Federal Office
for Information Security

Common Criteria Protection Profile
Cryptographic Service Provider Light
BSI-CC-PP-0111-2019

Federal Office for Information Security
Post Box 20 03 63
D-53133 Bonn

Internet: https://www.bsi.bund.de

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1 PP introduction

1.1 PP reference

Title:	Common Criteria Protection Profile Cryptographic Service Provider Light
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Assurance Level:	EAL2 augmented with ALC_CMS.3, ALC_LCD.1
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1.2 TOE overview

TOE type

The Target of Evaluation (TOE) is a cryptographic service provider (CSP) component. The TOE is dedicated to provide cryptographic services for the protection of the confidentiality and the integrity of user data, and for entity authentication. Parts of these features may be supported by the underlying hardware/software platform.

TOE definition

The TOE is defined as a software component, i.e. a cryptographic library. The TOE is installed on and runs on a dedicated hardware platform, i.e. an embedded system. The hardware platform is not part of the TOE, but it is expected that the TOE adheres to the platform guidance and the TOE relies on functionality provided by the operating system.

"Platform Guidance" is defined as all documentation provided by the hardware manufacturer, or software platform manufacturer, that provides information on how to securely implement functionality. Documentation that merely describes usage and functionality, but that is not relevant for the secure operation of the TOE is out of scope. Examples of such security-relevant documentation include, but are not limited to:

- Guidance information of the hardware manufacturer on the use of cryptographic functionality provided by the hardware, such as on the use of random number generators, or key usage limits when using hardware functionality for symmetric and asymmetric operations.
- Guidance information of the hardware manufacturer on the use of tamper detection mechanisms, in case that the underlying hardware provides such functionality
- Guidance information of the software manufacturer on the use of APIs, for example on the usage of "/dev/urandom" in the case of Unix-like operation systems, or API documentation w.r.t. the usage of the Cryptography API: Next Generation (CNG) in the case of Microsoft Windows.

In general, the platform guidance depends on the underlying hardware and software used. Both the underlying hardware and software that the TOE is intended to be run on, as well as all available platform guidance, MUST be documented by the ST-Writer.

The TOE security functionality (TSF) is logically defined by a common set of security services for users and security mechanisms for internal use. The cryptographic services for users comprise

– authentication of users,

– authentication and attestation of the TOE to entities,

– data authentication and non-repudiation including time stamps,
– encryption and decryption of user data,
– trusted channel functionality including mutual authentication of the communicating entities, encryption and message authentication proof for the sent data, decryption and message authentication verification for received data,
– management of cryptographic keys with security attributes including key generation, key derivation and key agreement, internal storage of keys, import and export of keys with protection of their confidentiality and integrity,
– generation of random bits which may be used for security services outside the TOE.

The TOE is intended to be used as one part within a larger, composed IT products. Such products consist of the TOE and one or more application components. The TOE provides the security services for these application components. The PP considers two different architecture of the composed IT product:

– Platform architecture: The TOE is part of a platform that consists of hardware and an operating system providing a secure execution environment and security services for the application component running on top, all within the same hardware.
– Client-server architecture: The TOE and the application component are physically separated components interacting through a trusted channel. The application component (in client role) uses the security services of the TOE (in server role).

The communication between the TOE and the application is protected by means of secure channel. A secure channel is a trusted channel (cf. for definition CC part 1 [CC1], paragraph 97) which is either a physically protected and logically separated communication channel between the TOE and the user, or it is protected by means of cryptographic mechanisms. The TOE functionally always supports to establish a cryptographically protected trusted channel between the TOE and external entities.

In case of the platform architecture, the TOE protects the communication with the application using a physically and logically separated communication channel. In case of the client-server architecture, the protection of the communication depends on the capabilities of the application. If the application supports establishing cryptographically protected trusted channels, the TOE and the application should enforce a cryptographically protected communication. If the application does not support to establish a cryptographically protected trusted channel, the operational environment of the TOE shall protect the communication between the TOE and the application. In that case, the operational environment must be subject to a security audit (e.g. ISO 27001) that verifies that the communication between the TOE and the application is indeed protected.

The internal cryptographic TSF is used for

– TSF data import including certificates and cryptographic keys,
– confidentiality protection of stored user data and TSF data.

The non-cryptographic TSF provides human user authentication, access control on cryptographic TSF and cryptographic keys and TSF protection.

The TOE supports downloading, authenticity verification and decryption of update code packages for the CSP.

The TOE may provide functionality to establish a cluster of TOE samples for scalability of performance and availability of security services. In this case the security target shall claim conformance to the PP configuration consisting of this PP as the Base-PP together with the PP-Module “Cryptographic Service Provider: Clustering”.

The TOE may provide a time service, time stamp service and secure auditing functionality. In this case, the security target shall claim conformance to the PP configuration consisting of this PP as the Base-PP together with the PP-Module “Cryptographic Service Provider: Time Stamp and Audit”.

Method of use

The TOE is intended to be used with different applications. The TOE security services are logically separated and provided through well-defined external interfaces towards these applications. The operational environment can not affect the security and correctness of the TSF, but it supports the availability of the TSF.

Life cycle

The protection profile in hand allows for a wide range of life cycle models for the development and maintenance of a TOE. The TOE implementation may belong to the technical domain “Smartcards and Similar Devices” or “Hardware Devices with Security Boxes” (cf. [SOGIS IT-TDs]). The security target shall provide a more detailed description of the life cycle description as necessary for the understanding of the stages of existence of the TOE in time. If the TOE belongs to the technical domain “Smartcards and Similar Devices” the life cycle definition should meet [JILGuidance].

The TOE shall store authentication keys used to prove of its own identity. TOE samples shall be delivered with attestation keys to attest these samples as genuine certified products, cf. chapter 6.1.5. Here identity authentication keys denote keys that are used by the TOE to authenticate itself towards external entities. The identity authentication keys and the attestation keys shall be managed by the TOE manufacturer, a TOE vendor, or a trust centre depending on the security policy for the TOE delivery or usage.

The life cycle of the TOE ends when any update code package is applied. This changes the TOE into a new IT product, cf. chapter 6.1.10.

Non-TOE hardware/software/firmware available to the TOE

The TOE is expected to run within a dedicated hardware platform together with an operating system that supports execution of CSP. In general, there are no restrictions w.r.t. to the hardware platform. As mentioned, the ST-Writer MUST describe, on which hardware/software combinations the TOE is expected to be run on.

Some applications that use CSP may impose requirements on the used hardware/software. Examples for such requirements are a demand for dedicated hardware platforms that support trust in the overall platform (the overall platform here means the combination of CSP and underlying hardware and software). An application developer might e.g. require that CSP runs on

- a CC evaluated smartcard chip,
- a trusted execution environment,
- or other implementations of dedicated trust zones.

Such requirements MUST be formulated by application developers in protection profiles or security targets for such applications, and are outside of the scope of this PP. In particular, the underlying platform (i.e. the underlying hardware and software) is not part of the certification.

2 Conformance claims

2.1 CC conformance claims

The PP claims conformance to CC version 3.1 revision 5.

Conformance of this PP with respect to CC Part 2 [CC2] (security functional components) is CC Part 2 extended.

Conformance of this PP with respect to CC Part 3 [CC3] (security assurance components) is CC Part 3 conformant.

2.2 Package claim

This PP claims package-augmented conformance to EAL2 augmented with ALC_CMS.3 and ALC_LCD.1

2.3 PP claim

This PP does not claim conformance to any PP.

2.4 Conformance rationale

This chapter is not applicable because the PP does not claim conformance to any PP.

2.5 Conformance statement

Security targets and protection profiles claiming conformance to this PP at hand must conform with **strict** conformance to this PP.

3 Security problem definitions

3.1 Introduction

Assets

The assets of the TOE are

– user data, whose integrity and confidentiality shall be protected,

– cryptographic services and keys which shall be protected against unauthorized use or misuse, and whose integrity shall be protected

– update code packages (UCP), whose integrity and confidentiality shall be protected.

– additional TSF-data (e.g. security flags), whose integrity and/or confidentiality shall be protected,

– other TOE resources, whose unauthorized use and misuse shall be prevented

The cryptographic keys are TSF data because they are used for cryptographic operations protecting user data and the enforcement of the SFR relies on these data for the operation of the TOE.

Users and subjects

The TOE knows external entities (users) as

– *human user* communicating with the TOE for security management of the TOE,

– *application component* using the cryptographic and other security services of the TOE and supporting the communication with remote entities (e. g. by providing certificates),

– *remote entity* exchanging user data and TSF data with the TOE over insecure media.

The TOE communicates with

– human user through a secure channel,

– application component through a secure channel,

– remote entities over a trusted channel using cryptographic mechanisms including mutual authentication.

The subjects as active entities in the TOE perform operations on objects. Objects obtain their associated security attributes from the authenticated users, or the security attributes are defined by default values.

Objects

The TSF operates user data objects and TSF data objects (i. e. passive entities, that contain or receive information, and upon which subjects perform operations). User data objects are imported, used in cryptographic operation, temporarily stored, exported and destroyed after use. The update code packages are user data objects that are imported and stored in the TOE until they are used to create an updated version of the CSP. TSF data objects are created, temporarily or permanently stored, imported, exported and destroyed as objects of the security management. They may contain e. g. cryptographic keys with their security attributes, certificates, or authentication data records with authentication reference data of a user. Cryptographic keys are objects of the key management.

Security attributes

A *Role* is a set of certain access rights and permissions. By defining roles, and associating users with roles (“a user or a subject takes a role”) it is immediately clear, what access rights and permissions this user is granted.

The security attributes of users known to the TOE are stored in *Authentication Data Records* containing

– *User Identity* (User-ID),
– *Authentication reference data*,
– *Role*

Passwords as Authentication Reference Data have the security attributes

– *status*: values *initial password*, *operational password*,
– *number of unsuccessful authentication attempts.*

Certificates contain security attributes of users including User Identity, a public key and security attributes of the key. If certificates are used as authentication reference data for cryptographic entity authentication mechanisms they may contain the *Role* of the entity.

The TOE knows at least the following roles that can be taken by a user or a subject:

– *Unidentified User*: this role is associated with any user not (successfully) identified by the TOE. This role is assumed after start-up of the TOE. The TSF associated actions allowed for the Unidentified User are defined in SFR FIA_UID.1.
– *Unauthenticated User*: this role is associated with an identified user but not (successfully) authenticated user. The TSF associated actions allowed for the Unauthenticated User are defined in SFR FIA_UAU.1.
– *Administrator*: a successful authenticated user in this role is allowed to access the TOE in order to perform management functions. It is taken by a human user or a subject acting on behalf of a human user after successful authentication as an Administrator.

  The Administrator role may be split into more detailed roles:

  • *Crypto-Officer*: a role that is allowed to access the TOE in order to manage a cryptographic TSF.
  • *User Administrator*: a role that is allowed to access the TOE in order to manage users.
  • *Update Agent*: a role that is allowed to import and install update code packages.

  The SFR uses the general term Administrator or a selection between Administrator role and these detailed roles in case they are supported by the TOE and separation of duties is appropriate.
– *Key Owner*: successful authenticated user allowed to perform cryptographic operation with his own keys. This role may be claimed by human user or an entity.
– *Application Component*: subjects in this role are allowed to use assigned security services of the TOE without being authenticated as a human user (e. g. exporting and importing of wrapped keys). This role may be assigned to an entity communicating through a physically separated secure channel or through a trusted channel (which requires assured identification of its end points).

The user uses authentication verification data to prove its identity to the TOE. The TSF uses Authentication reference data to verify the claimed identity of a user. The TSF supports

– human user authentication by knowledge, where the authentication verification data is a password and the authentication reference data is a password or an image of the password e. g. a salted hash value or a derived cryptographic key,
– human user authentication by possession of a token, or as user of a terminal by implementing user authentication by cryptographic entity authentication mechanisms,
– cryptographic entity authentication mechanisms where the authentication verification data is a secret or private key and the authentication reference data is a secret or public key.

A human user may authenticate himself to the TOE, and the TOE authenticates itself to an external entity in charge of the authenticated authorized user.

The TOE is delivered with initial Authentication Data Records for Unidentified User, Unauthenticated User and administrator role(s). The Authentication Data Records for Unidentified User and Unauthenticated User have no Authentication Reference Data. The roles are not exclusive, i. e. a user or subject may be in more then one role, e. g. a human user may claim the Crypto-Officer and Key Owner role at the same time. The SFR may define limitation on roles (especially combinations of roles) a user may be associated with.

Cryptographic keys have at least the security attributes

– *Key identity* , i.e. an attribute that uniquely identifies the key,
– *Key Owner*, i. e. the identity of the owner this key is assigned to,
– *Key type*, i. e. whether the key is as secret key, a private key, or a public key,
– *Key usage type,* an attribute that identifies the cryptographic mechanism or services the key can be used for. For example, a private signature key may be used by a digital signature-creation mechanism (cf. FCS_COP.1/CDS-ECDSA or FCS_COP.1/CDS-RSA); and depending on the corresponding certificate (cf. FDP_DAU.2/Sig) be used for signing data, or for device-attestation.
– *Key access control attributes*, i. e. a list of combinations of the identity of the user, the role for which the user is authenticated, and the allowed key management functions or cryptographic operations. This includes that
  - the *import* of the key is allowed or forbidden,
  - the *export* of the key is allowed or forbidden,

and may have the security attributes

– *key validity time period*, i. e. the time period for operational use of the key: The key must not be used before or after a defined time slot. Note that exceptions could be required: For example it might be required that an expired root certificate can be updated with a valid link certificate to a new valid root certificate.
– *key usage counter*, i. e. the number of operations performed with this key – for example the current number of signatures created with a private signature key.

The UCP have at least the security attributes

– *issuer* of the UCP,
– *version number* of the UCP.

3.2 Threats

T.DataCompr Compromise of communication data
An unauthorized entity gets knowledge of information that are stored on media controlled by the TSF, or an unauthorized entity gets knowledge of information that are transferred between the TOE and an authenticated external entity.

T.DataMani Unauthorized generation or manipulation of communication data
An unauthorized entity generates or manipulates user data that are stored on media controlled by the TSF or transferred between the TOE and an authenticated external entity, and manipulates such data so that they are accepted as valid by the recipient.

T.Masqu Masquerade authorized user
A threat agent masquerades as an authorized entity in order to gain unauthorized access to user data, TSF data, or TOE resources.

T.ServAcc Unauthorized access to TOE security services
An attacker gets unauthorized access to security services of the TOE.

T.PhysAttack Physical attacks
An attacker gets physical access to the underlying hardware platform that the TOE is running on and may (1) disclose or manipulate user data under TSF control and TSF data, and (2) affect TSF by (a) physical probing and manipulation, (b) applying environmental stress or (c) exploiting information leakage from the TOE.

T.FaUpD Faulty Update Code Package
An unauthorized entity provides and installs a faulty update code package. Thus attacks against the integrity of the TSF implementation, and against the confidentiality and integrity of user data and TSF data becomes possible.

3.3 Organisational security policies

OSP.SecCryM Secure cryptographic mechanisms
The TOE uses only secure cryptographic mechanisms as confirmed by the certification body for the specified TSF, the assurance security requirements and the operational environment.

OSP.SecService Security services of the TOE
The TOE provides security services to the authorized users for encryption and decryption of user data, authentication prove and verification of user data, entity authentication to external entities including attestation, trusted channels and random bit generation.

OSP.KeyMan Key Management
The key management ensures the integrity of all cryptographic keys and the confidentiality of all secret or private keys over the whole life cycle. The life-cycle comprises key generation, storage, distribution, application, archival and deletion. The cryptographic keys and cryptographic key components shall be generated, operated and managed by secure cryptographic mechanisms, assigned to the secure cryptographic mechanisms they are intended to be used with, and to the entities authorized for their use.

OSP.TC Trust centre
Trust centres provide secure certificates for trustworthy certificate holders with correct security attributes. The TOE uses certificates for identification and authentication of users, access control and secure use of security services of the TOE. In particular, this includes key management and attestation.

OSP.Update Authorized Update Code Packages
Update Code Packages are delivered in encrypted form, and are signed by the authorized issuer. The TOE verifies the authenticity of the received Update Code Package using the CSP before storing any update data in the TOE. The TOE restricts the storage of authentic Update Code Package to authorized users.

3.4 Assumptions

A.SecComm Secure communication
Remote entities support trusted channels by cryptographic mechanisms. The operational environment shall protect the local communication channels by trusted channels using cryptographic mechanisms, or by secure channels using non-cryptographic security measures. The operational environment must be subject to a security audit that verifies that the communication between the TOE and the application is indeed protected.

4 Security objectives

4.1 Security objectives for the TOE

O.AuthentTOE Authentication of the TOE to external entities
The TOE authenticates itself in charge of authorized users to external entities by means of secure cryptographic entity authentication and attestation.

O.Enc Confidentiality of user data by encryption and decryption
The TOE provides secure encryption and decryption as security services for the users to protect the confidentiality of exported or imported user data, or user data stored on media that is within the scope of control of the TSF.

O.DataAuth Data authentication by cryptographic mechanisms
The TOE provides secure symmetric and asymmetric data authentication mechanisms as security services for the users to protect the integrity and authenticity of user data.

O.RBGSRandom bit generation service
The TOE provide cryptographically secure random bit generation for the users.

O.TChann Trusted channel
The TSF provides trusted channel functionality using secure cryptographic mechanisms for the communication between the TSF and external entities. The TOE provides authentication of all communication end points, and ensures the confidentiality and integrity of the communication data that are exchanged through the trusted channel.

Note that the TSF can establish the trusted channel by means of secure cryptographic mechanisms only if the other external entity supports these secure cryptographic mechanisms as well. If the trusted channel cannot be established by means of secure cryptographic mechanisms – i.e. due to missing security functionality on the user side – then the operational environment shall provide a secure channel that protects the communication by non-cryptographic security mechanisms, cf. A.SecComm and OE.SecComm.

O.I&A Identification and authentication of users
The TOE shall uniquely identify users and verify the claimed identity of the user before providing access to any controlled resources; The TOE shall authenticate IT entities using secure cryptographic mechanisms.

O.AccCtrl Access control
The TOE provides access control of security services, operations on user data, and management of TSF and TSF data.

O.SecMan Security management
The TOE provides security management of users, TSF, TSF data and cryptographic keys by means of secure cryptographic mechanisms and certificates. The TSF generates, derives, agrees, imports and exports cryptographic keys as a security service for users and for internal use. The TSF shall destruct unprotected secret or private keys in such a way that any previous information content of the resource is made unavailable.

O.TST Self-test
The TSF performs self-tests during initial start-up, and after power-on. The TSF enters a secure state if the self-test fails or if attacks are detected. It relies on the underlying hardware platform and operating system (cf. OE.SecPlatform) to implement this functionality.

O.SecUpCP Secure import of Update Code Packages
The TSF verifies the authenticity of a received encrypted Update Code Package, decrypts the Update Code Package if it is verified to be authentic, and installs it after verifying that it is suitable for the TOE and does not downgrade the TOE's firmware to a previous version.

4.2 Security objectives for the operational environment

OE.CommInf Communication infrastructure
The operational environment shall provide a public key infrastructure for entities in the relevant communication networks. Trust centres must generate secure certificates for trustworthy certificate holders with correct security attributes. They must distribute their certificate signing public key securely such that a verification of the digital signature of the generated certificates is possible. Trust centres should further operate a directory service for dissemination of certificates and provision of revocation status information of certificates.

OE.AppComp Support of the Application component
The Application component supports the TOE for communication with users and trust centres.

OE.SecManag Security management
The operational environment shall implement appropriate security management functionality for secure use of the TOE. This includes user management as well as key management. It ensures secure key management outside of the TOE and uses the trust centre's services to determine the validity of certificates. Cryptographic keys and cryptographic key components shall be assigned to the secure cryptographic mechanisms they are intended to be used with, and to the entities authorized for their use.

OE.SecComm Protection of communication channel
Remote entities shall support establishing trusted channels with the TOE by using cryptographic mechanisms. The operational environment shall protect the local communication channels by trusted channels using cryptographic mechanisms, or by secure channels using non-cryptographic security measures. In the latter case, the operational environment must be subject to a security audit that verifies that the communication between the TOE and the application is indeed protected.

OE.SUCP Signed Update Code Packages
The secure Update Code Package is delivered in encrypted form and signed by the authorized issuer together with its security attributes.

OE.SecPlatformSecure Hardware Platform

The TOE runs on a secure hardware platform. The hardware platform and its operating system support the implementation of the TSF; this in particular includes the protection of the confidentiality and integrity of user data, TSF data and its correct operation against physical attacks and environmental stress.

4.3 Security objective rationale

The following table traces the security objectives for the TOE back to threats countered by that security objective and OSPs enforced by that security objective, and the security objective for the operational environment back to threats countered by that security objective, OSPs enforced by that security objective, and assumptions upheld by that security objective.

