W75F40W[W/R][I/J/W][B/C]

&

W75F40W[BY/Q3][I/J/W][C/B]G

Secure Flash Memory

Security Target

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1 Security Target Introduction

This introductory chapter contains the following sections:

- Security Target Reference
- TOE Reference
- TOE Overview
- TOE Description
- TOE operating modes and life-cycle

This Security Target is based on the Security IC Platform Protection Profile with Augmentation Packages [5]. However, the Security Target does not include the Random Generation and the IC Identification security objectives. The corresponding assumptions of the Protection Profile are not used and replaced by other assumptions.

On the other hand, the Security Target includes additional elements which are not required by the Protection Profile [5]. Those security elements (threats, security objectives, SFR) are clearly identified in each Chapter of this document.

1.1 Security Target Reference

Title: W75F40W[W/R][I/J/W][B/C] & W75F40W[BY/Q3][I/J/W][C/B]G Secure Flash Memory Security Target

Version: I

Authors: Winbond Technology Ltd.

Evaluator: Applus

Certified by: CCN Organismo de Certificacion

1.2 TOE Reference

The Target of Evaluation is identified as below:

Commercial Name	SpiFlash® TrustME™ Secure Flash Memory
Product Name	W75F40W[W/R][I/J/W][B/C] & W75F40W[BY/Q3][I/J/W][C/B]G
Version	AA
Guidance	Refer to table 2

Table 1 TOE Identification

1.3 TOE Overview

1.3.1 TOE Type

The Target of Evaluation is a Memory Flash IC.

1.3.2 TOE Intended Usage

The TOE is dedicated to be embedded into highly critical hardware devices such as smart card, secure element, USB token, secure micro SD, etc. These devices will embed secure applications such as financial, telecommunication, identity (e-Government), etc and will be working in a hostile environment. In particular, the TOE is dedicated to the secure storage of the code and data of critical applications.

The security needs for the TOE consist in:

- Maintaining the integrity of the content of the memories and the confidentiality of the content of protected memory areas as required by the critical HW products (e.g. Security IC) the Memory Flash is built for;
- Providing a secure communication with the Host device that will embed the TOE in a secure HW product such as Security IC;

1.3.3 Non-TOE Hardware/Software/Firmware

For the present ST, the TOE is a pure storage hardware device.

The TOE does not comprise:

a) The Host device that will embed the TOE and will be needed to run the TOE in order to stimulate the TSF
b) SPI Bus for the communication between the Host device and the TOE.

The ST assumes that all components (Hardware or Software) of the Host Device are appropriately protected in the TOE security environment.

1.4 TOE Description

1.4.1 Physical Scope

The TOE comprises:

- All security functionality necessary to ensure the secure execution of the Memory Flash:

No	Type	Identifier	Part Number [1]	Delivery Method	Notes
Form of delivery: Known Good Die Device					
1	HW	IC Part number	W75F40WWIB	Via Courier	4Mb, 1.8V, Wafer Form, Industrial, No Pre-bind, HW SFI
2	HW	IC Part number	W75F40WWJB	Via Courier	4Mb, 1.8V, Wafer Form, Industrial Plus, No Pre-bind, HW SFI
3	HW	IC Part number	W75F40WWWB	Via Courier	4Mb, 1.8V, Wafer Form, Wireless, No Pre-bind, HW SFI
4	HW	IC Part number	W75F40WWIC	Via Courier	4Mb, 1.8V, Wafer Form, Industrial, Pre-bind, HW SFI
5	HW	IC Part number	W75F40WWJC	Via Courier	4Mb, 1.8V, Wafer Form, Industrial Plus, Pre-bind, HW SFI
6	HW	IC Part number	W75F40WWWC	Via Courier	4Mb, 1.8V, Wafer Form, Wireless, Pre-bind, HW SFI
7	HW	IC Part number	W75F40WRIB	Via Courier	4Mb, 1.8V, RDL Wafer Form, Industrial, No Pre-bind, HW SFI
8	HW	IC Part number	W75F40WRJB	Via Courier	4Mb, 1.8V, Wafer Form, Industrial Plus, No Pre-bind, HW SFI
9	HW	IC Part number	W75F40WRWB	Via Courier	4Mb, 1.8V, RDL Wafer Form, Wireless, No Pre-bind, HW SFI
10	HW	IC Part number	W75F40WRIC	Via Courier	4Mb, 1.8V, RDL Wafer Form, Industrial, Pre-bind, HW SFI
11	HW	IC Part number	W75F40WRJC	Via Courier	4Mb, 1.8V, RDL Wafer Form, Industrial Plus, Pre-bind, HW SFI
12	HW	IC Part number	W75F40WRWC	Via Courier	4Mb, 1.8V, RDL Wafer Form, Wireless, Pre-bind, HW SFI
Form of delivery: Assembled Device					
1	HW	IC Part number	W75F40WBYICG	Via Courier	4Mb, 1.8V, WLCSP, Industrial, Pre-bind, HW-SFI, Green package
2	HW	IC Part number	W75F40WQ3ICG	Via Courier	4Mb, 1.8V, QFN32, Industrial, Pre-bind, HW-SFI, Green package
3	HW	IC Part number	W75F40WBYIBG	Via Courier	4Mb, 1.8V, WLCSP, Industrial, No Pre-bind, HW-SFI, Green package

[1] TOE part numbers options as described in chaper 9 - ORDERING INFORMATION of the Datasheet [6] .
TOE IC is identical for all part numbers and meets the superset range of temperatures.

No	Type	Identifier	Part Number [1]	Delivery Method	Notes
4	HW	IC Part number	W75F40WQ3IBG	Via Courier	4Mb, 1.8V, QFN32, Industrial, No Pre-bind, HW-SFI, Green package
5	HW	IC Part number	W75F40WBYWCG	Via Courier	4Mb, 1.8V, WLCSP, Wireless, Pre-bind, HW-SFI, Green package
6	HW	IC Part number	W75F40WQ3WCG	Via Courier	4Mb, 1.8V, QFN32, Wireless, Pre-bind, HW-SFI, Green package
7	HW	IC Part number	W75F40WBYWBG	Via Courier	4Mb, 1.8V, WLCSP, Wireless, No Pre-bind, HW-SFI, Green package
8	HW	IC Part number	W75F40WQ3WBG	Via Courier	4Mb, 1.8V, QFN32, Wireless, No Pre-bind, HW-SFI, Green package
9	HW	IC Part number	W75F40WBYJCG	Via Courier	4Mb, 1.8V, WLCSP, Industrial plus, Pre-bind, HW-SFI, Green package
10	HW	IC Part number	W75F40WQ3JCG	Via Courier	4Mb, 1.8V, QFN32, Industrial plus, Pre-bind, HW-SFI, Green package
11	HW	IC Part number	W75F40WBYJBG	Via Courier	4Mb, 1.8V, WLCSP, Industrial plus, No Pre-bind, HW-SFI, Green package
12	HW	IC Part number	W75F40WQ3JBG	Via Courier	4Mb, 1.8V, QFN32, Industrial plus, No Pre-bind, HW-SFI, Green package

Form of delivery: Associated IC Dedicated Documentation

No	Type	Identifier	Version	Delivery Method	Full Name	Hash	Notes
1	PDF	W75F40WxxBx AGD Preparative User Guide	C	Encrypted mail	W75F40WxxBx_AGD_PRE_RevC_21Nov23.pdf	db882c00381109c682943d5e8529eda73ccbb5f907e52863bdfa4f5641b5966f	For No Pre-bind
2	PDF	W75F40WxxCx AGD Preparative User Guide	C	Encrypted mail	W75F40WxxCx_AGD_PRE_RevC_21Nov23.pdf	2fab87fc33a77b354c463ac8a90f76472594f163fe697d03e1473d738dba21e2	For Pre-bind
3	PDF	W75F40WxxBx AGD Operational User Guide	B	Encrypted mail	W75F40WxxBx_AGD_OPE_RevB_14Jun23.pdf	e07c660c0ccfd1a9ee5b4876441b1f0c501b7f83039e7f1139d454a8ac2adeb2	For No Pre-bind
4	PDF	W75F40WxxCx AGD Operational User Guide	B	Encrypted mail	W75F40WxxCx_AGD_OPE_RevB_14Jun23.pdf	6b830089fbda5db400d3cdc05378979c5201579b30018a5a83094920df6eb6e2	For Pre-bind
5	PDF	W75F40WxxCx/ W75F40WxxBx Secure Flash Datasheet	A5	Mail	W75F40WxxBx_W75F40WxxCx_Datasheet_RevA5_20Nov23.pdf	2bb12f23755aa3690240c8e9817c070d4ca382188668eb095ba5a545d005c17e	For all
6	PDF	SFI IP Functional Specification	A2	Encrypted mail	SFI3_FS_v3.22_RevA2_210728.pdf	85e21393db862cd3c7b51fb4802bcf22ddb91739d7276005aa7c719797da7e34	For all

No	Type	Identifier	Part Number [1]	Delivery Method	Notes		
7	PDF	W75F Pre-Binding Application Note	B	Encrypted mail	W75F Pre-Binding AN RevB 11May23.pdf	4e2063aec42fd25940c16dc497328b2847afc0688034db1369d46a2fb6de6601	For Pre-bind
8	PDF	HUID to pre-Binding Key mapping formula	N/A	Encrypted mail	N/A	N/A	For Pre-bind[2]

Table 2 TOE Physical Scope

1.4.1.1 TOE Physical Characteristics

The TOE physical characteristics are described as follows.

Performance

50MHz Standard/Dual/Quad SPI clocks

20.5 MB/S continuous encrypted and authenticated data transfer rate

More than 100,000 erase/program cycles

More than 20-year data retention

Efficiency

16-byte burst read

Data Integrity Check

Allows secure execution in place (S-XIP) operation

Operating conditions

- Single 1.62 to 1.98V supply
- 20mA active current, <1µA Power-down (typ.)
- -40°C to +105°C operating range

1Mb-block Architecture

Uniform Block Erase (4K-bytes)

Program 1 to 16 byte in a single command

Erase/Program Suspend & Resume

1.4.1.2 TOE Architecture

The architecture of the Memory Flash is described in **Figure 1**. The TOE is delimited by the Red box.

[2] The 'HUID to pre-Binding Key mapping formula' document has unique values for each customer, uniformly identification is unfeasible.

