

Comment: Comment-1-

# Protection Profile for Mobile Device Management



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National Information Assurance Partnership

## Revision History

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Version	Date	Comment
1.0	2013-10-21	Initial Release
1.1	2014-02-07	Typographical changes and clarifications to front-matter
2.0	2014-12-31	Separation of MDM agent SERs Updated cryptography, protocol, X.509 requirements. Updated management functions to match MDF PP v2.0. Included SSH as a remote administration protocol. Removed IPsec as protocol to communicate to MDM agent. Added X509 enrollment objective requirement. Added Optional Mobile Application Store requirements.
3.0	2016-11-21	Updates to align with Technical Decisions Added requirements to support BYOD use case Removed IPsec and SSH requirements, which are now contained in EPs
4.0	2018-09-24	Updates to align with Technical Decisions Removed platform dependency Removed TLS SERs and use the TLS Functional Package Allowed for a distributed TOE
5.0	2024-11-15	Updates to align with Technical Decisions Updates to align with CC:2022 Updates to support subordinate MDM

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# 1 Introduction

## 1.1 Overview

Mobile Device Management (**MDM**) products allow enterprises to apply security policies to managed devices (MDs), such as smartphones, tablets, and workstations. The purpose of these policies is to establish a security posture adequate to permit MDs to process enterprise data and connect to enterprise network resources.

This document provides a baseline set of Security Functional Requirements (**SFRs**) for an **MDM** system, which is the Target of Evaluation (**TOE**). The **MDM** system is only one component of an enterprise deployment of MDs. Other components, such as the **MD** platforms, which enforce the security policies and network access control servers are out of scope.

## 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 <a href="#">[CC]</a> .
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.
Direct Rationale	A type of Protection Profile, PP-Module, or Security Target in which the security problem definition (SPD) elements are mapped directly to the SFRs and possibly to the security objectives for the operational environment. There are no security objectives for the TOE.
Distributed TOE	A TOE composed of multiple components operating as a logical whole.
Extended Package (EP)	A deprecated document form for collecting SFRs that implement a particular protocol, technology, or functionality. See Functional Packages.
Functional Package (FP)	A document that collects SFRs for a particular protocol, technology, or functionality.
Operational Environment (OE)	Hardware and software that are outside the TOE boundary that support the TOE functionality and security policy.
Protection Profile (PP)	An implementation-independent set of security requirements for a category of products.
Protection Profile Configuration (PP-Configuration)	A comprehensive set of security requirements for a product type that consists of at least one Base-PP and at least one PP-Module.
Protection Profile Module (PP-Module)	An implementation-independent statement of security needs for a TOE type complementary to one or more Base-PPs.
Security Assurance Requirement (SAR)	A requirement to assure the security of the TOE.

Security Functional 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

API Application Programming Interface (API)	A specification of routines, data structures, object classes, and variables that allows an application to make use of services provided by another software component, such as a library. APIs are often provided for a set of libraries included with the platform.
Administrator	The person who is responsible for management activities, including setting the policy that is applied by the enterprise on the MD.
Critical Security Parameter (CSP)	Security-related information whose disclosure or modification can compromise the security of a cryptographic module or authentication system.
Data	Program or application or data files that are stored or transmitted by a server or MD.
Data Encryption Key (DEK)	A key used to encrypt data-at-rest.
Developer Modes	States in which additional services are available to a user in order to provide enhanced system access for debugging of software.
Enrolled State	The state in which a MD is administered and configured by a policy from an MDM.
Enrollment over Secure Transport (EST)	Cryptographic protocol that describes an X.509 certificate management protocol targeting public key infrastructure (PKI) clients that need to acquire client certificates and associated certificate authority (CA) certificates.
Enterprise Applications	Applications that are provided and managed by the enterprise as opposed to a public application store.
Enterprise Data	Any data residing in enterprise servers or temporarily stored on MDs to which the MD user is allowed access according to the security policy defined by the enterprise and implemented by the administrator.
Key Encryption Key (KEK)	A key that is used to encrypt other keys, such as DEKs or storage repositories that contain keys.
Locked State	Device state where the device is powered on but most functionality is unavailable for use without authentication.
Managed Device (MD)	A device enrolled and managed, or to be enrolled and managed, by an MDM system. This device is a mobile device typically evaluated under the MDF PP or a device utilizing a GPOS typically evaluated under the GPOS PP.
Managed Device User	The person who uses and is held responsible for an MD.
Mobile Application Store (MAS)	An MDM feature that allows for an organization to substitute a device manufacturer's application store for one that restricts what applications are made available to users.
Mobile Device	A device which is composed of a hardware platform and its system software. The device typically provides wireless connectivity and may include software for functions like secure messaging, email, web, VPN connection, and VoIP (Voice over IP), for access to the protected enterprise network, enterprise data and applications, and for communicating to other MDs.
Mobile Device Management	Products that allow enterprises to apply security policies to MDs. This system consists of two primary components: the MDM server and the MDM agent.

## (MDM)

Operating System (OS)	Software which runs at the highest privilege level and can directly control hardware resources. Modern mobile devices typically have at least two primary operating systems: one which runs on the cellular baseband processor and one which runs on the application processor. The platform of the application processor handles most user interaction and provides the execution environment for apps. The platform of the cellular baseband processor handles communications with the cellular network and may control other peripherals. The term OS, without context, may be assumed to refer to the platform of the application processor.
Powered-Off State	MD shutdown state.
Protected Data	All non-TSF data on the MD, including user or enterprise data. Protected data is encrypted while the MD is in the powered-off state. This includes keys in software-based storage. May overlap with sensitive data.
Root Encryption Key (REK)	A key tied to a particular device that is used to encrypt all other keys for that device.
Sensitive Data	Data that is encrypted by the MD. May include all user or enterprise data or may be data for specific applications such as emails, messaging, documents, calendar items, or contacts. May be protected while the MD is in the locked state. Must include at minimum some keys in software-based key storage.
Subordinate MDM Server	The subordinate MDM server is used to facilitate communications between a primary MDM server and an MDM agent on a managed device. The subordinate MDM server may modify/interpret the MDM policy sent from the primary MDM server to the MDM agent, using well-defined rules, and re-sign the resulting MDM policy for delivery to the MDM agent.
Trust Anchor Database	A list of trusted root Certificate Authority certificates.
Unenrolled State	Device state when it is not managed by an MDM.
Unlocked State	Device state where it is powered on and the user has been authenticated. The device functionality is available for use by the user.

## 1.3 Compliant Targets of Evaluation

The Mobile Device Management (MDM) system consists of two primary components: the MDM server software and the MDM agent. Optionally, the MDM system may consist of a separate Mobile Application Store (MAS) server or a subordinate MDM server.

### 1.3.1 TOE Boundary

The MDM system operational environment consists of the MD on which the MDM agent resides, the platform on which the MDM server runs, and an untrusted wireless network over which they communicate, as pictured below.



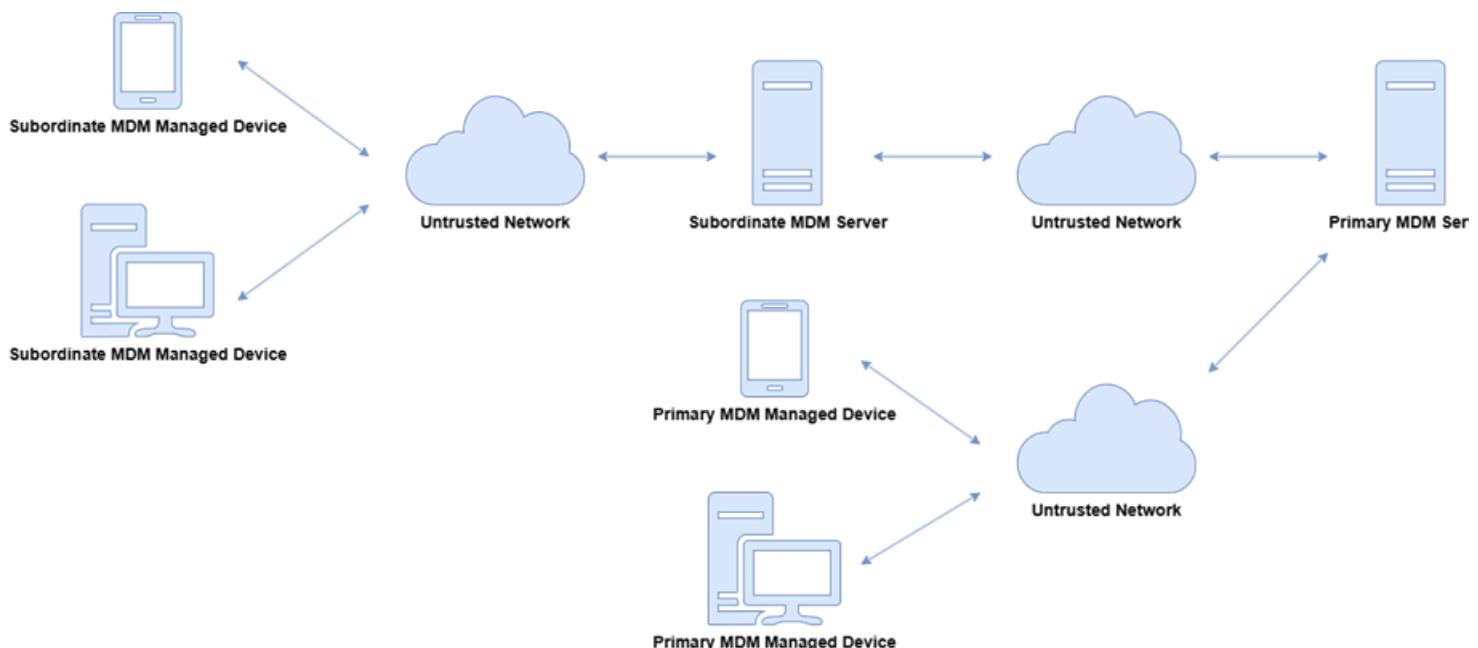
Figure 1: MDM System Operating Environment

The MDM server is software (an application, service, etc.) on a general-purpose platform, a network device, or cloud architecture executing in a trusted network environment. The MDM server provides administration of MD policies and reporting on the device behavior. The MDM server is responsible for managing device enrollment, configuring and sending policies to the MDM agents, collecting reports on device status, and sending commands to the agents. The MDM server may be standalone or distributed, where a distributed TOE is one that requires multiple distinct components to operate as a logical whole in order to fulfill the requirements of this PP (a more extensive description of distributed MDMs is given in section 3).

The **MDM agent** establishes a secure connection back to the **MDM server** controlled by an enterprise administrator and configures the **MD** per the administrator's policies. The **MDM agent** is addressed in the **PP-Module** for **MDM Agents**. If the **MDM agent** is installed on a **MD** as an application developed by the **MDM developer**, the **PP-Module** extends this **PP** and is included in the **TOE**. In this case, the **TOE** security functionality specified in this **PP** must be addressed by the **MDM agent** in addition to the **MDM Server**. Otherwise, the **MDM agent** is provided by the **MD vendor** and is out of scope of this **PP**; however, MDMs are required to indicate the device platforms supported by the **MDM server** and must be tested against the native **MDM agent** of those platforms.

The **Mobile Application Store (MAS)** hosts applications for the enterprise, authenticates agents, and securely transmits applications to enrolled MDs. The **MAS** functionality can be included as part of the **MDM server Software** or can be logically distinct. If the **MAS** functionality is on a physically separate server, then the **TOE** is distributed with the **MDM server** and **MAS** server being separate components.

The **Subordinate MDM Server** is an optional, physically separate, server that sits between a primary **MDM server** and an **MDM agent** on a managed device. The purpose of the subordinate **MDM server** is to forward signed policy files from a primary **MDM server** to an **MDM agent** on a managed device for which the subordinate **MDM** is responsible. The subordinate **MDM server** can either directly pass these signed policies to the managed device, or can interpret the policy into a different format if necessary. This interpretation process will follow well defined rules to ensure that the resulting interpreted policy matches the actions defined in the original policy. This interpreted policy is signed by the subordinate **MDM server** for delivery to the **MDM agent**. Any alerts or notifications generated by an **MDM agent** will be passed by the subordinate **MDM server** back to the primary **MDM server** to alert the enterprise administrators.



**Figure 2: MDM System with Subordinate MDM**

## 1.4 Use Cases

This **PP** defines four use cases:

### [USE CASE 1] Enterprise-owned device for general-purpose enterprise use

An enterprise-owned device for general-purpose business use is commonly called Corporate-Owned, Personally-Enabled (COPE). This use case entails a significant degree of enterprise control over configuration and software inventory. Enterprise administrators use an **MDM** product to establish policies on the MDs prior to user issuance. Users may use internet connectivity to browse the web, access corporate mail, or run enterprise applications, but this connectivity may be under significant control of the enterprise. The user may also be expected to store data and use applications for personal, non-enterprise use. The enterprise administrator uses the **MDM** product to deploy security policies and query **MD** status. The **MDM** may issue commands for remediation actions.

### [USE CASE 2] Enterprise-owned device for specialized, high-security use

An enterprise-owned device with intentionally limited network connectivity, tightly controlled configuration, and limited software inventory is appropriate for specialized, high-security use cases. As in the previous use case, the **MDM** product is used to establish such policies on MDs prior to issuance to users. The device may not be permitted connectivity to any external peripherals. It may only be able to communicate via its Wi-Fi or cellular radios with the enterprise-run network, which may not even permit connectivity to the internet. Use of the device may require compliance with usage policies that are more restrictive than those in any general-purpose use case, yet may mitigate risks to highly sensitive information. Based on the operational environment and the acceptable risk level of

the enterprise, those security functional requirements outlined in Section 5 of this PP along with the selections in the Use Case 2 template defined in Appendix G are sufficient for the high-security use case.

#### [USE CASE 3] Personally-owned device for personal and enterprise use

A personally-owned device which is used for both personal activities and enterprise data is commonly called Bring Your Own Device (BYOD). The device may be provisioned for access to enterprise resources after significant personal usage has occurred. Unlike in the enterprise-owned cases, the enterprise is limited in what security policies it can enforce because the user purchased the device primarily for personal use and is unlikely to accept policies that limit the functionality of the device.

However, because the enterprise allows the user full (or nearly full) access to the enterprise network, the enterprise will require certain security policies, for example a password or screen lock policy and health reporting, such as the integrity of the MD system software, before allowing access. The administrator of the MDM can establish remediation actions, such as wipe of the enterprise data, for non-compliant devices. These controls could potentially be enforced by a separation mechanism built-in to the device itself to distinguish between enterprise and personal activities, or by a third-party application that provides access to enterprise resources and leverages security capabilities provided by the MD. Based on the operational environment and the acceptable risk level of the enterprise, those security functional requirements outlined in Section 5 of this PP along with the selections in the Use Case 3 template defined in Appendix G are sufficient for the secure implementation of this BYOD use case.

#### [USE CASE 4] Personally-owned device for personal and limited enterprise use

A personally-owned device may also be given access to limited enterprise services such as enterprise email. The enterprise may not need to enforce any security policies on this device because the user does not have full access to the enterprise or enterprise data. However, the enterprise may want secure email and web browsing with assurance that the services being provided to those clients by the device are not compromised. Based on the operational environment and the acceptable risk level of the enterprise, those security functional requirements outlined in Section 5 of this PP are sufficient for the secure implementation of this BYOD use case.

## 1.5 Package Usage

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This section contains selections and assignments that are required when the listed Functional Packages are claimed by this PP.

### Functional Package for X.509, Version 1.0

#### Certificate Verification Required in FIA\_XCU\_EXT.1.1

The ST author shall select the option to verify identities in certificates in FIA\_XCU\_EXT.1.1. If the TOE implements a certificate authority, the ST author shall select the option to assert identities in certificates.

#### Restrictions on Certificate Functions in FDP\_CER\_EXT.1.1/OLTLeaf

This usage requirement applies only if the TOE implements a certificate authority. The PP does not define S/MIME functionality, therefore the ST author shall not select the option to implement a certificate profile supporting this protocol.

#### Restrictions on Certificate Functions in FDP\_CER\_EXT.1.2/OLTLeaf

This usage requirement applies only if the TOE implements a certificate authority. The PP does not define S/MIME functionality, therefore the ST author shall not select the option to set extendedKeyUsage bits for email protection.

#### Generation of Certificate Status Required in FDP\_CSIR\_EXT.1.1

This usage requirement applies only if the TOE implements a certificate authority. The ST author shall only select the option to generate certificate status information in FDP\_CSIR\_EXT.1.1.

#### Restrictions on Signature Algorithms in FDP\_OCSP\_EXT.1.1

This usage requirement applies only if the TOE implements a certificate authority. The TOE must use CNSA-compliant signature algorithms. Thus, the ST author shall not select the use of SHA-512 or secp521 for OCSP response signatures.

#### Required Iteration Names for FIA\_X509\_EXT.1

A TOE may utilize FIA\_X509\_EXT.1 as defined in the package in two different manners in this PP. Use of the requirement for validating X.509 certificates presented from outside the TOE boundary shall be iterated as FIA\_X509\_EXT.1/External. Use of the requirement for validating X.509 certificates presented between components of a distributed TOE shall be iterated as FIA\_X509\_EXT.1/Internal.

#### Limitations on Signature Algorithms in FIA\_X509\_EXT.1.1

This usage requirement applies to both internal and external iterations of FIA\_X509\_EXT.1. The TOE must use CNSA-compliant signature algorithms. Thus, the ST author shall select no other algorithms outside of those specified in RFC 8603 for certificate or CRL signatures. Additionally, the TOE shall not use ECDSA with SHA-512 signatures for OCSP responses, and shall utilize no other algorithms for OCSP responses.

#### Required Extension Processing for FIA\_X509\_EXT.1.2

This usage requirement applies to both internal and external iterations of FIA\_X509\_EXT.1. The ST author shall select the options to process the basicConstraints and extendedKeyUsage extensions. Other extensions may be selected as appropriate without restriction.

### **Restrictions on Revocation Functionality for FIA\_X509\_EXT.1.3**

This usage requirement applies in different manners to the different iterations of FIA\_X509\_EXT.1.

For the external iteration of FIA\_X509\_EXT.1, the ST author shall select only from options involving CRL or OCSP in FIA\_X509\_EXT.1.3.

For the internal iteration of FIA\_X509\_EXT.1, the ST author shall not select the option to validate certificate revocation status by validity period. Other selections may be selected without restriction.

### **Restrictions on Revocation Information Retrieval for FIA\_X509\_EXT.1.4**

This usage requirement applies in different manners to the different iterations of FIA\_X509\_EXT.1.

For the external iteration of FIA\_X509\_EXT.1, the ST author shall not select to not obtain revocation status information for any reason, utilize local revocation information or utilize a network connection directly to a CA. Revocation information must be retrieved via an option involving CRL or OCSP.

For the internal iteration of FIA\_X509\_EXT.1, the ST author shall not select the option to determine that the certificate expires within a certain period.

### **Restrictions on Acceptable Key Usage Values for FIA\_X509\_EXT.1.5**

This usage requirement applies to both internal and external iterations of FIA\_X509\_EXT.1. The ST author shall not select the option to pass certificate information to supported functions and shall select the option to verify certificates by evaluating the extendedKeyUsage field in the leaf certificate. The ST author shall additionally not select the option to validate certificates against any rules for S/MIME.

### **Restrictions on Acceptable Functions for FIA\_X509\_EXT.2.1**

The ST author shall not select options that utilize the S/MIME protocol.

# 2 Conformance Claims

## Conformance Statement

An **ST** must claim exact conformance to this **PP**.

The evaluation methods used for evaluating the **TQE** are a combination of the workunits defined in **[CEM]** as well as the Evaluation Activities for ensuring that individual **SFRs** and **SARs** have a sufficient level of supporting evidence in the Security Target and guidance documentation and have been sufficiently tested by the laboratory as part of completing **ATE\_IND.1**. Any functional packages this **PP** claims similarly contain their own Evaluation Activities that are used in this same manner.

## CC Conformance Claims

This **PP** is conformant to Part 2 (extended) and Part 3 (conformant) of Common Criteria **CC:2022**, Revision 1.

## PP Claim

This **PP** does not claim conformance to any Protection Profile.

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

- Protection Profile for Mobile Device Fundamentals, Version 4.0
- Protection Profile for Application Software, Version 2.0
- **PP-Module** for **MDM Agents**, Version 2.0
- **PP-Module** for **VPN Client**, Version 3.0

## Package Claim

- This **PP** is Functional Package for SSH, Version 2.0 conformant.
- This **PP** is Functional Package for TLS, Version 2.1 conformant.
- This **PP** is Functional Package for X.509, Version 1.0 conformant.
- This **PP** does not conform to any assurance packages.

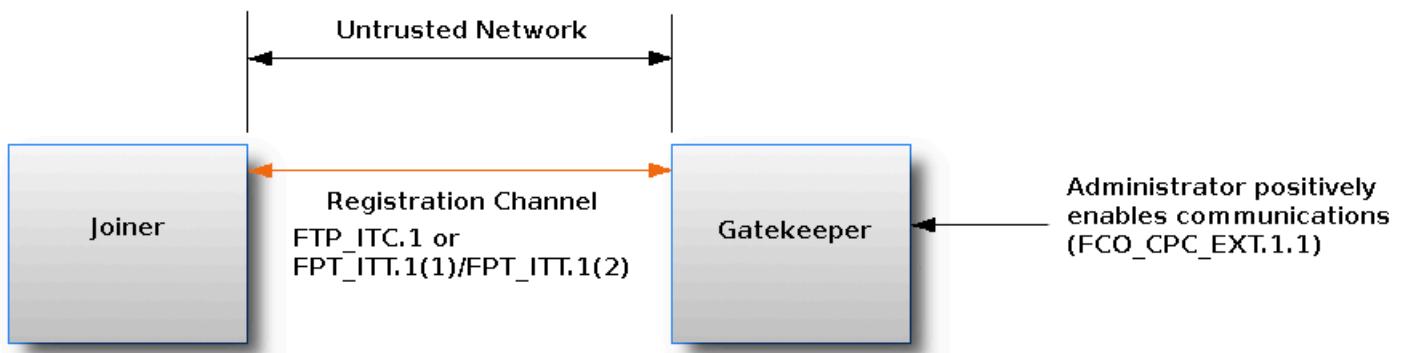
The functional packages to which the **PP** conforms may include **SFRs** that are not mandatory to claim for the sake of conformance. An **ST** that claims one or more of these functional packages may include any non-mandatory **SFRs** that are appropriate to claim based on the capabilities of the **TSF** and on any triggers for their inclusion based inherently on the **SFR** selections made.

# 3 Introduction to Distributed TOEs

This PP includes support for distributed MDM TOEs. MDMs can sometimes be composed of multiple components operating as a logical whole. Frequently we see this architecture when dealing with products hosted in the cloud and offered as Software as a Service. There are a number of different architectures; but fundamentally, they are variations of the following model where the SFRs of this PP can only be fulfilled if the components are deployed and operate together. To be considered a distributed TOE, a minimum of two interconnected components are required.

## 3.1 Registration of Distributed TOE Components

When dealing with a distributed TOE, a number of separate components need to be brought together in the operational environment in order to create the TOE. This requires that trusted communications channels are set up between certain pairs of components (it is assumed that all components need to communicate with at least one other component, but not that all components need to communicate with all other components). The underlying model for creation of the TOE is to have a "registration process" in which components "join" the TOE. The registration process starts with two components, one of which (the "joiner") is about to join an existing TOE by registering with the other (the "gatekeeper"). The two components will use one or more specified authentication and communication channel options so that the components authenticate each other and protect any sensitive data that is transmitted during the registration process (e.g., a key might be sent by a gatekeeper to the joiner as a result of the registration). The following figures illustrate the three supported registration models. Figure 3 illustrates a distributed TOE registration approach which uses an instance of FPT\_ITT.1/INTER\_XFER / FPT\_ITT.1/INTER\_XFER\_AGENT or FTP\_ITC.1/INTER\_XFER\_IT to protect the registration exchange.



- 1) Registration may be performed over any untrusted network
- 2) Registration performed over IPsec, TLS, SSH, or HTTPS channel
- 3) Choose FPT\_ITT.1(1) if certificate revocation checking is not performed
- 4) Choose FPT\_ITT.1(2) if registration is between the TSF and an MDM agent that is included in the TOE
- 5) Choose FTP\_ITC.1 if certificate revocation checking is performed
- 6) Registration channel may be re-used for internal TSF communications

Figure 3: Distributed TOE registration using channel satisfying FPT\_ITT.1/INTER\_XFER / FPT\_ITT.1/INTER\_XFER\_AGENT or FTP\_ITC.1/INTER\_XFER\_IT

The second approach (Figure 4) uses an alternative registration channel and supports use cases where the channel relies on environmental security constraints to provide the necessary protection of the registration exchange.



- 1) Registration channel must be authenticated, provide integrity protection and optionally confidentiality
- 2) Registration channel relies on environmental constraints for some aspects of its protection, or to increase strength of protection, e.g. direct physical connection between Joiner and Gatekeeper (FTP\_TRP.1(3))
- 3) Registration channel must not be re-used and must be replaced after registration is complete with an internal TSF channel that satisfies either FPT\_ITT.1(1)/FPT\_ITT.1(2) or FTP\_ITC.1

**Figure 4: Distributed TOE registration using channel satisfying [FTP\\_TRP.1/TRUSTPATH\\_JOIN](#)**

The final approach ([Figure 5](#)) supports use cases where registration is performed manually through direct configuration of both the Joiner and Gatekeeper devices. Once configured, the two components establish an internal TSF channel that satisfies [FPT\\_ITT.1/INTER\\_XFER](#) / [FPT\\_ITT.1/INTER\\_XFER\\_AGENT](#) or [FTP\\_ITC.1/INTER\\_XFER\\_IT](#).



- 1) Joiner and Gatekeeper are manually pre-configured with information necessary to build inter-TOE communications channel
- 2) Once configured, Joiner and Gatekeeper establish internal TSF channel that satisfies either FPT\_ITT.1(1)/FPT\_ITT.1(2) or FTP\_ITC.1

**Figure 5: Distributed TOE registration without a registration channel**

In each case, during the registration process, the administrator must positively enable the joining components before it can act as part of the TSF. [Figure 6](#) illustrates the approaches that this enablement step may take;



Figure 6: Joiner enablement options for Distributed TOEs

Note that in the case where no registration channel is required, that is the joiner and gatekeeper are directly configured (Figure 5), enablement is implied as part of this direct configuration process.

After registration, the components will communicate between themselves using a normal SSH, TLS, DTLS, IPsec, or HTTPS channel (which is specified in an ST as an instance of [FPT\\_ITT.1/INTER\\_XFER](#) / [FPT\\_ITT.1/INTER\\_XFER\\_AGENT](#) or [FTP\\_ITC.1/INTER\\_XFER\\_IT](#) in terms of [Section 6 Security Requirements](#) and [Table t-audit-optional](#)). This channel for inter-component communications is specified at the top level with the new (extended) SER [FCO\\_CPC\\_EXT.1](#) and is in addition to the other communication channels required for communication with entities outside the TOE (which are specified in an ST as instances of [FTP\\_ITC.1/INTER\\_XFER\\_IT](#) and [FTP\\_TRP.1/TRUSTPATH\\_Rem\\_ADMIN](#)).

### 3.2 Allocation of Requirements in Distributed TOEs

For a distributed TOE, the security functional requirements in this PP need to be met by the TOE as a whole, but not all SERs will necessarily be implemented by all components. The following categories are defined in order to specify when each SER 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 as a whole requires that at least one component implements these requirements if they are specified in [Section 6 Security Requirements](#)).

[Table 1](#) specifies how each of the SERs in this PP must be met, using the categories above.

Table 1: Security Functional Requirements for Distributed TOEs

Requirement	Description	Distributed TOE SER Allocation
<a href="#">FAU_ALT_EXT.1</a>	Server Alerts	One
<a href="#">FAU_CRP_EXT.1</a>	Support for Compliance Reporting of Mobile Device Configuration	One
<a href="#">FAU_GEN.1/AUDITGEN</a>	Audit Data Generation	All
<a href="#">FAU_GEN.1/MAS_SERVER</a>	Audit Data Generation	Feature Dependent
<a href="#">FAU_NET_EXT.1</a>	Network Reachability Review	One

FAU_SAR.1	Audit Review	Feature Dependent
FAU_SEL.1	Security Audit Event Selection	One
FAU_STG.1	External Trail Storage	All
FAU_STG.2	Audit Event Storage	Feature Dependent
FCO_CPC_EXT.1	Communication Partner Control	All
FCS_CKM.1/AKG	Cryptographic Key Generation - Asymmetric Key	All
FCS_CKM.1/SKG	Cryptographic Key Generation - Symmetric Key	All
FCS_CKM.2	Cryptographic Key Establishment	All
FCS_CKM.6	Cryptographic Key Destruction	All
FCS_CKM_EXT.7	Cryptographic Key Agreement	Feature Dependent
FCS_COP.1/Hash	Cryptographic Operation - Hashing	All
FCS_COP.1/KeyedHash	Cryptographic Operation - Keyed Hash	All
FCS_COP.1/KeyEncap	Cryptographic Operation - Key Encapsulation	Feature Dependent
FCS_COP.1/KeyWrap	Cryptographic Operation - Key Wrapping	Feature Dependent
FCS_COP.1/SigGen	Cryptographic Operation - Signature Generation	All
FCS_COP.1/SigVer	Cryptographic Operation - Signature Verification	All
FCS_COP.1/SKC	Cryptographic Operation - Encryption/Decryption	All
FCS_COP.1/XOF	Cryptographic Operation - Extendable-Output Function	Feature Dependent
FCS_HTTPS_EXT.1	HTTPS Protocol	Feature Dependent
FCS_IV_EXT.1	Initialization Vector Generation	Feature Dependent
FCS_RBG.1	Random Bit Generation (RBG)	All
FCS_RBG.2	Random Bit Generation (External Seeding)	Feature Dependent
FCS_RBG.3	Random Bit Generation (Internal Seeding - Single Source)	Feature Dependent
FCS_RBG.4	Random Bit Generation (Internal Seeding - Multiple Sources)	Feature Dependent
FCS_RBG.5	Random Bit Generation (Combining Noise Sources)	Feature Dependent
FCS_STG_EXT.1	Cryptographic Key Storage	All
FCS_STG_EXT.2	Encrypted Cryptographic Key Storage	Feature Dependent
FIA_CLI_EXT.1	Client Authorization	One
FIA_ENR_EXT.1	Enrollment	One
FIA_TOK_EXT.1	Client Tokens	One
FIA_UAU.1	Timing of Authentication	One
FIA_UAU.4	Single-Use Authentication Mechanisms	One
FMT_MOF.1/FUNCBE	Management of functions behavior	Feature Dependent
FMT_MOF.1/MANAGEMENT_ENROLL	Management of functions behavior (Enrollment)	Feature Dependent
FMT_MOF.1/MANAGEMENT_MAS	Management of Functions in (MAS Server Downloads)	Feature Dependent

FMT_POL_EXT.1	Trusted Policy Update	One
FMT_SAE_EXT.1	Security Attribute Expiration	One
FMT_SMF.1/MAS	Specification of Management Functions ( <a href="#">MAS Server</a> )	Feature Dependent
FMT_SMF.1/SERVER_CONF_AGENT	Specification of Management Functions (Server configuration of Agent)	One
FMT_SMF.1/SERVER_CONF_SERVER	Specification of Management Functions (Server configuration of Server)	Feature Dependent
FMT_SMR.1/SECMAN_ROLES	Security Management Roles	One
FMT_SMR.1/SECMAN_ROLES_MAS	Security Management Roles	Feature Dependent
FPT_API_EXT.1	Use of Supported Services and APIs	All
FPT_FLS.1	Failure with Preservation of Secure State	Feature Dependent
FPT_ITT.1/INTER_XFER	Internal <a href="#">TOE TSF</a> Data Transfer	Feature Dependent
FPT_ITT.1/INTER_XFER_AGENT	Internal <a href="#">TOE TSF</a> Data Transfer ( <a href="#">MDM Agent</a> )	Feature Dependent
FPT_LIB_EXT.1	Use of Third-Party Libraries	All
FPT_TST.1	<a href="#">TSF</a> Self-Testing	Feature Dependent
FPT_TST_EXT.1	Functionality Testing	All (except for agent components)
FPT_TUD_EXT.1	Trusted Update	All
FTA_TAB.1	Default <a href="#">TOE</a> Access Banners	One
FTP_ITC.1/INTER_TSF_XFER_AGENT	Inter-TSF Trusted Channel ( <a href="#">MDM Agent</a> )	One
FTP_ITC.1/INTER_XFER_IT	Inter-TSF Trusted Channel (Authorized IT Entities)	One
FTP_ITC_EXT.1	Trusted Channel	One
FTP_TRP.1/TRUSTPATH_ENROLL	Trusted Path for Enrollment	Feature Dependent
FTP_TRP.1/TRUSTPATH_JOIN	Trusted Path for Joining	Feature Dependent
FTP_TRP.1/TRUSTPATH_Rem_ADMIN	Trusted Path for Remote Administration	Feature Dependent

Only those [SERs](#) included in the [ST](#) are required to be audited. The [ST](#) for a distributed [TOE](#) must include a mapping of [SERs](#) to each of the components of the [TOE](#). (Note that this deliverable is examined as part of the [ASE\\_TSS.1](#) and [AVA\\_VAN.1](#) Evaluation Activities.) The [ST](#) for a distributed [TOE](#) may also introduce a "minimum configuration" and identify components that may have instances added to an operational configuration without affecting the validity of the [CC](#) certification. Appendix E describes Evaluation Activities relating to these equivalency aspects of a distributed [TOE](#) (and hence what is expected in the [ST](#)).

### 3.3 Security Audit for Distributed TOEs

For distributed [TOEs](#), the handling of audit information might be more complicated than for [TOEs](#) consisting only of one component. There are a few basic requirements to be fulfilled:

- Every component must be able to generate audit information.
- Every component must be able to buffer audit information and forward it to another [TOE](#) component or an external audit server. Optionally, each component may store audit information locally.
- For the overall [TOE](#) it must be possible to send out audit information to an external audit server.

In general, every component must be able to generate its own audit information. It would be possible that every component also stores its own audit information locally as well as every component could be able to send out audit data to an external audit server. It would also be sufficient that every component would be able to generate its own audit data and buffer it locally before the information is sent out to one or

more other **TOE** components for local storage or transmission to an external audit server. For the transfer of audit records between **TOE** components the secure connection via [FTP\\_ITC.1/INTER\\_XFER\\_IT](#) or [FPT\\_ITT.1/INTER\\_XFER / FPT\\_ITT.1/INTER\\_XFER\\_AGENT](#) must be used.

Such a solution would still be suitable to fulfill the requirement that all audit-related **SFRs** have to be fulfilled by all **TOE** components, although formally not every component would support local storage or transfer to an external audit server itself.

Regarding the establishment of inter-**TOE** communication, error conditions as well as successful connection and tear-down events should be captured by both ends of the connection.

All **TOE** components shall be able to generate its own audit data according to FAU\_GEN.1 for all **SFRs** that it implements. For distributed **TOEs**, a mapping shall be provided to show which auditable events according to FAU\_GEN.1 are covered by which components (also giving a justification that the records generated by each component cover all the **SFRs** that it implements). The overall **TOE** has to provide audit information about all events defined for FAU\_GEN.1. As a result, at least one **TOE** component has to be assigned to every auditable event defined for FAU\_GEN.1. The part of the mapping related to [Table 3](#) shall be consistent with the mapping of **SFRs** to **TOE** components for [ASE\\_TSS.1](#) in the sense that all components defined as generating audit information for a particular **SFR** should also contribute to that **SFR** in the mapping for [ASE\\_TSS.1](#). This applies not only to audit events defined for mandatory **SFRs** but also to all audit events for optional, selection-based, and objective **SFRs** as defined in [Table t-audit-optional](#), [Table t-audit-objective](#), and [Table t-audit-sel-based](#).

If one or more of the optional audit components [FAU\\_STG.1](#) or [FAU\\_STG.2](#) are selected in the **ST** derived from this **PP**, then the **SFR** mapping for [ASE\\_TSS.1](#) must include a specific identification of the **TOE** components to which they apply.

# 4 Security Problem Definition

## 4.1 Threats

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### T.MALICIOUS\_APPS

Malicious or flawed application threats exist because apps loaded onto anMD may include malicious or exploitable code. An administrator of the MDM or MD user may inadvertently import malicious code, or an attacker may insert malicious code into the TOE, resulting in the compromise of TOE or TOE data.

### T.NETWORK\_ATTACK

An attacker may masquerade as an MDM server and attempt to compromise the integrity of the MD by sending malicious management commands.

### T.NETWORK\_EAVESDROP

An attacker is positioned on a communications channel or elsewhere on the network infrastructure. Attackers may monitor and gain access to data exchanged between the MDM server and other endpoints.

### T.PHYSICAL\_ACCESS

The MD may be lost or stolen, and an unauthorized individual may attempt to access user data. Although these attacks are primarily directed against the MD platform, the TOE configures features on MDs that mitigate this threat against them. Therefore, misuse or failure of the TOE may also compromise the MD, exposing it to this threat.

## 4.2 Assumptions

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### A.COMPONENTS\_RUNNING

This assumption applies to distributed TOEs only. For distributed TOEs, it is assumed that the availability of all TOE components is checked as appropriate to reduce the risk of an undetected attack on (or failure of) one or more TOE components. It is also assumed that in addition to the availability of all components it is also checked as appropriate that the audit functionality is running properly on all TOE components.

### A.CONNECTIVITY

The TOE relies on network connectivity to carry out its management activities. The TOE will robustly handle instances when connectivity is unavailable or unreliable.

### A.MDM\_SERVER\_PLATFORM

The MDM server relies on a trustworthy platform and local network from which it provides administrative capabilities.

The MDM server relies on this platform to provide a range of security-related services including reliable timestamps, user and group account management, logon and logout services via a local or network directory service, remote access control, and audit log management services to include offloading of audit logs to other servers. The platform is expected to be configured specifically to provide MDM services, employing features such as a host-based firewall, which limits its network role to providing MDM functionality.

### A.PROPER\_ADMIN

One or more competent, trusted personnel who are not careless, willfully negligent, or hostile, are assigned and authorized as the TOE Administrators, and do so using and abiding by guidance documentation.

### A.PROPER\_USER

MD users are not willfully negligent or hostile, and use the device within compliance of a reasonable enterprise security policy.

## 4.3 Organizational Security Policies

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### P.ACOUNTABILITY

Personnel operating the TOE shall be accountable for their actions within the TOE.

### P.ADMIN

The configuration of the MD security functions must adhere to the enterprise security policy.

### P.DEVICE\_ENROLL

A MD must be enrolled for a specific user by the administrator of the MDM prior to being used in the enterprise network by the user.

### P.NOTIFY

The **MD** user must immediately notify the administrator if a **MD** is lost or stolen so that the administrator may apply remediation actions via the **MDM** system.

# 5 Security Objectives

## 5.1 Security Objectives for the Operational Environment

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### OE.COMPONENTS\_RUNNING

For distributed TOEs, the administrator ensures that the availability of every TOE component is checked as appropriate to reduce the risk of an undetected attack on (or failure of) one or more TOE components. The administrator also ensures that it is checked as appropriate for every TOE component that the audit functionality is running properly.

### OE.IT\_ENTERPRISE

The enterprise IT infrastructure provides security for a network that is available to the TOE and MDs that prevents unauthorized access.

### OE.PROPER\_ADMIN

TOE Administrators are trusted to follow and apply all administrator guidance in a trusted manner.

### OE.PROPER\_USER

Users of the MD are trained to securely use the MD and apply all guidance in a trusted manner.

### OE.TIMESTAMP

Reliable timestamps are provided by the operational environment for the TOE.

### OE.WIRELESS\_NETWORK

A wireless network will be available to the MDs.

## 5.2 Security Objectives Rationale

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This section describes how the assumptions and organizational security policies map to operational environment security objectives.

**Table 2: Security Objectives Rationale**

Assumption or OSP	Security Objectives	Rationale
A.COMPONENTS_RUNNING	OE.COMPONENTS_RUNNING	The operational environment objective OE.COMPONENTS_RUNNING is realized through A.COMPONENTS_RUNNING.
A.CONNECTIVITY	OE.WIRELESS_NETWORK	The operational environment objective OE.WIRELESS_NETWORK is realized through A.CONNECTIVITY.
A.MDM_SERVER_PLATFORM	OE.TIMESTAMP	The operational environment objective OE.TIMESTAMP is realized through A.MDM_SERVER_PLATFORM.
A.PROPER_ADMIN	OE.PROPER_ADMIN	The operational environment objective OE.PROPER_ADMIN is realized through A.PROPER_ADMIN.
A.PROPER_USER	OE.PROPER_USER	The operational environment objective OE.PROPER_USER is realized through A.PROPER_USER.
P.ADMIN	OE.PROPER_ADMIN	The organizational security policy P.ADMIN is realized through OE.PROPER_ADMIN.
P.DEVICE_ENROLL	OE.IT_ENTERPRISE	The organizational security policy P.DEVICE_ENROLL is realized through OE.IT_ENTERPRISE.
P.NOTIFY	OE.PROPER_USER	The organizational security policy P.NOTIFY is realized through OE.PROPER_USER.

# 6 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 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."

For a distributed **TOE**, the **ST** author should reference [Table 1](#) for guidance on how each **SFR** should be met. The table details whether **SFRs** should be met by all **TOE** components, by at least one **TOE** component or whether they are dependent on the feature being implemented by the **TOE** component. The **ST** for a distributed **TOE** must include a mapping of **SFRs** to each of the components of the **TOE**. (Note that this deliverable is examined as part of the [ASE\\_TSS.1](#) and [AVA\\_VAN.1](#) Evaluation Activities.)

## Test Environment for Evaluation Activities

As described in the evaluation activities below, the **ST** for an **MDM** system is required to list all the supported **MDM** agents and **MD** platforms with which an **MDM** server operates. The identified evaluation activities for testing that includes the use of an agent should be completed for each **MDM** agent and platform listed in the **ST**.

The evaluator's activities for testing that include use of an agent will ensure that the Server interacts appropriately with the agent (i.e., sends a policy update to the agent), but will not ensure that the agent handles the received data correctly (i.e., appropriately applies the policy to the device), as that is accounted for in the Evaluation Activities in the Mobile Device Fundamentals [PP](#) or the [PP-Module](#) for Mobile Device Management Agents.

In addition to the above guidance, if the **TOE** server acts as a primary **MDM** server and interfaces with one or more subordinate **MDM** servers, then the **ST** is required to list all of the supported subordinate **MDM** servers. All evaluation activity testing that includes the use of a subordinate **MDM** server should be completed for each of the subordinate **MDM** servers listed in the **ST**. **MDM** Agent testing should be done for devices managed directly by the primary **MDM** Server. **MDM** Agent testing with a subordinate **MDM** server will be done during the subordinate **MDM** server evaluation. If the **TOE** server acts as a subordinate **MDM** server and interfaces with one or more primary **MDM** servers, then the **ST** is required to list all of the supported primary **MDM** servers, along with all of the supported **MDM** agents and **MD** platforms with which it operates. A test primary **MDM** server may be used for evaluation activity testing that requires the use of a primary **MDM** server. For clarification purposes "primary **MDM** server" and "subordinate **MDM** server" will be specified when the distinction is necessary and relevant to explanations and testing, otherwise "**MDM** server" may be used when the distinction is not necessary and could reference either a primary **MDM** server or subordinate **MDM** server.

## 6.1 Security Functional Requirements

### 6.1.1 Auditable Events for Mandatory SFRs

**Table 3: Auditable Events for Mandatory Requirements**

Requirement	Auditable Events	Additional Audit Record Contents
<a href="#">FAU_ALT_EXT.1</a>	Type of alert	Identity of <b>MD</b> that sent alert.
<a href="#">FAU_CRP_EXT.1</a>	No events specified	N/A
<a href="#">FAU_GEN.1/AUDITGEN</a>	No events specified	N/A
<a href="#">FAU_NET_EXT.1</a>	No events specified	N/A
<a href="#">FAU_STG.1</a>	No events specified	N/A
<a href="#">FCS_CKM.1/AKG</a>	No events specified	N/A

FCS_CKM.1/SKG	No events specified	N/A
FCS_CKM.6	No events specified	N/A
FCS_COP.1/AEAD	No events specified	N/A
FCS_COP.1/Hash	No events specified	N/A
FCS_COP.1/KeyedHash	No events specified	N/A
FCS_COP.1/SigGen	No events specified	N/A
FCS_COP.1/SigVer	No events specified	N/A
FCS_RBG.1	No events specified	N/A
FCS_STG_EXT.1	No events specified	N/A
FIA_CLI_EXT.1	No events specified	N/A
FIA_ENR_EXT.1	Failure of <b>MD</b> user authentication	Presented username
FIA_UAU.1	No events specified	N/A
FMT_MOF.1/FUNCBE	Issuance of command to perform function	Command sent and identity of <b>MDM</b> agent recipients
	Change of policy settings	Policy changed and value or full policy
FMT_MOF.1/MANAGEMENT_ENROLL	Enrollment by a user	Identity of user
FMT_POL_EXT.1	No events specified	N/A
FMT_SMF.1/SERVER_CONF_AGENT	No events specified	N/A
FMT_SMF.1/SERVER_CONF_SERVER	Success or failure of function	No additional information
FMT_SMR.1/SECMAN_ROLES	No events specified	N/A
FPT_API_EXT.1	No events specified	N/A
FPT_LIB_EXT.1	No events specified	N/A
FPT_TST_EXT.1	Initiation of self-test	No additional information
	Failure of self-test	Algorithm that caused failure
	Detected integrity violation	The <b>TSE</b> code file that caused the integrity violation
FPT_TUD_EXT.1	Success or failure of signature verification	No additional information
FTP_ITC.1/INTER_XFER_IT	Initiation and termination of the trusted channel	<ul style="list-style-type: none"> <li>• Trusted channel protocol</li> <li>• Non-TOE endpoint of connection</li> </ul>
FTP_ITC_EXT.1	No events specified	N/A
FTP_TRP.1/TRUSTPATH_ENROLL	Initiation and termination of the trusted channel	Trusted channel protocol
FTP_TRP.1/TRUSTPATH_Rem_ADMIN	Initiation and termination of the trusted channel	<ul style="list-style-type: none"> <li>• Trusted channel protocol</li> <li>• Identity of administrator</li> </ul>

## 6.1.2 Security Audit (FAU)

### FAU\_ALT\_EXT.1 Server Alerts

## FAU\_ALT\_EXT.1.1

The TSE shall alert the administrators in the event of any of the following:

- Change in enrollment status
- Failure to apply policies to a MD
- [selection: *[assignment: other events]*, no other events]

**Application Note:** An alert can be defined as anything providing straightaway notice to the administrator. An alert is different from an audit record, however the fact that an alert was sent should be audited per FAU\_GEN.1. Email, pop-up notifications, or other methods are acceptable forms of alerts. If the TOE is a subordinate MDM server, then sending an alert to the primary MDM server over the trusted channel is sufficient to fulfil this requirement.

The MDM agent is required to report to the MDM server on successful application of policies on a MD, and failures can be inferred from the absence of such alerts. This requirement is intended to ensure that the MDM server notifies administrators when policies are not properly installed. Failure to properly install policy updates does not affect the enrollment status of the MD.

## Evaluation Activities ▾

### FAU\_ALT\_EXT.1

#### TSS

*The evaluator shall examine the TSS and verify that it describes how the alert system is implemented. The evaluator shall also verify that a description of each assigned event is provided in the TSS.*

#### Guidance

*The evaluator shall examine the guidance document and verify that it describes how the alerts can be configured, if configurable.*

#### Tests

*For each MDM agent or platform listed as supported in the ST:*

- *Test FAU\_ALT\_EXT.1:1: The evaluator shall enroll a device and ensure that the MDM server alerts the administrator of the change in enrollment status. The evaluator shall unenroll (retire) a device and ensure that the MDM server alerts the administrator of the change in enrollment status.*
- *Test FAU\_ALT\_EXT.1:2: The evaluator shall configure policies, which the MDM agent should not be able to apply. These policies shall include:*
  - *a setting which is configurable on the MDM server interface but not supported by the platform on which the MDM agent runs, if any such settings exist*
  - *a valid configuration setting with an invalid parameter, which may require manual modification of the policy prior to transmission to the device*

*The evaluator shall deploy such policies and verify that the MDM server alerts the administrator about the failed application of the policy.*

*Alternate test: The evaluator shall configure a policy that the MDM agent can successfully apply. The evaluator blocks the response from the MDM agent of the successful application of the policy, resulting in the MDM server alerting of a failure of application. The evaluator shall verify that the MDM server alerts the administrator about the failed application of the policy.*

- *Test FAU\_ALT\_EXT.1:3: (Conditional) The evaluator shall trigger each of the events listed and ensure that the MDM server alerts the administrator.*

## FAU\_CRP\_EXT.1 Support for Compliance Reporting of Mobile Device Configuration

### FAU\_CRP\_EXT.1.1

The TSE shall provide [selection: *an interface that provides responses to queries about the configuration of enrolled devices, an interface that permits the export of data about the configuration of enrolled devices*] to authorized entities over a channel that meets the secure channel requirements in FTP\_ITC.1/INTER\_XFER\_IT. The provided information for each enrolled MD includes:

- The current version of the MD firmware or software
- The current version of the hardware model of the device
- [selection:
  - *The current version of installed mobile applications*
  - *List of MD configuration policies that are in place on the device (as defined in FMT\_SMF.1.1/SERVER\_CONF\_AGENT)*
  - *[assignment: list of other available information about enrolled devices]*

- no other information
- ].