	T.DataCompr	T.DataMani	T.Masqu	T.ServAcc	T.PhysAttack	T.FaUpD	OSP.SecCryM	OSP.SecService	OSP.KeyMan	OSP.TC	OSP.Update	A.SecComm
O.AccCtrl				x								
O.AuthentTOE							x	x				
O.DataAuth		x					x	x				
O.Enc	x						x	x				

	T.DataCompr	T.DataMani	T.Masqu	T.ServAcc	T.PhysAttack	T.FaUpD	OSP.SecCryM	OSP.SecService	OSP.KeyMan	OSP.TC	OSP.Update	A.SecComm
O.I&A			x	x			x	x				
O.RBGS							x	x				
O.SecMan			x				x		x	x		
O.SecUpCP						x					x	
O. TChann	x	x	x	x			x	x				
O.TST					x							
OE.AppComp	x	x		x						x		
OE.CommInf	x	x		x				x	x	x		
OE.SecComm	x	x		x								x
OE.SecManag			x					x	x			
OE.SUCP						x					x	
OE.SecPlatform					x							

Table 1: Security objective rationale

The following part of the chapter demonstrate that the security objectives counter all threats and enforce all OSPs, and the security objectives for the operational environment uphold all assumptions.

The threat T.DataCompr “Compromise of communication data” is countered by the security objectives for the TOE and the operational environment:

– O.Enc requires the TOE to provide encryption and decryption as a security service for the users to protect the confidentiality of user data,

– O.TChann requires the TOE to support establishing a trusted channel between the TSF and the application component, between the TSF and other users, and between the application component and other users. The trusted channel ensures authentication of all communication end points, and protected communication for the confidentiality and integrity of the communication and to prevent misuse of sessions of authorized users.

– OE.AppComp requires the application component to support the TOE for communication with users and trust centres.

– OE.CommInf requires the operational environment to provide a communication infrastructure; especially w.r.t. trust centre services.

– OE.SecComm requires the operational environment to protect the confidentiality and integrity of communication over local communication channels by physical security measures, and requires remote entities to support trusted channels by means of cryptographic mechanisms. If a trusted channel cannot be established due to missing security functionality of the application component, the operational environment shall protect the communication, cf. A.SecComm and OE.SecComm. Note that OE.SecComm requires measures that the operational environment must be subject to a security audit that verifies that the communication between the TOE and the application is indeed protected.

The threat T.DataMani “Unauthorized generation or manipulation of communication data” is countered by the security objectives for the TOE and the operational environment:

– O.DataAuth requires the TOE to provide symmetric and asymmetric data authentication mechanisms as a security service for the users to protect the integrity and authenticity of user data.
– O.TChann requires the TOE to support trusted channels for the authentication of all communication end points, for the protected communication with the application component, and for other users. This ensures the confidentiality and integrity of the communication between the TOE and the other parties and prevents misuse of sessions of authorized users.
– OE.AppComp requires the application component to support the TOE for communication with users and trust centres.
– OE.CommInf requires the operational environment to provide trust centre services and securely distribute root public keys.
– OE.SecComm requires the operational environment to protect the confidentiality and integrity of communication with the TOE. Remote entities shall support trusted channels with the TOE using cryptographic mechanisms. The operational environment shall protect local communication channels by trusted channels using cryptographic mechanisms, or by secure channels using non-cryptographic security measures.

The threat T.Masqu “Masquerade authorized user” is countered by the security objectives for the TOE and the operational environment:

– O.I&A requires the TSF to identify uniquely users and verify the claimed identity of the user before providing access to any controlled resources.
– O.TChann requires the TSF to provide authentication of all communication end points of the trusted channel.
– O.SecMan requires the TSF to provides security management of users, TSF, TSF data and cryptographic keys by means of secure cryptographic mechanisms and certificates.
– OE.SecMan requires the operational environment to implement appropriate security management functionality for the secure use of the TOE. This includes user management.

The threat T.ServAcc “Unauthorized access to TOE security services” is countered by the security objectives for the TOE and the operational environment:

– O.I&A requires the TSF to uniquely identify users and to authenticate users before providing access to any controlled resources.
– O.AccCtrl requires the TSF to control access of security services, operations on user data, and management of TSF and TSF data.
– O. TChann requires mutual authentication of the external entity and the TOE, and the authentication of communicated data between them to prevent misuse of the communication with external entities. The operational environment is required by OE.SecComm to ensure that a secure channel is available if a trusted channel cannot be established.
– The operational environment OE.CommInf requires the provision of a public key infrastructure for entity authentication. OE.AppComp requires the application to support the communication with trust centres.

The threat T.PhysAttack “Physical attacks” is countered by the next security objectives:

– OE.SecPlatform ensures that the TOE runs on a secure hardware platform and operating system that provides protection against physical attacks.
– As means to ensure robustness against perturbation O.TST requires the TSF to perform self-tests and to enter a secure state if the self-test fails or attacks are detected.

The threat T.FaUpD ”Faulty Update Code Package” is directly countered by the security objective O.SecUpCP verifying the authenticity of UCP under the condition that trustworthy UCPs are signed as required by OE.SUCP

– O.SecUpCP “Secure import of Update Code Package” requires the TOE to verify the authenticity of received encrypted Update Code Packages before decrypting and storing an authentic Update Code Package.
– OE.SUCP “Signed Update Code Packages” requires the *Issuer* to sign both the secure Update Code packages as well as its security attributes.

The organizational security policy OSP.SecCryM “Secure cryptographic mechanisms” is implemented by means of secure cryptographic mechanisms required in

– O.I&A “Identification and authentication of users” and O.AuthentTOE “Authentication of the TOE to external entities” which require secure entity authentication of users and the TOE,
– O.Enc “Confidentiality of user data by means of encryption and decryption” and O.DataAuth ”Data authentication by cryptographic mechanisms” require secure cryptographic mechanisms for protection of the confidentiality and integrity of user data,
– O.TChann “Trusted channel” require secure cryptographic mechanisms for entity authentication of users and the TOE, and the protection of confidentiality and integrity of communication data.
– O.RBGS “Random bit generation service” requires the TOE to provide a cryptographically secure random bit generation service for the users.
– O.SecMan “Security management” requires secure management of TSF data and cryptographic keys by means of secure cryptographic mechanisms and certificates.

The organizational security policy OSP.SecService “Security services of the TOE” is directly implemented by security objectives for the TOE O.Enc “Confidentiality of user data by means of encryption and decryption”, O.DataAuth ”Data authentication by cryptographic mechanisms”, O.I&A “Identification and authentication of users”, O.AuthentTOE “Authentication of the TOE to external entities”, O.TChann “Trusted channel” and O.RBGS “Random bit generation service”, which require the TSF to provide cryptographic security services for the user. The OSP.SecService is supported by OE.CommInf “Communication infrastructure” and OE.SecManag “Security management” which provide the necessary measures for the secure use of these services.

The organizational security policy OSP.KeyMan “Key Management” is directly implemented by O.SecMan “Security management” and supported by trust centre services according to OE.CommInf “Communication infrastructure” and OE.SecManag “Security management”.

The organizational security policy OSP.TC “Trust centre” is implemented by security objectives for the TOE and the operational environment:

– O.SecMan “Security management” uses certificates for secure management of users, TSF, TSF data and cryptographic keys.
– OE.CommInf “Communication infrastructure” requires trust centres to generate secure certificates for trustworthy certificate holders with correct security attributes, and to distribute certificates and revocation status information.
– OE.AppComp “Support of the Application component” requires the Application component to support the TOE for the communication with trust centres.

The organizational security policy OSP.Update “Authorized Update Code Packages” is implemented directly by the security objectives for the TOE O.SecUpCP and the operational environment OE.SUCP.

The assumption A.SecComm “Secure communication” assumes that the operational environment protects the confidentiality and integrity of communication data and ensures reliable identification of its end points. The security objective for the operational environment OE.SecComm require the operational environment

to protect local communication physically or via trusted channel, and remote entities to support trusted channels using cryptographic mechanisms.

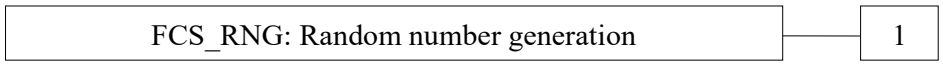
5 Extended component definition

5.1 Generation of random numbers (FCS_RNG)

Family Behaviour

This family defines quality requirements for the generation of random numbers that are intended to be used for cryptographic purposes.

Component levelling:



FCS_RNG.1 Generation of random numbers, requires that the random number generator implements defined security capabilities and that the random numbers meet a defined quality metric.

Management: FCS_RNG.1

There are no management activities foreseen.

Audit: FCS_RNG.1

There are no auditable events foreseen.

FCS_RNG.1 Random number generation

Hierarchical to:	No other components.
Dependencies:	No dependencies.
FCS_RNG.1.1	The TSF shall provide a [selection: *physical, non-physical true, deterministic, hybrid physical, hybrid deterministic*] random number generator that implements: [assignment: *list of security capabilities*].
FCS_RNG.1.2	The TSF shall provide random numbers that meet [assignment: *a defined quality metric*].

5.2 Cryptographic key derivation (FCS_CKM.5)

This chapter describes a component of the family Cryptographic key management (FCS_CKM) for key derivation as process by which one or more keys are calculated from either a pre-shared key or a shared secret and other information. Key derivation is the deterministic repeatable process by which one or more keys are calculated from both a pre-shared key or shared secret, and other information, while key generation required by FCS_CKM.1 uses internal random numbers.

The component FCS_CKM.5 is on the same level as the other components of the family FCS_CKM.

Management: FCS_CKM.5

There are no management activities foreseen

Audit: FCS_CKM.5

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

a) Minimal: Success and failure of the activity.

b) Basic: The object attribute(s), and object value(s) excluding any sensitive information (e.g. secret or private keys).

FCS_CKM.5 Requires the TOE to provide key derivation.

FCS_CKM.5 Cryptographic key derivation

Hierarchical to: No other components.

Dependencies: [FCS_CKM.2 Cryptographic key distribution, or FCS_COP.1 Cryptographic operation] FCS_CKM.4 Cryptographic key destruction

FCS_CKM.5.1 The TSF shall derive cryptographic keys [assignment: *key type*] from [assignment: *input parameters*] in accordance with a specified cryptographic key derivation algorithm [assignment: *cryptographic key derivation algorithm*] and specified cryptographic key sizes [assignment: *cryptographic key sizes*] that meet the following: [assignment: *list of standards*].

5.3 Authentication Proof of Identity (FIA_API)

To describe the IT security functional requirements of the TOE a sensitive family (FIA_API) of the Class FIA (Identification and authentication) is defined here. This family describes the functional requirements for the proof of the claimed identity for the authentication verification by an external entity where the other families of the class FIA address the verification of the identity of an external entity.

Family Behaviour

This family defines functions provided by the TOE to prove its identity and to be verified by an external entity in the TOE IT environment.

Component levelling:

FIA_API.1 Authentication Proof of Identity, provides prove of the identity of the TOE to an external entity.

Management: FIA_API.1

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

a) Management of authentication information used to prove the claimed identity.

Audit: FIA_API.1

There are no auditable events foreseen.

FIA_API.1 Authentication Proof of Identity

Hierarchical to: No other components.

Dependencies: No dependencies.

FIA_API.1.1 The TSF shall provide a [assignment: *authentication mechanism*] to prove the identity of the [assignment: *object, authorized user or role*] to an external entity.

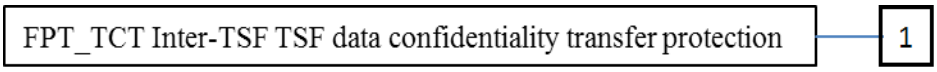
5.4 Inter-TSF TSF data confidentiality transfer protection (FPT_TCT)

This section describes the functional requirements for confidentiality protection of inter-TSF transfer of TSF data. The family is similar to the family Basic data exchange confidentiality (FDP_UCT) which defines functional requirements for confidentiality protection of exchanged user data.

Family Behaviour

This family requires confidentiality protection of exchanged TSF data.

Component levelling:



FPT_TCT.1 Requires the TOE to protect the confidentiality of information in exchanged the TSF data.

Management: FPT_TCT.1

There are no management activities foreseen.

Audit: FPT_TCT.1

There are no auditable events foreseen.

FPT_TCT.1 TSF data confidentiality transfer protection

Hierarchical to:	No other components.
Dependencies:	[FDP_ACC.1 Subset access control, or FDP_IFC.1 Subset information flow control] [FMT_MTD.1 Management of TSF data or FMT_MTD.3 Secure TSF data]
FPT_TCT.1.1	The TSF shall enforce the [assignment: *access control SFP, information flow control SFP*] by providing the ability to [selection: *transmit, receive, transmit and receive*] TSF data in a manner protected from unauthorised disclosure.

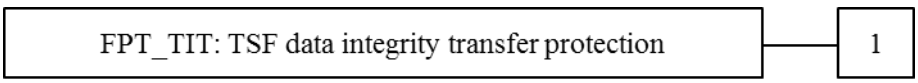
5.5 Inter-TSF TSF data integrity transfer protection (FPT_TIT)

This section describes the functional requirements for integrity protection of TSF data exchanged with another trusted IT product. The family is similar to the family Inter-TSF user data integrity transfer protection (FDP_UIT) which defines functional requirements for integrity protection of exchanged user data.

Family Behaviour

This family requires integrity protection of exchanged TSF data.

Component levelling:



FPT_TIT.1 Requires the TOE to protect the integrity of information in exchanged the TSF data.

Management: FPT_TIT.1

There are no management activities foreseen.

Audit: FPT_TIT.1

There are no auditable events foreseen.

FPT_TIT.1 TSF data integrity transfer protection

Hierarchical to: No other components.

Dependencies: [FDP_ACC.1 Subset access control, or
FDP_IFC.1 Subset information flow control]
[FMT_MTD.1 Management of TSF data or
FMT_MTD.3 Secure TSF data]

FPT_TIT.1.1 The TSF shall enforce the [assignment: *access control SFP, information flow control SFP*] to [selection: *transmit, receive, transmit and receive*] TSF data in a manner protected from [selection: *modification, deletion, insertion, replay*] errors.

FPT_TIT.1.2 The TSF shall be able to determine on receipt of TSF data, whether [selection: *modification, deletion, insertion, replay*] has occurred.

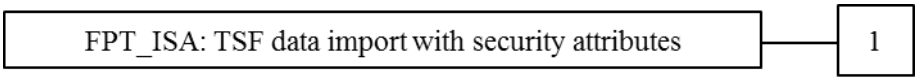
5.6 TSF data import with security attributes (FPT_ISA)

This section describes the functional requirements for TSF data import with security attributes from another trusted IT product. The family is similar to the family Import from outside of the TOE (FDP_ITC) which defines functional requirements for user data import with security attributes.

Family Behaviour

This family requires TSF data import with security attributes.

Component levelling:



FPT_ISA.1 Requires the TOE to import TSF data with security attributes.

Management: FPT_ISA.1

There are no management activities foreseen.

Audit: FPT_ISA.1

There are no auditable events foreseen.

FPT_ISA.1 Import of TSF data with security attributes

Hierarchical to: No other components.

Dependencies: [FDP_ACC.1 Subset access control, or
FDP_IFC.1 Subset information flow control]
[FMT_MTD.1 Management of TSF data or
FMT_MTD.3 Secure TSF data]
[FMT_MSA.1 Management of security attributes, or
FMT_MSA.4 Security attribute value inheritance]
FPT_TDC.1 Inter-TSF basic TSF data consistency

FPT_ISA.1.1 The TSF shall enforce the [assignment: *access control SFP, information flow control SFP*] when importing TSF data, controlled under the SFP, from outside of the TOE.

FPT_ISA.1.2 The TSF shall use the security attributes associated with the imported TSF data.

FPT_ISA.1.3 The TSF shall ensure that the protocol used provides for the unambiguous association between the security attributes and the TSF data received.

FPT_ISA.1.4 The TSF shall ensure that interpretation of the security attributes of the imported TSF data is as intended by the source of the TSF data.

FPT_ISA.1.5 The TSF shall enforce the following rules when importing TSF data controlled under the SFP from outside the TOE: [assignment: *additional importation control rules*].

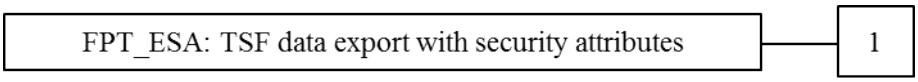
5.7 TSF data export with security attributes (FPT_ESA)

This section describes the functional requirements for TSF data export with security attributes to another trusted IT product. The family is similar to the family Export to outside of the TOE (FDP_ETC) which defines functional requirements for user data export with security attributes.

Family Behaviour

This family requires TSF data export with security attributes.

Component levelling:



FPT_ESA.1 Requires the TOE to export TSF data with security attributes.

Management: FPT_ESA.1

There are no management activities foreseen.

Audit: FPT_ESA.1

There are no auditable events foreseen.

FPT_ESA.1 Export of TSF data with security attributes

Hierarchical to: No other components.

Dependencies: [FDP_ACC.1 Subset access control, or
FDP_IFC.1 Subset information flow control]
[FMT_MTD.1 Management of TSF data or
FMT_MTD.3 Secure TSF data]
[FMT_MSA.1 Management of security attributes, or
FMT_MSA.4 Security attribute value inheritance]
FPT_TDC.1 Inter-TSF basic TSF data consistency

FPT_ESA.1.1 The TSF shall enforce the [assignment: *access control SFP, information flow control SFP*] when exporting TSF data, controlled under the SFP(s), outside of the TOE.

FPT_ESA.1.2 The TSF shall export the TSF data with the TSF data's associated security attributes.

FPT_ESA.1.3 The TSF shall ensure that the security attributes, when exported outside the TOE, are unambiguously associated with the exported TSF data.

FPT_ESA.1.4 The TSF shall enforce the following rules when TSF data is exported from the TOE: [assignment: *additional exportation control rules*].

6 Security requirements

The CC allows several operations to be performed on functional requirements: *refinement*, *selection*, *assignment*, and *iteration.* Each of these operations is used in this PP.
The **refinement** operation is used to add detail to a requirement, and thus further restricts a requirement. Refinement of security requirements is (i) denoted by the word "refinement" in **bold** text and the added/changed words are in bold text, or (ii) directly included in the requirement text as **bold** text. In cases where words from a CC requirement component were deleted, these words are ~~crossed out~~.
The **selection** operation is used to select one or more options provided by the CC in stating a requirement. Selections that have been made by the PP authors are denoted as *italic* text and the original text of the component is given by a footnote. Selections to be filled in by the ST author appear in square brackets with an indication that a selection is to be made, [selection:], and are *italicized*.
The **assignment** operation is used to assign a specific value to an unspecified parameter, such as e.g. the length of a password. Assignments that have been made by the PP authors are denoted by showing as *italic* text and the original text of the component is given by a footnote. Assignments to be filled in by the ST author appear in square brackets with an indication that an assignment is to be made [assignment:], and are *italicized*.
The **iteration** operation is used when a component is repeated with varying operations. Iteration is denoted by showing a slash "/" and the iteration indicator after the component identifier.

6.1 Security functional requirements

The TOE provides cryptographic security services for encryption and decryption of user data, entity authentication of external entities and to external entities, authentication prove and verification of user data, trusted channel establishment and random number generation.

The TOE enforces the *Cryptographic Operation SFP* for protection of theses cryptographic services. Corresponding Subjects, objects, and operations are defined in the SFRs FDP_ACC.1/Oper and FDP_ACF/Oper.

The TOE provides hybrid encryption and decryption combined with data integrity mechanisms for the cipher text as a cryptographic security service of the TOE. The encryption FCS_COP.1/HEM combines the generation of a data encryption key and message authentication code (MAC) key, the asymmetric encryption of the data encryption key with an asymmetric key encryption key, cf. FCS_CKM.1/ECKA-EG, FCS_CKM.1/RSA, and the symmetric encryption of the data with the data encryption key and data integrity mechanism with MAC calculation for the cipher text. The receiver reconstructs the data encryption key and the MAC key, cf. FCS_CKM.5/ECKA-EG, calculates the MAC for the cipher text and compares it with the received MAC. If the integrity of the cipher text is determined, then the receiver decrypts the cipher text with the data decryption key, cf. FCS_COP.1/HDM.

In general, authentication is the provision of assurance of the claimed identity of an entity. The TOE authenticates human users by passwords, cf. FIA_UAU.5.1 clause 1 (1-Factor Authentication). But a human user may also authenticate himself to a token and the token authenticates to the TOE (2-Factor Authentication). Cryptographic authentication mechanisms allow an entity to prove its identity or the origin of its data to a verifying entity by demonstrating its knowledge of a secret. The entity authentication is required by FIA_UAU.5.1 clauses (2) to (6). Chapter 5.3 describes SFRs for the authentication of the TOE to external entities required by the SFR FIA_API.1. This authentication may include attestation of the TOE as a genuine TOE sample, cf. 6.1.4. The authentication may be mutual as required for trusted channels in chapter 6.1.5.

Protocols may use symmetric cryptographic algorithms, where the proving and the verifying entity using the same secret key may demonstrate that the proving entity belongs to a group of entities sharing this key, e.g. the sender and receiver (cf. FTP_ITC.1, FCS_COP.1/TCM). In case of asymmetric entity authentication mechanisms, the proving entity uses a private key, and the verifying entity uses the corresponding public

key, where the latter is usually closely linked to the claimed identity by means of a certificate. Depending on the security attributes of the cryptographic keys – e.g. encoded in the certificate (cf. FPT_ISA.1/Cert) –, the same cryptographic mechanisms for digital signature generation (FCS_COP.1/CDS-*) and signature verification(cf. FCS_COP.1/VDS-*) may be used for entity authentication, data authentication and non-repudiation as well.