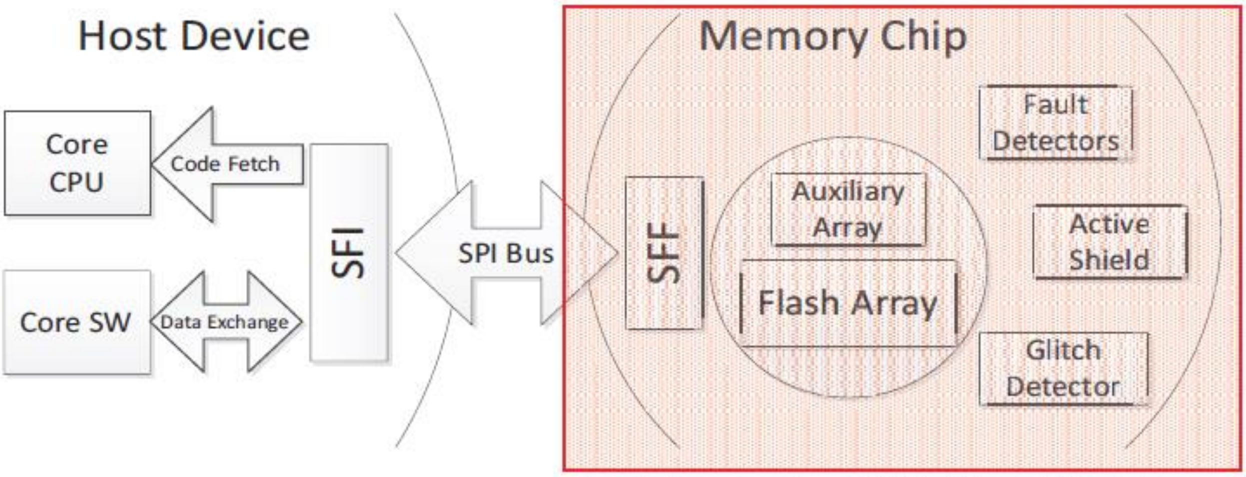


Figure 1 TOE Architecture

The TOE consists of the following Hardware components

- Auxiliary array contains the flash specific data: the binding key (and its digest value), the failure and session counters;
- Flash array stores the User data (i.e. the mass data including executable codes) and translates SPI commands into Flash operations;
- SFF (Secure Flash Front-end) which implements encrypted and authenticated interface for Flash operation and supports Flash memories up to 4GB;
- Detectors of abnormal operating conditions;

1.4.1.3 Interfaces of the TOE

- The physical interface of the TOE with the external environment is the entire surface of the Memory Flash module.
- The electrical interface of the TOE with the external environment is made of the chip's pads including the data pins for SPI bus:
  - Standard SPI: CLK, /CS, DI_IO0, DO_IO1
  - Dual SPI: CLK, /CS, DI_IO0, DO_IO1
  - Quad SPI: CLK, /CS, DI_IO0, DO_IO1, IO2, IO3

1.4.2 Logical Scope

The main security features of the TOE are described as follows:

- Secure separation between Test mode and User mode. More precisely,
  - The switch from User mode to Test mode can only be done after completely erasing the flash content.
  - The confidentiality and the integrity of the flash content are protected in both Test mode and User mode.
- The confidentiality and the integrity of the transmitted data from/to the Host device

are protected by a secure channel;

- Integrity protection of the flash content by error detection codes (CRC-32);
- Confidentiality protection of the flash content by memory scrambling with diversified key;
- Security sensors or detectors including power glitch detector and out-of-specified operating conditions (voltage, temperature, clock frequency);
- Active Shields against physical intrusive attacks (e.g. reverse-engineering, probing);
- State machine protection to counter fault injection;
- Dual Flip-Flops and bus encoding to counter fault injection and information leakage;
- Failure counter to detect and react to tamper attempts;

The logical interface of the TOE is made of Flash commands.

1.5 TOE Configurations

Part Number	Density	Binding Method	Note
W75F40WxxBx	4 Mbit	Single-Phase	Support secure binding to be completed in secure environment
W75F40WxxCx	4 Mbit	Two-Phase	Support secure binding to be completed in non-secure environment

Table 3 TOE Configurations

The guidance for the usage of the TOE, See table 2

1.6 TOE Operating Modes

TEST mode	USER mode
In TEST mode, the TOE provides access to both the auxiliary and flash arrays. However, there are some restrictions in the Test mode: - The Binding Key (Kb) cannot be read out; - The auxiliary array can only be erased if a complete erase has been done after the last reset; - The read and write commands do not read and write effective values of the flash;	In USER mode, the access to the flash arrays is authenticated and controlled via the flash commands. There is no interface to access to the auxiliary array. TOE cannot switch back from USER mode to TEST mode without erasing all the memory.

Table 4 Operating modes

1.7 TOE Life Cycle

The development, manufacturing and integration processes of the TOE into a composite product can be separated into two distinct phases.

Phase	Title	Description	Company	Locations
1	TOE Development	Memory flash designer is responsible for: - TOE (HW) development	Winbond	- Herzlia (Israel) - San Jose (USA)
2	TOE Manufacturing and Testing	Memory flash Manufacturer is responsible for: - Photomask manufacturing - wafer manufacturing and - testing	Winbond, Toshiba – DTF	Winbond: - Jhubei (Taiwan) - Taichung (Taiwan) Mask shop (Japan): - Toshiba -KSC (mask data handeling) - Toshiba - DTF - KITAKAMI site - Toshiba - DTF - KAWASAKI site – Shipment only!
3	TOE Packaging and Final Testing	Memory flash packaging: Memory flash final test:	ASE Winstek Winbond	- Taiwan - Taichung (Taiwan)

Table 5 TOE life-cycle

The TOE is delivered as KGD (Known Good die) after phase 2 and in packaging form after phase 3.

TOE Development:

- Winbond Technology Ltd [WTL]: 1 Sderot Abba Eban St., Herzlia, Israel – Responsible for TOE security functions design.
- Winbond Electronics Corporation America [WECA]: 2727 North First Street, San Jose, CA 95134, U.S.A. – Responsible for the flash array design and TOE tape-out process.

TOE Manufacturing and Testing:

- Photomask Manufacturing:
    1. Toshiba Memory System Co.,Ltd. [KSC]:
        a. Mitaka Site (Address sticktly secured)
        b. Solid Square East Tower 9F, 580, Horikawa-cho, Saiwai-ku, Kawasaki, Kanagawa, 212-0013, Japan – Data handling from Winbond to the mask manufacturing
    2. DT FINE ELECTRONICS CO. LTD. [DTF] :
        a. KITAKAMI Site: 6-6, Kitakami Kougyou danchi, Kitakami-shi, Iwate-ken 024-8510, Japan – Mask manufacturing
        b. KAWASAKI Site: 1, Komukai Toshiba-cho, Saiwai-ku, Kawasaki-shi, Kanagawa-ken 212-8583, Japan – Mask shipment to Winbond.
- Wafers manufacturing, Chip Probing (CP) and Final Test (FT) testing: Winbond Electronics Corp. CTSP Site [WEC]: No. 8, Keya 1st Rd.,Daya Dist., Taichung City 428, Taiwan, R.O.C.
- Wafers Chip Probing (CP) and Final Test (FT) program development: Winbond Electronics Corp. Jhubei Office [WEC]: No. 539, Sec. 2, Wenxing Rd., Zhubei City, Hsinchu County 302052, Taiwan, R.O.C.
- QFN32 TOE Packaging – ASE GROUP ChungLi: 550,Chung-Hwa Road, Section 1 , Chung-Li, 320,Taiwan, R.O.C.
- WLCSP TOE Packaging – WINSTEK STATS ChipPAC (SCT) : No 176-5, 6 Ling, Hualung Chun, Chiung Lin, 307 Hsinchu, Taiwan, R.O.C.

The TOE user is responsible for developing the Host-based dedicated driver and for generating a random and unique binding key (Kb) for binding the TOE to a unique Host.

2 Conformance Claim

This chapter 2 contains the following sections:

- CC Conformance Claim
- PP Claim
- Package Claim
- Conformance Claim Rationale

2.1 CC Conformance Claim

This Security target claims to be conformant to the Common Criteria version 3.1 Release 5.

Furthermore it claims to be CC Part 2 extended and CC Part 3 conformant.

2.2 PP Claim

This Security Target does not claim conformance to any Protection Profile.

2.3 Package Claim

The assurance level for this Security Target is EAL5 augmented with ALC_DVS.2 and AVA_VAN.5 because the TOE is dedicated to store highly critical applications and data which are submitted to advanced logical and physical attacks.

3 Security Problem Definition

3.1 Assets

Assets include all data stored in the TOE (including executable code of the applications). They include:

- User data, that is typically stored in the "flash array" part of the memory chip;
- TSF data, that is relied upon for the enforcement of the TOE security functionality.
  - TSF data contains only sensitive data stored in registers or in the auxiliary array of the memory chip. Legacy registers are not part of the TSF (i.e. non-TSF).
  - The TOE does not include any software, however the logic of the TOE security mechanisms is still part of the TSF data. This logic is hardcoded in SFF.

3.1.1 TSF data

TSF logic

The TSF logic is the functionality of the TSF, and is hardcoded in the SFF component.

The TSF logic is protected in terms of integrity and confidentiality.

Binding key (Kb)

A unique 256-bit key that is shared between the TOE and the Host.

This key is protected in terms of integrity and confidentiality.

Runtime data

The internal runtime data necessary for the execution of the SFF: session key, memory scrambling keys, Integrity Checking Engine register, stream-ciphering buffer, Bit mixing key, Failure counter, session counter, etc. All runtime data shall be protected in terms of integrity. All runtime data (except for the session counter) shall be protected in terms of confidentiality.

3.1.2 User data

User data corresponds to all data stored inside the memory flash (including executable code of the applications).

User Data

Mass data (including executable codes) stored in the "flash array" part of the memory chip. User data is protected in terms of integrity and confidentiality.

3.2 Users / Subjects

U.Host-Device

The host device communicates with the TOE through a SPI Bus.

3.3 Threats

T.Phys-Manipulation

Physical Manipulation

An attacker may physically modify the Memory Flash in order to

- modify *User Data* stored in the TOE;
- modify *TSF Data* stored in the TOE;
- modify or deactivate the security services of the TOE (provided by *TSF logic*);
- modify the security mechanisms of the TOE (provided by *TSF logic*) to enable attacks disclosing or manipulating *User Data*, for example the integrity protection mechanism.

T.Phys-Probing

Physical Probing

An attacker may perform physical probing of the TOE in order to disclose *User Data* and *TSF Data* while stored in Memory Flash.

T.Malfunction

Malfunction due to Environmental Stress

An attacker may cause a malfunction of *TSF logic* by applying environmental stress in order to deactivate or affect security mechanisms of the TOE. This enables attacks disclosing or manipulating *User Data*.

This may be achieved by operating the Memory Flash outside the normal operating conditions.

T.Abuse-Func

Abuse of Functionality

An attacker may use functions of the TOE which may not be used after TOE Delivery in order to

- disclose or manipulate *User Data* (user data or code stored in the TOE) or
- enable an attack disclosing or manipulating *User Data*.

T.Leak-Inherent

Inherent Information Leakage

An attacker may exploit information which is leaked from the TOE during usage of the Memory Flash in order to disclose confidential *User Data*.

T.Leak-Forced

Forced Information Leakage

An attacker may exploit information which is leaked from the TOE during usage of the Memory Flash in order to disclose confidential *User Data* even if the information leakage is not inherent but caused by the attacker.

T.Abuse-Communication

Communication Probing and Manipulation

An attacker may probe and modify the communication between the TOE and **U.Host-Device** in order to manipulate *User/TSF Data* or disclose *User/TSF Data* read from the TOE.

T.Host-Forging

Forge the functionality of an authorized Host device

An attacker may access to the User data currently stored in the TOE by:

- illegaly establishing a secure channel with the TOE (e.g. by tampering the Binding key or by forging the secure channel without knowing the Binding key) in order to execute the Flash commands;
- binding the TOE with another Host device in order to execute the Flash commands;

3.4 Organisational Security Policies

N/A, there is no OSP.

3.5 Assumptions

A.Secure-Channel

External protection during the secure channel

It is assumed that **U.Host-Device** supports the trusted communication channel with the TOE by protecting the confidentiality and the integrity of the transmitted data.

In particular, **U.Host-Device** is assumed to correctly protect the secure channel in order to prevent data modification, disclosure, insertion, deletion and replaying.

A.Binding-Process

Protection during Binding process

It is assumed that security procedures are used after delivery of the TOE by the TOE Manufacturer to maintain confidentiality and integrity of the TOE (to prevent any possible copy, modification, or unauthorised use).

This means that the binding process (i.e. generating a unique and random key Kb for **U.Host-Device** and the TOE) or the first stage of the two-stage binding, is assumed to be done in a secure environment where the communication between **U.Host-Device** and the TOE is protected.

Furthermore, **U.Host-Device** is assumed to provide a secure random source for generating a fresh Binding key (Kb) for the TOE.

The confidentiality and authenticity of the binding process is guarentied by uniqe pre-binding process during TOE manufacturing.

4 Security Objectives

4.1 Security Objectives for the TOE

This chapter contains the following sections:

- Security Objectives for the TOE
- Security Objectives for the operational Environment
- Security Objectives Rationale

O.Phys-Probing

Protection against Physical Probing

The TOE must provide protection against disclosure/reconstruction of *User Data* and *TSF Data* while stored in the Flash.