**Application Note:** The intent of this requirement is that the **MDM** server be able to provide compliance information about enrolled MDs for use by other enterprise security infrastructure systems. There are active standards efforts underway by the Internet Engineering Task Force (IETF) Security Automation and Continuous Monitoring (SACM) Working Group and others to define protocols and standards to assess and report on endpoint device posture. It is expected that this requirement will evolve in future versions of this Protection Profile as standards efforts mature.

If the **TOE** acts as a subordinate **MDM** server, then this **SER** also ensures that there is a mechanism for the primary **MDM** server to query information about the devices managed by the subordinate **MDM** server.

## Evaluation Activities ▾

### [FAU\\_CRP\\_EXT.1](#)

#### **TSS**

The evaluator shall examine the **TSS** to verify that it describes the **TOE**'s compliance reporting capability with respect to whether it provides responses to queries about the configuration of enrolled devices or whether it permits the export of data about the configuration of these devices. The evaluator shall also verify that the **TSS** identifies the trusted channel used to protect data that is transmitted over this interface. Lastly, the evaluator shall verify that the **TSS** identifies the information that is provided for each enrolled device.

#### **Guidance**

The evaluator shall check to ensure that the operational guidance contains instructions on how to access the **MDM** server's compliance reporting interface.

#### **Tests**

- Test FAU\_CRP\_EXT.1:1: Using the operational guidance, the evaluator shall demonstrate the ability to access the compliance reporting interface from an authorized entity and successfully obtain information about enrolled devices.
- Test FAU\_CRP\_EXT.1:2: The evaluator shall attempt to access the compliance reporting interface from an unauthorized entity and demonstrate that the attempt is denied.

## FAU\_GEN.1/AUDITGEN Audit Data Generation

### FAU\_GEN.1.1/AUDITGEN

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

- a. All administrative actions
  - b. [selection: Commands issued to the **MDM** agent, Commands issued to the subordinate **MDM** server, Status updates provided to the primary **MDM** server, none]
  - c. Specifically defined auditable events listed in [Table 3](#)
  - d. [selection:
    - Start up and shut down of the audit functions
    - Auditable events defined in [Table t-audit-optimal](#) for Strictly Optional **SERs**
    - Auditable events defined in [Table t-audit-objective](#) for Objective **SERs**
    - Auditable events defined in [Table t-audit-sel-based](#) for Selection-Based **SERs**
    - Auditable events for the [Functional Package for Secure Shell \(SSH\), version 2.0](#)
    - Auditable events for the [Functional Package for Transport Layer Security \(TLS\), version 2.1](#)
    - Auditable events for the [Functional Package for X.509, version 1.0](#)
    - no other events
- ].

**Application Note:** This requirement outlines the events for which audit data must be generated by either the **MDM** system or the **MDM** server platform. Each audit data event may be written by the **MDM** system or may be dispatched to the operating system on which it runs. It is acceptable to select both "invoke platform-provided functionality" and "implement functionality." It should be specified which auditable events are completed by the **MDM** system and which are completed by the **MDM** platform.

The ST author can include other auditable events in the assignment; they are not limited to the list presented. All audits must contain at least the information mentioned in [FAU\\_GEN.1.2/AUDITGEN](#).

For distributed TOEs, each component must generate audit data for each of the SERs that it implements. If more than one TOE component is involved when an audit event is triggered, the event has to be audited on each component (e.g., rejection of a connection by one component while attempting to establish a secure communication channel between two components should result in an audit event being generated by both components). This is not limited to error cases but also includes events about successful actions like successful build up or tear down of a secure communication channel between TOE components.

Item **a** above requires all administrative actions to be auditable. Administrative actions refer to any management functions specified by [FMT\\_MOF.1/FUNCBE](#). Thus no additional specification for the auditability of these actions is specified in [Table 3](#) aside from those that require additional record content. If the TOE is distributed and the given component does not deal with setting the policy applied to the MDM agent, it is acceptable to not have any administrative actions to audit.

Item **b** includes those commands, which may be performed automatically based on triggers or on a schedule. If the TOE server acts as a primary MDM server and interfaces with a subordinate MDM server, then "Commands issued to the subordinate MDM server" must be selected. If the TOE server acts as a subordinate MDM server and interfaces with a primary MDM server, then "Status updates provided to the primary MDM Server" must be selected. For distributed TOEs, if the TOE component directly interacts with a primary MDM server, subordinate MDM server, or MDM agent then the corresponding selection should be made for that component. If the TOE component does not directly interact with any of these entities, then it is acceptable to select "none."

In item **d** above, "start up and shut down of the MDM system" must be selected if the TSF has a start up and shut down phase. Additionally, if the TOE is distributed, this applies to all components. If the TOE is not distributed then MDM system is equivalent to MDM server. If the TSF does not have a distinct start up or shut down phase (e.g., a cloud service), this selection is not required.

Depending on the specific requirements selected by the ST author from SER, optional requirements, selection-based requirements, and objective requirements, the ST author should include the appropriate auditable events from [Table t-audit-optimal](#), [Table t-audit-sel-based](#), and [Table t-audit-objective](#) in the ST for the requirements selected. Each functional package includes auditable events for the SERs defined in the package. The ST author is expected to include the auditable events (if any) for each SER that the ST claims from a functional package.

The auditable event for "start up and shut down of the audit functions" must be selected if the TSF has a start up and shut down phase. Additionally, if the TOE is distributed, this applies to all components. If the TOE is not distributed then MDM system is equivalent to MDM server. If the TSF does not have a distinct start up or shut down phase (e.g., a cloud service), this selection is not required.

#### [FAU\\_GEN.1.2/AUDITGEN](#)

The TSF shall record within the audit data at least the following information:

- date and time of the event
- type of event
- subject identity (if applicable)
- and the outcome (success or failure) of the event
- additional information in [Table 3](#)
- [selection:
  - *Additional information defined in [Table t-audit-optimal](#) for Strictly Optional SERs*
  - *Additional information defined in [Table t-audit-objective](#) for Objective SERs*
  - *Additional information defined in [Table t-audit-sel-based](#) for Selection-Based SERs*
  - *Additional information defined in [Functional Package for Secure Shell \(SSH\), version 2.0](#)*
  - *Additional information defined in [Functional Package for Transport Layer Security \(TLS\), version 2.1](#)*
  - *Additional information defined in [Functional Package for X.509, version 1.0](#)*
  - *no other additional information*

]

**Application Note:** This requirement outlines the information to be included in audit data. All audits must contain at least the information mentioned in [FAU\\_GEN.1.2/AUDITGEN](#). The ST author must identify in the TSS which information of the audit data is performed by the TSF and that which is

performed by the TOE platform.

## Evaluation Activities ▾

### [FAU\\_GEN.1.1/AUDITGEN](#)

#### TSS

The evaluator shall check the TSS and ensure that it lists all of the auditable events. The evaluator shall check to make sure that every audit event type mandated by the PP is described in the TSS. The evaluator shall verify that for every audit event described in the TSS, the description indicates where the audit event is generated (TSF, TOE platform).

If "invoke platform-provided functionality" is selected, the evaluator shall examine the TSS to verify that it describes (for each supported platform) how this functionality is invoked (it should be noted that this may be through a mechanism that is not implemented by the MDM server; nonetheless, that mechanism will be identified in the TSS as part of this evaluation activity).

#### **Guidance**

The evaluator shall check the administrative guide and ensure that it lists all of the auditable events. The evaluator shall check to make sure that every audit event type mandated by the PP is described.

The evaluator shall also make a determination of the administrative actions that are relevant in the context of this PP including those listed in the management section. The evaluator shall examine the administrative guide and make a determination of which administrative commands are related to the configuration (including enabling or disabling) of the mechanisms implemented in the TOE that are necessary to enforce the requirements specified in the PP.

The evaluator shall document the methodology or approach taken while determining which actions in the administrative guide are security relevant with respect to this PP. The evaluator may perform this activity as part of the activities associated with ensuring the AGD\_OPE guidance satisfies the requirements.

#### **Tests**

The evaluator shall test the TOE's ability to correctly generate audit data by having the TOE generate audit data for the events listed in the provided table and administrative actions. This should include all instances of an event. The evaluator shall test that audit data are generated for the establishment and termination of a channel for each of the cryptographic protocols contained in the ST. For administrative actions, the evaluator shall test that each action determined by the evaluator above to be security relevant in the context of this PP is auditable.

Note that the testing here can be accomplished in conjunction with the testing of the security mechanisms directly. For example, testing performed to ensure that the administrative guidance provided is correct verifies that AGD\_OPE.1 is satisfied and should address the invocation of the administrative actions that are needed to verify the audit data are generated as expected.

### [FAU\\_GEN.1.2/AUDITGEN](#)

#### TSS

The evaluator shall check the TSS and ensure that it provides a format for audit data. Each audit data format type must be covered, along with a brief description of each field.

#### **Guidance**

The evaluator shall check the administrative guide and ensure that it provides a format for audit data. Each audit data format type must be covered, along with a brief description of each field. The evaluator shall check to make sure that the description of the fields contains the information required in [FAU\\_GEN.1.2/AUDITGEN](#).

#### **Tests**

When verifying the test results from [FAU\\_GEN.1.1/AUDITGEN](#), the evaluator shall ensure the audit data generated during testing matches the format specified in the administrative guide, and that the fields for each audit data have the proper entries.

Note that the testing here can be accomplished in conjunction with the testing of the security mechanisms directly. For example, testing performed to ensure that the administrative guidance provided is correct verifies that AGD\_OPE.1 is satisfied and should address the invocation of the administrative actions that are needed to verify the audit data are generated as expected.

## **FAU\_GEN.1/MAS\_SERVER Audit Data Generation (MAS Server)**

**This is a selection-based component. Its inclusion depends upon selection from [FMT\\_MOE.1.1/FUNCBE](#).**

The **MAS Server** shall be able to generate audit data of the following auditable events: [

- a. Failure to push a new application on a **MD**.
- b. Failure to update an existing application on a **MD**.

].

**Application Note:** The **MDM** agent is required to report to the **MAS Server** on successful receipt of an application or update on a **MD**, and failures can be inferred from the absence of such alerts.

#### FAU\_GEN.1.2/MAS\_SERVER

The [**selection: MAS Server , MAS Server platform**] shall record within the audit data at least the following information:

- date and time of the auditable event
- type of event
- **MD** identity
- [**assignment: other audit relevant information.**]

**Application Note:** All audits must contain at least the information mentioned in **FAU\_GEN.1.2/MAS\_SERVER**, but may contain more information which can be assigned. The **ST** author must identify in the **TSS** which information of the audit data is performed by the **TSF** and that which is performed by the **TOE** platform.

This requirement is claimed if "enable, disable, and modify policies listed in **FMT\_SMF.1/MAS**" is selected in **FMT\_MOF.1.1/FUNCBE**.

#### Evaluation Activities ▾

##### **FAU\_GEN.1/MAS\_SERVER**

###### **TSS**

The evaluator shall check the **TSS** and ensure that it provides a format for audit data. Each audit data format type must be covered, along with a brief description of each field.

###### **Guidance**

The evaluator shall check the administrative guide and ensure that it provides a format for audit data. Each audit data format type must be covered, along with a brief description of each field.

The evaluator shall check to make sure that the description of the fields contains the information required in **FAU\_STG.2.1**.

###### **Tests**

The evaluator shall verify that when an application or update push fails, that the audit data generated match the format specified in the guidance and that the fields in each audit data have proper entries.

When verifying the test results from **FMT\_MOF.1.1/FUNCBE**, the evaluator shall ensure the audit data generated during testing match the format specified in the administrative guide, and that the fields in each audit data have the proper entries.

Note that the testing here can be accomplished in conjunction with the testing of the security mechanisms directly. For example, testing performed to ensure that the administrative guidance provided is correct verifies that **AGD\_OPE.1** is satisfied and should address the invocation of the administrative actions that are needed to verify the audit data are generated as expected.

#### FAU\_NET\_EXT.1 Network Reachability Review

##### FAU\_NET\_EXT.1.1

The **TSF** shall provide authorized administrators with the capability to read the network connectivity status of an enrolled agent.

**Application Note:** The **MDM** server establishes the network connectivity status of enrolled agents using periodic reachability event alerts from the agents according to FAU\_ALT\_EXT.2.1 in the **PP-Module for MDM Agent**. This status may be determined by sending an update request from the **MDM** server which the agent is required to respond to or by using scheduled periodic notifications of connectivity initiated by the **MDM** agent.

If the **TOE** server acts as a subordinate **MDM** server then there should be some mechanism for the

primary MDM server to initialize and read results of the network reachability tests performed by the subordinate MDM server on those devices that it manages.

## Evaluation Activities ▾

### FAU\_NET\_EXT.1

#### TSS

The evaluator ensures that the TSS describes how reachability events are implemented, for each supported MD platform. The evaluator verifies that this description clearly indicates who (MDM agent or MDM server) initiates reachability events.

#### Guidance

The evaluator shall verify that the guidance instructs administrators on the method of determining the network connectivity status of an enrolled agent.

#### Tests

For each MDM agent or platform listed as supported in the ST:

The evaluator shall configure the MDM agent or platform to perform a network reachability test, both with and without such connectivity and shall ensure that by following the guidance, the evaluator can determine results that reflect both.

## FAU\_SAR.1 Audit Review

*This is an optional component. However, applied modules or packages might redefine it as mandatory.*

### FAU\_SAR.1.1

The TSF shall [selection: **invoke platform-provided functionality , implement functionality**] to provide [authorized administrators] with the capability to read [all audit information] from the audit data.

### FAU\_SAR.1.2

The TSF shall [selection: **invoke platform-provided functionality , implement functionality**] to provide the audit data in a manner suitable for the **authorized administrators** to interpret the information.

**Application Note:** The intent of this requirement is to ensure that the administrator can view and interpret the audit data and to prevent unauthorized users from accessing the logs.

## Evaluation Activities ▾

### FAU\_SAR.1

#### TSS

If "invoke platform-provided functionality" is selected, the evaluator shall examine the TSS to verify that it describes (for each supported platform) how this functionality is invoked (it should be noted that this may be through a mechanism that is not implemented by the MDM server; nonetheless, that mechanism will be identified in the TSS as part of this evaluation activity).

#### Guidance

The evaluator shall check the operational guidance and ensure that it describes how the administrator accesses the audit data and describes the format of audit data.

#### Tests

The evaluator shall attempt to view the audit data as the authorized administrator and verify that the action succeeds. The evaluator shall ensure the audit data generated during testing match the format specified in the administrative guide.

## FAU\_SEL.1 Security Audit Event Selection

*This is an optional component. However, applied modules or packages might redefine it as mandatory.*

## FAU\_SEL.1.1

The TSF shall [selection: **invoke platform-provided functionality , implement functionality**] to select the set of events to be audited from the set of all auditable events based on the following attributes:

- a. [event type]
- b. [success of auditable security events]
- c. failure of auditable security events
- d. [assignment: other attributes]]

**Application Note:** The intent of this requirement is to identify all criteria that can be selected to trigger an audit event. The ST author must select whether the TSF or the platform maintains the audit data. For the ST author, the assignment is used to list any additional criteria or "none."

## Evaluation Activities ▾

### FAU\_SEL.1

#### TSS

If "invoke platform-provided functionality" is selected, the evaluator shall examine the TSS to verify that it describes (for each supported platform) how this functionality is invoked (it should be noted that this may be through a mechanism that is not implemented by the MDM server; nonetheless, that mechanism will be identified in the TSS as part of this evaluation activity).

#### **Guidance**

The evaluator shall review the administrative guidance to ensure that the guidance itemizes all event types, as well as describes all attributes that are to be selectable in accordance with the requirement, to include those attributes listed in the assignment. The administrative guidance shall also contain instructions on how to set the pre-selection as well as explain the syntax (if present) for multi-value pre-selection. The administrative guidance shall also identify those audit data that is always recorded, regardless of the selection criteria currently being enforced.

#### **Tests**

The evaluator shall also perform the following tests:

- Test FAU\_SEL.1:1: For each attribute listed in the requirement, the evaluator shall devise a test to show that selecting the attribute causes only audit events with that attribute (or those that are always recorded, as identified in the administrative guidance) to be recorded.
- Test FAU\_SEL.1:2: [conditional] If the TSF supports specification of more complex audit pre-selection criteria (e.g., multiple attributes, logical expressions using attributes) then the evaluator shall devise tests showing that this capability is correctly implemented. The evaluator shall also, in the test plan, provide a short narrative justifying the set of tests as representative and sufficient to exercise the capability.

## FAU\_STG.1 Audit Data Storage Location

### FAU\_STG.1.1

The TSF shall be able to **transmit the generated audit data to an external IT entity using a trusted channel according to [FTP\\_ITC.1/INTER\\_XFER\\_IT](#)** and store generated audit data on the [selection: TOE itself, no other storage].

**Application Note:** Per [FAU\\_GEN.1.1/AUDITGEN](#), audit data may be generated by the TOE, the platform, or both. If audit data is generated by the TOE, the TSF must have the ability to securely transmit this data to a remote entity. It may additionally store this data within the TOE boundary, in which case "the TOE itself" is selected and [FAU\\_STG.2](#) must be included in the ST. Regardless of whether the TSF stores the audit data it generates within the TOE boundary, the TOE must always be able to securely transmit the audit data it generates to a remote entity. If audit data is generated by the platform, any secure local storage or secure remote transmission of this data is the responsibility of the platform.

Although the audit server is outside of the TOE, the TSF should still be able to support mutual authentication. There are no requirements levied on the audit server, but the TOE should be able to support TLS client certificate authentication. This way if the non-TOE audit server does support verifying client certificates, the TSF is able to make use of that.

For distributed TOEs, each component must be able to export any audit data it generates across a protected channel. This may involve individual components independently transmitting audit data to the same environmental audit server via [FTP\\_ITC.1/INTER\\_XFER\\_IT](#), or it may involve one component of a distributed TOE aggregating audit data generated by other components prior to external transmission. In this case, the internal communication of audit data is protected via the

mechanisms specified in [FPT\\_ITT.1/INTER\\_XFER](#) or [FPT\\_ITT.1/INTER\\_XFER\\_AGENT](#) as appropriate. The intent of this requirement in the context of a distributed [TOE](#) is that all audit data generated by all components of the [TSF](#) be transmitted to an environmental entity entirely through trusted channels, regardless of whether it is transmitted directly from the [TSF](#) to the operational environment or whether it is first transmitted to another part of the [TOE](#).

## Evaluation Activities ▾

### [FAU\\_STG.1](#)

#### [TSS](#)

The evaluator shall examine the [TSS](#) to ensure it describes the means by which the audit data are transferred to the external audit server, and how the trusted channel is provided.

#### **Guidance**

The evaluator shall also examine the operational guidance to determine that it describes the relationship between the local audit data and the audit data that are sent to the audit log server. For example, when an audit event is generated, is it simultaneously sent to the external server and the local store, or is the local store used as a buffer and "cleared" periodically by sending the data to the audit server.

The evaluator shall also examine the operational guidance to ensure it describes how to establish the trusted channel to the audit server, as well as describe any requirements on the audit server (particular audit server protocol, version of the protocol required, etc.), as well as configuration of the [TOE](#) needed to communicate with the audit server.

#### **Tests**

Testing of the trusted channel mechanism will be performed as specified in the associated evaluation activities for the particular trusted channel mechanism.

The evaluator shall perform the following test for this requirement:

- **Test FAU\_STG.1:1:** The evaluator shall establish a session between the [TOE](#) and the audit server according to the configuration guidance provided. The evaluator shall then examine the traffic that passes between the audit server and the [TOE](#) during several activities of the evaluator's choice designed to generate audit data to be transferred to the audit server. The evaluator shall observe that these data are not able to be viewed in the clear during this transfer, and that they are successfully received by the audit server. The evaluator shall record the particular software (name, version) used on the audit server during testing.

## [FAU\\_STG.2 Audit Event Storage](#)

**This is a selection-based component. Its inclusion depends upon selection from [FAU\\_STG.1.1](#).**

### FAU\_STG.2.1

The [TSF](#) shall [selection: **invoke platform-provided functionality , implement functionality**] to protect the stored audit data in the audit trail from unauthorized **modification**.

**Application Note:** If "store audit data locally" is selected in [FAU\\_STG.1.1](#), this [SFR](#) must be included in the [ST](#).

The purpose of this requirement is to ensure that audit data are stored securely. The [ST](#) author is responsible for selecting whether audit data are maintained when audit storage or failure occurs. The [ST](#) author must choose a means by which audit data are saved and select the events during which the data will be saved. The [TSF](#) may rely on the underlying operating system for this functionality, and the first selection should be made appropriately.

### FAU\_STG.2.2

The [TSF](#) shall be able to [selection, choose one of: prevent, detect] unauthorized modifications to the stored audit data in the audit trail.

## Evaluation Activities ▾

### [FAU\\_STG.2](#)

#### [TSS](#)

If "invoke platform-provided functionality" is selected, the evaluator shall examine the TSS to verify that it describes (for each supported platform) how the audit data protection functionality is invoked (it should be noted that this may be through a mechanism that is not implemented by the MDM server; nonetheless, that mechanism will be identified in the TSS as part of this evaluation activity).

If "implement functionality" is selected, the evaluator shall ensure that the TSS describes how the audit data are protected from unauthorized modification or deletion. The evaluator shall ensure that the TOE uses audit trail specific protection mechanisms.

#### **Guidance**

There are no additional Guidance evaluation activities for this component.

#### **Tests**

The evaluator shall perform the following tests:

- Test FAU\_STG.2:1: The evaluator shall access the audit trail as an unauthorized user and attempt to modify and delete the audit data. The evaluator shall verify that these attempts fail.
- Test FAU\_STG.2:2: The evaluator shall access the audit trail as an authorized user and attempt to modify and delete the audit data. The evaluator shall verify that these attempts succeed. The evaluator shall verify that only the records intended for modification and deletion are modified and deleted.

### **6.1.3 Communication (FCO)**

#### **FCO\_CPC\_EXT.1 Component Registration Channel Definition**

*This is an objective component.*

##### **FCO\_CPC\_EXT.1.1**

The TSF shall [**selection**: *invoke platform-provided functionality, implement functionality*] to require an Administrator to enable communications between any pair of TOE components before such communication can take place.

##### **FCO\_CPC\_EXT.1.2**

The TSF shall [**selection**: *invoke platform-provided functionality, implement functionality*] to implement a registration process in which components establish and use a communications channel that uses [**selection**:

- A channel that meets the secure channel requirements in [**selection**: *FTP\_ITC.1, FPT\_ITT.1/INTER\_XFER, FPT\_ITT.1/INTER\_XFER\_AGENT*]
- A channel that meets the secure registration channel requirements in [**selection**: *FTP\_TRP.1/TRUSTPATH\_ENROLL, FTP\_TRP.1/TRUSTPATH\_JOIN*]
- No channel

] for at least TSF data.

##### **FCO\_CPC\_EXT.1.3**

The TSF shall [**selection**: *invoke platform-provided functionality, implement functionality*] to enable an administrator to disable communications between any pair of TOE components.

**Application Note:** This SER is only applicable if the TOE is distributed and therefore has multiple components that need to communicate via an internal TSF channel. When creating the TSF from the initial pair of components, either of these components may be identified as the TSF for the purposes of satisfying the meaning of "TSF" in this SER.

The intention of this requirement is to ensure that there is a registration process that includes a positive enablement step by an administrator before components joining a distributed TOE can communicate with the other components of the TOE and before the new component can act as part of the TSF. The registration process may itself involve communication with the joining component: many implementations use a bespoke process for this, and the security requirements for the "registration communication" are then defined in [FCO\\_CPC\\_EXT.1.2](#). Use of this "registration communication" channel is not deemed inconsistent with the requirement of [FCO\\_CPC\\_EXT.1.1](#) (i.e., the registration channel can be used before the enablement step, but only in order to complete the registration process).

The channel selection (for the registration channel) in [FCO\\_CPC\\_EXT.1.2](#) is essentially a choice between the use of a normal secure channel that is equivalent to a channel used to communicate with external IT entities (FTP\_ITC.1) or existing TOE components ([FPT\\_ITT.1/INTER\\_XFER](#) and [FPT\\_ITT.1/INTER\\_XFER\\_AGENT](#)), or else a separate type of channel that is specific to registration

([FTP\\_TRP.1/TRUSTPATH\\_ENROLL](#) or [FTP\\_TRP.1/TRUSTPATH\\_JOIN](#)). If the [TOE](#) does not require a communications channel for registration (e.g., because the registration is achieved entirely by configuration actions by an administrator at each of the components) then the main selection in [FCO\\_CPC\\_EXT.1.2](#) is completed with the "No channel" option.

If the [ST](#) author selects the [FTP\\_ITC.1](#) or [FPT\\_ITT.1/INTER\\_XFER](#) and [FPT\\_ITT.1/INTER\\_XFER\\_AGENT](#) channel type in the main selection in [FCO\\_CPC\\_EXT.1.2](#) then the [TSS](#) identifies the relevant [SFR](#) iteration that specifies the channel used. If the [ST](#) author selects the [FTP\\_TRP.1/TRUSTPATH\\_ENROLL](#) or [FTP\\_TRP.1/TRUSTPATH\\_JOIN](#) channel type, then the [TSS](#) (possibly with support from the operational guidance) describes details of the channel and the mechanisms that it uses (and describes how the registration process ensures that the channel can only be used by the intended joiner and gatekeeper). Note that the [FTP\\_TRP.1/TRUSTPATH\\_ENROLL](#) or [FTP\\_TRP.1/TRUSTPATH\\_JOIN](#) channel type may require support from security measures in the operational environment (see the definition of [FTP\\_TRP.1/TRUSTPATH\\_ENROLL](#) or [FTP\\_TRP.1/TRUSTPATH\\_JOIN](#) for details).

If the [ST](#) author selects the [FTP\\_ITC.1](#) or [FPT\\_ITT.1/INTER\\_XFER](#) / [FPT\\_ITT.1/INTER\\_XFER\\_AGENT](#) channel type in the main selection in [FCO\\_CPC\\_EXT.1.2](#) then the [ST](#) identifies the registration channel as a separate iteration of [FTP\\_ITC.1](#) or [FPT\\_ITT.1/INTER\\_XFER](#) / [FPT\\_ITT.1/INTER\\_XFER\\_AGENT](#) and gives the iteration identifier (e.g., "FPT\_ITT.1/Join") in an [ST](#) Application Note for [FCO\\_CPC\\_EXT.1](#).

Note that the channel that is set up and used for registration may be adopted as a continuing internal communication channel (i.e., between different [TOE](#) components) provided that the channel meets the requirements of [FTP\\_ITC.1](#) or [FPT\\_ITT.1/INTER\\_XFER](#) / [FPT\\_ITT.1/INTER\\_XFER\\_AGENT](#). Otherwise the registration channel is closed after use and a separate channel is used for the internal communications.

Specific requirements for Preparative Procedures relating to [FCO\\_CPC\\_EXT.1](#) are defined in the Evaluation Activities.

## Evaluation Activities ▾

### [FCO\\_CPC\\_EXT.1](#)

#### [TSS](#)

*If "invoke platform-provided functionality" is selected, the evaluator shall examine the [TSS](#) to verify that it describes (for each supported platform) how the audit record protection functionality is invoked (it should be noted that this may be through a mechanism that is not implemented by the [MDM](#) server; nonetheless, that mechanism will be identified in the [TSS](#) as part of this evaluation activity).*

#### **Guidance**

*The evaluator shall examine the guidance documentation to confirm that it contains instructions for enabling and disabling communications with any individual component of a distributed [TOE](#). The evaluator shall confirm that the method of disabling is such that all other components can be prevented from communicating with the component that is being removed from the [TOE](#) (preventing the remaining components from either attempting to initiate communications to the disabled component, or from responding to communications from the disabled component).*

#### **Tests**

- Test FCO\_CPC\_EXT.1:1: The evaluator shall confirm that an IT entity that is not currently a member of the distributed TOE cannot communicate with any component of the TOE until the non-member entity is enabled by an administrator for each of the non-equivalent TOE components that it is required to communicate with (non-equivalent TOE components are as defined in the minimum configuration for the distributed TOE)
- Test FCO\_CPC\_EXT.1:2: The evaluator shall confirm that after enablement, an IT entity can communicate only with the components that it has been enabled for. This includes testing that the enabled communication is successful for the enabled component pair, and that communication remains unsuccessful with any other component for which communication is possible but has not been explicitly enabled.  
Some TOEs may set up the registration channel before the enablement step is carried out, but in such a case the channel must not allow communications until after the enablement step has been completed.
- Test FCO\_CPC\_EXT.1:3: The evaluator shall separately disable each TOE component in turn and ensure that the other TOE components cannot then communicate with the disabled component, whether by attempting to initiate communications with the disabled component or by responding to communication attempts from the disabled component. In situations where one component acts as the 'Gatekeeper' for all other components, the test would involve disabling the components in turn on the Gatekeeper and ensuring that the TOE no longer communicates with disabled components.

#### 6.1.4 Cryptographic Support (FCS)

##### FCS\_CKM.1/AKG Cryptographic Key Generation - Asymmetric Key

###### FCS\_CKM.1.1/AKG

The TSE shall [selection: invoke platform-provided functionality, implement functionality] to generate asymmetric cryptographic keys in accordance with a specified cryptographic key generation algorithm [selection: Cryptographic Key Generation Algorithm] and specified cryptographic **algorithm parameters** [selection: Cryptographic Algorithm Parameters] that meet the following: [selection: List of Standards]

The following table provides the allowable choices for completion of the selection operations of FCS\_CKM.1/AKG.

Table 4: Allowable choices for FCS\_CKM.1/AKG

Identifier	Cryptographic Key Generation Algorithm	Cryptographic Algorithm Parameters	List of Standards
RSA	RSA	Modulus of size [selection: 3072, 4096, 6144, 8192] bits	NIST FIPS PUB 186-5 (Section A.1.1)
ECC-ERB	ECC-ERB - Extra Random Bits	Elliptic Curve [selection: P-384, P-521]	FIPS PUB 186-5 (Section A.2.1)  NIST SP 800-186 (Section 3) [NIST Curves]
ECC-RS	ECC-RS - Rejection Sampling	Elliptic Curve [selection: P-384, P-521]	FIPS PUB 186-5 (Section A.2.2)  NIST SP 800-186 (Section 3) [NIST Curves]
FFC-ERB	FFC-ERB - Extra Random Bits	Static domain parameters approved for [selection: <ul style="list-style-type: none"><li>IKE Groups [selection: MODP-3072, MODP-4096, MODP-6144, MODP-8192]</li><li>TLS Groups [selection: ffdhe3072, ffdhe4096, ffdhe6144, ffdhe8192]</li></ul> ]	NIST SP 800-56A Revision 3 (Section 5.6.1.1.3) [key pair generation]  [selection: RFC 3526 [IKE groups], RFC 7919 [TLS groups]]
FFC-RS	FFC-RS - Extra Random Bits	Static domain parameters approved for [selection:	NIST SP 800-56A Revision 3 (Section

		<ul style="list-style-type: none"> <li>• IKE Groups [<b>selection</b>: MODP-3072, MODP-4096, MODP-6144, MODP-8192]</li> <li>• TLS Groups [<b>selection</b>: ffdhe3072, ffdhe4096, ffdhe6144, ffdhe8192]</li> </ul>	5.6.1.1.3) [key pair generation] [ <b>selection</b> : RFC 3526 [IKE groups], RFC 7919 [TLS groups]]
LMS	LMS	Private key size = [ <b>selection</b> : <ul style="list-style-type: none"> <li>• 192 bits with [<b>selection</b>: SHA-256/192, SHAKE256/192]</li> <li>• 256 bits with [<b>selection</b>: SHA-256, SHAKE256]</li> </ul> ]	RFC 8554 [LMS] NIST SP 800-208 [parameters]
ML-KEM	ML-KEM KeyGen	Parameter set = ML-KEM-1024	NIST FIPS 203 (Section 7.1)
ML-DSA	ML-DSA KeyGen	Parameter set = ML-DSA-87	NIST FIPS 204 (Section 5.1)
XMSS	XMSS	Private key size = [ <b>selection</b> : <ul style="list-style-type: none"> <li>• 192 bits with [<b>selection</b>: SHA-256/192, SHAKE256/192]</li> <li>• 256 bits with [<b>selection</b>: SHA-256, SHAKE256]</li> </ul> ]	RFC 8391 [XMSS] NIST SP 800-208 [parameters]
		Tree height = [ <b>selection</b> : 5, 10, 15, 20, 25]	Tree height = [ <b>selection</b> : 10, 16, 20]

**Application Note:** For RSA the choice of the modulus implies the resulting key sizes of the public and private keys generated using the specified standard methods. RSA key generation with modulus size 2048 bits is no longer permitted by CNSA.

For Finite Field Cryptography (FFC) DSA, ST authors should consult schemes for guidelines on use. FIPS PUB 186-5 does not approve DSA for digital signature generation but allows DSA for digital signature verification for legacy purposes. “FFC-ERB” or “FFC-RS” may be claimed only for generating private and public keys when “DH” is claimed in [FCS\\_CKM\\_EXT.7](#).

When generating ECC keys pairs for key agreement and if “ECDH” is claimed in [FCS\\_CKM\\_EXT.7](#), then “ECC-ERB” or “ECC-RS” must be claimed. The sizes of the private key, which is a scalar, and the public key, which is a point on the elliptic curve, are determined by the choice of the curve.

When generating ECC key pairs for digital signature generation and if “ECDSA” is claimed in [FCS\\_COP.1/SigGen](#), then “ECC-ERB” or “ECC-RS” must be claimed. The sizes of the private key, which is a scalar, and the public key, which is a point on the elliptic curve, are determined by the choice of the curve.

If the TSE acts only as a receiver in the RSA key establishment scheme, the ST does not need to implement RSA key generation.

## Evaluation Activities ▾

### [FCS\\_CKM.1/AKG](#)

#### TSS

The evaluator shall examine the TSS to verify that it describes how the TOE generates a key based on output from a random bit generator as specified in [FCS\\_RBG.1](#). The evaluator shall review the TSS to verify that it describes how the functionality described by [FCS\\_RBG.1](#) is invoked.

The evaluator shall examine the TSS to verify that it identifies the usage and key lifecycle for keys generated using each selected algorithm.

The evaluator shall examine the *TSS* to verify that any one-time values such as nonces or masks are constructed in accordance with the relevant standards.

If the *TOE* uses the generated key in a key chain or hierarchy then the evaluator shall verify that the *TSS* describes how the key is used as part of the key chain or hierarchy.

### Guidance

The evaluator shall verify that the guidance instructs the administrator how to configure the *TOE* to generate keys for the selected key generation algorithms for all key types and uses identified in the *TSS*.

### Tests

The following tests are conditional based on the selections made in the *SER*. The evaluator shall perform the following tests or witness respective tests executed by the developer. The tests must be executed on a platform that is as close as practically possible to the operational platform (but which may be instrumented in terms of, for example, use of a debug mode). Where the test is not carried out on the *TOE* itself, the test platform shall be identified and the differences between test environment and *TOE* execution environment shall be described.

### RSA Key Generation

Identifier	Cryptographic Key Generation Algorithm	Cryptographic Algorithm Parameters	List of Standards
RSA	RSA	Modulus of size [selection: 3072, 4096, 6144, 8192] bits	NIST FIPS PUB 186-5 (Section A.1.1)

FIPS PUB 186-5 Key Pair generation specifies five methods for generating the primes  $p$  and  $q$ .

These are:

1. Random provable primes
2. Random probable primes
3. Provable primes with conditions based on auxiliary provable primes
4. Probable primes with conditions based on auxiliary provable primes
5. Probable primes with conditions based on auxiliary probable primes

In addition to the key generation method, the input parameters are:

- Modulus [3072, 4096, 6144, 8192]
- Hash algorithm [SHA-384, SHA-512] (methods 1, 3, 4 only)
- Rabin-Miller prime test [ $2^{100}$ , 2Security String] (methods 2, 4, 5 only)
- $p \bmod 8$  value [0,1,3,5,7]
- $q \bmod 8$  value [0,1,3,5,7]
- Private key format [standard, Chinese Remainder Theorem]
- Public exponent [fixed value, random]

The evaluator shall verify the ability of the *TSF* to correctly produce values for the RSA key components, including the public verification exponent  $e$ , the private prime factors  $p$  and  $q$ , the public modulus  $n$ , and the calculation of the private signature exponent  $d$ .

### Testing for Random Provable Primes and Conditional Methods

To test the key generation method for the random provable primes method and for all the primes with conditions methods (methods 1, 3-5), the evaluator must seed the *TSF* key generation routine with sufficient data to deterministically generate the RSA key pair.

For each supported combination of the above input parameters, the evaluator shall have the *TSF* generate 25 key pairs. The evaluator shall verify the correctness of the *TSF*'s implementation by comparing values generated by the *TSF* with those generated by a known good implementation using the same input parameters.

### Testing for Random Probable Primes Method

If the *TOE* generates random probable primes (method 2) then, if possible, the random probable primes method should also be verified against a known good implementation as described above. If verification against a known good implementation is not possible, the evaluator shall have the *TSF* generate 25 key pairs for each supported key length  $nlen$  and verify that all of the following are true.

- $n = p * q$
- $p$  and  $q$  are probably prime according to Miller-Rabin tests with error probability  $< 2^{-125}$
- $2^{16} < e < 2^{256}$  and  $e$  is an odd integer

- $GCD(p-1, e) = 1$
- $GCD(q-1, e) = 1$
- $|p-q| > 2^{(nlen/2 - 100)}$
- $p \geq \text{sqrt}(2) * (2^{(nlen/2 - 1)})$
- $q \geq \text{sqrt}(2) * (2^{(nlen/2 - 1)})$
- $2^{(nlen/2)} < d < LCM(p-1, q-1)$
- $e*d = 1 \bmod LCM(p-1, q-1)$

### **Elliptic Curve Key Generation**

<b>Identifier</b>	<b>Cryptographic Key Generation Algorithm</b>	<b>Cryptographic Algorithm Parameters</b>	<b>List of Standards</b>
ECC-ERB	ECC – Extra Random Bits	Elliptic Curve [ <b>selection:</b> P-384, P-521]	NIST FIPS PUB 186-5 (Section A.2.1) NIST SP 800-186 (Section 3) [NIST Curves]
ECC-RS	ECC – Rejection Sampling	Elliptic Curve [ <b>selection:</b> P-384, P-521]	NIST FIPS PUB 186-5 (Section A.2.2) NIST SP 800-186 (Section 3) [NIST Curves]

To test the TOE's ability to generate asymmetric cryptographic keys using elliptic curves, the evaluator shall perform the ECC Key Generation Test and the ECC Key Validation Test using the following input parameters.

- Elliptic curve [P-384, P-521]
- Key pair generation method [extra random bits, rejection sampling]

### **ECC Key Generation Test**

For each supported combination of the above input parameters the evaluator shall require the implementation under test to generate 10 private and public key pairs ( $d, Q$ ). The private key,  $d$ , shall be generated using a random bit generator as specified in [FCS\\_RBG.1](#). The private key,  $d$ , is used to compute the public key,  $Q'$ . The evaluator shall confirm that  $0 < d < n$  (where  $n$  is the order of the group), and the computed value  $Q'$  is then compared to the generated public and private key pairs' public key,  $Q$ , to confirm that  $Q$  is equal to  $Q'$ .

### **ECC Key Validation Test**

For each supported combination of the above parameters the evaluator shall generate 12 private and public key pairs using the key generation function of a known good implementation. For each set of 12 public keys, the evaluator shall modify four public key values by shifting  $x$  or  $y$  out of range by adding the order of the field and modify four other public key values by shifting  $x$  or  $y$  so that they are still in bounds, but not on the curve. The remaining public key values are left unchanged (i.e., correct). To determine correctness, the evaluator shall submit the public keys to the public key validation (PKV) function of the TOE and confirm that the results correspond as expected for the modified and unmodified values.

### **Finite Field Cryptography Key Generation**

<b>Identifier</b>	<b>Cryptographic Key Generation Algorithm</b>	<b>Cryptographic Algorithm Parameters</b>	<b>List of Standards</b>
FFC-ERB	FFC – Extra Random Bits	Static domain parameters approved for [ <b>selection:</b> IKE groups [ <b>selection:</b> MODP-3072, MODP-4096, MODP-6144, MODP-8192], TLS groups [ <b>selection:</b> ffdhe3072, ffdhe4096, ffdhe6144, ffdhe8192]]]	NIST SP 800-56A Revision 3 (Section 5.6.1.1.3) [key pair generation] [ <b>selection:</b> RFC 3526 [IKE groups], RFC 7919 [TLS groups]]
FFC-RS	FFC – Rejection Sampling	Static domain parameters approved for [ <b>selection:</b> IKE groups [ <b>selection:</b> MODP-3072, MODP-4096, MODP-6144, MODP-8192], TLS groups [ <b>selection:</b> ffdhe3072, ffdhe4096, ffdhe6144, ffdhe8192]] ]	NIST SP 800-56A Revision 3 (Section 5.6.1.1.4) [key pair generation]

		[selection: RFC 3526 [IKE groups], RFC 7919 [TLS groups]]
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To test the **TOE**'s ability to generate asymmetric cryptographic keys using finite fields, the evaluator shall perform the **Safe Primes Generation Test** and the **Safe Primes Validation Test** using the following input parameter:

- Fields/Groups [MODP-3072, MODP-4096, MODP-6144, MODP-8192, ffdhe3072, ffdhe4096, ffdhe6144, ffdhe8192]

#### **Safe Primes Generation Test**

For each supported safe primes group, generate 10 key pairs. The evaluator shall verify the correctness of the **TSE**'s implementation by comparing values generated by the **TSE** with those generated by a known good implementation using the same input parameters.

#### **Safe Primes Verification Test**

For each supported safe primes group, use a known good implementation to generate 10 key pairs. For each set of 10, the evaluator shall modify three so they are incorrect. The remaining values are left unmodified (i.e. correct). To determine correctness, the evaluator shall submit the key pairs to the public key validation (PKV) function of the **TOE** and shall confirm that the results correspond as expected for the modified and unmodified values.

#### **LMS Key Generation**

<b>Identifier</b>	<b>Cryptographic Key Generation Algorithm</b>	<b>Cryptographic Algorithm Parameters</b>	<b>List of Standards</b>
LMS	LMS Key Generation	Private key size = [selection: 192 bits with [selection: SHA-256/192, SHAKE256/192], 256 bits with [selection: SHA-256, SHAKE256]]; Winternitz parameter = [selection: 1, 2, 4, 8]; Tree height = [selection: 5, 10, 15, 20, 25]	RFC 8554 [LMS] NIST SP 800-208 [parameters]

To test the **TOE**'s ability to generate asymmetric cryptographic keys using LMS, the evaluator shall perform the **LMS Key Generation Test** using the following input parameters:

- Hash algorithm [SHA-256/192, SHAKE256/192, SHA-256, SHAKE256]
- Winternitz [1, 2, 4, 8]
- Tree height [5, 10, 15, 20, 25]

#### **LMS Key Generation Test**

For each supported combination of the hash algorithm, Winternitz parameter, and tree height, the evaluator shall generate one public key for each of the test cases. The number of test cases depends on the tree height:

**Table 5: Number of LMS Test Cases**

<b>Height</b>	<b>Number of test cases</b>
5	5
10	4
15	3
20	2
25	1

The evaluator shall verify the correctness of the **TSE**'s implementation by comparing the public key generated by the **TSE** with that generated by a known good implementation using the same input parameters.

#### **ML-KEM Key Generation**

<b>Identifier</b>	<b>Cryptographic Key Generation Algorithm</b>	<b>Cryptographic Algorithm Parameters</b>	<b>List of Standards</b>
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<b>ML-KEM</b>	<b>ML-KEM Key Generation</b>	<b>Parameter set = [ML-KEM-1024]</b>	<b>NIST FIPS PUB 203 (Section 7.1)</b>
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To test the TOE's ability to generate asymmetric cryptographic keys using ML-KEM, the evaluator shall perform the Algorithm Functional Test using the following input parameters:

- Parameter set [ML-KEM-1024]
- Random seed d [32 bytes]
- Random seed z [32 bytes]

#### **Algorithm Functional Test**

For each supported parameter set the evaluator shall require the implementation under test to generate 25 key pairs using 25 different randomly generated pairs of 32-byte seed values (d, z). To determine correctness, the evaluator shall compare the resulting key pairs (ek, dk) with those generated using a known good implementation using the same inputs.

#### **ML-DSA Key Generation**

<b>Identifier</b>	<b>Cryptographic Key Generation Algorithm</b>	<b>Cryptographic Algorithm Parameters</b>	<b>List of Standards</b>
ML-DSA	ML-DSA Key Generation	Parameter set = ML-DSA-87	NIST FIPS PUB 204 (Section 5.1)

To test the TOE's ability to generate asymmetric cryptographic keys using ML-DSA, the evaluator shall perform the Algorithm Functional Test using the following input parameters:

- Parameter set [ML-DSA-87]
- Random seed [32 bytes]

#### **Algorithm Functional Test**

For each supported parameter set the evaluator shall require the implementation under test to generate 25 key pairs using 25 different randomly generated 32-byte seed values. To determine correctness, the evaluator shall compare the resulting key pairs with those generated using a known good implementation using the same inputs.

#### **XMSS Key Generation**

<b>Identifier</b>	<b>Cryptographic Key Generation Algorithm</b>	<b>Cryptographic Algorithm Parameters</b>	<b>List of Standards</b>
XMSS	XMSS	Private key size = [selection: 192 bits with [selection: SHA-256/192, SHAKE256/192], 256 bits with [selection: SHA-256, SHAKE256] ], tree height = [selection: 10, 16, 20]	RFC 8391 [XMSS] NIST SP 800-208 [parameters]

To test the TOE's ability to generate asymmetric cryptographic keys using XMSS, the evaluator shall perform the XMSS Key Generation Test using the following input parameters:

- Hash algorithm [SHA-256/192, SHAKE256/192, SHA-256, SHAKE256]
- Tree height [10, 16, 20] (XMSS only)

**Table 6: Number of Test Cases for XMSS<sup>MT</sup>**

<b>Height</b>	<b>Number of test cases</b>
10	5
16	4
20	3
40	2
60	1

### **XMSS Key Generation Test**

For each supported combination of hash algorithm and tree height, the evaluator shall generate one public key for each test case. The number of test cases depends on the tree height as specified in [Table 6](#).

The evaluator shall verify the correctness of the [TSE](#)'s implementation by comparing values generated by the [TSE](#) with those generated by a known good implementation using the same input parameters.

Note: The number of test cases is limited due to the extreme amount of time it can take to generate XMSS trees.

## **FCS\_CKM.1/SKG Cryptographic Key Generation - Symmetric Key**

### **FCS\_CKM.1.1/SKG**

The [TSE](#) shall [selection: invoke platform-provided functionality, implement functionality] to generate **symmetric** cryptographic keys in accordance with a specified cryptographic key generation algorithm [selection: Cryptographic Key Generation Algorithm] and specified cryptographic key sizes [selection: Cryptographic Key Sizes] that meet the following: [selection: List of standards]

The following table provides the allowable choices for completion of the selection operations of [FCS\\_CKM.1/SKG](#).

**Table 7: Allowable Choices for FCS\_CKM.1/SKG**

Identifier	Cryptographic Key Generation Algorithm	Cryptographic Key Sizes	List of standards
RSK	Direct Generation from a Random Bit Generator as specified in <a href="#">FCS_RBG.1</a>	[selection: 256, 384, 512] bits	NIST SP 800-133 Revision 2 (Section 6.1)[Direct generation of symmetric keys]

## **Evaluation Activities ▾**

### [FCS\\_CKM.1/SKG](#)

#### [TSS](#)

The evaluator shall examine the [TSS](#) to verify that it describes how the [TOE](#) obtains a symmetric cryptographic key through direct generation from a random bit generator as specified in [FCS\\_RBG.1](#). The evaluator shall review the [TSS](#) to verify that it describes how the functionality described by [FCS\\_RBG.1](#) is invoked.

The evaluator shall examine the [TSS](#) to verify that it identifies the usage, and key lifecycle for keys generated using each selected algorithm.

If the [TOE](#) uses the generated key in a key chain/hierarchy then the evaluator shall verify that the [TSS](#) describes how the key is used as part of the key chain/hierarchy.

#### **Guidance**

The evaluator shall verify that the AGD instructs the administrator how to configure the [TOE](#) to use the RBG to generate symmetric keys for all uses identified in the [ST](#).

#### **Tests**

The following tests are conditional based upon the selections made in the [SER](#). The evaluator shall perform the following test or witness respective tests executed by the developer. The tests must be executed on a platform that is as close as practically possible to the operational platform (but which may be instrumented in terms of, for example, use of a debug mode). Where the test is not carried out on the [TOE](#) itself, the test platform shall be identified and the differences between test environment and [TOE](#) execution environment shall be described.

To test the [TOE](#)'s ability to generate symmetric cryptographic keys using a random bit generator, the evaluator shall configure the symmetric cryptographic key generation capability for each claimed key size. The evaluator shall use the description of the RBG interface to verify that the [TOE](#) requests and receives an amount of RBG output greater than or equal to the requested key size.

## **FCS\_CKM.2 Cryptographic Key Distribution**

**This is an implementation-based component. Its inclusion depends on whether the TOE implements one or more of the following features:**

- 
- 

**as described in Appendix A.3: Implementation-based Requirements.**

## FCS\_CKM.2.1

The TSF shall distribute cryptographic keys in accordance with a specified cryptographic key distribution method [**selection: key encapsulation, key wrapping**] that meets the following: [none].