A trusted channel requires mutual authentication of both endpoints with a key exchange of a key agreement, and the protection of confidentiality by encryption and cryptographic data integrity protection.

The TSF provide security management for user and TSF data, including cryptographic keys. Key management comprises administration and use of keying material in accordance with a security policy. This includes generation, derivation, registration, certification, deregistration, distribution, installation, storage, archival, revocation and destruction of keying material. The key management functionality of the TOE supports the generation, derivation, export, import, storage and destruction of cryptographic keys. The cryptographic keys are managed together with their security attributes.

The TOE enforces the *Key Management SFP* to protect all cryptographic keys (as data objects of TSF data) and key management services (as operation, cf. to SFR of the FMT class) provided for Administrators, Crypto-Officers, and Key Owners. Note that the cryptographic keys will be used for cryptographic operations under the Cryptographic Operation SFP as well.

The subjects, objects and operations of the *Update SFP* are defined in the SFR FDP_ACC.1/UCP and FDP_ACF.1/UCP.

The SFRs for cryptographic mechanisms based on elliptic curves refer to the following table for selection of curves, key sizes and standards.

Elliptic curve	Key size	Standard
brainpoolP256r1	*256 bits*	*RFC5639 [RFC5639], TR-03111, section 4.1.3 [TR-03111]*
brainpoolP384r1,	*384 bits*	*RFC5639 [RFC5639], TR-03111, section 4.1.3 [TR-03111]*
brainpoolP512r1	*512 bits*	*RFC5639 [RFC5639], TR-03111, section 4.1.3 [TR-03111]]*
Curve P-256	*256 bits*	*FIPS PUB 186-4 B.4 and D.1.2.3 [FIPS PUB 186-4]*
Curve P-384	*384 bits*	*FIPS PUB 186-4 B.4 and D.1.2.4 [FIPS PUB 186-4]*
Curve P-521	*521 bits*	*FIPS PUB 186-4 B.4 and D.1.2.5 [FIPS PUB 186-4]*

Table 2: Elliptic curves, key sizes and standards

For Diffie-Hellman key exchange refer to the following groups

Name	IANA no.	Specified in
256-bit random ECP group	19	[RFC5903]
384-bit random ECP group	20	[RFC5903]
521-bit random ECP group	21	[RFC5903]
brainpoolP256r1	28	[RFC6954]
brainpoolP384r1	29	[RFC6954]
brainpoolP512r1	30	[RFC6954]

Table 3: Recommended groups for the Diffie-Hellman key exchange

6.1.1 Key management

6.1.1.1 Management of security attributes

FDP_ACC.1/KM Subset access control – Cryptographic operation

Hierarchical to: No other components.

Dependencies: FDP_ACF.1 Security attribute based access control

FDP_ACC.1.1/KM The TSF shall enforce the *Key Management SFP*[1] on

(1) *subjects: [selection: Administrator, Crypto-Officer], Key Owner;*

(2) *objects: operational cryptographic keys*;

(3) *operations: key generation, key derivation, key import, key export, key destruction*[2].

FMT_MSA.1/KM Management of security attributes – Key security attributes

Hierarchical to: No other components.

Dependencies: [FDP_ACC.1 Subset access control, or
FDP_IFC.1 Subset information flow control]
FMT_SMR.1 Security roles
FMT_SMF.1 Specification of Management Functions

FMT_MSA.1.1/KM The TSF shall enforce the *Key Management SFP and Cryptographic Operation SFP*[3] to restrict the ability to

(1) *set and change default values for*[4] the security attributes *Identity of the key, Key owner of the key, Key type, Key usage type, Key access control attributes, Key validity time period*[5] to *[selection: Administrator, Crypto-Officer]*[6],

(2) ***modify or delete***[7] **the security attributes *Identity of the key, Key owner, Key type, Key usage type, Key validity time period of an existing key***[8] **to *none***[9],

(3) ***modify independent on key usage***[10] ***the security attributes Key usage counter of an existing key***[11] **to *none***[12].

(4) ***modify***[13] **the security attributes *Key access control attribute of an existing key***[14] **to *[selection: Administrator, Crypto-Officer, Key Owner]***[15],

1 [assignment: *access control SFP*]
2 [assignment: *list of subjects, objects, and operations among subjects and objects covered by the SFP*]
3 [assignment: *access control SFP, information flow control SFP*]
4 [selection: *change_default, query, modify, delete, [assignment: other operations]*]
5 [assignment: *list of security attributes*]
6 [assignment: *the authorised identified roles*]
7 [selection: *change_default, query, modify, delete, [assignment: other operations]*]
8 [assignment: *list of security attributes*]
9 [assignment: *the authorised identified roles*]
10 [selection: *change_default, query, modify, delete, [assignment: other operations]*]
11 [assignment: *list of security attributes*]
12 [assignment: *the authorised identified roles*]
13 [selection: *change_default, query, modify, delete, [assignment: other operations]*]
14 [assignment: *list of security attributes*]
15 [assignment: *the authorised identified roles*]

(5) ***query***[16] **the security attributes** ***Key type, Key usage type, Key access control attributes, Key validity time period and Key usage counter of an identified key***[17] **to** ***[selection: Administrator, Crypto-Officer, Key Owner]***[18].

Application note 1: The refinements repeats parts of the SFR component in order to avoid iteration of the component.

FMT_MSA.3/KM Static attribute initialisation – Key management

Hierarchical to: No other components.

Dependencies: FMT_MSA.1 Management of security attributes
FMT_SMR.1 Security roles

FMT_MSA.3.1/KM The TSF shall enforce the *Key Management SFP, Cryptographic Operation SFP and Update SFP*[19] to provide *restrictive*[20] default values for security attributes that are used to enforce the SFP.

FMT_MSA.3.2/KM The TSF shall allow the [selection: *Administrator, Crypto-Officer*][21] to specify alternative initial values to override the default values when a **cryptographic key** ~~object or information~~ is created.

FMT_MTD.1/KM Management of TSF data – Key management

Hierarchical to: No other components.

Dependencies: FMT_SMR.1 Security roles
FMT_SMF.1 Specification of Management Functions

FMT_MTD.1.1/KM The TSF shall restrict the ability to

(1) *create according to FCS_CKM.1*[22] the *cryptographic keys*[23] to [selection: *Administrator, Crypto-Officer, Key Owner*][24],

(2) ***import according to FPT_TCT.1/CK, FPT_TIT.1/CK and FPT_ISA.1/CK***[25] **the** ***cryptographic keys***[26] **to** ***[selection: Administrator, Crypto-Officer, Key Owner]***[27]**,**

(3) ***export according to FPT_TCT.1/CK, FPT_TIT.1/CK and FPT_ESA.1/CK***[28] **the** ***cryptographic keys***[29] **to** ***[selection: Administrator, Crypto-Officer, Key Owner]***[30] ***if security attribute of the key allows export (keys with security attribute Key Usage Counter must never be exported),***

16 [selection: *change_default, query, modify, delete, [assignment: other operations]*]
17 [assignment: *list of security attributes*]
18 [assignment: *the authorised identified roles*]
19 [assignment: *access control SFP, information flow control SFP*]
20 [selection, choose one of: *restrictive, permissive,[assignment: other property]*]
21 [assignment: *the authorised identified roles*]
22 [selection: *change_default, query, modify, delete, clear, [assignment: other operations]*]
23 [assignment: *list of TSF data*]
24 [assignment: *the authorised identified roles*]
25 [selection: *change_default, query, modify, delete, clear,[assignment: other operations]*]
26 [assignment: *list of TSF data*]
27 [assignment: *the authorised identified roles*]
28 [selection: *change_default, query, modify, delete, clear,[assignment: other operations]*]
29 [assignment: *list of TSF data*]
30 [assignment: *the authorised identified roles*]

(4) *delete according to FCS_CKM.4*[31] the *cryptographic keys*[32] to *[selection: Administrator, Crypto-Officer, Key Owner]*[33].

Application note 2: The bullets (2) to (4) are refinements to avoid an iteration of component and therefore printed in bold.

6.1.1.2 Hash based functions

FCS_COP.1/Hash Cryptographic operation – Hash

Hierarchical to: No other components.

Dependencies: [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]
FCS_CKM.4 Cryptographic key destruction

FCS_COP.1.1/Hash The TSF shall perform *hash generation*[34] in accordance with a specified cryptographic algorithm *SHA-256, SHA-384, SHA-512*[35] and cryptographic key sizes *none*[36] that meet the following: *FIPS 180-4 [FIPS PUB 180-4]*[37].

Application note 3: The hash function is a cryptographic primitive used for HMAC, cf. FCS_COP.1/HMAC, digital signature creation, cf. FCS_COP.1/CDS-*, digital signature verification, cf. FCS_COP.1/VDS-*, and key derivation, cf. FCS_CKM.5.

6.1.1.3 Management of Certificates

FMT_MTD.1/RK Management of TSF data – Root key

Hierarchical to: No other components.

Dependencies: FMT_SMR.1 Security roles
FMT_SMF.1 Specification of Management Functions

FMT_MTD.1.1/RK The TSF shall restrict the ability to

(1) *create*[38]*, modify, clear and delete*[39] the *root key pair*[40] to [selection: *Administrator, Crypto-Officer*][41].

(2) *import and delete*[42] a *known as authentic public key of a certification authority in a PKI*[43] to *[selection: Administrator, Crypto-Officer]*[44].

31 [selection: *change_default, query, modify, delete, clear, [assignment: other operations]*]
32 [assignment: *list of TSF data*]
33 [assignment: *the authorised identified roles*]
34 [assignment: *list of cryptographic operations*]
35 [assignment: *cryptographic algorithm*]
36 [assignment: *cryptographic key sizes*]
37 [assignment: *list of standards*]
38 “create” denotes initial setting a root key
39 [selection: *change_default, query, modify, delete, clear, [assignment: other operations]*]
40 [assignment: *list of TSF data*]
41 [assignment: *the authorised identified roles*]
42 [selection: *change_default, query, modify, delete, clear,[assignment: other operations]*]
43 [assignment: *list of TSF data*]
44 [assignment: *the authorised identified roles*]

Application note 4: The root key is defined here with respect to the key hierarchy known to the TOE. In case of clause (1), i. e. may be a key pair of an TOE internal key hierarchy. In clause (2) it may be a root public key of a PKI or a public key of another certification authority in a PKI known as being an authentic certificate signing key. The PKI may be used for user authentication, key management and signature-verification. The second bullet is a refinement to avoid an iteration of component and therefore printed in bold.

FPT_TIT.1/Cert TSF data integrity transfer protection – Certificates

Hierarchical to: No other components.

Dependencies: [FDP_ACC.1 Subset access control, or
FDP_IFC.1 Subset information flow control]
[FMT_MTD.1 Management of TSF data or
FMT_MTD.3 Secure TSF data]

FPT_TIT.1.1/Cert The TSF shall enforce the *Key Management SFP*[45] to *receive*[46] a **certificate** ~~TSF data~~ in a manner protected from *modification and insertion*[47] errors.

FPT_TIT.1.2/Cert The TSF shall be able to determine on receipt of a **certificate** ~~TSF data~~ , whether *modification and insertion*[48] has occurred.

FPT_ISA.1/Cert Import of TSF data with security attributes - Certificates

Hierarchical to: No other components.

Dependencies: [FDP_ACC.1 Subset access control, or
FDP_IFC.1 Subset information flow control]
[FMT_MTD.1 Management of TSF data or
FMT_MTD.3 Secure TSF data]
[FMT_MSA.1 Management of security attributes, or
FMT_MSA.4 Security attribute value inheritance]
FPT_TDC.1 Inter-TSF basic TSF data consistency

FPT_ISA.1.1/Cert The TSF shall enforce the *Key management SFP*[49] when importing **certificates** ~~TSF data~~, controlled under the SFP, from outside of the TOE.

FPT_ISA.1.2/Cert The TSF shall use the security attributes associated with the imported **certificate** ~~TSF data~~.

FPT_ISA.1.3/Cert The TSF shall ensure that the protocol used provides for the unambiguous association between the security attributes and the **certificates** ~~TSF data~~ received.

FPT_ISA.1.4/Cert The TSF shall ensure that **the** interpretation of the security attributes of the imported **certificates** ~~TSF data~~ is as intended by the source of the **certificates** ~~TSF data~~.

FPT_ISA.1.5/Cert The TSF shall enforce the following rules when importing **certificates** ~~TSF data~~ controlled under the SFP from outside the TOE:

(1) *The TSF imports the TSF data in certificates only after successful verification of the validity of the certificate in the certificate chain until it is known as an authentic certificate according to FMT_MTD.1/RK.*

(2) *The validity verification of the certificate shall include*

(a) except for root certificates, the verification of the digital signature of the certificate issuer and

45 [assignment: *access control SFP, information flow control SFP*]

46 [selection: *transmit, receive, transmit and receive*]

47 [selection: *modification, deletion, insertion, replay*]

48 [selection: *modification, deletion, insertion, replay*]

49 [assignment: *access control SFP, information flow control SFP*]

(b) a verification that the security attributes in the certificate pass the interpretation according to FPT_TDC.1[50].

FPT_TDC.1/Cert Inter-TSF basic TSF data consistency - Certificate

Hierarchical to: No other components.

Dependencies: No dependencies.

FPT_TDC.1.1/Cert The TSF shall provide the capability to consistently interpret *security attributes of cryptographic keys in the certificate and the identity of the certificate issuer*[51] when shared between the TSF and another trusted IT product.

FPT_TDC.1.2/Cert The TSF shall use **the following rules**:

(1) *the TOE reports about conflicts between the Key identities of stored cryptographic keys and cryptographic keys to be imported,*

(2) *the TOE does not change the security attributes Key identity, Key owner, Key type, Key usage type and Key validity time period of a public key that is imported from the certificate,*

(3) *the identity of the certificate issuer shall meet the identity of the signer of the certificate*[52]

when interpreting **the certificate from a trust centre** ~~TSF data from another trusted IT product~~.

Application note 5: The security attributes assigned to a certificate holder and the cryptographic key in the certificate are used as TSF data of the TOE. The certificate is imported from a trust centre directory service, but must be verified by the TSF (i.e. if it is verified successfully that the source is the trust centre's directory server of the trusted IT product).

6.1.1.4 Key generation, agreement and destruction

Key generation (cf. FCS_CKM.1/ECC, FCS_CKM.1/RSA) is a randomized process which uses random secrets (cf. FCS_RNG.1), applies key generation algorithms and defines security attributes depending on the intended use of the keys. It has the property that it is computationally infeasible to deduce the output without prior knowledge of the secret input. *Key derivation* (cf. FCS_CKM.5/ECC) is a deterministic process by which one or more keys are calculated from a pre-shared key or shared secret or other information. It allows repeating the key generation if the same input is provided. *Key agreement* (cf. FCS_CKM.5/ECDHE) is a key-establishment procedure process for establishing a shared secret key between entities in such a way that neither of them can predetermine the value of that key independently of the other party's contribution. Key agreement allows each participant to enforce the cryptographic quality of the agreed key. The component FCS_CKM.1 was refined for key agreement because it normally uses random bits as input. Hybrid cryptosystems (FCS_CKM.1/ECKA-EG, FCS_CKM.1/AES_RSA) are a combination of a public key cryptosystem with an efficient symmetric key cryptosystem.

The user may need to specify the type of key, the cryptographic key generation algorithm, the security attributes and other necessary parameters.

50 [assignment: *additional importation control rules*]

51 [assignment: *list of TSF data types*]

52 [assignment: *list of interpretation rules to be applied by the TSF*]

FCS_RNG.1 Random number generation

Hierarchical to: No other components.

Dependencies: No dependencies.

FCS_RNG.1.1 The TSF shall provide a [selection: *physical, non-physical true, deterministic, hybrid physical, hybrid deterministic*] random number generator that implements: [assignment: *list of security capabilities*].

FCS_RNG.1.2 The TSF shall provide random numbers that meet [assignment: *a defined quality metric*].

Application note 6: The random bit generation shall be used for key generation and key agreement according to all instantiations of FCS_CKM.1, challenges in cryptographic protocols and cryptographic operations using random values according to FCS_COP.1/HEM and FCS_COP.1/TCE. The TOE also provides the random number generation as security service for the user.

FCS_CKM.1/AES Cryptographic key generation – AES key

Hierarchical to: No other components.

Dependencies: [FCS_CKM.2 Cryptographic key distribution, or FCS_COP.1 Cryptographic operation] FCS_CKM.4 Cryptographic key destruction

FCS_CKM.1.1/AES The TSF shall generate cryptographic **AES** keys in accordance with a specified cryptographic key generation algorithm *AES*[53] and specified cryptographic key sizes *128 bits, [*selection: *256 bits, [assignment: additional cryptographic key sizes > 128 bits]]*[54] that meet the following: *ISO 18033-3 [ISO/IEC 18033-3]*[55].

Application note 7: The cryptographic key(s) may be also used together with FCS_COP.1/ED, e. g. for internal purposes.

FCS_CKM.5/AES Cryptographic key derivation – AES key derivation

Hierarchical to: No other components.

Dependencies: [FCS_CKM.2 Cryptographic key distribution, or FCS_COP.1 Cryptographic operation] FCS_CKM.4 Cryptographic key destruction

FCS_CKM.5.1/AES The TSF shall derive cryptographic *AES* keys[56] from [assignment: *input parameters*] in accordance with a specified cryptographic key derivation algorithms *AES key generation using a bit string derived from input parameters with a KDF*[57] and specified cryptographic key sizes *128 bits, [*selection: *256 bits, [assignment: additional cryptographic key sizes > 128 bits]]*[58] that meet the following: *NIST SP800-56C [NIST-SP800-56C]*[59].

FCS_CKM.1/ECC Cryptographic key generation – Elliptic curve key pair ECC

Hierarchical to: No other components.

Dependencies: [FCS_CKM.2 Cryptographic key distribution, or FCS_COP.1 Cryptographic operation] FCS_CKM.4 Cryptographic key destruction

FCS_CKM.1.1/ECC The TSF shall generate cryptographic **elliptic curve** key~~s~~ ***pairs*** in accordance with a specified cryptographic key generation algorithm *ECC key pair generation with [selection:*

53 [assignment: *cryptographic key generation algorithm*]

54 [assignment: *cryptographic key sizes*]

55 [assignment: *list of standards*]

56 [assignment: *key type*]

57 [assignment: *cryptographic key derivation algorithm*]

58 [assignment: *cryptographic key sizes*]

59 [assignment: *list of standards*]

elliptic curves in table 2][60] and specified cryptographic key sizes *[selection: key size in table 2]*[61] that meet the following: *[selection: standards in table 2]*[62].

Application note 8: The elliptic key pair generation uses a random bit string as input for the ECC key generation algorithm. The keys generation according to FCS_CKM.1/ECC and key derivation according to FCS_CKM.5/ECC are intended for different key management use cases but the keys itself may be used for same cryptographic operations.

FCS_CKM.5/ECC Cryptographic key derivation – ECC key pair derivation

Hierarchical to: No other components.

Dependencies: [FCS_CKM.2 Cryptographic key distribution, or FCS_COP.1 Cryptographic operation]
FCS_CKM.4 Cryptographic key destruction

FCS_CKM.5.1/ECC The TSF shall derive cryptographic *elliptic curve* key**s** *pairs*[63] from [assignment: *input parameters*] in accordance with a specified cryptographic key derivation algorithm *ECC key pair generation with [selection: elliptic curves in table 2] using bit string derived from input parameters with [assignment: KDF]* [64] and specified cryptographic key sizes *[selection: key size in table 2]*[65] that meet the following: *[selection: standards in table 2], [TR-03111]*[66].

Application note 9: The elliptic key pair derivation applies a key derivation function (KDF), e.g. from *[TR-03111] (Section 4.3.3.)* to the input parameter. It uses the output string of a KDF instead of the random bit string as input for the ECC key generation algorithm (*[TR-03111],, Section 4.1.1, Algorithms 1 or 2)*. The input parameters shall include a secret of the length of at least of the key size to ensure the confidentiality of the private key. The input parameters may include public known values or even values provided by external entities.

FCS_CKM.1/RSA Cryptographic key generation – RSA key pair

Hierarchical to: No other components.

Dependencies: [FCS_CKM.2 Cryptographic key distribution, or FCS_COP.1 Cryptographic operation]
FCS_CKM.4 Cryptographic key destruction

FCS_CKM.1.1/RSA The TSF shall generate cryptographic **RSA** key **pairs** in accordance with a specified cryptographic key generation algorithm *RSA*[67] and specified cryptographic key sizes [assignment: *cryptographic key sizes*] that meet the following: *PKCS #1 v2.2 [PKCS#1]*[68].

Application note 10: The cryptographic key sizes assigned in FCS_CKM.1/RSA must be at least 2000 bits. Cryptographic key sizes of at least 3000 bits are recommended. The SFR FCS_CKM.1/RSA assigns given security attributes *Key identity* and *Key owner*.