This includes protection against

- o measuring through galvanic contacts which is direct physical probing on the chips surface except on pads being bonded (using standard tools for measuring voltage and current) or
- o measuring not using galvanic contacts but other types of physical interaction between charges (using tools used in solid-state physics research and IC failure analysis) with a prior reverse-engineering to understand the design and its properties and functions.

The TOE must be designed and fabricated so that it requires a high combination of complex equipment, knowledge, skill, and time to be able to derive detailed design information or other information which could be used to compromise security through such a physical attack.

O.Malfunction

Protection against Malfunctions

The TOE must ensure its correct operation. The TOE must indicate and prevent its operation outside the normal operating conditions where reliability and secure operation has not been proven or tested. This is to prevent malfunctions. Examples of environmental conditions are voltage, and clock frequency, temperature, or external energy fields.

O.Phys-Manipulation

Protection against Physical Manipulation

The TOE must provide protection against manipulation of *User Data* (the user data stored in the TOE) and *TSF data*. This includes protection against

- o reverse-engineering (understanding the design and its properties and functions),
- o manipulation of the hardware and TSF data, as well as
- o undetected manipulation of User data (i.e. Flash array).

O.Abuse-Func

Protection against Abuse of Functionality

The TOE must prevent that functions of the TOE which may not be used after TOE Delivery can be abused in order to (i) disclose sensitive user data stored in the TOE, (ii) manipulate sensitive user data stored in the TOE.

O.Leak-Inherent

Protection against Inherent Information Leakage

The TOE must provide protection against disclosure of confidential data stored and processed in the TOE

- by measurement and analysis of the shape and amplitude of signals (for example on the power, clock, or I/O lines) and
- by measurement and analysis of the time between events found by measuring signals (for instance on the power, clock, or I/O lines).

O.Leak-Forced

Protection against Forced Information Leakage

The TOE must be protected against disclosure of confidential data processed in the TOE (using methods as described under O.Leak-Inherent) even if the information leakage is not inherent but caused by the attacker

- by forcing a malfunction (refer to "Protection against Malfunction due to Environmental Stress O.Malfunction") and/or
- by a physical manipulation (refer to "Protection against Physical Manipulation - O.Phys-Manipulation").

If this is not the case, signals which normally do not contain significant information about secrets could become an information channel for a leakage attack.

O.Sec-Binding

Protection of residual information at Re-binding

This objective protects against the disclosure of the User data when the TOE is re-bound to another Host device.

This includes protection against:

- integrity failure on Binding Key
- illegal modification on Binding Key
- illegal attempt to erase the Binding key

O.Trusted-Path

Trusted communication with authorized Host

The TSF provides a trusted path only with authorized **U.Host-Device** (based on the shared Binding key), and protects the confidentiality and the integrity of the User data /TSF data to be communicated with **U.Host-Device**.

4.2 Security Objectives for the Operational Environment

OE.Secure-Channel

Secure communication with the TOE

The authorized **U.Host-Device** shall support the trusted communication channel with the TOE by protecting the confidentiality and the integrity of the transmitted data.

In particular, **U.Host-Device** shall correctly protect the secure channel in order to prevent data modification, disclosure, insertion, deletion and replaying.

OE.Binding-Process

Protection during Binding process

Security procedures shall be used after the TOE delivery to maintain confidentiality and integrity of the TOE (to prevent any possible copy, modification, retention, theft or unauthorised use).

In addition, **U.Host-Device** shall provide a secure random source for generating a fresh Binding key (Kb) for the TOE.

4.3 Security Objectives Rationale

4.3.1 Threats

T.Phys-Manipulation This threat is countered by the security objectives O.Phys-Manipulation. This objective ensures that the protection against manipulation of the user data is provided by the TOE.

T.Phys-Probing This threat is countered by the security objectives O.Phys-Probing. This objective ensures that the protection against disclosure/reconstruction of User Data and TSF Data while stored in the Flash is provided by the TOE.

T.Malfunction This threat is countered by the security objectives O.Malfunction. This objective ensures the correct operation of the TOE outside the normal operating conditions.

T.Abuse-Func This threat is countered by the security objectives O.Abuse-Func. This objective prevents that functions of the TOE which may not be used after TOE Delivery can be abused in order to manipulate/disclose sensitive user data stored in the TOE.

T.Leak-Inherent This threat is countered by the security objectives O.Leak-Inherent. This objective ensures the protection against disclosure of confidential data stored and processed in the TOE.

T.Leak-Forced This threat is countered by the security objectives O.Leak-Forced. This objective ensures the protection against disclosure of confidential data stored and processed in the TOE even if the information leakage is not inherent but caused by the attacker.

T.Abuse-Communication This threat is countered by the security objective O.Trusted-Path. This objective protects the confidentiality and the integrity of the User/TSF data to be communicated with U.Host-Device.

T.Host-Forging This threat is countered by the security objectives:

- O.Trusted-Path to protect the confidentiality and the integrity of the User data to be communicated with U.Host-Device.
- O.Sec-Binding to protect against the disclosure of the User data when the TOE is re-bound to another Host device

4.3.2 Assumptions

A.Secure-Channel Since OE.Secure-Channel requires the Host device to implement the protection assumed in A.Secure-Channel, the assumption is covered by this objective.

A.Binding-Process Since OE.Binding-Process requires the Composite Product Manufacturer to implement those measures assumed in A.Binding-Process, the assumption is covered by this objective.

4.3.3 SPD and Security Objectives

Threats	Security Objectives	Rationale
T.Phys-Manipulation	O.Phys-Manipulation	Section 4.3.1
T.Phys-Probing	O.Phys-Probing	Section 4.3.1
T.Malfunction	O.Malfunction	Section 4.3.1
T.Abuse-Func	O.Abuse-Func	Section 4.3.1
T.Leak-Inherent	O.Leak-Inherent	Section 4.3.1
T.Leak-Forced	O.Leak-Forced	Section 4.3.1
T.Abuse-Communication	O.Trusted-Path	Section 4.3.1
T.Host-Forging	O.Trusted-Path, O.Sec-Binding	Section 4.3.1

Table 6 Threats and Security Objectives - Coverage

Security Objectives	Threats
O.Phys-Probing	T.Phys-Probing
O.Malfunction	T.Malfunction
O.Phys-Manipulation	T.Phys-Manipulation
O.Abuse-Func	T.Abuse-Func
O.Leak-Inherent	T.Leak-Inherent
O.Leak-Forced	T.Leak-Forced
O.Sec-Binding	T.Host-Forging
O.Trusted-Path	T.Abuse-Communication, T.Host-Forging
OE.Secure-Channel	
OE.Binding-Process	

Table 7 Security Objectives and Threats - Coverage

Security Objectives
O.Phys-Probing
O.Malfunction
O.Phys-Manipulation

Security Objectives
O.Abuse-Func
O.Leak-Inherent
O.Leak-Forced
O.Sec-Binding
O.Trusted-Path
OE.Secure-Channel
OE.Binding-Process

Table 8 Security Objectives and OSPs - Coverage

Assumptions	Security Objectives for the Operational Environment	Rationale
A.Secure-Channel	OE.Secure-Channel	Section 4.3.2
A.Binding-Process	OE.Binding-Process	Section 4.3.2

Table 9 Assumptions and Security Objectives for the Operational Environment - Coverage

Security Objectives for the Operational Environment	Assumptions
OE.Secure-Channel	A.Secure-Channel
OE.Binding-Process	A.Binding-Process

Table 10 Security Objectives for the Operational Environment and Assumptions - Coverage

5 Extended Requirements

5.1 Extended Families

5.1.1 Extended Family FMT_LIM - Limited capabilities and availability

5.1.1.1 Description

To define the IT security functional requirements of the TOE an additional family (FMT_LIM) of the Class FMT (Security Management) is defined here. This family describes the functional requirements for the Test Features of the TOE. The new functional requirements were defined in the class FMT because this class addresses the management of functions of the TSF. The examples of the technical mechanism used in the TOE (refer to Section 6.2) appropriate to address the specific issues of preventing the abuse of functions by limiting the capabilities of the functions and by limiting their availability.

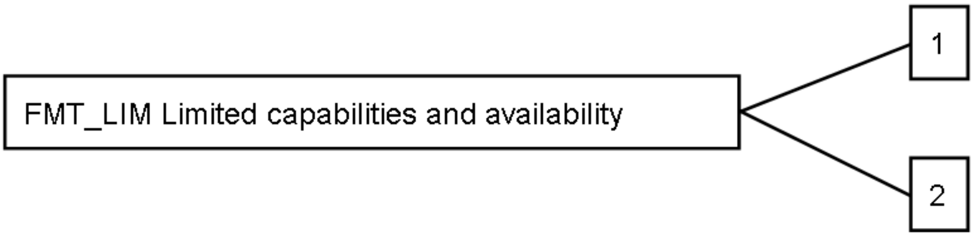
The family "Limited capabilities and availability (FMT_LIM)" is specified as follows.

FMT_LIM Limited capabilities and availability

Family behaviour

This family defines requirements that limit the capabilities and availability of functions in a combined manner. Note that FDP_ACF restricts the access to functions whereas the component Limited Capability of this family requires the functions themselves to be designed in a specific manner.

Component levelling:



FMT_LIM.1 Limited capabilities requires that the TSF is built to provide only the capabilities (perform action, gather information) necessary for its genuine purpose.

FMT_LIM.2 Limited availability requires that the TSF restrict the use of functions (refer to Limited capabilities (FMT_LIM.1)). This can be achieved, for instance, by removing or by disabling functions in a specific phase of the TOE's life-cycle.

Management: FMT_LIM.1, FMT_LIM.2

There are no management activities foreseen.

Audit: FMT_LIM.1, FMT_LIM.2

There are no actions defined to be auditable.

5.1.1.2 Extended Components

Extended Component FMT_LIM.1

Description

Limited capabilities requires that the TSF is built to provide only the capabilities (perform action, gather information) necessary for its genuine purpose.

Hierarchical to: No other components.

Definition

FMT_LIM.1 Limited capabilities

FMT_LIM.1.1 The TSF shall be designed and implemented in a manner that limits its capabilities so that in conjunction with "Limited availability (FMT_LIM.2)" the following policy is enforced [assignment: Limited capability policy].

Dependencies: (FMT_LIM.2)

Extended Component FMT_LIM.2

Description

Limited availability requires that the TSF restrict the use of functions (refer to Limited capabilities (FMT_LIM.1)). This can be achieved, for instance, by removing or by disabling functions in a specific phase of the TOE's life-cycle.

Hierarchical to: No other components.

Definition

FMT_LIM.2 Limited availability

FMT_LIM.2.1 The TSF shall be designed in a manner that limits its availability so that in conjunction with "Limited capabilities (FMT_LIM.1)" the following policy is enforced [assignment: Limited availability policy].

Dependencies: (FMT_LIM.1)

Application Note:

The functional requirements FMT_LIM.1 and FMT_LIM.2 assume that there are two types of mechanisms (limitation of capabilities and limitation of availability) which together shall provide protection in order to enforce the same policy or two mutual supportive policies related to the same functionality. This allows e.g. that

(i) the TSF is provided without restrictions in the product in its user environment but its capabilities are so limited that the policy is enforced or conversely

(ii) the TSF is designed with high functionality but is removed or disabled in the product in its user environment.

5.1.2 Extended Family FDP_SDC - Stored data confidentiality

5.1.2.1 Description

To define the security functional requirements of the TOE an additional family (FDP_SDC.1) of the Class FDP (User data protection) is defined here.

The family "Stored data confidentiality (FDP_SDC)" is specified as follows.

FDP_SDC Stored data confidentiality

Family behaviour

This family provides requirements that address protection of user data confidentiality while these data are stored within memory areas protected by the TSF. The TSF provides access to the data in the memory through the specified interfaces only and prevents compromise of their information bypassing these interfaces. It complements the family Stored data integrity (FDP_SDI) which protects the user data from integrity errors while being stored in the memory.