**Application Note:** Key encapsulation is used in support of TLS when ML-KEM is used as the method of key establishment. Key wrapping is used in support of wireless LAN communications.

## Evaluation Activities ▾

### FCS\_CKM.2

#### TSS

*The evaluator shall ensure that the TSS documents that the security strength supported by the selected key distribution methods is sufficient for the security strength of the keys distributed through those methods.*

*It is not necessary to identify the services that use each key distribution method here. That information should be documented in the requirements for the individual services and protocols that invoke key distribution.*

#### Guidance

*The evaluator shall verify that the AGD guidance instructs the administrator how to configure the TOE to use the selected key distribution methods.*

#### Tests

*Specific testing for this component is covered by testing for the claimed components in FCS\_COP.1/KeyEncap or FCS\_COP.1/KeyWrap, depending on selections made.*

## FCS\_CKM.6 Timing and Event of Cryptographic Key Destruction

### FCS\_CKM.6.1

The TSF shall destroy [all plaintext keying material and critical security parameters (CSPs)] when [**selection: no longer needed, assignment: other circumstances for destruction** ].

### FCS\_CKM.6.2

The TSF shall destroy **plaintext** keying material **and critical security parameters** by [**selection:**

- *invoking platform-provided functionality with the following rules:*
  - *For volatile memory, the destruction shall be executed by [selection:*
    - *a single direct overwrite consisting of [selection: a pseudo-random pattern using the TSF or platform DRBG (as specified in FCS\_RB.G.1), zeroes, ones, a new value of a key, assignment: some value that does not contain any CSP]]*
    - *removal of power to the memory*
    - *destruction of reference to the key directly followed by a request for garbage collection*
  - *] For non-volatile memory that consists of the invocation of an interface provided by the underlying platform that [selection:*
    - *logically addresses the storage location of the key and performs a [selection: single, assignment: ST author defined multi-pass]] direct overwrite consisting of [selection: a pseudo-random pattern using the TSF or platform DRBG (as specified in FCS\_RB.G.1), zeroes, ones, a new value of a key, assignment: some value that does not contain any CSP]]*
    - *instructs the underlying platform to destroy the abstraction that represents the key*
- *implementing key destruction in accordance with the following rules:*
  - *For volatile memory, the destruction shall be executed by a single direct overwrite consisting of [selection: a pseudo-random pattern using the TSF or platform DRBG (as specified in FCS\_RB.G.1), zeroes]*

- For non-volatile EEPROM, the destruction shall be executed by a single direct overwrite consisting of a pseudo-random pattern using the TSE or platform DRBG (as specified in FCS\_RBG.1), followed by a read-verify.
  - For non-volatile flash memory, that is not wear-leveled, the destruction shall be executed [selection: by a single direct overwrite consisting of zeroes followed by a read-verify, by a block erase that erases the reference to memory that stores data as well as the data itself]
  - For non-volatile flash memory that is wear-leveled, the destruction shall be executed by a [selection: single direct overwrite consisting of zeroes, block erase]
  - For non-volatile memory other than EEPROM and flash, the destruction shall be executed by a single direct overwrite with a random pattern that is changed before each write
- ].

**Application Note:** For the purposes of this requirement, keying material refers to authentication data, passwords, secret/private symmetric keys, private asymmetric keys, data used to derive keys, values derived from passwords, etc. “Plaintext keying material” may refer to a KEK that is used to encrypt other keying material. Destruction of encrypted keying material may be accomplished by destroying the KEK used to encrypt it. If different mechanisms are used for destroying different keying material, all relevant claims should be selected and the TSS should identify which keying material is destroyed by which mechanism.

Key storage areas in non-volatile storage can be overwritten with any value that renders the keys unrecoverable. The value used can be all zeroes, all ones, or any other pattern or combination of values significantly different than the value of the key itself. When ‘a value that does not contain any CSP’ is chosen, it means that the TOE uses some other specified data not drawn from a source that may contain keying material or reveal information about it or any other TSE-protected data. In other words, the data used for overwriting is carefully selected and not taken from a general ‘pool’ that might contain current or residual data that itself requires confidentiality protection. If multiple copies exist, all copies must be destroyed.

Since this is a software-only TOE, the hardware controllers that manage non-volatile storage media are necessarily outside the TOE boundary. Thus, the TOE developer is likely to have little control over—or insight into—the functioning of these storage devices. The TOE must make a “best-effort” to destroy disused cryptographic keys by invoking the appropriate hardware interfaces—recognizing that the specific actions taken by the hardware are out of the TOE’s control. But in cases where the TOE has insight into the non-volatile storage technologies used by the hardware, or where the TOE can specify a preference or method for destroying keys, the destruction should be executed by a single, direct overwrite consisting of pseudorandom data or a new key, by a repeating pattern of any static value, or by a block erase.

The interface referenced in the requirement could take different forms, the most likely of which is an API to an OS kernel. There may be various levels of abstraction visible. For instance, in a given implementation that overwrites a key stored in non-volatile memory, the application may have access to the file system details and may be able to logically address specific memory locations. In another implementation where an application instructs the underlying platform to destroy the representation of a key stored in non-volatile memory, the application may simply have a handle to a resource and can only ask the platform to delete the resource, as may be the case with a platforms secure key store. The latter implementation should only be used for the most restricted access. The level of detail to which the TOE has access should be described in the TSS.

## Evaluation Activities ▾

### FCS\_CKM.6

#### TSS

The evaluator shall verify that the TSS identifies all plaintext keying material and CSPs stored by the TOE, the type of memory in which it is stored, and when and how the keying material is erased. If the TOE uses one or more KEKs to protect stored keying material, the evaluator shall verify that the TSS describes the destruction of that keying material, either directly or by destruction of the KEK used to encrypt it.

If different types of memory are used to store the materials to be protected, the evaluator shall check to ensure that the TSS describes the clearing procedure in terms of the memory in which the data are stored (for example, “secret keys stored on flash are cleared by overwriting once with zeros, while secret keys stored on the internal persistent storage device are cleared by overwriting one time with a random pattern that is changed before each write”). For block erases, the evaluator shall also ensure that the TSS identifies the block erase command that is used and shall verify that the command used also addresses any copies of the plaintext key material that may be created, e.g. in order to optimize the use of Flash memory.

If platform-provided functionality is invoked for key destruction, the evaluator shall verify that the TSS identifies the platform functions used for this.

## **Guidance**

There are no additional Guidance evaluation activities for this component.

## **Tests**

**Evaluation Activity Note:** The following tests likely require the **TOE** developer to provide access to a test platform that provides the evaluator with tools that are typically not found on the end consumer version of the **TOE**.

The evaluator shall perform the following tests for all keys and key material subject to destruction by the **TOE**, whether the **TSF** destroys this key material itself or invokes the platform to do so.

For these tests, the evaluator shall utilize an appropriate development environment (e.g., a virtual machine) and development tools (debuggers, simulators, etc.) to test that keys are cleared, including all copies of the key that may have been created internally by the **TOE** during normal cryptographic processing with that key.

- **Test FCS\_CKM.6:1:** Applied to each key held as plaintext in volatile memory and subject to destruction by overwrite by the **TOE** (whether or not the plaintext value is subsequently encrypted for storage in volatile or non-volatile memory). In the case where the only selection made for the destruction method key was removal of power, then this test is unnecessary. The evaluator shall:
  1. Record the value of the key in the **TOE** subject to clearing.
  2. Cause the **TOE** to perform a normal cryptographic processing with the key from Step #1.
  3. Cause the **TOE** to clear the key.
  4. Cause the **TOE** to stop the execution but not exit.
  5. Cause the **TOE** to dump the entire memory of the **TOE** into a binary file.
  6. Search the content of the binary file created in Step #5 for instances of the known key value from Step #1.
  7. Break the key value from Step #1 into 3 similar sized pieces and perform a search using each piece.

Steps 1-6 ensure that the complete key does not exist anywhere in volatile memory. If a copy is found, then the test fails.

Step 7 ensures that partial key fragments do not remain in memory. If a fragment is found, there is a minuscule chance that it is not within the context of a key (e.g., some random bits that happen to match). If this is the case the test should be repeated with a different key in Step #1. If a fragment is found the test fails.

- **Test FCS\_CKM.6:2:** Applied to each key held in non-volatile memory and subject to destruction by overwrite by the **TOE**. The evaluator shall use special tools (as needed), provided by the **TOE** developer if necessary, to view the key storage location:
  1. Record the value of the key in the **TOE** subject to clearing.
  2. Cause the **TOE** to perform a normal cryptographic processing with the key from Step #1.
  3. Cause the **TOE** to clear the key.
  4. Search the non-volatile memory the key was stored in for instances of the known key value from Step #1. If a copy is found, then the test fails.
  5. Break the key value from Step #1 into 3 similar sized pieces and perform a search using each piece. If a fragment is found then the test is repeated (as described for test 1 above), and if a fragment is found in the repeated test then the test fails.
- **Test FCS\_CKM.6:3:** Applied to each key held as non-volatile memory and subject to destruction by overwrite by the **TOE**. The evaluator shall use special tools (as needed), provided by the **TOE** developer if necessary, to view the key storage location:
  1. Record the storage location of the key in the **TOE** subject to clearing.
  2. Cause the **TOE** to perform a normal cryptographic processing with the key from Step #1.
  3. Cause the **TOE** to clear the key.
  4. Read the storage location in Step #1 of non-volatile memory to ensure the appropriate pattern is utilized.

The test succeeds if correct pattern is used to overwrite the key in the memory location. If the pattern is not found the test fails.

In cases where testing reveals that third-party software modules or programming language run-time environments do not properly overwrite keys, this fact must be documented. Likewise, it must be documented if there is no practical way to determine whether such modules or environments destroy keys properly.

In cases where it is impossible or impractical to perform the above tests, the evaluator shall describe how keys are destroyed in such cases, to include:

- Which keys are affected
- The reasons why testing is impossible or impractical
- Evidence that keys are destroyed appropriately (e.g., citations to component documentation, component developer/vendor attestation, component vendor test results)
- Aggravating and mitigating factors that may affect the timeliness or execution of key destruction (e.g., caching, garbage collection, operating system memory management)

## FCS\_CKM\_EXT.7 Cryptographic Key Agreement

*This is an implementation-based component. Its inclusion in depends on whether the TOE implements one or more of the following features:*

- *as described in Appendix A.3: Implementation-based Requirements.*

### FCS\_CKM\_EXT.7.1

The TSF shall derive shared cryptographic keys with input from multiple parties in accordance with specified cryptographic key agreement algorithms [**selection: Cryptographic algorithm**] and specified cryptographic parameters [**selection: Cryptographic parameters**] that meet the following: [**selection: List of standards**]

The following table provides the allowable choices for completion of the selection operations of [FCS\\_CKM\\_EXT.7](#).

**Table 8: Allowable choices for FCS\_CKM\_EXT.7**

Identifier	Cryptographic algorithm	Cryptographic parameters	List of standards
KAS2	RSA	Modulus size [ <b>selection: 3072, 4096, 6144, 8192</b> ] bits	NIST SP 800-56B Revision 2 (Section 8.3) [KAS2]
DH	Finite Field Cryptography Diffie-Hellman	Static domain parameters approved for [ <b>selection:</b> <ul style="list-style-type: none"><li>• <i>IKE Groups</i> [<b>selection: MODP-3072, MODP-4096, MODP-6144, MODP-8192</b>]</li><li>• <i>TLS Groups</i> [<b>selection: ffdhe3072, ffdhe4096, ffdhe6144, ffdhe8192</b>]</li></ul> ]	NIST SP 800-56A Revision 3 (Section 5.7.1.1) [DH] [ <b>selection: RFC 3526 [IKE groups], RFC 7919 [TLS groups]</b> ]
ECDH	Elliptic Curve Diffie-Hellman	Elliptic Curve [ <b>selection: P-384, P-521</b> ]	NIST SP 800-56A Revision 3 (Section 5.7.1.2) [ECDH] NIST SP 800-186 (Section 3.2.1) [NIST Curves]

**Application Note:** This SER is claimed if the TSF supports key agreement schemes as a method of key establishment for trusted channels. This will generally apply to all conformant TOEs, except in the rare (but possible) case where only key encapsulation is used.

All of the above algorithms with the selectable parameters are CNSA 1.0 compliant.

This SFR must be included in the ST if key agreement or transport is a service provided by the TOE to tenant software, or if they are used by the TOE itself to support or implement PP-specified security functionality.

## Evaluation Activities

### FCS\_CKM\_EXT.7

#### TSS

*The evaluator shall ensure that the TSS documents that the security strength of the material contributed by the TOE is sufficient for the security strength of the key and the agreement method.*

#### Guidance

*There are no additional Guidance evaluation activities for this component.*

### Tests

The following tests are conditional based upon the selections made in the SER. The evaluator shall perform the following test or witness respective tests executed by the developer. The tests must be executed on a platform that is as close as practically possible to the operational platform (but which may be instrumented in terms of, for example, use of a debug mode). Where the test is not carried out on the TOE itself, the test platform shall be identified and the differences between test environment and TOE execution environment shall be described.

### KAS2

Identifier	Cryptographic Algorithm	Cryptographic Parameters	List of Standards
KAS2	RSA	Modulus Size [selection: 3072, 4096, 6144, 8192] bits	NIST SP 800-56B Revision 2 (Section 8.3) [KAS2]

To test the TOE's implementation of the KAS2 RSA Key Agreement scheme, the evaluator shall perform the Algorithm Functional Test and Validation Test using the following input parameters:

- RSA Private key format [Basic, Prime Factor, Chinese Remainder Theorem]
- Modulo value [3072, 4096, 6144, 8192]
- Role [initiator, responder]

The evaluator shall generate a test group (i.e. set of tests) for each parameter value of the above parameter type with the largest number of supported values. For example, if the TOE supports all five Modulo values, then the evaluator shall generate five test groups. Each of the above supported parameter values must be included in at least one test group.

Regardless of how many parameter values are supported, there must be at least two test groups.

Half of the test groups are designated as Algorithm Functional Tests (AFT) and the remainder are designated as Validation Tests (VAT). If there is an odd number of groups, then the extra group is designated randomly as either AFT or VAT.

#### Algorithm Functional Test

For each test group designated as AFT, the evaluator shall generate 10 test cases using random data (except for a fixed public exponent, if supported). The resulting shared secrets shall be compared with those generated by a known-good implementation using the same inputs.

#### Validation Test

For each test group designated as VAT, the evaluator shall generate 25 test cases are using random data (except for a fixed public exponent, if supported). Of the 25 test cases:

- Two test cases must have a shared secret with a leading nibble of 0s,
- Two test cases have modified derived key material,
- Two test cases have modified tags, if key confirmation is supported,
- Two test cases have modified MACs, if key confirmation is supported, and
- The remaining test cases are not modified.

To determine correctness, the evaluator shall confirm that the resulting 25 shared secrets correspond as expected for both the modified and unmodified values.

### FFC Diffie-Hellman Key Agreement

Identifier	Cryptographic Algorithm	Cryptographic Parameters	List of Standards
DH	Finite Field Cryptography Diffie-Hellman	Static domain parameters approved for [selection: IKE groups [selection: MODP-3072, MODP-4096, MODP-6144, MODP-8192], TLS groups [selection: ffdhe3072, ffdhe4096, ffdhe6144, ffdhe8192]]]	NIST SP 800-56A Revision 3 (Section 5.7.1.1) [DH] [selection: RFC 3526 [IKE Groups], RFC 7919 [TLS Groups]]

To test the TOE's implementation of FFC Diffie-Hellman Key Agreement, the evaluator shall perform the Algorithm Functional Test and Validation Test using the following input parameters:

- Domain Parameter Group [MODP-3072, MODP-4096, MODP-6144, MODP-8192, ffdhe3072, ffdhe4096, ffdhe6144, ffdhe8192]

#### Algorithm Functional Test

For each supported domain parameter group, the evaluator shall generate 10 test cases by generating the initiator and responder secret keys using random data, calculating the responder public key, and creating the shared secret. The resulting shared secrets shall be compared with those generated by a known-good implementation using the same inputs.

#### **Validation Test**

For each supported combination of the above parameters the evaluator shall generate 15 Diffie Hellman initiator/responder key pairs using the key generation function of a known-good implementation. For each set of key pairs, the evaluator shall modify five initiator private key values. The remaining key values are left unchanged (i.e., correct). To determine correctness, the evaluator shall confirm that the 15 shared secrets correspond as expected for both the modified and unmodified inputs.

#### **Elliptic Curve Diffie-Hellman Key Agreement**

<b>Identifier</b>	<b>Cryptographic Algorithm</b>	<b>Cryptographic Parameters</b>	<b>List of Standards</b>
ECDH	Elliptic Curve Diffie-Hellman	Elliptic Curve [ <b>selection:</b> P-384, P-521]	NIST SP 800-56A Revision 3 (Section 5.7.1.2) [ECDH] NIST SP 800-186 (Section 3.2.1) [NIST Curves]

To test the TOE's implementation of Elliptic Curve Diffie-Hellman Key Agreement, the evaluator shall perform the Algorithm Functional Test and Validation Test using the following input parameters:

- Elliptic Curve [P-384, P-521]

#### **Algorithm Functional Test**

For each supported Elliptic Curve the evaluator shall generate 10 test cases by generating the initiator and responder secret keys using random data, calculating the responder public key, and creating the shared secret. The resulting shared secrets shall be compared with those generated by a known-good implementation using the same inputs.

#### **Validation Test**

For each supported Elliptic Curve the evaluator shall generate 15 Diffie Hellman initiator/responder key pairs using the key generation function of a known-good implementation. For each set of key pairs, the evaluator shall modify five initiator private key values. The remaining key values are left unchanged (i.e., correct). To determine correctness, the evaluator shall confirm that the 15 shared secrets correspond as expected for the modified and unmodified values.

### **FCS\_COP.1/AEAD Cryptographic Operation – Authenticated Encryption with Associated Data**

#### **FCS\_COP.1.1/AEAD**

The TSF shall perform [*authenticated encryption with associated data*] in accordance with a specified cryptographic algorithm [**selection:** *Cryptographic Algorithm*] and cryptographic key sizes [**selection:** *Cryptographic Key Sizes*] that meet the following: [**selection:** *List of Standards*]

The following table provides the allowable choices for completion of the selection operations of **FCS\_COP.1/AEAD**.

**Table 9: Allowable choices for FCS\_COP.1/AEAD**

<b>Identifier</b>	<b>Cryptographic Algorithm</b>	<b>Cryptographic Key Sizes</b>	<b>List of Standards</b>
AES-GCM	AES in GCM mode with non-repeating IVs using [ <b>selection:</b> <i>deterministic, RBG-based</i> ], IV construction; the tag must be of length [ <b>selection:</b> 96, 104, 112, 120, 128] bits.	256 bits	[ <b>selection:</b> ISO/IEC 18033-3:2010 ( <i>Subclause 5.2</i> ), FIPS PUB 197] [AES] [ <b>selection:</b> ISO/IEC 19772:2020 ( <i>Clause 10</i> ), NIST SP 800-38D] [GCM]

**Application Note:** This SER is claimed when the TOE has wireless LAN client functionality so that the TSF can provide AEAD algorithms in support of wireless communications.

The use of 256-bit keys for AES encryption is required by CNSA 1.0 and 2.0.

## Evaluation Activities ▾

### FCS\_COP.1/AEAD

#### TSS

The evaluator shall examine the TSS to ensure that it describes the construction of any IVs, nonces, and tags in conformance with the relevant specifications.

If a CCM mode algorithm is selected, then the evaluator shall examine the TOE summary specification to confirm that it describes how the nonce is generated and that the same nonce is never reused to encrypt different plaintext pairs under the same key.

If a GCM mode algorithm is selected, then the evaluator shall examine the TOE summary specification to confirm that it describes how the IV is generated and that the same IV is never reused to encrypt different plaintext pairs under the same key. The evaluator shall also confirm that for each invocation of GCM, the length of the plaintext is at most  $(2^{32}-2)$  blocks.

#### Guidance

There are no additional Guidance evaluation activities for this component.

#### Tests

The following tests may require the developer to provide access to a test platform that provides the evaluator with tools that are typically not found on factory products.

The following tests are conditional based upon the selections made in the SFR. The evaluator shall perform the following test or witness respective tests executed by the developer. The tests must be executed on a platform that is as close as practically possible to the operational platform (but which may be instrumented in terms of, for example, use of a debug mode). Where the test is not carried out on the TOE itself, the test platform shall be identified and the differences between test environment and TOE execution environment shall be described.

## AES-GCM

Identifier	Cryptographic Algorithm	Cryptographic Key Sizes	List of Standards
AES-GCM	AES in GCM mode with nonrepeating IVs using [selection: deterministic, RBG-based] IV construction; the tag must be of length [selection: 96, 104, 112, 120, or 128] bits.	256 bits	[selection: ISO/IEC 18033-3:2010 (Subclause 5.2), FIPS PUB 197] [AES]  [selection: ISO/IEC 19772:2020 (Clause 10), NIST SP 800-38D] [GCM]

To test the TOE's implementation of AES-GCM authenticated encryption functionality the evaluator shall perform the Encryption Algorithm Functional Tests and Decryption Algorithm Functional Tests as described below using the following input parameters:

- Key Size [256] bits
- Associated data size [0-65536] bits
- Payload size [0-65536] bits
- IV size [96] bits
- Tag size [96, 104, 112, 120, 128] bits

### Encryption Algorithm Functional Tests

The evaluator shall generate 15 test cases using random data for each combination of the above parameters as follows:

- Each claimed key size,
- Each supported tag size,
- Four supported non-zero payload sizes, such that two are multiples of 128 bits and two are not multiples of 128 bits,
- Four supported non-zero associated data sizes, such that two are multiples of 128 bits and two are not multiples of 128 bits, and
- An associated data size of zero, if supported.

Note that the IV size is always 96 bits.

The evaluator shall compare the output from each test case against results generated by a known-good implementation with the same input parameters.

### Decryption Algorithm Functional Tests

The evaluator shall test the authenticated decrypt functionality of AES-GCM by supplying 15 test cases for the supported combinations of the parameters as described above. For each parameter combination the evaluator shall introduce an error into either the Ciphertext or the Tag such that approximately half of the cases are correct and half the cases contain errors.

## FCS\_COP.1/Hash Cryptographic Operation - Hashing

### FCS\_COP.1.1/Hash

The **TSE** shall [selection: invoke platform-provided functionality, implement functionality] to perform **cryptographic hashing** in accordance with specified cryptographic algorithm [selection: SHA-256, SHA-384, SHA-512, SHA3-384, SHA3-512] that meet the following: [selection: ISO/IEC 10118-3:2018 [SHA, SHA3], FIPS PUB 180-4 [SHA], FIPS PUB 202 [SHA3]].

**Application Note:** In accordance with CNSA 1.0 and 2.0:

- SHA-1 hash is no longer permitted to be used as a hash function,
- SHA3 hashes may be used only for internal hardware functionality such as boot integrity checks, and
- SHA-256 is permitted only for use as a PRF or MAC as part of a key derivation function, or as part of LMS or XMSS.

The hash selection should be consistent with the overall strength of the algorithm used for signature generation. For example, the **TQE** should choose SHA-384 for 3072-bit RSA, 4096-bit RSA, or ECC with P-384; and SHA-512 for ECC with P-521.

### Evaluation Activities ▾

#### FCS\_COP.1/Hash

##### TSS

The evaluator shall examine the **TSS** to verify that if SHA-256 is selected, that it is being used only as a PRF or MAC step in a key derivation function or as part of LMS, and not as a hash algorithm.

If "invoke platform-provided functionality" is selected:

The evaluator shall examine the **TSS** to verify that it describes (for each supported platform) how the hash functionality is invoked for each digest size selected in the **MDM** server's **ST**. (it should be noted that this may be through a mechanism that is not implemented by the **MDM** server; nonetheless, that mechanism will be identified in the **TSS** as part of this evaluation activity).

If "implement functionality" is selected:

The evaluator shall check that the association of the hash function with other **TSE** cryptographic functions (for example, the digital signature verification function) is documented in the **TSS**. The evaluator shall check the AGD documents to determine that any configuration that is required to be done to configure the functionality for the required hash sizes is present. The **TSE** hashing functions can be implemented in one of two modes.

The first mode is the byte-oriented mode. In this mode the **TSE** only hashes messages that are an integral number of bytes in length (i.e., the length (in bits) of the message to be hashed is divisible by 8).

The second mode is the bit-oriented mode. In this mode the **TSE** hashes messages of arbitrary length. As there are different tests for each mode, an indication is given in the following sections for the bit-oriented vs. byte-oriented TestMAC.

##### Guidance

There are no additional Guidance evaluation activities for this component.

##### Tests

The following tests may require the developer to provide access to a test platform that provides the evaluator with tools that are typically not found on factory products.

The following tests are conditional based upon the selections made in the **SER**. The evaluator shall perform the following test or witness respective tests executed by the developer. The tests must be executed on a platform that is as close as practically possible to the operational platform (but which may be instrumented in terms of, for example, use of a debug mode). Where the test is not carried out on the **TQE** itself, the test platform shall be identified and the differences between test environment and **TQE** execution environment shall be described.

**SHA-256, SHA-384, SHA-512**

To test the TOE's ability to generate hash digests using SHA2 the evaluator shall perform the Algorithm Functional Test, Monte Carlo Test, and Large Data Test for each claimed SHA2 algorithm.

### **Algorithm Functional Test**

The evaluator shall generate a number of test cases equal to the block size of the hash (512 for SHA2-256; 1024 for the other SHA2 algorithms).

Each test case is to consist of random data of a random length between 0 and 65536 bits, or the largest size supported.

Each test case is to consist of random data of a random length between 0 and 65536 bits, or the largest size supported.

### **Monte Carlo Test**

Monte Carlo tests begin with a single seed and run 100 iterations of the chained computation.

There are two versions of the Monte Carlo test for SHA-1 and SHA-2. Either one is acceptable. For the Standard Monte Carlo test the message hashed is always three times the length of the initial seed.

```
For j = 0 to 99
    A = B = C = SEED
    For i = 0 to 999
        MSG = A || B || C
        MD = SHA(MSG)
        A = B
        B = C
        C = MD
        Output MD
        SEED = MD
```

For the alternate version of the Monte Carlo Test, the hashed message is always the same length as the seed.

```
INITIAL_SEED_LENGTH = LEN(SEED)
For j = 0 to 99
    A = B = C = SEED
    For i = 0 to 999
        MSG = A || B || C
        if LEN(MSG) >= INITIAL_SEED_LENGTH:
            MSG = leftmost INITIAL_SEED_LENGTH bits of MSG
        else:
            MSG = MSG || INITIAL_SEED_LENGTH - LEN(MSG) 0 bits
        MD = SHA(MSG)
        A = B
        B = C
        C = MD
        Output MD
        SEED = MD
```

The evaluator shall compare the output against results generated by a known-good implementation with the same input.

### **Large Data Test**

The implementation must be tested against one test case each on large data messages of 1GB, 2GB, 4GB, and 8GB of data as supported. The data need not be random. It may, for example, consist of a repeated pattern of 64 bits.

The evaluator shall compare the output against results generated by a known-good implementation with the same input.

### **SHA3-384, SHA3-512**

To test the TOE's ability to generate hash digests using SHA3 the evaluator shall perform the Algorithm Functional Test, Monte Carlo Test, and Large Data Tests for each claimed SHA3 algorithm.

### **Algorithm Functional Test**

Generate a test case consisting of random data for every message length from 0 bits (or the smallest supported message size) to rate bits, where rate equals

- 832 for SHA3-384 and
- 576 for SHA3-512.

Additionally, generate tests cases of random data for messages of every multiple of (rate+1) bits starting at length rate, and continuing until 65535 is exceeded.

The evaluator shall compare the output against results generated by a known-good implementation with the same input.

### **Monte Carlo Test**

Monte Carlo tests begin with a single seed and run 100 iterations of the chained computation.

For this Monte Carlo Test, the hashed message is always the same length as the seed.

```

MD[0] = SEED
INITIAL_SEED_LENGTH = LEN(SEED)
For 100 iterations
For i = 1 to 1000
MSG = MD[i-1];
if LEN(MSG) >= INITIAL_SEED_LENGTH:
MSG = leftmost INITIAL_SEED_LENGTH bits of MSG
else:
MSG = MSG || INITIAL_SEED_LENGTH - LEN(MSG) 0 bits
MD[i] = SHA3(MSG)
MD[0] = MD[1000]
Output MD[0]

```

The evaluator shall compare the output against results generated by a known-good implementation with the same input.

### **Large Data Test**

The implementation must be tested against one test case each on large data messages of 1GB, 2GB, 4GB, and 8GB of data as supported. The data need not be random. It may, for example, consist of a repeated pattern of 64 bits.

The evaluator shall compare the output against results generated by a known-good implementation with the same input.

## **FCS\_COP.1/KeyedHash Cryptographic Operation - Keyed-Hash**

### **FCS\_COP.1.1/KeyedHash**

The TSF shall [selection: invoke platform-provided functionality, implement functionality] to perform [keyed-hash message authentication] in accordance with a specified cryptographic algorithm [selection: Keyed Hash Algorithm] and cryptographic key sizes [selection: Cryptographic Key Sizes] that meet the following: [selection: List of Standards]

The following table provides the allowable choices for completion of the selection operations of FCS\_COP.1/KeyedHash.

**Table 10: Allowable choices for FCS\_COP.1/KeyedHash**

<b>Keyed Hash Algorithm</b>	<b>Cryptographic Key Sizes</b>	<b>List of Standards</b>
HMAC-SHA-256	256 bits	[selection: ISO/IEC 9797-2:2021 (Section 7 “MAC Algorithm 2”), FIPS PUB 198-1 ]
HMAC-SHA-384	[selection: 384 (ISO, FIPS), 256 (FIPS)] bits	[selection: ISO/IEC 9797-2:2021 (Section 7 “MAC Algorithm 2”), FIPS PUB 198-1 ]
HMAC-SHA-512	[selection: 512 (ISO, FIPS), 384 (FIPS), 256 (FIPS)] bits	[selection: ISO/IEC 9797-2:2021 (Section 7 “MAC Algorithm 2”), FIPS PUB 198-1 ]

**Application Note:** The intent of this requirement is to specify the keyed-hash message authentication function used when used for key establishment purposes for the various cryptographic protocols used by the TOE (e.g., trusted channel). The hash selection must support the message digest size selection. The hash selection should be consistent with the overall strength of the algorithm used for FCS\_COP.1/Hash.

IN accordance with CNSA 1.0 and 2.0, HMAC-SHA-256 may be used only as a PRF or MAC step in a key derivation function.

### **Evaluation Activities ▼**

#### **FCS\_COP.1/KeyedHash**

##### **TSS**

The evaluator shall examine the TSS to ensure that the size of the key is sufficient for the desired security strength of the output.

The evaluator shall examine the TSS to verify that if HMAC-SHA-256 is selected, that it is being used only as a PRF or MAC step in a key derivation function.

If "invoke platform-provided functionality" is selected:

The evaluator shall examine the TSS to verify that it describes (for each supported platform) how the keyed-hash

functionality is invoked for each mode and key size selected in the MDM server's ST (it should be noted that this may be through a mechanism that is not implemented by the MDM server; nonetheless, that mechanism will be identified in the TSS as part of this evaluation activity).

If "implement functionality" is selected:

The evaluator shall examine the TSS to ensure that it specifies the following values used by the HMAC function: key length, hash function used, block size, and output MAC length used.

#### Guidance

There are no additional Guidance evaluation activities for this component.

#### Tests

The following tests are conditional based on the selections made in the SER. The evaluator shall perform the following tests or witness respective tests executed by the developer. The tests must be executed on a platform that is as close as practically possible to the operational platform (but which may be instrumented in terms of, for example, use of a debug mode). Where the test is not carried out on the TOE itself, the test platform shall be identified and the differences between test environment and TOE execution environment shall be described.

#### HMAC

Keyed Hash Algorithm	Cryptographic Key Sizes	List of Standards
HMAC-SHA-256	256 bits	[selection: ISO/IEC 9797-2:2021 (Section 7 "MAC Algorithm 2"), FIPS PUB 198-1]
HMAC-SHA-384	[selection: (ISO, FIPS) 384, (FIPS 256] bits	[selection: ISO/IEC 9797-2:2021 (Section 7 "MAC Algorithm 2"), FIPS PUB 198-1]
HMAC-SHA-512	[selection: (ISO, FIPS) 512, (FIPS 384, 256] bits	[selection: ISO/IEC 9797-2:2021 (Section 7 "MAC Algorithm 2"), FIPS PUB 198-1]

To test the TOE's ability to generate keyed hashes using HMAC the evaluator shall perform the Algorithm Functional Test for each combination of claimed HMAC algorithm the following parameters:

- Hash function [SHA-256, SHA-384, SHA-512]
- Key length [8-65536] bits by 8s
- MAC length [32-[digest size of hash function (256, 384, 512)]] bits

#### Algorithm Functional Test

For each supported Hash function the evaluator shall generate 150 test cases using random input messages of 128 bits, random supported key lengths, random keys, and random supported MAC lengths such that across the 150 test cases:

- The key length includes the minimum, the maximum, a key length equal to the block size, and key lengths that are both larger and smaller than the block size.
- The MAC size includes the minimum, the maximum, and two other random values.

The evaluator shall compare the output against results generated by a known good implementation with the same input.

## FCS\_COP.1/KeyEncap Cryptographic Operation - Key Encapsulation

This is a selection-based component. Its inclusion depends upon selection from [FCS\\_CKM.2.1](#).

### FCS\_COP.1.1/KeyEncap

The TSF shall perform [key encapsulation] in accordance with a specified cryptographic algorithm [selection: Cryptographic algorithm] and cryptographic key sizes [selection: Cryptographic key sizes] that meet the following: [selection: List of standards]

The following table provides the allowable choices for completion of the selection operations of [FCS\\_COP.1/KeyEncap](#).

Table 11: Allowable choices for [FCS\\_COP.1/KeyEncap](#)

Identifier	Cryptographic algorithm	Cryptographic key sizes	List of standards
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**Application Note:** For this PP, the only anticipated use of key encapsulation is the use of ML-KEM as part of key establishment for trusted communications.

## Evaluation Activities ▾

### FCS\_COP.1/KeyEncap

#### TSS

The evaluator shall ensure that the TSS documents that the selection of the key size is sufficient for the security strength of the key encapsulated.

The evaluator shall examine the TSS to verify that any one-time values such as nonces or masks are constructed and used in accordance with the relevant standards.

#### Guidance

There are no additional Guidance evaluation activities for this component.

#### Tests

The following test may require the developer to provide access to a test platform that provides the evaluator with tools that are typically not found on factory products.

The following tests are conditional based upon the selections made in the SER. The evaluator shall perform the following test or witness respective tests executed by the developer. The tests must be executed on a platform that is as close as practically possible to the operational platform (but which may be instrumented in terms of, for example, use of a debug mode). Where the test is not carried out on the TOE itself, the test platform shall be identified and the differences between test environment and TOE execution environment shall be described.

## ML-KEM Key Encapsulation

Identifier	Cryptographic Algorithm	Cryptographic Key Sizes	List of Standards
ML-KEM	ML-KEM	Parameter set = ML-KEM-1024	NIST FIPS PUB 203

To test the TOE's implementation of ML-KEM key encapsulation/decapsulation, the evaluator shall perform the Encapsulation Test and the Decapsulation Test using the following input parameters:

- *Encapsulation Parameters:*
  - Parameter set [ML-KEM-1024]
  - Previously generated encapsulation key (ek)
  - Random value (m) [32 bytes]
- *Decapsulation Parameters:*
  - Parameter set [ML-KEM-1024]
  - Previously generated decapsulation key (dk)
  - Previously generated ciphertext (c) [32 bytes]

### Encapsulation Test

For each supported parameter set the evaluator shall generate 25 test cases consisting of an encapsulation key ek and random value m. For each test case the evaluator shall require the implementation under test to generate the corresponding shared secret k and ciphertext c. To determine correctness, the evaluator shall compare the resulting values with those generated using a known-good implementation using the same inputs.

### Encapsulation Key Check (if supported)

The evaluator shall generate 10 encapsulation keys such that:

- Five of the encapsulation keys are valid, and
- Five of the encapsulation keys are modified such that a value in the noisy linear system is encoded into the key as a value greater than Q.

The evaluator shall invoke the TOE's Encapsulation Key Check functionality to determine the validity of the 10 keys. The unmodified keys should be determined valid, and the modified keys should be determined invalid.

### Decapsulation Key Check (if supported)

The evaluator shall generate 10 decapsulation keys such that:

- Five of the decapsulation keys are valid, and
- Five of the decapsulation keys are modified such that the concatenated values  $ek||H(ek)$  will no longer match by modifying  $H(ek)$  to be a different value.

The evaluator shall invoke the [TQE's Decapsulation Key Check functionality](#) to determine the validity of the 10 keys. The unmodified keys should be determined valid, and the modified keys should be determined invalid.

### **Decapsulation Test**

For each supported parameter set the evaluator shall use a single previously generated decapsulation key  $dk$  and generate 10 test cases consisting of valid and invalid ciphertexts  $c$ . For each test case the evaluator shall require the implementation under test to generate the corresponding shared secret  $k$  whether or not the ciphertext is valid. To determine correctness, the evaluator shall compare the resulting values with those generated using a known-good implementation using the same inputs.

## **FCS\_COP.1/KeyWrap Cryptographic Operation - Key Wrapping**

**This is a selection-based component. Its inclusion depends upon selection from [FCS\\_CKM.2.1](#).**

### **FCS\_COP.1.1/KeyWrap**

The [TSF](#) shall perform [key wrapping] in accordance with a specified cryptographic algorithm [**selection: Cryptographic algorithm**] and cryptographic key sizes [**selection: Cryptographic key sizes**] that meet the following: [**selection: List of standards**]

The following table provides the allowable choices for completion of the selection operations of [FCS\\_COP.1/KeyWrap](#).

**Table 12: Allowable choices for FCS\_COP.1/KeyWrap**

<b>Identifier</b>	<b>Cryptographic algorithm</b>	<b>Cryptographic key sizes</b>	<b>List of standards</b>
AES-KW	AES in KW mode	256 bits	[ <b>selection: ISO/IEC 18033-3:2010 (Subclause 5.2), FIPS PUB 197</b> ] [AES] [ <b>selection: ISO/IEC 19772:2020 (clause 6), NIST SP 800-38F (Section 6.2)</b> ] [KW mode]
AES-KWP	AES in KWP mode	256 bits	[ <b>selection: ISO/IEC 18033-3:2010 (Subclause 5.2), FIPS PUB 197</b> ] [AES] NIST SP 800-38F (Section 6.3) [KWP mode]
AES-CCM	AES in CCM mode with unpredictable, non-repeating nonce, minimum size of 64 bits	256 bits	[ <b>selection: ISO/IEC 18033-3:2010 (Subclause 5.2), FIPS PUB 197</b> ] [AES] [ <b>selection: ISO/IEC 19772:2020 (Clause 7), NIST SP 800-38C</b> ] [CCM]
AES-GCM	AES in GCM mode with non-repeating IVs using [ <b>selection: deterministic, RBG-based</b> ], IV construction; the tag must be of length [ <b>selection: 96, 104, 112, 120, 128</b> ] bits.	256 bits	[ <b>selection: ISO/IEC 18033-3:2010 (Subclause 5.2), FIPS PUB 197</b> ] [AES]

**Application Note:** NIST 800-57p1rev5 sec. 5.6.2 specifies that the size of key used to protect the key being transported should be at least the security strength of the key it is protecting.

## Evaluation Activities ▼

### [FCS\\_COP.1/KeyWrap](#)

#### TSS

The evaluator shall ensure that the TSS documents that the selection of the key size is sufficient for the security strength of the key wrapped.

The evaluator shall examine the TSS to ensure that it describes the construction of any IVs, nonces, and MACs in conformance with the relevant specifications.

#### Guidance

There are no additional Guidance evaluation activities for this component.

#### Tests

For tests of AES-GCM and AES-CCM, see testing for [FCS\\_COP.1/AEAD](#).

The following tests are conditional based upon the selections made in the SER. The evaluator shall perform the following test or witness respective tests executed by the developer. The tests must be executed on a platform that is as close as practically possible to the operational platform (but which may be instrumented in terms of, for example, use of a debug mode). Where the test is not carried out on the TOE itself, the test platform shall be identified and the differences between test environment and TOE execution environment shall be described.

## AES-KW

Identifier	Cryptographic Algorithm	Cryptographic Key Sizes	List of Standards
AES-KW	AES in KW mode	256 bits	<p>[selection: ISO/IEC 18033-3:2010 (Subclause 5.2), FIPS PUB 197] [AES]</p> <p>[selection: ISO/IEC 19772:2020 (clause 6), NIST SP 800-38F (Section 6.2)] [KW mode]</p>

To test the TOE's ability to wrap keys using AES in Key Wrap mode the evaluator shall perform the Algorithm Functional Tests using the following input parameters:

- Key size [256] bits
- Keyword cipher type [cipher, inverse]
- Payload sizes [128-4096] bits by 64s

#### Algorithm Functional Test

The evaluator shall generate 100 encryption test cases using random data for each combination of claimed key size, keyword cipher type, and six supported payload sizes such that the payload sizes include the minimum, the maximum, two that are divisible by 128, and two that are not divisible by 128.

The results shall be compared with those generated by a known-good implementation using the same inputs.

The evaluator shall generate 100 decryption test cases using the same parameters as above, but with 20 of each 100 test cases having modified ciphertext to produce an incorrect result. To determine correctness, the evaluator shall confirm that the results correspond as expected for both the modified and unmodified values.

## AES-KWP

Identifier	Cryptographic Algorithm	Cryptographic Key Sizes	List of Standards
AES-KWP	AES in KWP mode	256 bits	[selection: ISO/IEC 18033-3:2010 (Subclause 5.2), FIPS PUB 197] [AES]

To test the TOE's ability to wrap keys using AES in Key Wrap with Padding mode with padding the evaluator shall perform the Algorithm Functional Tests using the following input parameters:

- Key size [256] bits
- Keyword cipher type [cipher, inverse]
- Payload sizes [8-4096] bits by 8s

#### **Algorithm Functional Test**

The evaluator shall generate 100 encryption test cases using random data for each combination of claimed key size, keyword cipher type, and six supported payload sizes such that the payload sizes include the minimum, the maximum, two that are divisible by 128, and two that are not divisible by 128.

The results shall be compared with those generated by a known-good implementation using the same inputs.

The evaluator shall generate 100 decryption test cases using the same parameters as above, but with 20 of each 100 test cases having modified ciphertext to produce an incorrect result. To determine correctness, the evaluator shall confirm that the results correspond as expected for both the modified and unmodified values.

### **FCS\_COP.1/SigGen Cryptographic Operation - Signature Generation**

#### **FCS\_COP.1.1/SigGen**

The TSE shall [selection: invoke platform-provided functionality, implement functionality] to perform [digital signature generation] in accordance with a specified cryptographic algorithm [selection: Cryptographic Algorithm] and cryptographic key sizes [selection: Cryptographic Key Sizes] that meet the following: [selection: List of Standards]

The following table provides the allowable choices for completion of the selection operations in FCS\_COP.1/SigGen.

**Table 13: Allowable choices for FCS\_COP.1/SigGen**

<b>Identifier</b>	<b>Cryptographic Algorithm</b>	<b>Cryptographic Key Sizes</b>	<b>List of Standards</b>
RSA-PKCS	RSASSA-PKCS1-v1_5	Modulus of size [selection: 3072, 4096, 6144, 8192] bits, hash [selection: SHA-384, SHA-512]	RFC 8017 (Section 8.2) [PKCS #1 v2.2] FIPS PUB 186-5 (Section 5.4) [RSASSA-PKCS1-v1_5]
RSA-PSS	RSASSA-PSS	Modulus of size [selection: 3072, 4096, 6144, 8192] bits, hash [selection: SHA-384, SHA-512], Salt Length () such that [assignment: $0 \leq sLen \leq hLen$ (Hash Output Length)] and Mask Generation Function = MGF1	RFC 8017 (Section 8.1) [PKCS#1 v2.2] FIPS PUB 186-5 (Section 5.4) [RSASSA-PSS]
ECDSA	ECDSA	Elliptic Curve [selection: P-384, P-521], per-message secret number generation [selection: extra random bits, rejection sampling, deterministic] and hash function using [selection: SHA-384, SHA-512]	[selection: ISO/IEC 14888-3:2018 (Subclause 6.6), FIPS PUB 186-5 (Sections 6.3.1, 6.4.1)] [ECDSA] NIST SP-800 186 (Section 4) [NIST Curves]
ML-DSA	ML-DSA Signature Generation	Parameter set = ML-DSA-87	NIST FIPS 204 (Section 5.2)

**Application Note:** The ST author should choose the algorithm implemented to perform digital signatures; if more than one algorithm is available, this requirement should be iterated to specify the

functionality. For the algorithm chosen, the **ST** author should make the appropriate assignments and selections to specify the parameters that are implemented for that algorithm.

## Evaluation Activities ▾

### FCS\_COP.1/SigGen

#### TSS

The evaluator shall examine the **TSS** and verify that any hash function is the appropriate security strength for the signing algorithm.

The evaluator shall examine the **TSS** to verify that any one-time values such as nonces or masks are constructed and used in accordance with the relevant standards.

The evaluator shall examine the **TSS** to verify that the **TOE** has appropriate measures in place to ensure that hash-based signature algorithms do not reuse private keys.

#### Guidance

There are no additional Guidance evaluation activities for this component.

#### Tests

The following tests are conditional based on the selections made in the **SER**. The evaluator shall perform the following tests or witness respective tests executed by the developer. The tests must be executed on a platform that is as close as practically possible to the operational platform (but which may be instrumented in terms of, for example, use of a debug mode). Where the test is not carried out on the **TOE** itself, the test platform shall be identified and the differences between test environment and **TOE** execution environment shall be described.

### RSA-PKCS Signature Generation

Identifier	Cryptographic Algorithm Parameters	Cryptographic Key Sizes	List of Standards
RSA-PKCS	RSASSA-PKCS1-v1_5	Modulus of size [ <b>selection:</b> 3072, 4096, 6144, 8192] bits, hash [ <b>selection:</b> SHA-384, SHA-512]	<b>RFC 8017 (Section 8.2) [PKCS #1 v2.2]</b> <b>NIST FIPS PUB 186-5 (Section 5.4) [RSASSA-PKCS1-v1_5]</b>

To test the **TOE**'s ability to perform RSA Digital Signature Generation using PKCS1-v1,5 signature type, the evaluator shall perform the Generated Data Test using the following input parameters:

- Modulus size [3072, 4096, 6144, 8192] bits
- Hash algorithm [SHA-384, SHA-512]

#### Generated Data Test

For each supported combination of the above parameters, the evaluator shall cause the **TOE** to generate three test cases using random data. The evaluator shall compare the results against those from a known good implementation.

### RSA-PSS Signature Generation

Identifier	Cryptographic Algorithm Parameters	Cryptographic Key Sizes	List of Standards
RSA-PSS	RSASSA-PSS	Modulus of size [ <b>selection:</b> 3072, 4096, 6144, 8192] bits, hash [ <b>selection:</b> SHA-384, SHA-512], Salt Length ( <i>sLen</i> ) such that [ <b>assignment:</b> $0 \leq sLen \leq hLen$ (Hash Output Length)] and Mask Generation Function = MGF1	<b>RFC 8017 (Section 8.2) [PKCS #1 v2.2]</b> <b>NIST FIPS PUB 186-5 (Section 5.4) [RSASSA-PSS]</b>

To test the **TOE**'s ability to perform RSA Digital Signature Generation using PSS signature type, the evaluator shall perform the Generated Data Test using the following input parameters:

- Modulus size [3072, 4096, 6144, 8192] bits
- Hash algorithm [SHA-384, SHA-512]

- Salt length [Fixed based on implementation]
- Mask function [MGF1]

### **Generated Data Test**

For each supported combination of the above parameters, the evaluator shall cause the *TOE* to generate three test cases using random data. The evaluator shall compare the results against those from a known good implementation.

### **ECDSA Signature Generation**

<b>Identifier</b>	<b>Cryptographic Algorithm Parameters</b>	<b>Cryptographic Key Sizes</b>	<b>List of Standards</b>
ECDSA	ECDSA	Elliptic Curve [ <b>selection:</b> P-384, P-521], per-message secret number generation [ <b>selection:</b> extra random bits, rejection sampling, deterministic] and hash function using [ <b>selection:</b> SHA-384, SHA-512]	[ <b>selection:</b> ISO/IEC 14888-3:2018 (Subclause 6.6), NIST FIPS PUB 186-5 (Sections 6.3.1, 6.4.1) [ECDSA] NIST SP-800 186 (Section 4) [NIST Curves]]

To test the *TOE*'s ability to perform ECDSA Digital Signature Generation using extra random bits or rejection sampling for secret number generation, the evaluator shall perform the Algorithm Functional Test using the following input parameters:

- Elliptic Curve [P-384, P-521]
- Hash algorithm [SHA-384, SHA-512]

To test the *TOE*'s ability to perform ECDSA Digital Signature Generation using deterministic secret number generation, the evaluator shall perform the Algorithm Functional Test using the following input parameters:

- Elliptic Curve [P-384, P-521]
- Hash algorithm [SHA-384, SHA-512]

### **Algorithm Functional Test**

For each supported combination of the above parameters, the evaluator shall cause the *TOE* to generate 10 test cases using random data. The evaluator shall compare the results against those from a known good implementation.