60 [assignment: c*ryptographic key generation algorithm*]

61 [assignment: *cryptographic key sizes*]

62 [assignment: *list of standards*]

63 [assignment: *key type*]

64 [assignment: c*ryptographic key derivation algorithm*]

65 [assignment: *cryptographic key sizes*]

66 [assignment: *list of standards*]

67 [assignment: c*ryptographic key generation algorithm*]

68 [assignment: *list of standards*]

FCS_CKM.5/ECDHE Cryptographic key derivation – Elliptic Curve Diffie-Hellman ephemeral key agreement

Hierarchical to: No other components.

Dependencies: [FCS_CKM.2 Cryptographic key distribution, or FCS_COP.1 Cryptographic operation]
FCS_CKM.4 Cryptographic key destruction

FCS_CKM.5.1/ECDHE The TSF shall derive cryptographic *ephemeral* keys[69] **for data encryption and MAC with AES-128, [selection: *AES-256, none other*]** from *an agreed shared secret*[70] in accordance with a specified cryptographic key derivation algorithm *Elliptic Curve Diffie-Hellman ephemeral key agreement [selection: elliptic curves in table 2] and [selection: DH group in table 3] with a key derivation from the shared secret [assignment: key derivation function]*[71] and specified cryptographic key sizes *128 bits [selection:256 bits, none other]*[72] that meet the following: *TR-03111 [TR-03111]*[73].

Application note 11: The input parameters for key derivation is an agreed shared secret established by means of Elliptic Curve Diffie-Hellman. *T*able 2 lists elliptic curves and table 3 lists Diffie-Hellman Groups for the agreement of the shared secret. SHA-1 shall be supported for generation of 128 bits AES keys. SHA-256 shall be selected and used to generate 256 bits AES keys.

FCS_CKM.1/ECKA-EG Cryptographic key generation – ECKA-EG key generation with ECC encryption

Hierarchical to: No other components.

Dependencies: [FCS_CKM.2 Cryptographic key distribution, or FCS_COP.1 Cryptographic operation]
FCS_CKM.4 Cryptographic key destruction

FCS_CKM.1.1/ECKA-EG
The TSF shall generate **ephemeral** cryptographic **elliptic curve** key **pairs for ECKGA-EG***[TR-03111], sender role*) in accordance with a specified cryptographic key generation algorithm *ECC key pair generation with [selection: elliptic curves in table 2]*[74] and specified cryptographic key sizes *[selection: key size in table 2]*[75] that meet the following: *[selection: standards in table 2]*[76].

FCS_CKM.5/ECKA-EG Cryptographic key derivation – ECKA-EG key derivation

Hierarchical to: No other components.

Dependencies: [FCS_CKM.2 Cryptographic key distribution, or FCS_COP.1 Cryptographic operation]
FCS_CKM.4 Cryptographic key destruction

FCS_CKM.5.1/ECKA-EG The TSF shall derive cryptographic *data encryption and MAC* keys *for AES-128, [selection: AES-256, none other]*[77] from *a private and a public ECC key*[78] in accordance with a specified cryptographic key derivation algorithm *ECKGA-EG[TR-03111] [selection: elliptic curves in table 2] and X9.63 Key Derivation Function*[79] and specified cryptographic

69 [assignment: *key type*]

70 [assignment: *input parameters*]

71 [assignment: *cryptographic key derivation algorithm*]

72 [assignment: *cryptographic key sizes*]

73 [assignment: *list of standards*]

74 [assignment: *cryptographic key generation algorithm*]

75 [assignment: *cryptographic key sizes*]

76 [assignment: *list of standards*]

77 [assignment: *key type*]

78 [assignment: *input parameters*]

79 [assignment: *cryptographic key derivation algorithm*]

symmetric key sizes *128 bits [selection:256 bits, none other]*[80] that meet the following: *TR-03111[TR-03111], chapter 4.3.2.2*[81].

Application note 12: FCS_CKM.5/ECKA-EG is used by both the sender (encryption) and the recipient (decryption) to compute a secret point S_{AB} on an elliptic curve and derived a shared secret Z_{AB}. The shared secret is then used as the input to the key derivation function to derive two symmetric keys: the encryption key and the MAC key. These are then used to encrypt or decrypt messages according to FCS_COP.1/HEM or FCS_COP.1/HDM, respectively. Sender and recipient use however different inputs to FCS_CKM.5/ECKA-EG. The sender first generates an ephemeral ECC key pair according to FCS_CKM.1/ECKA-EG and uses the generated ephemeral private key and the static public key of the recipient as input. The recipient first extracts the ephemeral public key from the message and uses the ephemeral public key and the static private key (cf. FCS_CKM.1/ECC for key generation) as the input to derive the symmetric keys. The selection of the elliptic curve, the ECC key size and length of the shared secret shall correspond to the selection of the AES key size, e. g. brainpoolP256r1 and 256 bits seed for ECC key and AES keys. FCS_CKM.1/ECKA-EG and FCS_CKM.5/ECKA-EG do not provide self-contained security services for the user but are necessary steps for FCS_COP.1/HEM and FCS_COP.1/HDM (refer to the next section 6.1.3).

FCS_CKM.1/AES_RSA Cryptographic key generation – Key generation and RSA encryption

Hierarchical to: No other components.

Dependencies: [FCS_CKM.2 Cryptographic key distribution, or FCS_COP.1 Cryptographic operation]
FCS_CKM.4 Cryptographic key destruction

FCS_CKM.1.1/AES_RSA The TSF shall generate **and encrypt** a **seed, derive** cryptographic keys **from the seed for data encryption and MAC with AES-128, [selection: *AES-256, none other*]** in accordance with a specified cryptographic key generation algorithm *X9.63 Key Derivation Function[ANSI-X9.63] and RSA EME-OAEP[PKCS#1]*[82] and specified cryptographic **symmetric** key sizes *128 bits [selection:256 bits, none other]*[83] that meet the following: *ISO/IEC18033-3 [ISO/IEC 18033-3], PKCS #1 v2.2 [PKCS#1]*[84].

Application note 13: The asymmetric cryptographic key sizes used in FCS_CKM.1/AES_RSA must be at least 2000 bits. Cryptographic key sizes of at least 3000 bits are recommended. FCS_CKM.1/AES_RSA and FCS_CKM.5/AES_RSA do not provide self-contained security services for the user but they are only necessary steps for FCS_COP.1/HEM respective FCS_COP.1/HDM (refer to the next section 6.1.3).

FCS_CKM.5/AES_RSA Cryptographic key derivation – RSA key derivation and decryption

Hierarchical to: No other components.

Dependencies: [FCS_CKM.2 Cryptographic key distribution, or FCS_COP.1 Cryptographic operation]
FCS_CKM.4 Cryptographic key destruction

FCS_CKM.5.1/AES_RSA The TSF shall derive cryptographic *data encryption* keys *and MAC* keys *for AES-128, [selection: AES-256, none other]*[85] from **a decrypted** *RSA encrypted seed*[86] in accordance with a specified cryptographic key derivation algorithm *RSA EME-OAEP[PKCS#1] and X9.63[ANSI-X9.63] Key Derivation Function*[87] and specified cryptographic **symmetric** key

80 [assignment: *cryptographic key sizes*]

81 [assignment: *list of standards*]

82 [assignment: *cryptographic key generation algorithm*]

83 [assignment: *cryptographic key sizes*]

84 [assignment: *list of standards*]

85 [assignment: *key type*]

86 [assignment: *input parameters*]

87 [assignment: *cryptographic key derivation algorithm*]

sizes *128 bits [selection:256 bits, none other]*[88] that meet the following: *ISO/IEC 14888-2 [ISO/IEC 14888-2]*[89].

FCS_CKM.4 Cryptographic key destruction

Hierarchical to: No other components.

Dependencies: [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]

FCS_CKM.4.1 The TSF shall destroy cryptographic keys in accordance with a specified cryptographic key destruction method [assignment: *cryptographic key destruction method*] that meets the following: [assignment: *list of standards*].

Refinement: The destruction of cryptographic keys shall ensure that any previous information content of the resource about the key is made unavailable upon the deallocation of the resource.

6.1.1.5 Key import and export

FCS_COP.1/KW Cryptographic operation – Key wrap

Hierarchical to: No other components.

Dependencies: [FDP_ITC.1 Import of user data without security attributes, or
FDP_ITC.2 Import of user data with security attributes,
FCS_CKM.1 Cryptographic key generation]
FCS_CKM.4 Cryptographic key destruction

FCS_COP.1.1/KW The TSF shall perform *key wrap*[90] in accordance with a specified cryptographic algorithm *AES-Keywrap [selection: KW, KWP]*[91] and cryptographic key sizes **of the *key encryption key*** *128 bits [selection:256 bits, none other]*[92] that meet the following: *NIST SP800-38F [NIST-SP800-38F]*[93].

Application note 14: The selection of the length of the key encryption key shall be equal or greater than the security bits of the wrapped key for its cryptographic algorithm.

FCS_COP.1/KU Cryptographic operation – Key unwrap

Hierarchical to: No other components.

Dependencies: [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]
FCS_CKM.4 Cryptographic key destruction

FCS_COP.1.1/KU The TSF shall perform *key unwrap*[94] in accordance with a specified cryptographic algorithm *AES-Keywrap [selection: KW, KWP]*[95] and cryptographic key sizes **of the *key encryption key*** *128 bits [selection:256 bits, none other]*[96] that meet the following: *NIST SP800-38F [NIST-SP800-38F]*[97].

88 [assignment: *cryptographic key sizes*]

89 [assignment: *list of standards*]

90 [assignment: *list of cryptographic operations*]

91 [assignment: *cryptographic algorithm*]

92 [assignment: *cryptographic key sizes*]

93 [assignment: *list of standards*]

94 [assignment: *list of cryptographic operations*]

95 [assignment: *cryptographic algorithm*]

96 [assignment: *cryptographic key sizes*]

97 [assignment: *list of standards*]

FPT_TCT.1/CK TSF data confidentiality transfer protection – Cryptographic keys

Hierarchical to: No other components.

Dependencies: [FDP_ACC.1 Subset access control, or
FDP_IFC.1 Subset information flow control]
[FMT_MTD.1 Management of TSF data or
FMT_MTD.3 Secure TSF data]

FPT_TCT.1.1/CK The TSF shall enforce the *Key Management SFP*[98] by providing the ability to *transmit and receive*[99] **a cryptographic key** ~~TSF data~~ in a manner protected from unauthorised disclosure **according to FCS_COP.1/KW and FCS_COP.1/KU**.

FPT_TIT.1/CK TSF data integrity transfer protection – Cryptographic keys

Hierarchical to: No other components.

Dependencies: [FDP_ACC.1 Subset access control, or
FDP_IFC.1 Subset information flow control]
[FMT_MTD.1 Management of TSF data or
FMT_MTD.3 Secure TSF data]

FPT_TIT.1.1/CK The TSF shall enforce the *Key Management SFP*[100] to *transmit and receive*[101] **cryptographic keys** ~~TSF data~~ in a manner protected from *modification and insertion*[102] errors **according to FCS_COP.1/KW**.

FPT_TIT.1.2/CK The TSF shall be able to determine on receipt of **cryptographic keys** ~~TSF data~~, whether *modification and insertion*[103] has occurred **according to FCS_COP.1/KU**.

FPT_ISA.1/CK Import of TSF data with security attributes – Cryptographic keys

Hierarchical to: No other components.

Dependencies: [FDP_ACC.1 Subset access control, or
FDP_IFC.1 Subset information flow control]
[FMT_MTD.1 Management of TSF data or
FMT_MTD.3 Secure TSF data]
[FMT_MSA.1 Management of security attributes, or
FMT_MSA.4 Security attribute value inheritance]
FPT_TDC.1 Inter-TSF basic TSF data consistency

FPT_ISA.1.1/CK The TSF shall enforce the *Key Management SFP*[104] when importing **cryptographic key** ~~TSF data~~, controlled under the SFP, from outside of the TOE.

FPT_ISA.1.2/CK The TSF shall use the security attributes associated with the imported **cryptographic key** ~~TSF data~~.

FPT_ISA.1.3/CK The TSF shall ensure that the protocol used provides for the unambiguous association between the security attributes and the **cryptographic key** ~~TSF data~~ received.

FPT_ISA.1.4/CK The TSF shall ensure that interpretation of the security attributes of the imported **cryptographic key** ~~TSF data~~ is as intended by the source of the **cryptographic key** ~~TSF data~~.

98 [assignment: *access control SFP, information flow control SFP*]

99 [selection: *transmit, receive, transmit and receive*]

100 [assignment: *access control SFP, information flow control SFP*]

101 [selection: *transmit, receive, transmit and receive*]

102 [selection: *modification, deletion, insertion, replay*]

103 [selection: *modification, deletion, insertion, replay*]

104 [assignment: *access control SFP, information flow control SFP*]

FPT_ISA.1.5/CK The TSF shall enforce the following rules when importing **a cryptographic key** ~~TSF data~~ controlled under the SFP from outside the TOE:

(1) *The TSF imports the TSF data in certificates only after successful verification of the validity of the certificate including the verification of the digital signature of the issuer and the validity time period.*

(2) *[assignment: additional importation control rules]*[105].

Application note 15: The operational environment is obligated to use trust centre services for secure key management, cf. OE.SecManag.

FPT_TDC.1/CK Inter-TSF basic TSF data consistency – Key import

Hierarchical to: No other components.

Dependencies: No dependencies.

FPT_TDC.1.1/CK The TSF shall provide the capability to consistently interpret *security attributes of* the *imported cryptographic keys* [106] when shared between the TSF and another trusted IT product.

FPT_TDC.1.2/CK The TSF shall use **the following rules**:

(1) *the TOE reports about conflicts between the Key identity of stored cryptographic keys and cryptographic keys to be imported,*

(2) *the TOE does not change the security attributes Key identity, Key type, Key usage type and Key validity time period of the key being imported*[107]

when interpreting **the imported key data object** ~~TSF data from another trusted IT product~~.

FPT_ESA.1/CK Export of TSF data with security attributes – Cryptographic keys

Hierarchical to: No other components.

Dependencies: [FDP_ACC.1 Subset access control, or
FDP_IFC.1 Subset information flow control]
[FMT_MTD.1 Management of TSF data or
FMT_MTD.3 Secure TSF data]
[FMT_MSA.1 Management of security attributes, or
FMT_MSA.4 Security attribute value inheritance]
FPT_TDC.1 Inter-TSF basic TSF data consistency

FPT_ESA.1.1/CK The TSF shall enforce the *Key Management SFP*[108] when exporting **a cryptographic key** ~~TSF data~~, controlled under the SFP(s), outside of the TOE.

FPT_ESA.1.2/CK The TSF shall export the **cryptographic key** ~~TSF data~~ with the **cryptographic key's** ~~TSF data~~ associated security attributes.

FPT_ESA.1.3/CK The TSF shall ensure that the security attributes, when exported outside the TOE, are unambiguously associated with the exported **cryptographic key** ~~TSF data~~.

FPT_ESA.1.4/CK The TSF shall enforce the following rules when **a cryptographic key** ~~TSF data~~ is exported from the TOE: *For keys with the security attribute "Key Usage Counter", the TSF must*

105 [assignment: *importation control rules*]

106 [assignment: *list of TSF data types*]

107 [assignment: *list of interpretation rules to be applied by the TSF*]

108 [assignment: *access control SFP, information flow control SFP*]

ensure that decreasing the counter importing an older version of the key is impossible. Additionally [assignment: additional exportation control rules][109].

Application note 16: There are no fixed rules for presentation of security attributes defined. The element FPT_ESA.1.4/CK must define rules expected in FPT_TDC.1 Inter-TSF basic TSF data consistency if inter-TSF key exchange is intended.

W.r.t. to FPT_ESA.1.4/CK note the following naive attack: 1) A user exports a key having the attribute "Key Usage Counter". 2) The key is then re-imported and used several times. 3) The key is exported again and 4) the exported version of 1) instead of the one of 3.) is re-imported, thus effectively decreasing the attribute "Key Usage Counter". A straight-forward way to counter this is to prohibit keys with the attribute "Key Usage Counter" from being exported.

6.1.2 Data encryption

FCS_COP.1/ED Cryptographic operation – Data encryption and decryption

Hierarchical to: No other components.

Dependencies: [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]
FCS_CKM.4 Cryptographic key destruction

FCS_COP.1.1/ED The TSF shall perform *data encryption and decryption*[110] in accordance with a specified cryptographic algorithm *symmetric data encryption according to AES-128 and [selection: AES-256, no other algorithm] in CBC and [selection: CRT, OFB, CFB, no other] mode* [111] and cryptographic key size *128 bits, [*selection: *256 bits, no other key size]*[112] that meet the following: *NIST-SP800-38A[NIST-SP800-38A], ISO 18033-3 [ISO/IEC 18033-3], ISO 10116 [ISO/IEC 10116]*[113].

Application note 17: Data encryption and decryption should be combined with data integrity mechanisms in Encrypt-then-MAC order, i. e. the MAC is calculated over the ciphertext and verified before decryption. The modes of operation should combine encryption with data integrity mechanisms into authenticated encryption, e. g. Cipher Block Chaining Mode (CBC, cf. NIST SP800-38A) should be combined with CMAC (cf. FCS_COP.1/MAC) or HMAC (cf. FCS_COP.1/HMAC). For combination of symmetric encryption, decryption and data integrity mechanisms by means of CCM or GCM refer to the next section 6.1.3.

6.1.3 Hybrid encryption with MAC for user data

FCS_COP.1/HEM Cryptographic operation – Hybrid data encryption and MAC calculation

Hierarchical to: No other components.

Dependencies: [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]
FCS_CKM.4 Cryptographic key destruction

FCS_COP.1.1/HEM The TSF shall perform *hybrid data encryption and MAC calculation*[114] in accordance with a specified cryptographic algorithm *asymmetric key encryption according to [selection: FCS_CKM.1/ECKA-EG, FCS_CKM.1/AES_RSA, FCS_CKM.5/ECDHE], symmetric data*

109 [assignment: *additional exportation control rules*]
110 [assignment: *list of cryptographic operations*]
111 [assignment: *cryptographic algorithm*]
112 [assignment: *cryptographic key sizes*]
113 [assignment: *list of standards*]
114 [assignment: *list of cryptographic operations*]

encryption according to AES-128, [selection: AES-256, none other][FIPS197] in [selection: CBC[NIST-SP800-38A], CCM[NIST-SP800-38C], GCM[NIST-SP800-38D]] mode with [selection: CMAC[NIST-SP800-38B], GMAC[NIST-SP800-38D], HMAC[RFC2104]] calculation[115] and cryptographic **symmetric** key sizes *128 bits,* [selection: *256 bits, no other key size]*[116] that meet the following: *the referenced standards above according to the chosen selection*[117].

Application note 18: Hybrid data encryption and MAC calculation is a self-contained security service of the TOE. The generation and encryption of the seed, derivation of encryption and MAC keys as well as AES encryption and MAC calculation are only steps of this service. Hybrid encryption is combined with MACs as data integrity mechanisms for the cipher text, i. e. encrypt-then-MAC creation for CMAC.

FCS_COP.1/HDM Cryptographic operation – Hybrid data decryption and MAC verification

Hierarchical to: No other components.

Dependencies: [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]
FCS_CKM.4 Cryptographic key destruction

FCS_COP.1.1/HDM The TSF shall perform *hybrid MAC verification and data decryption*[118] in accordance with a specified cryptographic algorithm *asymmetric key decryption according to [selection: FCS_CKM.5/ECDHE, FCS_CKM.5/ECKA-EG, FCS_CKM.5/AES_RSA], verification of [selection: CMAC[NIST-SP800-38B], GCM[NIST-SP800-38D], HMAC[RFC2104]] and symmetric data decryption according to AES with [selection: AES-128, AES-256][FIPS197] in mode [selection: CBC[NIST-SP800-38A], CCM[NIST-SP800-38C], GMAC[NIST-SP800-38D]]* [119] and cryptographic **symmetric** key sizes *128 bits, [selection: 256 bits, no other key size]*[120] that meet the following: *the referenced standards above according to the chosen selection*[121].

Application note 19: Hybrid data decryption and MAC verification is a self-contained security service of the TOE. The decryption of the seed and derivation of the encryption key and MAC key as well as the AES decryption and MAC verification are only steps of this service. The used symmetric key shall fit to the AES CMAC or GMAC and the AES algorithm for decryption of the cipher text for MAC, e. g. verification-then-decrypt for CMAC.

6.1.4 Data integrity mechanisms

Cryptographic data integrity mechanisms comprise two types of mechanisms – symmetric message authentication code mechanisms and asymmetric digital signature mechanisms. A message authentication code mechanism comprises the generation of a MAC for the original message, the verification of a given pair of a message and MAC, and management of the underlying symmetric key(s). The MAC may be applied to a plaintext without encryption, but when combined with encryption it should be applied to ciphertexts in Encrypt-then-MAC order.