Component levelling:

FDP_SDC.1 Requires the TOE to protect the confidentiality of information of the user data in specified memory areas.

Management: FDP_SDC.1

There are no management activities foreseen.

Audit: FDP_SDC.1

There are no actions defined to be auditable.

5.1.2.2 Extended Components

Extended Component FDP_SDC.1

Description

Requires the TOE to protect the confidentiality of information of the user data in specified memory areas.

Hierarchical to: No other components.

Definition

FDP_SDC.1 Stored data confidentiality

FDP_SDC.1.1 The TSF shall ensure the confidentiality of the information of the user data while it is stored in the **[assignment: memory areas]**.

Dependencies: No dependencies.

6 Security Requirements

6.1 Security Functional Requirments Rational

In order to define the Security Functional Requirements Part 2 of the Common Criteria was used. However, some Security Functional Requirements have been refined.

The refinements are described below the associated SFR:

> The refinement operation is used to add detail to a requirement, and, thus, further restricts a requirement. In such a case a extra paragraph starting with "Refinement" may be given.
>
> The selection operation is used to select one or more options provided by the CC in stating a requirement. Selections having been made by the ST author are denoted as bold and italicized.
>
> The assignment operation is used to assign a specific value to an unspecified parameter, such as the length of a password. Assignments having been made by the ST author appear in bold text. 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.

6.2 Security Functional Requirements

6.2.1 Malfunctions

FRU_FLT.2 Limited fault tolerance

FRU_FLT.2.1 The TSF shall ensure the operation of all the TOE's capabilities when the following failures occur: [assignment: *list of type of failures*].

The TSF shall ensure the operation of all the TOE's capabilities when the following failures occur: **exposure_to_operating_conditions_which_are_not_detected_according_to_the requirement_Failure_with_preservation_of_secure_state_(FPT_FLS.1/Detectors)**.

Application Note:

The term "failure" above means "circumstances". The TOE prevents failures for the "circumstance" defined above.

FPT_FLS.1/Detectors Failure with preservation of secure state

FPT_FLS.1.1/Detectors The TSF shall preserve a secure state when the following types of failures occur: [assignment**:** *list of types of failures in the TSF*].

The TSF shall preserve a secure state when the following types of failures occur:

- o **Out-of-specified range voltage**
- o **Out-of-specified range temperature**
- o **Out-of specified range clock frequency**
- o **Power glitch.**

Application Note:

The term "failure" above means "circumstances". The TOE prevents failures for the "circumstance" defined above.

The secure state is maintained by TSF's detectors. The TSF's detectors monitor the failures. If a failure happens, the TSF disturbs the cryptographic computations, interrupts data interchange and inform **U.Host-Device**.

6.2.2 Abuse of Functionality

FMT_LIM.1 Limited capabilities

FMT_LIM.1.1 The TSF shall be designed and implemented in a manner that limits its capabilities so that in conjunction with "Limited availability (FMT_LIM.2)" the following policy is enforced [assignment**:** *Limited capability policy*]**.**

The TSF shall be designed and implemented in a manner that limits its capabilities so that in conjunction with "Limited availability (FMT_LIM.2)" the following policy is enforced **Deploying Test Features after TOE Delivery does not allow user data to be disclosed or manipulated, TSF data to be disclosed or manipulated, and no substantial information about construction of TSF to be gathered which may enable other attacks.**

Application Note:

In the Test mode, the following restrictions are enforced by the TSF:

- The Binding Key (Kb) cannot be read out by the Flash commands;
- The Binding key cannot be erased unless a complete erase has been done after the last reset;
- The read and write commands do not read and write effective values of the flash array;

FMT_LIM.2 Limited availability

FMT_LIM.2.1 The TSF shall be designed in a manner that limits its availability so that in conjunction with "Limited capabilities (FMT_LIM.1)" the following policy is enforced [assignment: *Limited availability policy*]**.**

The TSF shall be designed in a manner that limits its availability so that in conjunction with "Limited capabilities (FMT_LIM.1)" the following policy is enforced **Deploying Test Features after TOE Delivery does not allow user data to be disclosed or manipulated, TSF data to be disclosed or manipulated, and no substantial**

information about construction of TSF to be gathered which may enable other attacks.

Application Note:

The switch from User mode to Test mode is allowed after TOE delivery but after the flash array is completely erased.

6.2.3 Physical Manipulation and Probing

FDP_SDC.1 Stored data confidentiality

FDP_SDC.1.1 The TSF shall ensure the confidentiality of the information of the user data while it is stored in the [assignment**:** *memory areas***]**.

The TSF shall ensure the confidentiality of the information of the user data while it is stored in the **Flash array**.

FDP_SDI.2 Stored data integrity monitoring and action

FDP_SDI.2.1 The TSF shall monitor user data stored in containers controlled by the TSF for [assignment**:** *integrity errors*] on all objects, based on the following attributes: [assignment**:** *user data attributes***]**.

The TSF shall monitor user data stored in containers controlled by the TSF for **CRC-32 error detecting code** on all objects, based on the following attributes: **stored in the Flash array with CRC-32 and read via authenticated read**.

FDP_SDI.2.2 Upon detection of a data integrity error, the TSF shall [assignment**:** *action to be taken***]**.

Upon detection of a data integrity error, the TSF shall **inform U.Host-Device about the error. In addition, the TSF also sends a pseudo-randomly chosen part of the CRC-32 error detecting bits to U.Host-Device in a secure manner so that data integrity can be independently verified by U.Host-Device.**

FPT_PHP.3 Resistance to physical attack

FPT_PHP.3.1 The TSF shall resist [assignment**:** *physical tampering scenarios***]** to the [assignment**:** *list of TSF devices/elements***]** by responding automatically such that the SFRs are always enforced.

The TSF shall resist **physical manipulation and physical probing** to the **TSF** by responding automatically such that the SFRs are always enforced.

Application Note:

The TSF will implement appropriate mechanisms to continuously counter physical manipulation and physical probing. Due to the nature of these attacks (especially manipulation) the TSF can by no means detect attacks on all of its elements. Therefore, permanent protection against these attacks is required ensuring that security functional requirements are enforced. Hence, "automatic response" means here (i) assuming that there might be an attack at any time and (ii) countermeasures are provided at any time.

6.2.4 Leakage

FDP_ITT.1 Basic internal transfer protection

FDP_ITT.1.1 The TSF shall enforce the [assignment**:** *access control SFP(s) and/or information flow control SFP(s)*] to prevent the [selection: disclosure, modification, loss of use] of user data when it is transmitted between physically-separated parts of the TOE.

The TSF shall enforce the **Data Processing Policy** to prevent the ***disclosure*** of user data when it is transmitted between physically-separated parts of the TOE.

Application Note:

The Flash array and the SFF are seen as physically-separated parts of the TOE.

FPT_ITT.1 Basic internal TSF data transfer protection

FPT_ITT.1.1 The TSF shall protect TSF data from [selection: disclosure, modification] when it is transmitted between separate parts of the TOE.

The TSF shall protect TSF data from ***disclosure*** when it is transmitted between separate parts of the TOE.

Application Note:

The Flash array and the SFF are seen as physically-separated parts of the TOE.

FDP_IFC.1 Subset information flow control

FDP_IFC.1.1 The TSF shall enforce the [assignment**:** *information flow control SFP*] on [assignment*: list of subjects, information, and operations that cause controlled information to flow to and from controlled subjects covered by the SFP*].

The TSF shall enforce the **Data Processing Policy** on **User data that is processed or transferred by the TOE or by U.Host-Device**.

Application Note:

The following Security Function Policy (SFP) Data Processing Policy is defined for the requirement "Subset information flow control (FDP_IFC.1)"

"User data and TSF data shall not be accessible from the TOE except when the U.Host-Device decides to communicate the User data via an external interface".

6.2.5 Secure Data Exchange

FDP_UCT.1 Basic data exchange confidentiality

FDP_UCT.1.1 The TSF shall enforce the [assignment: *access control SFP(s) and/or information flow control SFP(s)*] to [selection: transmit, receive] user data in a manner protected from unauthorised disclosure.

The TSF shall enforce the **Data Processing Policy** to ***receive*** and ***transmit*** user data in a manner protected from unauthorised disclosure.

FDP_UIT.1 Data exchange integrity

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

The TSF shall enforce the **Data Processing Policy** to ***transmit*** and ***receive*** user data in a manner protected from ***replay, modification, deletion*** and ***insertion*** errors.

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

The TSF shall be able to determine on receipt of user data, whether ***replay, modification, deletion*** and ***insertion*** has occurred.

FTP_TRP.1 Trusted path

FTP_TRP.1.1 The TSF shall provide a communication path between itself and [selection: remote, local] users that is logically distinct from other communication paths and provides assured identification of its end points and protection of the communicated data from [selection: modification, disclosure, [assignment: *other types of integrity or confidentiality violation*]].

The TSF shall provide a communication path between itself and ***remote*** users that is logically distinct from other communication paths and provides assured identification of its end points and protection of the communicated data from ***modification*** and ***disclosure***.

FTP_TRP.1.2 The TSF shall permit [selection: the TSF, local users, remote users] to initiate communication via the trusted path.

The TSF shall permit ***remote users*** to initiate communication via the trusted path.

FTP_TRP.1.3 The TSF shall require the use of the trusted path for [selection: initial user authentication, [assignment: *other services for which trusted path is required*]].

The TSF shall require the use of the trusted path for **any access to User data stored in the Flash array.**

6.2.6 Protection of Binding Key

FPT_FLS.1/Binding_Key Failure with preservation of secure state

FPT_FLS.1.1/Binding_Key The TSF shall preserve a secure state when the following types of failures occur: [assignment: *list of types of failures in the TSF*].

The TSF shall preserve a secure state when the following types of failures occur: **integrity failure on Binding Key**.

Application Note:

The secure state is defined as follows:

- if the Binding key is illegaly modified, then the TOE is locked;
- if the Binding key is erased, then the TOE User data (stored in the Flash array) is also erased;

FDP_RIP.1 Subset residual information protection

FDP_RIP.1.1 The TSF shall ensure that any previous information content of a resource is made unavailable upon the [selection: allocation of the resource to, deallocation of the resource from] the following objects: [assignment: *list of objects*].

Refinement:

The TSF shall ensure that any previous information content of the Flash array is made unavailable upon the ***allocation of the resource*** to and ***deallocation of the resource*** from the following objects: the **Binding key (Kb)**.

Application Note:

- "Object Allocation" means that a new Binding key is set in order to replace the current Binding key.
- "Object Deallocation" means that the current Binding key is erased from the TSF (more precisely, from the auxiliary array).

6.3 Security Assurance Requirements

The Evaluation Assurance Level is EAL5 augmented with ALC_DVS.2 and AVA_VAN.5.

6.3.1 ADV Development

6.3.1.1 ADV_ARC Security Architecture

ADV_ARC.1 Security architecture description

ADV_ARC.1.1D The developer shall design and implement the TOE so that the security features of the TSF cannot be bypassed.

ADV_ARC.1.2D The developer shall design and implement the TSF so that it is able to protect itself from tampering by untrusted active entities.

ADV_ARC.1.3D The developer shall provide a security architecture description of the TSF.

ADV_ARC.1.1C The security architecture description shall be at a level of detail commensurate with the description of the SFR-enforcing abstractions described in the TOE design document.

ADV_ARC.1.2C The security architecture description shall describe the security domains maintained by the TSF consistently with the SFRs.

ADV_ARC.1.3C The security architecture description shall describe how the TSF initialisation process is secure.

ADV_ARC.1.4C The security architecture description shall demonstrate that the TSF protects itself from tampering.

ADV_ARC.1.5C The security architecture description shall demonstrate that the TSF prevents bypass of the SFR-enforcing functionality.

ADV_ARC.1.1E The evaluator shall confirm that the information provided meets all requirements for content and presentation of evidence.

