidance
The evaluator will examine the operational guidance to determine that it provides guidance to administrators on the composition of strong text-based pre-shared keys, and (if the selection indicates keys of various lengths can be entered) that it provides information on the range of lengths supported. The guidance must specify the allowable characters for pre-shared keys, and that list must be a superset of the list contained in FIA_PSK_EXT.1.2.

The evaluator will confirm the operational guidance contains instructions for either entering bit-based pre-shared keys for each protocol identified in the requirement or for generating a bit-based pre-shared key (or both).

Tests
The evaluator will also perform the following tests for each protocol (or instantiation of a protocol, if performed by a different implementation on the TOE). Note that one or more of these tests can be performed with a single test case.

- ***Test 1:*** *The evaluator will compose a pre-shared key of 22 characters that contains a combination of the allowed characters in accordance with the operational guidance and demonstrates that a successful protocol negotiation can be performed with the key.*
- ***Test 2:*** *[conditional]: If the TOE supports pre-shared keys of multiple lengths, the evaluator will repeat Test 1 using the minimum length; the maximum length; a length inside the allowable range; and invalid lengths beyond the supported range (both higher and lower). The minimum, maximum, and included length tests should be successful, and the invalid lengths must be rejected by the TOE.*
- ***Test 3:*** *[conditional]: If the TOE does not generate bit-based pre-shared keys, the evaluator will obtain a bit-based pre-shared key of the appropriate length and enter it according to the instructions in the operational guidance. The evaluator will then demonstrate that a successful protocol negotiation can be performed with the key.*
- ***Test 4:*** *[conditional]: If the TOE does generate bit-based pre-shared keys, the evaluator will generate a bit-based pre-shared key of the appropriate length and use it according to the instructions in the operational guidance. The evaluator will then demonstrate that a successful protocol negotiation can be performed with the key.*

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 4: Extended Component Definitions

Functional Class	Functional Components
Cryptographic Support (FCS)	FCS_EAPTLS_EXT EAP-TLS Protocol FCS_RADIUS_EXT Authentication Protocol FCS_RADSEC_EXT RadSec FCS_STG_EXT Cryptographic Key Storage
Identification and Authentication (FIA)	FIA_PSK_EXT Pre-Shared Key Composition

C.2 Extended Component Definitions

C.2.1 Cryptographic Support (FCS)

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

C.2.1.1 FCS_EAPTLS_EXT EAP-TLS Protocol

Family Behavior

This family defines requirements for how the TSF implements the Extensible Authentication Protocol (EAP) and EAP-Transport Layer Security.

Component Leveling

FCS_EAPTLS_EXT ——— 1

FCS_EAPTLS_EXT.1, EAP-TLS Protocol, requires the TSF to implement EAP and EAP-TLS according to appropriate standards.

Management: FCS_EAPTLS_EXT.1

No specific management functions are identified.

Audit: FCS_EAPTLS_EXT.1

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

- Protocol failures
- Establishment of a TLS session

FCS_EAPTLS_EXT.1 EAP-TLS Protocol

Hierarchical to: No other components.

Dependencies to: FCS_RBG_EXT.1 Random Bit Generation

[FCS_TLSC_EXT.1 TLS Client Protocol Without Mutual Authentication, or

FCS_DTLSC_EXT.1 DTLS Client Protocol Without Mutual Authentication]

[FCS_TLSC_EXT.2 TLS Client Support for Mutual Authentication, or

FCS_DTLSC_EXT.2 DTLS Client Support for Mutual Authentication]

FIA_X509_EXT.1 X.509 Certificate Validation

FCS_EAPTLS_EXT.1.1

The TSF shall implement [**selection**: *EAP-TLS as specified in RFC 5216*, *EAP-TTLS as specified in RFC 5881*] as updated by RFC 8996 with [**selection**: *TLS*, *DTLS*] implemented using mutual authentication in accordance with [**selection**: *FCS_TLSS_EXT.1 and FCS_TLSS_EXT.2*, *FCS_DTLSS_EXT.1 and FCS_DTLSS_EXT.2*].