115 [assignment: *cryptographic algorithm*]

116 [assignment: *cryptographic key sizes*]

117 [assignment: *list of standards*]

118 [assignment: *list of cryptographic operations*]

119 [assignment: *cryptographic algorithm*]

120 [assignment: *cryptographic key sizes*]

121 [assignment: *list of standards*]

FCS_COP.1/MAC Cryptographic operation – MAC using AES

Hierarchical to: No other components.

Dependencies: [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]
FCS_CKM.4 Cryptographic key destruction

FCS_COP.1.1/MAC The TSF shall perform *MAC generation and verification*[122] in accordance with a specified cryptographic algorithm *AES-128 and [selection: AES-256, none other][FIPS197] CMAC[NIST-SP800-38B] and [selection: GMAC[NIST-SP800-38D], no other]*[123] and cryptographic key sizes *128 bits [selection: 256 bits, no other key size]*[124] that meet the following: *the referenced standards above according to the chosen selection* [125].

Application note 20: The MAC may be applied to plaintexts and cipher texts. The algorithm AES-128 CMAC is mandatory.

FCS_COP.1/HMAC Cryptographic operation – HMAC

Hierarchical to: No other components.

Dependencies: [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]
FCS_CKM.4 Cryptographic key destruction

FCS_COP.1.1/HMAC The TSF shall perform *HMAC generation and verification*[126] in accordance with a specified cryptographic algorithm *HMAC-SHA256 and [selection: HMAC-SHA-1, HMAC-SHA384, no other]*[127] and cryptographic key sizes [assignment: *cryptographic key sizes*] that meet the following: *RFC2104 [RFC2104] , ISO 9797-2 [ISO/IEC 9797-2]*[128].

Application note 21: The cryptographic key is a random bit string generated by FCS_RNG.1 or a referenced internal secret. The cryptographic key sizes assigned in FCS_COP.1/HMAC must be at least 128 bits.

FCS_COP.1/CDS-ECDSA Cryptographic operation – Creation of digital signatures ECDSA

Hierarchical to: No other components.

Dependencies: [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]
FCS_CKM.4 Cryptographic key destruction

FCS_COP.1.1/CDS-ECDSA The TSF shall perform *signature-creation*[129] in accordance with a specified cryptographic algorithm *ECDSA with [selection: elliptic curves in table 2]*[130] and cryptographic key sizes *[selection: key size in table 2]*[131] that meet the following: *[selection: standards in table 2]*[132].

122 [assignment: *list of cryptographic operations*]

123 [assignment: *cryptographic algorithm*]

124 [assignment: *cryptographic key sizes*]

125 [assignment: *list of standards*]

126 [assignment: *list of cryptographic operations*]

127 [assignment: *cryptographic algorithm*]

128 [assignment: *list of standards*]

129 [assignment: *list of cryptographic operations*]

130 [assignment: *cryptographic key generation algorithm*]

131 [assignment: *cryptographic key sizes*]

132 [assignment: *list of standards*]

FCS_COP.1/VDS-ECDSA Cryptographic operation – Verification of digital signatures ECDSA

Hierarchical to: No other components.

Dependencies: [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]
FCS_CKM.4 Cryptographic key destruction

FCS_COP.1.1/VDS-ECDSA The TSF shall perform *signature-verification*[133] in accordance with a specified cryptographic algorithm *ECDSA with [selection: elliptic curves in table 2]*[134] and cryptographic key sizes *[selection: key size in table 2]*[135] that meet the following: *[selection: standards in table 2]*[136].

FCS_COP.1/CDS-RSA Cryptographic operation – Creation of digital signatures RSA

Hierarchical to: No other components.

Dependencies: [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]
FCS_CKM.4 Cryptographic key destruction

FCS_COP.1.1/CDS-RSA The TSF shall perform *signature-creation*[137] in accordance with a specified cryptographic algorithm *RSA and EMSA-PSS*[138] and cryptographic key sizes [assignment: *cryptographic key sizes*] that meet the following: *ISO/IEC 14888-2 [ISO/IEC 14888-2], PKCS #1, v2.2 [PKCS#1]*[139].

FCS_COP.1/VDS-RSA Cryptographic operation – Verification of digital signatures RSA

Hierarchical to: No other components.

Dependencies: [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]
FCS_CKM.4 Cryptographic key destruction

FCS_COP.1.1/VDS-RSA The TSF shall perform *signature-verification*[140] in accordance with a specified cryptographic algorithm *RSA and EMSA-PSS*[141] and cryptographic key sizes [assignment: *cryptographic key sizes*] that meet the following: *ISO/IEC 14888-2 [ISO/IEC 14888-2] , PKCS #1, v2.2 [PKCS#1]*[142].

133 [assignment: *list of cryptographic operations*]

134 [assignment: *cryptographic key generation algorithm*]

135 [assignment: *cryptographic key sizes*]

136 [assignment: *list of standards*]

137 [assignment: *list of cryptographic operations*]

138 [assignment: *cryptographic algorithm*]

139 [assignment: *list of standards*]

140 [assignment: *list of cryptographic operations*]

141 [assignment: *cryptographic algorithm*]

142 [assignment: *list of standards*]

FDP_DAU.2/Sig Data Authentication with Identity of Guarantor - Signature

Hierarchical to: FDP_DAU.1 Basic Data Authentication

Dependencies: FIA_UID.1 Timing of identification

FDP_DAU.2.1/Sig The TSF shall provide a capability to generate evidence that can be used as a guarantee of the validity of *user data*[143] **imported according to FDP_ITC.2/UD by means of** [**selection: *FCS_COP.1/CDS-RSA, FCS_COP.1/CDS-ECDSA***] **and keys holding the security attribute Key identity assigned to the guarantor and Key usage type "digitalSignature"**.

FDP_DAU.2.2/Sig The TSF shall provide *external entities*[144] with the ability to verify evidence of the validity of the indicated information and the identity of the user that generated the evidence.

Application note 22: The TSF according to FDP_DAU.2/Sig is intended for a signature service for user data. The user data source shall select the security attributes *Key owner* of the guarantor and *Key usage type* "*digitalSignature*" of the cryptographic key for the signature service in the security attributes provided with the user data. The user data source subject shall meet the *Key access control attributes* for the signature-creation operation. The verification of the evidence requires a certificate showing the identity of the key owner.

6.1.5 Authentication and attestation of the TOE, trusted channel

FIA_API.1/PACE Authentication Proof of Identity – PACE authentication to Application component

Hierarchical to: No other components.

Dependencies: No dependencies.

FIA_API.1.1/PACE The TSF shall provide *PACE in ICC role*[145] to prove the identity of the *TOE*[146] to an external entity **and to establish a trusted channel according to FTP_ITC.1 case 1 or 2**.

FIA_API.1/CA Authentication Proof of Identity – Chip authentication to user

Hierarchical to: No other components.

Dependencies: No dependencies.

FIA_API.1.1/CA The TSF shall provide *Chip Authentication Version 2 according to [TR-03110] section 3.4*[147] to prove the identity of the *TOE*[148] to an external entity **and to establish a trusted channel according to FTP_ITC.1 case 3**.

FDP_DAU.2/Att Data Authentication with Identity of Guarantor - Attestation

Hierarchical to: FDP_DAU.1 Basic Data Authentication

Dependencies: FIA_UID.1 Timing of identification

FDP_DAU.2.1/Att The TSF shall provide a capability to generate evidence that can be used as a guarantee of the validity of *attestation data*[149] **by means of** [**selection: *FCS_COP.1/CDS-RSA, FCS_COP.1/CDS-ECDSA, ECDAA according to [selection: [TPMLib,Part 1][FIDO-ECDAA]], [assignment: other cryptographic authentication mechanisms]***] **and keys holding the security attributes Key identity assigned to the TOE sample, and Key usage type "contentCommitment".**

143 [assignment: *list of objects or information types*]

144 [assignment: l*ist of subjects*]

145 [assignment: *authentication mechanism*]

146 [assignment: *object, authorized user or role*]

147 [assignment: *authentication mechanism*]

148 [assignment: *object, authorized user or role*]

149 [assignment: *list of objects or information types*]

FDP_DAU.2.2/Att The TSF shall provide *external entities*[150] with the ability to verify evidence of the validity of the indicated information and the identity of the user that generated the evidence.

Application note 23: The attestation data shall represent the TOE sample as a genuine sample of the certified product. The attestation data may include the identifier of the certified product, the serial number of the device or a group of product samples, the hash value of the TSF implementation and some TSF data as result of a self-test, or other data. It may be generated internally or may include internally generated and externally provided data. The assigned cryptographic mechanisms shall be appropriate for attestation meeting OSP.SecCryM, e. g. a digital signature, a group signature or a direct anonymous attestation mechanism as e.g. used for Trusted Platform Modules ***[TPMLib,Part 1]*** or FIDO U2F Authenticators ***[FIDO-ECDAA]***.

FTP_ITC.1 Inter-TSF trusted channel

Hierarchical to: No other components.

Dependencies: No dependencies.

FTP_ITC.1.1 The TSF shall provide a communication channel between TSF and another trusted IT product that is ~~logically distinct from other communication channels~~ [**selection: *logically separated from other communication channels, using physical separated ports***] and provides assured identification of its end points [**selection: *Authentication of the TOE and remote entity according to the case in table 4***] and protection of the channel data from modification or disclosure [**assignment: *according to the case in table 4*] as required by** [**selection: *cryptographic operation according to the case in table 4*]*.*

FTP_ITC.1.2 The TSF shall permit *the remote trusted IT product*[151] **determined according to FMT_MOF.1.1 clause (3)** to initiate communication via the trusted channel.

FTP_ITC.1.3 The TSF shall initiate communication via the trusted channel for *communication with entities defined according to FMT_MOF.1 clause (4)*[152]**.**

Case	Authentication of TOE and remote entity	Key agreement	Protection of communication data	Cryptographic operation
1	FIA_API.1/PACE, FIA_UAU.5.1 (2)	FCS_CKM.1/PACE	modification	FCS_COP.1/TCM
2	FIA_API.1/PACE, FIA_UAU.5.1 (2)	FCS_CKM.1/PACE	modification	FCS_COP.1/TCM
			disclosure	FCS_COP.1/TCE
3	FIA_API.1/CA, FIA_UAU.5.1 (4) or (5), and (6)	FCS_CKM.1/TCAP	modification	FCS_COP.1/TCM
			disclosure	FCS_COP.1/TCE

Table 4: Operation in SFR for trusted channel

FCS_CKM.1/PACE Cryptographic key generation – Key agreement for trusted channel PACE

Hierarchical to: No other components.

Dependencies: [FCS_CKM.2 Cryptographic key distribution, or FCS_COP.1 Cryptographic operation] FCS_CKM.4 Cryptographic key destruction

FCS_CKM.1.1/PACE The TSF shall generate cryptographic keys ***for MAC with for FCS_COP.1/TCM and if selected encryption keys for FCS_COP.1/TCE*** in accordance with a specified

150 [assignment: l*ist of subjects*]

151 [selection: *the TSF, the remote trusted IT product*]

152 [assignment: *list of functions for which a trusted channel is required*]

cryptographic key ~~generation~~ **agreement** algorithm *PACE with [selection: elliptic curves in table 2] and Generic Mapping in ICC role*[153] and specified cryptographic key sizes *[selection: 128 bits, 192 bits, 256 bits]*[154] that meet the following: *ICAO Doc9303*, *Part 11, section 4.4 [ICAO Doc9303]*[155].

Application note 24: PACE is used to authenticate the TOE and the application component, or TOE and human user using a terminal. It establishes a trusted channel with MAC integrity protection and – if selected – also encryption.

FCS_CKM.1/TCAP Cryptographic key generation – Key agreement by Terminal and Chip authentication protocols

Hierarchical to: No other components.

Dependencies: [FCS_CKM.2 Cryptographic key distribution, or FCS_COP.1 Cryptographic operation]
FCS_CKM.4 Cryptographic key destruction

FCS_CKM.1.1/TCAP The TSF shall generate cryptographic keys **for *encryption according to FCS_COP.1/TCE and MAC according to FCS_COP.1/TCM*** in accordance with a specified cryptographic key ~~generation~~ **agreement** algorithms *Terminal Authentication version 2 and Chip Authentication Version 2* [156] and specified cryptographic key sizes *[selection: 128 bits, 192 bits, 256 bits]*[157] that meet the following: *BSI TR-03110 [TR-03110], section 3.3 and 3.4*[158].

FCS_COP.1/TCE Cryptographic operation - Encryption for trusted channel

Hierarchical to: No other components.

Dependencies: [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]
FCS_CKM.4 Cryptographic key destruction

FCS_COP.1.1/TCE The TSF shall perform *encryption and decryption*[159] in accordance with a specified cryptographic algorithm *AES in [selection: CBC[NIST-SP800-38A], CCM[NIST-SP800-38C], GCM[NIST-SP800-38D]] mode*[160] and cryptographic key sizes [*selection: 128 bits, 192 bits, 256 bits]*[161] that meet the following: *[FIPS197]*[162].

153 [assignment: *cryptographic algorithm*]

154 [assignment: *cryptographic key sizes*]

155 [assignment: *list of standards*]

156 [assignment: *cryptographic algorithm*]

157 [assignment: *cryptographic key sizes*]

158 [assignment: *list of standards*]

159 [assignment: *list of cryptographic operations*]

160 [assignment: *cryptographic algorithm*]

161 [assignment: *cryptographic key sizes*]

162 [assignment: *list of standards*]

FCS_COP.1/TCM Cryptographic operation - MAC for trusted channel

Hierarchical to: No other components.

Dependencies: [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]
FCS_CKM.4 Cryptographic key destruction

FCS_COP.1.1/TCM The TSF shall perform *MAC calculation and MAC verification*[163] in accordance with a specified cryptographic algorithm *AES [selection: CMAC[NIST-SP800-38B], GMAC[NIST-SP800-38D]]*[164] and cryptographic key sizes *[selection: 128 bits, 192 bits, 256 bits]*[165] that meet the following: *[FIPS197]*[166].

6.1.6 User identification and authentication

FIA_ATD.1 User attribute definition – Identity based authentication

Hierarchical to: No other components.

Dependencies: No dependencies.

FIA_ATD.1.1 The TSF shall maintain the following list of security attributes belonging to individual users:

(1) *Identity*,

(2) *Authentication reference data,*

(3) *Role*.

FMT_MTD.1/RAD Management of TSF data – Authentication reference data and Authentication Data Records

Hierarchical to: No other components.

Dependencies: FMT_SMR.1 Security roles
FMT_SMF.1 Specification of Management Functions

FMT_MTD.1.1/RAD The TSF shall restrict the ability to

(1) create[167] the *initial Authentication reference data of all authorized users*[168] to *[selection: Administrator, User Administrator]*[169],

(2) *delete*[170] the *Authentication reference data of an authorized user*[171] to *[selection: Administrator, User Administrator]*[172],

163 [assignment: *list of cryptographic operations*]

164 [assignment: *cryptographic algorithm*]

165 [assignment: *cryptographic key sizes*]

166 [assignment: *list of standards*]

167 [selection: *change_default, query, modify, delete, clear, [assignment: other operations]*]

168 [assignment: *list of TSF data*]

169 [assignment: *the authorised identified roles*]

170 [selection: *change_default, query, modify, delete, clear, [assignment: other operations]*]

171 [assignment: *list of TSF data*]

172 [assignment: *the authorised identified roles*]

(3) ***modify***[173] **the** ***Authentication reference data***[174] **to** ***the corresponding authorized user***[175].

(4) ***create***[176] **the** ***permanently stored session key of a trusted channel as Authentication reference data***[177] **to** ***[selection: Administrator, User Administrator]***[178]

(5) ***define***[179] **the** ***time in range [assignment: time frame] after which the user security attribute Role of the authentication data record is reset according to FMT_SAE.1***[180] ***to [selection: Administrator, User Administrator]***[181]**,**

(6) ***define***[182] **the** ***value [selection: Unidentified user, Unauthenticated user] to which the security attribute Role of the authentication data record shall be reset according to FMT_SAE.1***[183] ***to [selection: Administrator, User Administrator]***[184].

Application note 25: The Administrator is responsible for user management. The Administrator creates and revokes a user as a known authorized user of the TSF by creating resp. deleting authentication data records and additionally authentication reference data for the user identities in these records, as defined in clause (1). The Administrator may define additional authentication reference data as described in clause (3), i. e. the trusted channel combines initial authentication of communication endpoints (cf. FIA_UAU.5.1 clause (3) and (4)) with an agreement of session keys used for authentication of exchanged messages (cf. FIA_UAU.5.1 clause (5)). The session keys may be permanently stored for trusted communication with the known authorized entity. The user manages its own authentication reference data to prevent impersonation based of known authentication data (e.g. as addressed by FMT_MTD.3). The bullets (2) to (6) are refinements in order to avoid an iteration of component and therefore printed in bold.

FMT_MTD.3 Secure TSF data

Hierarchical to: No other components.

Dependencies: FMT_MTD.1 Management of TSF data

FMT_MTD.3.1 The TSF shall ensure that only secure values are accepted for *passwords*[185] **by enforcing a change of initial passwords to a different operational password on the first successful authentication of the user**

173 [selection: *change_default, query, modify, delete, clear,[assignment: other operations]*]

174 [assignment: *list of TSF data*]

175 [assignment: *the authorised identified roles*]

176 [selection: *change_default, query, modify, delete, clear,[assignment: other operations]*]

177 [assignment: *list of TSF data*]

178 [assignment: *the authorised identified roles*]

179 [selection: *change_default, query, modify, delete, clear,[assignment: other operations]*]

180 [assignment: *list of TSF data*]

181 [assignment: *the authorised identified roles*]

182 [selection: *change_default, query, modify, delete, clear,[assignment: other operations]*]

183 [assignment: *list of TSF data*]

184 [assignment: *the authorised identified roles*]

185 [assignment: list of TSF data]

FIA_AFL.1 Authentication failure handling

Hierarchical to: No other components.

Dependencies: FIA_UAU.1 Timing of authentication

FIA_AFL.1.1 The TSF shall detect when [selection: [assignment: *positive integer number*], *an ~~administrator~~ **[selection: Administrator, User Administrator]** configurable positive integer within [assignment: range of acceptable values]*] unsuccessful authentication attempts occur related to [assignment: *list of authentication events*].

FIA_AFL.1.2 When the defined number of unsuccessful authentication attempts has been [selection: *met, surpassed*], the TSF shall [assignment: *list of actions*].

FIA_USB.1 User-subject binding

Hierarchical to: No other components.

Dependencies: FIA_ATD.1 User attribute definition

FIA_USB.1.1 The TSF shall associate the following user security attributes with subjects acting on the behalf of that user:

(1) *Identity*,

(2) *Role*[186].

FIA_USB.1.2 The TSF shall enforce the following rules on the initial association of user security attributes with subjects acting on the behalf of users: *the initial role of the user is Unidentified user*[187].

FIA_USB.1.3 The TSF shall enforce the following rules governing changes to the user security attributes associated with subjects acting on the behalf of users:

(1) *after successful identification of the user, the attribute Role of the subject shall be changed from Unidentified user to Unauthenticated user;*

(2) *after successful authentication of the user for a selected role, the attribute Role of the subject shall be changed from Unauthenticated User to that role;*

(3) *after successful re-authentication of the user for a selected role, the attribute Role of the subject shall be changed to that role*[188].

FMT_SAE.1 Time-limited authorisation

Hierarchical to: No other components.

Dependencies: FMT_SMR.1 Security roles
FPT_STM.1 Reliable time stamps

FMT_SAE.1.1 The TSF shall restrict the capability to specify an expiration time for *a Role*[189] to *[selection: Administrator, User Administrator]*[190].

FMT_SAE.1.2 For each of these security attributes, the TSF shall be able to *reset the Role to the value assigned according to FMT_MTD.1/RAD, clause (6)*[191], after the expiration time for the indicated security attribute has passed.

186 [assignment: *list of user security attributes*]

187 [assignment: *rules for the initial association of attributes*]

188 [assignment: *rules for the changing of attributes*]

189 [assignment: *list of security attributes for which expiration is to be supported*]

190 [assignment: *the authorised identified roles*]

191 [assignment: *list of actions to be taken for each security attribute*]

Application note 26: The TSF shall implement means to handle an expiration time for the roles within a session (i.e. between power-up and power-down of the TOE) which may not necessarily meet the requirements for a reliable time stamp as required by FPT_STM.1. If the security target requires FPT_STM.1 (e.g. if the PP-module "Time Stamp and Audit" claimed), this time stamp shall be used to meet FMT_SAE.1.

FIA_UID.1 Timing of identification

Hierarchical to: No other components.

Dependencies: No dependencies.

FIA_UID.1.1 The TSF shall allow

(1) *self test according to FPT_TST.1*,

(2) *identification of the TOE to the user*,

(3) *[assignment: list of other TSF-mediated actions]*[192]

on behalf of the user to be performed before the user is identified.

FIA_UID.1.2 The TSF shall require each user to be successfully identified before allowing any other TSF-mediated actions on behalf of ~~that user~~ **the Unauthenticated User**.

FIA_UAU.1 Timing of authentication

Hierarchical to: No other components.