6.3.1.2 ADV_FSP Functional specification

ADV_FSP.5 Complete semi-formal functional specification with additional error information

ADV_FSP.5.1D The developer shall provide a functional specification.

ADV_FSP.5.2D The developer shall provide a tracing from the functional specification to the SFRs.

ADV_FSP.5.1C The functional specification shall completely represent the TSF.

ADV_FSP.5.2C The functional specification shall describe the TSFI using a semi-formal style.

ADV_FSP.5.3C The functional specification shall describe the purpose and method of use for all TSFI.

ADV_FSP.5.4C The functional specification shall identify and describe all parameters associated with each TSFI.

ADV_FSP.5.5C The functional specification shall describe all actions associated with each TSFI.

ADV_FSP.5.6C The functional specification shall describe all direct error messages that may result from an invocation of each TSFI.

ADV_FSP.5.7C The functional specification shall describe all error messages that do not result from an invocation of a TSFI.

ADV_FSP.5.8C The functional specification shall provide a rationale for each error message contained in the TSF implementation yet does not result from an invocation of a TSFI.

ADV_FSP.5.9C The tracing shall demonstrate that the SFRs trace to TSFIs in the functional specification.

ADV_FSP.5.1E The evaluator shall confirm that the information provided meets all requirements for content and presentation of evidence.

ADV_FSP.5.2E The evaluator shall determine that the functional specification is an accurate and complete instantiation of the SFRs.

6.3.1.3 ADV_IMP Implementation representation

ADV_IMP.1 Implementation representation of the TSF

ADV_IMP.1.1D The developer shall make available the implementation representation for the entire TSF.

ADV_IMP.1.2D The developer shall provide a mapping between the TOE design description and the sample of the implementation representation.

ADV_IMP.1.1C The implementation representation shall define the TSF to a level of detail such that the TSF can be generated without further design decisions.

ADV_IMP.1.2C The implementation representation shall be in the form used by the development personnel.

ADV_IMP.1.3C The mapping between the TOE design description and the sample of the implementation representation shall demonstrate their correspondence.

ADV_IMP.1.1E The evaluator shall confirm that, for the selected sample of the implementation representation, the information provided meets all requirements for content and presentation of evidence.

6.3.1.4 ADV_INT TSF internals

ADV_INT.2 Well-structured internals

ADV_INT.2.1D The developer shall design and implement the entire TSF such that it has well-structured internals.

ADV_INT.2.2D The developer shall provide an internals description and justification.

ADV_INT.2.1C The justification shall describe the characteristics used to judge the meaning of ``well-structured''.

ADV_INT.2.2C The TSF internals description shall demonstrate that the entire TSF is well-structured.

ADV_INT.2.1E The evaluator shall confirm that the information provided meets all requirements for content and presentation of evidence.

ADV_INT.2.2E The evaluator shall perform an internals analysis on the TSF.

6.3.1.5 ADV_TDS TOE design

ADV_TDS.4 Semiformal modular design

ADV_TDS.4.1D The developer shall provide the design of the TOE.

ADV_TDS.4.2D The developer shall provide a mapping from the TSFI of the functional specification to the lowest level of decomposition available in the TOE design.

ADV_TDS.4.1C The design shall describe the structure of the TOE in terms of subsystems.

ADV_TDS.4.2C The design shall describe the TSF in terms of modules, designating each module as SFR-enforcing, SFR-supporting, or SFR-non-interfering.

ADV_TDS.4.3C The design shall identify all subsystems of the TSF.

ADV_TDS.4.4C The design shall provide a semiformal description of each subsystem of the TSF, supported by informal, explanatory text where appropriate.

ADV_TDS.4.5C The design shall provide a description of the interactions among all subsystems of the TSF.

ADV_TDS.4.6C The design shall provide a mapping from the subsystems of the TSF to the modules of the TSF.

ADV_TDS.4.7C The design shall describe each SFR-enforcing and SFR-supporting module in terms of its purpose and relationship with other modules.

ADV_TDS.4.8C The design shall describe each SFR-enforcing and SFR-supporting module in terms of its SFR-related interfaces, return values from those interfaces, interaction with other modules and called SFR-related interfaces to other SFR-enforcing or SFR-supporting modules.

ADV_TDS.4.9C The design shall describe each SFR-non-interfering module in terms of its purpose and interaction with other modules.

ADV_TDS.4.10C The mapping shall demonstrate that all TSFIs trace to the behaviour described in the TOE design that they invoke.

ADV_TDS.4.1E The evaluator shall confirm that the information provided meets all requirements for content and presentation of evidence.

ADV_TDS.4.2E The evaluator shall determine that the design is an accurate and complete instantiation of all security functional requirements.

6.3.2 AGD Guidance documents

6.3.2.1 AGD_OPE Operational user guidance

AGD_OPE.1 Operational user guidance

AGD_OPE.1.1D The developer shall provide operational user guidance.

AGD_OPE.1.1C The operational user guidance shall describe, for each user role, the user-accessible functions and privileges that should be controlled in a secure processing environment, including appropriate warnings.

AGD_OPE.1.2C The operational user guidance shall describe, for each user role, how to use the available interfaces provided by the TOE in a secure manner.

AGD_OPE.1.3C The operational user guidance shall describe, for each user role, the available functions and interfaces, in particular all security parameters under the control of the user, indicating secure values as appropriate.

AGD_OPE.1.4C The operational user guidance shall, for each user role, clearly present each type of security-relevant event relative to the user-accessible functions that need to be performed, including changing the security characteristics of entities under the control of the TSF.

AGD_OPE.1.5C The operational user guidance shall identify all possible modes of operation of the TOE (including operation following failure or operational error), their consequences and implications for maintaining secure operation.

AGD_OPE.1.6C The operational user guidance shall, for each user role, describe the security measures to be followed in order to fulfil the security objectives for the operational environment as described in the ST.

AGD_OPE.1.7C The operational user guidance shall be clear and reasonable.

AGD_OPE.1.1E The evaluator shall confirm that the information provided meets all requirements for content and presentation of evidence.

6.3.2.2 AGD_PRE Preparative procedures

AGD_PRE.1 Preparative procedures

AGD_PRE.1.1D The developer shall provide the TOE including its preparative procedures.

AGD_PRE.1.1C The preparative procedures shall describe all the steps necessary for secure acceptance of the delivered TOE in accordance with the developer's delivery procedures.

AGD_PRE.1.2C The preparative procedures shall describe all the steps necessary for secure installation of the TOE and for the secure preparation of the operational environment in accordance with the security objectives for the operational environment as described in the ST.

AGD_PRE.1.1E The evaluator shall confirm that the information provided meets all requirements for content and presentation of evidence.

AGD_PRE.1.2E The evaluator shall apply the preparative procedures to confirm that the TOE can be prepared securely for operation.

6.3.3 ALC Life-cycle support

6.3.3.1 ALC_CMC CM capabilities

ALC_CMC.4 Production support, acceptance procedures and automation

ALC_CMC.4.1D The developer shall provide the TOE and a reference for the TOE.

ALC_CMC.4.2D The developer shall provide the CM documentation.

ALC_CMC.4.3D The developer shall use a CM system.

ALC_CMC.4.1C The TOE shall be labelled with its unique reference.

ALC_CMC.4.2C The CM documentation shall describe the method used to uniquely identify the configuration items.

ALC_CMC.4.3C The CM system shall uniquely identify all configuration items.

ALC_CMC.4.4C The CM system shall provide automated measures such that only authorised changes are made to the configuration items.

ALC_CMC.4.5C The CM system shall support the production of the TOE by automated means.

ALC_CMC.4.6C The CM documentation shall include a CM plan.

ALC_CMC.4.7C The CM plan shall describe how the CM system is used for the development of the TOE.

ALC_CMC.4.8C The CM plan shall describe the procedures used to accept modified or newly created configuration items as part of the TOE.

ALC_CMC.4.9C The evidence shall demonstrate that all configuration items are being maintained under the CM system.

ALC_CMC.4.10C The evidence shall demonstrate that the CM system is being operated in accordance with the CM plan.

ALC_CMC.4.1E The evaluator shall confirm that the information provided meets all requirements for content and presentation of evidence.

6.3.3.2 ALC_CMS CM scope

ALC_CMS.5 Development tools CM coverage

ALC_CMS.5.1D The developer shall provide a configuration list for the TOE.

ALC_CMS.5.1C The configuration list shall include the following: the TOE itself; the evaluation evidence required by the SARs; the parts that comprise the TOE; the implementation representation; security flaw reports and resolution status; and development tools and related information.

ALC_CMS.5.2C The configuration list shall uniquely identify the configuration items.

ALC_CMS.5.3C For each TSF relevant configuration item, the configuration list shall indicate the developer of the item.

ALC_CMS.5.1E The evaluator shall confirm that the information provided meets all requirements for content and presentation of evidence.

6.3.3.3 ALC_DEL Delivery

ALC_DEL.1 Delivery procedures

ALC_DEL.1.1D The developer shall document and provide procedures for delivery of the TOE or parts of it to the consumer.

ALC_DEL.1.2D The developer shall use the delivery procedures.

ALC_DEL.1.1C The delivery documentation shall describe all procedures that are necessary to maintain security when distributing versions of the TOE to the consumer.

ALC_DEL.1.1E The evaluator shall confirm that the information provided meets all requirements for content and presentation of evidence.

6.3.3.4 ALC_DVS Development security

ALC_DVS.2 Sufficiency of security measures

ALC_DVS.2.1D The developer shall produce and provide development security documentation.

ALC_DVS.2.1C The development security documentation shall describe all the physical, procedural, personnel, and other security measures that are necessary to protect the confidentiality and integrity of the TOE design and implementation in its development environment.

ALC_DVS.2.2C The development security documentation shall justify that the security measures provide the necessary level of protection to maintain the confidentiality and integrity of the TOE.

ALC_DVS.2.1E The evaluator shall confirm that the information provided meets all requirements for content and presentation of evidence.

ALC_DVS.2.2E The evaluator shall confirm that the security measures are being applied.

6.3.3.5 ALC_LCD Life-cycle definition

ALC_LCD.1 Developer defined life-cycle model

ALC_LCD.1.1D The developer shall establish a life-cycle model to be used in the development and maintenance of the TOE.

ALC_LCD.1.2D The developer shall provide life-cycle definition documentation.

ALC_LCD.1.1C The life-cycle definition documentation shall describe the model used to develop and maintain the TOE.

ALC_LCD.1.2C The life-cycle model shall provide for the necessary control over the development and maintenance of the TOE.

ALC_LCD.1.1E The evaluator shall confirm that the information provided meets all requirements for content and presentation of evidence.

6.3.3.6 ALC_TAT Tools and techniques

ALC_TAT.2 Compliance with implementation standards

ALC_TAT.2.1D The developer shall provide the documentation identifying each development tool being used for the TOE.

ALC_TAT.2.2D The developer shall document and provide the selected implementation-dependent options of each development tool.

ALC_TAT.2.3D The developer shall describe and provide the implementation standards that are being applied by the developer.

ALC_TAT.2.1C Each development tool used for implementation shall be well-defined.

ALC_TAT.2.2C The documentation of each development tool shall unambiguously define the meaning of all statements as well as all conventions and directives used in the implementation.

ALC_TAT.2.3C The documentation of each development tool shall unambiguously define the meaning of all implementation-dependent options.

ALC_TAT.2.1E The evaluator shall confirm that the information provided meets all requirements for content and presentation of evidence.

ALC_TAT.2.2E The evaluator shall confirm that the implementation standards have been applied.

6.3.4 ASE Security Target evaluation

6.3.4.1 ASE_CCL Conformance claims

ASE_CCL.1 Conformance claims

ASE_CCL.1.1D The developer shall provide a conformance claim.

ASE_CCL.1.2D The developer shall provide a conformance claim rationale.

ASE_CCL.1.1C The conformance claim shall contain a CC conformance claim that identifies the version of the CC to which the ST and the TOE claim conformance.