FCS_EAPTLS_EXT.1.2

The TSF shall generate random values used in the [**selection**: *EAP-TLS*, *EAP-TTLS*] exchange using the RBG specified in FCS_RBG_EXT.1.

FCS_EAPTLS_EXT.1.3

The TSF shall support claimant authentication using certificates and [**selection**: *static PSK*, *HOTP*, *TOTP*, *[**assignment**: other authentication-verification protocols]*, *other authentication-verification protocols via pass-through functionality*, *no other authentication methods*].

FCS_EAPTLS_EXT.1.4

The TSF shall not forward an EAP-success response to the relying party if the client certificate is not valid according to FIA_X509_EXT.1, if the [**selection**: *TLS*, *DTLS*] session is not established, or if any of [**selection**: *PSK*, *HOTP value*, *TOTP value*, *no other authenticator*] required by the authentication policy are not provided or if any of the required authenticators presented in the authentication request is not valid.

C.2.1.2 FCS_RADIUS_EXT Authentication Protocol

Family Behavior

Components in this family define requirements for implementation of authentication protocols.

Component Leveling

FCS_RADIUS_EXT.1, Authentication Protocol, requires the TSF to implement the specified authentication protocols.

FCS_RADIUS_EXT.1, Authentication Protocol, requires the TSF to identify a mechanism used to securely store cryptographic keys.

Management: FCS_RADIUS_EXT.1

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

- Ability to configure RADIUS shared secret
- Ability to define authorized NAS

Audit: FCS_RADIUS_EXT.1

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

- Protocol failures
- Success/failure of authentication

FCS_RADIUS_EXT.1 Authentication Protocol

Hierarchical to: No other components.

Dependencies to: FCS_EAPTLS_EXT.1 EAP-TLS Protocol

FCS_RADIUS_EXT.1.1

The TSF shall implement the [**selection**: *RADIUS protocol as specified in RFC 2865*, *DIAMETER protocol as specified in RFC 6733*, *[**assignment**: other direct identity federation protocol]*] for communication of identity and authentication information with a relying party.

FCS_RADIUS_EXT.1.2

The TSF shall implement encapsulated EAP in accordance with FCS_EAPTLS_EXT.1.

FCS_RADIUS_EXT.1.3

The TSF shall provide [**selection**: *a key indicator*, *an encrypted parameter*, *an encrypted value*] for a key held by the successfully authenticated claimant derived from the supported EAP mode and provided to the relying party in accordance with the protocol indicated in FCS_RADIUS_EXT.1.1.

Management: FCS_RADIUS_EXT.1

No specific management functions are identified.

Audit: FCS_RADIUS_EXT.1

There are no auditable events foreseen.

FCS_RADIUS_EXT.1 Authentication Protocol

Hierarchical to: No other components.

Dependencies to: None

FCS_RADIUS_EXT.1.1

Persistent private and secret keys shall be stored within the TSF [**selection**:

- *encrypted within a hardware protected key*
- *in a hardware cryptographic module*
- *within an isolated execution environment protected by a hardware key*

].

C.2.1.3 FCS_STG_EXT Cryptographic Key Storage

Family Behavior

Components in this family define requirements for secure storage of cryptographic keys.

Component Leveling

C.2.1.4 FCS_RADSEC_EXT RadSec

Family Behavior

Components in this family describe requirements for implementation of the RadSec (RADIUS over TLS) protocol.

Component Leveling

FCS_RADSEC_EXT.1, RadSec, requires the TSF to implement RadSec using a specified peer authentication method.

FCS_RADSEC_EXT.2, RadSec using Pre-Shared Keys, requires the TSF to implement RadSec using pre-shared key authentication in a manner that conforms to relevant TLS specifications.

FCS_RADSEC_EXT.3, RadSec using Pre-Shared Keys and RSA, requires the TSF to validate the external entity used for trusted communications.

Management: FCS_RADSEC_EXT.1

No specific management functions are identified.

Audit: FCS_RADSEC_EXT.1

There are no auditable events foreseen.

FCS_RADSEC_EXT.1 RadSec

Hierarchical to: No other components.