Dependencies: FIA_UID.1 Timing of identification

FIA_UAU.1.1 The TSF shall allow

(1) *self test according to FPT_TST.1*,

(2) *authentication of the TOE to the user after authentication of the user to the TOE*,

(3) *identification of the user to the TOE and selection of [selection: a role, a set of role] for authentication,*

(4) *[assignment: list of other TSF mediated actions]*[193]

on behalf of the user. ~~to be performed before the user is authenticated.~~

FIA_UAU.1.2 The TSF shall require each user to be successfully authenticated before allowing any other TSF-mediated actions on behalf of that user.

Application note 27: Clause (2) and (3) in FIA_UAU.1.1 allows mutual identification for mutual authentication, e. g. by exchange of certificates.

FIA_UAU.5 Multiple authentication mechanisms

Hierarchical to: No other components.

Dependencies: No dependencies.

FIA_UAU.5.1 The TSF shall provide

(1) *password authentication*,

(2) *PACE with Generic Mapping with the TOE in ICC and the user in PCD context with the establishment of trusted channel according to FTP_ITC.1,*

(3) *certificate based Terminal Authentication Version 2 according to section 3.3 in [TR-03110] with the TOE in ICC and the user in PCD context,*

192 [assignment: *list of TSF mediated actions*]

193 [assignment: *list of TSF mediated actions*]

(4) *Terminal Authentication Version 2 with the TOE in ICC context and user in PCD context modified by omitting the verification of the certificate chain (simplified TA2),*

(5) *Chip Authentication Version 2 with establishment of a trusted channel according to FTP_ITC.1,*

(6) *message authentication by MAC verification of received messages*[194]

to support user authentication.

FIA_UAU.5.2 The TSF shall authenticate any user's claimed identity according to the **rules**

(1) *password authentication shall be used for authentication of human users if enabled according to FMT_MOF.1.1, clause (1),*

(2) *PACE shall be used for authentication of human users using terminals with the establishment of a trusted channel according to FTP_ITC.1,*

(3) *PACE may be used for authentication of IT entities with the establishment of a trusted channel according to FTP_ITC.1,*

(4) *certificate based Terminal Authentication Version 2 may be used for authentication of users whose certificate is imported as TSF data,*

(5) the *simplified version of Terminal Authentication Version 2 may be used for authentication of identified users associated with a known user's public key,*

(6) *message authentication by MAC verification of received messages shall be used after initial authentication of a remote entity according to clauses (2) or (3) for a trusted channel according to FTP_ITC.1,*

(7) *[assignment: additional rules]*[195].

FIA_UAU.6 Re-authenticating

Hierarchical to: No other components.

Dependencies: No dependencies.

FIA_UAU.6.1 The TSF shall re-authenticate the user under the conditions

(1) *changing to a role not selected for the current valid authentication session,*

(2) *power on or reset,*

(3) *every message received from entities after establishing trusted channel according to FIA_UAU.5.1, clause (2), (3) or (6),*

(4) *[assignment: list of other conditions under which re-authentication is required]*[196].

194 [assignment: *list of multiple authentication mechanisms*]

195 [assignment: *rules describing how the multiple authentication mechanisms provide authentication*]

196 [assignment: *list of conditions under which re-authentication is required*]

6.1.7 Access control

FDP_ITC.2/UD Import of user data with security attributes – User data

Hierarchical to: No other components.

Dependencies: [FDP_ACC.1 Subset access control, or FDP_IFC.1 Subset information flow control]
[FTP_ITC.1 Inter-TSF trusted channel, or FTP_TRP.1 Trusted path]
FPT_TDC.1 Inter-TSF basic TSF data consistency

FDP_ITC.2.1/UD The TSF shall enforce the *Cryptographic Operation SFP*[197] when importing user data, controlled under the SFP, from outside of the TOE.

FDP_ITC.2.2/UD The TSF shall use the security attributes associated with the imported user data.

FDP_ITC.2.3/UD The TSF shall ensure that the protocol used provides for the unambiguous association between the security attributes and the user data received.

FDP_ITC.2.4/UD The TSF shall ensure that the interpretation of the security attributes of the imported user data is as intended by the source of the user data.

FDP_ITC.2.5/UD The TSF shall enforce the following rules when importing user data controlled under the SFP from outside the TOE:

(1) *user data imported for encryption according to FCS_COP.1/ED shall be imported with the attribute Key identity of the key and the identification of the requested cryptographic operation,*

(2) *user data imported for encryption according to FCS_COP.1/HEM shall be imported with the attribute Key identity of the public key encryption key or key agreement method,*

(3) *user data imported for decryption according to FCS_COP.1/HDM shall be imported with the attribute Key identity of the asymmetric decryption key, encrypted seed and data integrity check sum*,

(4) *user data imported for digital signature creation shall be imported with the attribute Key identity of the private signature key,*

(5) *user data imported for digital signature verification shall be imported with digital signature and Key identity of the public signature key*[198].

Application note 28: Keys to be used for the cryptographic operation of the imported user data are identified by security attribute *Key identity*.

FDP_ETC.2 Export of user data with security attributes

Hierarchical to: No other components.

Dependencies: [FDP_ACC.1 Subset access control, or FDP_IFC.1 Subset information flow control]

FDP_ETC.2.1 The TSF shall enforce the *Cryptographic Operation SFP*[199] when exporting user data, controlled under the SFP(s), outside of the TOE.

FDP_ETC.2.2 The TSF shall export the user data with the user data's associated security attributes.

FDP_ETC.2.3 The TSF shall ensure that the security attributes, when exported outside the TOE, are unambiguously associated with the exported user data.

FDP_ETC.2.4 The TSF shall enforce the following rules when user data is exported from the TOE:

197 [assignment: *access control SFP, information flow control SFP*]

198 [assignment: *additional importation control rules*]

199 [assignment: *access control SFP, information flow control SFP*]

(1) *user data exported as ciphertext according to FCS_COP.1/HEM shall be exported with reference to the key decryption key, encrypted data encryption key and data integrity check sum*,

(2) *user data exported as plaintext according to FCS_COP.1/HDM shall be exported only if the MAC verification confirmed the integrity of the ciphertext,*

(3) *user data exported as signed data according to FCS_COP.1/CDS-ECDSA or FCS_COP.1/CDS-RSA shall be exported with a digital signature and Key identity of the used signature-creation key*[200].

Application note 29: In case of internally generated data exported as signed data, the Key identity of the used key should be exported as well in order to identify the corresponding signature-verification key. Notethat the TOE may implement more than one signature-creation key for signing internally generated data.

FDP_ETC.1 Export of user data without security attributes

Hierarchical to: No other components.

Dependencies: [FDP_ACC.1 Subset access control, or FDP_IFC.1 Subset information flow control]

FDP_ETC.1.1 The TSF shall enforce the *Cryptographic Operation SFP*[201] when exporting user data **as plaintext according to FCS_COP.1/HDM**, controlled under the SFP(s), outside of the TOE.

FDP_ETC.1.2 The TSF shall export the ~~user data~~ **successfully MAC verified and decrypted ciphertext as plaintext according to FCS_COP.1/HDM** without the user data's associated security attributes.

FDP_ACC.1/Oper Subset access control – Cryptographic operation

Hierarchical to: No other components.

Dependencies: FDP_ACF.1 Security attribute based access control

FDP_ACC.1.1/Oper The TSF shall enforce the *Cryptographic Operation SFP*[202] on

(1) *subjects: [selection: Administrator, Crypto-Officer], Key Owner, [assignment: other roles];*

(2) *objects: operational cryptographic keys*, *user data*;

(3) *operations: cryptographic operation*[203]

FDP_ACF.1/Oper Security attribute based access control – Cryptographic operations

Hierarchical to: No other components.

Dependencies: FDP_ACC.1 Subset access control
FMT_MSA.3 Static attribute initialisation

FDP_ACF.1.1/Oper The TSF shall enforce the *Cryptographic Operation SFP*[204] to objects based on the following:

(1) *subjects: subjects with security attribute Role [selection: Administrator, Crypto-Officer], Key Owner, [assignment: other roles]*;

(2) *objects:*

200 [assignment: *additional exportation control rules*]

201 [assignment: *access control SFP(s) and/or information flow control SFP(s)*]

202 [assignment: *access control SFP*]

203 [assignment: *list of subjects, objects, and operations among subjects and objects covered by the SFP*]

204 [assignment: *access control SFP*]

(a) *cryptographic keys with security attributes: Identity of the key, Key owner, Key type, Key usage type, Key access control attributes, Key validity time period*;

(b) *user data*[205].

FDP_ACF.1.2/Oper The TSF shall enforce the following rules to determine if an operation among controlled subjects and controlled objects is allowed:

(1) A *Subject in [selection: Administrator, Crypto-Officer] role is allowed to perform cryptographic operations on cryptographic keys in accordance with their security attributes.*

(2) The *Subject Key Owner is allowed to perform cryptographic operations on user data with cryptographic keys in accordance with the security attribute Key owner, Key type, Key usage type, Key access control attributes and Key validity time period*;

(3) *[assignment: other rules governing access among controlled subjects and controlled objects using controlled operations on controlled objects]*[206].

FDP_ACF.1.3/Oper The TSF shall explicitly authorise access of subjects to objects based on the following additional rules:

(1) *subjects with the security attribute Role are allowed to perform cryptographic operations on user data and cryptographic keys with security attributes as shown in the rows of table 5*.

(2) [assignment: *additional rules, based on security attributes, that explicitly authorise access of subjects to objects*].

FDP_ACF.1.4/Oper The TSF shall explicitly deny access of subjects to objects based on the following additional rules:

(1) *No subject is allowed to use cryptographic keys by cryptographic operation other than those identified in the security attributes Key usage type and the Key access control attributes*;

(2) *No subject is allowed to decrypt ciphertext according to FCS_COP.1/HDM if MAC verification fails.*

(3) *[assignment: additional rules, based on security attributes, that explicitly deny access of subjects to objects].*[207]

Access control rules for cryptographic operation:

205 [assignment: *list of subjects and objects controlled under the indicated SFP, and for each, the SFP-relevant security attributes, or named groups of SFP-relevant security attributes*]

206 [assignment: *rules governing access among controlled subjects and controlled objects using controlled operations on controlled objects*]

207 [assignment: *rules, based on security attributes, that explicitly deny access of subjects to objects*]

Security attribute Role of the subject	Security attribute of the cryptographic key	Cryptographic operation referenced by SFR allowed for the subject on user data with the cryptographic key
[selection: Administrator, Crypto-Officer, Key Owner]	*Key type: symmetric* *Key usage type: Key wrap* *Key validity time period:*	*FCS_COP.1/KW*
[selection: Administrator, Crypto-Officer, Key Owner]	*Key type: symmetric* *Key usage type: Key unwrap* *Key validity time period:*	*FCS_COP.1/KU*
(any authenticated user)	*Key type: public* *Key usage type: ECKA-EG* *Key validity time period: as in certificate*	*FCS_COP.1/HEM,* *FCS_CKM.1/ECKA-EG*
Key Owner	*Key type: private* *Key usage type: ECKA-EG* *Key validity time period:*	*FCS_COP.1/HDM* *FCS_CKM.5/ECKA-EG*
(any authenticated user)	*Key type: public* *Key usage type: RSA_ENC* *Key validity time period: as in certificate*	*FCS_COP.1/HEM* *FCS_CKM.1/AES_RSA*
Key Owner	*Key type: private* *Key usage type: RSA_ENC* *Key validity time period: as in certificate*	*FCS_COP.1/HDM* *FCS_CKM.5/AES_RSA*
Key Owner	*Key type: private* *Key usage type: DS-ECDSA* *Key validity time period:*	*FCS_COP.1/CDS-ECDSA*
(any authenticated user)	*Key type: public* *Key usage type: DS-ECDSA* *Key validity time period:*	*FCS_COP.1/VDS-ECDSA*
Key Owner	*Key type: private* *Key usage type: DS-RSA* *Key validity time period:*	*FCS_COP.1/CDS-RSA*
(any authenticated user)	*Key type: public* *Key usage type: DS-RSA* *Key validity time period:*	*FCS_COP.1/VDS-RSA*

Table 5: Security attributes and access control

6.1.8 Security Management

FMT_SMF.1 Specification of Management Functions

Hierarchical to: No other components.

Dependencies: No dependencies.

FMT_SMF.1.1 The TSF shall be capable of performing the following management functions:

(1) *management of security functions behaviour (FMT_MOF.1)*,

(2) *management of Authentication reference data (FMT_MTD.1/RAD),*

(3) *management of security attributes of cryptographic keys (FMT_MSA.1/KM, FMT_MSA.2, FMT_MSA.3/KM,*

(4) *[assignment: additional list of security management functions to be provided by the TSF]*[208].

FMT_SMR.1 Security roles

Hierarchical to: No other components.

Dependencies: FIA_UID.1 Timing of identification

FMT_SMR.1.1 The TSF shall maintain the roles: *Unidentified User, Unauthenticated User, Key Owner, Application component, [selection: Administrator, Crypto-Officer, User Administrator, Update Agent] [selection: [assignment: other roles], no other roles]*[209].

FMT_SMR.1.2 The TSF shall be able to associate users with roles.

Application note 30: The ST may select the general role *Administrator* or more detailed administrator roles as supported by the TOE.

FMT_MSA.2 Secure security attributes

Hierarchical to: No other components.

Dependencies: [FDP_ACC.1 Subset access control, or FDP_IFC.1 Subset information flow control]
FMT_MSA.1 Management of security attributes
FMT_SMR.1 Security roles

FMT_MSA.2.1 The TSF shall ensure that only secure values are accepted for *security attributes*

(1) *Key identity,*

(2) *Key type,*

(3) *Key usage type,*

(4) *[assignment: additional security attributes]*[210].

The cryptographic keys shall have

(1) a Key identity uniquely identifying the key among all keys implemented in the TOE,

(2) the Key type defined as exactly one of secret key, private key, or public key,

(3) a Key usage type identifying at least one cryptographic mechanism the key can be used for.

FMT_MOF.1 Management of security functions behaviour

Hierarchical to: No other components.

Dependencies: FMT_SMR.1 Security roles
FMT_SMF.1 Specification of Management Functions

FMT_MOF.1.1 The TSF shall restrict the ability to

208 [assignment: *list of management functions to be provided by the TSF*]

209 [assignment: *authorised identified roles*]

210 [assignment: *list of security attributes*]

(1) *enable*[211] the functions *password authentication according to FIA_UAU.5.1, clause (1)*[212] to *[selection: Administrator, User Administrator]*[213].

(2) *disable*[214] the functions *password authentication according to FIA_UAU.5.1, clause (1)*[215] to *[selection: Administrator, User Administrator]*[216],

(3) *determine the behavior of*[217] the functions *trusted channel according to FDP_ITC.1.2*[218] by defining the remote trusted IT products permitted to initiate communication via the trusted channel to *[selection: Administrator, User Administrator]*[219],

(4) *determine the behavior of*[220] the functions *trusted channel according to FDP_ITC.1.3*[221] by defining the entities for which the TSF shall enforce communication via the trusted channel to *[selection: Administrator, User Administrator]*[222].

Application note 31: The refinements of FMT_MOF.1.1 in bullets (2) to (4) are made in order to avoid iteration of the component. In case of the client-server architecture, the applications using the TOE and supporting the cryptographically protected trusted channel belong to the entities for which the TSF shall enforce a trusted channel according to FDP_ITC.1, cf. FMT_MOF.1.1 in bullet (4).

6.1.9 Protection of the TSF

FPT_FLS.1 Failure with preservation of secure state

Hierarchical to:	No other components.
Dependencies:	No dependencies.
FPT_FLS.1.1	The TSF shall preserve a secure state when the following types of failures occur:
	(1) *self test fails*
	(2) [*assignment*: list of types of additional failures].

Refinement: When the TOE is in a secure error mode the TSF shall not perform any cryptographic operations and all data output interfaces shall be inhibited by the TSF.

211 [selection: *determine the behaviour of, disable, enable, modify the behaviour of*]
212 [assignment: *list of functions*]
213 [assignment: *the authorised identified roles*]
214 [selection: *determine the behaviour of, disable, enable, modify the behaviour of*]
215 [assignment: *list of functions*]
216 [assignment: *the authorised identified roles*]
217 [selection: *determine the behaviour of, disable, enable, modify the behaviour of*]
218 [assignment: *list of functions*]
219 [assignment: *the authorised identified roles*]
220 [selection: *determine the behaviour of, disable, enable, modify the behaviour of*]
221 [assignment: *list of functions*]
222 [assignment: *the authorised identified roles*]

FPT_TST.1 TSF testing

Hierarchical to:	No other components.
Dependencies:	No dependencies.
FPT_TST.1.1	The TSF shall run a suite of self tests *during initial start-up and after power-on*[223] to demonstrate the correct operation of [assignment: *parts of TSF]*[224].
FPT_TST.1.2	The TSF shall provide authorised users with the capability to verify the integrity of *TSF data*[225].
FPT_TST.1.3	The TSF shall provide authorised users with the capability to verify the integrity of *TSF **implementation***[226].

6.1.10 Import and verification of Update Code Package

The TOE imports Update Code Package as user data objects with security attributes according to FDP_ITC.2/UCP, verifies the authenticity of the received Update Code Package according to FCS_COP.1/VDSUCP, and decrypts authentic Update Code Package according to FCS_COP.1/DecUCP.

FDP_ITC.2/UCP Import of user data with security attributes – Update Code Package

Hierarchical to:	No other components.
Dependencies:	[FDP_ACC.1 Subset access control, or FDP_IFC.1 Subset information flow control] [FTP_ITC.1 Inter-TSF trusted channel, or FTP_TRP.1 Trusted path] FPT_TDC.1 Inter-TSF basic TSF data consistency
FDP_ITC.2.1/UCP	The TSF shall enforce the *Update SFP*[227] when importing user data, controlled under the SFP, from outside of the TOE.
FDP_ITC.2.2/UCP	The TSF shall use the security attributes associated with the imported user data.
FDP_ITC.2.3/UCP	The TSF shall ensure that the protocol used provides for the unambiguous association between the security attributes and the user data received.
FDP_ITC.2.4/UCP	The TSF shall ensure that interpretation of the security attributes of the imported user data is as intended by the source of the user data.
FDP_ITC.2.5/UCP	The TSF shall enforce the following rules when importing user data controlled under the SFP from outside the TOE: (1) *encrypted Update Code Package are stored only after successful verification of authenticity according to FCS_COP.1/VDSUCP,* (2) *authentic Update Code Package are decrypted according to FCS_COP.1/DecUCP*[228].

223 [selection: *during initial start-up, periodically during normal operation, at the request of the authorised user, at the conditions[assignment: conditions under which self test should occur]*]

224 [selection: *[assignment: parts of TSF], the TSF]*

225 [selection: *[assignment: parts of TSF data], TSF data*]

226 [selection: *[assignment: parts of TSF], TSF*]

227 [assignment: *access control SFP(s) and/or information flow control SFP(s)*]

228 [assignment: *additional importation control rules*]

FPT_TDC.1/UCP Inter-TSF basic TSF data consistency

Hierarchical to: No other components.

Dependencies: No dependencies.

FPT_TDC.1.1/UCP The TSF shall provide the capability to consistently interpret *security attributes Issuer and Version Number*[229] when shared between the TSF and another trusted IT product.

FPT_TDC.1.2/UCP The TSF shall use **the following rules**:

(1) *the Issuer must be identified and known,*

(2) *the Version Number must be identified*

when interpreting the TSF data from another trusted IT product.

FCS_COP.1/VDSUCP Cryptographic operation – Verification of digital signature of the Issuer

Hierarchical to: No other components.

Dependencies: [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]
FCS_CKM.4 Cryptographic key destruction

FCS_COP.1.1/VDSUCP The TSF shall perform *verification of the digital signature of the authorized Issuer*[230] in accordance with a specified cryptographic algorithm [assignment: *cryptographic algorithm*] and cryptographic key sizes [assignment: *cryptographic key sizes*] that meet the following: [assignment: *list of standards*].

Application note 32: The authorized *Issuer* is identified in the security attribute of the received Update Code Package and the public key of the authorized *Issuer* shall be known as TSF data before receiving the Update Code Package. Only the public key of the authorized Issuer shall be used for the verification of the digital signature of the Update Code Package.

FCS_COP.1/DecUCP Cryptographic operation – Decryption of authentic Update Code Package

Hierarchical to: No other components.

Dependencies: [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]
FCS_CKM.4 Cryptographic key destruction

FCS_COP.1.1/DecUCP The TSF shall perform *decryption of authentic encrypted Update Code Package*[231] in accordance with a specified cryptographic algorithm [assignment: *cryptographic algorithm*] and cryptographic key sizes [assignment: *cryptographic key sizes*] that meet the following: [assignment: *list of standards*].

FDP_ACC.1/UCP Subset access control – Update code Package

Hierarchical to: No other components.

Dependencies: FDP_ACF.1 Security attribute based access control

FDP_ACC.1.1/UCP The TSF shall enforce the *Update SFP*[232] on

(1) *subjects: [selection: Administrator, Update Agent];*

(2) *objects: Update Code Package*;

229 [assignment: *list of TSF data types*]

230 [assignment: *list of cryptographic operations*]

231 [assignment: *list of cryptographic operations*]

232 [assignment: *access control SFP*]

(3) *operations: import, store*[233].