ASE_CCL.1.2C The CC conformance claim shall describe the conformance of the ST to CC Part 2 as either CC Part 2 conformant or CC Part 2 extended.

ASE_CCL.1.3C The CC conformance claim shall describe the conformance of the ST to CC Part 3 as either CC Part 3 conformant or CC Part 3 extended.

ASE_CCL.1.4C The CC conformance claim shall be consistent with the extended components definition.

ASE_CCL.1.5C The conformance claim shall identify all PPs and security requirement packages to which the ST claims conformance.

ASE_CCL.1.6C The conformance claim shall describe any conformance of the ST to a package as either package-conformant or package-augmented.

ASE_CCL.1.7C The conformance claim rationale shall demonstrate that the TOE type is consistent with the TOE type in the PPs for which conformance is being claimed.

ASE_CCL.1.8C The conformance claim rationale shall demonstrate that the statement of the security problem definition is consistent with the statement of the security problem definition in the PPs for which conformance is being claimed.

ASE_CCL.1.9C The conformance claim rationale shall demonstrate that the statement of security objectives is consistent with the statement of security objectives in the PPs for which conformance is being claimed.

ASE_CCL.1.10C The conformance claim rationale shall demonstrate that the statement of security requirements is consistent with the statement of security requirements in the PPs for which conformance is being claimed.

ASE_CCL.1.1E The evaluator shall confirm that the information provided meets all requirements for content and presentation of evidence.

6.3.4.2 ASE_ECD Extended components definition

ASE_ECD.1 Extended components definition

ASE_ECD.1.1D The developer shall provide a statement of security requirements.

ASE_ECD.1.2D The developer shall provide an extended components definition.

ASE_ECD.1.1C The statement of security requirements shall identify all extended security requirements.

ASE_ECD.1.2C The extended components definition shall define an extended component for each extended security requirement.

ASE_ECD.1.3C The extended components definition shall describe how each extended component is related to the existing CC components, families, and classes.

ASE_ECD.1.4C The extended components definition shall use the existing CC components, families, classes, and methodology as a model for presentation.

ASE_ECD.1.5C The extended components shall consist of measurable and objective elements such that conformance or nonconformance to these elements can be demonstrated.

ASE_ECD.1.1E The evaluator shall confirm that the information provided meets all requirements for content and presentation of evidence.

ASE_ECD.1.2E The evaluator shall confirm that no extended component can be clearly expressed using existing components.

6.3.4.3 ASE_INT ST introduction

ASE_INT.1 ST Introduction

ASE_INT.1.1D The developer shall provide an ST introduction.

ASE_INT.1.1C The ST introduction shall contain an ST reference, a TOE reference, a TOE overview and a TOE description.

ASE_INT.1.2C The ST reference shall uniquely identify the ST.

ASE_INT.1.3C The TOE reference shall identify the TOE.

ASE_INT.1.4C The TOE overview shall summarise the usage and major security features of the TOE.

ASE_INT.1.5C The TOE overview shall identify the TOE type.

ASE_INT.1.6C The TOE overview shall identify any non-TOE hardware/software/firmware required by the TOE.

ASE_INT.1.7C The TOE description shall describe the physical scope of the TOE.

ASE_INT.1.8C The TOE description shall describe the logical scope of the TOE.

ASE_INT.1.1E The evaluator shall confirm that the information provided meets all requirements for content and presentation of evidence.

ASE_INT.1.2E The evaluator shall confirm that the TOE reference, the TOE overview, and the TOE description are consistent with each other.

6.3.4.4 ASE_OBJ Security objectives

ASE_OBJ.2 Security objectives

ASE_OBJ.2.1D The developer shall provide a statement of security objectives.

ASE_OBJ.2.2D The developer shall provide a security objectives rationale.

ASE_OBJ.2.1C The statement of security objectives shall describe the security objectives for the TOE and the security objectives for the operational environment.

ASE_OBJ.2.2C The security objectives rationale shall trace each security objective for the TOE back to threats countered by that security objective and OSPs enforced by that security objective.

ASE_OBJ.2.3C The security objectives rationale shall trace each 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.

ASE_OBJ.2.4C The security objectives rationale shall demonstrate that the security objectives counter all threats.

ASE_OBJ.2.5C The security objectives rationale shall demonstrate that the security objectives enforce all OSPs.

ASE_OBJ.2.6C The security objectives rationale shall demonstrate that the security objectives for the operational environment uphold all assumptions.

ASE_OBJ.2.1E The evaluator shall confirm that the information provided meets all requirements for content and presentation of evidence.

6.3.4.5 ASE_REQ Security requirements

ASE_REQ.2 Derived security requirements

ASE_REQ.2.1D The developer shall provide a statement of security requirements.

ASE_REQ.2.2D The developer shall provide a security requirements rationale.

ASE_REQ.2.1C The statement of security requirements shall describe the SFRs and the SARs.

ASE_REQ.2.2C All subjects, objects, operations, security attributes, external entities and other terms that are used in the SFRs and the SARs shall be defined.

ASE_REQ.2.3C The statement of security requirements shall identify all operations on the security requirements.

ASE_REQ.2.4C All operations shall be performed correctly.

ASE_REQ.2.5C Each dependency of the security requirements shall either be satisfied, or the security requirements rationale shall justify the dependency not being satisfied.

ASE_REQ.2.6C The security requirements rationale shall trace each SFR back to the security objectives for the TOE.

ASE_REQ.2.7C The security requirements rationale shall demonstrate that the SFRs meet all security objectives for the TOE.

ASE_REQ.2.8C The security requirements rationale shall explain why the SARs were chosen.

ASE_REQ.2.9C The statement of security requirements shall be internally consistent.

ASE_REQ.2.1E The evaluator shall confirm that the information provided meets all requirements for content and presentation of evidence.

6.3.4.6 ASE_SPD Security problem definition

ASE_SPD.1 Security problem definition

ASE_APD.1.1D The developer shall provide a security problem definition.

ASE_SPD.1.1C The security problem definition shall describe the threats.

ASE_SPD.1.2C All threats shall be described in terms of a threat agent, an asset, and an adverse action.

ASE_SPD.1.3C The security problem definition shall describe the OSPs.

ASE_SPD.1.4C The security problem definition shall describe the assumptions about the operational environment of the TOE.

ASE_SPD.1.1E The evaluator shall confirm that the information provided meets all requirements for content and presentation of evidence.

6.3.4.7 ASE_TSS TOE summary specification

ASE_TSS.1 TOE summary specification

ASE_TSS.1.1D The developer shall provide a TOE summary specification.

ASE_TSS.1.1C The TOE summary specification shall describe how the TOE meets each SFR.

ASE_TSS.1.1E The evaluator shall confirm that the information provided meets all requirements for content and presentation of evidence.

ASE_TSS.1.2E The evaluator shall confirm that the TOE summary specification is consistent with the TOE overview and the TOE description.

6.3.5 ATE Tests

6.3.5.1 ATE_COV Coverage

ATE_COV.2 Analysis of coverage

ATE_COV.2.1D The developer shall provide an analysis of the test coverage.

ATE_COV.2.1C The analysis of the test coverage shall demonstrate the correspondence between the tests in the test documentation and the TSFIs in the functional specification.

ATE_COV.2.2C The analysis of the test coverage shall demonstrate that all TSFIs in the functional specification have been tested.

ATE_COV.2.1E The evaluator shall confirm that the information provided meets all requirements for content and presentation of evidence.

6.3.5.2 ATE_DPT Depth

ATE_DPT.3 Testing: modular design

ATE_DPT.3.1D The developer shall provide the analysis of the depth of testing.

ATE_DPT.3.1C The analysis of the depth of testing shall demonstrate the correspondence between the tests in the test documentation and the TSF subsystems and modules in the TOE design.

ATE_DPT.3.2C The analysis of the depth of testing shall demonstrate that all TSF subsystems in the TOE design have been tested.

ATE_DPT.3.3C The analysis of the depth of testing shall demonstrate that all TSF modules in the TOE design have been tested.

ATE_DPT.3.1E The evaluator shall confirm that the information provided meets all requirements for content and presentation of evidence.

6.3.5.3 ATE_FUN Functional tests

ATE_FUN.1 Functional testing

ATE_FUN.1.1D The developer shall test the TSF and document the results.

ATE_FUN.1.2D The developer shall provide test documentation.

ATE_FUN.1.1C The test documentation shall consist of test plans, expected test results and actual test results.

ATE_FUN.1.2C The test plans shall identify the tests to be performed and describe the scenarios for performing each test. These scenarios shall include any ordering dependencies on the results of other tests.

ATE_FUN.1.3C The expected test results shall show the anticipated outputs from a successful execution of the tests.

ATE_FUN.1.4C The actual test results shall be consistent with the expected test results.

ATE_FUN.1.1E The evaluator shall confirm that the information provided meets all requirements for content and presentation of evidence.

6.3.5.4 ATE_IND Independent testing

ATE_IND.2 Independent testing - sample

ATE_IND.2.1D The developer shall provide the TOE for testing.

ATE_IND.2.1C The TOE shall be suitable for testing.

ATE_IND.2.2C The developer shall provide an equivalent set of resources to those that were used in the developer's functional testing of the TSF.

ATE_IND.2.1E The evaluator shall confirm that the information provided meets all requirements for content and presentation of evidence.

ATE_IND.2.2E The evaluator shall execute a sample of tests in the test documentation to verify the developer test results.

ATE_IND.2.3E The evaluator shall test a subset of the TSF to confirm that the TSF operates as specified.

6.3.6 AVA Vulnerability assessment

6.3.6.1 AVA_VAN Vulnerability analysis

AVA_VAN.5 Advanced methodical vulnerability analysis

AVA_VAN.5.1D The developer shall provide the TOE for testing.

AVA_VAN.5.1C The TOE shall be suitable for testing.

AVA_VAN.5.1E The evaluator shall confirm that the information provided meets all requirements for content and presentation of evidence.

AVA_VAN.5.2E The evaluator shall perform a search of public domain sources to identify potential vulnerabilities in the TOE.

AVA_VAN.5.3E The evaluator shall perform an independent, methodical vulnerability analysis of the TOE using the guidance documentation, functional specification, TOE design, security architecture description and implementation representation to identify potential vulnerabilities in the TOE.

AVA_VAN.5.4E The evaluator shall conduct penetration testing based on the identified potential vulnerabilities to determine that the TOE is resistant to attacks performed by an attacker possessing High attack potential.

6.4 Security Requirements Rationale

6.4.1 Objectives

6.4.1.1 Security Objectives for the TOE

O.Phys-Probing The SFR FDP_SDC.1 requires the TSF to protect the confidentiality of the user data stored in specified memory areas and prevent its compromise by physical attacks bypassing the specified interfaces for memory access. The scenario of physical probing as described for this objective is explicitly included in the assignment chosen for the physical tampering scenarios in FPT_PHP.3. Therefore, it is clear that this security functional requirement supports the objective.

O.Malfunction The definition of this objective shows that it covers a situation, where malfunction of the TOE might be caused by the operating conditions of the TOE (while direct manipulation of the TOE is covered O.Phys-Manipulation). There are two possibilities in this situation: Either the operating conditions are inside the tolerated range or at least one of them is outside of this range. The second case is covered by FPT_FLS.1/Detectors, because it states that a secure state is preserved in this case. The first case is covered by FRU_FLT.2 because it states that the TOE operates correctly under normal (tolerated) conditions.

O.Phys-Manipulation The SFR FDP_SDI.2 requires the TSF to detect the integrity errors of the stored user data and react in case of detected errors. More precisely, FDP_SDI.2 prevents manipulation of memory contents by ensuring detection and response from the TSF (use of a filure counter and capability to lock the session or the TOE itself).

The scenario of physical manipulation as described for this objective is explicitly included in the assignment chosen for the physical tampering scenarios in FPT_PHP.3. Therefore, it is clear that this security functional requirement supports the objective.