Dependencies to: FCS_TLSC_EXT.1 TLS Client Protocol
FIA_PSK_EXT.1 Pre-Shared Key Composition
FIA_X509_EXT.1 X.509v3 Certificate Validation

FCS_RADSEC_EXT.1.1

The TSF shall implement RADIUS over TLS as specified in RFC 6614 to communicate securely with a RADIUS server.

FCS_RADSEC_EXT.1.2

The TSF shall perform peer authentication using [**assignment**: *some authentication method*].

Management: FCS_RADSEC_EXT.2

No specific management functions are identified.

Audit: FCS_RADSEC_EXT.2

There are no auditable events foreseen.

FCS_RADSEC_EXT.2 RadSec using Pre-Shared Keys

Hierarchical to: No other components.

Dependencies to: FCS_CKM.1 Cryptographic Key Generation
FCS_COP.1 Cryptographic Operation
FCS_RADSEC_EXT.1 RadSec
FCS_RBG_EXT.1 Random Bit Generation

FCS_RADSEC_EXT.2.1

The TSF shall implement [**assignment**: *list of allowed TLS versions*] and reject all other TLS and SSL versions. The TLS implementation shall support the following ciphersuites for use when acting as a RADIUS over TLS client: [**assignment**: *list of supported ciphersuites*].

FCS_RADSEC_EXT.2.2

The TSF shall be able to [**selection**: *accept, generate using the random bit generator specified in FCS_RBG_EXT.1*] bit-based pre-shared keys.

Management: FCS_RADSEC_EXT.3

No specific management functions are identified.

Audit: FCS_RADSEC_EXT.3

There are no auditable events foreseen.

FCS_RADSEC_EXT.3 RadSec using Pre-Shared Keys and RSA

Hierarchical to: No other components.

Dependencies to: FCS_RADSEC_EXT.2 RadSec using Pre-Shared Keys
FIA_X509_EXT.1 X.509v3 Certificate Validation

FCS_RADSEC_EXT.3.1

When the TSF negotiates a TLS_RSA_PSK cipher suite, the TSF shall verify that the presented identifier matches the reference identifier per RFC 6125 section 6.

FCS_RADSEC_EXT.3.2

When the TSF negotiates a TLS_RSA_PSK cipher suite, the TSF shall [**selection**: *not establish the connection, request authorization to establish the connection, [**assignment**: other action]*] if the presented server certificate is deemed invalid.

C.2.2 Identification and Authentication (FIA)

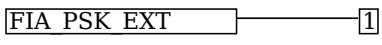
This Module defines the following extended components as part of the FIA class originally defined by CC Part 2:

C.2.2.1 FIA_PSK_EXT Pre-Shared Key Composition

Family Behavior

Components in this family describe requirements for the creation and composition of pre-shared keys used to establish trusted communications channels.

Component Leveling



FIA_PSK_EXT.1, Pre-Shared Key Composition, requires the TSF to support pre-shared keys that meet various characteristics for specific communications usage.

Management: FIA_PSK_EXT.1

No specific management functions are identified.

Audit: FIA_PSK_EXT.1

There are no auditable events foreseen.

FIA_PSK_EXT.1 Pre-Shared Key Composition

Hierarchical to: No other components.

Dependencies to: FCS_RBG_EXT.1 Random Bit Generation

FIA_PSK_EXT.1.1

The TSF shall be able to use pre-shared keys for [**selection**: *RADIUS over TLS (RadSec)*, *IPsec*, *WPA3-SAE*, *WPA3-SAE-PK*, *IEEE 802.11 WPA2-PSK*, *[**assignment**: other protocols that use pre-shared keys]*].

FIA_PSK_EXT.1.2

The TSF shall be able to accept text-based pre-shared keys that:

- are 22 characters and [**selection**: *[**assignment**: other supported lengths]*, *no other lengths*];
- are composed of any combination of upper and lower case letters, numbers, and special characters (that include: “!”, “@”, “#”, “$”, “%”, “^”, “&”, “*”, “(“, and “)”).

FIA_PSK_EXT.1.3

The TSF shall be able to [**selection**: *accept*, *generate using the random bit generator specified in FCS_RBG_EXT.1*] bit-based pre-shared keys.

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 or inherited from the Base-PP.