### **ML-DSSA Signature Generation**

<b>Identifier</b>	<b>Cryptographic Algorithm Parameters</b>	<b>Cryptographic Key Sizes</b>	<b>List of Standards</b>
ML-DSSA	ML-DSSA SigGen	Parameter set = ML-DSSA-87	NIST FIPS PUB 204 (Section 5.2)

To test the *TOE*'s ability to generate digital signatures using ML-DSSA, the evaluator shall perform the Algorithm Functional Test using the following input parameters:

- Parameter set [ML-DSSA-87]
- Seed [32 random bytes] (for non-deterministic signature testing), or
- Seed [32 zero bytes] (for deterministic signature testing)
- Message to sign [8-65535] bytes
- Mu value (if generated externally)
- Previously generated private key (sk)
- Context (for external interface testing)

### **Algorithm Functional Test**

For each combination of supported parameter set and capabilities, the evaluator shall require the implementation under test to generate 15 signatures pairs using 15 different randomly generated 32-byte seed values. To determine correctness, the evaluator shall compare the resulting key pairs with those generated using a known good implementation using the same inputs.

### **Known Answer Test for Rejection Cases**

For each supported parameter set, the evaluator shall cause the *TOE* to generate signatures using the data below and a deterministic seed of all 0's. Correctness is determined by comparing the hash of the resulting signature with the hash in the fourth row for each corresponding test case below.

The test values are defined as follows:

- Seed is the seed to generate the key pair ( $pk$ ,  $sk$ )
- Hash of keys is computed by SHA-256( $pk||sk$ )
- Message is the message to be signed
- Hash of sig is computed by SHA-256(sig)

### ML-DSA-87 Test Cases for Rejection Cases

#### Test case 87-RC-01

Seed: E4F5AFCF697E0EC3C1BDEB66FAA903221E803902F9C3F716E1056A63D77DC250  
Hash of Keys: 61618E8DDA6998072C8EB36974E03880D741CAF0BD523356DFC161E7C9E63934  
Message: F4F1C05004D5B946F69EAEF104C4020519086ADD89582A20FDE887D13DFC36B1  
Hash of sig: B584E38FA442FC3C81A147D4DBBF058D73C822CAF5CA4C06B0110867F60A8001

#### Test case 87-RC-02

Seed: 8B828D871254D6C57384A8E7025AA3F7160CAD1D2C754499DF3844426062C3DD  
Hash of Keys: BB64481317D6C0DBAD20C0C7EF11078AD54E5D574F4A07652115A95F77C655FA  
Message: 0F9409C5A4930C25B83FC5B77FDB5BB49C75372DE724D9C1A77DB700CF0CF154  
Hash of sig: F86B49BE9DEB2B209BDEB4E922E5939E92D38E562C44BB09AFBD67323C345192

#### Test case 87-RC-03

Seed: E693D282CACB8CE65FD4D108DA7A373F097F0AA9713550BE242AAD5B3D3E2E452  
Hash of Keys: B0BEAF56713A69BD4AB2CBE006FA5001E7B41F3AE541E05F088933AA0CC78DF  
Message: 24DABB9D57ADEBD560ED65D9451C5106D437061708F849BA53F3543CDF9AAAE0  
Hash of sig: DBF65CEFF9F96A74AAF6F3AB27B043231BE6AA04FBA2EEC987A24A00BDD6A08E

#### Test case 87-RC-04

Seed: 4002163EB8EED01A8E0919BA8C07D291341EDCAE25B02B9779A2CFFE50561AF0  
Hash of Keys: FED1BE685C20ECB322FC40D41DEE7E0E98D0409FBF989CAE71B8AD2D58AD645E  
Message: EE316BB5EBED53325B4A55571C60657B53E353B51B831F4A0BBB28107EBA4BA8  
Hash of sig: 3BE9B5545FDCED92547B3409C83B3312CCB5792A8EC3A4DA63BA692C79BEF17C

#### Test case 87-RC-05

Seed: 9C7AD524F65854C27E565BCEDF8E6D650F13A40D0448F9AE10C05F10F777120  
Hash of Keys: 0EA872CA5A4BEA94F4E8EF7ED31800727899A51059FDEE111E5CB15F0233B534  
Message: CE09831294AA96CAF684B9E667947B021C57B24C138EC7D4DA270694C82F2E08  
Hash of sig: 3B9526CEE6587F2418BFE603ADB0F7DF0D69EBA31C9F9F005C60C993945EBD33

#### Test case 87-RC-06

Seed: 2EB7676D4A28700DA7772A7A035EB495CAA6F842352A74824EF5FD891BC38B2A  
Hash of Keys: D5B73703A1DDC5BCB0D14AE39B193A25D6ADA6535827973181ADB0BE70435A5B  
Message: C2B3A0AC483A5517682285C205974B2A506946448A8F7D3E1934C155EFDDE922  
Hash of sig: 375D598704B722C8A1FEF1626FD7738A532C06329AA4217357460E3B729660F8

#### Test case 87-RC-07

Seed: E4E80CCE8B26DF1B02B99949851EE2F907FE4F0CC34790352C76D5D91634D073  
Hash of Keys: 84B7E61684A12698400B9E9A332EA3C4FBCFA47FE37FD6AE725CBC5FA8A99D3F  
Message: 89E6AB43C9CB1CC59C3986D53217A558357E62102A26F666F2B64CD1DBB7A536  
Hash of sig: 7C4AABD163CAEF8F6EBFDA3E3EEBC0A9604675B0E991ABA0D284F1AE8BA07B2A

#### Test case 87-RC-08

Seed: 5787262B803499223D4E5A8C1EE572E89F7A69B359B3F8505355B0BDEAB95E5C  
Hash of Keys: 85AE1DE605A7B479C02730BF4B7DD6D0FD8FFE5C980893CA6DAD00BD8BD1CE68  
Message: D3230C4E061964BFB177024320D536FC1E83D1068F8CCA84044776E3B5C55  
Hash of sig: D3ABE460EE2DD9595F413CFE2780A319E4E4DFD6592995298A7AB0B82A5E2815

#### Test case 87-RC-09

Seed: CE099B99330537DD153052243FC32ACAD509A126AB982410258858567D410D79  
Hash of Keys: E04A9F15EDF8078EB336CE624249E2A8EDF2CDBF6A8276E9F5E92ED9B0BAE8  
Message: 0035931762665F561A1B22176567E3B10FDE2441521F77030733A8E39312EEE  
Hash of sig: 3EEF413CB5EB179896ECA172D0DBF9B251545DC561D61580BD5BBC8B6D734E1

#### Test case 87-RC-10

Seed: FC8F2929878CBD81E1CC23913F290380120C043A4A8A251AEEBF09705B8E590  
Hash of Keys: 7E2ECCA86F532E8E8092FEBB6E0007F92E7909AD2BCBE2E02AB375DAC9969E5E  
Message: D3C28875D2671C0EF23BFD8869F8ECF8868D3F0561C3134D254F7479D0CE0E5  
Hash of sig: EB69A908EDCC04320A0B61AD57E21B044465F2037698636B64229CF2DB259789

### Known Answer Test for Large Number of Rejection Cases (Total Rejection Count)

For each supported parameter set, the evaluator shall cause the TQE to generate signatures using the data below and a deterministic seed of all 0's. Correctness is determined by comparing the hash of the resulting signature with the hash in the fourth row of the corresponding test case below.

### ML-DSA-87 Test Cases for Total Rejection Count

#### Test case 87-LN-01

Seed: 98B6298051D92BF37293C93C97370747BF527B87B1F6C4264182F45155ADE4C  
Hash of Keys: 04A135B5C9B7020332C7B16E7108E8FF7FC1EAE1C23C5FA0B5D5CED0FEEE7424  
Message: D7B0341269259083ABF3C8DC47559A19D57669B448E0224F376DC43E577A3D8  
Hash of sig: 58D72D76EC0FB65FBF9893C4479366B79DD7B8B7577E4291D13514FCC76C26DD

#### Test case 87-LN-02

Seed: DFB5BDD90F58571DCA962426C623F13D046BBE814D183886AC90D143EAD725A7  
Hash of Keys: 2B6AB8CFCCCC41F759CAF01932E9413F5DC6D949BC827F739866929683FB155E

*Message:* 21005DB2B583CC826A9684BFFD0EE00AB97E0479FE4A1D266699337540145778  
*Hash of sig:* C93EA34E00FFF3CECA072D5FB038A83B5539CAF7B831AEDCFA785E50B3CA5E

*Test case 87-LN-03*

*Seed:* 5AD414E0DD0EF2FE685F342871875FDF06F503717A86C3B3466565ADD2096417  
*Hash of Keys:* BD9C2D52F3FC78DB17E682DA2E78947ECFC0898333838D60C892700B2B0DDA9F  
*Message:* 29139C279816B25F2D6BB52C8247D163544F7BA332C3CF63359B9E23FBC56515  
*Hash of sig:* DB4BE2DE19FB40437BDB7E9B6578D665DB05B4E88C16907DF4546EBA9BE03AEA

*Test case 87-LN-04*

*Seed:* 484DD2F406A4D15F49A91AD5F3BDC1D0FF253622EB68F83D6E1C870D0E89E29  
*Hash of Keys:* A719DC9A77C91C4629555C2353BA0CBEA513DA9A92A5C34D2E949EFF46A12D8  
*Message:* 6AD6E959F0EA60126364FB7C95FA71133F246A9265A11B4965EE78AB0CB5AF0E  
*Hash of sig:* 5050D7A665074EC63D9F3966C1F01A1BFB18F9E83AE0B09F838BC1E2342EDF4

*Test case 87-LN-05*

*Seed:* B25C1816F82D59940D5CB829BAC364AAD013C4C16415CE1CF6DCC2F15199B391  
*Hash of Keys:* ADBB2CD43F222640BD9FF4E61C80E63853E8DC1F759C581B7447C9C166EAA38E  
*Message:* 824E47322895BFFE37B6B4FC41CF6115C07EEC0C24EB81076C87A1B01AE8617  
*Hash of sig:* 667ADA46073BC69D64DC47BB9A76DD0D78302E7415D87D5E816B05FB95F9E84D

*Test case 87-LN-06*

*Seed:* B2CE72B3560AF07E06465881F56ADA00262BA708D87B73F39E04E310F3B8A3E9  
*Hash of Keys:* FD9C4AC53AE803242A62D933B8E8BAD6CE5207AC4A73683B6D9383B5E70B17A  
*Message:* A1501CC84C917E0D2D7C27C2AC38220BDB8FFF807DB38E37A9E429EC2781911  
*Hash of sig:* 779553B195E11558E59EF3942F5F6B446A2144600D1F4F50B300C6C56504760

*Test case 87-LN-07*

*Seed:* AB01D0E591B7DDCD3C03395AE808FA2763C0A486D44119D621BE0FD0B022B25  
*Hash of Keys:* 93B6ADE34F78A4ADB36B2F6D2C51DB793E659E1243E80488AE1C03B65125D6D7  
*Message:* 8DE8122D89D15FE844C34F6B59B2C4B11F33B6A053154D199B634F557FDF5F6  
*Hash of sig:* 0483045999A79B583F403DB96A736F0F0B24E2DFBC4E5CFA9B50E3D910786F07

*Test case 87-LN-08*

*Seed:* 15D60D3693762F82C9AC1DCB0576936651AC81D863842EDB91109C8EE83AE705  
*Hash of Keys:* 2DF544E2E939AA717741C2437288FAEB398DEB8FF37A2652FAE34BAE8B84D779  
*Message:* F05946A6113905C34163AEF2246FD69016CE24A7BA40F8E7E42EDAC2D0A44605  
*Hash of sig:* F8383917AF79C8E540D2356AB05F08B465BF32DFEC444B787CE31BF48CC6C3DD

*Test case 87-LN-09*

*Seed:* 21212285BED53B3411705DAF5F3BDB6F0618EB571B36EE11A74053407A269F5  
*Hash of Keys:* 737061155A9A03F11F9FEBB940BED4DD54542C4A6212F89A5EB4EC2BE542782  
*Message:* FFE38246BF3DEF94CAD15CC17CEA511C067D582E04227B479E32F9197CF91482  
*Hash of sig:* C4C12C58032052FB2D21F0C6A7388A63154FB85B74287D2859DE6C1C6F7F277B

*Test case 87-LN-10*

*Seed:* A2744470587C71BA43EC26DC390CE3531978F315993C653E5D3EFD2849D5D9F1  
*Hash of Keys:* B1BF37BFFB11531B6ADD697870D7DB2E2462D0A97A63F09C1D0038457C6D795A  
*Message:* 9831A830231A160B9847203341A5F30BF3E87A2A482AEEA6886315C92B5C4E4C  
*Hash of sig:* 46C669D2FEB643A38E54FF87B790C33F44043A1B6B31DB9474D301328CA2A7F

## FCS\_COP.1/SigVer Cryptographic Operation - Signature Verification

### FCS\_COP.1.1/SigVer

The TSF shall [selection: invoke platform-provided functionality, implement functionality] to perform [digital signature verification] in accordance with a specified cryptographic algorithm [selection: Cryptographic Algorithm] and cryptographic key sizes [selection: Cryptographic Key Sizes] that meet the following: [selection: List of Standards]

The following table provides the allowable choices for completion of the selection operations in FCS\_COP.1/SigVer.

Table 14: Allowable choices for FCS\_COP.1/SigVer

Identifier	Cryptographic Algorithm	Cryptographic Key Sizes	List of Standards
RSA-PKCS	RSASSA-PKCS1-v1_5	Modulus of size [selection: 3072, 4096, 6144, 8192] bits and hash [selection: SHA-384, SHA-512]	RFC 8017 (Section 8.2) [PKCS #1 v2.2] FIPS PUB 186-5 (Section 5.4) [RSASSA-PKCS1-v1_5]

RSA-PSS	RSASSA-PSS	Modulus of size [ <b>selection</b> : 3072, 4096, 6144, 8192] bits and hash [ <b>selection</b> : SHA-384, SHA-512]	RFC 8017 (Section 8.1) [PKCS#1 v2.2] FIPS PUB 186-5 (Section 5.4) [RSASSA-PSS]
ECDSA	ECDSA	Elliptic Curve [ <b>selection</b> : P-384, P-521] using hash [ <b>selection</b> : SHA-384, SHA-512]	[ <b>selection</b> : ISO/IEC 14888-3:2018 (Subclause 6.6), FIPS PUB 186-5 (Section 6.4.2)] [ECDSA] NIST SP-800 186 (Section 4) [NIST Curves]
LMS	LMS	Private key size = [ <b>selection</b> : • 192 bits with [ <b>selection</b> : SHA-256/192, SHAKE256/192] • 256 bits with [ <b>selection</b> : SHA-256, SHAKE256]] Winternitz parameter = [ <b>selection</b> : 1, 2, 4, 8] Tree height = [ <b>selection</b> : 5, 10, 15, 20, 25]	RFC 8554 [LMS] NIST SP 800-208 [parameters]
XMSS	XMSS	Private key size = [ <b>selection</b> : • 192 bits with [ <b>selection</b> : SHA-256/192, SHAKE256/192] • 256 bits with [ <b>selection</b> : SHA-256, SHAKE256]] Tree height = [ <b>selection</b> : 10, 16, 20]	RFC 8391 [XMSS] NIST SP 800-208 [parameters]
ML-DSA	ML-DSA Signature Verification	Parameter set = ML-DSA-87	NIST FIPS 204 (Section 5.3)

**Application Note:** The ST author should choose the algorithm implemented to perform digital signatures; if more than one algorithm is available, this requirement should be iterated to specify the functionality. For the algorithm chosen, the ST author should make the appropriate assignments and selections to specify the parameters that are implemented for that algorithm.

## Evaluation Activities ▾

### FCS\_COP.1/SigVer

#### TSS

The evaluator shall examine the TSS to verify that any one-time values such as nonces or masks are constructed and used in accordance with the relevant standards.

#### Guidance

There are no additional Guidance evaluation activities for this component.

#### Tests

The following tests are conditional based on the selections made in the SFR. The evaluator shall perform the following tests or witness respective tests executed by the developer. The tests must be executed on a platform that is as close as practically possible to the operational platform (but which may be instrumented in terms of, for example, use of a debug mode). Where the test is not carried out on the TOE itself, the test platform shall be identified and the differences between test environment and TOE execution environment shall be described.

### RSA-PKCS Signature Verification

Identifier	Cryptographic Algorithm Parameters	Cryptographic Key Sizes	List of Standards
------------	------------------------------------	-------------------------	-------------------

RSA-PKCS	RSASSA-PKCS1-v1_5	Modulus of size [ <b>selection:</b> 3072, 4096, 6144, 8192] bits, hash [ <b>selection:</b> SHA-384, SHA-512]	RFC 8017 (Section 8.2) [PKCS #1 v2.2] NIST FIPS PUB 186-5 (Section 5.4) [RSASSA-PKCS1-v1_5]
----------	-------------------	--------------------------------------------------------------------------------------------------------------	------------------------------------------------------------------------------------------------

To test the TOE's ability to perform RSA Digital Signature Verification using PKCS1-v1,5 signature type, the evaluator shall perform Generated Data Test using the following input parameters:

- Modulus size [3072, 4096, 6144, 8192] bits
- Hash algorithm [SHA-384, SHA-512]

#### Generated Data Test

For each supported combination of the above parameters, the evaluator shall cause the TOE to generate six test cases using a random message and its signature such that the test cases are modified as follows:

- One test case is left unmodified
- For one test case the Message is modified
- For one test case the Signature is modified
- For one test case the exponent (e) is modified
- For one test case the IR is moved
- For one test case the Trailer is moved

The TOE must correctly verify the unmodified signatures and fail to verify the modified signatures.

#### RSA-PSS Signature Verification

Identifier	Cryptographic Algorithm Parameters	Cryptographic Key Sizes	List of Standards
RSA-PSS	RSASSA-PSS	Modulus of size [ <b>selection:</b> 3072, 4096, 6144, 8192] bits, hash [ <b>selection:</b> SHA-384, SHA-512]	RFC 8017 (Section 8.2) [PKCS #1 v2.2] NIST FIPS PUB 186-5 (Section 5.4) [RSASSA-PSS]

To test the TOE's ability to perform RSA Digital Signature Verification using PSS signature type, the evaluator shall perform the Generated Data Test using the following input parameters:

- Modulus size [3072, 4096, 6144, 8192] bits
- Hash algorithm [SHA-384, SHA-512]
- Salt length [0-hash length]
- Mask function [MGF1]

#### Generated Data Test

For each supported combination of the above parameters, the evaluator shall cause the TOE to generate six test cases using random data such that the test cases are modified as follows:

- One test case is left unmodified
- For one test case the Message is modified
- For one test case the Signature is modified
- For one test case the exponent (e) is modified
- For one test case the IR is moved
- For one test case the Trailer is moved

The TOE must correctly verify the unmodified signatures and fail to verify the modified signatures.

#### ECDSA Signature Verification

Identifier	Cryptographic Algorithm Parameters	Cryptographic Key Sizes	List of Standards
ECDSA	ECDSA	Elliptic Curve [ <b>selection:</b> P-384, P-521] and hash function using	[ <b>selection:</b> ISO/IEC 14888-3:2018 (Subclause 6.6), NIST FIPS PUB 186-5

		<i>[selection: SHA-384, SHA-512]</i>	(Sections 6.3.1, 6.4.1] [ECDSA] NIST SP-800 186 (Section 4) [NIST Curves]
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To test the *TOE*'s ability to perform ECDSA Digital Signature Verification, the evaluator shall perform the Algorithm Functional Test using the following input parameters:

- Elliptic Curve [P-384, P-521]
- Hash algorithm [SHA-384, SHA-512]

#### Algorithm Functional Test

For each supported combination of the above parameters, the evaluator shall cause the *TOE* to generate test cases consisting of messages and signatures such that the 21 test cases are modified as follows:

- Three test cases are left unmodified
- For three test cases the Message is modified
- For three test cases the key is modified
- For three test cases the r value is modified
- For three test cases the s value is modified
- For three test cases the value r is zeroed
- For three test cases the value s is zeroed

The *TOE* must correctly verify the unmodified signatures and fail to verify the modified signatures.

#### LMS Signature Verification

Identifier	Cryptographic Algorithm Parameters	Cryptographic Key Sizes	List of Standards
LMS	LMS	Private key size = <i>[selection: 192 bits with [selection: SHA256/192, SHAKE256/192], 256 bits with [selection: SHA-256, SHAKE256] ]</i> , Winternitz parameter = <i>[selection: 1, 2, 4, 8]</i> , and tree height = <i>[selection: 5, 10, 15, 20, 25]</i>	RFC 8554 [LMS] NIST SP 800-208 [parameters]

To test the *TOE*'s ability to verify cryptographic digital signature using LMS, the evaluator shall perform the Algorithm Functional Test using the following input parameters:

- Hash algorithm [SHA-256/192, SHAKE256/192, SHA-256, SHAKE256]
- Winternitz [1, 2, 4, 8]
- Tree height [5, 10, 15, 20, 25]

#### Algorithm Functional Test

For each supported combination of the above parameters, the evaluator shall generate four test cases consisting of signed messages and keys, such that

- One test case is unmodified (i.e. correct)
- For one test case modify the message, i.e. the message is different
- For one test case modify the signature, i.e. signature is different
- For one test case modify the signature header so that it is a valid header for a different LMS parameter set.

The *TOE* must correctly verify the unmodified test case and fail to verify the modified test cases.

#### XMSS Signature Verification

Identifier	Cryptographic Algorithm Parameters	Cryptographic Key Sizes	List of Standards
XMSS	XMSS	Private key size = <i>[selection: 192 bits with [selection: SHA256/192, SHAKE256/192], 256 bits with [selection: SHA-256, SHAKE256] ]</i> , and tree height = <i>[selection: 10, 16, 20]</i>	RFC 8391 [XMSS] NIST SP 800-208 [parameters]

To test the **TQE**'s ability to verify digital signatures using XMSS or XMSS MT, the evaluator shall perform the XMSS digital signature verification test using the following input parameters:

- Hash algorithm [SHA-256/192, SHAKE256/192, SHA-256, SHAKE256]
- Tree height [10, 16, 20]

### **XMSS Digital Signature Verification Test**

For each supported combination of the above parameters, the evaluator shall generate four test cases consisting of signed messages and keys, such that

- One test case is unmodified (i.e. correct)
- For one test case modify the message, i.e. the message is different
- For one test case modify the signature, i.e. signature is different
- For one test case modify the signature header so that it is a valid header for a different XMSS parameter set

The evaluator shall verify the correctness of the implementation by verifying that the **TQE** correctly verifies the unmodified test case and fails to verify the modified test cases.

### **ML-DSA Signature Verification**

<b>Identifier</b>	<b>Cryptographic Algorithm Parameters</b>	<b>Cryptographic Key Sizes</b>	<b>List of Standards</b>
ML-DSA	ML-DSA SigVer	Parameter set = ML-DSA-87	NIST FIPS PUB 204 (Section 5.2)

To test the **TQE**'s ability to validate digital signatures using ML-DSA, the evaluator shall perform the Algorithm Functional Test using the following input parameters:

- Parameter set [ML-DSA-87]
- Previously generated signed Message [8-65535] bytes
- Mu value (if generated externally)
- Context (for external interface testing)
- Previously generated public key (pk)
- Previously generated Signature

### **Algorithm Functional Test**

For each combination of supported parameter set and capabilities, the evaluator shall require the implementation under test to validate 15 signatures. Each group of 15 test cases is modified as follows:

- Three test cases are left unmodified
- For three test cases the Signed message is modified
- For three test cases the component of the signature that commits the signer to the message is modified
- For three test cases the component of the signature that allows the verifier to construct the vector z is modified
- For three test cases the component of the signature that allows the verifier to construct the hint array is modified

The **TQE** must correctly verify the unmodified signatures and fail to verify the modified signatures.

## **FCS\_COP.1/SKC Cryptographic Operation - Encryption/Decryption**

**This is a selection-based component. Its inclusion depends upon selection from .**

### **FCS\_COP.1.1/SKC**

The **TSF** shall [selection: invoke platform-provided functionality, implement functionality] to perform [symmetric-key encryption and decryption] in accordance with a specified cryptographic algorithm [selection: Cryptographic Algorithm] and cryptographic key sizes [selection: Cryptographic Key Sizes] that meet the following: [selection: List of Standards]

The following table provides the allowable choices for completion of the selection operations in **FCS\_COP.1/SKC**.

**Table 15: Allowable choices for FCS\_COP.1/SKC**

<b>Identifier</b>	<b>Cryptographic Algorithm</b>	<b>Cryptographic Key Sizes</b>	<b>List of Standards</b>
-------------------	--------------------------------	--------------------------------	--------------------------

AES-CBC	AES in CBC mode with non-repeating and unpredictable IVs	256 bits	[selection: ISO/IEC 18033-3:2010 (Subclause 5.2), FIPS PUB 197] [AES]
			[selection: ISO/IEC 10116:2017 (Clause 7), NIST SP 800-38A] [CBC]

## Evaluation Activities ▾

### FCS\_COP.1/SKC

#### TSS

The evaluator shall examine the TSS to ensure that it describes the construction of any IVs, tweak values, and counters in conformance with the relevant specifications.

If XTS-AES is claimed then the evaluator shall examine the TSS to verify that the TOE creates full-length keys by methods that ensure that the two key halves are different and independent.

#### Guidance

There are no additional Guidance evaluation activities for this component.

#### Tests

The following tests require the developer to provide access to a test platform that provides the evaluator with tools that are typically not found on factory products.

The following tests are conditional based on the selections made in the SFR. The evaluator shall perform the following tests or witness respective tests executed by the developer. The tests must be executed on a platform that is as close as practically possible to the operational platform (but which may be instrumented in terms of, for example, use of a debug mode). Where the test is not carried out on the TOE itself, the test platform shall be identified and the differences between test environment and TOE execution environment shall be described.

#### AES-CBC

Identifier	Cryptographic Algorithm	Cryptographic Key Sizes	List of Standards
AES-CBC	AES in CBC mode with non-repeating and unpredictable IVs	256 bits	[selection: ISO/IEC 18033-3:2010 (Subclause 5.2), FIPS PUB 197] [AES] [selection: ISO/IEC 10116:2017 (Clause 7), NIST SP 800-38A] [CBC]

To test the TOE's ability to encrypt and decrypt data using AES in CBC mode, the evaluator shall perform Algorithm Functional Tests and Monte Carlo Tests using the following input parameters:

- Key size [256] bits
- Direction [encryption, decryption]

#### Algorithm Functional Tests

Algorithm Functional Tests are designed to verify the correct operation of the logical components of the algorithm implementation under normal operation using different block sizes. For AES-CBC, there are two types of AFTs:

#### Known-Answer Tests

For each combination of direction and claimed key size, the TOE must be tested using the GFSBox, KeySbox, VarTxt, and VarKey test cases listed in Appendixes B through E of The Advanced Encryption Standard Algorithm Validation Suite (AESAVS), NIST, 15 November 2002.

#### Multi-Block Message Tests

For each combination of direction and claimed key size, the TOE must be tested against 10 test cases consisting of a random IV, random key, and random plaintext or ciphertext. The plaintext or ciphertext starts with a length of 16 bytes and increases by 16 bytes for each test case until reaching 160 bytes.

#### Monte Carlo Tests

Monte Carlo tests are intended to test the implementation under strenuous conditions. The *TOE* must process the test cases according to the following algorithm once for each combination of direction and key size:

```

Key[0] = Key
IV[0] = IV
PT[0] = PT
for i = 0 to 99 {
    Output Key[i], IV[i], PT[0]
    for j = 0 to 999 {
        if (j == 0) {
            CT[j] = AES-CBC-Encrypt(Key[i], IV[i], PT[j])
            PT[j+1] = IV[i]
        } else {
            CT[j] = AES-CBC-Encrypt(Key[i], PT[j])
            PT[j+1] = CT[j-1]
        }
    }
    Output CT[j]
    AES_KEY_SHUFFLE(Key, CT)
    IV[i+1] = CT[j]
    PT[0] = CT[j-1]
}

```

where

*AES\_KEY\_SHUFFLE*

is defined as:

```

If (keylen = 128)
    Key[i+1] = Key[i] xor MSB(CT[j], 128)
If (keylen = 192)
    Key[i+1] = Key[i] xor (LSB(CT[j-1], 64) || MSB(CT[j], 128))
If (keylen = 256)
    Key[i+1] = Key[i] xor (MSB(CT[j-1], 128) || MSB(CT[j], 128))

```

The above pseudocode is for encryption. For decryption, swap all instances of *CT* and *PT*.

The initial *IV*, *key*, and *plaintext* or *ciphertext* should be random.

The evaluator shall test the decrypt functionality using the same test as above, exchanging *CT* and *PT*, and replacing AES-CBC-Encrypt with AES-CBC-Decrypt.

## FCS\_COP.1/XOF Cryptographic Operation - Extendable-Output Function

This is a selection-based component. Its inclusion depends upon selection from [FCS\\_CKM.1.1/AKG](#), [FCS\\_COP.1.1/SigVer](#).

### FCS\_COP.1.1/XOF

The *TSF* shall perform [extendable-output function] in accordance with a specified cryptographic algorithm [**selection: Cryptographic Algorithm**] and parameters [**selection: Parameters**] that meet the following: [**selection: List of Standards**]

The following table provides the allowable choices for completion of the selection operations of [FCS\\_COP.1/XOF](#).

Table 16: Allowable choices for [FCS\\_COP.1/XOF](#)

Cryptographic Algorithm	Parameters	List of Standards
SHAKE	Functions = [SHAKE128, SHAKE256]	NIST FIPS PUB 202 Section 6.2 [SHAKE]

**Application Note:** In accordance with CNSA 2.0, SHAKE is permitted to be used only as a component of LMS or XMSS. Therefore this component is claimed only if LMS or XMSS is claimed in [FCS\\_COP.1/SigVer](#).

Since LMS and XMSS use both SHAKE128 and SHAKE256 internally, claiming and testing of both functions is mandatory.

## Evaluation Activities

[FCS\\_COP.1/XOF](#)

## **TSS**

*There are no additional TSS evaluation activities for this component.*

## **Guidance**

*There are no additional Guidance evaluation activities for this component.*

## **Tests**

*The following tests are conditional based on the selections made in the SER. The evaluator shall perform the following tests or witness respective tests executed by the developer. The tests must be executed on a platform that is as close as practically possible to the operational platform (but which may be instrumented in terms of, for example, use of a debug mode). Where the test is not carried out on the TOE itself, the test platform shall be identified and the differences between test environment and TOE execution environment shall be described.*

## **SHAKE**

Cryptographic Algorithm	Parameters	List of Standards
SHAKE	Function = [SHAKE128, SHAKE256]	NIST FIPS PUB 202 Section 6.2 [SHAKE]

*To test the TOE's implementation of the SHAKE Extendable Output Function the evaluator shall perform the Algorithm Functional Test, Monte Carlo Test, and Variable Output Test using the following input parameters:*

- Function [SHAKE128, SHAKE256]
- Output length [16-65536] bits

### **Algorithm Functional Test**

*For each supported function, generate test cases consisting of random data for every message length from 0 bits (if supported) to rate -1 bits, where rate equals*

- 1344 for SHAKE128, and
- 1088 for SHAKE256.

*Additionally, generate test cases of random data for messages of every multiple of (rate+1) bits starting at length rate, and continuing until 65535 is exceeded. For SHAKE128, this should result in a total of 1391 test cases.*

### **Monte Carlo Test**

*The Monte Carlos test takes in a single 128-bit message (SEED) and desired output length in bits, and runs 100 iterations of the chained computation. MaxOutBytes and MinOutBytes are the largest and smallest supported input and output sizes in bytes, respectively.*

```

Range = maxOutBytes - minOutBytes + 1
OutputLen = maxOutBytes
For j = 0 to 99
MD[0] = SEED
For i = 1 to 1000
MSG[i] = 128 leftmost bits of MD[i-1]
if (MSG[i] < 128 bits)
Append 0 bits on rightmost side of MSG[i] til MSG[i] is 128 bits
MD[i] = SHAKE(MSG[i], OutputLen * 8)

RightmostOutputBits = 16 rightmost bits of MD[i] as an integer
OutputLen = minOutBytes + (RightmostOutputBits % Range)
Output MD[1000], OutputLen
SEED = MD[1000]

```

### **Variable Output Test**

*This test measures the ability of the TOE to generate output digests of varying sizes.*

*The evaluator shall generate 512 test cases such that the input for each test case consists of 128- bits of random data, and the output length includes the minimum supported value, the maximum supported value, and 510 random values between the minimum and maximum digest sizes supported by the implementation.*

## **FCS\_HTTPS\_EXT.1 HTTPS Protocol**

*This is a selection-based component. Its inclusion depends upon selection from [FPT\\_ITT.1.1/INTER\\_XFER](#), [FPT\\_ITT.1.1/INTER\\_XFER\\_AGENT](#), [FTP\\_ITC.1.1/INTER\\_TSF\\_XFER\\_AGENT](#), [FTP\\_ITC.1.1/INTER\\_XFER\\_IT](#),*

### FCS\_HTTPS\_EXT.1.1

The TSF shall [selection: invoke platform-provided functionality to implement, implement] the HTTPS protocol that complies with RFC 2818.

### FCS\_HTTPS\_EXT.1.2

The TSF shall [selection: invoke platform-provided functionality to implement, implement] HTTPS using TLS in accordance with the Functional Package for Transport Layer Security.

**Application Note:** The requirement is claimed if the TSF selects HTTPS in any iteration of FPT\_ITT.1, FPT\_ITC.1, or FTP\_TRP.1. It is expected that if the TOE invokes platform-provided functionality to perform HTTPS, that the platform implementation of HTTPS is conformant to the functional package.

## Evaluation Activities ▾

### [FCS\\_HTTPS\\_EXT.1](#)

#### TSS

The evaluator shall verify that the TSS describes whether the TOE's HTTPS functionality is implemented by the TOE or invoked from the TOE platform. If the TOE implements HTTPS, the evaluator shall verify that the corresponding claims from the TLS Functional Package (client, server, or both) are present.

#### Guidance

There are no additional Guidance evaluation activities for this component.

#### Tests

- Test FCS\_HTTPS\_EXT.1.1: The evaluator shall attempt to establish an HTTPS connection with a web server, observe the traffic with a packet analyzer, and verify that the connection succeeds and that the traffic is identified as TLS or HTTPS.

Other tests are performed in conjunction with the TLS evaluation activities.

### FCS\_IV\_EXT.1 Initialization Vector Generation

This is a selection-based component. Its inclusion depends upon selection from [FCS\\_STG\\_EXT.1.1](#).

### FCS\_IV\_EXT.1.1

The TSF shall [selection: invoke platform-provided functionality, implement functionality] to generate IVs in accordance with [Table 17](#).

**Application Note:** This requirement must be included in the ST if the selection in [FCS\\_STG\\_EXT.1](#) indicates that the TSF is protecting private keys and persistent secrets with encryption rather than the platform-provided key storage.

[Table 17](#) lists the requirements for composition of IVs according to the corresponding NIST Special Publications for each cipher mode. The composition of IVs generated for encryption according to a cryptographic protocol is addressed by the protocol. Thus, this requirement addresses only IVs generated for key storage encryption.

**Table 17: References and IV Requirements for NIST-approved Cipher Modes**

Cipher Mode	Reference	IV Requirement
Electronic Codebook (ECB)	SP800-38A	No IV
Counter (CTR)	SP800-38A	"Initial Counter" shall be non-repeating. No counter value shall be repeated across multiple messages with the same secret key.

Cipher Block Chaining (CBC)	SP800-38A	IVs shall be unpredictable. Repeating IVs leak information about whether the first one or more blocks are shared between two messages, so IVs should be non-repeating in such situations.
Output Feedback (OFB)	SP800-38A	IVs shall be non-repeating and shall not be generated by invoking the cipher on another IV.
Cipher Feedback (CFB)	SP800-38A	IVs should be non-repeating as repeating IVs leak information about the first plaintext block and about common shared prefixes in messages.
XOR Encrypt XOR (XEX) Tweakable Block Cipher with Ciphertext Stealing (XTS)	SP800-38E	No IV. Tweak values shall be non-negative integers, assigned consecutively, and starting at an arbitrary non-negative integer.
Cipher-based Message Authentication Code (CMAC)	SP800-38B	No IV
Key Wrap and Key Wrap with Padding	SP800-38F	No IV
Counter with CBC-Message Authentication Code (CCM)	SP800-38C	No IV. Nonces shall be non-repeating.
Galois Counter Mode (GCM)	SP800-38D	IV shall be non-repeating. The number of invocations of GCM shall not exceed $2^{32}$ for a given secret key unless an implementation only uses 96-bit IVs (default length).

## Evaluation Activities ▾

### FCS\_IV\_EXT.1

#### TSS

If "invoke platform-provided functionality" is selected:

The evaluator shall examine the TSS to verify that it describes (for each supported platform) how the IV generation is invoked for each mode selected in the MDM server's ST (it should be noted that this may be through a mechanism that is not implemented by the MDM server; nonetheless, that mechanism will be identified in the TSS as part of this evaluation activity).

If "implement functionality" is selected:

The evaluator shall examine the TSS to ensure that it details the encryption of user credentials, persistent secrets, and private keys and the generation of the IVs used for that encryption.

#### Guidance

There are no additional Guidance evaluation activities for this component.

#### Tests

The evaluator shall ensure that the generation of IVs for each key encrypted by the same KEK meets Table 17.

## FCS\_RBG.1 Random Bit Generation (RBG)

### FCS\_RBG.1.1

The TSF shall [selection: **invoke platform-provided functionality, implement functionality**] to perform all deterministic random bit generation services in accordance with NIST Special Publication 800-90A using [selection:

- Hash\_DRBG (any)
- HMAC\_DRBG (any)
- CTR\_DRBG (AES)

] in accordance with [NIST SP 800-90A] after initialization with a seed.

**Application Note:** NIST SP 800-90A contains three different methods of generating random numbers; each of these, in turn, depends on underlying cryptographic primitives (hash functions/ciphers). The **ST** author will select the function used and include the specific underlying cryptographic primitives used in the requirement or in the **TSS**.

#### FCS\_RBG.1.2

The **TSF** shall use a [**selection**: **TSF noise source** [**assignment**: name of noise source], **multiple TSF noise sources** [**assignment**: names of noise sources] , **TSF interface for seeding**] for initialized seeding.

**Application Note:** For the selection in this requirement, the **ST** author selects "TSF noise source" if a single noise source is used as input to the DRBG. The **ST** author selects "multiple TSF noise sources" if a seed is formed from a combination of two or more noise sources within the **TOE** boundary. If the **TSF** implements two or more separate DRBGs that are seeded in separate manners, this **SFR** should be iterated for each DRBG. If multiple distinct noise sources exist such that each DRBG only uses one of them, then each iteration would select "TSF noise source"; "multiple TSF noise sources" is only selected if a single DRBG uses multiple noise sources for its seed. The **ST** author selects "TSF interface for seeding" if noise source data is generated outside the **TOE** boundary.

If "TSF noise source" is selected, **FCS\_RBG.3** must be claimed.

If "multiple TSF noise sources" is selected, **FCS\_RBG.4** and **FCS\_RBG.5** must be claimed.

If "TSF interface for seeding" is selected, **FCS\_RBG.2** must be claimed.

#### FCS\_RBG.1.3

The **TSF** shall update the RBG state by [**selection**: reseeding, uninstantiating and reinstating] using a [**selection**: **TSF noise source** [**assignment**: name of noise source], **TSF interface for seeding**] in the following situations: [**selection**:

- never
- on demand
- on the condition: [**assignment**: condition]
- after [**assignment**: time]

] in accordance with [**assignment**: list of standards].

### Evaluation Activities ▾

#### **FCS\_RBG.1.1**

##### **TSS**

The evaluator shall verify that the **TSS** identifies the DRBGs used by the **TOE**.

If "invoke platform-provided functionality" is selected:

The evaluator shall examine the **TSS** to verify that it describes (for each supported platform) how the RBG functionality is invoked for each operation they are used for in the **MDM** server (it should be noted that this may be through a mechanism that is not implemented by the **MDM** server; nonetheless, that mechanism will be identified in the **TSS** as part of this evaluation activity).

##### **Guidance**

If the DRBG functionality is configurable, the evaluator shall verify that the operational guidance includes instructions on how to configure this behavior.

##### **Tests**

If "implement functionality" is selected:

The evaluator shall perform the following tests.

The evaluator shall perform 15 trials for the RNG implementation. If the RNG is configurable, the evaluator shall perform 15 trials for each configuration. The evaluator shall also confirm that the operational guidance contains appropriate instructions for configuring the RNG functionality.

If the RNG has prediction resistance enabled, each trial consists of (1) instantiate DRBG, (2) generate the first block of random bits, (3) generate a second block of random bits, and (4) uninstantiate. The evaluator verifies that the second block of random bits is the expected value. The evaluator shall generate eight input values for each trial. The first is a count (0 - 14). The next three are entropy input, nonce, and personalization string for the instantiate operation. The next two are additional input and entropy input for the first call to generate. The final two are additional input and entropy input for the second call to generate. These values are randomly generated. "generate one block of random bits" means to generate random bits with number of returned bits equal to the Output Block Length (as defined in NIST SP 800-90A).

If the RNG does not have prediction resistance, each trial consists of (1) instantiate DRBG, (2) generate the first block of random bits (3) reseed, (4) generate a second block of random bits, and (5) uninstantiate. The evaluator verifies that the second block of random bits is the expected value. The evaluator shall generate eight input values for each trial. The first is a count (0 - 14). The next three are entropy input, nonce, and personalization string for the instantiate operation. The fifth value is additional input to the first call to generate. The sixth and seventh are additional input and entropy input to the call to reseed. The final value is additional input to the second generate call.

The following paragraphs contain more information on some of the input values to be generated or selected by the evaluator.

**Entropy input:** the length of the entropy input value must equal the seed length.

**Nonce:** If a nonce is supported (CTR\_DRBG with no Derivation Function does not use a nonce), the nonce bit length is one-half the seed length.

**Personalization string:** The length of the personalization string must be less than or equal to seed length. If the implementation only supports one personalization string length, then the same length can be used for both values. If more than one string length is support, the evaluator shall use personalization strings of two different lengths. If the implementation does not use a personalization string, no value needs to be supplied.

**Additional input:** the additional input bit lengths have the same defaults and restrictions as the personalization string lengths.

The evaluator shall perform the following tests:

The evaluator shall perform 15 trials for the RNG implementation. If the RNG is configurable, the evaluator shall perform 15 trials for each configuration. The evaluator shall also confirm that the operational guidance contains appropriate instructions for configuring the RNG functionality.

If the RNG has prediction resistance enabled, each trial consists of (1) instantiate DRBG, (2) generate the first block of random bits (3) generate a second block of random bits (4) uninstantiate. The evaluator verifies that the second block of random bits is the expected value. The evaluator shall generate eight input values for each trial. The first is a count (0 - 14). The next three are entropy input, nonce, and personalization string for the instantiate operation. The next two are additional input and entropy input for the first call to generate. The final two are additional input and entropy input for the second call to generate. These values are randomly generated. "generate one block of random bits" means to generate random bits with number of returned bits equal to the Output Block Length (as defined in NIST SP 800-90A).

If the RNG does not have prediction resistance, each trial consists of (1) instantiate DRBG, (2) generate the first block of random bits (3) reseed, (4) generate a second block of random bits (5) uninstantiate. The evaluator verifies that the second block of random bits is the expected value. The evaluator shall generate eight input values for each trial. The first is a count (0 - 14). The next three are entropy input, nonce, and personalization string for the instantiate operation. The fifth value is additional input to the first call to generate. The sixth and seventh are additional input and entropy input to the call to reseed. The final value is additional input to the second generate call.

The following list contains more information on some of the input values to be generated/selected by the evaluator.

- **Entropy input:** The length of the entropy input value must equal the seed length.
- **Nonce:** If a nonce is supported (CTR\_DRBG with no Derivation Function does not use a nonce), the nonce bit length is one-half the seed length.
- **Personalization string:** The length of the personalization string must be less than or equal to seed length. If the implementation only supports one personalization string length, then the same length can be used for both values. If more than one string length is support, the evaluator shall use personalization strings of two different lengths. If the implementation does not use a personalization string, no value needs to be supplied.
- **Additional input:** The additional input bit lengths have the same defaults and restrictions as the personalization string lengths.

### [FCS\\_RB.G.1.2](#)

Documentation will be produced - and the evaluator shall perform the activities - in accordance with and the Clarification to the Entropy Documentation and Assessment Annex.

### [TSS](#)

There are no additional TSS evaluation activities for this element.

### [Guidance](#)

There are no additional Guidance evaluation activities for this element.

### [Tests](#)

There are no test activities for this element.

### [FCS\\_RB.G.1.3](#)

### [TSS](#)

The evaluator shall verify that the TSS identifies how the DRBG state is updated, and the situations under which this may occur.

**Guidance**

If the ST claims that the DRBG state can be updated on demand, the evaluator shall verify that the operational guidance has instructions for how to perform this operation.

**Tests**

There are no test activities for this element.

## FCS\_RBG.2 Random Bit Generation (External Seeding)

This is a selection-based component. Its inclusion depends upon selection from [FCS\\_RBG.1.2](#).

### FCS\_RBG.2.1

The TSF shall be able to accept a minimum input of [assignment: minimum input length greater than zero] from a TSF interface for the purpose of seeding.

**Application Note:** This requirement is claimed when a DRBG is seeded with entropy from one or more noise sources that is outside the TOE boundary. Typically the entropy produced by an environmental noise source is conditioned such that the input length has full entropy and is therefore usable as the seed. However, if this is not the case, it should be noted what the minimum entropy rate of the noise source is so that the TSF can collect a sufficiently large sample of noise data to be conditioned into a seed value.

This requirement is claimed if "TSF interface for seeding" is selected in [FCS\\_RBG.1.2](#).

### Evaluation Activities ▾

#### FCS\_RBG.2

The evaluator shall examine the entropy documentation required by [FCS\\_RBG.1.2](#) to verify that it identifies, for each DRBG function implemented by the TOE, the TSF external interface used to seed the TOE's DRBG. The evaluator shall verify that this includes the amount of sampled data and the min-entropy rate of the sampled data such that it can be determined that sufficient entropy can be made available for the highest strength keys that the TSF can generate (e.g., 256 bits). If the seed data cannot be assumed to have full entropy (e.g., the min-entropy of the sampled bits is less than 1), the evaluator shall ensure that the entropy documentation describes the method by which the TOE estimates the amount of entropy that has been accumulated to ensure that sufficient data is collected and any conditioning that the TSF applies to the output data to create a seed of sufficient size with full entropy.

**TSS**

There are no additional TSS evaluation activities for this component.

**Guidance**

There are no additional Guidance evaluation activities for this component.

**Tests**

There are no test activities for this component.

## FCS\_RBG.3 Random Bit Generation (Internal Seeding - Single Source)

This is a selection-based component. Its inclusion depends upon selection from [FCS\\_RBG.1.2](#).

### FCS\_RBG.3.1

The TSF shall be able to seed the RBG using a [selection, choose one of: TSF software-based noise source, TSF hardware-based noise source [assignment: name of noise source]] with a minimum of [assignment: number of bits] bits of min-entropy.

**Application Note:** This requirement is claimed when a DRBG is seeded with entropy from a single noise source that is within the TOE boundary. Min-entropy should be expressed as a ratio of entropy bits to sampled bits so that the total amount of data needed to ensure full entropy is known, as well as the conditioning function by which that data is reduced in size to the seed.

This requirement is claimed if "TSF noise source..." is selected in [FCS\\_RBG.1.2](#).

## Evaluation Activities ▾

### [FCS\\_RBG.3](#)

The evaluator shall examine the entropy documentation required by [FCS\\_RBG.1.2](#) to verify that it identifies, for each DRBG function implemented by the [TOE](#), the [TSF](#) noise source used to seed the [TOE](#)'s DRBG. The evaluator shall verify that this includes the amount of sampled data and the min-entropy rate of the sampled data such that it can be determined that sufficient entropy can be made available for the highest strength keys that the [TSF](#) can generate (e.g., 256 bits). If the seed data cannot be assumed to have full entropy (e.g., the min-entropy of the sampled bits is less than 1), the evaluator shall ensure that the entropy documentation describes the method by which the [TOE](#) estimates the amount of entropy that has been accumulated to ensure that sufficient data is collected and any conditioning that the [TSF](#) applies to the output data to create a seed of sufficient size with full entropy.

### [TSS](#)

There are no additional [TSS](#) evaluation activities for this component.

### [Guidance](#)

There are no additional [Guidance](#) evaluation activities for this component.

### [Tests](#)

There are no test activities for this component.

## FCS\_RBG.4 Random Bit Generation (Internal Seeding - Multiple Sources)

*This is a selection-based component. Its inclusion depends upon selection from [FCS\\_RBG.1.2](#).*

### FCS\_RBG.4.1

The [TSF](#) shall be able to seed the RBG using [**selection: [assignment: number]** [TSF](#) software-based noise sources, **[assignment: number]** [TSF](#) hardware-based noise sources].

**Application Note:** This requirement is claimed when a DRBG is seeded with entropy from multiple noise sources that are within the [TOE](#) boundary. [FCS\\_RBG.5](#) defines the mechanism by which these sources are combined to ensure sufficient minimum entropy.

This requirement is claimed if "multiple [TSF](#) noise sources..." is selected in [FCS\\_RBG.1.2](#).

## Evaluation Activities ▾

### [FCS\\_RBG.4](#)

The evaluator shall examine the entropy documentation required by [FCS\\_RBG.1.2](#) to verify that it identifies, for each DRBG function implemented by the [TOE](#), each [TSF](#) noise source used to seed the [TOE](#)'s DRBG. The evaluator shall verify that this includes the amount of sampled data and the min-entropy rate of the sampled data from each data source.