O.Abuse-Func This objective states that abuse of functions (especially provided by the IC Dedicated Test Software, for instance in order to read secret data) must not be possible when TOE is used by the final user. There are two possibilities to achieve this: (i) They cannot be used by an attacker (i. e. its availability is limited) or (ii) using them would not be of relevant use for an attacker (i. e. its capabilities are limited) since the functions are designed in a specific way. The first possibility is specified by FMT_LIM.2 and the second one by FMT_LIM.1. Since these requirements are combined to support the policy, which is suitable to fulfil O.Abuse-Func, both security functional requirements together are suitable to meet the objective. Other security functional requirements (FPT_ITT.1, FDP_ITT.1, FPT_PHP.3, FRU_FLT.2, FPT_FLS.1/Detectors and FDP_IFC.1) which prevent attackers from circumventing the functions implementing these two security functional requirements (for instance by manipulating the hardware) also support the objective. The relevant objectives are O.Leak-Inherent, O.Phys-Probing, O.Malfunction, O.Phys-Manipulation, O.Leak-Forced.

O.Leak-Inherent The security functional requirements FPT_ITT.1 and FDP_ITT.1 together with the policy statement in FDP_IFC.1 explicitly require the prevention of disclosure of secret data (TSF data as well as user data) when while being processed. This includes that attackers cannot reveal such data by measurements of emanations, power consumption or other behaviour of the TOE while data is processed by TOE parts.

O.Leak-Forced This objective is directed against attacks, where an attacker wants to force an information leakage, which would not occur under normal conditions. In order to achieve this the attacker has to combine a first attack step, which modifies the behaviour of the TOE (either by exposing it to extreme operating conditions or by directly manipulating it) with a second attack step measuring and analysing some output produced by the TOE. The first step is prevented by the same mechanisms which support O.Malfunction (FPT_FLS.1/Detectors, FRU_FLT.2) and O.Phys-Manipulation (FPT_PHP.3), respectively. The requirements covering O.Leak-Inherent (FPT_ITT.1, FDP_ITT.1, FDP_IFC.1) also support O.Leak-Forced because they prevent the attacker from being successful if he tries the second step directly.

O.Sec-Binding The security functional requirement FDP_RIP.1 ensures that the User data is erased before the Host device is changed. The security functional requirement FPT_FLS.1/Binding_Key protects against integrity failure on Binding Key and illegal modification on Binding Key

O.Trusted-Path The security functional requirement FTP_TRP.1 contribute in this protection because it only establishes a trusted path between the TSF and authorized **U.Host-Device** for the communication purpose.

The security functional requirement FPT_FLS.1/Binding_Key protects the Binding key against the tampering.

The security functional requirements FDP_UCT.1 and FDP_UIT.1 protect against the modification (integrity) and the disclosure (confidentiality) of the User data communication between the TSF and **U.Host-Device**.

6.4.2 Rationale tables of Security Objectives and SFRs

Security Objectives	Security Functional Requirements	Rationale
O.Phys-Probing	FPT_PHP.3, FDP_SDC.1	Section 6.4.1.1
O.Malfunction	FRU_FLT.2, FPT_FLS.1/Detectors	Section 6.4.1.1

Security Objectives	Security Functional Requirements	Rationale
O.Phys-Manipulation	FDP_SDI.2, FPT_PHP.3	Section 6.4.1.1
O.Abuse-Func	FDP_ITT.1, FPT_ITT.1, FPT_PHP.3, FRU_FLT.2, FPT_FLS.1/Detectors, FMT_LIM.1, FMT_LIM.2, FDP_IFC.1	Section 6.4.1.1
O.Leak-Inherent	FDP_ITT.1, FPT_ITT.1, FDP_IFC.1	Section 6.4.1.1
O.Leak-Forced	FDP_ITT.1, FPT_ITT.1, FRU_FLT.2, FPT_FLS.1/Detectors, FPT_PHP.3, FDP_IFC.1	Section 6.4.1.1
O.Sec-Binding	FDP_RIP.1, FPT_FLS.1/Binding_Key	Section 6.4.1.1
O.Trusted-Path	FDP_UCT.1, FDP_UIT.1, FPT_FLS.1/Binding_Key, FTP_TRP.1	Section 6.4.1.1

Table 11 Security Objectives and SFRs - Coverage

Security Functional Requirements	Security Objectives
FRU_FLT.2	O.Malfunction, O.Abuse-Func, O.Leak-Forced
FPT_FLS.1/Detectors	O.Malfunction, O.Abuse-Func, O.Leak-Forced
FMT_LIM.1	O.Abuse-Func
FMT_LIM.2	O.Abuse-Func
FDP_SDC.1	O.Phys-Probing
FDP_SDI.2	O.Phys-Manipulation
FPT_PHP.3	O.Phys-Probing, O.Phys-Manipulation, O.Abuse-Func, O.Leak-Forced
FDP_ITT.1	O.Abuse-Func, O.Leak-Inherent, O.Leak-Forced
FPT_ITT.1	O.Abuse-Func, O.Leak-Inherent, O.Leak-Forced
FDP_IFC.1	O.Abuse-Func, O.Leak-Inherent, O.Leak-Forced
FDP_UCT.1	O.Trusted-Path
FDP_UIT.1	O.Trusted-Path
FTP_TRP.1	O.Trusted-Path
FPT_FLS.1/Binding_Key	O.Trusted-Path, O.Sec-Binding
FDP_RIP.1	O.Sec-Binding

Table 12 SFRs and Security Objectives

6.4.3 Dependencies

6.4.3.1 SFRs Dependencies

Requirements	CC Dependencies	Satisfied Dependencies
FRU_FLT.2	(FPT_FLS.1)	FPT_FLS.1/Detectors
FPT_FLS.1/Detectors	No Dependencies	
FMT_LIM.1	(FMT_LIM.2)	FMT_LIM.2

Requirements	CC Dependencies	Satisfied Dependencies
FMT_LIM.2	(FMT_LIM.1)	FMT_LIM.1
FDP_SDC.1	No Dependencies	
FDP_SDI.2	No Dependencies	
FPT_PHP.3	No Dependencies	
FDP_ITT.1	(FDP_ACC.1 or FDP_IFC.1)	FDP_IFC.1
FPT_ITT.1	No Dependencies	
FDP_IFC.1	(FDP_IFF.1)	
FDP_UCT.1	(FDP_ACC.1 or FDP_IFC.1) and (FTP_ITC.1 or FTP_TRP.1)	FDP_IFC.1, FTP_TRP.1
FDP_UIT.1	(FDP_ACC.1 or FDP_IFC.1) and (FTP_ITC.1 or FTP_TRP.1)	FDP_IFC.1, FTP_TRP.1
FTP_TRP.1	No Dependencies	
FPT_FLS.1/Binding_Key	No Dependencies	
FDP_RIP.1	No Dependencies	

Table 13 SFRs Dependencies

Rationale for the exclusion of Dependencies

The dependency FDP_IFF.1 of FDP_IFC.1 is discarded. Part 2 of the Common Criteria defines the dependency of FDP_IFC.1 (information flow control policy statement) on FDP_IFF.1 (Simple security attributes). The specification of FDP_IFF.1 would not capture the nature of the security functional requirement nor add any detail.

As stated in the Data Processing Policy referred to in FDP_IFC.1, there are no attributes necessary. The security functional requirement for the TOE is sufficiently described using FDP_ITT.1 and its Data Processing Policy (FDP_IFC.1).

6.4.3.2 SARs Dependencies

Requirements	CC Dependencies	Satisfied Dependencies
ADV_ARC.1	(ADV_FSP.1) and (ADV_TDS.1)	ADV_FSP.5, ADV_TDS.4
ADV_FSP.5	(ADV_IMP.1) and (ADV_TDS.1)	ADV_IMP.1, ADV_TDS.4
ADV_IMP.1	(ADV_TDS.3) and (ALC_TAT.1)	ADV_TDS.4, ALC_TAT.2
ADV_INT.2	(ADV_IMP.1) and (ADV_TDS.3) and (ALC_TAT.1)	ADV_IMP.1, ADV_TDS.4, ALC_TAT.2
ADV_TDS.4	(ADV_FSP.5)	ADV_FSP.5
AGD_OPE.1	(ADV_FSP.1)	ADV_FSP.5
AGD_PRE.1	No Dependencies	
ALC_CMC.4	(ALC_CMS.1) and (ALC_DVS.1) and (ALC_LCD.1)	ALC_CMS.5, ALC_DVS.2, ALC_LCD.1
ALC_CMS.5	No Dependencies	
ALC_DEL.1	No Dependencies	

Requirements	CC Dependencies	Satisfied Dependencies
ALC_DVS.2	No Dependencies	
ALC_LCD.1	No Dependencies	
ALC_TAT.2	(ADV_IMP.1)	ADV_IMP.1
ASE_CCL.1	(ASE_ECD.1) and (ASE_INT.1) and (ASE_REQ.1)	ASE_ECD.1, ASE_INT.1, ASE_REQ.2
ASE_ECD.1	No Dependencies	
ASE_INT.1	No Dependencies	
ASE_OBJ.2	(ASE_SPD.1)	ASE_SPD.1
ASE_REQ.2	(ASE_ECD.1) and (ASE_OBJ.2)	ASE_ECD.1, ASE_OBJ.2
ASE_SPD.1	No Dependencies	
ASE_TSS.1	(ADV_FSP.1) and (ASE_INT.1) and (ASE_REQ.1)	ADV_FSP.5, ASE_INT.1, ASE_REQ.2
ATE_COV.2	(ADV_FSP.2) and (ATE_FUN.1)	ADV_FSP.5, ATE_FUN.1
ATE_DPT.3	(ADV_ARC.1) and (ADV_TDS.4) and (ATE_FUN.1)	ADV_ARC.1, ADV_TDS.4, ATE_FUN.1
ATE_FUN.1	(ATE_COV.1)	ATE_COV.2
ATE_IND.2	(ADV_FSP.2) and (AGD_OPE.1) and (AGD_PRE.1) and (ATE_COV.1) and (ATE_FUN.1)	ADV_FSP.5, AGD_OPE.1, AGD_PRE.1, ATE_COV.2, ATE_FUN.1
AVA_VAN.5	(ADV_ARC.1) and (ADV_FSP.4) and (ADV_IMP.1) and (ADV_TDS.3) and (AGD_OPE.1) and (AGD_PRE.1) and (ATE_DPT.1)	ADV_ARC.1, ADV_FSP.5, ADV_IMP.1, ADV_TDS.4, AGD_OPE.1, AGD_PRE.1, ATE_DPT.3

Table 14 SARs Dependencies

6.4.4 Rationale for the Security Assurance Requirements

The assurance level EAL5 and the augmentation with the requirements ALC_DVS.2, and AVA_VAN.5 were chosen in order to meet assurance expectations explained in the following paragraphs.

An assurance level of EAL5 with the augmentations AVA_VAN.5 and ALC_DVS.2 are required for this type of TOE since it is intended to defend against sophisticated attacks. This evaluation assurance package was selected to permit a developer to gain maximum assurance from positive security engineering based on good commercial practices. In order to provide a meaningful level of assurance that the TOE provides an adequate level of defence against such attacks, the evaluators should have access to the low level design and source code.

6.4.5 ALC_DVS.2 Sufficiency of security measures

Development security is concerned with physical, procedural, personnel and other technical measures that may be used in the development environment to protect the TOE.

In the particular case of a memory flash the TOE is developed and produced within a complex and distributed industrial process which must especially be protected. Details about the implementation, (e.g. from design, test and development tools as well as Initialisation Data) may make such attacks easier. Therefore, in the case of a memory flash, maintaining the confidentiality of the design is very important.

This assurance component is a higher hierarchical component to EAL5 (which only requires ALC_DVS.1). ALC_DVS.2 has no dependencies.

6.4.6 AVA_VAN.5 Advanced methodical vulnerability analysis

Due to the intended use of the TOE, it must be shown to be highly resistant to penetration attacks. This assurance requirement is achieved by the AVA_VAN.5 component.