Appendix E - Allocation of Requirements in Distributed TOEs

For a distributed TOE, the security functional requirements in this PP-Module need to be met by the TOE as a whole, but not all SFRs will necessarily be implemented by all components. The following categories are defined in order to specify when each SFR must be implemented by a component:

- **All Components ("All")** —All components that comprise the distributed TOE must independently satisfy the requirement.
- **At least one Component ("One")** —This requirement must be fulfilled by at least one component within the distributed TOE.
- **Feature Dependent ("Feature Dependent")** — These requirements will only be fulfilled where the feature is implemented by the distributed TOE component (note that the requirement to meet the PP-Module as a whole requires that at least one component implements these requirements if they are claimed by the TOE).

The table below specifies how each of the SFRs in this PP-Module must be met, using the categories above.

Requirement	Description	Distributed TOE SFR Allocation
FAU_GEN.1/WLAN	Audit Data Generation	All
FCS_CKM.1/WPA	Cryptographic Key Generation (Symmetric Keys for WPA2 Connections)	One
FCS_CKM.2/GTK	Cryptographic Key Distribution (GTK)	Feature Dependent
FCS_CKM.2/PMK	Cryptographic Key Distribution (PMK)	Feature Dependent
FIA_8021X_EXT.1	802.1X Port Access Entity (Authenticator) Authentication	One
FIA_UAU.6	Re-Authenticating	Feature Dependent
FMT_SMF.1/AccessSystem	Specification of Management Functions	Feature Dependent
FMT_SMR_EXT.1	No Administration from Client	All
FPT_FLS.1	Failure with Preservation of Secure State	All
FTA_TSE.1	TOE Session Establishment	All
FTP_ITC.1/Client	Inter-TSF Trusted Channel (WLAN Client Communications)	All
FCS_CKM.2/DISTRIB	Cryptographic Key Distribution (802.11 Keys)	Feature Dependent
FCS_RADSEC_EXT.1	RadSec	Feature Dependent
FCS_RADSEC_EXT.2	RadSec using Pre-Shared Keys	Feature Dependent
FCS_RADSEC_EXT.3	RadSec using Pre-Shared Keys and RSA	Feature Dependent
FIA_PSK_EXT.1	Pre-Shared Key Composition	Feature Dependent

Appendix F - 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-PP.

Appendix G - Acronyms

Acronym	Meaning
AAA	Authentication, Authorization, and Accounting
Base-PP	Base Protection Profile
CC	Common Criteria
CEM	Common Evaluation Methodology
cPP	Collaborative Protection Profile
CRL	Certificate Revocation List
CSI	Cryptographic Security Information
DTLS	Datagram Transport Layer Security
EAP	Extensible Authentication Protocol
HOTP	Hash-Based One-Time Password
IPsec	Internet Protocol Security
OCSP	Online Certificate Status Protocol
OE	Operational Environment
PP	Protection Profile
PP-Configuration	Protection Profile Configuration
PP-Module	Protection Profile Module
PSK	Pre-Shared Key
RADIUS	Remote Authentication Dial In User Service
RBG	Random Bit Generator
RP	Relying Party
SAR	Security Assurance Requirement
SFR	Security Functional Requirement
SSH	Secure Shell
ST	Security Target
TLS	Transport Layer Security
TOE	Target of Evaluation
TOTP	Time-Based One-Time Password
TSF	TOE Security Functionality
TSFI	TSF Interface
TSS	TOE Summary Specification
WLAN	Wireless Local Area Network

Appendix H - Bibliography

Identifier	Title
[CC]	Common Criteria for Information Technology Security Evaluation - • Part 1: Introduction and General Model, CCMB-2017-04-001, Version 3.1 Revision 5, April 2017. • Part 2: Security Functional Components, CCMB-2017-04-002, Version 3.1 Revision 5, April 2017. • Part 3: Security Assurance Components, CCMB-2017-04-003, Version 3.1 Revision 5, April 2017.
[NDcPP]	collaborative Protection Profile for Network Devices, Version 2.2e, March 23, 2020
[NDcPP SD]	Supporting Document - Evaluation Activities for Network Device cPP, Version 2.2, December 2019