### [TSS](#)

There are no additional [TSS](#) evaluation activities for this component.

### [Guidance](#)

There are no additional [Guidance](#) evaluation activities for this component.

### [Tests](#)

There are no test activities for this component.

## FCS\_RBG.5 Random Bit Generation (Combining Noise Sources)

*This is a selection-based component. Its inclusion depends upon selection from [FCS\\_RBG.1.2](#).*

### FCS\_RBG.5.1

The [TSF](#) shall [**assignment: combining operation**] [**selection: output from [TSF](#) noise sources, input from [TSF](#) interfaces for seeding**] to create the entropy input into the derivation function as defined in [**assignment: list of standards**], resulting in a minimum of [**assignment: number of bits**] bits of min-entropy.

**Application Note:** This requirement is claimed if "multiple TSF noise sources..." is selected in [FCS\\_RBG.1.2](#).

## Evaluation Activities ▾

### [FCS\\_RBG.5](#)

Using the entropy sources specified in [FCS\\_RBG.4](#), the evaluator shall examine the entropy documentation required by [FCS\\_RBG.1.2](#) to verify that it describes the method by which the various entropy sources are combined into a single seed. This should include an estimation of the rate at which each noise source outputs data and whether this is dependent on any system-specific factors so that each source's relative contribution to the overall entropy is understood. The evaluator shall verify that the resulting combination of sampled data and the min-entropy rate of the sampled data is described in sufficient detail to determine that sufficient entropy can be made available for the highest strength keys that the TSF can generate (e.g., 256 bits). If the seed data cannot be assumed to have full entropy (e.g., the min-entropy of the sampled bits is less than 1), the evaluator shall ensure that the entropy documentation describes the method by which the TOE estimates the amount of entropy that has been accumulated to ensure that sufficient data is collected and any conditioning that the TSF applies to the output data to create a seed of sufficient size with full entropy.

### **TSS**

There are no additional TSS evaluation activities for this component.

### **Guidance**

There are no additional Guidance evaluation activities for this component.

### **Tests**

There are no test activities for this component.

## [FCS\\_STG\\_EXT.1 Cryptographic Key Storage](#)

### [FCS\\_STG\\_EXT.1.1](#)

The TSF shall use [selection: platform-provided key storage, encryption as specified in [FCS\\_STG\\_EXT.2](#)] for all persistent secrets and private keys.

**Application Note:** This requirement ensures that persistent secrets (credentials, secret keys) and private keys are stored securely when not in use. If some secrets or keys are manipulated by the TOE and others are manipulated by the platform, then both of the selections can be specified by the ST author and the ST author must identify in the TSS those keys which are manipulated by the TOE and those by the platform.

If "encryption as specified in [FCS\\_STG\\_EXT.2](#)" is selected then [FCS\\_STG\\_EXT.2](#) and [FCS\\_IV\\_EXT.1](#) must be included in the ST.

If the TSF is an application, and not a dedicated server, then it should store its private keys in the platform-provided key storage.

The ST author is responsible for selecting the manner in which the keys are stored and where they are stored in the selections above.

## Evaluation Activities ▾

### [FCS\\_STG\\_EXT.1](#)

#### **TSS**

Regardless of whether this requirement is met by the TSF or the TOE platform, the evaluator will check the TSS to ensure that it lists each persistent secret (credential, secret key) and private key needed to meet the requirements in the ST. For each of these items, the evaluator will confirm that the TSS lists for what purpose it is used, and how it is stored. The evaluator then performs the following actions.

Persistent secrets and private keys manipulated by the TOE platform:

The evaluator shall examine the TSS to verify that it describes (for each supported platform) how the key storage functionality is invoked for each persistent secret and private key described in the TSS (it should be noted that this may be through a mechanism that is not implemented by the MDM Server; nonetheless, that mechanism will be identified in the TSS as part of this evaluation activity).

Persistent secrets and private keys manipulated by the TSF:

The evaluator reviews the [TSS](#) to determine that it makes a case that, for each item listed as being manipulated by the [TOE](#), it is not written unencrypted to persistent memory, and that the item is stored by the platform.

#### **Guidance**

There are no additional Guidance evaluation activities for this component.

#### **Tests**

There are no test activities for this component.

## **FCS\_STG\_EXT.2 Encrypted Cryptographic Key Storage**

**This is a selection-based component. Its inclusion depends upon selection from [FCS\\_STG\\_EXT.1.1](#).**

### **FCS\_STG\_EXT.2.1**

The [TSF](#) shall [selection: invoke platform-provided functionality, implement functionality] to encrypt all keys using AES in the [selection: Key Wrap (KW) mode, Key Wrap with Padding (KWP) mode, GCM, CCM, CBC mode].

**Application Note:** This requirement states that keys used by the [TSF](#) shall not be kept in plaintext. The intent of this requirement is to ensure that the private keys, credentials, and persistent secrets cannot be accessed in the [TOE](#) in an unencrypted state, allowing an attacker to access keys without having to exhaust the AES key space.

This requirement must be included in the [ST](#) if the selection in [FCS\\_STG\\_EXT.1](#) indicates that the [TSF](#) is protecting private keys and persistent secrets with encryption rather than the platform-provided key storage.

## **Evaluation Activities** ▾

### [FCS\\_STG\\_EXT.2](#)

#### **TSS**

The evaluator shall examine the [TSS](#) to ensure it describes in detail how user credentials, persistent secret and private keys are stored and encrypted. The evaluator shall review the [TSS](#) to determine that it makes a case that key material is not written unencrypted to persistent memory and that it identifies the mode of encryption.

If "invoke platform-provided functionality" is selected, the evaluator shall examine the [TSS](#) to verify that it describes (for each supported platform) how the key encryption functionality is invoked (it should be noted that this may be through a mechanism that is not implemented by the [MDM](#) server; nonetheless, that mechanism will be identified in the [TSS](#) as part of this evaluation activity).

#### **Guidance**

There are no additional Guidance evaluation activities for this component.

#### **Tests**

There are no test activities for this component.

## **6.1.5 Identification and Authentication (FIA)**

### **FIA\_CLI\_EXT.1 Client Authorization**

#### **FIA\_CLI\_EXT.1.1**

The [TSF](#) shall require a unique [selection: certificate, token as defined in [FIA\\_TOK\\_EXT.1](#)] for each client device.

**Application Note:** Token is used here in a generic way to be some form of unique identifier that is not certificate-based as defined in [FIA\\_TOK\\_EXT.1](#). If "token as defined in [FIA\\_TOK\\_EXT.1](#)" is selected, [FIA\\_TOK\\_EXT.1](#) must be included in the [ST](#).

## **Evaluation Activities** ▾

## [FIA\\_CLI\\_EXT.1](#)

### **TSS**

The evaluator shall ensure that the **TSS** describes how the client is uniquely identified.

### **Guidance**

None.

### **Tests**

None.

## **FIA\_ENR\_EXT.1 Enrollment**

### **FIA\_ENR\_EXT.1.1**

The **TSF** shall authenticate the remote users over a trusted channel during the enrollment of a **MD**.

**Application Note:** The **MDM** server may use its own directory or a directory server to perform the authentication decision for users performing the remote enrollment of a **MD**.

### **FIA\_ENR\_EXT.1.2**

The **TSF** shall limit the user's enrollment of devices to devices specified by [**selection**: *IMEI*, **[assignment**: *a unique device ID*], and [**selection**: *specific device models, a number of devices, specific time period*, **[assignment**: *other features*], no other features].

**Application Note:** This requirement is designed to permit the enterprise to restrict users' enrollment of devices. A unique device ID is required to limit the user's enrollment. The unique device ID can be the IMEI or an ID specific to a particular platform.

## Evaluation Activities ▾

### [FIA\\_ENR\\_EXT.1.1](#)

#### **TSS**

The evaluator shall examine the **TSS** and verify that it describes the process of enrollment for each **MDM** agent or platform listed as supported in the **ST**. This description shall include the trusted path used for enrollment ([FTP\\_TRP.1/TRUSTPATH\\_ENROLL](#)), the method of user authentication (username or password, token, etc.), the method of authentication decision (local or remote authentication services), and the actions performed on the **MDM** server upon successful authentication.

#### **Guidance**

The evaluator shall examine the operational guidance to verify that it describes the process by which the **TOE** enrolls mobile devices into management.

#### **Tests**

- *Test FIA\_ENR\_EXT.1.1:1: The evaluator shall attempt to enroll a device without providing correct credentials. The evaluator shall verify that the device is not enrolled and that the described enrollment actions are not taken.*
- *Test FIA\_ENR\_EXT.1.1:2: The evaluator shall attempt to enroll the device providing correct credentials. The evaluator shall verify that the device is enrolled and that the described enrollment actions are taken.*

### [FIA\\_ENR\\_EXT.1.2](#)

#### **TSS**

The evaluator shall examine the **TSS** and verify that it implements a policy to limit the user's enrollment of devices.

#### **Guidance**

The evaluator shall ensure that the administrative guidance describes the methods of restricting user enrollment and that it instructs the administrator how to configure the restrictions.

#### **Tests**

For each type of policy selected, the evaluator shall perform the following:

- *Test FIA\_ENR\_EXT.1.2:1: The evaluator shall attempt to configure the **MDM** server according to the administrative guidance in order to prevent enrollment. The evaluator shall verify that the user cannot enroll a device outside of the configured limitation. (For example, the evaluator may try to enroll a disallowed device, or may try to enroll additional devices beyond the number allowed.)*

## FIA\_TOK\_EXT.1 Client Tokens

*This is a selection-based component. Its inclusion depends upon selection from FIA\_CLI\_EXT.1.1.*

### FIA\_TOK\_EXT.1.1

The TSF shall [**selection**: invoke platform-provided functionality, implement functionality] to use [**selection**: IMEI, **assignment**: other unique device ID] to generate a unique token for each client device.

**Application Note:** This SER is included in the ST if "token as defined in FIA\_TOK\_EXT.1" is selected in FIA\_CLI\_EXT.1.

## Evaluation Activities ▾

### FIA\_TOK\_EXT.1

#### TSS

The evaluator shall review the TSS and verify that the TSF uses either unique identifiers from the client device or a server-specific mechanism to generate a unique token that will be used for verifying the identity of the client device. If the server generates the token using cryptographic functions, it must use algorithms in FCS\_COP.1(ANY) (specific algorithms as needed by the vendor).

If "invoke platform-provided functionality" is selected, the evaluator shall examine the TSS to verify that it describes (for each supported platform) how this functionality is invoked (it should be noted that this may be through a mechanism that is not implemented by the MDM server; nonetheless, that mechanism will be identified in the TSS as part of this evaluation activity).

If "implement functionality" is selected, the evaluator shall examine the TSS to verify that it describes the methods to generate the token.

#### Guidance

None.

#### Tests

For each MDM agent or platform listed as supported in the ST:

- **Test FIA\_TOK\_EXT.1:1:** The evaluator shall use appropriate combinations of specialized operational environment and development tools (debuggers, simulators, etc.) for the TOE and instrumented TOE builds as needed to perform this test.
- **Test FIA\_TOK\_EXT.1:2:** The evaluator shall concurrently enroll 10 devices and ensure that the token for each is unique, per the methods described in the TSS.

## FIA\_UAU.1 Timing of Authentication

### FIA\_UAU.1.1

The TSF shall [**selection**: invoke platform-provided functionality , implement functionality ] to allow [**assignment**: list of TSF mediated actions] on behalf of the user to be performed before the user is authenticated **with the server**.

### FIA\_UAU.1.2

The TSF shall [**selection**: invoke platform-provided functionality, implement functionality] that requires each user to be successfully authenticated **with the server** before allowing any other TSF-mediated actions on behalf of that user.

**Application Note:** This requirement ensures that any user attempting to access the TSF must be authenticated. These users may be administrators attempting to administer the TOE or ordinary users attempting to enroll for management by the MDM system. The ST author is responsible for assigning the list of actions that can take place before this authentication. The TSF or TOE platform may use enterprise authentication to meet this requirement.

For distributed TOEs, at least one TOE component has to support the authentication of administrators but not necessarily all TOE components. In case not all TOE components support authentication for administrators the TSS must describe how administrators are authenticated and identified.

## Evaluation Activities ▾

### FIA\_UAU.1

#### TSS

If "invoke platform-provided functionality" is selected, the evaluator shall examine the TSS to verify that it describes (for each supported platform) how this functionality is invoked (it should be noted that this may be through a mechanism that is not implemented by the MDM server; nonetheless, that mechanism will be identified in the TSS as part of this evaluation activity).

#### Guidance

The evaluator shall examine the operational guidance to verify that it describes the process by which users authenticate to the TOE.

#### Tests

The evaluator shall perform the following tests:

- Test FIA\_UAU.1:1: The evaluator shall attempt to perform the prohibited actions before authentication. The evaluator shall verify the actions cannot be performed.
- Test FIA\_UAU.1:2: The evaluator shall attempt to perform the prohibited actions after authentication. The evaluator shall verify the actions can be performed.

## FIA\_UAU.4 Single-Use Authentication Mechanisms

*This is an objective component.*

### FIA\_UAU.4.1

The TSF shall prevent reuse of authentication data related to [assignment: identified authentication mechanisms].

**Application Note:** This requirement references the authentication mechanisms used to authenticate the user for enrollment in FIA\_ENR\_EXT.1.1. If a username and password is used to authenticate the user for enrollment, the password must not be reused. Thus if the user has two devices enrolled in management or needs to re-enroll the same device (i.e., after a device wipe), the password must be different for each enrollment. Additionally, if two different users are enrolling the password must be different for each user.

## Evaluation Activities ▾

### FIA\_UAU.4

#### TSS

The evaluator shall verify that the TSS contains a description of the process of enrollment for each MDM agent or platform listed as supported in the ST. This description shall include the method of user authentication (username or password, token, etc.) and how reuse of the authentication data is prevented.

#### Guidance

The evaluator shall ensure that the administrative guidance describes the methods of restricting user enrollment and that it instructs the administrator on how to configure the restrictions.

#### Tests

- Test FIA\_UAU.4:1: The evaluator shall enroll a device providing correct credentials. The evaluator shall attempt to enroll a second device using the same credentials used to enroll the first device. The evaluator shall verify that the second device could not enroll.

## 6.1.6 Security Management (FMT)

### FMT\_MOF.1/FUNCBE Management of Security Functions Behavior

#### FMT\_MOF.1.1/FUNCBE

The **TSF** shall restrict the ability to **perform** the functions

- listed in [FMT\\_SMF.1/SERVER\\_CONF\\_AGENT](#)
- enable, disable, and modify policies listed in [FMT\\_SMF.1/SERVER\\_CONF\\_AGENT](#)
- listed in [FMT\\_SMF.1/SERVER\\_CONF\\_SERVER](#)
- [selection: enable, disable, and modify policies listed in [FMT\\_SMF.1/MAS](#), no other functions]

to [authorized administrators].

**Application Note:** This requirement outlines the functions that administrators will have the power to enable, disable, modify, and monitor functions and policies listed in [FMT\\_SMF.1/SERVER\\_CONF\\_AGENT](#). It also includes functions necessary to maintain and configure the **MDM** server itself.

You must select "enable, disable, and modify policies listed in [FMT\\_SMF.1/MAS](#)" if the **TQE** includes **MAS** functionality and [FMT\\_SMF.1/MAS](#), [FAU\\_GEN.1/MAS\\_SERVER](#), [FMT\\_MOF.1/MANAGEMENT\\_MAS](#), [FMT\\_SMR.1/SECMAN\\_ROLES\\_MAS](#) must be included in the **ST**.

If "enable, disable, and modify policies listed in [FMT\\_SMF.1/MAS](#)" is chosen, [FMT\\_SMR.1.1/SECMAN\\_ROLES](#) must be included in the **ST**.

## Evaluation Activities ▾

### [FMT\\_MOF.1/FUNCBE](#)

#### **TSS**

The evaluator shall examine the **TSS** to ensure that it describes what security management functions are restricted to the administrator and what actions can be taken for each management function. The evaluator shall verify that the security management functions are restricted to authorized administrators.

#### **Guidance**

The evaluator shall examine the operational guidance to verify that it describes the management functions that are available to authorized administrators and how administrators are authorized to perform those particular functions (e.g. default for the account, role membership, group membership).

#### **Tests**

- Test **FMT\_MOF.1/FUNCBE:1**: The evaluator shall attempt to access the functions and policies in [FMT\\_SMF.1/SERVER\\_CONF\\_AGENT](#) as an unauthorized user and verify that the attempt fails.
- Test **FMT\_MOF.1/FUNCBE:2**: [conditional] The evaluator shall attempt to access the functions and policies in [FMT\\_SMF.1/MAS](#) as an unauthorized user and verify that the attempt fails.

## **FMT\_MOF.1/MANAGEMENT\_ENROLL Management of Security Functions Behavior (Enrollment)**

### **FMT\_MOF.1.1/MANAGEMENT\_ENROLL**

The **MDM server** shall restrict the ability to [ **initiate the enrollment process** ] to [authorized administrators and **MD** users].

**Application Note:** This requirement outlines the enrollment functions that both administrators and **MD** users may perform. The enrollment actions are identified in the **TSS** as a part of [FIA\\_ENR\\_EXT.1](#).

The authorized administrator does not remotely initiate enrollment of the **MDs** that are in the possession of users but may enroll **MDs** when they are in the possession of the administrator, for example, before distributing the **MDs** to the users.

## Evaluation Activities ▾

### [FMT\\_MOF.1/MANAGEMENT\\_ENROLL](#)

#### **TSS**

The evaluator shall examine the **TSS** and verify that it describes how unauthorized users are prevented from enrolling in the **MDM** services.

#### **Guidance**

The evaluator shall examine the operational guidance to verify that it describes the enrollment process and any restrictions that may prevent unauthorized enrollment.

#### Tests

The test of this function is performed in conjunction with [FIA\\_ENR\\_EXT.1](#).

## FMT\_MOF.1/MANAGEMENT\_MAS Management of Functions in (MAS Server Downloads)

**This is a selection-based component. Its inclusion depends upon selection from FMT\_MOF.1.1/FUNCBE.**

### FMT\_MOF.1.1/MANAGEMENT\_MAS

The **MAS Server** shall restrict the ability to [enable, modify the behavior of] the functions [downloading applications] to [enrolled MDs that are compliant with **MDM** policies and assigned to a user in the application access group].

**Application Note:** This requirement is claimed if "enable, disable, and modify policies listed in [FMT\\_SMF.1/MAS](#)" is selected in [FMT\\_MOF.1.1/FUNCBE](#).

### Evaluation Activities ▾

#### [FMT\\_MOF.1/MANAGEMENT\\_MAS](#)

##### TSS

The evaluator shall examine the **TSS** to determine that all methods of initiating an application download or update push are specified.

##### Guidance

The evaluator shall confirm that the operational guidance contains how to initiate an application download or update push.

##### Tests

- **Test FMT\_MOF.1/MANAGEMENT\_MAS:1:** The evaluator shall ensure that the **MAS Server** verifies that the **MD** is enrolled in the **MDM Server** and is in a compliant state. The evaluator shall verify that either none, or only those applications needed for enrollment, can be downloaded from the **MAS Server** prior to enrolling the **MD** with the **MDM**.
- **Test FMT\_MOF.1/MANAGEMENT\_MAS:2:** The evaluator shall ensure that the **MAS Server** verifies that the **MD** is enrolled in the **MDM Server** and is in a compliant state. The evaluator shall make policy changes to make the enrolled **MD** non-compliant. The evaluator shall verify that either none, or only those applications needed to bring the **MD** back into compliance, are able to be downloaded.
- **Test FMT\_MOF.1/MANAGEMENT\_MAS:3:** The evaluator shall ensure that the **MAS Server** verifies that the **MD** is enrolled in the **MDM Server** and is in a compliant state. The evaluator shall unenroll the **MD** and verify that an application can not be downloaded from the **MAS Server** after unenrollment.

## FMT\_POL\_EXT.1 Trusted Policy Update

### FMT\_POL\_EXT.1.1

The **TSF** shall provide digitally signed policies and policy updates to the [**selection: MDM agent, subordinate MDM server**].

**Application Note:** The intent of this requirement is to cryptographically tie the policies to the enterprise that mandated the policy, not to protect the policies in transit (as they are already protected by [FPT\\_ITT.1/INTER\\_XFER](#) / [FPT\\_ITT.1/INTER\\_XFER\\_AGENT](#) or [FTP\\_ITC.1/INTER\\_TSF\\_XFER\\_AGENT](#)). This is especially critical for users who connect to multiple enterprises.

### FMT\_POL\_EXT.1.2

The **TSF** shall sign policies and policy updates using a private key associated with [**selection: an X509 certificate, a public key provisioned to the agent or subordinate MDM server**] trusted by the agent or subordinate **MDM server** for policy verification.

**Application Note:** If "an X509 certificate" is selected, the "policy signing" option in [FIA\\_X509\\_EXT.2](#) is also claimed.

## FMT\_POL\_EXT.1.3

For each unique policy managed by the **TSF**, the **TSF** shall validate that the policy is appropriate for an agent or subordinate **MDM** server using [selection: *client authentication via an X509 certificate representing the agent or subordinate MDM server, a token issued to the agent or subordinate MDM server and associated with a policy signing key uniquely associated to the policy*].

**Application Note:** If "client authentication via an X509 certificate representing the agent subordinate MDM server" is claimed, the appropriate protocol in FIA\_X509\_EXT.2 is also claimed. If "a token issued to the agent or subordinate MDM server and associated with a unique policy signing key uniquely associated to the policy" is claimed, [FIA\\_TOK\\_EXT.1.1](#) is also claimed and the **TSF** maintains the association of the key pairs and the agent or subordinate **MDM** server tokens. When multiple policies are supported, a unique policy signing key for each policy is used.

### Evaluation Activities ▾

#### [FMT\\_POL\\_EXT.1](#)

##### **TSS**

The evaluator shall verify that the **ST** describes how policies are signed, to include whether the private key used for signing is associated with an X509 certificate or public key, the method for distributing the policy verification material (a certificate or provisioned public key) to the agent or subordinate **MDM** server, and the method for distinguishing whether a policy is appropriate for an agent or subordinate **MDM** server. If tokens are claimed in [FMT\\_POL\\_EXT.1.3](#), the evaluator shall verify the **ST** describes how tokens are established and distributed to the agent or subordinate **MDM** server.

##### **Guidance**

If applicable, the evaluator shall verify that the operational guidance instructs administrators on configuring the enterprise certificate to be used for signing policies or signing the policies before applying them.

##### **Tests**

The evaluator shall perform a policy update in accordance with [FMT\\_SMF.1/SERVER\\_CONF\\_AGENT](#). The evaluator shall examine the policy either at the **TOE**, in transmission, or at the **MDM** agent, and verify the **TSF** signs the update and provides it to the **MDM** agent or subordinate **MDM** server.

## FMT\_POL\_EXT.3 Subordinate MDM Trusted Policy Update

*This is a selection-based component. Its inclusion depends upon selection from [FTP\\_ITC\\_EXT.1.1](#).*

### FMT\_POL\_EXT.3.1

The **TSF** shall only accept policies and policy updates that are digitally signed by a private key that has been authorized for policy updates by the primary **MDM** server.

**Application Note:** The intent of this requirement is to cryptographically tie the policies to the enterprise that mandated the policy, not to protect the policies in transit (as they are already protected by [FTP\\_ITC.1/INTER\\_XFER\\_IT](#)). This is especially critical for users who connect to multiple enterprises.

### FMT\_POL\_EXT.3.2

The **TSF** shall not process policies for the **MDM** agent if the signature check fails.

### Evaluation Activities ▾

#### [FMT\\_POL\\_EXT.3](#)

##### **TSS**

The evaluator ensures that the **TSS** describes how the candidate policies are obtained by the subordinate **MDM** server, the processing associated with verifying the digital signature of the policy updates, and the actions that take place for successful (signature was verified) and unsuccessful (signature could not be verified) cases. The software components that are performing the processing must also be identified in the **TSS** and verified by the evaluators.

##### **Guidance**

There are no additional Guidance evaluation activities for this component.

##### **Tests**

This evaluation activity is performed in conjunction with the evaluation activity for FIA\_X509\_EXT.1/CERTVAL\_MAN and FIA\_X509\_EXT.2

- Test FMT\_POL\_EXT.3:1: The evaluator shall perform a policy update from an available configuration interface (such as through a test primary MDM Server). The evaluator shall verify the update is signed and is provided to the subordinate MDM server. The evaluator shall verify the subordinate MDM server accepts the digitally signed policy.
- Test FMT\_POL\_EXT.3:2: The evaluator shall perform a policy update from an available configuration interface (such as through a test primary MDM Server). The evaluator shall provide an unsigned and an incorrectly signed policy to the subordinate MDM server. The evaluator shall verify the subordinate MDM server does not accept the digitally signed policy.

## FMT\_SAE\_EXT.1 Security Attribute Expiration

*This is an objective component.*

### FMT\_SAE\_EXT.1.1

The TSF shall be able to specify a configurable expiration time for enrollment authentication data.

### FMT\_SAE\_EXT.1.2

The TSF shall be able to deny enrollment after the expiration time for the enrollment authentication data has passed.

**Application Note:** This requirement references the user authenticator used for device enrollment in management in FIA\_ENR\_EXT.1.1. The user authenticator must only be valid for a configurable time limit. If the authenticator is expired, even if entered correctly, enrollment must not occur.

The length of the time the authenticator is valid for is configured per function c.5 in FMT\_SMF.1/SERVER\_CONF\_SERVER. If FMT\_SAE\_EXT.1 is included in the ST, then function g must be selected in FMT\_SMF.1/SERVER\_CONF\_SERVER.

## Evaluation Activities ▼

### FMT\_SAE\_EXT.1

#### TSS

The evaluator shall verify that the TSS contains a description of the process of enrollment for each MDM agent or platform listed as supported in the ST. This description shall be the method of user authentication (username or password, token, etc.).

#### Guidance

The evaluator shall check to ensure that the operational guidance contains instructions to configure the expiration time for each method of user authentication listed in the TSS.

#### Tests

- Test FMT\_SAE\_EXT.1:1: The evaluator shall configure the MDM server according to the administrative guidance to set an expiration time for the enrollment authentication data. For each method of user authentication listed in the TSS, the evaluator shall attempt to enroll using authentication data that has expired. The evaluator shall verify that enrollment was unsuccessful.

## FMT\_SMF.1/MAS Specification of Management Functions (MAS Server)

*This is a selection-based component. Its inclusion depends upon selection from FMT\_MOE.1.1/FUNCBE.*

### FMT\_SMF.1.1/MAS

The MAS Server shall be capable of performing the following management functions: [

- Configure application access groups
- Download applications
- [selection: assignment: other MAS management functions] , no other functions]

]

**Application Note:** This requirement captures all the configuration functionality in the **MAS** Server to configure the underlying **MAS** Server. The **SI** author can add more commands and configuration policies by completing the assignment statement.

The **MAS** Server must be able to create groups to configure which applications a user can access based on which group they are in. If the **MAS** Server uses the groups defined by the **MDM**, then it must communicate with the **MDM** server (if separate server) to determine which applications the user can access.

This requirement is claimed if "enable, disable, and modify policies listed in [FMT\\_SMF.1/MAS](#)" is selected in [FMT\\_MOF.1.1/FUNCBE](#).

## Evaluation Activities ▾

### [FMT\\_SMF.1/MAS](#)

#### **TSS**

*The evaluator shall examine the **TSS** to ensure that it describes each management function listed.*

*The evaluator shall examine the **TSS** to determine if the **MAS** Server creates its own groups or relies on the groups specified by the **MDM** server.*

#### **Guidance**

*The evaluator shall confirm that the operational guidance contains how to create and define user groups and how to specify which applications are accessible by which group.*

*The evaluator shall verify the operational guidance includes detailed instructions of what options are available and how to configure each management functional capability listed.*

#### **Tests**

*The evaluator shall ensure that the **MAS** client can only access the applications specified for the group they are enrolled in. The evaluator shall create a user group, making sure that the **MAS** client user is excluded from the group. Verify that an application accessible to that group cannot be accessed. The evaluator shall include the **MAS** client user in the group and assure that the application can be accessed.*

## **FMT\_SMF.1/SERVER\_CONF\_AGENT Specification of Management Functions (Server configuration of Agent)**

### **FMT\_SMF.1.1/SERVER\_CONF\_AGENT**

The **MDM server** shall be capable of **communicating the following commands to the MDM agent:**

1. Transition to the locked state (MDF Function 6)
2. Full wipe of protected data (MDF Function 7)
3. Unenroll from management
4. Install policies
5. Query connectivity status
6. Query the current version of the **MD** firmware or software
7. Query the current version of the hardware model of the device
8. Query the current version of installed applications
9. Import X.509v3 certificates into the Trust Anchor Database (MDF Function 11)
10. Install applications (MDF Function 16)
11. Update system software (MDF Function 15)
12. Remove applications (MDF Function 14)

**[selection:**

- 13. Remove enterprise applications (MDF Function 17)
- 14. Wipe enterprise data (MDF Function 28)
- 15. Remove imported X.509v3 certificates and **[selection:**

- no other X.509v3 certificates
- **[assignment: list of other categories of X.509v3 certificates]**

**] in the Trust Anchor Database (MDF Function 12)**

- 16. Alert the user
- 17. Import keys or secrets into the secure key storage (MDF Function 9)
- 18. Destroy imported keys or secrets and **[selection:**

- no other keys or secrets
- **[assignment: list of other categories of keys or secrets]**

- ] in the secure key storage (MDF Function 10)
  - 19. Read audit logs kept by the **MD** (MDF Function 32)
  - 20. Retrieve **MD**-software integrity verification values (MDF Function 38)
  - 21. Approve exceptions for sharing data between [selection]:
    - application processes
    - group of application processes
- ] (MDF Function 42)
- 22. Place applications into application process groups based on [assignment: application characteristics] (MDF Function 43)
  - 23. Revoke Biometric template (MDF Function 46)
  - 24. [assignment: list of other management functions to be provided by the **MD**]
  - no other management functions
- ] and the following **MD** configuration policies:
25. Password policy:
    - a. minimum password length
    - b. minimum password complexity
    - c. maximum password lifetime (MDF Function 1)
  26. Session locking policy:
    - a. screen-lock enabled and disabled
    - b. screen lock timeout
    - c. number of authentication failures (MDF Function 2)
  27. Wireless networks (SSIDs) to which the **MD** may connect (WLAN Client PP-Module Function WL-2)
  28. Security policy for each wireless network:
    - a. [selection:
      - specify the CAs from which the **MD** will accept WLAN authentication server certificates
      - specify the FQDNs of acceptable WLAN authentication server certificates
    - b. ability to specify security type
    - c. ability to specify authentication protocol
    - d. specify the client credentials to be used for authentication
    - e. [assignment: any additional WLAN management functions] (WLAN Client PP-Module Function WL-1)
  29. Application installation policy by [selection]:
    - specifying authorized application repositories
    - specifying a set of allowed applications and versions (an application allowlist)
    - denying application installation
- ], (MDF Function 8)
30. Enable and disable policy for [assignment: list of audio or visual collection devices] across device, [selection]:
    - on a per-app basis
    - on a per-group of applications processes basis
    - no other method
- ], (MDF Function 5)
- [selection:
- 31. Enable and disable policy for the VPN protection across **MD**, [selection:
    - on a per-app basis
    - on a per-group of application processes basis
    - no other method
- ] (MDF Function 3)
- 32. Enable and disable policy for [assignment: list of radios], (MDF Function 4)
  - 33. Enable and disable policy for data signaling over [assignment: list of externally accessible hardware ports], (MDF Function 24)
  - 34. Enable and disable policy for [assignment: list of protocols where the device acts as a server], (MDF Function 25)
  - 35. Enable and disable policy for developer modes, (MDF Function 26)
  - 36. Enable policy for data-at-rest protection, (MDF Function 19)
  - 37. Enable policy for removable media's data-at-rest protection, (MDF Function 20)
  - 38. Enable and disable policy for local authentication bypass, (MDF Function 27)

- o 39. *The Bluetooth trusted channel policy:*
  - a. *Disable/enable the Discoverable (for BR/EDR) and Advertising (for LE) modes (Bluetooth PP-Module Function BT-1)*
  - b. *change the Bluetooth device name (Bluetooth PP-Module Function BT-2), [selection]:*
    - *Provide separate controls for turning the BR/EDR and LE radios on and off (Bluetooth PP-Module Function BT-3)*
    - *allow and disallow additional wireless technologies to be used with Bluetooth (Bluetooth PP-Module Function BT-4)*
    - *configure allowable methods of Out of Band pairing (Bluetooth PP-Module Function BT-5)*
    - *disable and enable Discoverable (for BR/EDR) and Advertising (for LE) modes separately (Bluetooth PP-Module Function BT-6)*
    - *disable and enable the Connection mode (Bluetooth PP-Module Function BT-7)*
    - *disable and enable the Bluetooth services or profiles available on the device (Bluetooth PP-Module Function BT-8)*
    - *specify minimum level of security for each pairing (Bluetooth PP-Module Function BT-9)*
    - *no other Bluetooth configuration*
- o 40. *Enable and disable policy for display notification in the locked state of [selection]:*
  - *email notifications*
  - *calendar appointments*
  - *contact associated with phone call notification*
  - *text message notification*
  - *other application-based notifications*
  - *none*
- o 41. *Policy for establishing a trusted channel or disallowing establishment if the MD cannot establish a connection to determine the validity of a certificate, (MDF Function 30)*
- o 42. *Enable and disable policy for the cellular protocols used to connect to cellular network base stations, (MDF Function 31)*
- o 43. *Policy for import and removal by applications of X.509v3 certificates in the Trust Anchor Database, (MDF Function 29)*
- o 44. *[selection]:*
  - *certificate*
  - *public-key*

*] used to validate digital signature on applications, (MDF Function 33)*
- o 45. *Policy for exceptions for shared use of keys or secrets by multiple applications, (MDF Function 34)*
- o 46. *Policy for exceptions for destruction of keys or secrets by applications that did not import the key or secret, (MDF Function 35)*
- o 47. *The unlock banner policy, (MDF Function 36)*
- o 48. *Configure the auditable items (MDF Function 37)*
- o 49. *Enable and disable [selection]:*
  - *USB mass storage mode*
  - *USB data transfer without user authentication*
  - *USB data transfer without authentication of the connection system*
- o 50. *Enable and disable backup of [selection]:*
  - *all applications*
  - *selected applications*
  - *selected groups of applications*
  - *configuration data*

*] to [selection: locally connected system, remote system] (MDF Function 40)*
- o 51. *Enable and disable [selection]:*
  - *Hotspot functionality authenticated by [selection: pre-shared key, passcode, no authentication]*
  - *USB tethering authenticated by [selection: pre-shared key, passcode, no authentication]*

- 52. Enable and disable location services:  
~~[selection]~~
    - across device
    - on a per-app basis
    - on a per-group of application processes basis
    - no other method
  - ] (MDF Function 21)
  - 53. Enable and disable policy for user unenrollment
  - 54. Enable and disable policy for the Always-On VPN protection across device (MDF Function 45)
  - 55. Enable and disable policy for use of Biometric Authentication Factor (MDF Function 22)
  - 56. Connectivity timeout policy: ~~[selection]~~
    - allowed ~~[selection]~~: number of missed reachability events, length of time without server connectivity]
    - when server connectivity timeout is exceeded agent shall ~~[selection]~~: disable user password, wipe device] and ~~[selection]~~: ~~[assignment]~~: other action], none]
  - ]
  - 57. Enable and disable multi-user modes
  - 58. Enable and disable automatic updates of system software
  - 59. Enable and disable removable media
  - 60. ~~[assignment]~~: list of other policies to be provided by the ~~MD~~, no other policies
- ].

**Application Note:** This requirement captures all the configuration functionality the ~~TSF~~ provides the administrator to configure the ~~MDM~~ agent. This requirement is broken into two configurable areas: ~~MDM~~ agent commands and ~~MDM~~ agent policies. The ~~ST~~ author can add more commands and configuration policies by completing the appropriate assignment statements.

Function-specific Application Notes:

Function-specific application notes reference Mobile Device Fundamentals (MDF) ~~PP~~ v4.0.

Function 12 may be satisfied for the BYOD use case by application denylisting or disabling. In the case of BYOD, an enterprise may not want to remove "personal" applications, thus for that use case disabling the application rather than removing it would allow the user to not lose any information they might have in the application.

Function 16 provides the ~~MDM~~ server to display an alert to the user of the ~~MD~~.

The audit data read according to Function 19 are to be transmitted to an external audit server according to [FAU\\_STG.1](#). The ~~MDM~~ server is not expected to retain those logs.

Function 34 provides the ability to enable and disable policy for the list of protocols where the device acts as a server, such as a mobile hotspot.

Function 56 corresponds to FPT\_NET\_EXT.1.1 in agent. If the ~~MDM~~ agent has not had a successful reachability event with the ~~MDM~~ server in the amount of time specified in 'a', then the agent must perform the action selected in 'b'. It is feasible, but not required, that if multiple actions are selected in 'b', each action could be associated with a different timeout in 'a'. If function 56 is included in the ~~ST~~, then FPT\_NET\_EXT.1.1 must be included in the agent ~~ST~~.

## Evaluation Activities ▼

### [FMT\\_SMF.1/SERVER\\_CONF\\_AGENT](#)

#### ~~TSS~~

*The evaluator shall examine the ~~TSS~~ to ensure that it describes each management function claimed. The evaluator shall examine the ~~TSS~~ to ensure that it identifies the management functions implemented for each supported ~~MDM~~ agent or platform, which are likely to be subsets of all of the management functions available to the administrator on the ~~MDM~~ server. The evaluator shall examine the ~~TSS~~ to verify that any differences between management functions and policies for each supported ~~MDM~~ agent or platform are clearly indicated.*

*The evaluator shall determine if the ~~MD~~ has been evaluated. If so, the evaluator shall examine the ~~TSS~~ to verify that it*

*clearly identifies which management functions match the selections and assignments of the evaluated MDM and which management functions were not evaluated.*

#### **Guidance**

*For each command that the TSF can issue to an MDM agent and for each mobile device configuration policies that can be applied, the evaluator shall examine the operational guidance to verify that it includes instructions on how to perform these actions, and what particular parameters or options can be specified for them.*

#### **Tests**

*For each MDM agent or platform listed as supported in the ST:*

- *Test FMT\_SMF.1/SERVER\_CONF\_AGENT:1: The evaluator shall verify the ability to command each MDM agent functional capability and configure each MDM agent policy listed above.*

## **FMT\_SMF.1/SERVER\_CONF\_SERVER Specification of Management Functions (Server Configuration of Server)**

### **FMT\_SMF.1.1/SERVER\_CONF\_SERVER**

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

a. Configure the [selection]:

- devices specified by [selection: IMEI, assignment: a unique device ID]
- specific device models
- a number of devices
- specific time period

] and [selection: [assignment: other features], no other features] allowed for enrollment

b. [selection]:

1. Choose X.509v3 certificates for MDM server use,
2. Allow the administrator to choose whether to accept the certificate when connection cannot be made to establish validity,
3. Configure the TOE unlock banner,
4. Configure periodicity of the following commands to the agent: [assignment: list of commands],
5. Configure the privacy-sensitive information that will and will not be collected from particular MDs,
6. Configure the length of time the enrollment authenticator is valid,
7. Configure the interaction between TOE components,
8. Configure the cryptographic functionality,
9. Configure the interaction with the primary MDM server,
10. Configure the interaction with the subordinate MDM server,
11. [assignment: other management functions],
12. No other management functions]

**Application Note:** This requirement captures all the configuration functionality in the MDM server to configure the underlying MDM server. The ST author can add more commands and configuration policies by completing the assignment statement.

Function b1 is selection-based under the very limited circumstances when certificate management is both performed solely by platform-provided functionality and the platform uses cloud services; for all other instances it is mandatory. This requirement will be made fully mandatory again in a future version of the PP. Function b1 can be met by relying on the platform to configure the certificates used by the MDM server, however, the MDM server must allow the administrator to choose which certificate is used for a specific functionality. The selection in a corresponds to the selection in [FIA\\_ENR\\_EXT.1.2](#). The selection in b.2 includes a function that corresponds to the selection in . Function b.4 allows the administrator to configure periodicity of assigned commands, for example "read audit logs kept by the MD." In this way the administrator can configure the MDM system to retrieve audit logs from the MD on a periodic, such as daily, basis in order to ensure freshness of log data and to minimize loss of audit logs. Function b.5 allows the administrator to configure the privacy-sensitive information that will and will not be collected from particular MDs to handle BYOD environments where some information may not be appropriate to collect. Privacy sensitive information may include items such as device physical location and lists of installed personal applications, and would vary depending on the particular capabilities of the TOE and MDM agent. The TOE should provide the capability to group enrolled devices into categories such as enterprise-owned and personal-owned and define the information that will be collected from devices in each category. Function b.6 corresponds to configuring the length of time the user authenticator for enrollment is valid in

**FMT\_SAE\_EXT.1.** This function must be included in the **ST** if and only if **FMT\_SAE\_EXT.1** is included in the **ST**.

For distributed **TOEs**, the interaction between **TOE** components will be configurable (see **FCO\_CPC\_EXT.1**). Therefore, the **ST** author includes the selection "Ability to configure the interaction between **TOE** components" for distributed **TOEs**. A simple example would be the change of communication protocol according to **FPT\_ITT.1/INTER\_XFER**. Another example would be changing the management of a **TOE** component from direct remote administration to remote administration through another **TOE** component. A more complex use case would be if the realization of an **SFR** is achieved through two or more **TOE** components and the responsibilities between the two or more components could be modified.

For distributed **TOEs**, that implement a registration channel (as described in **FCO\_CPC\_EXT.1.2**), the **ST** author uses the selection "configure the cryptographic functionality" in this **SFR**, and its corresponding mapping in the **TSS**, to describe the configuration of any cryptographic aspects of the registration channel that can be modified by the operational environment in order to improve the channel security.

Functions b.9 and b.10 allow the administrator to configure the use of a subordinate **MDM** server to pass **MDM** policy files to an **MDM** agent on a managed device. This includes configuring the authentication and communication mechanisms necessary to establish secure channels between the primary **MDM** server and subordinate **MDM** server. If the **TOE** acts as the primary **MDM** server, then "*Configure the interaction with the subordinate **MDM** server*" should be selected. If the **TOE** acts as a subordinate **MDM** server then "*Configure the interaction with the primary **MDM** server*" should be selected.

## Evaluation Activities ▾

### **FMT\_SMF.1/SERVER\_CONF\_SERVER**

#### **TSS**

The evaluator shall examine the **TSS** to ensure that it describes each management function listed. For function b.5, the evaluator shall examine the **TSS** to ensure that it describes the privacy-sensitive information that the **TOE** has the capability to collect from enrolled MDs.

#### **Guidance**

The evaluator shall verify the operational guidance includes detailed instructions of what options are available and how to configure each management functional capability listed.

#### **Tests**

The tests of functions a, b.2, b.3, and b.6 are performed in conjunction with the use of the function. Test 3 also covers function b.5. The evaluator shall perform the following tests:

- Test FMT\_SMF.1/SERVER\_CONF\_SERVER:1: The evaluator shall configure the **TSF** authentication certificates and verify that the correct certificate is used in established trusted connections (**FPT\_ITT.1/INTER\_XFER**, **FPT\_ITT.1/INTER\_XFER\_AGENT**, **FTP\_ITC.1/INTER\_XFER\_IT**, and **FTP\_TRP.1/TRUSTPATH\_ENROLL**).
- Test FMT\_SMF.1/SERVER\_CONF\_SERVER:2: (conditional) The evaluator shall configure the periodicity for the assigned list of commands to the agent for several configured time periods and shall verify that the **MDM** server performs the commands schedule.
- Test FMT\_SMF.1/SERVER\_CONF\_SERVER:3: (conditional) The evaluator shall design and perform tests to demonstrate that the assigned function may be configured and that the intended behavior of the function is enacted by the **MDM** server.

## **FMT\_SMR.1/SECMAN\_ROLES Security Roles**

### **FMT\_SMR.1.1/SECMAN\_ROLES**

The **TSF** shall maintain the roles **administrator**, **MD user**, and [selection: *[assignment: additional authorized identified roles]*, **no additional roles**].

### **FMT\_SMR.1.2/SECMAN\_ROLES**

The **TSF** shall be able to associate users with roles.

**Application Note:** It is envisioned that the **MDM** server will be configured and maintained by different user roles. The assignment is used by the **ST** author to list the roles that are supported. At a minimum, one administrative role must be supported. If no additional roles are supported, then "no additional roles" is selected. The **MD** user role is used for enrollment of MDs to the **MDM** according

to [FIA\\_ENR\\_EXT.1](#).

For distributed TOEs, not every TOE component is required to implement its own user management to fulfill this SFR. At least one component has to support authentication and identification of users according to [FIA\\_UAU.1](#). For the other TOE components authentication can be realized through the use of a trusted channel (either according to [FTP\\_ITC.1](#) or [FPT\\_ITT.1/INTER\\_XFER / FPT\\_ITT.1/INTER\\_XFER\\_AGENT](#)) from a component that supports the authentication of users according to [FIA\\_UAU.1](#). The identification of users according to [FIA\\_UAU.1.2](#) and the association of users with roles according to [FMT\\_SMR.1.2/SECMAN\\_ROLES](#) is done through the components that support the authentication of users according to [FIA\\_UAU.1](#).

## Evaluation Activities ▾

### [FMT\\_SMR.1/SECMAN\\_ROLES](#)

#### **TSS**

*The evaluator shall examine the TSS to verify that it describes the administrator role and the powers granted to and limitations of the role.*

#### **Guidance**

*The evaluator shall review the operational guidance to ensure that it contains instructions for administering the TOE and which interfaces are supported.*

#### **Tests**

*In the course of performing the testing activities for the evaluation, the evaluator shall use all supported interfaces, although it is not necessary to repeat each test involving an administrative action with each interface. The evaluator shall ensure, however, that each supported method of administering the TOE that conforms to the requirements of this PP be tested; for instance, if the TOE can be administered through a local hardware interface or HTTPS then both methods of administration must be exercised during the evaluation team's test activities.*

## [FMT\\_SMR.1/SECMAN\\_ROLES\\_MAS](#) Security Roles (MAS Server)

*This is a selection-based component. Its inclusion depends upon selection from [FMT\\_MOF.1.1/FUNCBE](#).*

### FMT\_SMR.1.1/SECMAN\_ROLES\_MAS

The TSF shall **additionally** maintain the roles of [enrolled managed devices, application access groups, and [assignment: additional authorized identified roles]].

### FMT\_SMR.1.2/SECMAN\_ROLES\_MAS

The **MAS Server** shall be able to associate users with roles.

**Application Note:** It is envisioned that the **MAS Server** will be configured and maintained by different user roles. The assignment is used by the ST author to list the roles that are supported. At a minimum, one administrative role must be supported. If no additional roles are supported, then "no additional roles" is stated. The **MD** user role is used for enrollment of MDs to the **MAS** according to [FIA\\_ENR\\_EXT.1](#).

This requirement is claimed if "enable, disable, and modify policies listed in [FMT\\_SMF.1/MAS](#)" is selected in [FMT\\_MOF.1.1/FUNCBE](#).

## Evaluation Activities ▾

### [FMT\\_SMR.1/SECMAN\\_ROLES\\_MAS](#)

#### **TSS**

*The evaluator shall examine the TSS to verify that it describes the administrator role and the powers granted to and limitations of the role.*

#### **Guidance**

*The evaluator shall review the operational guidance to ensure that it contains instructions for administering the TOE and which interfaces are supported.*

#### **Tests**

In the course of performing the testing activities for the evaluation, the evaluator shall use all supported interfaces, although it is not necessary to repeat each test involving an administrative action with each interface. The evaluator shall ensure, however, that each supported method of administering the TOE that conforms to the requirements of this PP be tested; for instance, if the TOE can be administered through a local hardware interface or HTTPS then both methods of administration must be exercised during the evaluation team's test activities.

## 6.1.7 Protection of the TSF (FPT)

### FPT\_API\_EXT.1 Use of Supported Services and APIs

#### FPT\_API\_EXT.1.1

The TSF shall use only documented platform APIs.

**Application Note:** This requirement applies to the APIs used when "invoke platform-provided functionality" is selected in an SFR. The definition of documented may vary depending on whether the MDM software is provided by a third-party (who relies on documented platform APIs) or by a platform vendor who may be able to guarantee support for platform APIs.

#### Evaluation Activities ▾

##### [FPT\\_API\\_EXT.1](#)

###### TSS

The evaluator shall verify that the TSS lists the platform APIs used by the MDM software. The evaluator shall then compare the list with the supported APIs (available through e.g., developer accounts, platform developer groups) and ensure that all APIs listed in the TSS are supported.

###### Guidance

There are no additional Guidance evaluation activities for this component.

###### Tests

There are no test activities for this component.

### FPT\_FLS.1 Failure with Preservation of Secure State

*This is a selection-based component. Its inclusion depends upon selection from FCS\_RB.G.1.1.*

#### FPT\_FLS.1.1

The TSF shall preserve a secure state when the following types of failures occur: [DRBG self-test failure].

**Application Note:** The intent of this requirement is to ensure that cryptographic services requiring random bit generation cannot be performed if a failure of a self-test defined in FPT\_TST.1 occurs.

#### Evaluation Activities ▾

##### [FPT\\_FLS.1](#)

###### TSS

The evaluator shall verify that the TSF describes how the TOE enters an error state in the event of a DRBG self-test failure.