Independent vulnerability analysis is based on highly detailed technical information. The main intent of the evaluator analysis is to determine that the TOE is resistant to penetration attacks performed by an attacker possessing high attack potential.

AVA_VAN.5 has dependencies to ADV_ARC.1 "Security architecture description", ADV_FSP.2 "Security enforcing functional specification", ADV_TDS.3 "Basic modular design", ADV_IMP.1 "Implementation representation of the TSF", AGD_OPE.1 "Operational user guidance", and AGD_PRE.1 "Preparative procedures". All these dependencies are satisfied by EAL5.

It has to be assumed that attackers with high attack potential try to attack memory flashes embedded in smart cards used for digital signature applications or payment systems. Therefore, specifically AVA_VAN.5 was chosen in order to assure that even these attackers cannot successfully attack the TOE.

7 TOE Summary Specification

This Chapter describes the TSF security functionality by a set of security features and justifies how the SFR defined in Chapter 6 are enforced by those features.

7.1 TOE Summary Specification

SF.SEC-COM

Secure communication

SF.SEC-COM protects the confidentiality and the integrity of the communication between the TOE and **U.Host-Device** against probing, Man-in-the-Middle, hammering and replay attacks. In particular,

- a fresh session key is used for each session;
- for update operations (write/erase): the payload (access address and data) is encrypted and a MAC digest is added to ensure integrity;
- for reading operation: 8 transport integrity check bits are added to each 32 bit long word, providing a progressive authentication of the transmitted data;
- session and transaction counters are also used to protect against replaying;

SF.SEC-COM is devised to enable in-place execution of the code stored in the TOE. For this purpose, each data-word sent by TOE is separately encrypted by applying a cascade of a stream ciphering operation and a mixing operation that cryptographically maps input bits to output bits.

Also, to maintain the throughput needed for the in-place execution, the data sent by TOE is authenticated by a sequence of authentication bytes interleaved with the data-words so that each given byte cumulatively authenticates the data words that were authenticated by a previous byte in the sequence and the data words transmitted between the previous byte and the given byte.

SF.PHY-PRO

Physical protection

SF.PHY-PRO protects the TOE against physical manipulation (including the TOE probing). SF.PHY-PRO includes the following security mechanisms:

- Failure counter: this counter is incremented after each tamper-detection and the TOE is locked if the counter reaches a pre-defined value.
- Active Shielding: The Active Shield detection is filtered using a counter, when that number reaches a preset threshold, the Active Shield raises a tamper alarm.
- Dual flip-flops: A difference in the state of two joint flip-flops indicates a fault and raises the Fault Injection Alarm output signal. This mechanism is designed to detect perturbation attacks like Laser or Electro-Magnetic fault injections.
- Clock-tree protection: The 0-1 pattern spreads in a dedicated shift register with every clock pulse provided all clock signals are active. This mechanism is designed to ensure that the clock-tree is intact.
- State machine monitoring: The TOE implements Tamper Detectors that detects abnormal conditions and reports a fault state.

- Bus Encoding: Command bus to the Flash array is encoded, such that more than 1-bit flip distinguishes between any two commands. Further more, some of the bits of the command are used as qualifiers for internal analog processes within the Flash array.

SF.PHY-PRO also protects the TOE against the inherent or intentional leak of the TOE operations by the following security mechanisms:

- advanced stream cipher using long linear feedback shift registers: the calculations are protected against timing and power consumption leak;
- anti-leakage measures for the hash functions that are used for stream-ciphering and MAC digest: masking input data and undisclosure of intermediate output values;
- session setup: the logic is protected against timing and power consumption leak;

SF.OPE-MODE

Control of Operating Modes

SF.OPE-MODE ensures that the TSF and User Data is not disclosed or manipulated via the features avalailable in the TEST mode.

In particular, the Flash array is completely erased before switching to TEST mode. Furthermore, the access to the TSF and User data is also restricted in the Test mode. More precisely:

- The Binding Key (Kb) cannot be read out by the Flash commands;
- The Binding key cannot be erased unless a complete erase has been done after the last reset;
- The read and write commands do not read and write effective values of the Fash array;

SF.OPE-COND

Control of Operating Conditions

SF.OPE-COND detects the abnormal operation conditions (voltage, temperature, clock frequency, power glitch) using the corresponding sensors.

If an abnormal operation condition happens, then SF.OPE-COND disturbs the cryptographic computations, interrupts data interchange and inform **U.Host-Device**.

SF.SEC-MEM-INT

Storage Integrity

SF.SEC-MEM-INT protects the integrity of the User Data (including executable codes) stored in the flash array using CRC-32 error detecting code. All User data can be protected by CRC-32 error detecting code but the integrity verification is performed only if the access is done via an authenticated read (i.e. AUTH_READ command).

If an inconsistency is detected between an User data and its error detecting code, then SF.SEC-MEM-INT informs U.Host-Device about the error.

In addition, SF.SEC-MEM-INT also sends pseudo-randomly chosen of the CRC-32 error detecting code to **U.Host-Device** in a secure way so that data integrity can be independently verified by **U.Host-Device**.

SF.SEC-MEM-CONF

Storage Confidentiality

SF.SEC-MEM-CONF protects the confidentiality of the User Data stored in the flash array by a memory scrambling mechanism that is based on diversified keys. Both the addresses and the memory content are scrambled but by a key that is unique for each instance of the TOE.

SF.KEY-PRO

Protection of Binding Key

SF.KEY-PRO protects the User data against disclosure by manipulating the binding key. In particular, the Flash array is completely erased before

- a new Binding key is set, or
- the current Binding key is erased.

Furthermore, the current Binding key is stored in the Auxiliary array and cannot be read out by the Flash commands. The integrity of the Binding key is protected by a digest value: if an illegal modifcation is detected on the Binding key, then the TOE is locked and can only be unlocked in Test mode (and the Flash array has been erased).

SF.SEC-AUTH

Secure Authentication

SF.SEC-AUTH ensures that only an authorized Host device (i.e. a Host device that knows the Binding key Kb) can open a secure channel to communicate with the TOE.

More precisely, SF.SEC-AUTH provides a mutual authentication between the Host device and the TOE by verifying that both of them share the same Binding key. A failed authentication increases the Failure counter: if this counter reaches a pre-defined value, then the TOE is locked.

7.2 SFRs and TSS

7.2.1 SFRs and TSS - Rationale

7.2.1.1 TOE Summary Specification

SF.SEC-COM enforces the FDP_UCT.1 and FDP_UIT.1 because the the User Data is protected while being transmitted to **U.Host-Device**. SF.SEC-COM enforces the FDP_IFC.1 in particular the user data is protected in terms of confidentility when being transferred by the TOE to **U.Host-Device**. Moreover, the user data is protected in terms of intergrity during the communication between the TOE and **U.Host-Device**.

SF.PHY-PRO enforces the TOE resistance against physical attacks (FPT_PHP.3). SF.PHY-PRO contributes to the integrity and confidentiality protection of the User data stored in the TOE (FDP_SDI.2 and FDP_SDC.1): the failure counter is increased when a data inconsistency is detected; the cryptographic services are also protected against the physical attacks.

SF.PHY-PRO protects against some attacks on the cryptographic services used for the transmission of the User data (FPT_ITT.1, FDP_ITT.1 and FDP_IFC.1).

SF.OPE-MODE enforces the restriction of the TSF capabilities and availabily during the deployment of the test features after the TOE delivery (respectively FMT_LIM.1 and FMT_LIM.2).

SF.OPE-COND enforces the TOE fault-tolerance and fail-secure (respectively FRU_FLT.2 and FPT_FLS.1/Detectors).

SF.SEC-MEM-INT By definition, SF.SEC-MEM-INT enforces FDP_SDI.2.

SF.SEC-MEM-CONF By definition, SF.SEC-MEM-CONF enforces FDP_SDC.1. SF.SEC-MEM-CONF also enforces the FDP_IFC.1 in particular the User data and TSF data are protected in terms of confidentility when being stored, processed or transferred between two TOE components (SFF and Flash array).

SF.KEY-PRO enforces FDP_RIP.1 because it erases the Flash content before a new Binding key is set or the current Binding key is erased. SF.KEY-PRO also detects the failure and put the TOE in a secure state (i.e. locked state) due to an illegal modification of the current Binding key. In other words, SF.KEY-PRO enforces FPT_FLS.1/Binding_Key.

SF.SEC-AUTH enforces the FTP_TRP.1 because only an authorized **U.Host-Device** can open a trusted channel with the TOE.

7.2.2 Association tables of SFRs and TSS

Security Functional Requirements	TOE Summary Specification
FRU_FLT.2	SF.OPE-COND
FPT_FLS.1/Detectors	SF.OPE-COND
FMT_LIM.1	SF.OPE-MODE
FMT_LIM.2	SF.OPE-MODE
FDP_SDC.1	SF.PHY-PRO, SF.SEC-MEM-CONF
FDP_SDI.2	SF.PHY-PRO, SF.SEC-MEM-INT
FPT_PHP.3	SF.PHY-PRO
FDP_ITT.1	SF.PHY-PRO
FPT_ITT.1	SF.PHY-PRO
FDP_IFC.1	SF.SEC-MEM-CONF, SF.SEC-COM, SF.PHY-PRO
FDP_UCT.1	SF.SEC-COM
FDP_UIT.1	SF.SEC-COM
FTP_TRP.1	SF.SEC-AUTH
FPT_FLS.1/Binding_Key	SF.KEY-PRO
FDP_RIP.1	SF.KEY-PRO

Table 15 SFRs and TSS - Coverage

TOE Summary Specification	Security Functional Requirements
SF.SEC-COM	FDP_IFC.1, FDP_UCT.1, FDP_UIT.1
SF.PHY-PRO	FDP_SDC.1, FDP_SDI.2, FPT_PHP.3, FDP_ITT.1, FPT_ITT.1, FDP_IFC.1
SF.OPE-MODE	FMT_LIM.1, FMT_LIM.2
SF.OPE-COND	FRU_FLT.2, FPT_FLS.1/Detectors
SF.SEC-MEM-INT	FDP_SDI.2
SF.SEC-MEM-CONF	FDP_SDC.1, FDP_IFC.1
SF.KEY-PRO	FPT_FLS.1/Binding_Key, FDP_RIP.1
SF.SEC-AUTH	FTP_TRP.1

Table 16 TSS and SFRs - Coverage

8 Revisions

Modification	Comment
A	New version
B	Update part numbers and typos , remove octal and quad SFI support, update Assumptions,
C	Update OR004
D	Update documents revision
E	Update Section 3.1
F	Update for AA version
G	Editorial updates
H	Doc rev update
I	

Update

OR008-ASE	

Table 17 History of Modifications

9 ANNEX

9.1 Glossary

SFI

Secure Flash Interface is the SPI interface on the Host device (i.e. SPI Master).

SFF

Secure Flash Front-end is the SPI interface on the memory chip (i.e. SPI Slave).

SPI

Serial Peripheral Interface is a synchronous serial data link, a *de facto* standard, that operates in full duplex mode.

9.2 Abbreviations

CC Common Criteria

EAL Evaluation Assurance Level

IT Information Technology

PP Protection Profile

ST Security Target

TOE Target of Evaluation

TSC TSF Scope of Control

TSF TOE Security Functionality

TSFI TSF Interface

TSP TOE Security Policy

9.3 References

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[4] *Common Methodology for Information Technology Security Evaluation, Evaluation Methodology*, Version 3.1, Revision 5, April 2017, CCMB-2017-04-004

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[12] *N/A*

[13] *Supporting Document Mandatory Technical Document: Application of Attack Potential to Smartcards* July 2020, Version 3.0.

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[15] *Joint Interpretation Library: Minimum Site Security Requirements*, Ver 3.0, Feb 2020

[16] ISO/IEC 7816-3. *Identification cards — integrated circuit cards. Part 3: Cards with contacts Electrical interface and transmission protocols*.

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