FDP_ACF.1/UCP Security attribute based access control – Import Update Code Package

Hierarchical to: No other components.

Dependencies: FDP_ACC.1 Subset access control
FMT_MSA.3 Static attribute initialisation

FDP_ACF.1.1/UCP The TSF shall enforce the *Update SFP*[234] to objects based on the following:

(1) *subjects: [selection: Administrator, Update Agent];*

(2) *objects: Update Code Package with security attributes Issuer and Version Number*[235].

FDP_ACF.1.2/UCP The TSF shall enforce the following rules to determine if an operation among controlled subjects and controlled objects is allowed:

(1) *[selection: Administrator, Update Agent] is allowed to import Update Code Package according to FDP_ITC.2/UCP.*

(2) *[selection: Administrator, Update Agent] is allowed to store a Update Code Package if*

(a) authenticity is successfully verified according to FCS_COP.1/VDSUCP and the Update Code Package is decrypted according to FCS_COP.1/DecUCP

(b) the Version Number of the Update Code Package is equal or higher than the Version Number of the TSF.[236]

FDP_ACF.1.3/UCP The TSF shall explicitly authorise access of subjects to objects based on the following additional rules: [assignment: *rules, based on security attributes, that explicitly authorise access of subjects to objects*].

FDP_ACF.1.4/UCP The TSF shall explicitly deny access of subjects to objects based on the following additional rules: [assignment: *rules, based on security attributes, that explicitly deny access of subjects to objects*].

FDP_RIP.1/UCP Subset residual information protection

Hierarchical to: No other components

Dependencies: No dependencies.

FDP_RIP.1.1/UCP The TSF shall ensure that any previous information content of a resource is made unavailable upon the *deallocation of the resource* ***after unsuccessful verification of the digital signature of the Issuer according to FCS_COP.1/VDSUCP***[237] the following objects: *received Update Code Package* [238].

6.2 Security assurance requirements

The PP requires the TOE to be evaluated according to EAL2 augmented with ALC_CMS3 (Implementation representation CM coverage) and ALC_LCD.1 (Developer-Defined Lifecycle Model) , and with specific refinements on ALC_CMS.3, ADV_ARC.1 and ATE_IND.2.

233 [assignment: *list of subjects, objects, and operations among subjects and objects covered by the SFP*]

234 [assignment: *access control SFP*]

235 [assignment: *list of subjects and objects controlled under the indicated SFP, and for each, the SFP-relevant security attributes, or named groups of SFP-relevant security attributes*]

236 [assignment: *rules governing access among controlled subjects and controlled objects using controlled operations on controlled objects*]

237 [selection: *allocation of the resource to, deallocation of the resource from*]

238 [assignment: *list of objects*]

6.2.1 Assurance Refinements

Refinement on ALC_CMS.3.1C:

The implementation representation listed shall comprise the implementation representation of the TOE defining the TSF to a level of detail such that the compliance of the TOE and TSF to the requirements imposed by the platform guidances on which the TOE is designed to run on, can be verified by that evidence.

Refinement on ADV_ARC.1.3D:

The security guidance documentation of each platform (hardware platform and operating system) on which the TOE is designed to run shall be provided in addition.

Refinement on ADV_ARC.1.1C to 1.5C:

The security architecture description shall include an assessment how each single security requirement imposed by the platform documentation (guidance documentation and if available evaluation or certification results) has been followed in the TOE design and implementation concept.

Examples for such security requirements could include but are not limited to:

- **Dedicated library calls: Dedicated calls protecting against attacks may be provided by the platform for cryptographic operation. For example, dedicated calls implement operations that are hardened against timing side channel attacks, while others execute faster, but are not hardened. The platform guidance may require such library calls to be used.**
- **Key usage limitations: Key usage above a certain limit may reveal side channel information which can then be exploited. The implementation must ensure that the key usage limit is adhered to.**
- **Dedicated calls to ensure a correct program flow are provided (i.e. for boolean verification calls) to ensure protection against attacks that disturb the execution flow. Such library calls must be made use of in critical operations.**
- **Dedicated library calls are provided for the secure generation of cryptographic random numbers. Other random number generation functionality is present, but is not suitable to generate cryptographic random numbers. It must be ensured that correct random number generation library calls are used.**

Refinement on ADV_ARC.1.1E:

The evaluators task includes to check consistency of the requirements considered in the architectural description against those outlined in the platform documentation.

Refinement on ATE_IND.2.1D:

Providing the TOE for testing shall include in addition the implementation representation of the TOE as defined by ALC_CMS.3.

Refinement of ATE_IND.2.2C:

The resources provided shall include additionally appropriate tools or access to the TOE development environment in order to enable the evaluator to perform source code review most efficiently.

Refinement of ATE_IND.2.3E:

The evaluators test activities shall include a verification of the TOE implementation representation provided in order to confirm code compliance of the TOE implementation representation to the security guidance of the hardware platform and operating system and libraries which the TOE/TSF is intended to be run on. Therefore, the evaluator shall assess and verify that all platform guidance requirements are met and indicate possible vulnerabilities to the AVA evaluation activity for the TOE for further consideration.

6.3 Security requirements rationale

6.3.1 Dependency rationale

This chapter demonstrates that each dependency of the security requirements is either satisfied, or justifies the dependency not being satisfied.

Note, the column SFR components showing the concrete SFR satisfying the dependencies are typical use cases. It does not exclude that the SFR in the first column may solve dependencies of other SFR as well. E. g. the SFR FCS_CKM.1 defines requirements for ECC key generation, and a generated ECC key pair may not only be directly used for ECDSA digital signatures according to FCS_COP.1/CDS-RSA and FCS_COP.1/VDS-RSA, but also for encryption and decryption of the AES key in FCS_COP.1/HEM and FCS_COP.1/HDM.

SFR	Dependencies of the SFR	SFR components
FCS_CKM.1/AES	[FCS_CKM.2 Cryptographic key distribution, or FCS_COP.1 Cryptographic operation] FCS_CKM.4 Cryptographic key destruction	FCS_COP.1/ED FCS_CKM.4
FCS_CKM.1/AES_RSA	[FCS_CKM.2 Cryptographic key distribution, or FCS_COP.1 Cryptographic operation] FCS_CKM.4 Cryptographic key destruction	FCS_COP.1/HEM with FCS_CKM.1/AES_RSA, FCS_CKM.4
FCS_CKM.1/ECC	FCS_CKM.2 Cryptographic key distribution, or FCS_COP.1 Cryptographic operation] FCS_CKM.4 Cryptographic key destruction	FCS_COP.1/CDS-ECDSA, FCS_COP.1/VDS-ECDSA, FCS_CKM.4
FCS_CKM.1/ECKA-EG	[FCS_CKM.2 Cryptographic key distribution, or FCS_COP.1 Cryptographic operation] FCS_CKM.4 Cryptographic key destruction	FCS_COP.1/HEM with FCS_CKM.1/ECKA-EG, FCS_CKM.4
FCS_CKM.1/PACE	[FCS_CKM.2 Cryptographic key distribution, or FCS_COP.1 Cryptographic operation] FCS_CKM.4 Cryptographic key destruction	FCS_COP.1/TCE, FCS_COP.1/TCM, FCS_CKM.4
FCS_CKM.1/RSA	FCS_CKM.2 Cryptographic key distribution, or FCS_COP.1 Cryptographic operation] FCS_CKM.4 Cryptographic key destruction	FCS_COP.1/CDS-RSA, FCS_COP.1/VDS-RSA FCS_CKM.4
FCS_CKM.1/TCAP	[FCS_CKM.2 Cryptographic key distribution, or FCS_COP.1 Cryptographic operation] FCS_CKM.4 Cryptographic key destruction	FCS_COP.1/TCE, FCS_COP.1/TCM, FCS_CKM.4
FCS_CKM.4	[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]	FCS_CKM.1/ECC, FCS_CKM.1/RSA, FCS_CKM.1/ECKA-EG, FCS_CKM.1/AES_RSA, FCS_CKM.1/TCAP, FCS_CKM.1/PACE
FCS_CKM.5/AES	[FCS_CKM.2 Cryptographic key distribution, or FCS_COP.1 Cryptographic operation] FCS_CKM.4 Cryptographic key destruction	FCS_COP.1/ED FCS_CKM.4
FCS_CKM.5/AES_RSA	[FCS_CKM.2 Cryptographic key distribution, or FCS_COP.1 Cryptographic operation] FCS_CKM.4 Cryptographic key destruction	FCS_COP.1/HDM with FCS_CKM.5/AES_RSA, FCS_CKM.4
FCS_CKM.5/ECC	[FCS_CKM.2 Cryptographic key distribution, or FCS_COP.1 Cryptographic operation] FCS_CKM.4 Cryptographic key destruction	FCS_COP.1/CDS-ECDSA, FCS_COP.1/VDS-ECDSA, FCS_CKM.4
FCS_CKM.5/ECDHE	[FCS_CKM.2 Cryptographic key distribution, or FCS_COP.1 Cryptographic operation] FCS_CKM.4 Cryptographic key destruction	FCS_COP.1/HEM with FCS_CKM.5/ECDHE, FCS_CKM.4
FCS_CKM.5/ECKA-EG	[FCS_CKM.2 Cryptographic key distribution, or FCS_COP.1 Cryptographic operation] FCS_CKM.4 Cryptographic key destruction	FCS_COP.1/HDM with FCS_CKM.5/ECKA-EG, FCS_CKM.4
FCS_COP.1/CDS-ECDSA	[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] FCS_CKM.4 Cryptographic key destruction	FCS_CKM.1/ECC, FCS_CKM.4

SFR	Dependencies of the SFR	SFR components
FCS_COP.1/CDS-RSA	[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] FCS_CKM.4 Cryptographic key destruction	FCS_CKM.1/RSA, FCS_CKM.4
FCS_COP.1/DecUCP	[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] FCS_CKM.4 Cryptographic key destruction	Import of UCP decryption key as TSF data with confidentiality protection FPT_TCT.1/CK and FCS_COP.1/KU, FCS_CKM.4
FCS_COP.1/ED	[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] FCS_CKM.4 Cryptographic key destruction	FCS_CKM.1/AES, FCS_CKM.4
FCS_COP.1/Hash	[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] FCS_CKM.4 Cryptographic key destruction	Hash functions do not use keys
FCS_COP.1/HDM	[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] FCS_CKM.4 Cryptographic key destruction	FCS_CKM.5/ECKA-EG, FCS_CKM.5/AES_RSA, FCS_CKM.5/ECDHE (note deterministic FCS_CKM.5 play the role of randomized FCS_CKM.1) FCS_CKM.4
FCS_COP.1/HEM	[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] FCS_CKM.4 Cryptographic key destruction	FCS_CKM.1/ECKA-EG, FCS_CKM.1/AES_RSA, FCS_CKM.5/ECDHE, FCS_CKM.1/AES_RSA FCS_CKM.4
FCS_COP.1/HMAC	[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] FCS_CKM.4 Cryptographic key destruction	FCS_RNG.1 generates random strings as HMAC keys FCS_CKM.4
FCS_COP.1/KU	[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] FCS_CKM.4 Cryptographic key destruction	FCS_CKM.1/AES FCS_CKM.4

SFR	Dependencies of the SFR	SFR components
FCS_COP.1/KW	[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] FCS_CKM.4 Cryptographic key destruction	FCS_CKM.1/AES FCS_CKM.4
FCS_COP.1/MAC	[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] FCS_CKM.4 Cryptographic key destruction MT_MSA.2 Secure security attributes	FCS_CKM.1/AES, FCS_CKM.4
FCS_COP.1/TCE	[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] FCS_CKM.4 Cryptographic key destruction	FCS_CKM.1/TCAP, FCS_CKM.1/PACE, FCS_CKM.4
FCS_COP.1/TCM	[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] FCS_CKM.4 Cryptographic key destruction	FCS_CKM.1/TCAP, FCS_CKM.1/PACE, FCS_CKM.4
FCS_COP.1/VDS-ECDSA	[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] FCS_CKM.4 Cryptographic key destruction	FPT_ISA.1/Cert (note keys are TSF data), FCS_CKM.4
FCS_COP.1/VDS-RSA	[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] FCS_CKM.4 Cryptographic key destruction	FPT_ISA.1/Cert (note keys are TSF data), FCS_CKM.4
FCS_COP.1/VDSUCP	[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] FCS_CKM.4 Cryptographic key destruction	Import of signature verification key of UCP Issuer as TSF data FPT_ISA.1/Cert, FPT_TIT.1/Cert, FCS_CKM.4
FCS_RNG.1	No dependencies	
FDP_ACC.1/KM	FDP_ACF.1 Security attribute based access control	Dependency on FDP_ACF.1 is not fulfilled. Access control to key management functions are specified by FMT_MTD.1/KM because cryptographic keys are TSF data.
FDP_ACC.1/Oper	FDP_ACF.1 Security attribute based access control	FDP_ACF.1/Oper

SFR	Dependencies of the SFR	SFR components
FDP_ACC.1/UCP	FDP_ACF.1 Security attribute based access control	FDP_ACF.1/UCP
FDP_ACF.1/Oper	FDP_ACC.1 Subset access control FMT_MSA.3 Static attribute initialisation	FDP_ACC.1/Oper, FMT_MSA.3/KM
FDP_ACF.1/UCP	FDP_ACC.1 Subset access control FMT_MSA.3 Static attribute initialisation	FDP_ACC.1/UCP, FMT_MSA.3 is not included, because the security attributes of UCP are imported according to FDP_ITC.2/UCP without default values.
FDP_DAU.2/Att	FIA_UID.1 Timing of identification	FIA_UID.1
FDP_DAU.2/Sig	FIA_UID.1 Timing of identification	FIA_UID.1
FDP_ETC.1	[FDP_ACC.1 Subset access control, or FDP_IFC.1 Subset information flow control]	FDP_ACC.1/Oper
FDP_ETC.2	[FDP_ACC.1 Subset access control, or FDP_IFC.1 Subset information flow control]	FDP_ACC.1/Oper
FDP_ITC.2/UCP	[FDP_ACC.1 Subset access control, or FDP_IFC.1 Subset information flow control] [FTP_ITC.1 Inter-TSF trusted channel, or FTP_TRP.1 Trusted path] FPT_TDC.1 Inter-TSF basic TSF data consistency	FDP_ACC.1/UCP trusted communication is provided by FCS_COP.1/VDSUCP and FCS_COP.1/DecUCP, FPT_TDC.1/UCP
FDP_ITC.2/UD	[FDP_ACC.1 Subset access control, or FDP_IFC.1 Subset information flow control] [FTP_ITC.1 Inter-TSF trusted channel, or FTP_TRP.1 Trusted path] FPT_TDC.1 Inter-TSF basic TSF data consistency	FDP_ACC.1/Oper trusted communication is provided by FCS_COP.1/HDM and FCS_COP.1/VDS-*, FPT_TDC.1/CK because import of user data is intended for cryptographic operation with key
FDP_RIP.1/UCP	No dependencies	
FIA_AFL.1	FIA_UAU.1 Timing of authentication	FIA_UAU.1
FIA_API.1/CA	No dependencies	
FIA_API.1/PACE	No dependencies	
FIA_ATD.1	No dependencies	
FIA_UAU.1	FIA_UID.1 Timing of identification	FIA_UID.1
FIA_UAU.5	No dependencies	
FIA_UAU.6	No dependencies	
FIA_UID.1	No dependencies	
FIA_USB.1	FIA_ATD.1 User attribute definition	FIA_ATD.1

SFR	Dependencies of the SFR	SFR components
FMT_MOF.1	FMT_SMR.1 Security roles FMT_SMF.1 Specification of Management Functions	FMT_SMF.1, FMT_SMR.1
FMT_MSA.1/KM	[FDP_ACC.1 Subset access control, or FDP_IFC.1 Subset information flow control] FMT_SMR.1 Security roles FMT_SMF.1 Specification of Management Functions	FDP_ACC.1/KM, FDP_ACC.1/Oper, FMT_SMF.1, FMT_SMR.1
FMT_MSA.2	[FDP_ACC.1 Subset access control, or FDP_IFC.1 Subset information flow control] FMT_MSA.1 Management of security attributes FMT_SMR.1 Security roles	FDP_ACC.1/KM, FDP_ACC.1/Oper, FMT_MSA.1/KM, FMT_SMR.1
FMT_MSA.3/KM	FMT_MSA.1 Management of security attributes FMT_SMR.1 Security roles	FMT_MSA.1/KM, FMT_SMR.1
FMT_MTD.1/KM	FMT_SMR.1 Security roles FMT_SMF.1 Specification of Management Functions	FMT_SMF.1, FMT_SMR.1
FMT_MTD.1/RAD	FMT_SMR.1 Security roles FMT_SMF.1 Specification of Management Functions	FMT_SMF.1, FMT_SMR.1
FMT_MTD.1/RK	FMT_SMR.1 Security roles FMT_SMF.1 Specification of Management Functions	FMT_SMF.1, FMT_SMR.1
FMT_MTD.3	FMT_MTD.1 Management of TSF data	FMT_MTD.1/RAD
FMT_SAE.1	FMT_SMR.1 Security roles, FPT_STM.1 Reliable time stamps	FMT_SMR.1, dependency on FPT_STM.1 is not fulfilled, cf. to the application note to FMT_SAE1
FMT_SMF.1	No dependencies	
FMT_SMR.1	FIA_UID.1 Timing of identification	FIA_UID.1
FPT_ESA.1/CK	[FDP_ACC.1 Subset access control, or FDP_IFC.1 Subset information flow control] [FMT_MTD.1 Management of TSF data or FMT_MTD.3 Secure TSF data] [FMT_MSA.1 Management of security attributes, or FMT_MSA.4 Security attribute value inheritance] FPT_TDC.1 Inter-TSF basic TSF data consistency	FDP_ACC.1/KM, FMT_MTD.1/KM FMT_MSA.1/KM FPT_TDC.1/CK
FPT_FLS.1	No dependencies	

SFR	Dependencies of the SFR	SFR components
FPT_ISA.1/Cert	[FDP_ACC.1 Subset access control, or FDP_IFC.1 Subset information flow control] [FMT_MTD.1 Management of TSF data or FMT_MTD.3 Secure TSF data] [FMT_MSA.1 Management of security attributes, or FMT_MSA.4 Security attribute value inheritance] FPT_TDC.1 Inter-TSF basic TSF data consistency	FDP_ACC.1/KM, FMT_MTD.1/RK, FMT_MSA.1/KM FPT_TDC.1/Cert
FPT_ISA.1/CK	[FDP_ACC.1 Subset access control, or FDP_IFC.1 Subset information flow control] [FMT_MTD.1 Management of TSF data or FMT_MTD.3 Secure TSF data] [FMT_MSA.1 Management of security attributes, or FMT_MSA.4 Security attribute value inheritance] FPT_TDC.1 Inter-TSF basic TSF data consistency	FDP_ACC.1/KM, FMT_MTD.1/RK, FMT_MTD.1/KM FMT_MSA.1/KM FPT_TDC.1/Cert
FPT_TCT.1/CK	[FDP_ACC.1 Subset access control, or FDP_IFC.1 Subset information flow control] [FMT_MTD.1 Management of TSF data or FMT_MTD.3 Secure TSF data]	FDP_ACC.1/KM, FMT_MTD.1/RK, FMT_MTD.1/KM
FPT_TDC.1/Cert	No dependencies	
FPT_TDC.1/CK	No dependencies	
FPT_TDC.1/UCP	No dependencies	
FPT_TIT.1/Cert	[FDP_ACC.1 Subset access control, or FDP_IFC.1 Subset information flow control] [FMT_MTD.1 Management of TSF data or FMT_MTD.3 Secure TSF data]	FDP_ACC.1/KM, FMT_MTD.1/RK
FPT_TIT.1/CK	[FDP_ACC.1 Subset access control, or FDP_IFC.1 Subset information flow control] [FMT_MTD.1 Management of TSF data or FMT_MTD.3 Secure TSF data]	FDP_ACC.1/KM, FMT_MTD.1/KM
FPT_TST.1	No dependencies	
FTP_ITC.1	No dependencies	

Table 6: Dependency rationale

6.3.2 Security functional requirements rationale

Table 7 traces each SFR back to the security objectives for the TOE.