###### Guidance

The evaluator shall verify that the guidance documentation describes the error state that results from a DRBG self-test failure and the actions that a user or administrator should take in response to attempt to resolve the error state.

###### Tests

There are no test activities for this component.

### FPT\_ITT.1/INTER\_XFER Internal TOE TSF Data Transfer

This is a selection-based component. Its inclusion depends upon selection from [FTP\\_ITC\\_EXT.1.1](#).

#### FPT\_ITT.1.1/INTER\_XFER

The **TSF** shall [selection]:

- invoke platform-provided functionality to use [selection]:
  - **IPsec**
  - **mutually authenticated TLS**
  - **mutually authenticated DTLS**
  - **HTTPS**
  - **SSH**
- implement functionality using [selection]:
  - **IPsec as defined in the PP-Module for VPN Client**
  - **mutually authenticated TLS as defined in the Package for Transport Layer Security**
  - **mutually authenticated DTLS as defined in the Package for Transport Layer Security**
  - **HTTPS in accordance with FCS\_HTTPS\_EXT.1**
  - **SSH as defined in the Functional Package for Secure Shell**

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] to protect all data from [*disclosure and modification*] when it is transferred between separate parts of the **TOE**.

**Application Note:** This requirement ensures all communications between components of a distributed **TOE** are protected through the use of an encrypted communications channel. The data passed in this trusted communication channel are encrypted as defined in the protocol chosen in the second selection.

The trusted channel uses secure protocols that preserve the confidentiality and integrity of **MDM** communications. The **ST** author chooses the mechanism or mechanisms supported by the **TOE**. To support mutual authentication, **FIA\_X509\_EXT.1** from [Functional Package for X.509, version 1.0](#) should be included in the **ST** and iterated as "FIA\_X509\_EXT.1/Internal" per the guidance in [Section 1.5 Package Usage](#) (to distinguish it from **TSF** validation of certificates presented by entities that are external to the **TOE** boundary). This channel may also be used as the registration channel for the registration process, as described in section 3.1 and [FCO\\_CPC\\_EXT.1.2](#).

If "IPsec as defined in the **PP-Module** for VPN Client" is selected, the **TSF** must claim conformance to a **PP-Configuration** that includes the VPN Client **PP-Module**.

If the **ST** author selects "SSH as defined in the Functional Package for Secure Shell," the **TSF** must be validated against the **PP** for Secure Shell with the **MDM PP**. It should be noted that due to constraints imposed by this **PP** that SHA-1 cannot be used.

If the **ST** author selects "mutually authenticated TLS as defined in the Package for Transport Layer Security" or "mutually authenticated DTLS as defined in the Package for Transport Layer Security," the **TSF** must be validated against requirements from the Package for Transport Layer Security, with the following selections made:

- **FCS\_TLS\_EXT.1:**
  - either TLS or DTLS is selected depending on the selection made in
  - either client or server is selected as appropriate
- **FCS\_TLSC\_EXT.1.1 or FCS\_TLSS\_EXT.1.1 (as appropriate):**
  - The cipher suites selected must correspond with the algorithms and hash functions allowed in **FCS\_COP.1**.
  - mutual authentication must be selected

Protocol, RBG, Certificate validation, algorithm, and similar services may be met with platform-provided services.

This requirement is claimed if "[FPT\\_ITT.1/INTER\\_XFER](#)" is selected in [FTP\\_ITC\\_EXT.1](#).

If HTTPS is chosen, [FCS\\_HTTPS\\_EXT.1](#) must be included in the **ST**.

#### Evaluation Activities ▾

[FPT\\_ITT.1/INTER\\_XFER](#)  
**TSS**

The evaluator shall examine the TSS to determine that the methods and protocols used to protect distributed TOE components are described. The evaluator shall also confirm that all protocols listed in the TSS in support of TOE administration are consistent with those specified in the requirement, and are included in the requirements in the ST.

If "invoke platform-provided functionality" is selected, the evaluator shall examine the TSS to verify that it describes (for each supported platform) how this functionality is invoked (it should be noted that this may be through a mechanism that is not implemented by the MDM server; nonetheless, that mechanism will be identified in the TSS as part of this evaluation activity).

#### Guidance

The evaluator shall confirm that the operational guidance contains instructions for establishing the communication paths for each supported method.

#### Tests

- Test FPT\_ITT.1/INTER\_XFER:1: The evaluator shall ensure that communications using each specified (in the operational guidance) communication method is tested during the course of the evaluation, setting up the connections as described in the operational guidance and ensuring that communication is successful.
- Test FPT\_ITT.1/INTER\_XFER:2: The evaluator shall ensure, for each method of communication, the channel data is not sent in plaintext.

Further evaluation activities are associated with the specific protocols.

### FPT\_ITT.1/INTER\_XFER\_AGENT Internal TOE TSF Data Transfer (MDM Agent)

This is a selection-based component. Its inclusion depends upon selection from [FTP\\_ITC\\_EXT.1.1](#).

#### FPT\_ITT.1.1/INTER\_XFER\_AGENT

The TSF shall [selection]:

- invoke platform-provided functionality to use [selection]:
  - mutually authenticated TLS
  - mutually authenticated DTLS
  - HTTPS
- implement functionality using [selection]:
  - mutually authenticated TLS as defined in the Package for Transport Layer Security
  - mutually authenticated DTLS as defined in the Package for Transport Layer Security
  - HTTPS in accordance with [FCS\\_HTTPS\\_EXT.1](#)

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] to protect all data from [disclosure and modification] when it is transferred between the TSF and MDM agent.

**Application Note:** This requirement ensures all communications between the TSF and MDM agent are protected through the use of an encrypted communications channel. The data passed in this trusted communication channel are encrypted as defined in the protocol chosen in the second selection.

The trusted channel uses secure protocols that preserve the confidentiality and integrity of MDM communications. The ST author chooses the mechanism or mechanisms supported by the TOE. To support mutual authentication, FIA\_X509\_EXT.1 from [Functional Package for X.509, version 1.0](#) should be included in the ST and iterated as "FIA\_X509\_EXT.1/External" per the guidance in [Section 1.5 Package Usage](#) (to distinguish it from TSF validation of certificates presented by entities that are other parts of a distributed TOE). This channel may also be used as the registration channel for the registration process, as described in section 3.1 and [FCO\\_CPC\\_EXT.1.2](#).

If the ST author selects "mutually authenticated TLS as defined in the Package for Transport Layer Security" or "mutually authenticated DTLS as defined in the Package for Transport Layer Security," the TSF must be validated against requirements from the Package for Transport Layer Security, with the following selections made:

- FCS\_TLS\_EXT.1:
  - either TLS or DTLS is selected depending on the selection made in FPT\_ITT.1.1(2)
  - either client or server is selected as appropriate
- FCS\_TLSC\_EXT.1.1 or FCS\_TLSS\_EXT.1.1 (as appropriate):

- o The cipher suites selected must correspond with the algorithms and hash functions allowed in FCS\_COP.1.
  - o mutual authentication must be selected
- Protocol, RBG, Certificate validation, algorithm, and similar services may be met with platform-provided services.

If HTTPS is chosen, you must include [FCS\\_HTTPS\\_EXT.1](#) in the [ST](#). This requirement is claimed if "[FPT\\_ITT.1/INTER\\_XFER\\_AGENT](#)" is selected in [FTP\\_ITC\\_EXT.1](#).

If HTTPS is chosen, [FCS\\_HTTPS\\_EXT.1](#) must be included in the [ST](#).

## Evaluation Activities ▾

### [FPT\\_ITT.1/INTER\\_XFER\\_AGENT](#)

#### [TSS](#)

The evaluator shall examine the [TSS](#) to determine that the methods and protocols used to protect distributed [TOE](#) components are described. The evaluator shall also confirm that all protocols listed in the [TSS](#) in support of [TOE](#) administration are consistent with those specified in the requirement, and are included in the requirements in the [ST](#).

If "invoke platform-provided functionality" is selected, the evaluator shall examine the [TSS](#) to verify that it describes (for each supported platform) how this functionality is invoked (it should be noted that this may be through a mechanism that is not implemented by the [MDM](#) server; nonetheless, that mechanism will be identified in the [TSS](#) as part of this evaluation activity).

#### **Guidance**

The evaluator shall confirm that the operational guidance contains instructions for establishing the communication paths for each supported method.

#### **Tests**

- Test [FPT\\_ITT.1/INTER\\_XFER\\_AGENT:1](#): The evaluator shall ensure that communications using each specified (in the operational guidance) communication method is tested during the course of the evaluation, setting up the connections as described in the operational guidance and ensuring that communication is successful.
- Test [FPT\\_ITT.1/INTER\\_XFER\\_AGENT:2](#): The evaluator shall ensure, for each method of communication, the channel data is not sent in plaintext.

Further evaluation activities are associated with the specific protocols.

## [FPT\\_LIB\\_EXT.1 Use of Third-Party Libraries](#)

### [FPT\\_LIB\\_EXT.1.1](#)

The [MDM](#) software shall be packaged with only [**assignment**: list of third-party libraries].

**Application Note:** The intention of this requirement is for the [ST](#) author to document which software libraries (including version numbers) the [MDM](#) software is including in case vulnerabilities are later discovered with those libraries. For cloud services, the assignment can be completed with a reference to a non-public library document as an annex for those libraries that are not or cannot be made public.

## Evaluation Activities ▾

### [FPT\\_LIB\\_EXT.1](#)

#### [TSS](#)

The evaluator shall verify that the [TSS](#) lists the libraries used by the [MDM](#) software or the public libraries used by the cloud [MDM](#) services. The evaluator shall verify that libraries found to be packaged with or employed by the [MDM](#) software are limited to those in the assignment.

#### **Library Document**

(conditional: The [TOE](#) is a cloud [MDM](#) service) The evaluator shall verify that the non-public library document lists the libraries used by the [MDM](#) service.

#### **Guidance**

There are no additional Guidance evaluation activities for this component.

### Tests

There are no test activities for this component.

## FPT\_TDC.1/Policy Inter-TSF Basic TSF Data Consistency (Policy Data)

This is a selection-based component. Its inclusion depends upon selection from [FTP\\_ITC\\_EXT.1.1](#).

### FPT\_TDC.1.1/Policy

The TSF shall provide the capability to consistently interpret [**assignment**: MDM policy] when shared between the primary MDM server and the MDM agent.

### FPT\_TDC.1.2/Policy

The TSF shall use [**assignment**: *list of interpretation rules to be applied by the TSF*] when interpreting MDM policy from the primary MDM server.

**Application Note:** The intent of this requirement is to verify that there are well-defined rules that the subordinate MDM server follows if it modifies/interprets the MDM policy sent from the primary MDM server that is then delivered to the MDM agent on the managed device. For example: a mapping between the command received from the primary MDM server and the matching command delivered to the MDM agent. If the subordinate MDM does not modify the policy for delivery to the MDM agent, then this requirement is implicitly satisfied.

## Evaluation Activities ▼

### [FPT\\_TDC.1/Policy](#)

#### TSS

The evaluator ensures that the TSS describes how the policies are translated between the policy that is accepted by the subordinate MDM server and the policy that is generated for delivery to the MDM agent on the managed device. This should include a description or mapping for each MDM agent configuration and policy function claimed in [FMT\\_SMF.1/SERVER\\_CONF\\_AGENT](#).

#### Guidance

There are no additional Guidance evaluation activities for this component.

#### Tests

The evaluator shall perform a policy update from an available configuration interface (such as through a test primary MDM Server) and retain a copy of the resulting policy. The evaluator then obtains a version of the policy modified by the subordinate MDM for delivery to the MDM agent. The evaluator shall compare the original policy to the modified policy and ensure that the translation rules are valid for each configuration and policy function claimed.

## FPT\_TST.1 TSF Self-Testing

This is a selection-based component. Its inclusion depends upon selection from [FCS\\_RB.G.1.1](#).

### FPT\_TST.1.1

The TSF shall run a suite of the following self-tests [**selection**: *during initial start-up, periodically during normal operation, at the request of the authorized user, at the conditions [**assignment**: conditions under which self-test should occur]*] to demonstrate the correct operation of [TSF DRBG specified in [FCS\\_RB.G.1](#)].

### FPT\_TST.1.2

The TSF shall provide authorized users with the capability to verify the integrity of [IDRBG seed and output data]].

### FPT\_TST.1.3

The TSF shall provide authorized users with the capability to verify the integrity of [TSF DRBG specified in [FCS\\_RB.G.1](#)]].

**Application Note:** This SFR is a required dependency of [FCS\\_RB.G.1](#). It is intended to require that any DRBG implemented by the TOE undergo health testing to ensure that the random bit generation

functionality has not been degraded. If the TSF supports multiple DRBGs, this SFR should be iterated to describe the self-test behavior for each.

## Evaluation Activities ▾

### FPT\_TST.1

#### TSS

The evaluator shall examine the TSS to ensure that it details the self-tests that are run by the TSF along with how they are run. This description should include an outline of what the tests are actually doing. The evaluator shall ensure that the TSS makes an argument that the tests are sufficient to demonstrate that the DRBG is operating correctly.

Note that this information may also be placed in the entropy documentation specified by [Appendix D - Entropy Documentation and Assessment](#).

#### Guidance

If a self-test can be executed at the request of an authorized user, the evaluator shall verify that the operational guidance provides instructions on how to execute that self-test.

#### Tests

For each self-test, the evaluator shall verify that evidence is produced that the self-test is executed when specified by [FPT\\_TST.1.1](#).

If a self-test can be executed at the request of an authorized user, the evaluator shall verify that following the steps documented in the operational guidance to perform the self-test will result in execution of the self-test.

## FPT\_TST\_EXT.1 Functionality Testing

### FPT\_TST\_EXT.1.1

The TSF shall run a suite of self tests during initial start-up (power on) to demonstrate correct operation of the TSF.

### FPT\_TST\_EXT.1.2

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

**Application Note:** While the TOE is typically a software package running in the IT Environment, it is still capable of performing the self-test activities required above. It should be understood, however, that there is a significant dependency on the host environment in assessing the assurance provided by the tests mentioned above (meaning that if the host environment is compromised, the self-tests will not be meaningful).

For distributed TOEs, all TOE components (except the Agent components) have to perform self-tests. This does not necessarily mean that each TOE component has to carry out the same self-tests: the ST describes the applicability of the selection (i.e., when self-tests are run) and the final assignment (i.e., which self-tests are carried out) to each TOE component.

## Evaluation Activities ▾

### FPT\_TST\_EXT.1

#### TSS

If "invoke platform-provided functionality" is selected, the evaluator shall examine the TSS to verify that it describes (for each supported platform) how this functionality is invoked (it should be noted that this may be through a mechanism that is not implemented by the MDM server; nonetheless, that mechanism will be identified in the TSS as part of this evaluation activity).

If "implement functionality" is selected, the evaluator shall examine the TSS to ensure that it details the self-tests that are run by the TSF on start-up; this description should include an outline of what the tests are actually doing (e.g., rather than saying "memory is tested," a description similar to "memory is tested by writing a value to each memory location and reading it back to ensure it is identical to what was written" shall be used). The evaluator shall ensure that the TSS makes an argument that the tests are sufficient to demonstrate that the TSF is operating correctly.

The evaluator shall examine the TSS to ensure that it describes how to verify the integrity of stored TSF executable code when it is loaded for execution. The evaluator shall ensure that the TSS makes an argument that the tests are sufficient to demonstrate that the integrity of stored TSF executable code has not been compromised. The evaluator also ensures that the TSS (or the operational guidance) describes the actions that take place for successful (e.g., hash verified) and unsuccessful e.g., hash not verified) cases.

#### Guidance

The evaluator shall verify that the operational guidance includes a description of how the administrator can verify that a self-test has failed and any potential corrective actions that can be used to resolve the failure state.

#### Tests

The evaluator shall perform the following tests:

- *Test FPT\_TST\_EXT.1:1: The evaluator performs the integrity check on a known good TSF executable and verifies that the check is successful.*
- *Test FPT\_TST\_EXT.1:2: The evaluator modifies the TSF executable, performs the integrity check on the modified TSF executable and verifies that the check fails.*

## FPT\_TUD\_EXT.1 Trusted Update

### FPT\_TUD\_EXT.1.1

The TSF shall provide authorized administrators the ability to query the current version of the software.

**Application Note:** For a distributed TOE, the method of determining the installed versions on each component of the TOE is described in the operational guidance. In the requirement, "software" refers to the component of the distributed TOE to which the requirement is being applied.

### FPT\_TUD\_EXT.1.2

The TSF shall [selection: invoke platform-provided functionality, implement functionality] to provide authorized administrators the ability to initiate updates to the TOE.

### FPT\_TUD\_EXT.1.3

The TSF shall [selection: invoke platform-provided functionality, implement functionality] to provide a means to verify software updates to the TSF using a digital signature mechanism prior to installing those updates.

**Application Note:** The software on the TSF will occasionally need to be updated. This requirement is intended to ensure that the TSF only installs updates provided by the vendor, as updates provided by another source may contain malicious code. If the server is not an appliance, the update will be verified by the platform on which the server software runs. If the server is an appliance, the update must be verified by the TSF.

For distributed TOEs, all TOE components must support Trusted Update. The verification of the signature or hash on the update must either be done by each TOE component itself (signature verification) or for each TOE component (hash verification).

Updating a distributed TOE might lead to the situation where different TOE components are running different software versions. Depending on the differences between the different software versions the impact of a mixture of different software versions might be no problem at all or critical to the proper functioning of the TOE. The TSS must detail the mechanisms that support the continuous proper functioning of the TOE during trusted update of distributed TOEs.

## Evaluation Activities ▼

### FPT\_TUD\_EXT.1.1

#### TSS

The evaluator shall verify that the TSS identifies the mechanism by which the current version of the TOE can be identified.

#### Guidance

The evaluator shall ensure that the administrator guidance includes instructions for determining the current version of the TOE.

#### Tests

The evaluator shall query the TSF for the current version of the software according to the operational guidance and shall

verify that the current version matches that of the documented and installed version.

#### FPT\_TUD\_EXT.1.2

##### TSS

If "invoke platform-provided functionality" is selected, the evaluator shall examine the TSS to verify that it describes (for each supported platform) how this functionality is invoked (it should be noted that this may be through a mechanism that is not implemented by the MDM server; nonetheless, that mechanism will be identified in the TSS as part of this evaluation activity).

##### Guidance

The evaluator shall verify that the operational guidance provides instructions for how to initiate an update to the TOE and any restrictions on this function such that only an authorized administrator can perform it.

##### Tests

There are no test activities for this element.

#### FPT\_TUD\_EXT.1.3

##### TSS

If "invoke platform-provided functionality" is selected, the evaluator shall examine the TSS to verify that it describes (for each supported platform) how this functionality is invoked (it should be noted that this may be through a mechanism that is not implemented by the MDM server; nonetheless, that mechanism will be identified in the TSS as part of this evaluation activity).

If "implement functionality" is selected, the evaluator shall examine the TSS and verify that it describes the standards by which the updates are digitally signed and how the signature verification process is implemented.

##### Guidance

The evaluator shall examine the operational guidance to verify that it identifies how the TOE will verify the integrity of an update and how the administrator is made aware of a failure to verify the integrity of the update.

##### Tests

The evaluator shall perform the following tests:

- Test FPT\_TUD\_EXT.1.3:1: The evaluator shall attempt to initiate an update digitally signed by the vendor and verify that the update is successfully installed.
- Test FPT\_TUD\_EXT.1.3:2: The evaluator shall attempt to install an update not digitally signed by the vendor and verify that either the signature can be checked (allowing the update to be aborted) or the update is not installed.

## 6.1.8 TOE Access (FTA)

### FTA\_TAB.1 Default TOE Access Banners

This is an optional component. However, applied modules or packages might redefine it as mandatory.

#### FTA\_TAB.1.1

Before establishing a user session, the [TSE] shall [selection: invoke platform-provided functionality, implement functionality] to display an [administrator-specified advisory notice and consent warning] message regarding use of the TOE.

**Application Note:** This requirement is to ensure that an advisory notice or consent banner is presented to the user on start-up or unlock of the TSE.

### Evaluation Activities ▾

#### FTA\_TAB.1

##### TSS

If "invoke platform-provided functionality" is selected, the evaluator shall examine the TSS to verify that it describes (for each supported platform) how this functionality is invoked (it should be noted that this may be through a mechanism that is not implemented by the MDM server; nonetheless, that mechanism will be identified in the TSS as part of this evaluation activity).

If "implement functionality" is selected, the TSS shall describe when the banner is displayed.

##### Guidance

The evaluator follows the operational guidance to configure a notice and consent warning message.

### Tests

The evaluator shall also perform the following test: The evaluator shall start up or unlock the **TSF**. The evaluator shall verify that the notice and consent warning message is displayed in each instance described in the **TSS**.

## 6.1.9 Trusted Path/Channels (FTP)

### FTP\_ITC.1/INTER\_TSF\_XFER\_AGENT Inter-TSF Trusted Channel (MDM agent)

*This is a selection-based component. Its inclusion depends upon selection from [FTP\\_ITC\\_EXT.1.1](#).*

#### FTP\_ITC.1.1/INTER\_TSF\_XFER\_AGENT

The **TSF** shall [selection:

- *invoke platform-provided functionality to use [selection]:*
  - **mutually authenticated TLS**
  - **mutually authenticated DTLS**
  - **HTTPS**
- *implement functionality using [selection]:*
  - **mutually authenticated TLS as defined in the Package for Transport Layer Security**
  - **mutually authenticated DTLS as defined in the Package for Transport Layer Security**
  - **HTTPS in accordance with [FCS\\_HTTPS\\_EXT.1](#)**

]

] to provide a **trusted** communication channel between itself (**as a server**) and the **MDM** agent that is logically distinct from other communication channels, provides assured identification of its endpoints, **protects channel data from disclosure**, and **detects modification of the channel data**.

**Application Note:** The intent of the mandatory portion of the above requirement is to use the cryptographic protocols identified in the requirement to establish and maintain a trusted channel between the **TOE** and the **MDM** agent. If the **TOE** includes a separate **MAS** Server, this requirement also addresses the communication between the **MAS** Server and the **MDM** agent. Only TLS, DTLS, or HTTPS are used in this trusted channel.

This requirement is to ensure that the transmission of any audit logs, **MD** information data (software version, hardware model, and application versions), and configuration data collected by the **MDM** agent and sent from the **MDM** agent to the **MDM** Server, when commanded, or at configurable intervals, is properly protected. This trusted channel also protects any commands and policies sent by the **MDM** server to the **MDM** agent. Either the **MDM** agent or the **MDM** server is able to initiate the connection.

For TLS connections between the **MDM** server and agent, the **MDM** server is the Server side of the TLS connection, therefore it is appropriate to include the selection-based FCS\_TLSS\_SFRs in the **ST**, not FCS\_TLSC\_SFRs. With respect to mutual authentication, in cases where the agent is outside of the **TOE**, it should be verified that the server can support mutual authentication, meaning that the server includes support for client-side certificates for TLS mutual authentication post-enrollment. However, the client side is not evaluated since the agent is not in the **TOE**.

This trusted channel protects the connection between an enrolled **MDM** agent and the **MDM** server. [FTP\\_TRP.1/TRUSTPATH\\_ENROLL](#) provides a trusted channel to protect the connection between an unenrolled **MDM** agent and the **MDM** server during the enrollment operation.

The trusted channel uses TLS, DTLS, or HTTPS as the protocol that preserves the confidentiality and integrity of **MDM** communications. The **ST** author chooses the mechanism or mechanisms supported by the **TOE**.

If the **ST** author selects "mutually authenticated TLS as defined in the Package for Transport Layer Security" or "mutually authenticated DTLS as defined in the Package for Transport Layer Security," the **TSF** must be validated against requirements from the Package for Transport Layer Security, with the following selections made:

- **FCS\_TLS\_EXT.1:**
  - either TLS or DTLS is selected depending on the selection made in [FTP\\_ITC.1.1/INTER\\_TSF\\_XFER\\_AGENT](#)
  - server must be selected

- FCS\_TLSS\_EXT.1.1:
    - The cipher suites selected must correspond with the algorithms and hash functions allowed in FCS\_COP.1.
    - mutual authentication must be selected
- Protocol, RBG, Certificate validation, algorithm, and similar services may be met with platform-provided services.

The requirement implies that not only are communications protected when they are initially established, but also on resumption after an outage. It may be the case that some part of the TOE setup involves manually setting up tunnels to protect other communication, and if after an outage the TOE attempts to re-establish the communication automatically with (the necessary) manual intervention, there may be a window created where an attacker might be able to gain critical information or compromise a connection.

This requirement is claimed if "[FTP\\_ITC.1/INTER\\_TSF\\_XFER\\_AGENT](#)" is selected in [FTP\\_ITC\\_EXT.1](#).

If HTTPS is chosen, [FCS\\_HTTPS\\_EXT.1](#) must be included in the ST.

#### [FTP\\_ITC.1.2/INTER\\_TSF\\_XFER\\_AGENT](#)

The TSF shall **[selection: invoke platform-provided functionality, implement functionality]** to permit the [TSF and MDM agent] to initiate communication via the trusted channel.

#### [FTP\\_ITC.1.3/INTER\\_TSF\\_XFER\\_AGENT](#)

The TSF shall **[selection: invoke platform-provided functionality, implement functionality]** to initiate communication via the trusted channel for [*all communication between the TSF and the MDM agent*].

### Evaluation Activities ▾

#### [FTP\\_ITC.1/INTER\\_TSF\\_XFER\\_AGENT](#)

##### TSS

*The evaluator shall examine the TSS to determine that the methods of agent-server communication are indicated, along with how those communications are protected. The evaluator shall also confirm that all protocols listed in the TSS in support of remote TOE administration are consistent with those specified in the requirement, and are included in the requirements in the ST.*

*If "invoke platform-provided functionality" is selected, the evaluator shall examine the TSS to verify that it describes (for each supported platform) how this functionality is invoked (it should be noted that this may be through a mechanism that is not implemented by the MDM server; nonetheless, that mechanism will be identified in the TSS as part of this evaluation activity).*

##### **Guidance**

*The evaluator shall confirm that the operational guidance contains instructions for configuring the communication channel between the MDM agent and the MDM server for each supported method.*

##### **Tests**

- Test [FTP\\_ITC.1/INTER\\_TSF\\_XFER\\_AGENT:1](#): *The evaluator shall ensure that communications using each specified (in the operational guidance) agent-server communication method is tested during the course of the evaluation, setting up the connections as described in the operational guidance and ensuring that communication is successful.*
- Test [FTP\\_ITC.1/INTER\\_TSF\\_XFER\\_AGENT:2](#): *The evaluator shall ensure, for each method of agent-server communication, the channel data is not sent in plaintext.*
- Test [FTP\\_ITC.1/INTER\\_TSF\\_XFER\\_AGENT:3](#): *The evaluator shall ensure, for each communication channel with the MDM server, that a protocol analyzer identifies the traffic as the protocol under testing.*

*Further evaluation activities are associated with the specific protocols.*

#### **FTP\_ITC.1/INTER\_XFER\_IT Inter-TSF Trusted Channel (Authorized IT Entities)**

#### [FTP\\_ITC.1.1/INTER\\_XFER\\_IT](#)

The TSF shall **[selection:**

- **invoke platform-provided functionality to use [selection:**
  - IPsec
  - SSH

- ***mutually authenticated TLS***
  - ***mutually authenticated DTLS***
  - ***HTTPS***
- [  
• ***implement functionality using [selection:***
- ***IPsec as defined in the PP-Module for VPN Client***
  - ***SSH as defined in the Functional Package for Secure Shell***
  - ***mutually authenticated TLS as defined in the Package for Transport Layer Security***
  - ***mutually authenticated DTLS as defined in the Package for Transport Layer Security***
  - ***HTTPS in accordance with FCS\_HTTPS\_EXT.1***

]

] to provide a **trusted** communication channel between itself and **authorized IT entities supporting the following capabilities: audit server, [selection:**

- ***authentication server***
- ***primary MDM server***
- ***subordinate MDM server***
- ***[assignment: other capabilities]***

] that is logically distinct from other communication channels and provides assured identification of its endpoints and protection of the channel data from modification or disclosure.

**Application Note:** The intent of the mandatory portion of the above requirement is to use the cryptographic protocols identified in the requirement to establish and maintain a trusted channel with authorized IT entities that the **TOE** interacts with to perform its functions.

Protection (by one of the listed protocols) is required at least for communications with the server that collects the audit information. If it communicates with an authentication server (e.g., RADIUS), then the **ST** author chooses "authentication server" in **FTP\_ITC.1.1/INTER\_XFER\_IT** and this connection must be protected by one of the listed protocols. Likewise if the **TOE** acts as either a primary or subordinate **MDM** server, then "primary **MDM** server" or "subordinate **MDM** server" is selected for the device it communicates with and those communications are protected by one of the listed protocols. If other authorized IT entities (e.g., NTP server) are protected, the **ST** author makes the appropriate assignments (for those entities) and selections (for the protocols that are used to protect those connections).

To summarize, the connection to an external audit collection server is required to be protected by one of the listed protocols. If an external authentication server is supported, or the **TOE** interacts with a primary or subordinate **MDM** server, then it is required to protect that connection with one of the listed protocols. For any other external server, external communications are not required to be protected, but if protection is claimed, then it must be protected with one of the identified protocols.

For communications with any authorized IT entities outside of the **TOE**, the **MDM** server should still be able to support mutual authentication. There are no requirements levied on the external entities, but the **MDM** server should be able to support mutual authentication. This way if the non-**TOE** authorized entity does support mutual authentication, the **MDM** server is in a position to make use of that.

The trusted channel uses IPsec, TLS, DTLS, or HTTPS as the protocol that preserves the confidentiality and integrity of **MDM** communications. The **ST** author chooses the mechanism or mechanisms supported by the **TOE**.

If "IPsec as defined in the **PP-Module** for VPN Client" is selected, the **TSF** must claim conformance to a **PP-Configuration** that includes the VPN Client **PP-Module**.

If HTTPS is chosen, **FCS\_HTTPS\_EXT.1** must be included in the **ST**.

If the **ST** author selects "SSH as defined in the Functional Package for Secure Shell," the **TSF** must be validated against the **PP** for Secure Shell with the **MDM PP**. It should be noted that due to constraints imposed by this **PP** that SHA-1 cannot be used.

If the **ST** author selects "mutually authenticated TLS as defined in the Package for Transport Layer Security" or "mutually authenticated DTLS as defined in the Package for Transport Layer Security," the **TSF** must be validated against requirements from the Package for Transport Layer Security, with the following selections made:

- ***FCS\_TLS\_EXT.1:***
  - either TLS or DTLS is selected depending on the selection made in **FTP\_ITC.1.1/INTER\_XFER\_IT**
  - either client or server is selected as appropriate

- FCS\_TLSC\_EXT.1.1 or FCS\_TLSS\_EXT.1.1 (as appropriate):
  - The cipher suites selected must correspond with the algorithms and hash functions allowed in FCS\_COP.1.
  - mutual authentication must be selected
- FCS\_DTLS\_EXT.1.1 or FCS\_DTLSS\_EXT.1.1 (as appropriate):
  - The cipher suites selected must correspond with the algorithms and hash functions allowed in FCS\_COP.1.
  - mutual authentication must be selected

Protocol, RBG, Certificate validation, algorithm, and similar services may be met with platform-provided services.

The requirement implies that not only are communications protected when they are initially established, but also on resumption after an outage. It may be the case that some part of the **TOE** setup involves manually setting up tunnels to protect other communication, and if after an outage the **TOE** attempts to re-establish the communication automatically with (the necessary) manual intervention, there may be a window created where an attacker might be able to gain critical information or compromise a connection.

#### FTP\_ITC.1.2/INTER\_XFER\_IT

The **TSF** shall [selection: *invoke platform-provided functionality, implement functionality*] to permit the **MDM server or other authorized IT entities** to initiate communication via the trusted channel.

#### FTP\_ITC.1.3/INTER\_XFER\_IT

The **TSF** shall [selection: *invoke platform-provided functionality , implement functionality* ] to initiate communication via the trusted channel for [assignment: *list of functions for which a trusted channel is required*].

**Application Note:** While there are no requirements on the party initiating the communication, the **ST** author lists in the assignment for **FTP\_ITC.1.3/INTER\_XFER\_IT** the services for which the **TOE** can initiate the communication with the authorized IT entity.

### Evaluation Activities ▼

#### [FTP\\_ITC.1/INTER\\_XFER\\_IT](#)

##### **TSS**

The evaluator shall examine the **TSS** to determine that the methods of communication with authorized IT entities are indicated, along with how those communications are protected.

If "invoke platform-provided functionality" is selected, the evaluator shall examine the **TSS** to verify that it describes (for each supported platform) how this functionality is invoked (it should be noted that this may be through a mechanism that is not implemented by the **MDM server**; nonetheless, that mechanism will be identified in the **TSS** as part of this evaluation activity).

##### **Guidance**

The evaluator shall confirm that the operational guidance contains instructions for configuring the communication channel between the **MDM server** and authorized IT entities for each supported method.

##### **Tests**

- Test **FTP\_ITC.1/INTER\_XFER\_IT:1**: The evaluator shall ensure that communications using each specified (in the operational guidance) communication method is tested during the course of the evaluation, setting up the connections as described in the operational guidance and ensuring that communication is successful.
- Test **FTP\_ITC.1/INTER\_XFER\_IT:2**: The evaluator shall ensure, for each method of communication, the channel data is not sent in plaintext.
- Test **FTP\_ITC.1/INTER\_XFER\_IT:3**: The evaluator shall ensure, for each communication channel with the **MDM server**, that a protocol analyzer identifies the traffic as the protocol under testing.

Further evaluation activities are associated with the specific protocols.

### FTP\_ITC\_EXT.1 Trusted Channel

#### FTP\_ITC\_EXT.1.1

The **TSF** shall provide a communication channel between itself and [**selection**:

- an **MDM agent that is internal to the TOE**

- an **MDM** agent that is external to the **TOE**
- a subordinate **MDM** server
- a primary **MDM** server
- other components comprising the distributed **TOE**

] that is logically distinct from other communication channels, as specified in [**selection:** [FPT\\_ITT.1/INTER\\_XFER](#), [FPT\\_ITT.1/INTER\\_XFER\\_AGENT](#), [FTP\\_ITC.1/INTER\\_TSF\\_XFER\\_AGENT](#), [FTP\\_ITC.1/INTER\\_XFER\\_IT](#)].

**Application Note:** This SER describes the communication channels between the **MDM** server and an agent that may or may not be in the **TOE**, and optionally separate components comprising a distributed **TOE**, to determine which selection-based SERs will need to be included in the **ST**.

If the **TOE** includes an **MDM** agent, then the communication channel between the agent and **TSF** is internal to the **TOE** and thus "an **MDM** agent that is internal to the **TOE**" must be selected in the first selection. Additionally [FPT\\_ITT.1/INTER\\_XFER\\_AGENT](#) must be selected in the second selection and [FPT\\_ITT.1/INTER\\_XFER\\_AGENT](#) must be included in the **ST**.

If the **TOE** interoperates with an evaluated **MDM** agent built into a mobile device (i.e., the **TOE** does not include an **MDM** agent), the communication channel between the agent and **TSF** is external to the **TOE** and thus "an **MDM** agent that is external to the **TOE**" must be selected in the first selection. Additionally [FTP\\_ITC.1/INTER\\_TSF\\_XFER\\_AGENT](#) must be selected in the second selection and [FTP\\_ITC.1/INTER\\_TSF\\_XFER\\_AGENT](#) must be included in the **ST**.

If the **TOE** acts as a primary **MDM** server and interoperates with a subordinate **MDM** server to forward policies to a **MDM** agent on a managed device, then "a subordinate **MDM** server" must be selected in the first selection. Additionally "[FTP\\_ITC.1/INTER\\_XFER\\_IT](#)" must be selected in the second selection.

If the **TOE** acts as a subordinate **MDM** server that can accept and forward signed policy files from a primary **MDM** server, and forward those policies to an **MDM** agent on a managed device, then "a primary **MDM** server" must be selected in the first selection. Additionally "[FTP\\_ITC.1/INTER\\_XFER\\_IT](#)" must be selected in the second selection.

If "other components comprising the distributed **TOE**" is selected in the first selection then [FPT\\_ITC.1/INTER\\_XFER](#) must be selected in the second selection. [FPT\\_ITC.1/INTER\\_XFER](#) must be included in the **ST** for all internal channels used to transfer **TSF** data between **TOE** components other than an **MDM** agent.

## Evaluation Activities ▾

### [FTP\\_ITC\\_EXT.1](#)

#### **TSS**

The evaluator shall ensure that the **TSS** contains whether the **MDM** server communication channel is internal or external to the **TOE**.

#### **Guidance**

TBD

#### **Tests**

This testing can be completed in conjunction with the testing for [FPT\\_ITT.1/INTER\\_XFER](#) / [FPT\\_ITT.1/INTER\\_XFER\\_AGENT](#), [FTP\\_ITC.1/INTER\\_TSF\\_XFER\\_AGENT](#) or [FTP\\_ITC.1\(3\)](#) [FTP\\_ITC.1/INTER\\_XFER\\_IT](#).

## [FTP\\_TRP.1/TRUSTPATH\\_ENROLL](#) Trusted Path (for Enrollment)

### [FTP\\_TRP.1.1/TRUSTPATH\\_ENROLL](#)

The **TSF** shall [**selection**:

- invoke platform-provided functionality to use [**selection**:
  - **TLS**
  - **HTTPS**
- implement functionality using [**selection**:
  - **TLS** as defined in the Package for Transport Layer Security

- *HTTPS in accordance with FCS\_HTTPS\_EXT.1*

]

] to provide a **trusted** communication channel between itself and **another trusted IT product** that is logically distinct from other communication **channels** and provides assured identification of its endpoints and protection of the **channel** data from [modification or disclosure].

#### FTP\_TRP.1.2/TRUSTPATH\_ENROLL

The **TSE** shall [**selection: invoke platform-provided functionality, implement functionality**] to permit [**selection: the TSE, another trusted IT product**] to initiate communication via the trusted path.

#### FTP\_TRP.1.3/TRUSTPATH\_ENROLL

The **TSE** shall [**selection: invoke platform-provided functionality , implement functionality ] to initiate communication via the trusted channel for [assignment: list of functions for which a trusted channel is required]** .

**Application Note:** This requirement ensures that authorized **MD** users initiate all communication with the **TQE** via a trusted path, and that all communications with the **TQE** by **MD** users is performed over this path. The purpose of this connection is for enrollment by the **MD** user. The data passed in this trusted communication channel are encrypted as defined in the protocol chosen in the first selection. The **ST** author chooses the mechanism or mechanisms supported by the **TQE**.

If the **ST** author selects "TLS as defined in the Package for Transport Layer Security" the **TSE** must be validated against requirements from the Package for Transport Layer Security, with the following selections made:

- FCS\_TLS\_EXT.1:
  - TLS must be selected
  - server must be selected
- FCS\_TLSS\_EXT.1.1:
  - The cipher suites selected must correspond with the algorithms and hash functions allowed in FCS\_COP.1.

Protocol, RBG, Certificate validation, algorithm, and similar services may be met with platform-provided services.

If HTTPS is chosen, **FCS\_HTTPS\_EXT.1** must be included in the **ST**.

### Evaluation Activities ▼

#### FTP\_TRP.1/TRUSTPATH\_ENROLL

##### TSS

The evaluator shall examine the **TSS** to determine that the methods of remote enrollment are indicated, along with how those communications are protected. The evaluator shall also confirm that all protocols listed in the **TSS** in support of enrollment are consistent with those specified in the requirement, and are included in the requirements in the **ST**.

If "invoke platform-provided functionality" is selected, the evaluator shall examine the **TSS** to verify that it describes (for each supported platform) how this functionality is invoked (it should be noted that this may be through a mechanism that is not implemented by the **MDM** server; nonetheless, that mechanism will be identified in the **TSS** as part of this evaluation activity).

##### Guidance

The evaluator shall confirm that the operational guidance contains instructions for establishing the enrollment sessions for each supported method.

##### Tests

For each MDM agent or platform listed as supported in the ST:

- Test FTP\_TRP.1/TRUSTPATH\_ENROLL:1: The evaluator shall ensure that communications using each specified (in the operational guidance) enrollment method is tested during the course of the evaluation, setting up the connections as described in the operational guidance and ensuring that communication is successful.
- Test FTP\_TRP.1/TRUSTPATH\_ENROLL:2: For each method of enrollment supported, the evaluator shall follow the operational guidance to ensure that there is no available interface that can be used by a remote user to establish enrollment sessions without invoking the trusted path.
- Test FTP\_TRP.1/TRUSTPATH\_ENROLL:3: The evaluator shall ensure, for each method enrollment, the channel data is not sent in plaintext.

Further evaluation activities are associated with the specific protocols.

## FTP\_TRP.1/TRUSTPATH\_JOIN Trusted Path (for Joining)

This is an objective component.

### FTP\_TRP.1.1/TRUSTPATH\_JOIN

The TSF shall [selection: invoke platform-provided functionality , implement functionality ] to provide a communication path between itself and a joining component that is logically distinct from other communication paths and provides assured identification of [selection: the TSF endpoint , both joining component and TSF endpoint ] and protection of the communicated data from [modification] and [selection: disclosure, none ].

### FTP\_TRP.1.2/TRUSTPATH\_JOIN

The TSF shall [selection: invoke platform-provided functionality, implement functionality] to permit [selection: the TSF, the joining component] to initiate communication via the trusted path.

### FTP\_TRP.1.3/TRUSTPATH\_JOIN

The TSF shall [selection: invoke platform-provided functionality, implement functionality] to require the use of the trusted path for [joining components to the TSF under environmental constraints identified in [assignment: reference to operational guidance]].

**Application Note:** This SFR implements one of the types of channel identified in the main selection for FCO\_CPC\_EXT.1.2. The "joining component" in [FTP\\_TRP.1/TRUSTPATH\\_JOIN](#) is the IT entity that is attempting to join the distributed TOE by using the registration process.

The effect of this SFR is to require the ability for components to communicate in a secure manner while the distributed TSF is being created (or when adding components to an existing distributed TSF). When creating the TSF from the initial pair of components, either of these components may be identified as the TSF for the purposes of satisfying the meaning of "TSF" in this SFR.

The selection at the end of [FTP\\_TRP.1/TRUSTPATH\\_JOIN](#) recognizes that in some cases confidentiality (i.e., protection of the data from disclosure) may not be provided by the channel. The ST author distinguishes in the TSS whether in this case the TOE relies on the environment to provide confidentiality (as part of the constraints referenced in [FTP\\_TRP.1.3/TRUSTPATH\\_JOIN](#)) or whether the registration data exchanged does not require confidentiality (in which case this assertion must be justified). If "none" is selected, then this word may be omitted in the ST to improve readability.

The assignment in [FTP\\_TRP.1.3/TRUSTPATH\\_JOIN](#) ensures that the ST highlights any specific details needed to protect the registration environment. Note that when the ST uses [FTP\\_TRP.1/TRUSTPATH\\_JOIN](#) for the registration channel then this channel cannot be reused as the normal inter-component communication channel (the latter channel must meet [FTP\\_ITC.1](#) or [FPT\\_ITT.1/INTER\\_XFER / FPT\\_ITT.1/INTER\\_XFER\\_AGENT](#)). Specific requirements for Preparative Procedures relating to [FTP\\_TRP.1/TRUSTPATH\\_JOIN](#) are defined in the Evaluation Activities.

## Evaluation Activities ▾

### FTP\_TRP.1/TRUSTPATH\_JOIN

#### TSS

The evaluator shall examine the TSS to determine that the methods of joining TOE components are indicated, along with how those communications are protected. The evaluator shall also confirm that all protocols listed in the TSS in support of joining are consistent with those specified in the requirement, and are included in the requirements in the ST.

If "invoke platform-provided functionality" is selected, the evaluator shall examine the TSS to verify that it describes (for each supported platform) how this functionality is invoked (it should be noted that this may be through a mechanism that is not implemented by the MDM server; nonetheless, that mechanism will be identified in the TSS as part of this evaluation activity).

#### Guidance

The evaluator shall confirm that the operational guidance contains instructions for joining TOE components for each supported method.

#### Tests

The evaluator shall also perform the following tests:

- Test FTP\_TRP.1/TRUSTPATH\_JOIN:1: The evaluator shall ensure that the communications path for joining components to the TSF is tested for each distinct (nonequivalent) component type, setting up the connections as described in the guidance documentation and ensuring that communication is successful. In particular the evaluator shall confirm that requirements on environment protection for the registration process are consistent with observations made on the test configuration (for example, a requirement to isolate the components from the Internet during registration might be inconsistent with the need for a component to contact a license server). If no requirements on the registration environment are identified as necessary to protect confidentiality, then the evaluator shall confirm that the key used for registration can be configured (following the instructions in the guidance documentation) to be at least the same length as the key used for the internal TSF channel that is being enabled. The evaluator shall confirm that the key used for the channel is unique to the pair of components (this is done by identifying the relevant key during the registration test: it is not necessary to examine the key value).
- Test FTP\_TRP.1/TRUSTPATH\_JOIN:2: The evaluator shall follow the guidance documentation to ensure that in fact the communication channel can be enabled by an administrator for all the TOE components identified in the guidance documentation as capable of initiation.
- Test FTP\_TRP.1/TRUSTPATH\_JOIN:3: The evaluator shall ensure that if the guidance documentation states that the channel data is encrypted then the data observed on the channel is not plaintext.
- Test FTP\_TRP.1/TRUSTPATH\_JOIN:4: The evaluator shall ensure that, for each different pair of nonequivalent component types that can use the registration channel, the connection is physically interrupted during a joining attempt. The evaluator shall ensure that when physical connectivity is restored, communications are appropriately protected.

Further evaluation activities are associated with the specific protocols.

### FTP\_TRP.1/TRUSTPATH\_Rem\_ADMIN Trusted Path (for Remote Administration)

#### FTP\_TRP.1.1/TRUSTPATH\_Rem\_ADMIN

The TSF shall [selection]:

- invoke platform-provided functionality to use [selection]:
  - IPsec
  - TLS
  - HTTPS
  - SSH
- implement functionality using [selection]:
  - IPsec as defined in the PP\_Module for VPN Client
  - TLS as defined in the Package for Transport Layer Security
  - HTTPS in accordance with FCS\_HTTPS\_EXT.1
  - SSH as defined in the Functional Package for Secure Shell

]

] to provide a communication path between itself as a [selection: **server, peer**] and [remote administrators] that is logically distinct from other communication paths and provides assured identification of its endpoints and protection of the communicated data from [modification, disclosure].

#### FTP\_TRP.1.2/TRUSTPATH\_Rem\_ADMIN

The TSF shall [selection: **invoke platform-provided functionality, implement functionality**] to permit [remote administrators] to initiate communication via the trusted path.

#### FTP\_TRP.1.3/TRUSTPATH\_Rem\_ADMIN

The TSF shall require the use of the trusted path for [initial administrator authentication, [remote administration]].

**Application Note:** This requirement ensures that authorized remote administrators initiate all communication with the **TOE** via a trusted path, and that all communications with the **TOE** by remote administrators is performed over this path. The data passed in this trusted communication channel are encrypted as defined in the protocol chosen in the first selection. The **ST** author chooses the mechanism or mechanisms supported by the **TOE**.

If "IPsec as defined in the **PP-Module** for VPN Client" is selected, the **TSF** must claim conformance to a **PP-Configuration** that includes the VPN Client **PP-Module**.

If the **ST** author selects "SSH as defined in the Functional Package for Secure Shell," the **TSF** must be validated against the **FP** for Secure Shell with the **MDM PP**. It should be noted that due to constraints imposed by this **PP** that SHA-1 cannot be used.

If the **ST** author selects "TLS as defined in the Package for Transport Layer Security" the **TSF** must be validated against requirements from the Package for Transport Layer Security, with the following selections made:

- FCS\_TLS\_EXT.1:
  - TLS must be selected
  - Server must be selected
- FCS\_TLSS\_EXT.1.1:
  - The cipher suites selected must correspond with the algorithms and hash functions allowed in FCS\_COP.1.

Protocol, RBG, Certificate validation, algorithm, and similar services may be met with platform-provided services.

If HTTPS is chosen, **FCS\_HTTPS\_EXT.1** must be included in the **ST**.

## Evaluation Activities ▾

### [FTP\\_TRP.1/TRUSTPATH\\_Rem\\_ADMIN](#)

#### **TSS**

The evaluator shall examine the **TSS** to determine that the methods of remote **TOE** administration are indicated, along with how those communications are protected. The evaluator shall also confirm that all protocols listed in the **TSS** in support of **TOE** administration are consistent with those specified in the requirement, and are included in the requirements in the **ST**.

If "invoke platform-provided functionality" is selected, the evaluator shall examine the **TSS** to verify that it describes (for each supported platform) how this functionality is invoked (it should be noted that this may be through a mechanism that is not implemented by the **MDM** server; nonetheless, that mechanism will be identified in the **TSS** as part of this evaluation activity).

#### **Guidance**

The evaluator shall confirm that the operational guidance contains instructions for establishing the remote administrative sessions for each supported method.

#### **Tests**

The evaluator shall also perform the following tests:

- Test **FTP\_TRP.1/TRUSTPATH\_Rem\_ADMIN:1**: The evaluator shall ensure that communications using each specified (in the operational guidance) remote administration method is tested during the course of the evaluation, setting up the connections as described in the operational guidance and ensuring that communication is successful.
- Test **FTP\_TRP.1/TRUSTPATH\_Rem\_ADMIN:2**: For each method of remote administration supported, the evaluator shall follow the operational guidance to ensure that there is no available interface that can be used by a remote user to establish remote administrative sessions without invoking the trusted path.
- Test **FTP\_TRP.1/TRUSTPATH\_Rem\_ADMIN:3**: The evaluator shall ensure, for each method of remote administration, the channel data is not sent in plaintext.

Further evaluation activities are associated with the specific protocols.

## 6.1.10

If this feature is implemented by the **TOE**, the following requirements must be claimed in the **ST**:

## 6.1.11

If this feature is implemented by the TOE, the following requirements must be claimed in the ST:

## 6.1.12

If this feature is implemented by the TOE, the following requirements must be claimed in the ST:

### 6.1.13 TOE Security Functional Requirements Rationale

The following rationale provides justification for each SFR for the TOE, showing that the SFRs are suitable to address the specified threats:

**Table 18: SFR Rationale**

Threat	Addressed by	Rationale
T.MALICIOUS_APPS	FAU_ALT_EXT.1	A conformant <u>TOE</u> mitigates the threat of malicious apps by generating an alert if application of a policy fails, as this may indicate that a mechanism used to prevent the execution of malicious apps was not able to be enforced.
	FAU_CRP_EXT.1	A conformant <u>TOE</u> mitigates the threat of malicious apps by allowing MDs to report on their configuration status so it can be determined whether they have any unauthorized (and potentially malicious) apps installed.
	FAU_NET_EXT.1	A conformant <u>TOE</u> mitigates this threat by providing network status information so that an inaccessible <u>MD</u> can be flagged as potentially non-conformant to an <u>MDM</u> policy (and therefore potentially subject to the threat of executing malicious apps)
	FCS_COP.1/Hash	A conformant <u>TOE</u> mitigates the threat of malicious apps by implementing cryptographic algorithms which may be used to verify the integrity of apps (if the <u>TOE</u> includes its own <u>MAS</u> ).
	FCS_COP.1/SigGen	A conformant <u>TOE</u> mitigates the threat of malicious apps by generating asymmetric cryptographic keys to protect data in transit.
	FCS_COP.1/SigVer	A conformant <u>TOE</u> mitigates the threat of malicious apps by implementing cryptographic algorithms which may be used to verify the authenticity of apps (if the <u>TOE</u> includes its own <u>MAS</u> ).
	FIA_ENR_EXT.1	A conformant <u>TOE</u> mitigates the threat of malicious apps by providing a means to enroll MDs into management, where policies prohibiting the installation of potential malicious apps can be enforced.
	FIA_TOK_EXT.1 (Selection-based)	A conformant <u>TOE</u> mitigates the threats of malicious apps by providing a mechanism to securely enroll a unique <u>MD</u> into management.
	FIA_UAU.4 (Objective)	A conformant <u>TOE</u> mitigates the threat of malicious apps by limiting reuse of authentication credentials used to enroll MDs to provide assurance that MDs are properly enrolled into management.
	FMT_MOF.1/FUNCBE	A conformant <u>TOE</u> mitigates the threat of malicious apps by implementing mechanisms to control the apps that can be installed on an enrolled <u>MD</u> .
	FMT_MOF.1/MANAGEMENT_MAS (Selection-based)	A conformant <u>TOE</u> may mitigate the threat of malicious apps by implementing a <u>MAS</u> server that limits the apps that can be installed on enrolled MDs to those hosted by the <u>TOE</u> .
	FMT_POL_EXT.1	A conformant <u>TOE</u> mitigates the threat of malicious apps by providing signed policy updates that can prohibit the execution of potentially malicious apps.

	<b>FMT_SAE_EXT.1</b> (Objective)	A conformant <b>TOE</b> mitigates the threat of malicious apps by limiting the validity period of an enrollment request to provide assurance that MDs are properly enrolled into management.
	<b>FMT_SMF.1/MAS</b> (Selection-based)	A conformant <b>TOE</b> may mitigate the threat of malicious apps by implementing a <b>MAS</b> server that limits the apps that can be installed on enrolled MDs to those hosted by the <b>TOE</b> .
	<b>FMT_SMF.1/SERVER_CONF_AGENT</b>	A conformant <b>TOE</b> mitigates the threat of malicious apps by implementing mechanisms to control the apps that can be installed on an enrolled <b>MD</b> .
	<b>FTP_ITC_EXT.1</b>	A conformant <b>TOE</b> mitigates the threat of malicious apps by communicating its policy data to enrolled MDs securely over a trusted channel.
<b>T.NETWORK ATTACK</b>	<b>FAU_GEN.1/AUDITGEN</b>	A conformant <b>TOE</b> mitigates the threat of network attack by generating audit records of activity which may indicate attempts of such attacks.
	<b>FAU_SAR.1</b> (Optional)	A conformant <b>TOE</b> may mitigate the threat of network attack by implementing a mechanism within the <b>TOE</b> boundary to review audit data that may indicate attempted network attacks.
	<b>FAU_SEL.1</b> (Optional)	A conformant <b>TOE</b> may mitigate the threat of network attack by implementing a mechanism to specify the events that are audited by the <b>TOE</b> , which could include activities suggestive of a potential network attack.
	<b>FAU_STG.1</b>	A conformant <b>TOE</b> mitigates the threat of network attack by retaining audit records of activity which may indicate attempts of such attacks.
	<b>FAU_STG.2</b> (Selection-based)	A conformant <b>TOE</b> mitigates the threat of network attack by preventing unauthorized modification of locally stored audit records of activity which may indicate attempts of such attacks.
	<b>FCO_CPC_EXT.1</b> (Objective)	A conformant <b>TOE</b> may mitigate the threat of network attack by implementing a mechanism to register distributed <b>TOE</b> components so that individual endpoints are protected against impersonation.
	<b>FCS_CKM_EXT.7</b> (Implementation-based)	A conformant <b>TOE</b> mitigates the threat of a network attack by implementing secure methods to perform key agreement for trusted communications.
	<b>FCS_CKM.1/AKG</b>	A conformant <b>TOE</b> mitigates the threat of network attack by ensuring the generation of strong asymmetric keys used for trusted communications.
	<b>FCS_CKM.1/SKG</b>	A conformant <b>TOE</b> mitigates the threat of network attack by ensuring the generation of strong symmetric keys used for trusted communications.
	<b>FCS_CKM.2</b> (Implementation-based)	A conformant <b>TOE</b> mitigates the threat of network attack by implementing secure key establishment functions that prevent impersonation of the <b>TOE</b> .
	<b>FCS_CKM.6</b>	A conformant <b>TOE</b> mitigates the threat of network attack by securely destroying cryptographic keys to prevent their malicious reuse.
	<b>FCS_COP.1/AEAD</b>	A conformant <b>TOE</b> mitigates the threat of network attack by enforcing the use of secure authenticated encryption algorithms when wireless functionality is implemented by the <b>TOE</b> .

<a href="#">FCS_COP.1/Hash</a>	A conformant <a href="#">TQE</a> mitigates the threat of network attack by implementing hash algorithms to maintain integrity of data in transit.
<a href="#">FCS_COP.1/KeyedHash</a>	A conformant <a href="#">TQE</a> mitigates the threat of network attack by implementing HMAC algorithms to maintain authenticity and integrity of data in transit.
<a href="#">FCS_COP.1/KeyEncap</a> (Selection-based)	A conformant <a href="#">TQE</a> mitigates the threat of a network attack by using a secure key encapsulation method to transmit a symmetric key to a third party as part of key establishment for trusted communications.
<a href="#">FCS_COP.1/KeyWrap</a> (Selection-based)	A conformant <a href="#">TQE</a> mitigates the threat of a network attack by using a secure key wrap method to distribute key material to a third party for use in trusted communications.
<a href="#">FCS_COP.1/SigGen</a>	A conformant <a href="#">TQE</a> mitigates the threat of network attack by generating strong asymmetric cryptographic keys to protect data in transit.
<a href="#">FCS_COP.1/SigVer</a>	A conformant <a href="#">TQE</a> mitigates the threat of network attack by generating strong symmetric cryptographic keys to protect data in transit.
<a href="#">FCS_COP.1/SKC</a> (Selection-based)	A conformant <a href="#">TQE</a> mitigates the threat of network attack by implementing encryption algorithms to maintain confidentiality of data in transit.
<a href="#">FCS_COP.1/XOF</a> (Selection-based)	A conformant <a href="#">TQE</a> mitigates the threat of a network attack by supporting extendable output function implementations that are dependencies of some secure key generation and signature verification algorithms.
<a href="#">FCS_HTTPS_EXT.1</a> (Selection-based)	A conformant <a href="#">TQE</a> may mitigate the threat of network attack by implementing the HTTPS protocol to protect data in transit.
<a href="#">FCS_IV_EXT.1</a> (Selection-based)	A conformant <a href="#">TQE</a> may mitigate the threat of network attack by implementing functionality for appropriate IV generation based on the encryption algorithms it supports.
<a href="#">FCS_RB.G.1</a>	A conformant <a href="#">TQE</a> mitigates the threat of network attack by implementing a cryptographically strong DRBG to ensure generation of strong cryptographic keys.
<a href="#">FCS_RB.G.2</a> (Selection-based)	A conformant <a href="#">TQE</a> mitigates the threat of network attack by using sufficient entropy data to seed its DRBG to ensure a uniform keyspace of cryptographic key generation.
<a href="#">FCS_RB.G.3</a> (Selection-based)	A conformant <a href="#">TQE</a> mitigates the threat of network attack by using sufficient entropy data to seed its DRBG to ensure a uniform keyspace of cryptographic key generation.
<a href="#">FCS_RB.G.4</a> (Selection-based)	A conformant <a href="#">TQE</a> mitigates the threat of network attack by using sufficient entropy data to seed its DRBG to ensure a uniform keyspace of cryptographic key generation.
<a href="#">FCS_RB.G.5</a> (Selection-based)	A conformant <a href="#">TQE</a> mitigates the threat of network attack by using sufficient entropy data to seed its DRBG to ensure a uniform keyspace of cryptographic key generation.
<a href="#">FCS_STG_EXT.1</a>	A conformant <a href="#">TQE</a> mitigates the threat of network attack by implementing protected storage for secret and private keys that must be stored persistently for use in trusted communications and in proving the authenticity of policy information.
<a href="#">FCS_STG_EXT.2</a> (Selection-based)	A conformant <a href="#">TQE</a> mitigates the threat of network attack by using a particular method to protect persistently stored key data used for network communications.

	<a href="#">FIA_CLI_EXT.1</a>	A conformant <b>TOE</b> mitigates the threat of network attack by implementing a mechanism to ensure that the <b>MD</b> being enrolled is genuine.
	<a href="#">FIA_ENR_EXT.1</a>	A conformant <b>TOE</b> mitigates the threat of network attack by implementing a mechanism to ensure that the <b>MD</b> is enrolled via a trusted channel.
	<a href="#">FMT_POL_EXT.1</a>	A conformant <b>TOE</b> mitigates the threat of network attack by implementing a mechanism to ensure the authenticity of policies issued by the <b>TOE</b> .
	<a href="#">FPT_FLS.1</a> (Selection-based)	A conformant <b>TOE</b> mitigates the threat of network attack by implementing a mechanism to fail into a secure state if it cannot generate strong random numbers.
	<a href="#">FPT_ITT.1/INTER_XFER</a> (Selection-based)	A conformant <b>TOE</b> mitigates the threat of network attack by implementing a protected channel to protect data in transit between separate parts of the <b>TOE</b> .
	<a href="#">FPT_ITT.1/INTER_XFER_AGENT</a> (Selection-based)	A conformant <b>TOE</b> mitigates the threat of network attack by implementing a protected channel to protect data in transit between separate parts of the <b>TOE</b> , specifically in the case where an <b>MDM Agent</b> is also part of the <b>TOE</b> .
	<a href="#">FPT_TST.1</a> (Selection-based)	A conformant <b>TOE</b> mitigates the threat of network attack by implementing a mechanism to self-test its ability to generate strong random numbers.
	<a href="#">FTP_ITC_EXT.1</a>	A conformant <b>TOE</b> mitigates the threat of network attack by specifying the channels over which data in transit is protected.
	<a href="#">FTP_ITC.1/INTER_TSF_XFER_AGENT</a> (Selection-based)	A conformant <b>TOE</b> mitigates the threat of network attack by implementing a protected channel to protect data in transit between the <b>TOE</b> and an environmental <b>MDM Agent</b> .
	<a href="#">FTP_ITC.1/INTER_XFER_IT</a>	A conformant <b>TOE</b> mitigates the threat of network attack by implementing a mechanism to protect data in transit between the <b>TOE</b> and external IT entities that support its operation.
	<a href="#">FTP_TRP.1/TRUSTPATH_ENROLL</a>	A conformant <b>TOE</b> mitigates the threat of network attack by implementing a trusted path for enrollment of MDs.
	<a href="#">FTP_TRP.1/TRUSTPATH_JOIN</a> (Objective)	A conformant <b>TOE</b> may mitigate the threat of network attack by implementing a mechanism to securely join distributed <b>TOE</b> components to one another using a trusted path.
	<a href="#">FTP_TRP.1/TRUSTPATH_Rem_ADMIN</a>	A conformant <b>TOE</b> mitigates the threat of network attack by implementing a trusted path for remote administration.
<a href="#">T.NETWORK_EAVESDROP</a>	<a href="#">FCS_CKM_EXT.7</a> (Implementation-based)	A conformant <b>TOE</b> mitigates the threat of network eavesdrop by ensuring that a third-party cannot obtain the key used by the <b>TOE</b> to communicate securely with a remote entity.
	<a href="#">FCS_CKM.1/AKG</a>	A conformant <b>TOE</b> mitigates the threat of network eavesdrop by implementing secure key generation functions that prevent impersonation of the <b>TOE</b> .
	<a href="#">FCS_CKM.1/SKG</a>	A conformant <b>TOE</b> mitigates the threat of network eavesdrop by implementing secure key generation functions that prevent impersonation of the <b>TOE</b> .
	<a href="#">FCS_CKM.2</a> (Implementation-based)	A conformant <b>TOE</b> mitigates the threat of network eavesdrop by implementing secure key establishment functions that prevent impersonation of the <b>TOE</b> .

<a href="#">FCS_CKM.6</a>	A conformant <b>TQE</b> mitigates the threat of network eavesdrop by securely destroying cryptographic keys to prevent their malicious reuse.
<a href="#">FCS_COP.1/AEAD</a>	A conformant <b>TQE</b> mitigates the threat of network eavesdrop by enforcing the use of a cryptographic algorithm to protect data in transit that includes assurance of both authenticity and confidentiality.
<a href="#">FCS_COP.1/KeyEncap</a> (Selection-based)	A conformant <b>TQE</b> mitigates the threat of network eavesdrop by using a key encapsulation algorithm to protect data in transit
<a href="#">FCS_COP.1/KeyWrap</a> (Selection-based)	A conformant <b>TQE</b> mitigates the threat of network eavesdrop by using a key wrap algorithm to protect data in transit.
<a href="#">FCS_COP.1/SKC</a> (Selection-based)	A conformant <b>TQE</b> mitigates the threat of network eavesdrop by implementing encryption algorithms to maintain confidentiality of data in transit.
<a href="#">FCS_COP.1/XOF</a> (Selection-based)	A conformant <b>TQE</b> mitigates the threat of network eavesdrop by supporting extendable output function implementations that are dependencies of algorithms used for protection of data in transit.
<a href="#">FCS_HTTPS_EXT.1</a> (Selection-based)	A conformant <b>TQE</b> may mitigate the threat of network eavesdrop by implementing the HTTPS protocol to protect data in transit.
<a href="#">FCS_IV_EXT.1</a> (Selection-based)	A conformant <b>TQE</b> may mitigate the threat of network eavesdrop by implementing functionality for appropriate IV generation based on the encryption algorithms it supports.
<a href="#">FCS_RB.G.1</a>	A conformant <b>TQE</b> mitigates the threat of network eavesdrop by implementing a cryptographically strong DRBG to ensure generation of strong cryptographic keys.
<a href="#">FCS_RB.G.2</a> (Selection-based)	A conformant <b>TQE</b> mitigates the threat of network eavesdrop by using sufficient entropy data to seed its DRBG to ensure a uniform keyspace of cryptographic key generation.
<a href="#">FCS_RB.G.3</a> (Selection-based)	A conformant <b>TQE</b> mitigates the threat of network eavesdrop by using sufficient entropy data to seed its DRBG to ensure a uniform keyspace of cryptographic key generation.
<a href="#">FCS_RB.G.4</a> (Selection-based)	A conformant <b>TQE</b> mitigates the threat of network eavesdrop by using sufficient entropy data to seed its DRBG to ensure a uniform keyspace of cryptographic key generation.
<a href="#">FCS_RB.G.5</a> (Selection-based)	A conformant <b>TQE</b> mitigates the threat of network eavesdrop by using sufficient entropy data to seed its DRBG to ensure a uniform keyspace of cryptographic key generation.
<a href="#">FCS_STG_EXT.1</a>	A conformant <b>TQE</b> mitigates the threat of network eavesdrop by implementing protected storage for secret and private keys that must be stored persistently for use in trusted communications and in proving the authenticity of policy information.
<a href="#">FCS_STG_EXT.2</a> (Selection-based)	A conformant <b>TQE</b> mitigates the threat of network eavesdrop by using a particular method to protect persistently stored key data used for network communications.
<a href="#">FIA_ENR_EXT.1</a>	A conformant <b>TQE</b> mitigates the threat of network attack by implementing a mechanism to ensure that the <b>MD</b> is enrolled via a trusted channel.
<a href="#">FPT_FLS.1</a> (Selection-based)	A conformant <b>TQE</b> mitigates the threat of network eavesdrop by implementing a mechanism to fail into a secure state if it cannot generate strong random numbers.
<a href="#">FPT_ITT.1/INTER_XFER</a> (Selection-based)	A conformant <b>TQE</b> mitigates the threat of network eavesdrop by implementing a protected channel to protect data in transit

		between separate parts of the <b>TOE</b> .
	<a href="#">FPT_ITT.1/INTER_XFER_AGENT</a> (Selection-based)	A conformant <b>TOE</b> mitigates the threat of network eavesdrop by implementing a protected channel to protect data in transit between separate parts of the <b>TOE</b> , specifically in the case where an <b>MDM Agent</b> is also part of the <b>TOE</b> .
	<a href="#">FPT_TST.1</a> (Selection-based)	A conformant <b>TOE</b> mitigates the threat of network eavesdrop by implementing a mechanism to self-test its ability to generate strong random numbers.
	<a href="#">FTP_ITC_EXT.1</a>	A conformant <b>TOE</b> mitigates the threat of network eavesdrop by specifying the channels over which data in transit is protected.
	<a href="#">FTP_ITC.1/INTER_TSF_XFER_AGENT</a> (Selection-based)	A conformant <b>TOE</b> mitigates the threat of network eavesdrop by implementing a protected channel to protect data in transit between the <b>TOE</b> and an environmental <b>MDM Agent</b> .
	<a href="#">FTP_ITC.1/INTER_XFER_IT</a>	A conformant <b>TOE</b> mitigates the threat of network eavesdrop by implementing a mechanism to protect data in transit between the <b>TOE</b> and external IT entities that support its operation.
	<a href="#">FTP_TRP.1/TRUSTPATH_ENROLL</a>	A conformant <b>TOE</b> mitigates the threat of network eavesdrop by implementing a trusted path for enrollment of <b>MDs</b> .
	<a href="#">FTP_TRP.1/TRUSTPATH_JOIN</a> (Objective)	A conformant <b>TOE</b> may mitigate the threat of network eavesdrop by implementing a mechanism to securely join distributed <b>TOE</b> components to one another using a trusted path.
	<a href="#">FTP_TRP.1/TRUSTPATH_Rem_ADMIN</a>	A conformant <b>TOE</b> mitigates the threat of network eavesdrop by implementing a trusted path for remote administration.
<a href="#">T.PHYSICAL_ACCESS</a>	<a href="#">FAU_ALT_EXT.1</a>	A conformant <b>TOE</b> mitigates the threat of physical access to the <b>MD</b> by generating an alert when a <b>MD</b> is unable to receive policy information or has its enrollment status altered (e.g. unenrollment may be evidence of physical compromise).
	<a href="#">FAU_GEN.1/AUDITGEN</a>	A conformant <b>TOE</b> mitigates the threat of physical access to the <b>MD</b> by generating audit records of the management activities performed on the <b>TOE</b> that are applied to that device.
	<a href="#">FAU_GEN.1/MAS_SERVER</a> (Selection-based)	A conformant <b>TOE</b> potentially mitigates the threat of physical access to the <b>MD</b> by providing a mechanism on the <b>TOE</b> that logs a failure of the <b>TSF</b> to affect an enrolled <b>MD</b> 's installed apps.
	<a href="#">FAU_SAR.1</a> (Optional)	A conformant <b>TOE</b> potentially mitigates the threat of physical access to the <b>MD</b> by providing a review mechanism for audit records of the management activities performed on the <b>TOE</b> that are applied to that device (to detect potential misconfiguration of the device).
	<a href="#">FAU_SEL.1</a> (Optional)	A conformant <b>TOE</b> potentially mitigates the threat of physical access to the <b>MD</b> by providing a mechanism to specify audit records of the specific management activities performed on the <b>TOE</b> that are applied to that device (to detect potential misconfiguration of the device).
	<a href="#">FAU_STG.1</a>	A conformant <b>TOE</b> mitigates the threat of physical access to the <b>MD</b> by retaining audit logs that may indicate potential misuse of the <b>TOE</b> to misconfigure a <b>MD</b> .
	<a href="#">FAU_STG.2</a> (Selection-based)	A conformant <b>TOE</b> potentially mitigates the threat of physical access to the <b>MD</b> by providing a mechanism on the <b>TOE</b> that protects audit records of configuration of that device from unauthorized modification or destruction.
	<a href="#">FIA_UAU.1</a>	A conformant <b>TOE</b> mitigates the threat of physical access to the <b>MD</b> by enforcing user authentication on the <b>TOE</b> so that <b>MDs</b> cannot be configured without authorization.

<a href="#">FMT_MOF.1/FUNCBE</a>	A conformant <b>TOE</b> mitigates the threat of physical access to the <b>MD</b> by implementing management functions that allow for the <b>TOE</b> to place it into a secure configuration.
<a href="#">FMT_MOF.1/MANAGEMENT_ENROLL</a>	A conformant <b>TOE</b> mitigates the threat of physical access to the <b>MD</b> by implementing management functions that allow for the <b>TOE</b> to place it into a secure configuration.
<a href="#">FMT_MOF.1/MANAGEMENT_MAS</a> (Selection-based)	A conformant <b>TOE</b> potentially mitigates the threat of physical access to the <b>MD</b> by implementing management functions that allow for the <b>TOE</b> to download and install applications.
<a href="#">FMT_SMF.1/MAS</a> (Selection-based)	A conformant <b>TOE</b> potentially mitigates the threat of physical access to the <b>MD</b> by implementing management functions for its <b>MAS</b> Server functionality that allow the <b>TSF</b> to securely configure enrolled devices.
<a href="#">FMT_SMF.1/SERVER_CONF_AGENT</a>	A conformant <b>TOE</b> mitigates the threat of physical access to the <b>MD</b> by implementing management functions that allow for the <b>TOE</b> to place it into a secure configuration.
<a href="#">FMT_SMF.1/SERVER_CONF_SERVER</a>	A conformant <b>TOE</b> mitigates the threat of physical access to the <b>MD</b> by implementing management functions that allow the <b>TSF</b> to ensure its own secure operation with respect to applying policies.
<a href="#">FMT_SMR.1/SECMAN_ROLES</a>	A conformant <b>TOE</b> mitigates the threat of physical access to the <b>MD</b> by implementing roles for its own management that allow the <b>TSF</b> to ensure its own secure operation with respect to applying policies.
<a href="#">FMT_SMR.1/SECMAN_ROLES_MAS</a> (Selection-based)	A conformant <b>TOE</b> potentially mitigates the threat of physical access to the <b>MD</b> by implementing roles for its own management that allow the <b>TSF</b> to ensure its own secure operation with respect to applying <b>MAS</b> Server policies.
<a href="#">FPT_API_EXT.1</a>	A conformant <b>TOE</b> mitigates the threat of physical access to the <b>MD</b> by ensuring that the <b>TSF</b> is not subject to compromise through improper <b>API</b> usage.
<a href="#">FPT_LIB_EXT.1</a>	A conformant <b>TOE</b> mitigates the threat of physical access to the <b>MD</b> by ensuring that the <b>TSF</b> is not subject to compromise through insecure library usage.
<a href="#">FPT_TST_EXT.1</a>	A conformant <b>TOE</b> mitigates the threat of physical access to the <b>MD</b> by ensuring that the <b>TSF</b> performs self-tests to verify its own integrity so that it can be trusted as a management platform.
<a href="#">FPT_TUD_EXT.1</a>	A conformant <b>TOE</b> mitigates the threat of physical access to the <b>MD</b> by ensuring that the <b>TSF</b> uses a trusted update mechanism to verify its own integrity so that it can be trusted as a management platform.
<a href="#">FTA_TAB.1</a> (Optional)	A conformant <b>TOE</b> potentially mitigates the threat of physical access to the <b>MD</b> by providing a mechanism on the <b>TOE</b> that advises of actionable consequences for its misuse in configuration of <b>MDs</b> .

## 6.2 Security Assurance Requirements

The Security Objectives for the **TOE** in [Section 6 Security Requirements](#) were constructed to address threats identified in [Section 4.1 Threats](#). The Security Functional Requirements (**SFRs**) in [Section 6 Security Requirements](#) are a formal instantiation of the Security Objectives. The **PP** identifies the Security Assurance Requirements (**SARs**) to frame the extent to which the evaluator assesses the documentation applicable for the evaluation and performs independent testing. This section lists the set of **SARs** from CC part 3 that are required in evaluations against this **PP**. Individual Evaluation Activities (AAs) to be performed are specified both in [Section 6 Security Requirements](#) as well as in this section.

The general model for evaluation of TOEs against STs written to conform to this PP is as follows:

After the ST has been approved for evaluation, the ITSEF will obtain the TOE, supporting environmental IT, and the administrative and user guides for the TOE. The ITSEF is expected to perform actions mandated by the Common Evaluation Methodology (CEM) for the ASE and ALC SARs. The ITSEF also performs the Evaluation Activities contained within [Section 6 Security Requirements](#), which are intended to be an interpretation of the other CEM assurance requirements as they apply to the specific technology instantiated in the TOE. The Evaluation Activities that are captured in [Section 6 Security Requirements](#) also provide clarification as to what the developer needs to provide to demonstrate the TOE is compliant with the PP.

The TOE security assurance requirements are identified in [Table 19](#).

**Table 19:Security Assurance Requirements**

Assurance Class	Assurance Components
Security Target (ASE)	<u>ST</u> introduction (ASE_INT.1) Conformance claims (ASE_CCL.1) Security objectives for the operational environment (ASE_OBJ.1) Extended components definition (ASE_ECD.1) Stated security requirements (ASE_REQ.1) <u>TOE</u> summary specification ( <a href="#">ASE_TSS.1</a> )
Development (ADV)	Basic functional specification ( <a href="#">ADV_FSP.1</a> )
Guidance documents (AGD)	Operational user guidance ( <a href="#">AGD_OPE.1</a> ) Preparative procedures ( <a href="#">AGD_PRE.1</a> )
Life cycle support (ALC)	Labeling of the <u>TOE</u> ( <a href="#">ALC_CMC.1</a> ) <u>TOE</u> CM coverage ( <a href="#">ALC_CMS.1</a> )
Tests (ATE)	Independent testing - sample ( <a href="#">ATE_IND.1</a> )
Vulnerability assessment (AVA)	Vulnerability survey ( <a href="#">AVA_VAN.1</a> )

### 6.2.1 Class ASE: Security Target

The ST is evaluated as per ASE activities defined in the CEM. In addition, there may be Evaluation Activities specified within [Section 6 Security Requirements](#) and relevant appendices that call for necessary descriptions to be included in the TSS that are specific to the TOE technology type.

#### **ASE\_TSS.1 TOE summary specification**

##### **Developer action elements:**

##### **Content and presentation elements:**

###### **ASE\_TSS.1C**

The TOE summary specification shall describe how the TOE meets each SER.

##### **Evaluator action elements:**

#### **Evaluation Activities**

[ASE\\_TSS.1](#)

### 6.2.2 Class ADV: Development

The design information about the TOE is contained in the guidance documentation available to the end user as well as the TSS portion of the ST, and any additional information required by this PP that is not to be made public (e.g., Entropy Essay).

#### **ADV\_FSP.1 Basic Functional Specification (ADV\_FSP.1)**

The functional specification describes the Target Security Functions Interfaces (TSFIs). It is not necessary to have a formal or complete specification of these interfaces. Additionally, because TOEs conforming to this PP will necessarily have interfaces to the Operational Environment that are not directly invokable by TOE users, there is little point specifying that such interfaces be described in and of themselves since only indirect testing of such interfaces may be possible. For this PP, the activities for this

family should focus on understanding the interfaces presented in the TSS in response to the functional requirements and the interfaces presented in the AGD documentation. No additional "functional specification" documentation is necessary to satisfy the evaluation activities specified.

The interfaces that need to be evaluated are characterized through the information needed to perform the evaluation activities listed, rather than as an independent, abstract list.

#### **Developer action elements:**

ADV\_FSP.1.1D

The developer shall provide a functional specification.

ADV\_FSP.1.2D

The developer shall provide a tracing from the functional specification to the SFRs.

**Application Note:** As indicated in the introduction to this section, the functional specification is comprised of the information contained in the AGD\_OPE and AGD\_PRE documentation. The developer may reference a website accessible to application developers and the evaluator. The evaluation activities in the functional requirements point to evidence that should exist in the documentation and TSS section; since these are directly associated with the SFRs, the tracing in element ADV\_FSP.1.2D is implicitly already done and no additional documentation is necessary.

#### **Content and presentation elements:**

ADV\_FSP.1.1C

The functional specification shall describe the purpose and method of use for each SFR-enforcing and SFR-supporting TSEI.

ADV\_FSP.1.2C

The functional specification shall identify all parameters associated with each SFR-enforcing and SFR-supporting TSEI.

ADV\_FSP.1.3C

The functional specification shall provide rationale for the implicit categorization of interfaces as SFR-non-interfering.

ADV\_FSP.1.4C

The tracing shall demonstrate that the SFRs trace to TSEIs in the functional specification.

#### **Evaluator action elements:**

ADV\_FSP.1.1E

The evaluator shall confirm that the information provided meets all requirements for content and presentation of evidence.

ADV\_FSP.1.2E

The evaluator shall determine that the functional specification is an accurate and complete instantiation of the SFRs.

#### **Evaluation Activities** ▾

##### **ADV\_FSP.1**

*There are no specific evaluation activities associated with these SFRs, except ensuring the information is provided. The functional specification documentation is provided to support the evaluation activities described in Section 5 and the relevant appendices, and other activities described for AGD, ATE, and AVA SFRs. The requirements on the content of the functional specification information is implicitly assessed by virtue of the other evaluation activities being performed; if the evaluator is unable to perform an activity because there is insufficient interface information, then an adequate functional specification has not been provided.*

#### **6.2.3 Class AGD: Guidance Documentation**

The guidance documents will be provided with the ST. Guidance must include a description of how the IT personnel verifies that the Operational Environment can fulfill its role for the security functionality. The documentation should be in an informal style and readable by the IT personnel.

Guidance must be provided for every operational environment that the product supports as claimed in the ST. This guidance includes:

- instructions to successfully install the TSF in that environment

- instructions to manage the security of the TSF as a product and as a component of the larger operational environment
- instructions to provide a protected administrative capability

Guidance pertaining to particular security functionality must also be provided; requirements on such guidance are contained in the evaluation activities specified with each requirement.

### **AGD\_OPE.1 Operational User Guidance (AGD\_OPE.1)**

#### **Developer action elements:**

##### **AGD\_OPE.1.1D**

The developer shall provide operational user guidance.

**Application Note:** The operational user guidance does not have to be contained in a single document. Guidance to users, administrators and application developers can be spread among documents or web pages. Where appropriate, the guidance documentation is expressed in the eXtensible Configuration Checklist Description Format (XCCDF) to support security automation.

Rather than repeat information here, the developer should review the evaluation activities for this component to ascertain the specifics of the guidance that the evaluator will be checking for. This will provide the necessary information for the preparation of acceptable guidance.

#### **Content and presentation elements:**

##### **AGD\_OPE.1.1C**

The operational user guidance shall describe, for each user role, the user-accessible functions and privileges that should be controlled in a secure processing environment, including appropriate warnings.

**Application Note:** User and administrator are to be considered in the definition of user role.

##### **AGD\_OPE.1.2C**

The operational user guidance shall describe, for each user role, how to use the available interfaces provided by the TOE in a secure manner.

##### **AGD\_OPE.1.3C**

The operational user guidance shall describe, for each user role, the available functions and interfaces, in particular all security parameters under the control of the user, indicating secure values as appropriate.

##### **AGD\_OPE.1.4C**

The operational user guidance shall, for each user role, clearly present each type of security-relevant event relative to the user-accessible functions that need to be performed, including changing the security characteristics of entities under the control of the TSF.

##### **AGD\_OPE.1.5C**

The operational user guidance shall identify all possible modes of operation of the TOE (including operation following failure or operational error), their consequences, and implications for maintaining secure operation.

##### **AGD\_OPE.1.6C**

The operational user guidance shall, for each user role, describe the security measures to be followed in order to fulfill the security objectives for the operational environment as described in the ST.

##### **AGD\_OPE.1.7C**

The operational user guidance shall be clear and reasonable.

#### **Evaluator action elements:**

##### **AGD\_OPE.1.1E**

The evaluator shall confirm that the information provided meets all requirements for content and presentation of evidence.

#### **Evaluation Activities**

##### **AGD\_OPE.1**

*Some of the contents of the operational guidance will be verified by the evaluation activities in Sections 4.2, 4.3, and 4.4, and evaluation of the TOE according to the CEM. The following additional information is also required.*

If cryptographic functions are provided by the TOE, the operational guidance shall contain instructions for configuring the cryptographic engine associated with the evaluated configuration of the TOE. It shall provide a warning to the administrator that use of other cryptographic engines was not evaluated nor tested during the CC evaluation of the TOE.

The documentation must describe the process for verifying updates to the TOE by verifying a digital signature - this may be done by the TOE or the underlying platform. The evaluator shall verify that this process includes the following steps:

Instructions for obtaining the update itself. This should include instructions for making the update accessible to the TOE (e.g., placement in a specific directory).

Instructions for initiating the update process, as well as discerning whether the process was successful or unsuccessful. This includes generation of the hash or digital signature.

The TOE will likely contain security functionality that does not fall in the scope of evaluation under this PP. The operational guidance shall make it clear to an administrator which security functionality is covered by the evaluation activities.

## 6.2.4 Preparative Procedures (AGD\_PRE.1)

### AGD\_PRE.1 Preparative Procedures (AGD\_PRE.1)

#### Developer action elements:

##### AGD\_PRE.1.1D

The developer shall provide the TOE, including its preparative procedures.

**Application Note:** As with the operational guidance, the developer should look to the evaluation activities to determine the required content with respect to preparative procedures.

#### Content and presentation elements:

##### AGD\_PRE.1.1C

The preparative procedures shall describe all the steps necessary for secure acceptance of the delivered TOE in accordance with the developer's delivery procedures.

##### AGD\_PRE.1.2C

The preparative procedures shall describe all the steps necessary for secure installation of the TOE and for the secure preparation of the operational environment in accordance with the security objectives for the operational environment as described in the ST.

**Application Note:** It is recognized that the application of these requirements will vary depending on aspects such as whether the TOE is delivered in an operational state, or whether it has to be installed at the TOE owner's site, etc.

It might also be the case that no installation is necessary, for example as a Software as a Service implementation in a Cloud environment. In this case it may be inappropriate to require and analyze installation procedures and thus this requirement is implicitly satisfied.

#### Evaluator action elements:

##### AGD\_PRE.1.1E

The evaluator shall confirm that the information provided meets all requirements for content and presentation of evidence.

##### AGD\_PRE.1.2E

The evaluator shall apply the preparative procedures to confirm that the TOE can be prepared securely for operation.

#### Evaluation Activities ▾

##### AGD\_PRE.1

As indicated in the introduction above, there are significant expectations with respect to the documentation, especially when configuring the operational environment to support TOE functional requirements. The evaluator shall check to ensure that the guidance provided for the TOE adequately addresses all platforms claimed for the TOE in the ST.

## 6.2.5 Class ALC: Life-cycle Support

At the assurance level provided for TOEs conformant to this PP, life-cycle support is limited to end-user visible aspects of the life-cycle, rather than an examination of the TOE vendor's development and configuration management process. This is not meant to diminish the critical role that a developer's practices play in contributing to the overall trustworthiness of a product; rather, it's a reflection on the information to be made available for evaluation at this assurance level.

### ALC\_CMC.1 Labeling of the TOE (ALC\_CMC.1)

This component is targeted at identifying the TOE such that it can be distinguished from other products or versions from the same vendor and can be easily specified when being procured by an end user.

#### Developer action elements:

##### ALC\_CMC.1.1D

The developer shall provide the TOE and a reference for the TOE.

#### Content and presentation elements:

##### ALC\_CMC.1.1C

The TOE shall be labeled with its unique reference.

#### Evaluator action elements:

##### ALC\_CMC.1.1E

The evaluator shall confirm that the information provided meets all requirements for content and presentation of evidence.

### Evaluation Activities ▾

#### ALC\_CMC.1

*The evaluator shall check the ST to ensure that it contains an identifier (such as a product name and version number) that specifically identifies the version that meets the requirements of the ST. Further, the evaluator shall check the operational guidance and TOE samples received for testing to ensure that the version number is consistent with that in the ST. If the vendor maintains a website advertising the TOE, the evaluator shall examine the information on the website to ensure that the information in the ST is sufficient to distinguish the product.*

## 6.2.6 TOE CM Coverage (ALC\_CMS.1)

### ALC\_CMS.1 TOE CM Coverage (ALC\_CMS.1)

Given the scope of the TOE and its associated evaluation evidence requirements, this component's evaluation activities are covered by the evaluation activities listed for ALC\_CMC.1.

#### Developer action elements:

##### ALC\_CMS.1.1D

The developer shall provide a configuration list for the TOE.

#### Content and presentation elements:

##### ALC\_CMS.1.1C

The configuration list shall include the following: the TOE itself; and the evaluation evidence required by the SARs.

##### ALC\_CMS.1.2C

The configuration list shall uniquely identify the configuration items.

#### Evaluator action elements:

##### ALC\_CMS.1.1E

The evaluator shall confirm that the information provided meets all requirements for content and presentation of evidence.

**Application Note:** In cases where the MDM software is Software as a Service, running in a cloud environment where they have little to no control of the operating system and underlying hardware, the evaluated configuration is considered a snapshot of the MDM software with the OS or VM versions used at the time of testing.

## Evaluation Activities ▾

### ALC\_CMS.1

The "evaluation evidence required by the ~~SARs~~" in this PP is limited to the information in the ST coupled with the guidance provided to administrators and users under the AGD requirements. By ensuring that the TOE is specifically identified and that this identification is consistent in the ST and in the operational guidance (as done in the evaluation activity for ALC\_CMC.1), the evaluator implicitly confirms the information required by this component.

Life-cycle support is targeted aspects of the developer's life-cycle and instructions to providers of applications for the developer's devices, rather than an in-depth examination of the TSF manufacturer's development and configuration management process. This is not meant to diminish the critical role that a developer's practices play in contributing to the overall trustworthiness of a product; rather, it's a reflection on the information to be made available for evaluation.

The evaluator shall ensure that the TSF is uniquely identified (with respect to other products from the TSF vendor), and that documentation provided by the developer in association with the requirements in the ST is associated with the TSF using this unique identification.

## 6.2.7 Class ATE: Tests

Testing is specified for functional aspects of the system as well as aspects that take advantage of design or implementation weaknesses. The former is done through the ATE\_IND family, while the latter is through the AVA\_VAN family. At the assurance level specified in this PP, testing is based on advertised functionality and interfaces with dependency on the availability of design information. One of the primary outputs of the evaluation process is the test report as specified in the following requirements.

Since many of the APIs are not exposed at the user interface (e.g., touch screen), the ability to stimulate the necessary interfaces requires a developer's test environment. This test environment will allow the evaluator, for example, to access APIs and view file system information that is not available on consumer devices.

### ATE\_IND.1 Independent Testing - Conformance (ATE\_IND.1)

Testing is performed to confirm the functionality described in the TSS as well as the administrative (including configuration and operational) documentation provided. The focus of the testing is to confirm that the requirements specified in Sections 5.3 and 5.4 are being met, although some additional testing is specified for SARs in Section 6. The Evaluation Activities identify the additional testing activities associated with these components. The evaluator produces a test report documenting the plan for and results of testing, as well as coverage arguments focused on the TOE or platform combinations that are claiming conformance to this PP.

#### Developer action elements:

##### ATE\_IND.1.1D

The developer shall provide the TOE for testing.

#### Content and presentation elements:

##### ATE\_IND.1.1C

The TOE shall be suitable for testing.

#### Evaluator action elements:

##### ATE\_IND.1.1E

The evaluator shall confirm that the information provided meets all requirements for content and presentation of evidence.

##### ATE\_IND.1.2E

The evaluator shall test a subset of the TSF to confirm that the TSF operates as specified.

## Evaluation Activities ▾

### ATE\_IND.1

The evaluator shall prepare a test plan and report documenting the testing aspects of the system. The test plan covers all of the testing actions contained in the CEM and the body of this PP's Evaluation Activities. While it is not necessary to have one test case per test listed in an evaluation activity, the evaluator must document in the test plan that each applicable testing requirement in the ST is covered.

*The test plan identifies the platforms to be tested, and for those platforms not included in the test plan but included in the ST, the test plan provides a justification for not testing the platforms. This justification must address the differences between the tested platforms and the untested platforms, and make an argument that the differences do not affect the testing to be performed. It is not sufficient to merely assert that the differences have no effect; rationale must be provided. If all platforms claimed in the ST are tested, then no rationale is necessary.*

*The test plan describes the composition of each platform to be tested, and any setup that is necessary beyond what is contained in the part of a test or as a standard pre-test condition. This may include special test drivers or tools. For each driver or tool, an argument (not just an assertion) should be provided that the driver or tool will not adversely affect the performance of the functionality by the TOE and its platform. This also includes the configuration of the cryptographic engine to be used. The cryptographic algorithms implemented by this engine are those specified by this PP and used by the cryptographic protocols being evaluated (IPsec, TLS/HTTPS, SSH).*

*The test plan identifies high-level test objectives as well as the test procedures to be followed to achieve those objectives. These procedures include expected results. The test report (which could just be an annotated version of the test plan) details the activities that took place when the test procedures were executed, and includes the actual results of the tests. This shall be a cumulative account, so if there was a test run that resulted in a failure; a fix installed; and then a successful re-run of the test, the report would show a "fail" and "pass" result (and the supporting details), and not just the "pass" result.*

## 6.2.8 Class AVA: Vulnerability Analysis

For the first generation of this protection profile, the evaluation lab is expected to survey open sources to discover what vulnerabilities have been discovered in these types of products. In most cases, these vulnerabilities will require sophistication beyond that of a basic attacker. Until penetration tools are created and uniformly distributed to the evaluation labs, the evaluator will not be expected to test for these vulnerabilities in the TOE. The labs will be expected to comment on the likelihood of these vulnerabilities given the documentation provided by the vendor. This information will be used in the development of penetration testing tools and for the development of future protection profiles.

### AVA\_VAN.1 Vulnerability Survey (AVA\_VAN.1)

#### Developer action elements:

##### AVA\_VAN.1.1D

The developer shall provide the TOE for testing.

#### Content and presentation elements:

##### AVA\_VAN.1.1C

The TOE shall be suitable for testing.

#### Evaluator action elements:

##### AVA\_VAN.1.1E

The evaluator shall confirm that the information provided meets all requirements for content and presentation of evidence.

##### AVA\_VAN.1.2E

The evaluator shall perform a search of public domain sources to identify potential vulnerabilities in the TOE.

##### AVA\_VAN.1.3E

The evaluator shall conduct penetration testing, based on the identified potential vulnerabilities, to determine that the TOE is resistant to attacks performed by an attacker possessing Basic attack potential.

### Evaluation Activities ▾

#### AVA\_VAN.1

*As with ATE\_IND, the evaluator shall generate a report to document their findings with respect to this requirement. This report could physically be part of the overall test report mentioned in ATE\_IND, or a separate document. The evaluator performs a search of public information to determine the vulnerabilities that have been found in network infrastructure devices and the implemented communication protocols in general, as well as those that pertain to the particular TOE. The evaluator documents the sources consulted and the vulnerabilities found in the report. For each vulnerability found, the evaluator either provides a rationale with respect to its non-applicability, or the evaluator formulates a test (using the guidelines provided in ATE\_IND) to confirm the vulnerability, if suitable. Suitability is determined by assessing the attack*

*vector needed to take advantage of the vulnerability. If exploiting the vulnerability requires expert skills and an electron microscope, for instance, then a test would not be suitable and an appropriate justification would be formulated.*

# **Appendix A - Implementation-dependent Requirements**

Implementation-dependent Requirements Appendix defines requirements that must be claimed in the ST if the TOE implements particular product features. For this technology type, the following product features require the claiming of additional SFRs:

## **A.0.1**

If this feature is implemented by the TOE, the following requirements must be claimed in the ST:

## **A.0.2**

If this feature is implemented by the TOE, the following requirements must be claimed in the ST:

## **A.0.3**

If this feature is implemented by the TOE, the following requirements must be claimed in the ST:

# Appendix B - Extended Component Definitions

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

## B.1 Extended Components Table

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

**Table 20: Extended Component Definitions**

Functional Class	Functional Components
Communication (FCO)	FCO_CPC_EXT Component Registration Channel Definition
Cryptographic Support (FCS)	FCS_CKM_EXT Cryptographic Key Management FCS_HTTPS_EXT HTTPS Protocol FCS_IV_EXT Initialization Vector Generation FCS_STG_EXT Encrypted Cryptographic Key Storage
Identification and Authentication (FIA)	FIA_CLI_EXT Client Authorization FIA_ENR_EXT Enrollment FIA_TOK_EXT Client Tokens
Protection of the TSF (FPT)	FPT_API_EXT Use of Supported Services and APIs FPT_LIB_EXT Use of Third-Party Libraries FPT_TST_EXT Functionality Testing FPT_TUD_EXT Trusted Update
Security Audit (FAU)	FAU_ALT_EXT Server Alerts FAU_CRP_EXT Support for Compliance Reporting of Mobile Device Configuration FAU_NET_EXT Network Reachability Review
Security Management (FMT)	FMT_POL_EXT Trusted Policy Update FMT_SAE_EXT Security Attribute Expiration
Trusted Path/Channels (FTP)	FTP_ITC_EXT Trusted Channel

## B.2 Extended Component Definitions

### B.2.1 Communication (FCO)

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

#### B.2.1.1 FCO\_CPC\_EXT Component Registration Channel Definition

##### Family Behavior

This family describes the registration process, including the capability for the administrator to enable or disable communications between a distributed TOE and other components of the TOE.

##### Component Leveling



[FCO\\_CPC\\_EXT.1](#), Component Registration Channel Definition, defines requirements for the registration process for distributed TOEs.

##### Management: FCO\_CPC\_EXT.1

There are no management activities foreseen.

##### Audit: FCO\_CPC\_EXT.1

The following actions should be auditable if FAU\_GEN security audit data generation is included in the PP or ST:

- Enabling or disabling communications between a pair of components.
- Identities of the endpoint's pairs enabled or disabled.

### **FCO\_CPC\_EXT.1 Component Registration Channel Definition**

Hierarchical to: No other components.

Dependencies to: FPT\_ITT.1 TSF Data Transfer  
FTP\_TRP.1 Trusted Path

#### **FCO\_CPC\_EXT.1.1**

The TSF shall [**selection**: *invoke platform-provided functionality, implement functionality*] to require an Administrator to enable communications between any pair of TOE components before such communication can take place.

#### **FCO\_CPC\_EXT.1.2**

The TSF shall [**selection**: *invoke platform-provided functionality, implement functionality*] to implement a registration process in which components establish and use a communications channel that uses [**selection**:

- A channel that meets the secure channel requirements in [**selection**: *FTP\_ITC.1, FPT\_ITT.1/INTER\_XFER, FPT\_ITT.1/INTER\_XFER\_AGENT*]
- A channel that meets the secure registration channel requirements in [**selection**: *FTP\_TRP.1/TRUSTPATH\_ENROLL, FTP\_TRP.1/TRUSTPATH\_JOIN*]
- No channel

] for at least TSF data.

#### **FCO\_CPC\_EXT.1.3**

The TSF shall [**selection**: *invoke platform-provided functionality, implement functionality*] to enable an administrator to disable communications between any pair of TOE components.

## **B.2.2 Cryptographic Support (FCS)**

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

### **B.2.2.1 FCS\_CKM\_EXT Cryptographic Key Management**

#### **Family Behavior**

This family defines requirements for management of cryptographic keys using mechanisms beyond what are specified in CC Part 2.

#### **Component Leveling**



**FCS\_CKM\_EXT.7**, Cryptographic Key Agreement, requires that cryptographic key agreement be performed in accordance with specified standards.

#### **Management: FCS\_CKM\_EXT.7**

There are no management functions foreseen.

#### **Audit: FCS\_CKM\_EXT.7**

The following actions should be auditable if FAU\_GEN Security audit data generation is included in the PP, PP-Module, functional package or ST:

- minimal: Success and failure of the activity;
- basic: The object attribute(s), and object value(s) excluding any sensitive information.