	O.I&A	O.AuthentTOE	O.Enc	O.DataAuth	O.RBGS	O. TChann	O.AccCtrl	O.SecMan	O.TST	O.SecUpCP
FCS_CKM.1/AES			x	x				x		
FCS_CKM.1/AES_RSA			x	x				x		
FCS_CKM.1/ECC		x	x	x				x		
FCS_CKM.1/ECKA-EG			x	x				x		
FCS_CKM.1/PACE		x				x		x		
FCS_CKM.1/RSA		x	x	x				x		
FCS_CKM.1/TCAP		x				x		x		
FCS_CKM.4			x	x				x		
FCS_CKM.5/AES			x	x				x		
FCS_CKM.5/AES_RSA			x	x				x		
FCS_CKM.5/ECC			x	x				x		
FCS_CKM.5/ECDHE			x	x				x		
FCS_CKM.5/ECKA-EG			x	x				x		
FCS_COP.1/CDS-ECDSA		x		x						
FCS_COP.1/CDS-RSA		x		x						
FCS_COP.1/DecUCP										x
FCS_COP.1/ED			x					x		
FCS_COP.1/Hash				x				x		
FCS_COP.1/HDM			x	x						
FCS_COP.1/HEM			x	x						
FCS_COP.1/HMAC		x		x						
FCS_COP.1/KU								x		
FCS_COP.1/KW								x		
FCS_COP.1/MAC				x						
FCS_COP.1/TCE						x				
FCS_COP.1/TCM						x				
FCS_COP.1/VDS-ECDSA				x						
FCS_COP.1/VDS-RSA				x						
FCS_COP.1/VDSUCP										x
FCS_RNG.1					x			x		
FDP_ACC.1/KM							x	x		
FDP_ACC.1/Oper							x			

	O.I&A	O.AuthentTOE	O.Enc	O.DataAuth	O.RBGS	O. TChann	O.AccCtrl	O.SecMan	O.TST	O.SecUpCP
FDP_ACC.1/UCP										x
FDP_ACF.1/Oper							x			
FDP_ACF.1/UCP										x
FDP_DAU.2/Att		x								
FDP_DAU.2/Sig				x						
FDP_ETC.1				x						
FDP_ETC.2			x	x						
FDP_ITC.2/UCP										x
FDP_ITC.2/UD			x	x						
FDP_RIP.1/UCP										x
FIA_AFL.1	x									
FIA_API.1/CA	x	x				x				
FIA_API.1/PACE	x	x				x				
FIA_ATD.1	x						x	x		
FIA_UAU.1	x									
FIA_UAU.5	x					x				
FIA_UAU.6	x									
FIA_UID.1	x									
FIA_USB.1	x									
FMT_MOF.1	x					x				
FMT_MSA.1/KM			x	x		x	x	x		
FMT_MSA.2							x	x		
FMT_MSA.3/KM							x	x		x
FMT_MTD.1/KM								x		
FMT_MTD.1/RAD	x									
FMT_MTD.1/RK	x		x	x				x		
FMT_MTD.3	x									
FMT_SAE.1	x									
FMT_SMF.1								x		
FMT_SMR.1	x							x		
FPT_ESA.1/CK								x		
FPT_FLS.1									x	
FPT_ISA.1/Cert	x			x				x		x

	O.I&A	O.AuthentTOE	O.Enc	O.DataAuth	O.RBGS	O. TChann	O.AccCtrl	O.SecMan	O.TST	O.SecUpCP
FPT_ISA.1/CK								x		
FPT_TCT.1/CK								x		x
FPT_TDC.1/CK			x	x				x		
FPT_TDC.1/Cert	x		x	x				x		
FPT_TDC.1/UCP										x
FPT_TIT.1/Cert	x			x				x		x
FPT_TIT.1/CK								x		
FPT_TST.1									x	
FTP_ITC.1						x				

Table 7: Security functional requirement rationale

The following part of the chapter demonstrates that the SFRs meet all security objectives for the TOE.
The security objective for the TOE O.I&A “Identification and authentication of users” is met by the following SFR:

- The SFR FIA_ATD.1 lists the security attributes *Identity*, *Authentication reference data* and *Role* belonging to individual users and the SFR FMT_SMR.1 defines the security roles maintained by TSF.
- The SFR FIA_USB.1 requires the TSF to associate the user security attributes *Identity* and *Role* with subjects acting on the behalf of that user.
- The SFR FIA_UID.1 defines the TSF-mediated actions allowed on behalf of Unidentified User.
- The SFR FIA_UAU.1 defines the TSF-mediated actions allowed on behalf of Unauthenticated User.
- The SFR FIA_UAU.5 requires the TSF lists the authentication mechanisms and the rules for their application.
- The SFR FIA_API.1/CA and FIA_API.1/PACE require the TSF to authenticate external entities using Chip Authentication and PACE to communication endpoints of trusted channels.
- The SFR FIA_UAU.6 requires the TSF to request re-authentication of users under the listed conditions.
- The SFR FMT_MOF.1 requires the TSF to enable and disable of human user authentication.
- The SFR FMT_MTD.1/RAD and The SFR FMT_MTD.1/RK defines the management function of and the access limitation to authentication mechanisms and their TSF data including the root public keys.
- The SFR FMT_MTD.3 enforce secure values for password mechanisms.
- The SFR FMT_SAE.1 requires the TSF to limit the validity of user authentication and reset the security attribute Role to a values defined by an administrator according to FMT_MTD.1/RAD.
- The SFR FIA_AFL.1 requires the TSF to detect and react on failed authentication attempts.
- The SFR FPT_ISA.1/Cert and FPT_TIT.1/Cert require the TSF to import certificates integrity protected and with their security attributes including those for entity authentication.
- The SFR FPT_TDC.1/Cert requires the TSF to interpret the certificates correctly.

The security objective for the TOE O.AuthentTOE “Authentication of the TOE to external entities” is met by the following SFR:

– The SFR FCS_CKM.1/ECC, FCS_CKM.1/RSA require the TSF to generate TOE authentication keys and SFR FCS_CKM.1/PACE and FCS_CKM.1/TCAP require the TSF to agree keys for authentication of the TOE to external entities.
– The SFR FCS_COP.1/CDS-ECDSA and FCS_COP.1/CDS-RSA require the TSF to generate digital signatures for authentication of the TOE to external entities.
– SFR FCS_COP.1/HMAC requires the TSF to generate HMAC for authentication of the TOE to external entities.
– The SFR FIA_API.1/CA, and FIA_API.1/PACE require the TSF to authenticate themselves using Chip Authentication, and PACE to communication endpoints of trusted channels.
– The SFR FDP_DAU.2/Att requires the TSF to generate evidence that can be used as a guarantee of the validity of attestation data to external entities.

The security objective for the TOE O.Enc “Confidentiality of user data by means of encryption and decryption” is met by the following SFR:

– The SFR FCS_CKM.1/ECC and FCS_CKM.1/RSA require (long term) key generation for the encryption and decryption security service of the TSF.
– The SFR FCS_CKM.1/AES, FCS_CKM.1/AES_RSA, FCS_CKM.5/ECDHE, and FCS_CKM.1/ECKA-EG, require key generation and FCS_CKM.5/AES, FCS_CKM.5/AES_RSA, FCS_CKM.5/ECKA-EG and FCS_CKM.5/ECC require key derivation for encryption and decryption security service of the TSF. Note the keys must be generated or agreed with the appropriate key type for encryption respectively for decryption or in case of symmetric cryptographic mechanisms for both according to FMT_MSA.1/KM.
– The FCS_COP.1/ED requires encryption and decryption as cryptographic operations for the encryption and decryption security service of the TSF.
– The FCS_COP.1/HDM requires hybrid decryption and the SFR FCS_COP.1/HEM requires hybrid encryption and decryption as cryptographic operations for the encryption and decryption security service of the TSF.
– The SFR FDP_ETC.2 require the TSF to export encrypted user data with reference to the key and data integrity checksums for decryption and FDP_ITC.2/UD require import of encrypted user data with reference to decryption key and data integrity checksums for decryption.
– The SFR FCS_CKM.4 requires the TSF to implement secure key destruction.
– The SFR FMT_MTD.1/RK requires the TSF management of root keys for key hierarchy known to the TSF if used for encryption.
– The SFR FPT_TDC.1/Cert requires the TSF to interpret consistently the security attributes of certificates (including those used for encryption and decryption).
– The SFR FPT_TDC.1/CK requires the TSF to interpret consistently the security attributes of keys (including those used for encryption and decryption).

The security objective for the TOE O.DataAuth “Data authentication by cryptographic mechanisms” is met by the following SFR:

– The SFR FCS_CKM.1/ECC and FCS_CKM.1/RSA require (long term) key generation for the signature security service of the TSF. The SFR FCS_CKM.1/AES, FCS_CKM.1/ECKA-EG, FCS_CKM.1/AES_RSA require key generation and FCS_CKM.5/AES_RSA, FCS_CKM.5/ECDHE, FCS_CKM.5/ECC, FCS_CKM.5/ECKA-EG key derivation for MAC generation and verification. Note the keys must be generated or agreed with the appropriate key type for signature-creation, signature-verification or, in case of symmetric cryptographic mechanisms for data authentication according to FMT_MSA.1/KM.
– The SFR FDP_ETC.2 require the TSF to export signed data with and signature and public key reference for signature verification and FDP_ITC.2/UD import of signed data with signature and public key

reference for signature verification. The SFR FDP_ETC.1 require the TSF to export successfully MAC verified and decrypted ciphertext as plaintext according to FCS_COP.1/HDM without the user data's associated security attributes:

- The SFR FCS_COP.1/Hash requires the TSF to implement cryptographic primitive hash function used for HMAC, cf. FCS_COP.1/HMAC, digital signature creation, cf. FCS_COP.1/CDS-*and digital signature verification, cf. FCS_COP.1/VDS-*.
- The FCS_COP.1/CDS-ECDSA and FCS_COP.1/CDS-RSA require asymmetric cryptographic mechanisms for signature-creation.
- The SFR FCS_COP.1/VDS-ECDSA and FCS_VDS/RSA require asymmetric cryptographic mechanisms for signature-verification.
- The SFR for keyed hash FCS_COP.1/HMAC and block cipher based MAC FCS_COP.1/MAC require the TSF to provide symmetric data integrity mechanisms.
- The SFR FCS_COP.1/HEM requires hybrid MAC calculation and FCS_COP.1/HDM requires hybrid MAC verification for the ciphertext as security service of the TSF.
- The SFR FPT_ISA.1/Cert requires import of certificates with security attributes and integrity protection according to FPT_TIT.1/Cert.
- The SFR FCS_CKM.4 requires the TSF to implement secure key destruction.
- The SFR FPT_TDC.1/Cert requires the TSF to interpret consistently the security attributes in certificates (including those used for data authentication).
- The SFR FPT_TDC.1/CK requires the TSF to interpret consistently the security attributes keys (including those used for data authentication).

The security objective for the TOE O.RBGS “Random bit generation service” is met directly by the SFR FCS_RNG.1 as providing random bits for the service to the user.

The security objective for the TOE O.TChann “Trusted channel” is met by the following SFR:

- The SFR FTP_ITC.1 requires different types of trusted channel depending on the capability of the other endpoint. The cases are defined in table 4. The remote entity and the TOE may use mutual authentication and key agreement by means of PACE according to FCS_CKM.1/PACE, shall provide integrity protection according to FCS_COP.1/TCM and may support confidentiality of the communication data according to FCS_COP.1/TCE. The cases 3 requires support of trusted channel with mutual authentication by FIA_API.1/CA, FIA_UAU.5, key agreement TCAP according to FCS_CKM.1/TCAP, encryption and MAC data authentication.
- The TOE authenticate themselves according to FIA_API.1/PACE in case of PACE. It authenticates themselves according to FIA_API.1/CA in case of TCAP as Proximity Integrated Circuit Card (PICC).
- The SFR FMT_MOF.1 limits the configuration of the trusted channel according to FTP_ITC.1.3 to an administrator.
- The SFR FMT_MSA.1/KM describe the requirements for management of key security attributes for these mechanisms.

The security objective for the TOE O.AccCtrl “Access control” is met by the following SFR:

- The SFR FIA_ATD.1 defines the security attributes of individual users including *Role* which is used for access control according to FDP_ACF.1/Oper.
- The SFR FDP_ACC.1/Oper describes the subset access control for the *Cryptographic Operation* SFP.
- The SFR FDP_ACF.1/Oper defines the access control rules of the *Cryptographic Operation* SFP.
- The *Cryptographic Operation* SFP is defined by means of security attributes managed according to the SFR FMT_MSA.1/KM, FMT_MSA.2 and FMT_MSA.3/KM.

The security objective for the TOE O.SecMan “Security management” is met by the following SFR:

- The SFR FIA_ATD.1 defines the security attributes of individual users including *Role* which is used to enforce the *Key Management SFP*.
- The SFR FDP_ACC.1/KM defines subjects, objects and operations of the *Key Management SFP*.
- The SFR FMT_SMF.1 lists the security management functions provided by the TSF.
- The SFR FMT_SMR.1 lists the security role supported by the TOE especially the administrator and – if supported - Crypto-Officer responsible for key management.
- The SFR FCS_CKM.1/AES, FCS_CKM.1/ECC, FCS_CKM.1/ECKA-EG. FCS_CKM.1/PACE, FCS_CKM.1/RSA, FCS_CKM.1/AES_RSA, FCS_CKM.1/TCAP require the TSF to implement key generation function according to the assigned standards.
- The SFR FCS_CKM.5/ECDHE require the TSF to implement key agreement function according to the assigned standards.
- The SFR FCS_CKM.5/AES and FCS_CKM.5/ECKA-EG require the TSF to implement key derivation function according to the assigned standards.
- The SFR FCS_CKM.1/AES_RSA and FCS_CKM.5/AES_RSA require the TSF to implement AES session key generation function with RSA key encryption respective RSA key decryption and AES key derivation according to the assigned standards.
- The SFR FCS_RNG.1 requires the TSF to implement a random number generator for key generation, key agreement functions and cryptographic operations.
- The SFR FCS_COP.1/ED requires the TSF to provide encryption and decryption according to AES which may be used for key management.
- The SFR FCS_COP.1/Hash requires the TSF to implement cryptographic primitive hash function for key derivation, cf. FCS_CKM.5.
- The SFR FPT_ISA.1/CK requires import and FPT_ESA.1/CK the export of cryptographic keys with security attributes and protection of confidentiality according to SFR FPT_TCT.1/CK and integrity protection according to FPT_TIT.1/CK.
- The SFR FPT_ISA.1/Cert requires import of certificates with security attributes and integrity protection according to FPT_TIT.1/Cert.
- The SFR FPT_TDC.1/Cert requires consistent interpretation of certificate’s content. The SFR FPT_TDC.1/CK requires consistent interpretation of security attributes imported with the key.
- The SFR FCS_COP.1/KW and FCS_COP.1/KU require the TSF key wrapping and unwrapping for key management.
- The SFR FCS_CKM.4 requires the TSF to implement secure key destruction.
- The SFR FMT_MSA.1/KM and FMT_MSA3/KM limit the setting of default values and specification of alternative initial values for security attributes of cryptographic keys to administrators. The SFR FMT_MSA.1/KM prevents modification or deletion of security attributes of keys.
- FMT_MSA.2 enforce secure values for security attributes.
- The SFR FMT_MTD.1/KM and FMT_MTD.1/RK restricts the management of cryptographic keys espacially the import of root public keys to specifically authorized users.

TOE O.TST “Self-test” is directly met by the SFR FPT_TST.1 and FPT_FLS.1. The TSF shall preserve a secure state if self test fails.

The security objective for the TOE O.SecUpCP “Secure import of Update Code Package” is met by the following SFR:

- The SFR FDP_ACC.1/UCP and FDP_ACF.1/UCP requires the TSF to provide access control to enforce SFP *Update*. Note the verification of the authenticity of UCP and decryption of authentic UCP are performed under control of the TSF.
- The SFR FCS_COP.1/VDSUCP requires the verification of digital signature of the Issuer and FCS_COP.1/DecUCP requires decryption of authentic of UCP.
- The SFR FDP_ITC.2/UCP requires the TSF to import UCP as user data with security attributes if the authenticity of UCP is successful verified.
- The SFR FPT_TDC.1/UCP requires the TSF to import consistently the security attributes of the UCP.
- The SFR FMT_MSA.3 requires to provide restrictive initial security attributes to enforce the SFP *Update*.
- The SFR FDP_RIP.1/UCP requires the TSF to remove the received UCP after unsuccessful verification of its authenticity.
- The UCP signature verification key may be updated according to FPT_ISA.1/Cert with integrity protection according to FPT_TIT.1/Cert.
- The UCP decryption key may be updated with confidentiality protection according to FPT_TCT.1/CK with FCS_COP.1/KU.

6.3.3 Security assurance requirements rationale

Developers and users require for the TOE a low to moderate level of independently assured security in the absence of ready availability of the complete development record.

The EAL2 was chosen because it provides assurance by a full security target and an analysis of the SFRs in that ST, using a functional and interface specification, guidance documentation and a basic description of the architecture of the TOE, to understand the security behaviour. The analysis is supported by independent testing of the TSF, evidence of developer testing based on the functional specification, selective independent confirmation of the developer test results, and a vulnerability analysis (based upon the functional specification, TOE design, security architecture description and guidance evidence provided) demonstrating resistance to penetration attackers with a basic attack potential. EAL2 also provides assurance through use of a configuration management system and evidence of secure delivery procedures.

ALC_CMS.3 has been augmented to include the implementation representation as needed for ADV_ARC and ATE_IND refinements and to get evidence that the implementation representation provided is the one of the TOE. This means that the implementation representation is part of the configuration list.

CSPLight usually requires an initial configuration and/or the installation of key material and trust certificates. Hence, ALC_LCD.1 has been augmented such that the lifecycle of the TOE is defined by the developer and thus made explicit.

For getting confidence that the platform of the TOE (operational environment) is used by the TOE in a way that the requirements on security as outlined in the platform documentation (guidance documentation and if available evaluation or certification results) have been followed in the TOE design and implementation, refinements of ADV_ARC, ATE_IND and ALC_CMS have been defined.

The goal is to ensure that the TOE implementation does not include obvious vulnerabilities caused by incorrect use of the platform and that all relevant platform guidance requirements are adhered to. Therefore, only those requirements have to be considered that are related to the TOE functionality and security claims of the Security Target of the TOE.

The refinement of ADV_ARC ensures that the developer outlines how he has considered the requirements from the platform within his TOE security architecture and design concept. The evaluators task is to check consistency of the requirements considered against those outlined in the platform documentation.

As a second step of verification that the relevant platform requirements have been considered correctly, the independent evaluator activity at ATE_IND has been refined. The evaluator has to perform a specific „source

code review“, by means of cross check of the requirements from the platform to the implementation representation of the TOE by examine the implementation representation of the TOE using appropriate tools and the evidence from ADV_ARC.

7 Reference Documentation

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Keywords and Abbreviations

Term	Description
authentication reference data	data used by the TOE to verify the authentication attempt of a user
authentication verification data	data used by the user to authenticate themselves to the TOE
authenticity	the property that ensures that the identity of a subject or resource is the one claimed (cf. ISO/IEC 7498-2:1989)
cluster	a system of TOE samples initialized by an administrator and communication through trusted channels in order to manage known users and to share the cryptographic keys
cryptographic key	a variable parameter which is used in a cryptographic algorithm or protocol
data integrity	the property that data has not been altered or destroyed in an unauthorized manner (cf. ISO/IEC 7498-2:1989)
firmware	executable code that is stored in hardware and cannot be dynamically written or modified during execution while operating on a non-modifiable or limited execution platform, cf. ISO/IEC 19790
hardware	physical equipment or comprises the physical components used to process programs and data or to protect physically the processing components, cf. ISO/IEC 19790
Issuer of update code package	Trusted authority issuing an update code package (UCP) and holding the signature private key for signing the UCP and corresponding to the public key implemented in the TOE for verification of the UCP. The issuer is typically the TOE manufacturer. The issuer of an UCP is identified by the security attribute Issuer of the UCP.
Platform guidance	All documentation provided by the hardware manufacturer, or software platform manufacturer, that provides information on how to securely implement functionality.
private key	confidential key used for asymmetric cryptographic mechanisms like decryption of cipher text, signature-creation or authentication proof, where it is difficult for the adversary to derive the confidential private key from the known public key
public key	public known used for asymmetric cryptographic mechanisms like encryption of cipher text, signature-verification or authentication verification, where it is difficult for the adversary to derive the confidential private key from the known public key

secret key	key of symmetric cryptographic mechanisms, using two identical keys with the same secret value or two different values, where one may be easy calculated from the other one, for complementary operations like encryption / decryption, signature-creation / signature-verification, or authentication proof / authentication verification.
secure channel	a trusted channel which is physically protected and logical separated communication channel between the TOE and the user, or is protected by means of cryptographic mechanisms
software	executable code that is stored on erasable media which can be dynamically written and modified during execution while operating on a modifiable execution platform, cf. ISO/IEC 19790
trusted channel	a means by which a TSF and another trusted IT product can communicate with necessary confidence (cf. CC part 1[CC1], paragraph 97)
update code package	code if implemented changing the TOE implementation at the end of the TOE life time

Table 8: Glossary

Acronym	Term
A.xxx	Assumption
CC	Common Criteria
CSP	cryptographic service provider
ECC	Elliptic curve cryptography
HMAC	Keyed-Hash Message Authentication Code
KDF	Key derivation function
MAC	Message Authentication Code
n. a.	Not applicable
O.xxx	Security objective for the TOE
OE.xxx	Security objective for the TOE environment
OSP.xxx	Organisational security policy
PACE	Password Authenticated Connection Establishment
PKI	Public key infrastructure
PP	Protection profile
SAR	Security assurance requirements
SFR	Security functional requirement
T.xxx	Threat
TOE	Target of Evaluation
TSF	TOE security functionality
UCP	update code package

Table 9: Abbreviations