### **FCS\_CKM\_EXT.7 Cryptographic Key Agreement**

Hierarchical to: No other components.

Dependencies to:

[FDP\_ITC.1 Import of user data without security attributes, or  
FDP\_ITC.2 Import of user data with security attributes, or  
FCS\_CKM.1 Cryptographic key generation, or  
FCS\_CKM.5 Cryptographic key derivation, or  
FCS\_CKM\_EXT.8 Password-based key derivation],  
[FCS\_CKM.2 Cryptographic key distribution, or  
FCS\_COP.1 Cryptographic operation]  
FCS\_CKM.6 Timing and event of cryptographic key destruction  
FCS\_COP.1 Cryptographic operation

### **FCS\_CKM\_EXT.7.1**

The TSF shall derive shared cryptographic keys with input from multiple parties in accordance with specified cryptographic key agreement algorithms [**assignment**: *cryptographic algorithm*] and specified cryptographic parameters [**assignment**: *cryptographic parameters*] that meet the following: [**assignment**: *list of standards*]

## **B.2.2.2 FCS\_HTTPS\_EXT HTTPS Protocol**

### **Family Behavior**

This family defines requirements for protecting HTTP communications between the TQE and an external IT entity.

### **Component Leveling**



FCS\_HTTPS\_EXT.1, HTTPS Protocol, defines requirements for the implementation of the HTTPS protocol.

### **Management: FCS\_HTTPS\_EXT.1**

There are no management activities foreseen.

### **Audit: FCS\_HTTPS\_EXT.1**

The following actions should be auditable if FAU\_GEN security audit data generation is included in the PP or ST.

- Failure of the certificate validity check.
- Issuer Name and Subject Name of certificate.
- [**selection**: *User's authorization decision, No additional information*]

## **FCS\_HTTPS\_EXT.1 HTTPS Protocol**

Hierarchical to: No other components.

Dependencies to: FCS\_TLS\_EXT.1 TLS Protocol  
[FCS\_TLSC\_EXT.1 TLS Client Protocol or  
FCS\_TLSS\_EXT.1 TLS Server Protocol]

### **FCS\_HTTPS\_EXT.1.1**

The TSF shall [**selection**: *invoke platform-provided functionality to implement, implement*] the HTTPS protocol that complies with RFC 2818.

### **FCS\_HTTPS\_EXT.1.2**

The TSF shall [**selection**: *invoke platform-provided functionality to implement, implement*] HTTPS using TLS in accordance with the Functional Package for Transport Layer Security.

## **B.2.2.3 FCS\_IV\_EXT Initialization Vector Generation**

### **Family Behavior**

This family defines requirements for generating IVs in accordance with NIST-approved cipher modes.

### **Component Leveling**



[FCS\\_IV\\_EXT.1](#), Initialization Vector Generation, defines requirements for generating IVs.

#### **Management: FCS\_IV\_EXT.1**

There are no management activities foreseen.

#### **Audit: FCS\_IV\_EXT.1**

There are no auditable events foreseen.

### **FCS\_IV\_EXT.1 Initialization Vector Generation**

Hierarchical to: No other components.

Dependencies to: No dependencies.

#### **FCS\_IV\_EXT.1.1**

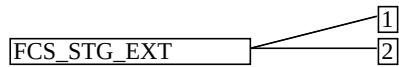
The [TSE](#) shall [selection: invoke platform-provided functionality, implement functionality] to generate IVs in accordance with [Table 17](#).

## **B.2.2.4 FCS\_STG\_EXT Encrypted Cryptographic Key Storage**

#### **Family Behavior**

This family defines requirements for ensuring the protection of keys and secrets.

#### **Component Leveling**



[FCS\\_STG\\_EXT.1](#), Cryptographic Key Storage, defines requirements for the security of persistent secrets and private keys.

[FCS\\_STG\\_EXT.2](#), Encrypted Cryptographic Key Storage, defines requirements for preventing access to private keys and persistent secrets.

#### **Management: FCS\_STG\_EXT.1**

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

- Import keys or secrets into the secure key storage (MDF Function 9)

#### **Audit: FCS\_STG\_EXT.1**

There are no auditable events foreseen.

### **FCS\_STG\_EXT.1 Cryptographic Key Storage**

Hierarchical to: No other components.

Dependencies to: No dependencies.

#### **FCS\_STG\_EXT.1.1**

The [TSE](#) shall use [selection: platform-provided key storage, encryption as specified in [FCS\\_STG\\_EXT.2](#)] for all persistent secrets and private keys.

#### **Management: FCS\_STG\_EXT.2**

There are no management activities foreseen.

#### **Audit: FCS\_STG\_EXT.2**

There are no auditable events foreseen.

### **FCS\_STG\_EXT.2 Encrypted Cryptographic Key Storage**

Hierarchical to: No other components.

Dependencies to: No dependencies.

### **FCS\_STG\_EXT.2.1**

The ~~TSF~~ shall [selection: invoke platform-provided functionality, implement functionality] to encrypt all keys using AES in the [selection: Key Wrap (KW) mode, Key Wrap with Padding (KWP) mode, GCM, CCM, CBC mode].

## **B.2.3 Identification and Authentication (FIA)**

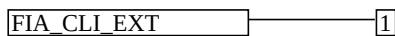
This ~~PP~~ defines the following extended components as part of the FIA class originally defined by ~~CC~~ Part 2:

### **B.2.3.1 FIA\_CLI\_EXT Client Authorization**

#### **Family Behavior**

This family defines requirements for unique certificate or token use.

#### **Component Leveling**



[FIA\\_CLI\\_EXT.1](#), Client Authorization, defines requirements for a unique certificate or token for each client device.

#### **Management: FIA\_CLI\_EXT.1**

There are no management activities foreseen.

#### **Audit: FIA\_CLI\_EXT.1**

There are no auditable events foreseen.

### **FIA\_CLI\_EXT.1 Client Authorization**

Hierarchical to: No other components.

Dependencies to: No dependencies.

#### **FIA\_CLI\_EXT.1.1**

The ~~TSF~~ shall require a unique [selection: certificate, token as defined in [FIA\\_TOK\\_EXT.1](#)] for each client device.

### **B.2.3.2 FIA\_ENR\_EXT Enrollment**

#### **Family Behavior**

This family defines requirements for authenticating remote users and limiting user enrollment.

#### **Component Leveling**



[FIA\\_ENR\\_EXT.1](#), Enrollment, defines requirements for authenticating and limiting user actions.

#### **Management: FIA\_ENR\_EXT.1**

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

- Configure the specific device models.
- Configure the specific time period.

#### **Audit: FIA\_ENR\_EXT.1**

The following actions should be auditable if FAU\_GEN security audit data generation is included in the ~~PP~~ or ~~SI~~.

- Failure of ~~MD~~ user authentication.
- Presented username.

## **FIA\_ENR\_EXT.1 Enrollment**

Hierarchical to: No other components.

Dependencies to: FIA\_UAU.4 Single-Use Authentication Mechanisms  
FMT\_SMF.1 Specification of Management Functions

### **FIA\_ENR\_EXT.1.1**

The TSF shall authenticate the remote users over a trusted channel during the enrollment of a MD.

### **FIA\_ENR\_EXT.1.2**

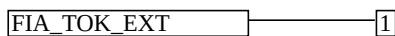
The TSF shall limit the user's enrollment of devices to devices specified by [**selection**: *IMEI*, **assignment**: *a unique device ID*] and [**selection**: *specific device models, a number of devices, specific time period*, **assignment**: *other features*], no other features].

## **B.2.3.3 FIA\_TOK\_EXT Client Tokens**

### **Family Behavior**

This family defines requirements for using a unique device to generate unique tokens for client devices.

### **Component Leveling**



**FIA\_TOK\_EXT.1**, Client Tokens, defines requirements for generating unique tokens.

### **Management: FIA\_TOK\_EXT.1**

There are no management activities foreseen.

### **Audit: FIA\_TOK\_EXT.1**

There are no auditable events foreseen.

## **FIA\_TOK\_EXT.1 Client Tokens**

Hierarchical to: No other components.

Dependencies to: No dependencies.

### **FIA\_TOK\_EXT.1.1**

The TSF shall [**selection**: *invoke platform-provided functionality, implement functionality*] to use [**selection**: *IMEI, other unique device ID*] to generate a unique token for each client device.

## **B.2.4 Protection of the TSF (FPT)**

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

## **B.2.4.1 FPT\_API\_EXT Use of Supported Services and APIs**

### **Family Behavior**

This family describes document platform APIs when selecting "invoke platform-provided functionality."

### **Component Leveling**



**FPT\_API\_EXT.1**, Use of Supported Services and APIs, defines requirements for API usage.

### **Management: FPT\_API\_EXT.1**

There are no management activities foreseen.

### **Audit: FPT\_API\_EXT.1**

There are no auditable events foreseen.

### **FPT\_API\_EXT.1 Use of Supported Services and APIs**

Hierarchical to: No other components.

Dependencies to: No dependencies.

#### **FPT\_API\_EXT.1.1**

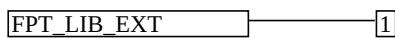
The TSF shall use only documented platform APIs.

### **B.2.4.2 FPT\_LIB\_EXT Use of Third-Party Libraries**

#### **Family Behavior**

This family describes packaging third-party libraries when selecting "implement functionality."

#### **Component Leveling**



[FPT\\_LIB\\_EXT.1](#), Use of Third-Party Libraries, defines requirements for third-party libraries.

#### **Management: FPT\_LIB\_EXT.1**

There are no management activities foreseen.

#### **Audit: FPT\_LIB\_EXT.1**

There are no auditable events foreseen.

### **FPT\_LIB\_EXT.1 Use of Third-Party Libraries**

Hierarchical to: No other components.

Dependencies to: No dependencies.

#### **FPT\_LIB\_EXT.1.1**

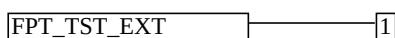
The MDM software shall be packaged with only [**assignment: list of third-party libraries**].

### **B.2.4.3 FPT\_TST\_EXT Functionality Testing**

#### **Family Behavior**

This family defines requirements for running self-tests and verifying integrity or executable code.

#### **Component Leveling**



[FPT\\_TST\\_EXT.1](#), Functionality Testing, defines requirements for the integrity of self-testing.

#### **Management: FPT\_TST\_EXT.1**

There are no management activities foreseen.

#### **Audit: FPT\_TST\_EXT.1**

The following actions should be auditable if FAU\_GEN security audit data generation is included in the PP or ST.

- Initiation of self-test.
- Failure of self-test.
- Detected integrity violation

### **FPT\_TST\_EXT.1 Functionality Testing**

Hierarchical to: No other components.

Dependencies to: FPT\_TST.1 TSF Self-Testing

### FPT\_TST\_EXT.1.1

The TSF shall run a suite of self tests during initial start-up (power on) to demonstrate correct operation of the TSF.

### FPT\_TST\_EXT.1.2

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

## B.2.4.4 FPT\_TUD\_EXT Trusted Update

### Family Behavior

This family defines requirements for allowing authorized administrators to query software versions, initiate updates, and verify software updates prior to installation.

### Component Leveling



FPT\_TUD\_EXT.1, Trusted Update, defines requirements for authorized administrators to manage software versions and updates.

### Management: FPT\_TUD\_EXT.1

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

- Query the current version of the MD firmware or software.
- Update system software (MDF Function 15).

### Audit: FPT\_TUD\_EXT.1

The following action should be auditable if FAU\_GEN security audit data generation is included in the PP or ST.

- Success or failure of signature verification

## FPT\_TUD\_EXT.1 Trusted Update

Hierarchical to: No other components.

Dependencies to: No dependencies.

### FPT\_TUD\_EXT.1.1

The TSF shall provide authorized administrators the ability to query the current version of the software.

### FPT\_TUD\_EXT.1.2

The TSF shall [selection: invoke platform-provided functionality, implement functionality] to provide authorized administrators the ability to initiate updates to the TOE.

### FPT\_TUD\_EXT.1.3

The TSF shall [selection: invoke platform-provided functionality, implement functionality] to provide a means to verify software updates to the TSF using a digital signature mechanism prior to installing those updates.

## B.2.5 Security Audit (FAU)

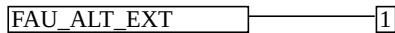
This PP defines the following extended components as part of the FAU class originally defined by CC Part 2:

## B.2.5.1 FAU\_ALT\_EXT Server Alerts

### Family Behavior

This family defines requirements for the TSF to alert administrators when a set of specified events occurs.

## Component Leveling



[FAU\\_ALT\\_EXT.1](#), Server Alerts, defines requirements for alerting the administrator to events.

### Management: FAU\_ALT\_EXT.1

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

- Install policies.

### Audit: FAU\_ALT\_EXT.1

The following actions should be auditable if FAU\_GEN security audit data generation is include in the [PP](#) or [ST](#).

- Type of alert.
- Identity of [MD](#) that sent alert.

### FAU\_ALT\_EXT.1 Server Alerts

Hierarchical to: No other components.

Dependencies to: No dependencies.

### FAU\_ALT\_EXT.1.1

The [TSF](#) shall alert the administrators in the event of any of the following:

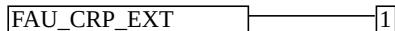
- Change in enrollment status
- Failure to apply policies to a [MD](#)
- [selection: [\[assignment: other events\]](#), no other events]

## B.2.5.2 FAU\_CRP\_EXT Support for Compliance Reporting of Mobile Device Configuration

### Family Behavior

This family defines requirements for the [TSF](#) to provide an interface for the [MDM](#) server to convey information about MDs for other systems.

### Component Leveling



[FAU\\_CRP\\_EXT.1](#), Support for Compliance Reporting of Mobile Device Configuration, defines requirements for providing information to enrolled MDs through a secure channel.

### Management: FAU\_CRP\_EXT.1

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

- Query the current version of the [MD](#) firmware or software.
- Query the current version of the hardware model of the device.
- Query the current version of installed applications.

### Audit: FAU\_CRP\_EXT.1

There are no auditable events foreseen.

## FAU\_CRP\_EXT.1 Support for Compliance Reporting of Mobile Device Configuration

Hierarchical to: No other components.

Dependencies to: [FTP\\_ITC.1](#) Inter-TSF Trusted Channel

### FAU\_CRP\_EXT.1.1

The [TSF](#) shall provide [\[assignment: type of interface\]](#) to authorized entities over a channel that meets the secure channel requirements in [FTP\\_ITC.1](#). The provided information for each enrolled [MD](#) includes:

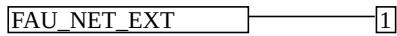
- The current version of the **MD** firmware or software
  - The current version of the hardware model of the device
  - [selection:
    - *The current version of installed applications*
    - *List of **MD** configuration policies that are in place on the device (as defined in [FMT\\_SMF.1.1/SERVER\\_CONF\\_AGENT](#))*
    - *[assignment: list of other available information about enrolled devices]*
    - *no other information*
- ].

### **B.2.5.3 FAU\_NET\_EXT Network Reachability Review**

#### **Family Behavior**

This family defines requirements for administrators to see network connectivity status.

#### **Component Leveling**



**FAU\_NET\_EXT.1**, Network Reachability Review, defines requirements for authorized administrators to read network connectivity status.

#### **Management: FAU\_NET\_EXT.1**

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

- Query connectivity status.

#### **Audit: FAU\_NET\_EXT.1**

There are no auditable events foreseen.

### **FAU\_NET\_EXT.1 Network Reachability Review**

Hierarchical to: No other components.

Dependencies to: FAU\_ALT\_EXT.2 Agent Alerts

#### **FAU\_NET\_EXT.1.1**

The **TSE** shall provide authorized administrators with the capability to read the network connectivity status of an enrolled agent.

### **B.2.6 Security Management (FMT)**

This **PP** defines the following extended components as part of the FMT class originally defined by **CC** Part 2:

### **B.2.6.1 FMT\_POL\_EXT Trusted Policy Update**

#### **Family Behavior**

This family describes how to use digitally signed policies and updates by using private keys, and validating the policy is appropriate.

#### **Component Leveling**



**FMT\_POL\_EXT.1**, Trusted Policy Update, defines requirements for using digitally signed policies and policy updates.

**FMT\_POL\_EXT.3**, Subordinate **MDM** Trusted Policy Update, defines requirements for using digitally signed policies and policy updates by the subordinate **MDM** server.

#### **Management: FMT\_POL\_EXT.1**

There are no management activities foreseen.

#### **Audit: FMT\_POL\_EXT.1**

The following actions should be auditable if FAU\_GEN security audit data generation is included in the **PP** or **ST**.

- Attempt to reuse enrollment data.
- Enrollment data.

## **FMT\_POL\_EXT.1 Trusted Policy Update**

Hierarchical to: No other components.

Dependencies to: No dependencies.

### **FMT\_POL\_EXT.1.1**

The TSE shall provide digitally signed policies and policy updates to the [**selection**: *MDM agent, subordinate MDM server*].

### **FMT\_POL\_EXT.1.2**

The TSE shall sign policies and policy updates using a private key associated with [**selection**: *an X509 certificate, a public key provisioned to the agent or subordinate MDM server*] trusted by the agent or subordinate MDM server for policy verification.

### **FMT\_POL\_EXT.1.3**

For each unique policy managed by the TSE, the TSE shall validate that the policy is appropriate for an agent or subordinate MDM server using [**selection**: *client authentication via an X509 certificate representing the agent or subordinate MDM server, a token issued to the agent or subordinate MDM server and associated with a policy signing key uniquely associated to the policy*].

### **Management: FMT\_POL\_EXT.3**

There are no management activities foreseen.

### **Audit: FMT\_POL\_EXT.3**

The following actions should be auditable if FAU\_GEN security audit data generation is included in the PP or ST.

- Attempt to reuse enrollment data.
- Enrollment data.

## **FMT\_POL\_EXT.3 Subordinate MDM Trusted Policy Update**

Hierarchical to: No other components.

Dependencies to: No dependencies.

### **FMT\_POL\_EXT.3.1**

The TSE shall only accept policies and policy updates that are digitally signed by a private key that has been authorized for policy updates by the primary MDM server.

### **FMT\_POL\_EXT.3.2**

The TSE shall not process policies for the MDM agent if the signature check fails.

## **B.2.6.2 FMT\_SAE\_EXT Security Attribute Expiration**

### **Family Behavior**

This family defines the requirements for using expiration time for enrollment and denying enrollment if that time has passed.

### **Component Leveling**



[FMT\\_SAE\\_EXT.1](#), Security Attribute Expiration, defines requirements for the expiration time for enrollment authentication.

### **Management: FMT\_SAE\_EXT.1**

The following action could be considered for the management functions in FMT.

- Configure the length of time the enrollment authenticator is valid.

## **Audit: FMT\_SAE\_EXT.1**

The following actions should be auditable if FAU\_GEN security audit data generation is included in the PP or ST.

- Enrollment attempted after expiration of authentication data.
- Identity of user.

### **FMT\_SAE\_EXT.1 Security Attribute Expiration**

Hierarchical to: No other components.

Dependencies to: FIA\_ENR\_EXT.1 Enrollment  
FIA\_UAU.4 Single-Use Authentication Mechanisms

#### **FMT\_SAE\_EXT.1.1**

The TSF shall be able to specify a configurable expiration time for enrollment authentication data.

#### **FMT\_SAE\_EXT.1.2**

The TSF shall be able to deny enrollment after the expiration time for the enrollment authentication data has passed.

## **B.2.7 Trusted Path/Channels (FTP)**

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

### **FTP\_ITC\_EXT Trusted Channel**

#### **Family Behavior**

The family defines requirements for communication channels between itself and other communication channels.

#### **Component Leveling**



[FTP\\_ITC\\_EXT.1](#), Trusted Channel, defines requirements for providing logically distinct communication channels.

#### **Management: FTP\_ITC\_EXT.1**

There are no management activities foreseen.

#### **Audit: FTP\_ITC\_EXT.1**

There are no auditable events foreseen.

### **FTP\_ITC\_EXT.1 Trusted Channel**

Hierarchical to: No other components.

Dependencies to: FTP\_ITC.1 Inter-TSF Trusted Channel  
FTP\_TRP.1 Trusted Path

#### **FTP\_ITC\_EXT.1.1**

The TSF shall provide a communication channel between itself and have to update this for subordinate MDM [selection:

- *an MDM agent that is internal to the TOE*
- *an MDM agent that is external to the TOE*
- *other components comprising the distributed TOE*

] that is logically distinct from other communication channels, as specified in [**assignment: inter-TSF trusted channel or internal TOE TSF data transfer type**]

# Appendix C - Implicitly Satisfied Requirements

This appendix lists requirements that should be considered satisfied by products successfully evaluated against this PP. 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, 8.3 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.

**Table 21: Implicitly Satisfied Requirements**

Requirement	Rationale for Satisfaction
<b>FIA_UID.1 - Timing of Identification</b>	<p><a href="#">FIA_UAU.1</a> has a dependency on FIA_UID.1 because authentication of an external entity requires that entity to first identify itself so that its identity can be validated by the authentication process.</p> <p>This SER has not been defined in this PP-Module because authentication of a user implicitly requires them to be identified as well.</p> <p>There are two cases in which a user must be authenticated by the TSF per the application note in <a href="#">FIA_UAU.1</a>: enrollment of a user's MD into management, and authentication of a user to the TOE's management interface. <a href="#">FIA_ENR_EXT.1</a> requires authentication of the user using a method such as a directory server, which implicitly expects that the user must identify themselves as well as provide a credential associated with the claimed identity. For management, FMT_SMR.1(1) requires the TSF to maintain an administrator role but it does not specify whether authentication to this role is role-based or identity-based. Therefore, the PP is not concerned with the specific mechanism by which an administrator presents their identity to the TSF, only that there is a mechanism to validate and authorize whatever information they do present.</p>
<b>FMT_MTD.1 - Management of TSF Data</b>	<p><a href="#">FAU_SEL.1</a> has a dependency on FMT_MTD.1 because the configuration settings that determine what events are audited is considered to be TSF data. While <a href="#">FAU_SEL.1</a> determines the extent to which the TOE's audit function is configured, it relies on FMT_MTD.1 to determine the administrative roles that are permitted to manipulate this data.</p> <p>The PP allows <a href="#">FAU_SEL.1</a> to be implemented either by the TSF or by the TOE platform because the TOE may rely on the audit functionality provided by the QS it runs on. If this is configured entirely through the platform, the administrator does not necessarily need to be authenticated by the TOE to do this. Therefore, requiring FMT_MTD.1 does not make sense in this situation. If this is configured through the TOE, it can be implied from a review of FMT_SMR.1(1) that the 'MD user' role cannot perform this function as they lack the authority to manage the TSF. It is therefore understood that this function can be performed by the 'administrator' role or potentially by one or more roles specified by the ST author if the selection to specify additional roles is chosen. An additional SFR that explicitly identifies the roles permitted to manage this function is redundant in this context.</p>
<b>FPT_STM.1 - Reliable Time Stamps</b>	<p>The PP's iterations of FAU_GEN.1 as well as its cryptographic functionality have a dependency on FPT_STM.1 because audit data require accurate timestamps as well as some cryptographic operations, such as determining if a presented X.509 certificate is expired. The TOE is installed on a general-purpose computer or specialized network device that is assumed to have the ability to provide certain functions to the TOE as specified in <a href="#">A.MDM_SERVER_PLATFORM</a>. This assumption explicitly lists 'reliable timestamps' as a function that the TSF is expected to have available to it.</p>

# Appendix D - Entropy Documentation and Assessment

This appendix describes the required supplementary information for each entropy source used by the TOE.

The documentation of the entropy sources should be detailed enough that, after reading, the evaluator will thoroughly understand the entropy source and why it can be relied on to provide sufficient entropy. This documentation should include multiple detailed sections: design description, entropy justification, operating conditions, and health testing. This documentation is not required to be part of the TSS.

## D.1 Design Description

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Documentation shall include the design of each entropy source as a whole, including the interaction of all entropy source components. Any information that can be shared regarding the design should also be included for any third-party entropy sources that are included in the product.

The documentation will describe the operation of the entropy source to include, how entropy is produced, and how unprocessed (raw) data can be obtained from within the entropy source for testing purposes. The documentation should walk through the entropy source design indicating where the entropy comes from, where the entropy output is passed next, any post-processing of the raw outputs (hash, XOR, etc.), if or where it is stored, and finally, how it is output from the entropy source. Any conditions placed on the process (e.g., blocking) should also be described in the entropy source design. Diagrams and examples are encouraged.

This design must also include a description of the content of the security boundary of the entropy source and a description of how the security boundary ensures that an adversary outside the boundary cannot affect the entropy rate.

If implemented, the design description shall include a description of how third-party applications can add entropy to the RBG. A description of any RBG state saving between power-off and power-on shall be included.

## D.2 Entropy Justification

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There should be a technical argument for where the unpredictability in the source comes from and why there is confidence in the entropy source delivering sufficient entropy for the uses made of the RBG output (by this particular TOE). This argument will include a description of the expected min-entropy rate (i.e., the minimum entropy (in bits) per bit or byte of source data) and explain that sufficient entropy is going into the TOE randomizer seeding process. This discussion will be part of a justification for why the entropy source can be relied on to produce bits with entropy.

The amount of information necessary to justify the expected min-entropy rate depends on the type of entropy source included in the product.

For developer provided entropy sources, in order to justify the min-entropy rate, it is expected that a large number of raw source bits will be collected, statistical tests will be performed, and the min-entropy rate determined from the statistical tests. While no particular statistical tests are required at this time, it is expected that some testing is necessary in order to determine the amount of min-entropy in each output.

For third-party provided entropy sources, in which the TOE vendor has limited access to the design and raw entropy data of the source, the documentation will indicate an estimate of the amount of min-entropy obtained from this third-party source. It is acceptable for the vendor to "assume" an amount of min-entropy, however, this assumption must be clearly stated in the documentation provided. In particular, the min-entropy estimate must be specified and the assumption included in the ST.

Regardless of type of entropy source, the justification will also include how the DRBG is initialized with the entropy stated in the ST, for example by verifying that the min-entropy rate is multiplied by the amount of source data used to seed the DRBG or that the rate of entropy expected based on the amount of source data is explicitly stated and compared to the statistical rate. If the amount of source data used to seed the DRBG is not clear or the calculated rate is not explicitly related to the seed, the documentation will not be considered complete.

The entropy justification shall not include any data added from any third-party application or from any state saving between restarts.

## D.3 Operating Conditions

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The entropy rate may be affected by conditions outside the control of the entropy source itself. For example, voltage, frequency, temperature, and elapsed time after power-on are just a few of the factors that may affect the operation of the entropy source. As such, documentation will also include the range of operating conditions under which the entropy source is expected to generate random data. Similarly, documentation shall describe the conditions under which the entropy source is no longer guaranteed to provide sufficient entropy. Methods used to detect failure or degradation of the source shall be included.

## D.4 Health Testing

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More specifically, all entropy source health tests and their rationale will be documented. This will include a description of the health tests, the rate and conditions under which each health test is performed (e.g., at startup, continuously, or on-demand), the expected results for each health test, TQE behavior upon entropy source failure, and rationale indicating why each test is believed to be appropriate for detecting one or more failures in the entropy source.

# Appendix E - Evaluating Additional Components for a Distributed TOE

In the case of a distributed TOE the ST will identify an evaluated configuration that consists of a number of separate components chosen by the ST author, which collectively satisfy the requirements of the PP. This evaluated configuration need not be the minimum set of components that could possibly meet the PP (e.g., if the TOE is intended for large enterprise deployments then the evaluated configuration might include some redundancy in components in order to support expected connectivity and loads), but because this is the main configuration referred to in the ST and the evaluation, it is treated in this section as the minimum configuration of interest and is referred to here as the 'minimum configuration' as well as the 'evaluated configuration'.

In addition to the minimum configuration above, the ST may also identify (at the author's discretion, and subject to verification as described in this section) which TOE components can have instances added to an operational configuration without affecting the validity of the CC certification. The ST description may include constraints on how such components are added, including required or prohibited configurations of the components.

Extra instances of a TOE component must have the same hardware and software as the original component included in the evaluated configuration.

## E.1 Evaluator Actions for Assessing the ST

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**TSS** The evaluator shall examine the TSS to identify any extra instances of TOE components allowed in the ST and shall examine the description of how the additional components maintain the SERs to confirm that it is consistent with the role that the component plays in the evaluated configuration. For example: the secure channels used by the extra component for intra-TOE communications (FPT\_ITT) and external communications (FTP\_ITC) must be consistent, the audit information generated by the extra component must be maintained, and the management of the extra component must be consistent with that used for the original instance of the component in the minimum configuration.

## E.2 Evaluator Actions for Assessing the Guidance Documentation

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**Guidance** w The evaluator shall examine the description of the extra instances of TOE components in the guidance documentation to confirm that they are consistent with those identified as allowed in the ST. This includes confirmation that the result of applying the guidance documentation to configure the extra component will leave the TOE in a state such that the claims for SER support in each component are as described in the ST and therefore that all SERs continue to be met when the extra components are present.

The evaluator shall examine the secure communications described for the extra components to confirm that they are the same as described for the components in the minimum configuration (additional connections between allowed extra components and the components in the minimum configuration are allowed of course).

## E.3 Evaluator Actions for Testing the TOE

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**Tests** The evaluator tests the TOE in the minimum configuration as defined in the ST (and the guidance documentation).

If the description of the use of extra components in the ST and guidance documentation identifies any difference in the SERs allocated to a component, or the scope of the SERs involved (e.g., if different selections apply to different instances of the component) then the evaluator tests these additional SER cases that were not included in the minimum configuration.

In addition, the evaluator tests the following aspects for each extra component that is identified as allowed in the distributed TOE:

- Communications: the evaluator follows the guidance documentation to confirm, by testing, that any additional connections introduced with the extra component and not present in the minimum configuration are consistent with the requirements stated in the ST (e.g., with regard to protocols and ciphersuites used). An example of such an additional connection would be if a single instance of the component is present in the minimum configuration and adding a duplicate component then introduces an extra communication between the two instances. Another example might be if the use of the additional components necessitated the use of a connection to an external authentication server instead of using locally stored credentials.

- Audit: the evaluator confirms that the audit records from different instances of a component can be distinguished so that it is clear which instance generated the record.
- Management: if the extra component manages other components in the distributed TOE then the evaluator shall follow the guidance documentation to confirm that management via the extra component uses the same roles and role holders for administrators as for the component in the minimum configuration.

# Appendix F - MDM Software Equivalency Guidelines

## F.1 Introduction

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The purpose of equivalence in PP-based evaluations is to find a balance between evaluation rigor and commercial practicability, to ensure that evaluations meet customer expectations while recognizing that there is little to be gained from requiring that every variation in a product or platform be fully tested. If a product is found to be compliant with a PP on one platform, then all equivalent products on equivalent platforms are also considered to be compliant with the PP.

A Vendor can make a claim of equivalence if the Vendor believes that a particular instance of their Product implements PP-specified security functionality in a way equivalent to the implementation of the same functionality on another instance of their Product on which the functionality was tested. The Product instances can differ in version number or feature level (model), or the instances may run on different platforms. Equivalency can be used to reduce the testing required across claimed evaluated configurations. It can also be used during Assurance Maintenance to reduce testing needed to add more evaluated configurations to a certification.

These equivalency guidelines do not replace Assurance Maintenance requirements or NIAP Policy #5 requirements for CAVP certificates. Nor may equivalency be used to leverage evaluations with expired certifications.

These Equivalency Guidelines represent a shift from complete testing of all product instances to more of a risk-based approach. Rather than require that every combination of product and platform be tested, these guidelines support an approach that recognizes that products are being used in a variety of environments, and often in cloud environments over where the vendor (and sometimes the customer) have little or no control over the underlying hardware. Developers should be responsible for the security functionality of their applications on the platforms they are developed for, whether that is an operating system, a virtual machine, or a software-based execution environment such as a container. But those platforms may themselves run within other environments, virtual machines or operating systems, that completely abstract away the underlying hardware from the application. The developer should not be held accountable for security functionality that is implemented by platform layers that are abstracted away. The implication is that not all security functionality will necessarily be tested for all platform layers down to the hardware for all evaluated configurations, especially for applications developed for software-based execution environments such as containers. For these cases, the balancing of evaluation rigor and commercial practicability tips in favor of practicability. Note that this does not affect the requirement that at least one product instance be fully tested on at least one platform with cryptography mapped to a CAVP certificate.

Equivalency has two aspects:

- **Product Equivalence:** Products may be considered equivalent if there are no differences between Product Models and Product Versions with respect to PP-specified security functionality.
- **Platform Equivalence:** Platforms may be considered equivalent if there are no significant differences in the services they provide to the Product, or in the way the platforms provide those services, with respect to PP-specified security functionality.

The equivalency determination is made in accordance with these guidelines by the Validator and Scheme using information provided by the evaluator or vendor.

## F.2 Approach to Equivalency Analysis

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There are two scenarios for performing equivalency analysis. One is when a product has been certified and the vendor wants to show that a later product should be considered certified due to equivalence with the earlier product. The other is when multiple product variants are going through evaluation together and the vendor would like to reduce the amount of testing that must be done. The basic rules for determining equivalence are the same in both cases. But there is one additional consideration that applies to equivalence with previously certified products. That is, the product with which equivalence is being claimed must have a valid certification in accordance with scheme rules and the Assurance Maintenance process must be followed. If a product's certification has expired, then equivalence cannot be claimed with that product.

When performing equivalency analysis, the evaluator or vendor should first use the factors and guidelines for Product Model equivalence to determine the set of Product Models to be evaluated. In general, Product Models that do not differ in PP-specified security functionality are considered equivalent for purposes of evaluation against the APP PP.

If multiple revision levels of Product Models are to be evaluated, or to determine whether a revision of an evaluated product needs re-evaluation, the evaluator or vendor and validator should use the factors and guidelines for Product Version equivalence to analyze whether Product Versions are equivalent.

Having determined the set of Product Models and Versions to be evaluated, the next step is to determine the set of Platforms that the Products must be tested on.

Each non-equivalent Product for which compliance is claimed must be fully tested on each non-equivalent platform for which compliance is claimed. For non-equivalent Products on equivalent platforms, only the differences that affect **PP**-specified security functionality must be tested for each product.

#### **"Differences in **PP**-Specified Security Functionality" Defined**

If **PP**-specified security functionality is implemented by the **TOE**, then differences in the actual implementation between versions or product models break equivalence for that feature. Likewise, if the **TOE** implements the functionality in one version or model and the functionality is implemented by the platform in another version or model, then equivalence is broken. If the functionality is implemented by the platform in multiple models or versions on equivalent platforms, then the functionality is considered different if the product invokes the platform differently to perform the function.

### **F.3 Specific Guidance for Determining Product Model Equivalence**

Product Model equivalence attempts to determine whether different feature levels of the same product across a product line are equivalent for purposes of **PP** testing. For example, if a product has a "basic" edition and an "enterprise" edition, is it necessary to test both models? Or does testing one model provide sufficient assurance that both models are compliant?

Product models are considered equivalent if there are no differences that affect **PP**-specified security functionality, as indicated in [Table 22](#).

**Table 22: Determining Product Model Equivalence**

Factor	Same or Different	Guidance
<b>PP</b> -Specified Functionality	Same	If the differences between Models affect only non- <b>PP</b> -specified functionality, then the Models are equivalent.
	Different	If <b>PP</b> -specified security functionality is affected by the differences between Models, then the Models are not equivalent and must be tested separately. It is necessary only to test the functionality affected by the software differences. If only differences are tested, then the differences must be enumerated, and for each difference the Vendor must provide an explanation of why each difference does or does not affect <b>PP</b> -specified functionality. If the Product Models are separately tested fully, then there is no need to document the differences.

### **F.4 Specific Guidance for Determining Product Version Equivalence**

In cases of version equivalence, differences are expressed in terms of changes implemented in revisions of an evaluated Product. In general, versions are equivalent if the changes have no effect on any security-relevant claims about the **TOE** or assurance evidence. Non-security-relevant changes to **TOE** functionality or the addition of non-security-relevant functionality does not affect equivalence.

**Table 23: Factors for Determining Product Version Equivalence**

Factor	Same or Different	Guidance
Product Models	Different	Versions of different Product Models are not equivalent unless the Models are equivalent as defined in subsection 3.
	Same	If the differences affect only non- <b>PP</b> -specified functionality, then the Versions are equivalent.
<b>PP</b> -Specified Functionality	Different	If <b>PP</b> -specified security functionality is affected by the differences, then the Versions are not considered equivalent and must be tested separately. It is necessary only to test the functionality affected by the changes. If only the differences are tested, then for each difference the Vendor must provide an explanation of why the difference does or does not affect <b>PP</b> -specified functionality. If the Product Versions are separately tested fully, then there is no need to document the differences.

### **F.5 Specific Guidance for Determining Platform Equivalence**

Platform equivalence is used to determine the platforms that equivalent versions of a Product must be tested on. Platform equivalence analysis done for one **MDM** cannot be applied to another **MDM**. Platform equivalence is not general, it is with respect to a particular **MDM**.

Product Equivalency analysis must already have been done and Products have been determined to be equivalent.

The platform can be hardware or virtual hardware, an operating system or similar entity, or a software execution environment such as a container. For purposes of determining equivalence for MDMs, we address each type of platform separately. In general, platform equivalence is based on differences in the interfaces between the **TOE** and Platform that are relevant to the implementation of **PP**-specified security functionality.

### F.5.1 Platform Equivalence, Hardware and Virtual Hardware Platforms

If an **MDM** runs directly on hardware without an operating system, or directly on virtualized hardware without an operating system, then platform equivalence is based on processor architecture and instruction sets. In the case of virtualized hardware, it is the virtualized processor and architecture that are presented to the **MDM** that matters, not the physical hardware.

Platforms with different processor architectures and instruction sets are not equivalent. This is not likely to be an issue for equivalency analysis for MDMs since there is likely to be a different version of the **MDM** for different hardware environments. Equivalency analysis becomes important when comparing processors with the same architecture. Processors with the same architecture that have instruction sets that are subsets or supersets of each other are not disqualified from being equivalent for purposes of an **MDM** evaluation. If the **MDM** takes the same code paths when executing **PP**-specified security functionality on different processors of the same family, then the processors can be considered equivalent with respect to that **MDM**. For example, if an **MDM** follows one code path on platforms that support the AES-NI instruction and another on platforms that do not, then those two platforms are not equivalent with respect to that **MDM** functionality. But if the **MDM** follows the same code path whether or not the platform supports AES-NI, then the platforms are equivalent with respect to that functionality.

The platforms are equivalent with respect to the **MDM** if the platforms are equivalent with respect to all **PP**-specified security functionality.

**Table 24: Factors for Determining Hardware and Virtual Hardware Platform Equivalence**

Factor	Same, Different, or None	Guidance
Platform Architectures	Different	Platforms that present different processor architectures and instruction sets to the <b>MDM</b> are not equivalent.
<b>PP</b> -Specified Functionality	Same	For platforms with the same processor architecture, the platforms are equivalent with respect to the <b>MDM</b> if execution of all <b>PP</b> -specified security functionality follows the same code path on both platforms.

### F.5.2 Platform Equivalence, OS Platforms

For MDMs that are built for and run on operating systems, platform equivalence is determined by the interfaces between the **MDM** and the operating system that are relevant to **PP**-specified security functionality. Generally, these are the processor interface, device interfaces, and **QS** APIs. The following factors applied in order:

**Table 25: Factors for Determining **QS** or **VS** Platform Equivalence**

Factor	Same, Different, or None	Guidance
Platform Architectures	Different	Platforms that run on different processor architectures and instruction sets are not equivalent.
Platform Vendors	Different	Platforms from different vendors are not equivalent.
Platform Versions	Different	Platforms from the same vendor with different major version numbers are not equivalent.
Platform Interfaces	Different	Platforms from the same vendor and major version are not equivalent if there are differences in device interfaces and <b>QS</b> APIs that are relevant to the way the platform provides <b>PP</b> -specified security functionality to the <b>MDM</b> .

Platform Interfaces	Same	Platforms from the same vendor and major version are equivalent if there are no differences in device interfaces and <b>QS</b> APIs that are relevant to the way the platform provides <b>PP</b> -specified security functionality to the <b>MDM</b> , or if the Platform does not provide such functionality to the <b>MDM</b> .
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### F.5.3 Software-based Execution Environment Platform Equivalence

If an **MDM** is built for and runs in a non-OS software-based execution environment, such as a Container or Java Runtime, then the below criteria must be used to determine platform equivalence. The key point is that the underlying hardware (virtual or physical) and **QS** is not relevant to platform equivalence. This allows MDMs to be tested and run on software-based execution environments on any hardware, as in cloud deployments.

**Table 26: Factors for Software-based Execution Environment Platform Equivalence**

Factor	Same, Different, or None	Guidance
Platform Type or Vendor	Different	Software-based execution environments that are substantially different or come from different vendors are not equivalent. For example, a java virtual machine is not the same as a container. A Docker container is not the same as a CoreOS container.
Platform Versions	Different	Execution environments that are otherwise equivalent are not equivalent if they have different major version numbers.
<b>PP</b> -Specified Security Functionality	Same	All other things being equal, execution environments are equivalent if there is no significant difference in the interfaces through which the environments provide <b>PP</b> -specified security functionality to MDMs.

## F.6 Level of Specificity for Tested Configurations and Claimed Equivalent Configurations

In order to make equivalency determinations, the vendor and evaluator must agree on the equivalency claims. They must then provide the scheme with sufficient information about the **TOE** instances and platforms that were evaluated, and the **TOE** instances and platforms that are claimed to be equivalent.

The **SI** must describe all configurations evaluated down to processor manufacturer, model number, and microarchitecture version.

The information regarding claimed equivalent configurations depends on the platform that the **MDM** was developed for and runs on.

### Bare-Metal MDMs

For **MDM** servers that run without an operating system on bare-metal or virtual bare-metal, the claimed configuration must describe the platform down to the specific processor manufacturer, model number, and microarchitecture version. The Vendor must describe the differences in the **TOE** with respect to **PP**-specified security functionality and how the **TOE** functions differently to leverage platform differences (e.g., instruction set extensions) in the tested configuration versus the claimed equivalent configuration.

### Traditional MDMs

For MDMs that run with an operating system as their immediate platform, the claimed configuration must describe the platform down to the specific operating system version. If the platform is a virtualization system, then the claimed configuration must describe the platform down to the specific virtualization system version. The Vendor must describe the differences in the **TOE** with respect to **PP**-specified security functionality and how the **TOE** functions differently to leverage platform differences in the tested configuration versus the claimed equivalent configuration. Relevant platform differences could include instruction sets, device interfaces, and **QS** APIs invoked by the **TOE** to implement **PP**-specified security functionality.

### Software-Based Execution Environments

For MDMs that run in a software-based execution environment such as a Java virtual machine or a Container, then the claimed configuration must describe the platform down to the specific version of the software execution environment. The Vendor must describe the differences in the **TOE** with respect to **PP**-specified security functionality and how the **TOE** functions differently to leverage platform differences in the tested configuration versus the claimed equivalent configuration.

# Appendix G - Use Case Templates

The following use case templates list those selections, assignments, and objective requirements that best support the use cases identified by this Protection Profile. Note that the templates assume that all SFRs listed in Section 5 are included in the ST, not just those listed in the templates. These templates and deviations from the template should be identified in the Security Target to assist customers with making risk-based purchasing decisions. Products that do not meet these templates are not precluded from use in the scenarios identified by this Protection Profile. Where selections for a particular requirement are not identified in a use case template, all available selections are equally applicable to the use case.

## G.1 Enterprise-owned device for general-purpose enterprise use

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Requirement	Action
FMT_SMF.1/SERVER_CONF_AGENT Function 32	Include in ST and assign GPS.
FMT_SMF.1/SERVER_CONF_AGENT Function 34	Include in ST. Assign personal hotspot connections (if feature exists).
FMT_SMF.1/SERVER_CONF_AGENT Function 47	Include in ST.
FMT_SMF.1/SERVER_CONF_AGENT Function 49	Include in ST and select "a. USB mass storage mode."
FMT_SMF.1/SERVER_CONF_AGENT Function 51	Include in ST. Select both options.

## G.2 Enterprise-owned device for specialized, high-security use

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Requirement	Action
FMT_SMF.1/SERVER_CONF_AGENT Function 15	Include in ST.
FMT_SMF.1/SERVER_CONF_AGENT Function 16	Include in ST.
FMT_SMF.1/SERVER_CONF_AGENT Function 31	Include in ST and select "no other method."
FMT_SMF.1/SERVER_CONF_AGENT Function 32	Include in ST.
FMT_SMF.1/SERVER_CONF_AGENT Function 33	Include in ST. Assign at least USB.
FMT_SMF.1/SERVER_CONF_AGENT Function 34	Include in ST. Assign all protocols where the TSF acts as a server.
FMT_SMF.1/SERVER_CONF_AGENT Function 36	Include in ST.
FMT_SMF.1/SERVER_CONF_AGENT Function 37	Include in ST.
FMT_SMF.1/SERVER_CONF_AGENT Function 40	Include in ST.
FMT_SMF.1/SERVER_CONF_AGENT Function 42	Include in ST.
FMT_SMF.1/SERVER_CONF_AGENT Function 47	Include in ST.
FMT_SMF.1/SERVER_CONF_AGENT Function 52	Include in ST.
FMT_SMF.1/SERVER_CONF_AGENT Function 54	Include in ST.
FMT_SMF.1/SERVER_CONF_AGENT Function c.1	Include in ST.
FMT_SMF.1/SERVER_CONF_AGENT Function c.2	Include in ST.

## G.3 Personally-owned device for personal and enterprise use

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Requirement	Action
FMT_SMF.1/SERVER_CONF_AGENT Function 13	Include in <u>ST</u>
FMT_SMF.1/SERVER_CONF_AGENT Function 14	Include in <u>ST</u>
FMT_SMF.1/SERVER_CONF_AGENT Function 21	Include in <u>ST</u>
FMT_SMF.1/SERVER_CONF_AGENT Function 22	Include in <u>ST</u>
FMT_SMF.1/SERVER_CONF_AGENT Function 30	Select "on a per-app basis," "on a per-group of application processes basis," or both
FMT_SMF.1/SERVER_CONF_AGENT Function 31	If included in <u>ST</u> , select "on a per-app basis," "on a per-group of application processes basis," or both
FMT_SMF.1/SERVER_CONF_AGENT Function 48	Include in <u>ST</u>
FMT_SMF.1/SERVER_CONF_AGENT Function 52	If included in <u>ST</u> , select "on a per-app basis," "on a per-group of application processes basis," or both
FMT_SMF.1/SERVER_CONF_SERVER Function f	Include in the <u>ST</u>

#### **G.4 Personally-owned device for personal and limited enterprise use**

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At this time no requirements are recommended for this use case.

## Appendix H - Acronyms

**Table 27: Acronyms**

Acronym	Meaning
<b>API</b>	Application Programming Interface
<b>Base-PP</b>	Base Protection Profile
<b>CC</b>	Common Criteria
<b>CEM</b>	Common Evaluation Methodology
<b>cPP</b>	Collaborative Protection Profile
<b>CSP</b>	Critical Security Parameter
<b>DEK</b>	Data Encryption Key
<b>EP</b>	Extended Package
<b>EST</b>	Enrollment over Secure Transport
<b>FP</b>	Functional Package
<b>KEK</b>	Key Encryption Key
<b>MAS</b>	Mobile Application Store
<b>MD</b>	Managed Device
<b>MDM</b>	Mobile Device Management
<b>OE</b>	Operational Environment
<b>OS</b>	Operating System
<b>PP</b>	Protection Profile
<b>PP-Configuration</b>	Protection Profile Configuration
<b>PP-Module</b>	Protection Profile Module
<b>REK</b>	Root Encryption Key
<b>SAR</b>	Security Assurance Requirement
<b>SFR</b>	Security Functional Requirement
<b>ST</b>	Security Target
<b>TOE</b>	Target of Evaluation
<b>TSF</b>	TOE Security Functionality
<b>TSFI</b>	TSF Interface
<b>TSS</b>	TOE Summary Specification

# Appendix I - Bibliography

**Table 28: Bibliography**

**Identifier**   **Title**

[CC]	Common Criteria for Information Technology Security Evaluation - <ul style="list-style-type: none"><li>• <a href="#">Part 1: Introduction and general model</a>, CCMB-2022-11-001, CC:2022, Revision 1, November 2022.</li><li>• <a href="#">Part 2: Security functional requirements</a>, CCMB-2022-11-002, CC:2022, Revision 1, November 2022.</li><li>• <a href="#">Part 3: Security assurance requirements</a>, CCMB-2022-11-003, CC:2022, Revision 1, November 2022.</li><li>• <a href="#">Part 4: Framework for the specification of evaluation methods and activities</a>, CCMB-2022-11-004, CC:2022, Revision 1, November 2022.</li><li>• <a href="#">Part 5: Pre-defined packages of security requirements</a>, CCMB-2022-11-005, CC:2022, Revision 1, November 2022.</li></ul>
[CEM]	Common Methodology for Information Technology Security Evaluation - <ul style="list-style-type: none"><li>• <a href="#">Evaluation methodology</a>, CCMB-2022-11-006, CC:2022, Revision 1, November 2022.</li></ul>
[CSA]	<a href="#">Computer Security Act of 1987</a> , H.R. 145, June 11, 1987.
[OMB]	<a href="#">Reporting Incidents Involving Personally Identifiable Information and Incorporating the Cost for Security in Agency Information Technology Investments</a> , OMB M-06-19, July 12, 2006.